

2018 Standard Specifications for Highway Construction



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Western Construction, Inc. 2017

On behalf of the Idaho Transportation Department, I hereby certify this document as the current, official edition of the 2018 Standard Specifications for Highway Construction.

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On behalf of the Federal Highway Administration - Idaho Division, I hereby certify this document as the current, official edition of the 2018 Standard Specifications for Highway Construction.

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U.S. Customary Measurement Symbols

Symbol	Unit Name
±	plus or minus
°F	degree fahrenheit
A	ampere
Acre	acre
cP	centipoises
cSt	centistokes
cwt	centum weight, hundred weight (100 lb)
db	decibel
fc	footcandle
ft or '	foot
ft ² or SF	square foot
ft ³ or CF	cubic foot
gal	gallon
gpm	gallons per minute
hp	horsepower
hr	hour
Hz	hertz
in or "	inch
in ²	square inch
in ³	cubic inch
J	joule
kip	1,000 pound-force
ksi	kilopound per square inch
kW	kilowatt
lb	pound
lbf	pound-force
lbf-ft	pound-force foot
lm	lumen
LS	lump sum
mA	milliampere
MG	1,000 gallons
mi	mile
mi ²	square mile
mil	0.001 inch
min	minute
mph	miles per hour
ms	millisecond
oz	ounce
P	poise
pil	pounds/inch/inch
pli	Pounder per linear inch
psf	pound-force per square foot
psi	pound-force per square inch
pt	pint
qt	quart
rpm	revolutions per minute
Station or Sta	100 feet
s	second
TOA	tons of asphalt
ton	ton, short (2,000 lb)
µm	micrometer
V	volt
VA	voltampere
vpm	vibrations per minute

Symbol	Unit Name
W	watt
Ω	ohm
yd	yard
yd ² or SY	square yard
yd ³ or CY	cubic yard
π or pi	3.14159

SECTION 100 – GENERAL PROVISIONS

SECTION 101 – GENERAL, ABBREVIATIONS, AND DEFINITIONS

101.01 Active Voice, Imperative Mood.

These Standard Specifications are written with an emphasis on the active voice. In a sentence written in the active voice, someone acts on something. For example: "The Contractor will place the concrete." A similar sentence in the passive voice – "The concrete will be placed" – would be unclear about who was responsible for placing the concrete.

The Standard Specifications also are written in the imperative mood. The imperative mood is used when the party issuing an instruction and the party receiving it are already understood. The Department is stating its requirements or directions for the work to the Contractor; such statements have the same force as if they contained the words "the Contractor will." In an imperative sentence such as, "Place the concrete," the Department is indicating that it requires the Contractor to place the concrete. Before contract award, imperative statements are directed to the bidder(s). After contract award, imperatives are directed to the Contractor.

The Department will identify parties other than the bidder or the Contractor to whom it gives a responsibility in these Standard Specifications. In phrasings where the responsible party is clearly identified or in factual statements when it is not important to do so, the Department may use the passive voice.

All approvals and consents are granted and all direction is given by the Engineer. All submittals are sent to the Engineer.

101.02 Organization of Specifications.

A. General.

With the exception of Section 100 "General Provisions" and Section 700 "Materials" Standard Specification sections are written in a five-part format. Each section contains the following primary subsections:

- XXX.01 Description.
- XXX.02 Materials.
- XXX.03 Construction Requirements.
- XXX.04 Method of Measurement.
- XXX.05 Basis of Payment.

The subsections contain varying numbers of titled subordinate subsections composed of higher and lower levels.

B. Hierarchy of Organization.

Subsection requirements apply to subordinate subsections. In addition, many subsections begin with a lower-level subsection titled General. General subsection requirements apply to the associated same-level subsections that follow; they do not apply to the higher level.

C. Title (or Headings).

Sections and subsection titles or headings are for referencing convenience, and do not necessarily bear on the text meaning or interpretation.

D. References.

The Standard Specifications rely on many internal cross references and to external sources in other contract documents, Department manuals, and other industry resources. To minimize the text necessary for internal cross references, the Standard Specifications will not precede internal cross references with the terms Section and Subsection. External cross references will contain just enough information to find the intended source.

101.03 Abbreviations and Acronyms.

1. Organizations.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AGC	Associated General Contractors
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standard Institute
AOSCA	Association of Official Seed Certifying Agency
AREA	American Railway Engineering Association
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWPA	American Wood Preservers Association
AWS	American Welding Society
CRD	United States Corps of Engineers Controller of Research and Development
CRSI	Concrete Reinforcing Steel Institute
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
ECTC	Erosion Control Technology Council
FCC	Federal Communications Commission
FHWA	Federal Highway Administration
ICRI	International Concrete Repair Institute
IES	Illuminating Engineering Society
IDWR	Idaho Department of Water Resources
ISDA	Idaho State Department of Agriculture
ISU	Idaho State University
ITD	Idaho Transportation Department
ITE	Institute of Transportation Engineers
NEMA	National Electrical Manufacturers Association
NGS	National Geodetic Survey
NOAA	National Oceanic and Atmospheric Administration
NPCA	National Precast Concrete Association
NRMCA	National Ready Mix Concrete Association
NRTL	Nationally Recognized Testing Laboratory
NTPEP	National Transportation Product Evaluation Program
NVLAP	National Voluntary Laboratory Accreditation Program
PCAA	Precast Concrete Association of America
PCI	Precast/Prestressed Concrete Institute
PLIB	Pacific Lumber Inspection Bureau
PTCSI	Pedestrian Traffic Control Signal Indicator
SAE	Society of Automotive Engineers

SHPO	State Historic Preservation Office
SSPC	Society for Protective Coatings
UL	Underwriters Laboratories
USDOL	United States Department of Labor
USDOT	United States Department of Transportation
WAQTC	Western Alliance for Quality Transportation Construction
WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association
WWPI	Western Wood Preservers Institute

2. Acronyms.

AAP	Affirmative Action Program
ABS	Acrylonitrile Butadiene Styrene
AC	Alternating Current
ACZA	Ammoniacal Copper Zinc Arsenate
ANFO	Ammonium Nitrate and Fuel Oil
ADA	American Disabilities Act
APA	Asphalt Price Adjustment or Asphalt Pavement Analyzer
ASR	Alkali Silica Reactivity
ATPB	Asphalt-Treated Permeable Base
ATPLC	Asphalt-Treated Permeable Base Leveling Course
AU	Acre Unit
AWG	American Wire Gauge
BAI	Base Asphalt Index
B&B	Balled and Burlapped
BFI	Base Fuel Index
BMP	Best Management Practice
CaO	Calcium Oxide
CaCO ₃	Calcium Carbonate
CA	Contingency Amount
CAI	Current Asphalt Index
CCA	Chromated Copper Arsenate
CFI	Current Fuel Index
CFR	Code of Federal Regulations
CGP	Construction General Permit
CIR	Cold In-Place Recycling
C-JMF	Contractor's Job Mix Formula
CO ₂	Carbon Dioxide
CPM	Critical Path Method
CRABS	Cement Recycle Asphalt Base Stabilization
CRI	Color Rendering Index
CUF	Commercially Useful Function
CVN	Charpy V-Notch
DBE	Disadvantaged Business Enterprise
DCTR	Distributor Certified Test Report
DP	Dust Proportion
DRB	Dispute Review Board
DTI	Direct Tension Indicator
EARA	Emulsified Asphalt Recycling Agent

EC	Electrical Conductivity
EEO	Equal Employment Opportunity
EMS	Electronic Marker System
ESA	Endangered Species Act
ESCP	Erosion and Sediment Control Plan
ESP	Exchangeable Sodium Percentage
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOB	Free on Board
FOP	Field Operating Procedure
FPA	Fuel Price Adjustment
GFE	Good Faith Effort
GPR	Ground Penetrating Radar
HECP	Hydraulic Erosion Control Products
HMA	Hot Mix Asphalt
IA	Independent Assurance
IDAPA	Idaho Administrative Procedure Act (67-52, Idaho Code)
IPCEA	Insulated Power Cable Engineers Association Publications
IRI	International Roughness Index
JMF	Job Mix Formula
LED	Light Emitting Diode
LOI	Loss of Ignition
LS	Lump Sum
MCPD	Multi-State Control Point Database
MCTR	Manufacturer Certified Test Report
MPH	Miles Per Hour
MTR	Mill Test Report or Minimum Test Requirement
MUTCD	Manual on Uniform Traffic Control Devices as adopted (IDAPA 39.03.41)
Na ₂ O	Sodium Oxide
NAPT-PAP	North American Proficiency Testing-Performance Assessment Program
NCHRP	National Cooperative Highway Research Program
NEC	National Electric Code
NEPA	National Environmental Policy Act
NMAS	Nominal Maximum Aggregate Size
NOI	Notice of Intent
NOT	Notice of Termination
NPT	National Pipe Tapered
OJT	On-The-Job Training
PCMS	Portable Changeable Message Sign
PDF	Portable Document Format
PE	Professional Engineer or Polyethylene
PG	Performance Graded
PH	Potential of Hydrogen
PLS	Professional Land Surveyor or Pure Live Seed
PLSS	Public Land Survey System
PPV	Peak Particle Velocity
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAP	Quality Assurance Program
QASP	Quality Assurance Special Provisions

QC	Quality Control
QPL	Qualified Products List
RAP	Recycled Asphalt Pavement
RAS	Recycled Asphalt Shingles
RECP	Rolled Erosion Control Products
RMS	Root Mean Square
RoHS	Restriction of Hazardous Substances
ROW	Right of Way
RTFOT	Rolling Thin Film Oven Test
SCM	Secondary Cementitious Material
SDS	Safety Data Sheet
SGC	Superpave Gyratory Compactor
SPCP	Spill Prevention and Control Plan
SPMDT	Superpave Mix Design Technician
SRRPE	Steel Reinforced Ribbed Polyethylene
SWPPP	Stormwater Pollution Prevention Plan
TAS	Technical Analysis Support
TE	Technical Expert
TMECC	Test Methods for Evaluation of Compost and Composting
TRM	Turf Reinforcement Mat
TSR	Tensile Strength Ratio
TTY/TTD	Telecommunications Device for the Deaf/Teletypewriting Device
UCP	United Certification Program
USSWG	United States Steel Wire Gauge
UV	Ultraviolet
VECP	Value Engineering Change Proposal
VOC	Volatile Organic Compound
VTCSH	Vehicle Traffic Control Signal Head
WMA	Warm Mix Asphalt
XCU	Explosion, Collapse, and Underground

101.04 Definitions.

Acceptance. Work that has met all contract requirements, including minimum sampling and testing, and/or certification requirements.

Acceptance Testing. Samples and tests that are conducted to determine whether the Department will accept a product or service for payment.

Addenda. Contract revisions issued after notice of letting and before bid opening.

Anticipated Profit. Profit for work not performed.

Automated Machine Guidance (AMG). AMG is the computerized guidance of construction equipment to follow the line and grade of an engineered design. Guidance is by direct control of the machinery or through visual or audible signals to the operator. Operation is based on digital input from positioning systems and may increase levels of precision, speed, and accuracy.

Award. Department execution of a contract.

Bid Opening. The public opening and reading of proposals.

Bidder. An individual, partnership, firm, corporation, or any acceptable combination, submitting a proposal.

Bid Schedule. A list of contract pay items and their estimated quantities included with the proposal forms on which bidders provide unit prices.

Board. Idaho Transportation Board. As established by [40-301, Idaho Code](#).

Bridge. A structure, including supports, constructed over a depression or obstruction (e.g., water, highway, railway), and having a track or passageway to carry traffic or other moving loads and a length more than 20 feet measured along the center of the traveled way or railroad between abutment undercopings or extreme ends of openings for multiple boxes.

Business Day. Any day except Saturdays, Sundays, and holidays.

Calendar Day. Any day shown on the calendar, beginning and ending at midnight. Time described in days will be calendar days.

Central Materials Laboratory. The Department's headquarters materials testing laboratory located at 3293 E Jordan St, Boise, ID 83702.

Change Order. A written order to the Contractor, detailing changes to the specified work quantities or modifications within the scope of the contract, and establishing the basis of payment and time adjustments for the work affected by the changes.

Chief Engineer. An administrator within the Department, who is designated by the Director as established by [40-503, Idaho Code](#).

Chip Seal Coat Warranty Guide. The Department's guide that describes the intent, evaluation method, and criteria for a warranty chip seal coat contract. The guide includes examples of commonly seen damage, defects, or other imperfections with its respective likely cause.

Claim. A written Contractor request or demand for a contract adjustment, equitable adjustment, additional time or compensation, delay damages, pass-through subcontractor claims, or for any other remedy arising from an unresolved dispute, disagreement, or controversy concerning respective rights and obligations under the contract.

Concurrent Delay. Are independent critical activity delays occurring at the same time.

Confidence Points. Random survey points measured in the field within the boundary of a digital terrain model (DTM) for the purpose of documenting that the natural ground DTM is a reasonable representation of the original natural ground for computation of catch points, volumes, and pay quantities.

Contingency Item. A contract pay item for which the Department provides a set price on the bid schedule. The Department will pay for authorized work performed under a contingency item as required by the contract.

Contract. The written agreement between the Department and the Contractor covering the work, performance of the work, basis of payment, time accounting, and other obligations of the parties. The contract includes the notice of letting, proposal forms, plans, specifications, contract bonds, change orders, the Standard Specifications, special provisions, Quality Assurance (QA) manual, Quality Assurance Special Provision (QASP), and other documents designated by the Department as part of the contract.

Contract Amount. The original total bid amount at the time of award.

Contract Date. The date the Contract is signed by both parties. For the purchase of supplies or services, by contract modification, the term contract date means the date of the contract modification.

Contract Bonds. Statutory bonds executed by the Contractor and the surety, including the performance bond and payment bond, guaranteeing performance of the contract and payment of lawful indebtedness pertaining thereto.

Contract Pay Item (Pay Item). A specific unit of the work for which a price is provided in the contract. Each individual work item is considered a major item of work. Contract pay items are numbered to correspond to the appropriate sections of the Standard Specifications. Special provision contract pay items are numbered beginning with an "S" followed by a section number to which work is similar or to a 900 generic series number.

Contract Time. The time allowed by the contract for substantial completion of the work.

Contractor (Prime Contractor). The individual, partnership, firm, corporation, or any acceptable combination thereof, contracting with the Department for performance of the work.

Contractor-Obligated Defects (CODs). Contractor-obligated defects (CODs) are the loss of asphalt or chips, or action simulating the loss of asphalt or chips, due to poor Contractor workmanship and/or materials which diminish the chip seal coat's effectiveness and appearance. Some of the most common CODs are described in the Department's Chip Seal Coat Warranty Guide.

Control Network. An array of control stations established by the Contractor or provided by the Department established by a surveyor.

Control Station. Any item identified in the project records as having an authoritative position or elevation on the project datum and intended to be used to control the phases of the work.

Critical Habitat. Critical habitat (CH) is a term that has special significance and meaning under the Endangered Species Act (ESA). It is a specific geographic area that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery. Critical habitat areas and boundaries are established by regulation and published in the Federal Register, where more specific information on each critical habitat area is included. ESA-listed species and their habitat are protected whether or not they are in an area designated as critical habitat.

Critical Path. The longest path of continuous activities through the project schedule that establishes the scheduled substantial completion date and typically has the least amount of total float.

Cultural Resource. Sites, structures, objects, or districts significant in history, architecture, archeology, or culture that is on or eligible for the National Register of Historic Places.

Culverts. A structure under the traveled way with a clear opening of 20 feet or less measured along the roadway centerline.

Delay. An unanticipated deferment of the start, progress, or finish of a scheduled activity.

Department. Idaho Transportation Department acting on behalf of the Board.

Digital Terrain Model (DTM). An electronic computer model of the shape of the natural ground.

Director. The chief administrative officer of the Department, as established by [40-503, Idaho Code](#) and the Director's authorized agents.

Dispute. A disagreement between the Engineer and the Contractor related to interpretation of the contract or the Engineer's decision under the contract, which is not a claim under the contract, and is handled informally between the Engineer and the Contractor.

Dispute Review Board (DRB). A contract-specific board of three neutral individuals selected by the Department and the Contractor to help in the administrative resolution process at the Resident Engineer level.

Engineer. The District Engineer of the Department acting directly or through the Resident Engineer and is an authorized representative of the Department having general supervision over construction and maintenance work in one of the several districts of the Department. The district boundaries are on file in the office of the Department.

Equipment. Machinery, tools, apparatus, and supplies necessary for upkeep, maintenance, proper construction, and acceptable completion of the work.

Erodible Material or Surface. Exposed earthen material, except solid rock, that may be carried or displaced by wind, rainfall, snowmelt, or mechanically applied water.

Extra Work. Work not provided for in the contract as awarded, but found essential for satisfactory completion of the contract within its intended scope, as determined by the Engineer.

Float (Total Float). The total number of days in the project schedule that a scheduled activity can be delayed and still achieve substantial completion within the contract time.

Force Account. A payment method for work performed by the Contractor.

Grade Verification Points. Random survey points measured in the field to verify that a constructed grade has been built according to the line and grade of the design.

Highway. A public way for vehicular travel, including the entire area within the right of way.

Holidays. In the state of Idaho, the recognized holidays are: New Year's Day, Martin Luther King Jr./Idaho Human Rights Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, and Christmas or on a day proclaimed as a holiday by legal authority.

Incidental. Work necessary to fulfill the contract that is not measured or paid for separately.

Independent Assurance (IA). An unbiased and independent evaluation of sampling and testing procedures.

Inspector. The Engineer's authorized representative assigned to inspect work and materials.

Laboratory. A laboratory used for materials sampling and testing qualified through appropriate programs as determined by the Department. An independent laboratory is a qualified laboratory not owned or controlled by the Department or the Contractor.

Limited Chip Seal Coat Warranty Acceptance. The Engineer's written acknowledgement the chip seal coat appears to have been satisfactorily constructed, including excess chips have been removed, and the warranty period can begin.

Lost Day of Work. When work on critical activities cannot proceed for at least 5 hours per day, as determined by the Engineer.

Lot. A specified material quantity from a single source or a measured construction quantity assumed to be produced by the same process.

Materials. A substance or product specified for incorporation in the work.

Manufacturer. A firm that operates or maintains a factory or establishment that produces, on premises, materials, supplies, articles, or equipment for use in the work.

Neat Line. The line established on the plans that designate the location, shape, and border to which work is to be built or formed.

Noncontractor-Obligated Defects (NCODs). Noncontractor-obligated defects (NCODs) are damage to the chip seal coat beyond the control of the Contractor as described in the Department's Chip Seal Coat Warranty Guide.

Nonexcusable Delay. Delays in the work that are the Contractor's fault or responsibility.

Notice of Letting. A public notification of the Department's intent to receive proposals and award a contract for construction. The notice of letting contains information regarding the receipt and opening of proposals.

Notification of Award. Written notice to the Contractor to begin the work.

Overburden. Surface soil or granular material which may or may not be suitable for construction purposes, and which overlays other material suitable for road or bridge construction.

Pavement Structure. The structure constructed on the roadbed and typically includes pavement surfacing, base courses, and granular subbase.

Pay Item. See Contract Pay Item.

Payment Bond. See Contract Bonds.

Performance (or Warranty) Bond. See Contract Bonds.

Plastic Pipe. Acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (ribbed or solid), corrugated polyethylene (Type S), polypropylene (double wall or triple wall), or steel reinforced ribbed polyethylene.

Plan Quantity. The quantity listed on the bid schedule paid for as specified in 109.01.B.

Plans. Approved drawings or approved drawing reproductions included in the contract, showing the location, type, dimensions, and details of the work.

Professional Engineer. An engineer licensed in accordance with [54-1215, Idaho Code](#) to practice the profession of engineering in the state of Idaho.

Project (Project Site). The highway section or the area on the plans where the work is to be performed. For contracts where Davis-Bacon Wages apply, the project site also includes the physical place or places where the work called for in the contract will remain and any other site where a significant portion of the work is constructed, provided the project site is established specifically for the performance of the contract and it is within one mile of the project limits. Job headquarters, tool yards, batch plants, borrow pits, etc., are part of the project site of work provided they are dedicated exclusively, or nearly so, to performance of the contract and they are within 1 mile of the project site. Not included in the project site are the Contractor's or the subcontractor's permanent home offices, branch plant establishments, fabrication

plants, tool yards, etc., whose location and continuance in operation are determined wholly without regard to a particular contract. In addition, commercial or material supplier fabrication plants, batch plants, borrow pits, job headquarters, tool yards, etc., which were established before bid advertisement and not on the project site, are not included in the project site. Such permanent, previously established facilities are not part of the project site, even where the operations for a period of time may be dedicated exclusively, or nearly so, to the performance of a contract.

Prompt Payment. When the Contractor pays each subcontractor or supplier by the 20th day after receiving payment from the Department.

Proposal. A bidder's written offer to perform the work.

Proposal Forms. The forms and information provided by the Department to prospective bidders to use in composing a proposal.

Proposal Guaranty. The required security (e.g., bid bond) submitted with the proposal to ensure execution of the contract.

Quality Analysis (QA). Evaluation performed to determine percent of material within limits and to assign a corresponding pay factor.

Quality Assurance Program (QAP). The planned and systematic actions necessary to provide adequate confidence a product or service will satisfy contract requirements for quality assurance program and includes quality control, independent assurance, verification testing, and acceptance testing.

Quality Control (QC). The activities to make sure a product meets contract requirements. Activities may include materials handling and construction procedures, calibration and maintenance of equipment, production process control, sampling, testing, and inspection.

Quality Level Analysis. A mathematical procedure that provides an estimate of the percentage of a lot that is within the specification limits (i.e., percent within limits).

Quick-Set Emulsion. An emulsion used for microsurfacing designed to allow acceptance of rolling traffic on a 1/2 inch-thick surface placed at 75 °F and 50 percent humidity within an optimal time of 1 hour.

Random Sample. A sample selected where every element of the population has an equally likely opportunity to be included.

Recreational Resource. A publicly owned site used solely for recreational purposes.

Recycled Asphalt Pavement (RAP). Salvaged, milled, pulverized, broken, or crushed bituminous material that may have minor coatings of dust or aggregate particles with no discernable seams, pockets, or amounts of base, soil, or deleterious material.

Record Drawings. A revised set of drawings submitted by the Contractor, upon completion of the work, showing all changes from the plans in the permanent work on the project site by the Contractor, any subcontractor, any utility companies, or municipal, local, county, state, or federal agencies completed from the time of contract award until substantial completion, including final quantities, and will include all revisions to the contract design made during the construction phase. Also known as as-constructed or as-built drawings or simply, as-builts.

Reference Stakes. Stakes set away from, but with information relating back to, the intended location and grade.

Regular Dealer. A firm that owns, operates, or maintains a store, warehouse, or other facility that supplies materials, articles, or equipment for purchase or lease, and regularly stocks, sells, and leases to the public during the usual course of business.

Regulatory Floodway. The channel of a river or other watercourse and the adjacent land areas, regulated by federal, state, or local requirements, that must be reserved in an open manner (i.e., unconfined or unobstructed) horizontally or vertically, to provide for the discharge of the base flood so the cumulative increase in water surface elevation does not exceed a designated amount.

Resident (Design Construction) Engineer. The authorized Engineer representative.

Responsible Bidder. A bidder that possesses the ability to perform the work and complete the contract.

Right of Way. A general term denoting land, property, or an interest therein acquired for or devoted to highway purposes.

Roadbed. The top of subgrade, on which the pavement structure, curbs, sidewalks, median, and other incidental facilities are constructed.

Roadside. The areas between the outside edges of the shoulders and the right of way boundaries, and areas between the roadways of a divided highway.

Roadway. A portion of the highway for vehicular use, including the shoulders and the portion of the highway within the limits of any construction.

Roadway Prism. The engineered/structural portion of the highway, which includes the pavement structure plus the area between the roadbed shoulders or back of curb, extending downward and outward at the slope of 1.5H:1.0V to the intercept of natural ground, removal limit, or slope of embankment keying benches. Included elements are the roadway pavement structure, embankment fill, foundations for embankment, and soft spot excavation/backfill. Embankment fill outside of the 1.5H:1.0V slope is not considered part of the roadway prism.

Roller Coverage. The rolling of the entire width 1 time, including roller overlap.

Roller Pass. The passing of the roller over an area (roller width) one time.

Run Chart. A plot of data in time sequence.

Shoulder. The portion of the roadway adjacent to the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Significant Change. When the character of the work as altered differs materially in kind or nature from that involved or included in the original proposed plans or work and when a contract pay item is increased in excess of 125 percent or decreased below 75 percent of the original contract quantity. An allowance for an increase in quantity will apply only to the portion in excess of 125 percent of the original contract item quantity, or in case of a decrease below 75 percent, to the actual amount of work performed.

Slope Catch. The location where a design slope intersects the existing natural ground and where excavation or embankment work should begin to provide the intended earthwork.

Slope Staking. The process of using measurements and calculations in the field to determine the slope catch. Slope staking will normally include setting stakes to mark the slope catch and setting a reference stake for every catch stake.

Snug-Tight. Is the tightness reached by a few blows from an impact wrench or the full effort of a person using a 12 inch spud wrench.

Special Provisions. Additions and revisions to the Standard Specifications covering conditions specific to the contract.

Specifications. A general term applied to all written provisions and requirements pertaining to performance of the work.

Specialty item. A contract pay item not chargeable to subcontract percentages if designated on the bid schedule.

Stakes. Stakes, nails, marks, stringlines, or other devices or mechanisms set or established for the purpose of indicating or controlling the location, orientation, or grade of any feature intended for construction or for the purpose of limiting or influencing the work.

Staking. The act of placing stakes.

Standard Drawing. Detailed engineering drawings approved for repetitive use for specific work items.

Standard Specifications. The Department's accumulation of specifications into a book or PDF document and approved by the FHWA.

State. The state of Idaho, acting through an authorized representative.

Statistical Analysis. A method of analyzing inspection test results to determine conformity with the contract.

Structures. Bridges, culverts, headwalls, retaining walls, cribbing, riprap, underdrains, pipelines, buildings, catch basins, manholes, and similar features that may be encountered or constructed in the work.

Subcontractor. The individual, partnership, firm, corporation, or any acceptable combination thereof, with the Department's written approval, which sublets part of the contract.

Subgrade. Materials directly below the pavement structure. The subgrade is natural in-place material (e.g., excavated areas) or compacted fill material (e.g., embankments).

Sublot. The quantity represented by 1 complete test.

Substantial Completion. When the work is to the point the traveling public can safely use the improvements without further delays, disruption, or impediments. For conventional bridge and highway work, substantial completion is when bridge deck, parapet, pavement structure, shoulder, permanent signing and markings, traffic barrier, and safety appurtenance work is complete.

Substructure. A part of the structure below the bridge beam/bearing seats, below the skewbacks of arches, below the top of footings of rigid frames, below the top of caps of trestle bents, or below the top of columns on box girders. Wingwalls and backwalls of abutments are part of the substructure.

Superintendent. The Contractor's authorized representative responsible for and in charge of the work.

Superstructure. A part of the structure not defined as substructure.

Surety. The corporation, firm, partnership, or individual supplying the contract bonds provided by the Contractor.

Survey Marker. Any survey monument, control station, or stake.

Survey Monument. Any physical structure, along with any references or accessories, used to mark the location of a land boundary survey corner, geodetic control point, or local control point. There are many different types of survey monuments (e.g., public and private land corners, highway and interstate monuments, National Geodetic Survey (NGS) horizontal control monuments and benchmarks). Survey monuments may be marked stones, brass or aluminum caps, reinforcing bar with or without metal or plastic caps, and various other installations or combinations intended to mark locations (e.g., public and private land corners, control points, benchmarks).

Surveyor. The individual designated by the Contractor and licensed in the state of Idaho as a professional land surveyor (PLS) and placed in responsible charge of the survey work as defined in [54-1202\(12\), Idaho Code](#).

Temporary Benchmark (TBM). A control station established for the purpose of providing authoritative vertical control for the work. A TBM may or may not have an established horizontal position.

Topsoil. Surface soil suitable for seed germination and the support of vegetative growth.

Traffic Control Device. Signs, signals, markings, and devices placed on, over, or adjacent to a street or highway by authority of a public body or official with jurisdiction to regulate, warn, or guide traffic.

Traffic Lane. The traveled way portion for the movement of a single line of vehicles.

Traveled Way. The right of way portion for the movement of vehicles, excluding shoulders.

Truck Volume. The truck volume created by the 3 inside dimensions of a truck box with the length and width confined by the physical limits of the truck box and the height measured from the truck box floor to the top of the shortest side.

Verification Testing. The sampling and testing carried out independent of acceptance sampling and testing to verify the Contractor's results.

Wetland. Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Work. The construction activity including the labor, materials, equipment, and other incidentals necessary for project completion as required by the contract and the carrying out of the duties and obligations imposed by the contract. The terms include buildings, structures, and improvements of all types (e.g., bridges, highways, parkways, streets, sewers, mains, pumping stations, railways, drilling, blasting, excavating, clearing, landscaping). The manufacture or furnishing of materials, articles, supplies or equipment (whether or not a federal or state agency acquires title to such materials, articles, supplies, or equipment during the course of the manufacture or furnishing, or owns the materials from which they are manufactured or furnished) is not work.

Working Day. All calendar days, except the following:

1. Saturdays, Sundays, holidays, July 3, and July 5.
2. For work on the critical path, days of Engineer ordered suspensions for reasons other than Contractor negligence or noncompliance.
3. Contract-identified, nonworking days.
4. Days during December, January, and February.
5. Days where one or more of the following prevent the Contractor from working on critical path items with normal production rates for at least 5 hours:
 - a. Earthquakes and other natural cataclysmic phenomena the Contractor cannot foresee or avoid.
 - b. Weather conditions.
 - c. Job conditions caused by weather.
 - d. During excusable delays as specified in 108.07.B and 108.07.D.

SECTION 102 – BIDDING REQUIREMENTS AND CONDITIONS

102.01 Contents of Proposal Forms.

The Department will provide proposal forms to a bidder through the QuestCDN.com website for purchase. Bidders must appear on the plan holders list for their proposal to be accepted by the Department. The proposal forms will include the following:

1. The proposed project location and description.
2. A schedule of items with an estimated quantity for each.
3. The proposed project contract time.
4. The proposal guaranty amount.
5. The bid opening date, time, and location.
6. Special provisions.
7. Requirements not contained in the Standard Specifications.

Documents bound with or attached to the proposal forms are a part of the proposal forms. The plans, specifications, and other documents referenced in the proposal forms are a part of the proposal form, whether attached or not, and do not need to be submitted with the proposal. Do not detach or alter bound or attached documents from the proposal forms when submitting the proposal.

Pay the amount stated in the notice of letting required for downloading of the proposal forms and the plans using the QuestCDN.com website.

102.02 Interpretation of Quantities in Bid Schedule.

The quantities provided in the bid schedule are approximate and are used to compare proposals. The Department may change these quantities or eliminate contract pay items as specified in 104.02. The Department will only pay for accepted work quantities as specified in 109.

102.03 Examination of Plans, Specifications, and Project Site.

Carefully examine the proposed contract, project site, plans, and the proposal forms before preparing and submitting a proposal. If a bidder chooses to not perform project site investigations and the Department awards the contract to that bidder, the bidder will be responsible for onsite project conditions that would have been discovered had the bidder performed a reasonable onsite project investigation. A reasonable project investigation includes investigating the project site, borrow sites, hauling routes, and other locations related to the performance of the work. A reasonable onsite project investigation also includes inspection of these documents. Department-provided information is for the bidder's general knowledge only and is not a substitute for the bidder's own reasonable investigation, interpretation, or judgment.

On request, the Department will provide electronic design data to the bidder. The electronic design data is provided for the bidder's convenience and information, and will not become part of the contract. The Department does not guarantee or warranty the electronic design data provided to the bidder, is compatible with any of the systems used by the bidder, is complete, is representative of actual conditions at the project site, or accurately reflects the quantities and character of the actual work required. Providing electronic design data does not relieve the bidder from risks or of duty to make onsite project examinations and investigations, or other responsibilities.

Immediately notify the Department of errors or omissions on the plans and proposal forms or inconsistencies between these documents and the project site. If the Department performed borings and subsurface investigations at the project site or other areas (e.g., possible material sources), the Department obtained and used these records

for study, estimating, and design purposes only; they may not necessarily reflect the actual subsurface conditions existing at the project site.

A submitted proposal is *prima facie* evidence the bidder understands and is satisfied with the conditions of the project site, plans, and proposal forms.

The Department does not consider written or oral explanations, instructions, and interpretations provided before contract award as binding, unless confirmed by addenda. It is the Department's intent to provide bidders an equal opportunity to access and acquire information to formulate a responsive proposal. If the Department discovers information, specifications, plans, data, or interpretations important for the bidding process to be deficient, the Department will provide this data to bidders as addenda. Bidders must acknowledge receipt of addenda.

102.04 Preparation of a Proposal.

Complete purchase proposal forms as described in 102.01. Submit an electronic or hard-copy proposal on the Department-provided forms. Submit hard-copy proposals that are typed or handwritten in ink. Provide a numeric unit price for each contract pay item on the bid schedule. Multiply each unit price by the corresponding contract pay item quantity and provide the numeric product in the amount bid column. Add the numeric products of the contract pay items and provide a numeric total bid amount at the bottom of the same column. If discrepancies exist between the unit prices and the products or total bid amount, the Department will use the unit prices and calculate a corrected total bid amount.

The Department accepts bids in electronic (E-bid using BidX.com and Expedite software) or hard-copy formats.

Addenda are uploaded to the QuestCDN.com software and plan holders are then notified to download the addenda. Acknowledgement of each addendum must be included with the submittal of the proposal.

The "No Bidding Errors" statement in electronic bidding program's output, in the bid summary, is only a verification of an entry made in provided E-bid fields. It does not mean the information provided is correct, acceptable, or complies with requirements or specifications.

Based on the bidder organization type, the Department requires the following on the submitted proposal:

1. Ink signatures or electronic digital identification for the following individuals, based on the bidder's organization:
 - a. The owner of a sole proprietorship.
 - b. At least 1 member of a partnership.
 - c. At least 1 member or officer from each firm representing a joint venture.
 - d. At least 1 officer of a corporation.
 - e. An agent of the bidder, legally qualified and accepted by the Department.
2. Name and business address of the following, based on the bidder's organization:
 - a. The owner of a sole proprietorship.
 - b. Each member of a partnership.
 - c. Each member or officer of the firms representing a joint venture.
 - d. The corporation and its corporate officials.

If the contract includes mechanical or electrical work (e.g., plumbing, heating, air conditioning, electrical), include the names, addresses, public works contractor license number, and contract or subcontract amount of work.

102.05 Conditional Proposals.

If a bidder wants to bid on more than 1 proposal at a single bid opening and wants protection from the Department awarding the bidder more contracts than it can successfully perform, the bidder may submit bid proposals for a number of proposals by signing and attaching the following statement to 1 or more of the hard-copy bid proposals:

This proposal is conditioned on my/our receiving the award for only (insert number) of the contracts for which I/we have submitted proposals at this bid opening. If proposals for a greater number of contracts than specified are accepted, then this proposal will be considered withdrawn.

A bidder may also condition, as above, to bids submitted in subsequent bid openings, if the Department has not made a determination of intent to award the prior project(s). The written condition for hard-copy bid proposals must include:

This proposal is conditioned on my/our receiving the award for only (insert number) of contracts for which I/we have submitted proposals at this bid opening or for proposals submitted at previous bid openings for which the Department has not made a determination of intent to award. If proposals for a greater number of contracts than specified are accepted, then this proposal will be considered withdrawn.

For either conditional proposal above, electronic bids require a completed Conditional Withdrawal form in the EBS file.

If a bidder submits conditional bid proposals and becomes the apparent low bidder on more than 1 conditional bid proposal, the Board will choose which contracts to award to that bidder.

102.06 Proposal Guaranty.

Provide a proposal guaranty of the type, and at least in the amount, stated in the proposal forms.

If using a surety bond, submit the bond on an acceptable form signed by the surety. Include a power of attorney for the person who executes the bond on behalf of the surety as attorney-in-fact.

102.07 Delivery of a Proposal.

Submit a complete proposal on the Department's proposal forms described in 102.01 and prepared as specified in 102.04. Submit the proposal electronically or in a sealed envelope marked on the outside with bid enclosed, proposal name, and key number, addressed to the Department in the care of Contracting Services. Submit before the bid opening date and time and to the location stated in the notice of letting. Submittals received after the bid opening date and time will be returned to the bidder unopened.

102.08 Withdrawal or Revision of a Proposal.

To withdraw or revise a proposal, submit a written request before the date and time set for the bid opening.

102.09 Public Opening of Proposals.

The Department will publicly open and read proposals on the date, time, and place stated in the notice of letting.

102.10 Irregular Proposals.

The Department will consider a proposal to be irregular and may reject it for the following reasons:

1. Submitting the proposal in pencil.
2. Not signing the proposal.

3. Submitting the proposal on proposal forms not purchased from the Department. Electronic submittals must represent the purchased proposal forms.
4. Altering or detaching part of the proposal forms as provided by the Department.
5. Submitting the proposal with unauthorized additions, conditional or alternate bids, addenda omissions, or irregularities that might make the proposal incomplete, indefinite, or ambiguous.
6. Adding provisions to the proposal reserving the right to accept or reject an award or to enter into a contract, except as specified in 102.05.
7. Submitting the proposal without a proposal guaranty (bid bond).
8. Submitting the proposal without a unit price for each contract pay item on the bid schedule, except for alternate contract pay items as specified in 102.04.
9. Not listing an electrical subcontractor when required by the Department and in accordance with [67-2310, Idaho Code](#).
10. Not acknowledging the number of addenda issued by the Department, if applicable.
11. Not completing the ITD DBE Acknowledgement form in the bid submittal for federally-funded projects.
12. Not submitting a completed [ITD-2396](#) DBE Commitments form and supporting documentation within the time allowed on federally-funded projects.
13. Not completing state-funded contract acknowledgement form in the bid submittal for state-funded projects.

102.11 Disqualification of Bidders.

The Department may disqualify a bidder and reject the bidder's proposals for the following reasons:

1. A bidder submits multiple bid proposals for the same proposal, under the same or a different name.
2. The Department finds evidence of collusion among bidders.

The Department will not allow a bidder that participated in collusion to bid future work until the Department reinstates the bidder.

102.12 Protesting a Proposal.

To protest a proposal or the waiver of an irregularity in a proposal, submit a written protest to the Chief Engineer within 5 calendar days after notification of irregularity.

102.13 Licensing of Bidders.

For contracts that include federal-aid funding, bidders and subcontractors that are required to be listed in the proposal will possess the appropriate license as specified in 107.03 before the Department awards the contract.

For contracts without federal-aid funding, bidders will possess the appropriate license as specified in 107.03 before submitting a proposal, and if the proposal forms require bidders to list subcontractors, the subcontractor will possess the appropriate license as specified in 107.03 and as stated in 102.04 before the bidder submits a bid proposal.

102.14 Tied Bids.

If 2 bids tie, a drawing will be conducted to determine the low apparent bidder. The award may be made by drawing lots or tossing of a coin in the presence of a witness in accordance with [IDAPA 38.05.01.082](#).

SECTION 103 – AWARD AND EXECUTION OF CONTRACT

103.01 Consideration of Proposals.

After the bid opening, the Department will post the total proposal amount for each bid received to the Department's website no later than 5pm the next business day.

After each bid opening, bid proposals will be reviewed to ensure the necessary requirements have been met (e.g., valid public works license, electrical contractor) no later than 5pm the next business day. The Contractor will be notified if their bid proposal was deemed irregular as specified in 102.10 and for what specific reason(s). The Department's website will be updated showing the bid proposal being marked only as irregular.

The Department will then review all proposals received on federal-aid projects for DBE commitment compliance. If a proposal fails to meet the DBE requirements, the proposal will be deemed irregular. The apparent low bidder will be notified if their proposal was deemed irregular as specified in 102.10 and for what specific reason(s). The Department's website will be updated showing the proposal was deemed irregular.

Once contracts have been distributed to the apparent low bidder with a letter of intent, the Department will post the bid abstracts (i.e., the dollar amount bid per bid item) to the Department's webpage. For proposals with only one bidder, the bid abstracts are not posted to the Department's website.

The Department may take the following actions if the Department determines the action is in its best interest:

1. Award the contract.
2. Reject proposals.
3. Waive technicalities in proposals.
4. Advertise for new proposals.
5. Proceed to do the work by other means.

A. Release of Bid Abstracts. The Department will post bid comparison results (i.e., bid abstracts) to the Department's website for projects with more than one bidder after contracts have been distributed to the apparent low bidder for execution.

103.02 Award of Contract.

The contract will be awarded to the lowest responsible bidder within 45 calendar days after the bid opening.

The Department and the lowest responsible bidder may mutually agree, in writing, to defer the award beyond 45 calendar days.

A. Federal-Aid Contracts. For contracts that include federal-aid funding, the 45-day period may be extended for a reasonable time for the lowest responsible bidder to secure a license, provided license application is filed with the Public Works Contractors License Board within 1 business day following receipt of the notice of intent to award letter.

If either of the following conditions precludes award, the Department will release the lowest responsible bidder's proposal guaranty:

1. Public Works Contractors License Board denies the bidder's application.
2. The Department determines it is not in the public interest to defer construction pending licensing.

If the lowest responsible bidder does not submit the license application on or before the first business day following receipt of the notice of intent to award letter or if the lowest responsible bidder withdraws the application, the bidder forfeits the proposal guaranty the same as if the bidder does not execute a contract.

B. Release of Engineer's Estimate. The Engineer's will be released only upon contract execution and posted to the Department's website.

103.03 Return of Surety Proposal Bond.

After the Department opens and compares the proposals, the Department will immediately return proposal guaranty received in the form of a certified or cashier's check to the bidders, except for the 2 lowest responsible bidders. The Department will return the surety proposal bonds received in the form of a certified or cashier's check to the unsuccessful of the 2 lowest responsible bidders within 10 business days after the contract notice of intent has been sent. The Department will return the proposal guaranty received in the form of a certified or cashier's check of the successful bidder after the successful bidder submits the required contract bonds and signed contract.

103.04 Contract Bonds.

As the lowest responsible bidder, provide a performance bond and a payment bond, each equal to the original contract amount, as specified in [54-19, Idaho Code](#). Execute the contract bonds on the Department-provided forms.

The Department will release the performance bond within 45 calendar days after final contract acceptance. The Department will subtract monies owed as a result of this contract from the obligations. For settlement of claims, the Department will hold obligations deposited as the payment bond for one year from the last day labor, equipment, or material was provided by the Contractor or from the final payment date to the subcontractors in accordance with [54-1927, Idaho Code](#).

103.05 Execution and Approval of Contract.

Sign and return the contract with the contract bonds within 15 calendar days after contract receipt. If the Department does not execute the contract within 15 calendar days after the Department's receipt of the signed contract and bonds, the bidder may withdraw the proposal without penalty. The contract will not be effective until fully executed.

103.06 Failure to Execute Contract.

If the bidder does not perform the following within 15 calendar days after contract receipt, the Department may cancel the contract award and keep the proposal guaranty as liquidation of damage:

1. Execute the contract.
2. File the contract bonds.

The Department may choose to proceed, award the contract to the next lowest responsible bidder, or advertise for new proposals.

SECTION 104 – SCOPE OF WORK

104.01 Intent of Contract.

The contract intent is to define the scope of work and identify the rights and obligations of the Department and the Contractor for the construction, execution, and completion of the work. Perform the work as required by the contract.

104.02 Contract Revisions.

A. General.

The Engineer and the Contractor will provide the appropriate contract revision notices as specified in 104.03.

On receiving the Engineer's written authorization or change order, proceed immediately with the revised work. The Department and the Contractor are responsible for mitigating contract revision cost and time impacts.

The Engineer will calculate the contract revision time and cost impacts as specified in 108.07 and 109.03, respectively.

If the Engineer issues a change order revising the contract, return the change order signed or unsigned to the Engineer within 5 business days after receipt. If returning an unsigned change order to the Engineer, include a written explanation for not signing. The Department may withhold payment for the change order work until the Contractor submits a signed change order or unsigned change order with a written explanation.

1. Engineer Initiated.

The Engineer may make changes in quantities and alterations in the work as are necessary to satisfactorily complete the project. The Contractor agrees to perform the work as altered without invalidating the contract or releasing the surety. An alteration in the work includes extra work which is not otherwise required by the contract.

2. Contractor Requested.

If the Contractor requests a contract revision, the Contractor will notify the Engineer using the Department's request for change form. Provide a detailed description of the change, the reason for the change, the benefit to the Department, the benefit to the Contractor, and a detailed cost analysis.

The Engineer will review the request and respond as follows:

- a. If the Engineer approves the request, the Engineer will issue a change order revising the contract.
- b. If the Engineer does not approve the request, the Engineer will provide a written response as specified in 104.03.

B. Extra Work.

When necessary or desirable to complete the contract, the Engineer may direct the Contractor to perform extra work. The Department will pay for extra work as specified in 109.03. The Engineer will determine time extensions, if warranted, as specified in 108.07.

The Engineer will provide direction to the Contractor as specified in 104.03.

C. Differing Site Conditions.

During the progress of the work, if subsurface or latent physical conditions are encountered at the project site differing materially from those indicated in the contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract, are encountered at the project site, the party discovering such conditions will promptly notify the

other party in writing of the specific differing conditions before the site is disturbed and before the affected work is performed.

On written notification, the Engineer will investigate the conditions, and if it is determined the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of work under the contract, an adjustment, excluding anticipated profits, will be made and the contract modified in writing accordingly. The Engineer will notify the Contractor of the determination whether or not a contract adjustment is warranted.

A contract adjustment which results in a benefit to the Contractor will not be allowed, unless the Contractor has provided the required written notice.

D. Suspensions of Work Ordered by the Engineer.

If the performance of work is suspended or delayed by the Engineer in writing for an unreasonable period of time (i.e., not originally anticipated, customary, or inherent to the construction industry) and the Contractor believes additional pay and/or contract time are due as a result of such suspension or delay, the Contractor will submit in writing a request for an adjustment within 7 calendar days of receipt of the notice to resume work. The request will set forth the reasons and support for the adjustment.

On receipt, the Engineer will evaluate the Contractor's request. If the Engineer agrees that the cost and/or time are required for contract performance has increased as a result of the suspension and the suspension was caused by conditions beyond the control of and not the fault of the Contractor, its suppliers, or its subcontractors at any approved tier and not caused by weather, the Engineer will make an adjustment, excluding profit, and modify the contract in writing accordingly. The Contractor will be notified of the Engineer's determination whether or not a contract adjustment is warranted.

A contract adjustment will not be allowed, unless the Contractor has submitted the request for adjustment within the time prescribed.

A contract adjustment will not be allowed under this clause to the extent that work performance would have been suspended or delayed by other causes or for which an adjustment is provided or excluded under other contract terms or conditions.

E. Significant Changes in the Character of the Work.

If the alterations or changes in quantities significantly change the character of the work under the contract, whether the alterations or changes are in themselves significant changes to the character of the work or by affecting other work, cause the other work to become significantly different in character, an adjustment, excluding anticipated profit, will be made to the contract. The basis for the adjustment will be agreed on before the work begins. If a basis cannot be agreed upon, an adjustment will be made for or against the Contractor in an amount the Engineer determines to be fair.

If the alterations or quantity changes do not significantly change the character of the work to be performed under the contract, the altered work will be paid for as provided elsewhere in the contract.

If the Engineer determines alterations or changes in quantities significantly change the character of the work, the Engineer will issue a change order revising the contract as specified in 104.02.A.

If the Engineer determines the alteration, or change in quantity, is not a significant change to the character of work, and the Contractor disagrees, follow the notification procedures as specified in 104.03.

If the alteration, or change in quantity, does not significantly change the character of the work, the Department will pay for the altered work at the contract unit price.

F. Eliminated Contract Pay Items.

The Engineer may eliminate a contract pay item determined to be unnecessary to complete the work. Eliminating a contract pay item will not invalidate the contract. The Contractor, when notified of the elimination, will be reimbursed for the direct costs incurred before notification of elimination.

104.03 Notification of Contract Revision.

A. General.

The step-by-step notification and documentation process to speed up the resolution of contract revisions is defined in 104.03. The responsibilities of the Department and the Contractor are outlined.

The Contractor's noncompliance with the notification requirements of this subsection may constitute a waiver of entitlement to a pay adjustment under 109.03 or a time extension under 108.07. Entitlement is waived if the Engineer is not afforded the opportunity by the Contractor to examine the project or is not afforded the opportunity to review the Contractor's records.

1. Engineer's Notification.

a. Engineer's Notification and Request for Proposal.

The Engineer will notify the Contractor of a contract revision, identify the scope of the revised work, and request a detailed cost and time proposal for the revised work. The request will specify a time requirement for the Contractor's response.

b. Contractor's Proposal.

Provide the Engineer with a complete and itemized proposal within the time specified in the request at no additional cost to the Department, and include the following information:

- (1) The estimated increase or decrease in the contract amount.
- (2) The estimated increase or decrease in the contract time.
- (3) Other perceived adjustments necessary to complete the work.

c. Engineer's Direction.

The Engineer may issue a change order to the Contractor as specified in 104.02.A. If the Contractor disagrees with the Engineer's decision, the Contractor may pursue a claim as specified in 105.16.

d. Contractor's Initial Written Notification.

If required by 104.02 or 108.07, or if the Contractor believes the Department's action, the Department's inaction, or some other situation has caused a contract revision, the Contractor must immediately provide initial written notification. On notification, the Engineer will investigate the issue.

The Contractor is encouraged to provide additional information requested as early as possible to help the Engineer in the prompt resolution of the issue. The Engineer will not require, in subsequent submissions, duplication of information already provided.

e. Engineer's Response to the Contractor's Notification.

Within 10 business days after receiving the Contractor's notification, the Engineer will provide a written response to the Contractor with one or more of the following responses:

- (1) If the Engineer determines that a contract revision exists, the Engineer will issue a change order as specified in 104.02.A.

- (2) If the Engineer determines that a contract revision does not exist, the Engineer will provide the Contractor with a statement as to why the issue does not necessitate a contract revision.
- (3) If the Engineer needs more information to make a determination, the Engineer will request the information and specify a due date.

If the Engineer does not provide a response or when the Contractor believes the Engineer has no further basis to request additional information as specified in 104.03.A.2.a, or disagrees with the Engineer's decision, the Contractor may pursue the claim as specified in 105.16.

104.04 Value Engineering Change Proposals (VECP).

To reduce construction cost without impairing the project functions or characteristics, the Contractor may submit proposals to modify the plans, specifications, or contract. The Engineer will not consider a VECP that changes the following:

1. Basic design or components of elevated structures.
2. Type, size, elevation, or structural requirements of foundations.
3. The types, thickness, or joint designs of a concrete, bituminous, or stabilized surface or base course.
4. Environmental mitigation commitments.

The Department and the Contractor will equally share cost savings as a result of a Department-approved VECP.

The Department will pay for a VECP through the change order process as specified in 104.02 and the payment will be considered as full consideration for performance of the change order work.

Do not base prices in a bid proposal on an anticipated VECP approval.

The Engineer will determine the acceptability of a VECP and the estimated net savings in construction cost. If the Engineer believes the contract unit prices do not represent the work, the Engineer may use other calculated costs (e.g., fair market value) for determining the estimated net savings. The Department will assume no liability in considering a VECP, including delays and VECP refusals.

A. Submittal and Review of VECP Concept or Idea.

To illustrate the VECP, submit the preliminary plans, specifications, and costs. Show whether sufficient time is available in the project schedule for a formal submittal and review before VECP implementation.

The savings generated by the VECP must be sufficient to warrant a VECP review and processing.

The Engineer will review the VECP concept or idea and will reject or approve the VECP concept or idea within 10 calendar days of the initial submittal. If the Engineer approves the VECP concept or idea, the Engineer will provide the Contractor with written authorization to submit a formal VECP.

The Engineer may evaluate the need for a contract time extension based on the additional time needed for the Engineer's review and the expected impact on the Contractor's schedule.

B. Formal Submittal of the VECP.

The Engineer will only consider a formal VECP after approval of the initial submittal as specified in 104.04.A. Submit a formal VECP within 30 calendar days after written authorization and include the following:

1. A statement the final proposal is submitted as a VECP.
2. A description of the difference between the existing contract and the proposed change.

3. The advantages and disadvantages of each difference, including effects on service life, economy of operations, ease of maintenance, benefits to the traveling public, desired appearance, and safety.
4. A complete set of plans and specifications that show the proposed revisions relative to the original contract features and requirements, including design calculations supporting the revision.
5. A complete cost analysis indicating the original estimated costs and quantities proposed to be replaced compared to the new costs and quantities in the VECP.
6. A schedule or date for the Engineer to issue a change order to maximize cost reduction during the remainder of the contract and the reason for this schedule.
7. A statement detailing the impact of the VECP on final project completion.
8. A revised CPM schedule showing changes to the construction schedule resulting from the VECP.
9. A description of the conditions and results of previous use of the VECP.
10. If the proposal was previously submitted, provide the date, ITD contract number, and the action taken by the Department.

C. Conditions.

A Contractor submitted VECP only applies to the contract referenced. When submitted, the VECP will become the Department's property. The Department may duplicate and disclose data, unless the Contractor specifically restricts the use of certain portions of the VECP. This provision is intended to protect trade secrets, bidding and pricing methods, and rights provided by law with respect to patented designs, materials, or processes.

The Department will not consider requests for additional costs or delays resulting from a VECP rejection.

The Department will not consider a submittal as a VECP if savings are the sole result of the elimination or reduction of a single contract pay item. The Department will consider the VECP if savings result from the elimination or reduction in quantity of a contract pay item specified as part of a VECP.

If specified as individual contract pay items, the Department may consider contingency items when reduced as part of a VECP to change the scope, method, or procedure.

D. Acceptance, Rejection, and Payment.

After the Contractor formally submits the complete VECP, the Engineer will accept or reject the VECP within 30 calendar days.

The Engineer will issue a change order that pays the Contractor 50 percent of the net savings amount. The Engineer will calculate the net savings amount by using the difference between the cost of the proposed changes to the work and the cost of the work as required by the contract, using contract unit prices or other calculated costs.

The Department will not reimburse the Contractor for the development, design, and implementation of the VECP. The Department's estimated cost to evaluate, review, and implement the VECP will not be included in the calculation of net savings.

The Engineer will calculate the incentive payment using the following equation:

$$S = (A-B)/2$$

Where:

S = Share in quantifiable cost savings from the VECP.

A = Cost of the work as required by the contract.

B = Cost of the work as revised by the VECP.

SECTION 105 – CONTROL OF WORK

105.01 Authority of the Engineer and Suspension of Work.

The Engineer decides questions regarding the quantity, quality, acceptability of materials provided and work performed, work progress, contract interpretation, and acceptable contract fulfillment.

The Engineer may order the Contractor in writing to suspend, delay, or interrupt the work for a condition or reason considered to be in the Department's best interest.

The Engineer may also suspend the work, wholly or in part for the Contractor's failure to:

1. Correct conditions unsafe for project personnel or the public.
2. Complete contract provisions.
3. Comply with the Engineer's direction.

During periods of suspensions, perform the following tasks:

1. Maintain traffic.
2. Prevent damage to the project.
3. Provide normal drainage.
4. Protect erodible surfaces using approved erosion and sediment control measures.
5. Prevent water pollution.
6. Prevent damage by sedimentary deposits.
7. Erect temporary facilities as directed.
8. Maintain and protect the condition of newly planted living material.

If a suspension increases the cost and/or time required to perform the work, the Engineer will determine the responsibility for and impacts of the suspension as specified in 104.02.D.

105.02 Plans and Working Drawings.

The Engineer will provide the Contractor with electronic plans and proposal sets.

The plans show structures, detail and roadway lines, grades, and typical cross-sections. The plans also show structure design and location and a schedule of items. Supplement the plans with working drawings to adequately control the work. Working drawings include shop and erection drawings, associated trade literature, calculations, schedules, manuals, and similar documents to detail required work. Keep 1 plan set, including approved working drawings, available at the project site.

Submit working drawings, including demolition plans, in PDF format. Include on each drawing and calculation sheet the project name as shown on the plans, district, county, route, bridge drawing number, contract number, contract drawing number, and key number. Obtain working drawing approval before starting work represented on the working drawings. Working drawing approval does not waive or relieve the Contractor's responsibility for working drawing accuracy, including details and dimensions.

For structures, submit working drawings in PDF format that include the following:

1. Stress sheets.
2. Shop drawings.
3. Erection plans.

4. Cofferdam plans.
5. Bending diagrams for reinforcing steel.
6. Demolition plans.
7. Other supplementary plans or similar data, if required.

For structures, the Engineer will require up to 30 calendar days from each submittal or resubmittal receipt for review and response to the Contractor. For other submittals and resubmittals, the Engineer will require up to 10 business days.

Working drawing costs are included in the contract unit prices of the contract pay items covering the work reflected in the working drawings.

Before project completion, submit record drawings in PDF format for any permanent part of the completed structure, as specified in 677.

105.03 Conformity with Plans and Specifications.

Perform work and provide materials to meet the contract. If the Engineer determines the Contractor did not perform the work or provide materials as specified, the Engineer will decide on the acceptability of the work.

If the Engineer accepts the work, the Engineer will document the basis of acceptance and adjust the contract price accordingly. The Engineer will use the schedule of price adjustments in the Department's [Laboratory Operations Manual](#) for materials not meeting the specifications and when allowed to stay in place.

If the Engineer does not accept the work, the Engineer will direct removal and replacement or repair of the work or materials as specified in 105.12.

105.04 Coordination of Contract Documents.

The specifications, plans, special provisions, and supplementary documents are all essential parts of the contract.

In case of discrepancy between contract documents:

1. Calculated dimensions govern over scaled dimensions.
2. Plan sheets govern over Standard Specifications and standard drawings.
3. Plan details govern over general notes.
4. Special provisions govern over Standard Specifications and plans.
5. Details on the bid schedule govern over other contract documents.

Do not take advantage of errors or omissions in the contract documents. Immediately notify the Engineer of an apparent error or omission encountered in the contract documents. The Engineer will determine if an error or omission exists, interpret and correct the error or omission to fulfill the intent of the contract documents, and determine if a contract revision is required as a result of the error or omission as specified in 104.02.

105.05 Administrative Cooperation.

Give the attention necessary to promote work progress and cooperate with the Department inspectors and other contractors.

Provide a superintendent to serve as the Contractor's representative, who is capable of reading and understanding the contract documents, and have experience in the type of work being performed. The superintendent will cooperate and communicate with, and receive directions and instructions from the Engineer.

Delegate authority to the superintendent to immediately execute the Engineer's directions and instructions and to supply materials, equipment, tools, labor, and incidentals necessary to perform the work.

105.06 Cooperation Between Contractors.

Other work may be ongoing on or near the work covered by the contract. Cooperate with other contractors that are working within or adjacent to the project site.

Do not interfere with or hinder work being performed by other contractors. Perform the work and place materials to avoid interference with other contractors' operations. Properly perform, join, and sequence the work with other contractors.

Each contractor involved will assume liability in connection with their contract, and will protect and save harmless the Department from damages or claims that arise because of inconvenience, delay, or loss from the presence and operations of other contractors working within or adjacent to the project site.

105.07 Utility Facilities.

The plans or special provisions will identify the location of known utility facilities requiring removal, relocation, or adjustment. Before beginning construction, verify location of identified utilities at no additional cost to the Department.

Immediately notify the Engineer on discovery of an unidentified utility facility that may require removal, relocation, or adjustment to continue the work. The Engineer will immediately notify the utility owner that an unidentified utility facility has been discovered. Coordinate the necessary utility facility removal, relocation, or adjustment with the utility owner. If the Engineer directs the Contractor to remove, relocate, or adjust the utility facility, the Department will consider this as extra work as specified in 104.02. If performed by others, the Contractor will not be responsible for the cost of the removal, relocation, or adjustment of the utility facility.

For utility facilities identified in the contract, perform the following:

1. Coordinate the work with utility owner operations and provide sufficient time in the project schedule for utility operations.
2. Provide sufficient prior notification to utility owners of when they need to schedule and perform their operations.
3. Provide required notification to utility owners in accordance with [55-22, Idaho Code](#).

Do not interfere with or delay utility work being performed by utility owners or their authorized agents. The Contractor is liable to the utility owners for damage or service interference resulting from the Contractor's operations as specified in 107.12.

The Contractor is responsible for cost and time impacts caused by utility removals, relocations, or adjustments not required by the contract and made only for the Contractor's benefit or convenience.

If the Contractor believes a utility owner caused a delay, immediately notify the Engineer in writing, of the location and circumstances as specified in 104.03. If the Engineer determines a utility owner delay occurred under the following conditions, the Engineer will issue a change order revising the contract as specified in 104.02:

1. The utility owner failed to remove, relocate, or adjust the facility within the time agreed to by the Contractor and utility owner.
2. The Contractor attempted to minimize the delay impact.
3. The Contractor showed the utility owner delayed the work.

The Department will consider delays caused by the Contractor's failure to communicate, coordinate, and schedule with utility owners or railroads as nonexcusable delays as specified in 108.07.

The Contractor will request locations of buried utility facilities by contacting the appropriate locate entity.

1. For all counties, except Kootenai, Bonner, Boundary, Shoshone, and Benewah, contact Dig Line, Inc., phone 811, 1-208-342-1585, or 1-800-342-1585, digline@digline.com, or fax 1-800-342-1586.
2. For Kootenai, Bonner, Boundary, Shoshone, and Benewah, contact Pass Word, Inc. For emergencies, call 1-800-669-8737.
 - a. Kootenai County: phone 1-800-428-4950
 - b. Bonner and Boundary Counties: phone 1-800-626-4950
 - c. Shoshone and Benewah Counties: phone 1-800-398-3285

The Contractor must notify the utility companies in the project site before digging.

Buried utility facilities (e.g., traffic signals, illumination, traffic recording sites, weather monitoring sites, video detection systems, electronic message signs) owned by the state of Idaho could be located within the project site and may or may not be shown on the plans. For location requests, contact the district traffic signal electrician.

Contact the appropriate utility company and arrange the initial utility hook up, when utility service (e.g., electrical, phone, water) for highway components (e.g., luminaries, signals, ITS) is required. Supply utility service in a timely manner to allow for testing of highway components. Pay any fees charged by the utility company and provide the Engineer acceptable proof of payment for reimbursement.

105.08 Construction Stakes, Lines, and Grades.

The Department will provide initial surveying, unless the contract requires the Contractor to provide surveying services.

The Engineer will set or provide the following:

1. Construction stakes to establish lines, slopes, and continuous grade for road work.
2. Roadway centerline and benchmarks for bridge work.
3. Structure centerline and benchmarks for culverts and other structures.
4. Additional information on lines, slopes, and grades to allow the Contractor to establish other necessary controls required to perform the work.

The Engineer will not provide additional stakes or marks.

The Engineer may spot check the lines and elevations established by the Contractor. Spot checks do not relieve the Contractor of the following responsibilities:

1. Performing normal checking and testing as required by the contract.
2. Producing work that meets the contract requirements.

The Contractor is responsible for correcting their surveying errors and work resulting from the error at no additional cost to the Department. Preserve construction stakes and benchmarks and replace stakes or benchmarks destroyed or disturbed by the Contractor at no additional cost to the Department.

The Department will be responsible for the accuracy of survey work performed by the Department and information provided by the Engineer. The Contractor will be responsible for controls provided and work performed by the Contractor.

The Department assumes no responsibility for staking delays, unless the Engineer is notified 10 calendar days before the Contractor begins work on an item and 72 hours before, if stakes are subsequently needed.

105.09 Authority of the Engineer.

As the authorized representative of the Engineer and under the direction of the District Engineer, the Resident Engineer has immediate charge of the engineering details of the work and has direct supervision of contract administration.

105.10 Duties of the Inspector.

Inspectors authorized by the Department will inspect the Contractor's completed work and the preparation, fabrication, or manufacture of the materials. Inspectors will not alter or waive the contract requirements, issue instructions contrary to the contract, or direct the Contractor's work. Inspectors may reject work or material and will refer disputes to the Engineer.

105.11 Inspection of Work.

The Engineer may inspect the Contractor's work and materials. Allow the Engineer access to the work and provide information and cooperation for inspection. The Engineer's inspections will not relieve the Contractor from the responsibility for providing quality control to ensure the work meets the contract.

The Engineer may reject defects when discovered. The lack of discovery of a rejected defect before this decision will not prevent this decision nor obligate the Department to accept.

The Engineer may direct the Contractor to remove work to access other portions of the work for inspection. After inspection, restore the removed work as specified. If the Engineer determines the inspected work is acceptable, the Department will pay for the restored work as extra work as specified in 104.02. If the Engineer determines the inspected work is unacceptable, proceed as specified in 105.12 and restore the removed work to the standard required by the contract at no additional cost to the Department.

When a government agency, utility, or railroad company is to accept or pay a portion of the contract cost, that organization's representatives may inspect the work. Inspections by organizations do not make them a party to the contract and do not interfere with the Department or the Contractor's rights to the contract.

105.12 Unacceptable and Unauthorized Work.

Except as otherwise specified in 105.03, the Contractor is responsible for removing and replacing or repairing unacceptable work at no additional cost to the Department.

The Department will not pay for unauthorized work and the Engineer may direct the Contractor to remove and replace the unauthorized work at no additional cost to the Department. The Department defines unauthorized work as any of the following:

1. Work performed contrary to the Engineer's instructions.
2. Work performed beyond the lines shown on the plans.
3. Extra work performed without the Engineer's authorization.

If the Contractor does not comply with the Engineer's instructions, the Engineer may direct others to remove and replace or repair unacceptable or unauthorized work, and deduct the cost of this work from monies due or become due to the Contractor.

105.13 Load Regulations.

Observe legal load regulations if hauling materials on public roads. The Engineer will not allow the Contractor to operate equipment that will damage structures, roadway, or completed work. Do not exceed legal load limits on structures, subbase, base, and pavement, unless otherwise approved in writing.

105.14 Maintenance During Construction.

A. General.

The Department does not consider snow removal part of the maintenance work covered in this subsection and will provide snow removal for the traveled way. Provide a safe, smooth surface usable by snow removal equipment. Do not interfere with snow removal operations.

B. Maintenance of Work.

Until the Department accepts a portion of or all of the work as specified in 105.15, continuously maintain the work as specified in the contract.

Maintain previously constructed work, when the contract involves placing material on, or the use of a previously constructed subgrade, base course, pavement, or structure.

If the Contractor does not correct unsatisfactory maintenance as directed, the Engineer may direct others to maintain the work and will deduct the cost of the maintenance work by others from monies due or become due to the Contractor.

The cost of maintaining work in place is included in the contract unit price of the contract pay items covering the work being maintained.

C. Maintenance of Public Haul Roads.

The Contractor is responsible for any damage to public highways and streets resulting from hauling on public haul roads at no additional cost to the Department.

Use water to abate accumulated dust on public highways and streets resulting from hauling, as directed. The Department will measure and pay for dust abatement as specified in 205.04 and 205.05, respectively, or if the contract does not specify a dust abatement contract pay item, as extra work as specified in 104.02.

The Engineer will measure acceptable soft repair by contingency amount.

D. Maintenance of Traffic.

Maintain the road for use by traffic and minimize traffic delays during roadway construction, unless otherwise directed. Ensure individual traffic delays do not exceed 15 minutes and traffic delays do not exceed a total of 30 minutes through the length of the project site, unless otherwise approved in writing. Implement remedial action to eliminate the excess traffic delays.

Before starting the work, submit a traffic control plan for approval, including the following information:

1. Construction phasing.
2. Areas of work.
3. Proposed detours.
4. Traffic control devices.
5. Pavement markings.

Submit proposed measures to address traffic delays resulting from emergencies, highway incidents, emergency vehicles, and scheduled school bus routes within the project site for approval. Notify the Engineer at least 2 business days before making traffic control plan changes and submit the revised traffic control plan for approval.

Provide a project traffic control supervisor, certified by the American Traffic Safety Services Association or an approved equal, to direct the required installation, modification, and maintenance of traffic control devices. Ensure vehicles used to perform traffic control activities (e.g., traffic control device installation, removal, maintenance, or monitoring) are equipped with a working high-intensity rotating, flashing, oscillating, or strobe light meeting the Manual on Uniform Traffic Control Devices (MUTCD) requirements.

Perform the following functions at no additional cost to the Department:

1. Maintain traffic so the roadway and structures are kept passable to traffic.
2. Provide and maintain temporary approaches, crossings, and intersections with trails, roads, streets, businesses, parking lots, residences, garages, and farms in a safe condition.

The cost of monitoring traffic control work during working hours is included in the contract unit prices for the respective traffic control devices.

Monitor and maintain traffic control devices during nonworking hours and nonworking days. During nonworking hours, have an employee available to maintain traffic control devices. During nonworking days, perform required maintenance and review the traffic control at least once per day as approved. Provide a written statement describing the time and work performed during nonworking hours and nonworking days. The Department will pay for approved time and work performed during nonworking hours and nonworking days under the traffic control maintenance contract pay item as specified in 626.

E. Maintenance of Temporary Detours.

If approved in writing, the Contractor may reroute traffic over detours constructed and maintained at no additional cost to the Department instead of maintaining traffic through the project site. The Department will not pay for quantities that exceed the estimated quantities provided by the Department on the bid schedule for traffic control devices, flagging, and pilot cars used to maintain traffic on approved temporary detours.

Use water to abate accumulated dust on public highways and streets resulting from hauling, as directed. The Department will measure and pay for dust abatement as specified in 205.04 and 205.05, respectively, or if the contract does not specify a dust abatement contract pay item, as extra work as specified in 104.02.

F. Protection of Existing Utilities. The Contractor will comply with all applicable state laws regarding the protection of existing utilities and other underground structures unless otherwise specified. Damage to utilities will be repaired at no additional cost to the Department.

G. Postal Delivery. Coordinate with property owners and ensure U.S. mail delivery to area residents remains in service during the work. If necessary, the Contractor will provide temporary mailboxes until the permanent mailboxes are reset. Temporarily relocating mailboxes, providing temporary mailboxes, and coordinating U.S. Mail delivery is incidental. The Contractor will be required to work with the local U.S. Postmaster to determine their requirements.

H. Property Owner Coordination. Provide reasonable access to adjacent property owners throughout the duration of the work with only temporary closures during paving or earthwork directly in front of driveway entrances or when driveway improvements are under construction. Coordinate with property owners when construction of the roadway or driveway will impact their access.

105.15 Acceptance.

Before the Engineer declares all or a portion of the work complete, clear the project areas and applicable authorized areas outside of the project site, except established commercial sites, of waste, excess material, temporary structures, and equipment. Leave the work in an acceptable condition.

A. Partial Acceptance.

After completing a portion of the work (e.g., a structure, a section of road), the Contractor may submit a written request to the Engineer for final inspection of that portion. For a portion of the work to receive partial acceptance, it must be able to be open to the traveling public with no restrictions. After inspection, if the Engineer determines the Contractor completed the portion of work as specified in the contract, the Engineer will consider this a final inspection for that portion. The Engineer will deem that portion of the work completed by written notification to the Contractor and relieve the Contractor of work responsibilities for that portion.

If the inspection discloses work not completed as specified in the contract, the Engineer will give written notice to the Contractor of the noncompliant work found. The Resident Engineer will not declare that portion complete until the Contractor addresses the noncompliant work to the Engineer's satisfaction to obtain declaration of completion.

If, after partial completion, the Contractor or its subcontractor damages the work, the Contractor will repair or replace the damaged work, as specified in the contract, to the Engineer's satisfaction at no additional cost to the Department.

Partial acceptance occurs after the Contractor executes and submits all documents, certificates, and proofs of compliance for that portion. When the Contractor submits and the Engineer accepts required documentation, the Engineer will make the partial acceptance for that portion and notify the Contractor in writing.

A partial completion and acceptance decision does not void or alter the terms of the contract.

B. Final Acceptance.

After completing the required work, provide a written notice of completion to the Engineer and the Engineer will inspect the work. If the Engineer determines the Contractor completed the work as specified in the contract, the Engineer will deem the contract complete by written notification to the Contractor, and relieve the Contractor of all contract responsibilities.

If the inspection discloses work not completed as specified in the contract, the Engineer will give written notice to the Contractor of the noncompliant work found in the inspection. The Engineer will not declare the contract complete until the Contractor addresses the noncompliant work to the Engineer's satisfaction to obtain declaration of completion.

Final acceptance occurs after the Contractor executes and submits all documents, certificates, and proofs of compliance.

105.16 Administrative Resolution Process for Claims.

The Department and the Contractor will seek to avoid or promptly resolve claims related to the contract or performance of the work. The District Engineer maintains authority for the contract per 105.09; all other notice and coordination of work obligations remain in effect. The Department and the Contractor will follow the administrative resolution process defined in this subsection to resolve all claims that arise out of the contract or the performance of the work, unless the contract specifically allows the use of an alternate resolution process in accordance with 105.19 to assist the administrative resolution process.

If the Contractor fails to follow the claim procedures as specified in this subsection, the Contractor will waive its right to pursue the claim under the contract.

The Contractor bears the burden of proving entitlement, damages (quantum), and causation related to its claim. The Contractor's burden includes providing all supporting documentation. At the request of the Department or if determined to be necessary by the Contractor, the Contractor may supplement the information provided to the Department at the District Engineer level of review as specified in 105.16.A. In such event, additional claim review time may be required for the District Engineer level of review.

The Contractor will continue to perform the work during review of its claims.

The Department and the Contractor may mutually agree to extend any time requirement related to the administrative resolution process.

At any time during the administrative resolution process, the Department and the Contractor may mutually agree to obtain technical analysis support from a technical expert as specified in 105.17.

The Contractor must exhaust all steps in this administrative resolution process before commencing litigation as specified in 105.18.

A. District Engineer Level of Review.

If a claim arises out of the contract or the performance of the work, the Contractor will immediately provide a signed written notice of intent to file a contract claim. To preserve the right to pursue a claim in accordance with the contract, the Contractor will perform the following:

1. Provide timely notice of intent to file a claim to the District Engineer.
2. Allow the Department to examine the project site.
3. Provide the District Engineer with daily records and other pertinent supporting documentation to demonstrate damages and actual costs incurred performing the disputed work.
4. Allow the Department to review all of the Contractor's contract records relevant to the claim.

The Contractor will submit unrelated claims separately.

The Contractor will supplement the written notice of intent to claim within 15 calendar days with a written statement provided to the District Engineer that contains the following:

1. Date of the dispute giving rise to the claim.
2. Nature and circumstances causing the claim.
3. Contract provisions that support the claim.
4. Estimated cost of the claim and supporting calculations.
5. An analysis of the project schedule showing schedule changes, disruptions, and delays.

If the circumstances causing the claim continue, provide the District Engineer with timely updates that supplement the above information.

Submit to the District Engineer full and final documentation to support the claim within 60 calendar days following the date the claim has fully matured. A claim fully matures when all the direct damages (i.e., money and/or time) resulting from the dispute can be reasonably quantified. Impact damages may be submitted later as separate claims. The possibility of impact damages will not delay the submittal of full and final documentation of claims with direct damages.

The Contractor will include the following information in the full and final documentation to support the claim:

1. A factual narration of events that detail the nature and circumstances causing the claim, including dates, locations, and the items of work affected by the claim.
2. Specific provisions of the contract or laws supporting the claim and a statement explaining how these provisions support the claim.
3. Identification and copies of all documents and oral communication that support the claim.
4. Reference to standard industry manuals that pertain to the claim.
5. Any other known information, arguments, and data relevant to the claim.

For time extension requests, the Contractor will provide the following:

1. Specific days or events that justify the request.
2. Reasons supporting the request.
3. Contract provisions supporting the request.
4. Detailed analysis of the Contractor's project schedule supporting the request in accordance with 108.07.

For additional compensation requests, identify the amount and provide justification in the following categories:

1. Labor, including a list of individuals, classifications, and hours worked.
2. Material, including invoices and purchase orders.
3. Equipment, including a detailed description and the hours and dates operated. Use equipment rates in accordance with 109.03.
4. Field office overhead.
5. Home office overhead (general and administrative), if applicable.
6. Other categories as necessary or as requested by the Department.

Provide a signed and notarized statement that contains the following certification:

Under penalty of law for perjury or falsification, the undersigned, hereby certifies that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Department is liable; and that I am duly authorized to certify the claim on behalf of the Contractor.

During performance of the disputed work, the Contractor will keep complete records of extra costs and time incurred. Provide copies of these records to the District Engineer during performance of the disputed work (daily if necessary) so that they can be verified concurrently.

After the Contractor provides a complete claim submittal, the District Engineer will review the claim submittal and issue a written letter of determination to the Contractor within:

1. Sixty (60) calendar days from the date the District Engineer receives the complete claim submittal if the claim amount is less than or equal to \$100,000.

2. Ninety (90) calendar days from the date the District Engineer receives the complete claim submittal if the claim amount is greater than \$100,000.

The District Engineer's time to issue a written letter of determination may be extended if the District Engineer and the Contractor mutually agree that additional time is necessary to obtain full documentation and information from the Contractor and/or to further review the claim. In the event additional documentation is needed, the District Engineer and the Contractor acknowledge that failure to extend the time may lead to a claim denial based on insufficient documentation.

At the District Engineer's discretion or upon timely request by the Contractor, the District Engineer and the Contractor will meet to discuss the claim, ask and respond to questions, and suggest possible resolutions.

If the District Engineer does not provide a written decision within the specified time, the Contractor will consider no response as a claim denial decision.

If the District Engineer decides a contract revision is justified, a change order will be issued in as specified in 104.02. If the Contractor disagrees with the decision, the Contractor may appeal the claim as specified in 105.16.B.

The District Engineer's decision will be final unless the Contractor submits a written appeal and a copy of the complete claim submittal to the Chief Engineer within 30 calendar days of the District Engineer's decision.

The District Engineer will compile and keep an administrative record of the claim review during the District Engineer level of review.

B. Chief Engineer Level of Review.

The Chief Engineer will provide written acknowledgment of the Contractor's appeal.

The Chief Engineer will review the claim submittal and schedule a Chief Engineer claim review meeting within 60 calendar days after the date the Chief Engineer receives the appeal and complete claim submittal.

The Chief Engineer and the Contractor may agree to extend any deadlines related to the Chief Engineer's claim review. The Chief Engineer and the Contractor acknowledge that failure to extend the time may lead to claim denial based on incomplete claim information.

Additional information cannot be submitted to the Chief Engineer unless the Chief Engineer makes an affirmative determination that the Department or the Contractor have shown good cause as to why such information was not previously submitted to the District Engineer. If the Chief Engineer finds good cause and allows the receipt of new information from the Contractor:

1. the matter will be remanded for further review at the District Engineer level (with revised deadlines as specified by the Chief Engineer),
2. any subsequent appeal to the Chief Engineer will reset the Chief Engineer's claim review deadlines, and
3. any interest claimed to be accruing on the claim will be suspended during the remand period.

The Chief Engineer's claim review meeting will proceed as follows:

1. the Contractor may present its claim,
2. the Department may provide claim analysis,
3. the Contractor may provide rebuttal in support of its claim,
4. the Department may provide rebuttal/closing argument in support of the claim analysis, and
5. the Contractor may provide a closing argument.

The District Engineer will attend the Chief Engineer's claim review meeting. At any point during the claim review meeting, the Chief Engineer may ask questions or make suggestions as to resolution. Within 30 calendar days of

the claim review meeting, the Chief Engineer will issue a written decision to address the claim. The Chief Engineer will compile and keep an administrative record of the claim review.

If the Contractor accepts the Chief Engineer's decision, the Department will, as needed, issue a change order as specified in 104.02.

If the Contractor disagrees with the Chief Engineer's decision, the Contractor may bring a lawsuit in Idaho state court as specified in 105.18.

The Chief Engineer's decision will be final and conclusive unless subsequently changed by a court of competent jurisdiction.

C. Audits.

Department auditors, or independent auditors under contract with the Department, may perform inspections and audits. The Contractor and its subcontractors will allow authorized auditors to perform an audit and/or inspection on wage, payroll, materials and equipment costs, and CPM schedules related to the claim. The Contractor and its subcontractors will retain these records at the respective company offices. During normal business hours, the Contractor and its subcontractors will provide facilities acceptable to the authorized auditors for the inspection and/or audit. The Contractor and its subcontractors will cooperate with the authorized auditors. The Department will notify the Contractor before the first, scheduled day of the audit. The Contractor will retain cost records supporting the claim value until the claim is resolved. The Department will maintain information obtained in an audit as confidential to the extent provided by law.

The Contractor and its subcontractors will perform the following for all parts of a claim or waive the right to that claim part:

1. Maintain and retain sufficient records.
2. Allow authorized auditors to verify the claim.
3. Allow authorized auditors to access the records of the Contractor or its subcontractors.

The Contractors and its subcontractors will allow the authorized auditors to access the following documents relating to the claim:

1. Daily time sheets and supervisors' daily reports.
2. Union agreements.
3. Insurance, welfare, and benefits records.
4. Payroll registers.
5. Earnings statements and records.
6. Payroll tax statements and records.
7. Material records, invoices, and requisitions.
8. Material cost distribution sheets.
9. Equipment records.
10. Vendors, rental agencies, its subcontractor's and lower-tier subcontractor's invoices.
11. Subcontractor's and lower-tier subcontractor's payment certificates.
12. Proof of payment for payroll and vendors.
13. Job cost reports.
14. Job payroll ledgers.

15. General ledgers.
16. Cash disbursement journals.
17. Financial statements for all years reflecting operations on the contract. The Department may require additional financial statements for 3 years before the work began and for 3 years after final acceptance of the contract.
18. Documents that relate to each claim for this contract; including documents that support the claim amount.
19. Documents used to prepare the elements of the contract claim including labor, benefits and insurance, material, equipment, subcontractors, time periods, individuals involved, and the hours and rates for the individuals.
20. Documents and computation sheets used during the course of bidding to the extent the claim is based upon the original bid proposal.
21. CPM scheduling documentation.

105.17 Technical Analysis Support (TAS).

If the Department and the Contractor agree to use TAS in the administrative resolution process as specified in 105.16, the Department and the Contractor will interview potential technical experts (TEs) jointly. The selected TE will be a neutral, impartial, and objective TE on the claim or dispute issues, and represent the interests of the contract.

The Department and the Contractor will sign a written agreement of the following:

1. Scope of the TE services.
2. Budget for the scope of TE services.
3. To not retain the services of the TE or to allow the TE to represent either party in subsequent steps in the administrative resolution process, and if necessary, any alternate resolution process, related to this contract.

The Department, the Contractor, and the TE will sign a written agreement of the following:

1. Notice to proceed with the analysis of the claim issues.
2. Deadline for the TE to report the findings and recommendations.

The TE will provide their findings and recommendations to the Department and the Contractor jointly. If requested by the Department or the Contractor, the TE will discuss clarifications of their findings and recommendations with both parties present.

The Department and the Contractor will separately accept or reject the TE's findings and recommendations and will notify the other party, in writing, of their decision within 10 calendar days of receipt. If the Department and the Contractor agree with the TE's findings and recommendations, the Resident Engineer will issue a change order as specified in 104.02.

The TE's findings and recommendations are nonbinding on the Department and the Contractor. However, the following information may be admissible as evidence in any subsequent claim resolution proceeding or forum to the extent permitted by law:

1. Qualifications of the TE.
2. The fact that an independent TE considered the claim.
3. TE's findings and recommendations.

The Department and the Contractor will equally share the cost and expenses of the TAS. The TE will invoice the Contractor. After the Department and the Contractor each approve the invoice, the Contractor will pay the TE invoice. The Contractor will submit to the Department an invoice for 50 percent of the total TE invoice. The Department will reimburse the Contractor for the invoiced amount representing 50 percent of the total TE invoice.

105.18 Claim Resolution.

A. Mediation.

Notwithstanding the formal claims procedure specified in 105.16, the parties may enter into mediation by mutual agreement at any time, in which case the claim review time requirements in 105.16 will be suspended pending the outcome of the mediation process. The rules, time, and place for mediation, as well as the selection of the mediator will be established by mutual agreement. The mediator's costs will be divided equally between the Department and the Contractor. Either party may terminate mediation at any time upon notice to the other party. The suspension of the claims review time requirements in 105.16 will automatically end if either party terminates the mediation.

B. District Court.

Claims unresolved by the procedures specified in 105.16 will be brought in Idaho state court. Unless affirmatively agreed to otherwise, the Department and the Contractor agree the jurisdiction and exclusive venue will be in Idaho's Fourth Judicial District (Ada County). The district court will review the administrative record compiled by the Chief Engineer.

If the district court remands the matter to the Department/Chief Engineer for lack of jurisdiction or any other reason:

1. the Chief Engineer will designate any additional review procedure,
2. the Chief Engineer will reset appropriate deadlines, and
3. any interest claimed to be accruing on the claim will be suspended from the date of the Chief Engineer's decision and throughout the remand period.

Nothing in the contract is intended to, nor will be deemed in any manner to waive, modify, or limit the Department's administrative authority as granted by the Idaho Legislature.

The Contractor will include 105.16 and 105.18 in subcontracts and contracts with suppliers. The Contractor will manage its subcontractor and supplier disputes.

105.19 Contract Specific Alternate Claim Resolution Process – Dispute Review Board.

The contract may specifically allow the following alternate resolution process to assist in the administrative resolution process specified in 105.16.

The DRB review may not be used as a substitute for the Department's and the Contractor's responsibilities to make a good-faith effort to resolve the dispute using the administrative resolution process.

This subsection describes the purpose, procedures, function, and features of the DRB process. If a DRB is used, the Department, the Contractor, and the DRB members must sign a Three-Party Agreement to:

1. Formalize the creation of the DRB.
2. Establish the scope of services for the DRB.
3. Establish the rights and responsibilities of the Department and the Contractor.

In the event of a conflict between this subsection and the Three-Party Agreement, the latter will govern.

Use of an alternate resolution process (i.e., DRB) does not relieve the Department or the Contractor from complying with the contract and with the requirements specified in 105.16. In general, the DRB will operate as specified in 105.19, however, it is desirable to allow flexibility in the DRB process in order to adapt to changing situations and

facilitate resolution of a dispute. The Department and the Contractor may mutually agree in writing on new procedures or modifications to the existing procedures for a specific dispute. The DRB may also establish new or modified procedures with the mutual written agreement of the Department and the Contractor. If the Department and the Contractor cannot agree, the Department will determine the new or modified procedures.

The purpose of a DRB is to address and seek to resolve issues that may arise during the work. The Contractor agrees that the DRB process will either be used before submission of a claim or will stay the claim process (including the District Engineer review time) until the DRB process is concluded or until the Department, after consultation with the Contractor, affirms in writing that the DRB process should be withdrawn or abandoned.

The DRB will consist of 3 members selected jointly by the Department and the Contractor in accordance with 105.19.1.

1. Member Criteria and Selection.

a. Experience, Qualifications, and Annual Recertification.

Prospective DRB members should have experience with the construction process, including design, construction, contract administration, contract law, industry practices, and resolution of disputes. Typical DRB members are retired or semi-retired engineers, contractors, claim consultants, or construction attorneys.

It is not necessary that prospective DRB members be intimately familiar with the specific type of construction involved in the dispute. If necessary, the DRB may consult technical and legal experts as specified in 105.19.4.g.

Prospective DRB members must have attended the Dispute Review Board Advanced Update workshop offered by the Dispute Resolution Board Foundation or its substantial equivalent in other training, or will be a pre-qualified DRB member in another state that has training as a prerequisite to qualification for services on a DRB.

b. DRB Pre-Qualification Roster.

The Department, after consultation with representatives of the Idaho Associated General Contractors (AGC), will establish and maintain a DRB pre-qualification roster of at least 12 qualified individuals available to serve on DRBs. The Department, with input from the Idaho AGC, will select members to the DRB pre-qualification roster from the prospective members as specified in 105.19.1.a.

Each January, the Department will contact each DRB member listed on the pre-qualification roster to have them recommit to serving as a DRB member. The Department will attempt to contact the DRB member at least twice using two different methods (e.g., phone call and email) within a 30-day period. DRB members who do not recommit, or who the Department is unable to reach, will be removed from the pre-qualification roster. The AGC will be notified and provided with reasoning (e.g., member is no longer interested) for each roster removal.

c. Neutrality.

DRB members must be neutral, act impartially and in the best interest of the contract, and be free of any conflict of interest.

For the purpose of this subsection, the term "member" also includes the member's current primary or full-time employer, and "involved" means having a contractual relationship with the Department, the Contractor, or any entity involved in the dispute (e.g., subcontractors, suppliers, architects, engineers, construction managers, consultants).

Prohibitions or disqualifying relationships for prospective members include any of the following:

- (1) An ownership interest in any entity involved in the contract, or a financial interest in the contract, except for payment for services on this DRB.
- (2) Previous employment by, or financial ties to, any party involved in the contract within a period of 1 year before award of the contract, except for fee-based consulting services on unrelated contracts.
- (3) A close professional or personal relationship with any key member of any entity involved in the contract that, in the judgment of the Department or the Contractor, could suggest partiality.
- (4) Previous involvement in the contract of a nature that could compromise the member's ability to participate impartially in the DRB's activities.

Prohibitions or disqualifying relationships for members include any of the following:

- (1) Current employment, including fee-based consulting services, by any entity involved in the contract.
- (2) Discussion concerning, or the making of, an agreement with any entity involved in the contract regarding employment after the contract is complete.

d. Disclosure Statement.

All prospective members for a DRB will submit complete disclosure statements to the Department. Each statement will include the following:

- (1) Resume of experience.
- (2) Declaration that describes all past, present, and anticipated or planned future relationships, including indirect relationships through the member's primary or full-time employer, to the Department, the Contractor, or any entity involved in the contract (e.g., subcontractors, suppliers, architects, engineers, construction managers, consultants).
- (3) Disclosure of any close professional or personal relationships with key members of the Department, the Contractor, or other entity involved in the contract.

e. Selection Process.

To form a DRB, the Department will provide the Contractor with access to all members on the current DRB pre-qualification roster. Within 20 calendar days after contract award the Department and the Contractor will each nominate 5 individuals from the roster and notify the other party of their nominees. The Department and the Contractor will each confirm the availability and neutrality of their nominees.

Within 30 calendar days after contract award, the Department and the Contractor will jointly select the DRB using the following procedure:

- (1) Combine all nominees into 1 list.
- (2) Flip a coin to see which party goes first.
- (3) Take turns striking names off the list until there are only 3 names left.
- (4) The 3 remaining nominees will constitute the 3-member DRB.

The Department will notify all members of their selection to the DRB. The members of the 3-member DRB will choose one member to act as chairperson.

If necessary, the Department and the Contractor will use the same selection process for selecting replacement members.

f. Three-Party Agreement.

Within 14 calendar days of the Department notifying the members of their selection to the DRB, the DRB members, the Department's authorized representatives, and the Contractor will execute a DRB Three-Party Agreement.

g. Tenure of the DRB.

The DRB becomes effective upon execution of the DRB Three-Party Agreement, and dissolves when the Department and the Contractor mutually agree to dissolve the DRB.

2. Ongoing Contract Involvement.

a. Contract Documents, Reports, and Information.

The Department will provide each DRB member with the contract, a set of the plans, and the specifications.

To keep the DRB members informed of work activity and other developments, the Department and the Contractor will provide, in a timely manner, relevant information and documentation requested by the DRB. The DRB may request information and the work documentation that the Department and the Contractor produce in the normal course of construction, including, but not limited to, periodic reports and minutes of progress meetings. The DRB may not request information or documentation that the Department or the Contractor would not have normally produced.

b. Periodic Meetings and Site Visits.

The DRB members may visit the project site and meet with representatives of the Department and the Contractor at regular intervals and during significant construction events as agreed to by the Department and the Contractor.

To minimize the time and expense of meetings, the Department and the Contractor may decide to use conference calls, videoconferences, or any other means. Each meeting will consist of an informal roundtable discussion followed by a field observation of the work. Representatives from the Department and the Contractor will attend the roundtable discussion. The meeting agenda will generally include the following:

- (1) Meeting convened by the DRB chairperson.
- (2) Contractor discussion topics, such as the following:
 - (a) Work performed since the last meeting.
 - (b) Status of the work schedule and schedule for future work.
 - (c) Anticipated or potential problems and proposed solutions.
 - (d) Status of past, current, and potential issues, disputes, and other controversies.
- (3) Department discussion topics, such as the following:
 - (a) The schedule and schedule updates.
 - (b) Perspective on potential issues, disputes, and other controversies.
 - (c) Status of past, current, and potential issues, disputes, and other controversies.
- (4) Any other topics the Department or the Contractor wants to discuss with the DRB.

(5) Setting a tentative date for next meeting.

The Department, the Contractor, and the DRB members will agree on the frequency and scheduling of visits depending on the progress of the work. Observations by the DRB members during project site visits will cover all active segments of the work. A representative from the Department and the Contractor will accompany the DRB members on project visits.

3. Informal Review Process.

The Department and the Contractor may involve the DRB in the review of an emerging dispute. Use of an informal review by the DRB does not relieve the Department or the Contractor from complying with all contract requirements. However, if informal review by the DRB is used, the dispute submittal time frames and review time frames of 105.16 may be revised by mutual written agreement of the Department and the Contractor, or if they are unable to agree, will be established by the Department.

At the request of the Department or the Contractor, the DRB is available to provide informal nonbinding preliminary review regarding an emerging dispute. After a dispute is initially brought before the DRB for informal review, the Department and the Contractor will have sufficient notice and time to prepare for informal review by the DRB. Upon the request of the Department or the Contractor to the DRB chairperson for an informal DRB review, the chairperson will contact the other DRB members to make necessary arrangements for the review.

Informal review meetings will consist of informal oral discussions with input and comments encouraged from the Department and the Contractor. After private deliberation, the DRB will provide initial impressions and oral guidance which will be limited to the dispute only and will not offer any opinion as to legal questions. Minority guidance (should it exist) will also be offered. The DRB will not make written findings and recommendations or any record of the informal review.

The DRB is not bound by its oral recommendations to the Department and the Contractor in the event that a dispute that was considered in informal review by the DRB is later submitted to the DRB for formal review.

It is the intent of the Department and the Contractor to establish informal review by the DRB as a method of dispute mitigation. To the extent permitted by law, the Department and the Contractor agree that all written or oral communications and documentation submitted and/or discussed during informal review by the DRB will be privileged and confidential pursuant to [Idaho Rules of Evidence 507](#) and [408](#). [Rule of Evidence 408](#) will also apply to all written or oral communications prepared for or exchanged during the informal review process.

4. Formal Review Process.

a. General.

The Department and the Contractor will cooperate to ensure that the DRB considers disputes promptly by taking into account the specific circumstances of the dispute, and the time required to prepare documentation.

b. Prerequisites to Request for Review.

The Department or the Contractor may request a review once negotiations will be, or have become, unsuccessful.

c. Requesting Review.

The requesting party will prepare and submit a written request for review to the DRB chairperson and the other party. The request for review will state clearly, and in full detail, the specific issues of the dispute to be considered by the DRB.

The DRB chairperson will confer with the Department and the Contractor to establish a submittal schedule to allow adequate time before presentations for both parties to review the requesting party's request for review and for both parties to prepare and submit position statements as specified in 105.19.4.e.

The Contractor will provide each DRB member with a complete copy of the dispute submittal at least 14 calendar days before the hearing if available at the time of the request for DRB.

d. Scheduling the Hearing.

After receiving a request for review, the DRB chairperson will schedule a hearing date.

e. Pre-Hearing Requirements.

The Department and the Contractor will prepare and submit concise, written position statements with page number references to any supporting documentation. First, the Contractor will submit its position statement to the DRB and the Department; then the Department will submit its position statement to the DRB and the Contractor.

f. Hearing.

Unless otherwise agreed by the Department, the Contractor, and the DRB members, the hearing will occur at the nearest Department District Office. The 3 parties may agree to any another location that would be more convenient and still provide the required facilities and access to necessary documentation.

The Department and the Contractor will each have representatives in attendance at all hearings. The Contractor will make its presentation first. The Department and the Contractor will take successive turns for rebuttals until all aspects of the dispute are fully covered. The DRB members, the Department, and the Contractor representatives may ask questions, request clarification, or ask for additional data during the presentations.

For difficult or complex disputes, the DRB may schedule additional hearings to facilitate full consideration and understanding of the information presented by the Department and the Contractor. The DRB will allow the Department and the Contractor adequate opportunity to present evidence, documentation, and testimony supporting their position regarding all issues of the dispute. The Department and the Contractor cannot present, and the DRB cannot consider in its review, any documents, reports, analysis, or other information, unless the same was previously provided to the other party as supporting documentation for the position statement.

Unless otherwise agreed to by the Department and the Contractor, the DRB will limit the position statements, presentations, and reviews to issues of entitlement only. If the Department and the Contractor agree to the DRB reviewing or giving guidance on issues of entitlement and quantum, the Department and the Contractor will complete their presentations on entitlement before presenting issues of quantum.

A formal transcript of the hearing is usually unnecessary. The Department or the Contractor may request that the DRB allow recordation and transcription by a court reporter. The Department and the Contractor will agree on the allocation of the associated cost. This transcription, if prepared, will not constitute the official record of the DRB review. The DRB-prepared record will be the official record of the DRB review. The DRB may provide for audio or video recordings of the hearing for DRB use only.

Unless affirmatively agreed to by the Department and the Contractor, no attorney for either entity will appear at or participate in the DRB proceeding. The Department and the Contractor may

mutually agree to allow the attorneys to attend and minimally advise or to play a more involved role in the hearing (e.g., making brief opening and closing remarks to the DRB).

If the Department or the Contractor representatives fail to appear before the DRB on the date scheduled for the hearing without justifiable cause, the party that is in attendance will prevail in their position on the dispute.

g. Deliberations.

After the conclusion of the hearing, the DRB members will hold private deliberations to prepare the DRB's findings and recommendations. The DRB may hold its private deliberations at any location. The individual views of the DRB members will be kept strictly confidential from disclosure to anyone other than the DRB members.

If necessary, the DRB may submit a written request to the Department and the Contractor that briefly describes the scope and budget for special services (e.g., legal, technical, accounting, data research, or other expert assistance, consultation, testimony). If the Department and the Contractor agree to the request, both parties will execute a written agreement with a provider of the necessary special services chosen by mutual agreement. The DRB's findings and recommendations will not be bound by any information provided by a special service provider. The Department and the Contractor will share and pay for the cost of the service provider as specified in 105.19.5.

Typically the special service provider will respond to the DRB's questions in private consultation and the Department and the Contractor may not request a permanent record of the questions or responses.

h. Findings and Recommendations.

The DRB's findings and recommendations concerning any dispute are nonbinding and inadmissible in any subsequent proceeding pursuant to [Rule 408](#) of the Idaho Rules of Evidence. The DRB is not responsible for resolving disputes; that responsibility remains with the Department and the Contractor.

The DRB will base its findings and recommendations on the contract, applicable contract law, industry practices, and the facts of the dispute. The DRB must also evaluate whether the burden of proof has been met.

Within 14 calendar days from completion of the hearing, the DRB will provide the Department and the Contractor with a written copy of its findings and recommendations by certified mail return receipt requested. For difficult or complex disputes, and in consideration of the DRB's availability, the Department, the Contractor, and the DRB may mutually agree to revise the time requirement.

The DRB will set forth, as clearly as possible, the logic and reasoning behind its findings and recommendations. The findings and recommendations will address entitlement only, unless the Department and the Contractor mutually request the DRB review entitlement and quantum as specified in 105.19.4.f. If the DRB cannot expeditiously determine the exact value of the quantum, the DRB may address quantum in its findings and recommendations by providing guidelines for determining the quantum. The Department and the Contractor will then make the final determination of quantum. If the Department and the Contractor continue to disagree on the determination of quantum, the Department and the Contractor may submit the disagreement back to the DRB for further review and amended findings and recommendations.

If the DRB is unable to reach unanimity in its deliberations, the DRB will advise the Department and the Contractor of that fact in their findings and recommendations. A dissenting DRB member may prepare a minority report to be included in the DRB findings and recommendations.

i. Acceptance or Rejection.

Within 7 calendar days of receipt of the DRB's findings and recommendations, the Department and the Contractor will provide a written notice of acceptance or rejection of the DRB findings and recommendations to the DRB and each other.

If, with the aid of the DRB's findings and recommendations, the Department and the Contractor are able to resolve the dispute, the Department will promptly process any necessary contract revisions as specified in 104.02. If the Department or the Contractor rejects the DRB's findings and recommendations, the dispute will continue under the administrative resolution process as specified in 105.16.

j. Clarification and Reconsideration.

If the dispute remains unresolved because the Department or the Contractor has a bona fide lack of understanding of the DRB's findings and recommendations, either party may request the DRB clarify specific parts of their findings and recommendations. The Department or the Contractor will provide a written request to the DRB and the other party within 7 calendar days of receipt of the DRB's findings and recommendations.

If evidence becomes available that was not available at the time of presentations, the Department or the Contractor may request that the DRB reconsider its findings and recommendations with the new evidence. The DRB will decide if reconsideration is necessary.

k. Admissibility.

Any DRB findings or recommendations will be deemed within the purview of [Rule 408 of the Idaho Rules of Evidence](#) (or comparable provision in any other forum) and hence precluded from admissibility in any subsequent proceeding.

l. Legal Relations.

Each DRB member, in the performance of his or her duties on the DRB, is acting as an independent agent and not as an employee of the Department or the Contractor.

Each DRB member is acting in a capacity intended to facilitate resolution of the dispute. Accordingly, the Department and the Contractor agree, to the fullest extent permitted by law, that each DRB member will be accorded quasi-judicial immunity for any actions or decisions associated with its review, findings, and recommendations. The Department and the Contractor may not call any DRB member as a witness in subsequent proceedings on a dispute. Other than the DRB's findings and recommendations, all records, proceedings, and deliberations of the DRB are to be kept confidential to the fullest extent permitted by law. The DRB will, upon completion of the contract, turn all records of the DRB over to the Department for storage and preservation.

Each DRB member will, by agreement, be held harmless for any personal or professional liability arising from or related to DRB activities. To the fullest extent permitted by law, the Department and the Contractor will indemnify all DRB members for disputes, losses, demands, and damages (including reasonable attorney fees) for bodily injury, property damage, or economic loss arising out of or related to the DRB members carrying out DRB functions. This indemnity is a joint and several obligation of the Department and the Contractor.

5. Payment.

The Department and the Contractor will equally bear the following costs and expenses related to the DRB work activities preauthorized by the Department and the Contractor, including the following:

- a. Time spent on the project site, at hearings, at meetings, or reviewing the dispute away from the project site.
- b. Travel time to and from the location of the DRB activities listed in 105.19.5.a.
- c. Travel expenses.
- d. Approved special service providers.

The Department and the Contractor will pay each DRB member for actual time spent at the rate of \$185 per hour with a maximum of \$1,500 per day. This rate includes all normal incidental expenses (e.g., telephone, fax, postage, courier, printing, computer services). The Department and the Contractor will compensate each DRB member at the same daily and hourly rate.

The Department and the Contractor will pay each DRB member for actual travel time to and from DRB meetings at the rate of \$75 per hour with a maximum of \$300 each way. The Department and the Contractor will reimburse DRB members at the state of Idaho's standard rates for transportation, lodging, and meals for each day, or portion thereof, for DRB member travel to or from, or attending, a DRB activity.

The Department will not pay for markups applied to the cost and expenses of the DRB by the Contractor or the DRB members.

The Department will provide administrative services (e.g., conference facilities, secretarial services) for the DRB, at no cost to the Contractor.

Each DRB member may submit invoices for payment for DRB activities completed and qualified expenses no more often than once per month during the progress of their DRB activities. The invoices will be in a format approved by the Department, and accompanied by a general description of DRB activities performed during that period. The value of DRB activities accomplished for payment will be established from the billing rate and hours expended by the DRB member together with qualified expenses incurred.

The Contractor will pay the invoices of all DRB members within 30 calendar days after approval by the Department and the Contractor. The Contractor will then invoice the Department for 50 percent of the approved DRB invoices.

The cost records and accounts related to DRB activities will be kept available for inspection by representatives of the Department and the Contractor for 5 years after final payment to the DRB members.

SECTION 106 – CONTROL OF MATERIAL

106.01 Source of Supply and Quality Requirements.

Provide materials meeting the contract and produced using acceptable quality control practices. The Contractor is responsible for quality control. The quality control process cost is included in the contract unit prices for the respective contract pay items. Use new materials, unless otherwise specified. Notify the Engineer of proposed material sources to allow for inspection before manufacture, fabrication, and material delivery. The Engineer may inspect and approve material at the source before delivery. If the Engineer determines the source no longer produces material meeting the contract, use another source to provide material that meets the contract.

Use material from the qualified products list (QPL) as specified in the contract and in 106.15.

Install or apply material in accordance with the manufacturer's written instructions. If a conflict exists between the contract and the manufacturer's written instructions, immediately notify the Engineer in writing.

A. Buy America. For contracts that involve federal-aid funding, ensure steel or iron materials permanently incorporated into the work are products of the United States. All manufacturing processes for these materials, including the application of coatings for such materials, must occur in the United States. Coating includes all processes which protect or enhance the value of the material to which the coating is applied.

Buy America requirements apply to any steel or iron components of a manufactured product regardless of the overall composition of the manufactured product and to miscellaneous steel or iron components and hardware (e.g., cabinets, covers, shelves, clamps, fittings, sleeves, washers, bolts, nuts, screws, tie wire, spacers, chairs, lifting hooks, faucets, or door hinges). The FHWA Clarification of Manufactured Products under Buy America dated December 21, 2012 which established the 90 percent threshold and the miscellaneous products exception is no longer valid.

Obtain certifications from the manufacturer, which document that steel and iron have been manufactured and that coatings for steel or iron have been applied in the United States. Submit the required certifications before incorporating these materials into the work. The Department will also require certifications for manufactured and fabricated products purchased by the Contractor.

Provide certifications conforming to 106.04.

The Engineer will permit small quantities of foreign manufactured steel, iron, or applied coatings for steel or iron so long as their total cost does not exceed 0.1 percent of the total contract amount or \$2,500, whichever is greater.

If foreign steel, iron, or applied coatings for steel or iron in excess of the quantities allowed become incorporated into the work, remove such materials in excess of the allowable maximum, and replace them with materials complying with these specifications at no additional cost to the Department.

B. Use Tax. The exercise of control over State-owned material by a Contractor who is improving real property (e.g., roadways) will incur the imposition of a use tax by the State.

Contact the Idaho State Tax Commission (Telephone No. 208-334-7618) concerning [63-3609, Idaho Code](#) and [IDAPA 35.01.02.012 and 35.01.02.013](#).

For aggregates, the amount of the use tax will differ depending on whether the material is obtained from a State-owned material source or whether it is obtained from a State-owned stockpile. Use tax is due on the fair market value of the material, and the crushed value (processed material) is higher than for unprocessed material.

The use tax will also differ depending on whether a Contractor crushed the material and placed it on the roadway, or if the Contractor only performed one of these operations and hired a subcontractor to perform the other. If the contractor hires a subcontractor to crush the material, he must pay a sales tax to the crusher for this fabrication

labor. If the Contractor crushed and applies the material, or gives material he crushed to a subcontractor for application, the Contractor owes use tax on the royalty value.

106.02 Ordering, Producing, and Delivering Materials.

Quantity estimates are only approximate. Do not place orders for or produce full quantities of materials required to complete the work until the work has advanced to a stage that allows the quantities to be determined with reasonable accuracy.

The Department is not responsible for:

1. Materials the Contractor may order, produce, or deliver in excess of requirements except as specified in 109.07.
2. Extra expense the Contractor may incur because materials were not ordered, produced, or delivered earlier.
3. The Contractor's expenses related to materials ordered, produced, or delivered by the Contractor that are not approved for use.

Before ordering pipe, pipe culvert, guardrail, pipe siphon, or sign posts, obtain approval of the quantities.

106.03 Samples, Tests, and Cited Specifications.

Refer to the Quality Assurance Special Provisions (QASP) for information on samples, tests, and cited specifications.

106.04 Certification of Materials.

The Engineer may base the acceptance of specified material on certifications provided by the manufacturer. Standard forms as specified in the [QA Manual](#) must be completed in their entirety, and be signed by the manufacturer's representative who has quality control responsibility for the material manufacture or fabrication. The manufacturer's certification will not prevent the Engineer from sampling and testing the material and considering acceptance or rejection on the basis of the test results. Ensure the manufacturer's certificate references the project identifiers (e.g., name, number), contract pay items, and numbers.

For the Engineer to accept material based on manufacturer certification, provide the certificate and backup documents (e.g., mill reports) with each shipment, and identify the certified material type and quantity in the shipment.

106.05 Plant Inspection.

The Engineer may inspect materials at the source. The Engineer may inspect manufacturing plants periodically for compliance with contract-required manufacturing methods. The Engineer will obtain material samples for testing to verify the material meets contract quality requirements. The Engineer may approve material by manufactured lot based on these test results. The Engineer will inspect plants under the following conditions:

1. The Contractor and the material manufacturer will cooperate with and help the Engineer.
2. The Contractor and the material manufacturer will allow the Engineer entry, during normal business hours, to the plant location that produces the material.
3. The Contractor and the material manufacturer will provide adequate safety measures and maintain the safety of the plant.

After delivery to the project site, the Engineer may inspect or retest materials the Engineer has already inspected, tested, and approved at the source. The Engineer will reject inspected or retested material that does not meet requirements. The Engineer will base final material acceptance on the material's in-place condition.

106.06 Storage and Handling of Material.

Provide material storage to maintain its quality. The Engineer may re-inspect stored material before use. Provide the Engineer with access to stored material for inspection. Store material at least 30 feet off the traveled way. If the posted speed limit for the traveled way is 40 mph or less, the Engineer may approve storage of material at least 10 feet off the traveled way.

If the contract allows or the Engineer approves, the Contractor may use specified portions of the right of way or other approved locations for material storage and for plant and temporary facility placement. The Contractor may use private property for material storage if the property owner or lessee provides written permission. The Contractor must submit a copy of the written permission.

Before storing material at storage locations, obtain clearances for the locations as specified in 107.17. Prevent separate stockpiled material from mixing.

106.07 Test Result Dispute Resolution.

Refer to the Quality Assurance Special Provisions (QASP) for information on the test dispute resolution process.

106.08 Test Facilities.

Provide necessary test facilities and equipment, including field laboratory trailers, for quality control and acceptance testing required by the contract to be performed by the Contractor. Provide field laboratories with standard equipment and supplies necessary to perform the required tests. Provide field laboratories that are qualified through the Department's laboratory qualification program.

If the Department requires a field laboratory, the Contractor will provide the features and services, specified in 645, needed to place and operate the Department's lab (e.g., all-weather parking area, minimum electrical service, trash containers, water, portable toilet). If the contract specifies the Contractor is responsible for testing, the Contractor will provide the field laboratory.

106.09 Material Sources.

The Department divides material sources into 2 groups: designated sources and contractor-provided sources. Construct and maintain haul roads, including dust abatement, from material sources to the project site or to the nearest public road. Do not discharge turbid water into streams or other bodies of water that does not comply with the contract.

A. Designated Sources.

The Department may acquire, and make available to the Contractor, material sources specified on the plans and in the special provisions. The contract lists the designated sources by number and location.

Variations in the limit, location, quality, and volume of material meeting requirements may occur. The Engineer may direct the Contractor to extract material, meeting requirements, from locations within a designated source, but will not require removal of material from below water.

Determine the amount of equipment and work necessary to produce material that meets the requirements.

The Department may acquire, and make available to the Contractor, the right to take materials from a designated source and the right to use the designated source property for plant sites, stockpiles, and hauling roads.

The Department will deduct royalty payments from partial payments, and will pay the designated source property owner for material removed by the Contractor.

If the state of Idaho or federal government does not own or control the designated source, provide the Engineer with 3 copies of a letter of release from the designated source owner. The release will verify the following:

1. The Contractor left the designated source in a presentable condition with the debris resulting from the Contractor's operations removed and disposed of.
2. The Contractor met the approved reclamation plan requirements.

The Department will not require a letter of release from commercial sources.

B. Contractor-Provided Sources.

The Contractor-provided sources are sources not specified by the contract as designated sources. The Engineer will provide the Contractor with a list of Department-controlled sources on request. If approved, the Contractor may use Department-controlled sources as Contractor-provided sources. If approved, the Engineer will include requirements specifying the final condition and appearance of a Department-controlled source. Determine if material from a Department-controlled source meets the requirements.

For Department-controlled sources, if the Engineer approves the Contractor's written request for use, the Engineer will establish the terms and conditions, and prepare an agreement for the Contractor's signature within 14 calendar days. The Department will not allow access to Department-controlled sources until the Contractor returns a signed agreement.

For Contractor-provided sources that are not Department-controlled, the Department will require the Contractor to obtain written approval from the source owner before using material. Submit a written request for using a Contractor-provided source, and allow the Department 14 calendar days for review.

Before beginning work at a Contractor-provided source, comply with the requirements of 107.17.

Obtain the rights, including access and conditional use permits for exploring, developing, and testing a Contractor-provided source for approval and use, at no additional cost to the Department. Do not use material from a Contractor-provided source until sampling and testing results show the material meets the contract requirements. Sample from areas within the Contractor-provided source where material will be extracted. Use a qualified independent laboratory to perform the sampling and testing. Ensure the independent laboratory provides test report copies for approval. Maintain and verify material quality during the work. Ensure the material meets the contract requirements.

The Contractor may use Contractor-provided sources instead of designated sources at no additional cost to the Department. The Contractor will be responsible for providing the material quantity necessary to complete the work.

106.10 Rights In and Use of Materials Found on the Work.

The Contractor, with approval, may use stone, gravel, sand, or other material found on the project site. The Department will pay the Contractor for these materials as follows:

1. At the corresponding contract unit price for excavating these materials.
2. At the contract unit price for which the excavated material is used.

The Contractor will replace the excavated material, used at the Contractor's discretion, with material meeting requirements, at no additional cost to the Department. The Department will not charge the Contractor for the value of the material found on the project site. Do not excavate or remove material that is not within the grading limits, unless approved in writing by the Engineer.

106.11 Production of Material in Department-Controlled Sources.

Reject material that contains an excessive amount of sand or unacceptable material, before starting secondary crushing. Use acceptable materials, regardless of size, for aggregate production.

Produce material as specified. Do not remove intermediate size aggregate for other contract pay items, unless the procedure produces material that meets the specified requirements and is approved.

Create material stockpiles in neat shapes using minimal surface area. Clear and grub the stockpile foundation and place a base of material to protect the stockpile from contamination. Build the stockpile in successive layers less than 3 feet thick.

Do not end-dump or conveyor-stack material over the sides of a stockpile. Do not stack conveyor placed stockpiles over 5 feet deep before leveling to minimize coarse and fine aggregate segregation.

Material produced, but not used in the work, will remain the Department's property. Stockpile rejected materials at Department-controlled sources as directed within the source. If the Engineer directs the Contractor to load and haul rejected material to a stockpile site outside the source, no greater than 1/2 mile beyond the source boundaries, the Department will pay the Contractor for loading, hauling, and stockpiling as specified in 109.03.C.5. If the Engineer directs the Contractor to haul material to stockpile sites over 1/2 mile beyond the source boundary, the Department will pay for hauling in excess of the 1/2 mile distance as extra work as specified in 104.02.B.

If the bid schedule includes a contract pay item for providing sanding material in stockpile, the pay provisions for reject material will apply after the Contractor reaches the sanding material plan quantity.

The Department will pay royalties to the source owner for material the Contractor removes from the material source, including reject material.

106.12 Depletion of Designated Sources.

If the Contractor depletes designated sources, the Department will designate a new material source. The Department will pay the Contractor, as specified in 109.03, for the additional cost of developing and reclaiming a new material source, including the cost of moving production plants.

The Department will not allow a time extension for moving a plant between designated sources, unless the Contractor depletes the designated sources or the source is otherwise found to be unsatisfactory.

106.13 Department-Provided Material.

Provide material required to complete the work.

The Department will make the Department-provided material available to the Contractor at locations specified in the special provisions.

Include the cost of handling and placing the Department-provided material in the contract unit price for the contract pay item incorporating the material including source recover fees, royalties, and use tax.

The Contractor is responsible for protecting the Department-provided material after its delivery. The Department will deduct the cost of replacing material from shortages, deficiencies and damage, and the cost of demurrage charges from Contractor payments.

106.14 Trade Names and Alternatives.

The contract may require certain materials under a trade name or manufacturer and catalog information. The Department will allow the Contractor to use alternative materials of equal quality and specified characteristics.

106.15 QPL and Non-QPL Products.

The Department will classify products as qualified product list (QPL) products or non-QPL products. Qualified products are manufactured products available and classified under at least 1 category included in the QPL. The Department website lists categories of products, covered by the QPL. The Department considers non-QPL products as manufactured products available on the market and not classified under a category covered in the QPL.

If testing required by the contract to determine product acceptability will take longer than 7 calendar days, the Engineer will notify the Contractor of the additional time necessary to make a decision.

A. QPL Products.

The Contractor may use approved products on the QPL within the specified conditions. The Department also lists, for information only, products under review that have yet to be approved.

Use of material from the QPL does not relieve the Contractor of its responsibility to incorporate the material into the work as required by the contract. If materials from the QPL do not meet the requirements, the Engineer will reject the material. Replace material rejected by the Engineer at no additional cost to the Department.

The Contractor may use products, covered by but not listed in the QPL as follows:

1. Submit a written request to substitute an alternate product for a product in the QPL.
2. Submit a QPL application form that includes data showing the proposed product is equal or better than the QPL product.
3. The Engineer will review and respond to the request within 7 calendar days after the request receipt.
4. The Contractor must receive written approval before using an alternative product.

If requesting the use of an alternative product, consider the following:

1. Intended purpose.
2. Compatibility with environmental conditions.
3. Aesthetics.

B. Non-QPL Products.

The Contractor may use products in categories not covered in the QPL as specified in the contract. The Engineer will review the Contractor's written request to use a non-QPL product and respond within 7 calendar days or as otherwise specified. The Contractor must receive written approval before using a proposed product.

106.16 Disposal of Materials.

Disposal material will become the Contractor's property. Remove these materials from the project site or dispose of them as specified or approved. Submit to the Engineer, in writing, the final hazardous materials disposal.

SECTION 107 – LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.01 Laws to be Observed.

Comply with all applicable local, state, and federal laws, ordinances, regulations, orders, and decrees. Protect and indemnify the Department, its agents, officials, employees, and the public owner (known as local public agency and local sponsor) against claims or liability that arise from, or are based on the violation of laws, ordinances, regulations, orders, or decrees, by the Contractor, the Contractor's employees, or subcontractors.

A. Federal-Aid Contracts.

On federal-aid contracts, each Contractor and/or subcontractor will submit a certified copy of each weekly payroll. Include a statement, verifying fringe benefits payment, to the employee or to an authorized agent.

B. Non-Federal-Aid Contracts.

Non-federal-aid contracts must adhere to [44-1001 through 44-1005, Idaho Code](#).

107.02 Permits and Licenses.

The Contractor is responsible for the following that are necessary to perform the work:

1. Obtaining and complying with permits and licenses.
2. Paying charges, fees, and taxes.
3. Providing the necessary notices.

The Department will not issue contract time extensions for delays resulting from the Contractor's failure to obtain permits in a prompt manner.

The Contractor agrees to the following:

1. Promptly pay taxes, except on real property, excises, and license fees due to the state of Idaho, its subdivisions, and municipal and quasi-municipal corporations, accrued during the contract, even if they are payable at the end of the contract term.
2. Secure to the Engineer's satisfaction, the taxes, excises, and license fees with officers of the taxing unit if they accrue and create a liability constituting a lien on the Contractor's property during the contract term, but are not payable at the end of the contract term.
3. Allow the Department, officer, board, or taxing unit, to withhold, from contract payments due, the estimated amounts of accrued taxes, excises, and license fees if the Contractor defaults on the payment or security of taxes, excises, and license fees.

107.03 Licensing of Contractors.

The Contractor and its subcontractors must possess the appropriate public works contractor license in accordance with [54-19, Idaho Code](#), as amended.

The Contractor and its subcontractors required to be listed in the bid proposal, must possess the license as specified as follows:

1. For contracts involving federal-aid funding, at the time the Department executes the contract.
2. For contracts without federal-aid funding, by the bid opening date and time.

Public works contractor licensing does not apply to professional service providers. The Department requires professional service providers to have appropriate professional licenses or certifications in the state for the work performed.

107.04 Patented Devices, Materials, and Processes.

If the Contractor uses a design, device, material, or process covered by letters of patent or copyright, the Contractor will submit proof of the legal agreement with the patentee or owner. The Contractor and the surety will protect and indemnify the Department, its agents, officials, employees, and the public owner from the following:

1. Infringement claims for the Contractor's use of a patented design, device, material, process, trademark, or copyright.
2. Costs, expenses, and damages, resulting from infringement claims, during or after work completion.

107.05 Restoring Surfaces Opened by Permit.

Allow individuals, firms, or corporations with authorized permits by the Department to enter the project site and perform the permitted work.

If directed in writing, repair the work damaged by the permit holder's actions to the original standard. The Department will pay for the repair work as specified in 104.02.

107.06 Traffic Control Devices.

Establish traffic control devices in accordance with the MUTCD adopted by the Board. Obtain the Engineer's approval before placing or removing traffic control devices.

107.07 Use of Explosives.

If the use of explosives is necessary for work performance, exercise the utmost care not to endanger life or property. Do not use explosives, in Department-controlled sources, without prior written approval.

Transport, use, and store explosives in compliance with applicable federal, state, and local laws, regulations, and ordinances. Notify each public utility company having structures in proximity to the project site. Provide notice sufficiently in advance to enable the public utility companies to protect their property from damage.

Submit blasting plan submittals as specified in 205. Perform blasting operations as specified in 205 and in a safe and professional manner.

107.08 Preservation, Protection, and Restoration of Property and Landscape.

Preserve and protect public and private property.

The Contractor is responsible for damage or injury to property due to acts, omissions, neglect, or misconduct during work performance, or due to defective work or materials. The Department will release the Contractor from this continuing responsibility for damage or injury to property when the work is deemed completed as specified in 105.15.

If the Contractor damages public or private property due to acts, omissions, or neglect in performing the work, the Contractor will restore the property to its original condition by repairing, rebuilding, or restoring as directed, at no additional cost to the Department. The Contractor will repair, rebuild, or restore damaged property in a manner to minimize loss and inconvenience to the property owner.

Protect and indemnify the Department, its agents, officials, employees, and the public owner from claims from property owners for property damage or injury caused by the Contractor's operations.

107.09 Forest Protection.

If performing work within or adjacent to state or national forests, comply with the regulations of the authority governing the protection and performance of work within forests.

Prevent and suppress forest wildfires, and help forest officials in preventing and suppressing forest wildfires. Immediately notify forest officials of the location and extent of a wildfire.

Comply with directives from forest officials or the Engineer in forest wildfire prevention or suppression.

107.10 Responsibility for Injury Damage.

Protect and indemnify the Department, its agents, officials, employees, and the public owner from the expenses of claims by third parties for money damages, including costs and attorney fees caused in whole or part by the following:

1. Operations of the Contractor or its subcontractors.
2. Neglect in safeguarding the work.
3. Use of unacceptable materials in constructing the work.
4. Acts, omissions, or neglect by the Contractor or its subcontractors.
5. Infringements of patent, trademark, or copyright.
6. Violations of the Workers' Compensation Act or other law, ordinance, order, or decree.

The Contractor's duty includes claims caused in whole or part by the Contractor, its subcontractors, anyone directly or indirectly employed by the Contractor or its subcontractors, or an entity or person whose actions the Contractor or its subcontractors may be liable for, regardless of whether the claim is caused in part by a party indemnified as specified in this subsection.

The Contractor will carry public liability and property damage insurance that will protect the Contractor, the Department, its agents, officials, employees, and the public owner from claims for bodily injury, including accidental death, and claims for property damages from operations under the contract whether by the Contractor, its subcontractors, anyone directly or indirectly employed by the Contractor or its subcontractors, or an entity or person whose actions the Contractor or its subcontractors may be liable.

Submit a certificate or other proof of the insurance and do not start work before obtaining approval of the insurance coverage.

Maintain the required insurance coverage until the Engineer deems the work completed as specified in 105.15.

The Contractor will be responsible for third party injury or damage until the Engineer deems the work completed as specified in 105.15. Submit damage claims to the Contractor's insurer and, if requested by the Engineer, submit proof of damage claim submissions within 15 calendar days.

Ensure the certificates state that cancellations or changes of the required policies and coverage are not effective without 30 calendar days prior written notice to the Department and affected railroads, if any.

A. Comprehensive or Commercial General Liability Insurance.

For comprehensive or commercial general liability insurance, provide at least a combined single limit of \$2,000,000 for each occurrence. Ensure the policy includes coverage for the following:

1. Bodily injury.
2. Broad form property damage, including completed operations.
3. Personal injury, including employee acts.
4. Blanket contractual.
5. Contractor's protective.
6. Products.

7. Completed operations.

Ensure the policy also includes coverage for the hazards commonly referred to as XCU (explosion, collapse, and underground). If a subcontractor is performing XCU operations, the subcontractor may provide this protection, naming the Department and the Contractor as additional insureds. For comprehensive or commercial general liability insurance policy containing an aggregate limit, ensure a limit of at least \$4,000,000.

The above limits may be met by policies having limits such as \$1,000,000 per occurrence, \$2,000,000 aggregate plus an umbrella policy of \$2,000,000.

Ensure the comprehensive or commercial general liability insurance is endorsed to include the Department, its agents, officials, employees, and the public owner as additional insureds. Ensure the general liability insurance also stipulates the Contractor's insurance coverage is primary insurance and insurance carried by the Department or public owner will not be applicable to a claim and will not be contributory insurance to that purchased by the Contractor for the benefit of the named insureds. The insurance will provide coverage for the named insureds for the Contractor's defense and indemnification duties under 107.10. Ensure the insurance contains a separation of insureds provision. The insurance provided will be first dollar coverage to the named insureds regardless of previous occurrence or aggregate deductible under the policy.

B. Comprehensive Automobile Liability Insurance.

For comprehensive automobile liability insurance, covering the owned, hired, or other vehicles used in the performance of the work, provide a combined single limit policy for bodily injury and property damage of at least \$2,000,000 each occurrence.

C. Workers Compensation Insurance.

Carry a minimum of \$500,000 in workers' compensation insurance and comply with [Title 72, Idaho Code](#) to cover the Contractor's and its subcontractor's workforce.

107.11 Contractor's Responsibility for Work.

A. General.

Provide and be responsible for the work and material, including change order work, until the Engineer deems the work completed as specified in 105.15.

Rebuild, repair, and restore damage to permanent or temporary work occurring before the Engineer deems the work completed as specified in 105.15 at no additional cost to the Department, except for damages due to the following causes:

1. Acts of God; a cataclysmic natural phenomenon (e.g., tornadoes, earthquakes, floods, and officially declared natural disasters).
2. Acts of the public enemy or governmental authority.

These exceptions do not apply to damages resulting from the Contractor's failure to take reasonable precautions, or to exercise sound engineering and construction practices in performing the work.

If damage by others delays the work, the Engineer will evaluate a contract time extension as specified in 108.07.

B. Relief of Responsibility for Completed Work.

The Department may relieve the Contractor of the duty of maintaining and protecting portions of the work the Engineer has deemed completed as specified in 105.15. This relief applies to damages caused by public traffic, the elements, or other causes, but not from damage caused by the Contractor's operations or negligence.

C. Relief of Responsibility for Damage by Public Traffic.

When it is necessary for public traffic to use a highway facility during construction, the Department will relieve the Contractor of its responsibility for damages to the permanent work caused by public traffic under the following conditions:

1. The work is as specified in the plans or approved construction plan stage or phase.
2. The contract requires the Contractor to open the roadway section to the traveling public.
3. The Contractor implements traffic controls in accordance with the approved traffic control plans.
4. The Contractor submits a written request for the work that is complete to a point where the Engineer can grant relief as specified in 107.11.B.

The Contractor will resume responsibility for the work when public traffic is relocated to another roadway section.

D. Repair of Damage.

Immediately repair damage to temporary or permanent work as directed. For damage to permanent work qualifying for relief under this subsection, the Department may direct the Contractor to perform the repair work as specified in 104.02 or direct others, including the Department's workforce, to perform the repair work.

The Department will pay the Contractor for repair of damaged permanent work only. The Department will not pay for delay or disruption caused by damage to, or repairs of, the temporary or permanent work, including extended home office overhead, idle equipment, or inefficiency.

107.12 Contractor's Responsibility for Utility Facilities and Property.

Prevent damage to utility facilities and property supporting utility facilities. Do not begin work adjacent to utility facilities if damage, loss, or inconvenience may result to the utility facility until arrangements necessary for damage prevention have been made.

Contact a representative from each utility company with facilities on the project site to locate underground facilities the work may affect.

Allow and accommodate utility companies and their representatives to enter the project site to make emergency connections or repairs to utility facilities.

Promptly notify the utility company representatives of service interruptions resulting from the Contractor's operations that cause the following:

1. Accidental breakage.
2. Facility exposure.
3. Unsupported facilities.
4. Other damages or disruption.

Cooperate with the utility company to restore interrupted utility service. If construction operations interrupt utility service, the Contractor and the utility company will perform continuous repair work to restore the utility service. Do not perform work around fire hydrants until the local fire authority approves of temporary means to maintain continued service.

If constructing or reconstructing structures during the irrigation season, provide temporary ditches, siphons, or other structures for conveying water without waste, loss, or delay. Temporary water conveyance costs are included in the contract unit prices for the respective contract pay items.

107.13 Personal Liability of Public Officials.

The Board members, administrator, and authorized Department representatives or public owner, personally, or in their official capacity, will have no personal liability in executing the provisions of this contract or exercising the power or authority granted them. The Board members, administrator, and authorized Department representatives or public owner act solely as agents and representatives of the state of Idaho or public owner.

107.14 No Waiver of Legal Rights.

The Department is not precluded or estopped by measurements, estimates, final pay quantities, or certificates, made before or after the completion and acceptance of the work and payment, from establishing the following:

1. The true amount and character of work performed and materials provided by the Contractor.
2. The measurements, estimates, final pay quantities, or certificates are untrue or incorrect.
3. The work or materials do not conform to the contract.

The Department is not precluded or estopped, despite measurements, estimates, final pay quantities, or certificates and payments, from recovering from the Contractor and its surety, damages the Department may sustain due to the Contractor's failure to comply with the terms of the contract or an incorrect measurement of a contract pay item. Damages will include overpayment the Department made due to an incorrect contract pay item measurement or calculation.

The Department does not waive its rights under this subsection, if there is:

1. Acceptance by the Department.
2. Payment for or acceptance of the whole or part of the work.
3. Time extensions.
4. Possession taken by the Department.

A breach of contract waiver will not occur.

107.15 Access to Records.

The Contractor and its subcontractors will keep the necessary books, documents, papers, accounting records, and other evidence pertaining to incurred costs.

The Contractor and its subcontractors will make these records available to authorized agents of the state of Idaho or federal government for inspection and copying at the Contractor's or its subcontractor's offices during normal business hours for the following time periods:

1. The contract time.
2. Five (5) years after the date on which the Department makes final payment to the Contractor.

Failure of the Contractor or its subcontractors to maintain the required records and provide access to these records may result in a waiver of a claim the Contractor may have for additional pay or for breach of contract by the Department.

107.16 Sanitary, Health, and Safety Provisions.

Federal, state, and local laws, rules, and regulations related to construction safety and health standards are essential terms of the contract. The Contractor will conduct its work in a safe and prudent manner at all times. The Department prohibits the Contractor from allowing or requiring workers to work in conditions that are unsanitary, hazardous, or dangerous to their health or safety.

Provide reasonable restroom facilities for personnel and adequate work time to use those facilities, including provision of portable facilities for moving operations.

107.17 Environmental and Cultural Resource Protection.

A. Non-compliance.

Comply with all federal, state, and local environmental and cultural resource laws, regulations, and ordinances. Comply with the project permits. Notify the Engineer immediately of:

1. Work that is out of compliance with regulations or permits. Immediately cease noncompliant activities and take corrective action to bring the work into compliance.
2. Discharges of pollutants, discharges exceeding water quality standards, discharges which may endanger health or the environment, or an upset (exceptional incident because of factors beyond the reasonable control of the permittee as defined in [40 CFR 122.41](#)). Perform actions to correct the discharge as soon as possible.
3. A notice of inspection or noncompliance or from a state or federal resource agency. Cooperate with inspectors.

If a regulatory agency identifies a failure to comply with the permits and modifications thereto, or other federal, state, or local requirements, the Contractor is responsible for:

1. Penalties, including monetary fines and damages, proposed or assessed to the Department for the Contractor's failure to comply with environmental regulations or permits
2. Costs to mitigate or remediate violations or environmental damage or for the Department to resolve enforcement actions, including payments made or costs incurred in settlement for alleged violations of applicable laws, regulations, or requirements.

The Department may withhold money due to the Contractor subject to the following:

The Department will withhold money due to the Contractor, in an amount estimated by the Department, to include the full amount of penalties and mitigation costs proposed, assessed, or levied as a result of the Contractor's violation of the permits, or Federal or State law, regulations, or requirements. Funds will be withheld by the Department until final disposition of these costs has been made. The Contractor will remain liable for the full amount until the potential liability is finally resolved with the entity seeking the penalties. Instead of the withhold, the Contractor may provide a suitable bond in favor of the Department to cover the highest estimated liability for any disputed penalties proposed as a result of the Contractor's violation of the permits, law, regulations, or requirements.

The Department will give the Contractor 30 calendar days' notice of the Department's intention to withhold funds from payments which may become due to the Contractor before acceptance of the contract. Funds withheld after acceptance of the contract will be made without prior notice to the Contractor.

No withholds of additional amounts out of payments will be made if the amount to be withheld does not exceed the amount being withheld from partial payments as specified in these Standard Specifications.

If the Department has withheld funds and it is subsequently determined that it is not subject to the entire amount of the costs and liabilities assessed or proposed in connection with the matter for which the withhold was made, the Department will return the excess amount withheld to the Contractor in the progress payment following the determination. If the matter is resolved for less than the amount withheld, the Department will pay interest at a rate of 6 percent per year on the excess withhold.

If the work results in noncompliance of a permit or regulatory requirement, the work may be suspended and the permitting agency notified, if required. Violation of a permit condition or provision may be a breach of contract as specified in 108.09.

The Contractor will not receive additional compensation, or time extensions, for any disruption of work or loss of time caused by any actions brought against the Contractor for failure to comply with good engineering, hydrologic, and pollution control practices.

B. Contract Revisions – Contractor Requested.

The Contractor requests to add, delete, or modify work activities, work areas, methods, sequencing, or work windows may require a new or modified permit or approval (e.g., Section 404 Clean Water Act, Endangered Species Act, National Historic Preservation Act Section 106, NEPA). Exception: A project without federal funds, a federal permit, or federal approval does not require approval under National Historic Preservation Act Section 106. Projects on federal lands require coordination with the appropriate federal lands management agency (e.g., BLM, Forest Service).

1. Submit a detailed description of new or modified work, and the required environmental documentation prepared by a qualified professional.
2. The Department will transmit documents to the approving jurisdictions.
3. Cost and contract time delays are the Contractor's responsibility.
4. Obtain the Engineer's written approval before beginning any work not included in the original contract.

C. Contractor Support Areas.

Contractor support activities (e.g., material sources, waste, stockpile or staging areas, access or haul roads) will not:

1. Encroach on regulated wetlands as defined by the U.S. Army Corps of Engineers.
2. Affect listed threatened or endangered species or critical habitat.
3. Adversely affect historic properties as specified in 107.18.

Materials sources active and open to the public before the project's bid advertisement are not considered a project-related action, and do not require Department environmental approvals.

D. Permits.

Work affecting wetlands or waterbodies requires a permit(s) issued by one or more of the following agencies:

1. U.S. Army Corps of Engineers ([Clean Water Act, Section 404](#)).
2. Idaho Department of Water Resources ([IDAPA 37.03.07](#)).
3. Idaho Department of Environmental Quality (water quality certification).

If a permit(s) has been obtained by the Department, the permit and the permit application is attached to the contract bid package. Perform work in conformance with the description of work, work area, methods, sequencing, work windows, conditions, and mitigations.

E. Endangered Species Act (ESA).

If the work affects listed species or designated critical habitat (under the Endangered Species Act), a biological assessment (BA) is attached to the contract bid package. Projects with an adverse effect will also include a biological opinion (BO) prepared by the USFWS or USNMFS.

Perform work in conformance with the description of work, work area, methods, sequencing, work windows, conditions and mitigations. Notify the Department of any issues identified as specified in 102.03. Refer conflict or ambiguity with the contract documents to the Engineer.

F. Migratory Bird Treaty Act and Bats.

The Migratory Bird Treaty Act protects migratory and nongame birds, their occupied nests, and their eggs. Bats are a protected non-game species in Idaho ([IDAPA 13.01.06](#)).

Work that may impact migratory birds or bats includes removal of vegetation or bridge structures and rock (cliff) excavation or blasting. See the contractors note for the approximate nesting and breeding window for species that may be anticipated.

During the nesting season, monitor vegetation or structures for nesting birds or bats. Preemptive measures to avoid migratory bird species and bats include clearing outside the nesting season, regular monitoring of bird or bat activity, removal and disposal of unoccupied nests to prevent occupation, and exclusion devices (e.g., bird repellent spray, netting) that does not result in death or injury to adult birds.

Notify the Engineer of a discovery of nesting birds or bats. An active nest is defined as one with eggs or a bird living in it. If active migratory bird nests are discovered on a project site, immediately stop work within 50 feet of the nest(s) or bird(s) and notify the Engineer.

If a nest has been abandoned or there are no eggs present, it can be removed and destroyed as needed. An active nest must be protected from harm. If an active nest becomes established (i.e., there are eggs or young in the nest), cease any work with potential to disturb the nesting bird until the young have fledged and the nest is unoccupied.

Work with the Engineer as needed to develop a plan to avoid impacts to birds, nestlings, or eggs. When directed, use exclusion devices, nesting prevention measures or remove and dispose of partially constructed and unoccupied nests of migratory or nongame birds on a regular basis to prevent their occupation. Nest removal activities must not result in depositing into or allowing materials to enter waters of Idaho. Unless otherwise provided, directed work will be paid as extra work as specified in 104. Adjustments may be made for delays the Engineer determines are not due to the Contractor's failure to perform the provision of the contract.

G. Hazardous Material.

Conditions (e.g., the presence of barrels, buried or above ground storage tanks, contamination indications, odors, excessively hot earth, stained and discolored soils, smoke, unidentifiable powders, sludges, pellets, debris) can be possible hazardous material indicators.

If an abnormal condition is encountered or exposed that indicates the presence of a hazardous material, immediately suspend work in the area, treat the conditions with extreme caution, and notify the Engineer. Do not attempt to excavate, open, or remove without approval. Notify the Engineer immediately after the discovery of either:

1. A petroleum-based spill that meets the reportable release definition as defined in [IDAPA 58.01.02.851](#). This includes spills greater than 25 gallons or any spill that results in a sheen on a waterbody surface.
2. A hazardous waste spill that meets the disclosure definition as defined in [IDAPA 58.01.05](#) and [58.01.02.850](#).

Notify StateComm at 1-800-632-8000.

In the event of a petroleum or hazardous waste spill, implement measures, if safe to do so, to minimize contaminant spread using spill kits or other appropriate methods. Capture and dispose of the spilled materials under the Engineer's direction in accordance with DEQ and EPA requirements. Document the spill and response action, and submit a copy to the Engineer.

Work related to the encounter of unidentified hazardous materials will be considered differing site conditions or extra work and managed as specified in 104.

H. Inadvertent Discovery of Cultural Resources Including Human Remains.

If cultural resources are discovered, cease all work within 50 feet in all directions.

If human remains are discovered, cease all work within 150 feet in all directions.

In both cases, clear the area of all unnecessary personnel, secure the area, and immediately notify the Engineer. If human remains are discovered, also notify the local police. One or more individuals must stay with the human remains until law enforcement officials are on the project site.

1. Call the local police and provide all known information related to the discovery. Follow their instructions. Inform the Engineer after the local authorities have been notified.
2. Photography of human remains is not allowed.
3. If allowed by the police, cover the human remains completely with a tarp or plain piece of cloth (e.g., rug, towel, blanket).
4. Do not disturb any additional ground.
5. Do not touch, move, or in any way cause the human remains to change position from the original position noted upon discovery.
6. Keep all information related to the discovery in the strictest confidence.
7. Follow all associated laws and policies.

The Engineer will communicate the status of any restrictions implemented as a result of the inadvertent discovery:

1. Time necessary for the Department to manage the inadvertent discovery process.
2. Project areas where the Contractor may work during the inadvertent discovery process.
3. Written confirmation when the inadvertent discovery process is complete.

Payment and contract time extension due to the inadvertent discovery and required cultural resource clearance not previously identified in the contract is specified in 104.02 and 108.07.

I. Stormwater Pollution Prevention.

All projects require one of the following:

1. A Stormwater Pollution Prevention Plan (SWPPP) as required by a Construction General Permit (CGP). A SWPPP is required when ground disturbance equals or exceeds one or more acres and discharges to waters of the U.S.A.
2. Pollution Prevention Plan (PPP) required by the Department.

Both plans are documents that address best management practices (BMPs) (e.g., erosion and sediment control, good housekeeping practices, inspection procedures, spill prevention, response, cleanup). Meet applicable requirements of 212.

The plan sheets (project clearance summary) identifies if a PPP or a CGP is anticipated based on estimates of ground disturbance.

PPP	CGP SWPPP
If the addition of construction support activities causes the project ground disturbance area to meet the requirements for a CGP, follow CGP requirements.	—
Prepare the entire PPP using the ITD-2788 form as a template provided by the Engineer.	Revise the draft SWPPP developed by the Department, consisting of plans sheets and a template narrative (using the ITD-2950 form), included with the bid package.
Conduct inspections by a person who is knowledgeable in erosion and sediment control and pollution prevention practices. This includes professional accreditation (e.g., the Department’s Water Pollution Control Manager (WPCM) training, Certified Professional in Erosion Control (CPESC), Certified Erosion, Sediment, and Stormwater Inspector (CESSWI)) or other applicable site management or project management experience which can be documented and provided to the Engineer.	Conduct inspections by a certified WPCM. Training requirements are posted on the Department’s website.
Document the inspections using the ITD-2786 form available online.	Document the inspections using the ITD-2802 form available online.

Submit the plan and plan revisions for approval before the preconstruction conference. The Engineer may also require submittal of an electronic, editable version of the plan. Allow 15 calendar days for review, unless otherwise specified. Revise to address comments and resubmit. Adjustments in cost or time are not allowed for SWPPP approval. Once approved, all operators will sign the plan. The plan must be approved before staging.

Construction activities, construction support activities, or pollutant-generating activities are not allowed beyond the project limits.

J. CGP Requirements.

For projects that require coverage under the national pollutant discharge elimination system (NPDES) General Permit for Discharges from Construction Activities (CGP), comply with the permit and the following Department requirements:

1. Designate a qualified WPCM to manage project site pollution prevention and CGP requirements. Ensure the WPCM meets the training qualification requirements posted on the Department's website. Submit the WPCM's contact information and training qualifications before the preconstruction meeting. Once approved, insert the qualification information into the SWPPP.
2. Revise the draft SWPPP template provided by the Department to include Contractor designated construction support activities, work areas, work methods, and phasing. Submit the revised SWPPP for review and approval before the preconstruction meeting.
3. Coordinate electronic NOI filing with the Engineer. Verify SWPPP certification requirements are met.
4. Do not begin construction activities until the EPA has acknowledged receipt of required NOIs on the EPA's website and the 14 calendar day waiting period is over.
5. Post the NPDES ID (permit tracking number associated with the project NOI) in addition to the other requirements of the CGP.

6. Inspect the project site and associated support areas per the CGP requirements. Use the current version of the ITD-2802 form. Sign the inspection report and insert it into the SWPPP within 24 hours of completion of any inspection. Submit a copy to the Engineer upon request. Joint inspections with the Department's inspector may be allowed at the discretion of the Engineer.
7. Field Controls. Ensure installation, operation, and maintenance of effective erosion and sediment control measures and pollution prevention measures per the CGP requirements. Ensure completion and documentation of corrective actions.
8. Recordkeeping. In accordance with the CGP, amend the SWPPP to conform to the Contractor's current sequencing and operation throughout the work. Submit proposed modifications for approval. Obtain necessary signatures and certifications from operators for required SWPPP modifications and corrective actions. Maintain all SWPPP records. Retain completed copies of required documentation and recordkeeping in the SWPPP and at the project site or at an Engineer-approved offsite location.

K. Notice of Termination (NOT).

When conditions for terminating the CGP coverage have been met, request written approval from the Engineer to file an NOT using the ITD-2961 form. Do not submit an NOT without the Engineer's written approval. Provide the most current version of the SWPPP, at the time of work completion, to the Engineer.

L. Turbidity Monitoring (if Plume is Visible).

1. Turbidity Monitoring. Turbidity monitoring is required for projects with CGP coverage that directly discharge pollutants from an unstabilized portion of the project site causing a visible plume into the waters of the United States.
 - a. If a visible plume is observed, collect and record turbidity readings from within the plume and compare the results to background measurements (upstream of plume, 50 NTU over background) unless otherwise directed in project specific requirements.
 - b. If turbidity is less than 50 NTU (instantaneously) over the background turbidity, continue monitoring as long as the plume is visible. If over 50 NTU, then immediately cease all earth-disturbing work.
 - c. Take immediate action to address the cause of the exceedance per the CGP.
 - d. Increase actions to address the cause of the exceedance and monitor frequency until state water standards are met.
 - e. Work may continue once turbidity readings return to within 50 NTUs (instantaneously) of background levels and 25 NTU for more than 10 consecutive days over the background turbidity.
 - f. Provide a verbal report to the Engineer within 24 hours of any exceedance of the Idaho State Water Quality Standards, followed by a written report within 5 days using the ITD-2790 form.
2. Turbidity Logbook and Diary.
 - a. Maintain a legible, organized logbook and construction diary at the project site and make it available for inspection with the SWPPP.
 - b. All logbook entries must include the following information.
 - (1) Date.
 - (2) Time.
 - (3) Sample location.
 - (4) Turbidity result (NTUs).

- (5) Cloud cover (i.e., cloudy, partly cloudy, or clear), wind direction and speed, precipitation (inches) in last 24 hours, and ambient air temperature (°F) at the time of sample collection.
 - (6) Visual observations of any discharge per the CGP.
 - (7) If applicable, corrective actions taken and their observed effectiveness.
 - (8) Printed name and signature of the sample collector.
- c. Include photographic documentation of any visible variation in water quality.
 - d. Include a map or sketch, including GPS coordinates, of each sample location.
 - e. Submit routine monitoring data to the Engineer or to regulatory agencies upon request.
 - f. Include documentation in the SWPPP that any personnel collecting samples and testing water quality are qualified to perform this task.

M. Basis of Payment.

PPP or SWPPP development, revisions, modifications, inspections, and costs associated with the permitting and compliance is incidental and included in the contract pay items, unless otherwise specified.

107.18 Fencing.

If the contract requires fence removal, replace the fence to the original or better condition. Ensure livestock confinement during the work. If a temporary fencing pay item is not included, temporary fencing will be paid by force account as specified in 109.03.C.5.

Submit advance written notice to adjacent landowners before removing fence. Contact and coordinate with adjacent landowners 48 hours before removing the fence and submit written evidence of coordination with adjacent landowners to the Engineer before removing the fence.

107.19 Survey Monument Preservation.

Retain an Idaho licensed professional land surveyor (PLS) to:

1. Locate, verify, and tie the position of the known survey monuments documented on the plans, if any, for each assigned project.
2. Perform historical research and field search for other survey monuments within the project site that are not documented on the plans. For any additional monuments found, locate, tie, reference, and report them to the Engineer and the Contractor.
3. Provide written confirmation to the Engineer and the Contractor that the work under 107.19.1 and 107.19.2 have been completed before allowing the Contractor to occupy the project site.
4. Furnish the necessary materials, equipment, and labor to:
 - a. Adjust existing monuments.
 - b. Replace substandard monuments.
 - c. Install new vaults or adjust existing vaults around the monuments within the paved surfaces to the grade established or as directed.
 - d. Reestablish monuments disturbed by the work.
5. Record positions of all survey monuments found within the work area (e.g., the median, roadway, shoulders, roadway slopes) and, for contracts with work planned at the right of way, along the right of way fences. Obtain and complete the Multi-State Control Point Database (MCPD) master template, in its

entirety, for all monuments located, referenced, and tied. Copies of plans showing original right of way monument positions can be obtained from the Department.

6. Material acceptance will be by visual inspection. Materials required for the installations and adjustment of vaults will be as specified in 618.02 and as in:

Portland Cement	701
Aggregates	703
Metals.....	708
Concrete Curing Compounds and Admixtures	709

7. Preliminary Procedure.

Before commencing work that will or may disturb survey monuments, the Contractor will retain an Idaho licensed PLS to locate, reference, and tie all survey monuments within the project site including, but not limited to, the following:

- a. Public and private land corners and all accessories to those corners.
- b. Control points set by agencies of the United States government, the state of Idaho, counties, cities, or private surveyors.
- c. Benchmarks set by agencies of the United States government, the state of Idaho, counties, cities, or private surveyors.
- d. Right of way monuments that may be disturbed by the work.
- e. A list of known survey monuments will be provided in the contract.

8. Preserve Existing Survey Monuments.

- a. The Contractor will retain and protect the survey monuments within the project site that are not shown on the plans to be disturbed by the work.
- b. The Contractor will not remove, destroy, bury, or alter any survey monuments, unless authorized by the PLS and the Engineer.

9. Survey Monuments Disturbed by the Work.

- a. Survey monuments disturbed during construction will be re-established in kind or with a monument of superior quality as determined by the PLS before project completion. Any survey monument set, adjusted, or replaced will be in accordance with [54-1227, Idaho Code](#) and will be surmounted with a cap of such material and size that it can be permanently and legibly marked with the date and PLS license number in responsible charge of placing, adjusting, or replacing the monument.
- b. Public and private land corner monuments disturbed during construction will be reestablished and re-monumented in accordance with [55-16, Idaho Code](#). A survey monument set or adjustment will be in accordance to 54-1227, Idaho Code and for Public Land Survey System (PLSS) corner monuments will be surmounted with a cap of such material and size that it can be permanently and legibly marked in accordance with the current Manual of Surveying. Instructions published by the United States Department of the Interior, Bureau of Land Management. Mark the cap as per the Manual of Surveying Instructions.
- c. Federal, state of Idaho, and local survey monuments disturbed by the work will be reestablished in the original position as determined before construction and in accordance with the standards, rules, and procedures of the original monumenting agency. In the case of NGS survey monuments, the NGS State Advisor or Idaho's NGS Geodetic Coordinator on staff at Idaho State University (ISU)

will be consulted before the removal and reestablishment of any NGS or United States Coast and Geodetic Survey monument.

- d. Unless the PLS directs the Contractor to proceed in a different manner, survey monuments lying within the paved portions that will or may be disturbed during the work will be treated as follows:
 - (1) If an existing survey monument meets the minimum requirements of 54-1227, Idaho Code, it can be retained or adjusted vertically in place as determined by the PLS.
 - (2) If an existing survey monument does not meet the minimum requirements of 54-1227, Idaho Code, a new survey monument which meets or exceeds the minimum requirements of 54-1227, Idaho Code or the standards of the original monumenting agency, whichever is a superior monument, will be installed by or under the direct supervision of the PLS.
 - (3) If an existing survey monument must be removed for the work, a new survey monument which meets or exceeds the minimum requirements of 54-1227, Idaho Code or the standards of the original monumenting agency, whichever is a superior monument, will be installed by or under the direct supervision of the PLS.
 - (4) Where a survey monument is within the paved portions of the roadway and more than 1 foot inside the edge of the asphalt shoulder (edge of oil), a vault (casing) will be installed over the monument as specified. Any new monument set in vaults (casings) will conform to the specifications for a street monument.
- e. Any survey monument discovered during the work and not identified in the plans will be located, referenced, tied, and reported under the responsible charge of the PLS. If an unidentified monument is to be disturbed during construction, it will be re-established and re-monumented.
- f. Any survey monument disturbed and not identified on the plans or referenced by the PLS before it being disturbed will be reestablished and re-monumented under the responsible charge of the PLS from the best available evidence and information of record in accordance with accepted survey methods and procedures of the Idaho Code and/or the original monumenting agency. Re-monumentation will be in accordance to this section.
- g. Any survey monument willfully or carelessly disturbed or destroyed by the Contractor will be re-established and re-monumented in accordance to this section at no additional cost to the Department.
- h. The PLS will mark his/her license number, the year, the word "RESET," and the original project stationing and offset on all centerline or right of way monuments reset, replaced, adjusted, restored, re-established, re-monumented, or reconstructed. All newly installed centerline, right of way, and street monuments on the state highway system will be in accordance with the Department's specifications.

10. Documentation.

Following the completion of the work, the PLS will verify the monument positions, stamp the survey monuments, and verify the vaults (casings) have been installed, if required. If public land corner monuments were adjusted or replaced, or if any accessories to the public land corner monuments have been established, the PLS will file the appropriate documentation in the county or counties where the project site is located in accordance with [55-16, Idaho Code](#). If private land corner monuments, center line monuments, or right of way monuments were adjusted or replaced, a record of survey will be filed in accordance with 55-19, Idaho Code. If NGS survey monuments were disturbed and/or reset, the PLS will submit copies of the monument reset information as provided to and approved by the NGS. The PLS will submit a copy of all documents recorded at the county offices. The PLS will submit a written report, which

documents all actions taken by him/her or the Contractor to preserve or restore each survey monument within the project site. The report will indicate the Geodetic or State Plane coordinate positions (including coordinate system, datum, and project combination factor used) of each survey monument within the project site before construction, the Geodetic or State Plane coordinate positions of each survey monument after the work has been completed, and the actions taken by the Contractor and the PLS to preserve, adjust, or replace each survey monument. The report must be submitted before issuance of the final payment. The PLS will seal and sign this document.

11. MCPD Submittal.

The PLS will obtain and complete the MCPD master template form with global positions (e.g., WGS-84 latitude, longitude, and orthometric height) of the monuments referenced during and checked after the work. The PLS will submit the completed MCPD template directly to the MCPD at ISU and submit a copy to the Engineer. The MCPD template is available at http://giscenter.isu.edu/research/Techpg/GC/zip/MCPD_MASTER_TEMPLATE.zip. In the submittal of the MCPD to ISU, include a letter of transmittal signed and sealed by the PLS.

Survey monument preservation work to locate, reference, reestablish, replace, install, adjust, or reconstruct survey monuments and vaults, and to obtain and complete the MCPD template for submittal will be paid by force account as specified in 109.03.C.5.

107.20 Weed Control.

Avoid transporting or transferring noxious or invasive weed into or out of the project site. Control noxious or invasive weeds within the project site, including stockpiles

Wash all vehicles and equipment before entering the project site or staging areas, and remove any dirt, mud, plant parts, or seed residue that remains after a visual inspection before beginning work. Additional washes may be required by the Engineer if vehicles or equipment come in contact with a noxious weed-infested area or travels off the project site or staging areas. Ensure invasive (including cheatgrass, medusahead rye, kochia, tumble mustard, prickly lettuce or Russian thistle) or noxious weed seed and plant parts, and dirt are completely removed. Washing vehicles and earth-moving equipment is considered incidental to excavation and related items.

Before beginning earth-disturbing operations, have the Engineer, county weed superintendent, and/or equivalent survey the project site to identify noxious weed sites and concerns. Avoid or treat and remove soil and material containing noxious weed seeds and/or plants before beginning disturbance or excavation.

Begin work in non-noxious weed-infested areas. Locate staging areas in non-noxious weed-infested areas unless a washing station is installed on the project site. Avoid or minimize vehicle and equipment travel through known noxious weed-infested areas. Service vehicles traveling frequently in and out of the project site that remain on the roadway are exempt from this requirement.

Herbicides are required to be approved before use and will be applied during the weed's growing cycle. Herbicides will be applied by an Idaho licensed applicator. Comply with all applicable local, state, and federal requirements including limitations imposed by the Secretary of the Interior. Herbicides may need to be applied multiple times throughout the growing season for weed control.

Do not apply herbicides to areas within 100 feet of a river, water source, or where there is standing or running water. Spraying herbicide on or adjacent to surface waters or wetlands is prohibited, unless it is an aquatic herbicide and the Contractor has an NPDES Pesticide General Permit (PGP) from the EPA. The Contractor is required to contact the EPA or Army Corps of Engineers to determine requirements.

In seasonal wetlands, riparian, and sensitive areas, and after new plantings and seeding, use mechanical or hand-weeding methods where herbicides may adversely affect new plantings or seeding. Complete hand-weeding before beginning seeding applications.

The Contractor is responsible for herbicide delivery, handling, storage, application, and left over herbicide and container disposal. Herbicide application is regulated by the EPA under the Federal Insecticide, Fungicide, Rodenticide and Algaecide Act (FIFRA) and a 2001 decision in the Ninth Circuit Court of Appeals. For seeding applications, including duration or timing, follow the product label and manufacturer's written instructions.

107.21 Seeding and Vegetation Special Guaranty.

This subsection only applies if the area to be reseeded/revegetated is greater than 1 acre.

The Contractor will ensure vegetation establishment, including watering, cultivating, plant or mulch replacement, reseeding, and any other work necessary to maintain planting and seeding in non-lawn areas in a healthy condition throughout the 1-year establishment period. The 1-year establishment time period begins when all planting and seeding installation is completed.

Seeding and vegetation establishment is successful when the desirable plant species cover at least 30 percent, undesirable or weedy plant species cover less than 30 percent, and state listed noxious and invasive weeds, including cheatgrass, medusahead rye, kochia, tumble mustard, prickly lettuce or Russian thistle, cover less than 1 percent of the seeded area after 1 year.

The Department will conduct an evaluation after 1 year and determine which areas, if any, do not meet the contract. Replace plants or reseed the areas that do not meet the contract at no additional cost. The replacement plants and reseeding will be the same species and sizes as originally specified. Provide materials, labor, fertilizer, and all other items as originally specified.

SECTION 108 – PROSECUTION, PROGRESS, AND TERMINATION

108.01 Subletting of Contract.

Do not sublet, sell, transfer, assign, or otherwise dispose of the contract or portion of the contract or of the right, title, or interest in the contract without written consent. If the Engineer consents to subletting a portion of the work, the Contractor will use its own organization to perform work amounting to at least 50 percent of the original contract amount for contracts that involve federal-aid funding and 20 percent for state-funded contracts. The phrase “its own organization” includes only workers employed and paid directly, inclusive of employees who are employed by a lease agreement acceptable to the Department, and equipment owned or rented with or without operators, and does not include employees or equipment of a subcontractor, assignee, or agent of the Contractor.

Calculate this percentage using the following equation:

$$X = \frac{C}{O - S} \times 100$$

Where:

X = Percentage of work performed by the Contractor’s own organization (%).

C = Contract amount of work performed by the Contractor’s own organization (\$).

O = Original contract amount (\$).

S = Contract amount of specialty items (\$), if included in the contract.

If the contract requires contract pay items to be performed at stipulated prices or invoice prices and these items are not on the bid schedule, add the prices of these items to the original contract amount to determine the minimum percentage specified above. Submit written quotations as support for invoice prices.

Do not allow a subcontractor to work until the subcontractor’s executed agreement (the subcontract) with the Contractor, including the required attachments and addenda, is approved. Neither of the following relieves or releases the Contractor or the surety of their responsibilities or liability under the contract or the contract bonds:

1. The Engineer’s consent to subcontract work.
2. The subcontract.

Subcontracting does not create a contract between the Department and the subcontractor. The subcontractor gains no rights and the Department accepts no responsibilities by reason of the subcontractor’s contract with the Contractor. The Contractor is responsible for the work performed.

108.02 Contract Time.

A. General.

Contract time starts as stated in the special provisions.

Do not begin work until the contract is fully executed as specified in 103.05.

Achieve substantial completion within the contract time. The Engineer will not charge contract time after substantial completion as determined and written by the Engineer, as long as the Contractor diligently performs the remaining work.

B. Working Day Contracts.

Beginning with the start of work specified in 108.02.A, the Engineer will assess working days for all days except as specified in 101.04.

The Engineer will assess working days if the Contractor is not performing work on the critical path and nonperformance is due to causes that the Contractor could have foreseen, controlled, or prevented.

The Engineer will prepare and provide to the Contractor a monthly statement showing the number of working days charged for the preceding month and the number of working days remaining in the contract time. If the Contractor disagrees with the working days assessed, the Contractor may give notice on the monthly statement as specified in 104.03.

C. Calendar Day Contracts.

Beginning with the start of work specified in 108.02.A, the Engineer will assess contract time for all calendar days.

D. Completion Date Contracts.

For completion date contracts, the contract time concludes on the specified contract completion date.

108.03 Project Schedule.

A. General.

Develop and maintain a project schedule that represents the scope of work required by the contract and the proposed sequence of operations. Include activities with reasonable durations for work that is the Department's responsibility. Reasonable is defined as "customary or normal" for the type of work involved or as required by the contract. The schedule will include the critical path. The critical path will typically be the path with the least amount of total float. The critical path may follow different activity paths at different times during work performance due to the work progress or revisions made to the schedule.

Float before substantial completion is not for the exclusive use or benefit of either party, but is a resource available to either party on a first-come, first-served basis as needed. Float after substantial completion is owned by the Contractor.

Notify the Engineer at least 2 business days before stopping work, resuming work, or changing the project schedule.

The cost of preparing, updating, and revising the schedules is incidental to other contract pay items.

The Department's schedule acceptance does not relieve the Contractor of its responsibilities to adjust labor, equipment, or work schedules and to provide sufficient materials to substantially complete the work within the contract time. Acceptance does not modify the contract or constitute endorsement or validation by the Engineer of the Contractor's logic, activity durations, or assumptions in creating the schedule.

Submit a critical path method (CPM) schedule including the following minimum requirements:

1. Created in a software format that is compatible with the most current version of Microsoft Project.
2. Includes activities required to complete the work, including, but not limited to, engineering, surveying, permitting, submittals, re-submittals, approvals, procurement, fabrication, deliveries, crushing, utility work, and third-party work.
3. Includes milestones, interim completion dates, substantial completion date, and contract completion date.
4. Describes activities that make the work readily identifiable.
5. Identifies the scheduled early and late start and finish dates for each activity.
6. Limits activity durations to 20 working days.
7. Limits activity relationships to finish-to-start, start-to-start, and finish-to-finish relationships. Do not use dummies, leads, or lags.

8. Uses only contractual date constraints.
9. Defines the work calendar for each activity.

Submit with the CPM schedule:

1. A narrative that describes the major equipment and assumed production rates for the major work activities.
2. A description on how the number of anticipated weather days as specified in Table 108.07-1 have been incorporated into the schedule; only required for calendar and completion date contracts.

Ensure each CPM schedule submittal includes 1 electronic CPM schedule copy and 2 paper copies including:

1. Time Scaled Logic Diagram.

Submit the time-scaled logic diagram with the following:

- a. Plot the logic diagram on plotted sheets with a horizontal time scale that is the project calendar. Ensure each activity's duration and dates are plotted on the horizontal time scale.
- b. Submit the logic diagram using an approved sheet size.
- c. Ensure the activity information includes activity numbers, activity descriptions, durations, total float, and scheduled or actual start and finish dates.

The time-scaled logic diagram must clearly show sequence activities and interdependence for the required work performance and show the critical path.

2. Predecessor and Successor Report.

The predecessor and successor report will define the schedule logic. It will clearly show logical relationships and constraints.

3. Bar Chart Printout.

Ensure the bar chart printout includes the following for each activity:

- a. Activity number or ID.
- b. Activity description.
- b. Activity calendar.
- c. Original duration.
- d. Remaining duration.
- e. Percent complete.
- f. Early or actual start and finish dates.
- g. Late start and finish dates.
- h. Total float.

B. Initial Schedule.

Submit the initial schedule for review at or before the preconstruction conference.

The initial schedule must meet the requirements and show that substantial completion can be achieved within the contract time.

When approved, the Contractor may submit a preliminary schedule defining the Contractor's planned operation for the first 60 calendar days after the award date and indicating the Contractor's general approach for the remaining work.

Meet with the Engineer to jointly review, correct, and adjust the initial schedule within 10 calendar days after submitting the initial schedule. Resubmit the initial schedule for acceptance within 10 calendar days after the meeting. If the Engineer does not accept the resubmitted schedule, repeat this process. Do not begin work until the initial schedule has been approved.

C. Monthly Update Schedules.

Attend monthly onsite project progress meetings to update the schedule. The Engineer and the Contractor will review progress to verify actual start and finish dates, remaining duration, percent complete of uncompleted work activities, and proposed schedule revisions. It is the Contractor's responsibility to provide the Engineer with work activities status at this progress meeting, and prepare schedule updates based on this information once it has been verified and agreed upon.

Each month, submit the updated schedule reflecting progress. Submit a written narrative describing the project schedule status, the critical path, and schedule revisions with the schedule update. Resubmit the schedule update if it does not contain the agreed-on as-built information.

At the Engineer's written request, and within 7 calendar days after written request receipt, submit a revised schedule as specified in 108.03.A if the actual work is, as determined by the Engineer, significantly different than that represented on the current schedule.

The Department will provide the Contractor with one of the following responses within 10 calendar days after the Department's receipt of the revised schedule:

1. Accept the revised schedule.
2. Reject the schedule and identify the reasons for rejection.
3. Request more information.

Address the reasons for rejection or submit the information requested within 10 calendar days after the Department's request.

D. Final Schedule.

Submit a final schedule with the written notice of completion once the Engineer deems the work completed, as specified in 105.15, that reflects actual start and finish dates for each work activity.

The Department will not grant final acceptance as specified in 105.15 until the Engineer receives and accepts the final schedule.

108.04 Preconstruction and Preoperational Conferences

Meet with the Engineer for a preconstruction conference at a mutually agreed time. At or before the preconstruction conference, submit the following to the Engineer:

1. Initial schedule as specified in 108.03.B.
2. List of material suppliers and subcontractors.
3. WH-5 public works contract report.
4. Other requested information.

Meet with the Engineer for preoperational conferences before beginning a new phase of work.

108.05 Limitation of Operations.

Do not start an operation impacting traffic until traffic control devices are approved and completely installed. Perform the work in a manner and sequence that will ensure the least interference with traffic. The Contractor is responsible for the location of detours and provisions for handling traffic. Access the project site only at existing interchange ramps, public road connections, or approaches. The Engineer may require the Contractor to finish a project section before starting on additional project sections if the section opening is essential for public convenience.

Do not work on a roadway open to the traveling public, except for normal maintenance operations, during a 3-day holiday weekend or on July 3, 4, and 5.

108.06 Methods, Equipment, and Character of Workers.

Provide sufficient labor and equipment for completing the work in a satisfactory manner and within the contract time.

Employ workers with sufficient skill and experience to properly perform the work assigned to them.

If, as determined by the Engineer, a person employed by the Contractor or its subcontractor does not perform the work in a proper and skillful manner or is intemperate or disorderly, the Engineer will issue a written direction for removal of the person. Do not employ the removed person in any future work portions without approval.

If the Contractor does not do the following, the Engineer may suspend the work by written notice until the Contractor complies with the contract:

1. Remove person or persons as required in this subsection.
2. Provide suitable and sufficient labor and equipment for the work.

Ensure the equipment used on a portion of the project does not damage the roadway, adjacent property, or other highways. Park unattended equipment at least 30 feet off the traveled way. If the posted speed limit for the traveled way is 40 mph or less, the Engineer may approve parked equipment at least 10 feet off the traveled way.

Use the methods and equipment required by the contract. If the Contractor desires to use a method or equipment type other than those specified in the contract, submit a written request that includes a full description of the proposed method, equipment, and the reasons for making the change. If the Engineer approves the change, the Contractor is fully responsible for performing the work as required by the contract. If, after trial use of the substituted methods or equipment, the Engineer determines the work produced does not meet the requirements, discontinue the substituted method or equipment use and complete the remaining work with the method and equipment required by the contract.

Remove the deficient work and replace it with work of specified quality, or take such other corrective action as directed.

Changed methods or equipment approvals do not modify the contract amount or the contract time.

If the methods and equipment required to complete a specific work portion are not specified in the contract, the Contractor may use any methods or equipment that will satisfactorily complete the work.

108.07 Extension of Contract Time.

A. General.

The Engineer will extend the contract time by issuing a change order if an excusable delay, as specified in 108.07.B, 108.07.D, or 108.07.F, extends the scheduled substantial completion date. The Engineer will only consider a request to revise contract time if the following conditions are met:

1. Notice as specified in 104.03.
2. Documentation from the project schedule, including updates, justifies the time extension.

The Engineer will evaluate the information submitted and determine the time extension, if any. The Contractor's request that insufficient contract time was specified is not a valid reason for a time extension.

Time is of the essence in the Contractor's performance of the contract. Delays inconvenience the traveling public, obstruct traffic, interfere with and delay commerce, and increase highway user risk. Delays also increase the Department's costs, adding time needed for administration, engineering, inspection, and supervision. It is essential, and in the public's interest, the Contractor work vigorously to contract completion.

Time extensions will not be granted for delays incurred during the months of December, January, and February, unless the Contractor's accepted project schedule shows the delayed work was scheduled to be performed during this time period and was critical at the time of the delay.

If contract time is extended, the Department will relieve the Contractor from associated liquidated damages, as specified in 108.08.

B. Excusable, Noncompensable Delays.

Excusable, noncompensable delays are delays that are not the Contractor's or the Department's fault or responsibility, and could not have been reasonably foreseen or anticipated by the Contractor before bid. A time extension will be granted, if justified as specified in 108.07.A, but the Contractor will not be paid for costs incurred due to the delays.

The following are examples of excusable, noncompensable delays:

1. Delays due to floods, tornadoes, lightning strikes, earthquakes, or other cataclysmic natural phenomena.
2. Weather delay as specified in 108.07.C.
3. Unavoidable material delivery delays resulting from freight embargoes, government acts, or area-wide material shortages. This applies to the Contractor and its subcontractors or suppliers. Delays due to the Contractor's and its subcontractors or suppliers, insolvency, or mismanagement are not excusable.
4. Delays due to civil disturbances.
5. Delays from fires or epidemics.
6. Delays from labor strikes that are beyond the Contractor's, its subcontractor's, or supplier's power to settle and are not caused by the Contractor's, its subcontractor's, or supplier's improper acts or omissions.
7. Added quantities that delay work on the critical path.
8. Delays due to acts of the government or a political subdivision other than the Department.
9. Delays from damage to temporary or permanent work.

C. Extension to the Contract Time for Weather.

For calendar day and completion date contracts, the contract time will be extended 1 day for each lost critical path work day caused by weather that exceeds the reasonably anticipated weather days per month as listed in Table 108.07-1.

Table 108.07-1 – Anticipated Weather Days per Month

Month	Number of Working Days Lost Due to Weather by District					
	D1	D2	D3	D4	D5	D6
January	10	7	8	8	8	8
February	7	6	6	6	6	6
March	7	6	6	6	6	6
April	5	6	4	4	4	4
May	5	6	4	5	5	5
June	4	4	2	3	3	3
July	1	1	1	1	1	1
August	1	1	1	1	1	1
September	2	1	1	1	1	1
October	4	3	2	1	1	1
November	9	6	6	5	5	5
December	11	7	7	7	7	7

Weather experienced on weekends or holidays will not be considered as lost working days, unless the Contractor normally works on those days or if directed to work on those days.

D. Excusable, Compensable Delays.

Excusable, compensable delays are delays that are caused only by the Department. The contract time will be extended for the following excusable, compensable delays, if the conditions specified in 108.07.A are met:

1. Delays due to contract revisions as defined in 104.02.B, 104.02.C, 104.02.E, or 104.02.F.
2. Delays due to utility interference within the project site as defined in 105.07.
3. Delays due to an Engineer-ordered suspension as defined in 104.02.D.
4. Delays due to the actions or neglect of the Department or its failure to act.

Pay will be determined for excusable, compensable delays as specified in 109.03.D.

E. Nonexcusable Delays.

Nonexcusable delays are non-compensable. Time extensions will not be granted for nonexcusable delays.

F. Concurrent Delays.

When a nonexcusable delay is concurrent with an excusable (compensable or noncompensable) delay, the Contractor is not entitled to a time extension or additional pay for the period the nonexcusable delay is concurrent with the excusable delay. When an excusable, noncompensable delay is concurrent with an excusable, compensable delay, the Contractor is entitled to a time extension but no additional pay for the period the noncompensable delay is concurrent with the compensable delay.

108.08 Failure to Complete on Time.

If the contract time expires, liquidated damages will be assessed for each working day the work remains substantially incomplete after the contract time or its most recent extension has expired. Liquidated damages are not a penalty. The Engineer will determine working days for the assessment of liquidated damages as specified in 108.02.B. For calendar day and completion date contracts, the Engineer will not exclude days during December, January, and February. Liquidated damages will be deducted from monies due to the Contractor or will be billed to the Contractor.

Liquidated damages will not be assessed after substantial completion of the work as evidenced in writing, as long as the Contractor performs the remaining work.

Allowing the Contractor to continue and finish the work after the contract time expires in no way operates as a waiver on the part of the Department of its rights under the contract.

108.09 Default and Termination of Contract.

If the Contractor is responsible for any of the following, the Engineer may provide written notice to the Contractor and surety of the delay, neglect, or default:

1. Failing to begin the work by the date specified in the notification of award.
2. Failing to perform the work with sufficient labor and equipment or with sufficient materials to ensure work completion within the contract time.
3. Performing the work unsuitably and neglecting or refusing to remove materials or to replace unacceptable or unsuitable work.
4. Discontinuing the work.
5. Failing to resume previously discontinued work within a reasonable time after notice to do so.
6. Becoming insolvent, being declared bankrupt, or committing an act of bankruptcy or insolvency.
7. Making an assignment for the benefit of creditors.
8. Failing to carry on the work in an acceptable manner.

If, within 10 calendar days after written notice receipt, the Contractor or surety does not respond as specified by the notice, the Department will have full power and authority, without violating the contract, to remove the work from the Contractor. The Department may appropriate or use suitable and acceptable materials and equipment within the project site, may enter into an agreement for contract completion in accordance with the terms and provisions of the contract, or use other methods that, in the Engineer's opinion, are necessary for work completion as required by the contract.

The Department will deduct the costs and charges, incurred for work completion under the contract from amounts due or which may become due to the Contractor. If the amount exceeds the sum that would have been payable under the contract, then the Contractor and the surety will be liable and will pay to the Department the excess amount. If, after termination of the contract, it is determined the Contractor was not in default, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Department as specified in 108.10.

108.10 Termination for Convenience of the Department.

A. General.

The Department may terminate the contract in whole or in part for:

1. Executive Orders of the President of the United States or the Governor of Idaho.

2. Court restraining orders based on acts or omissions of persons or agencies other than the Contractor.
3. Conditions determined to be in the Department's best interest.

The Department will detail the specifics on the termination and the effective date in a notice of termination.

B. Submittals and Procedures.

On receipt of a notice of termination:

1. Stop work as specified.
2. Enter into no new subcontracts, nor order materials, services, or facilities, except as approved to complete any remaining contract portion.
3. Terminate all subcontracts to the extent they relate to terminated work.
4. Settle outstanding liabilities and termination settlement proposals.
5. Transfer title and deliver to the Department:
 - a. Unfabricated or partially fabricated parts, work in process, completed work, supplies, and other material produced or acquired for the terminated work.
 - b. Completed or partially completed plans, drawings, information, and other property required to be submitted to the Department if the contract had been completed.
6. Complete work not terminated.
7. Coordinate a time and date with the Engineer to inventory materials obtained but not yet used.
8. Take necessary or directed action to protect contract related property that is in the Contractor's possession and in which the Department has or may have an interest.

C. Settlement Provisions.

Accept final payment for:

1. Completed work items at the contract bid price.
2. Eliminated work as specified in 104.02.F.
3. Partially completed work at agreed prices or as follows:
 - a. Submit a claim for additional damages or costs not covered above or elsewhere in the contract within 60 calendar days of the termination date.
 - b. Submit cost documentation. Exclude anticipated profits on work not completed. Ensure the claim is less than the total contract price, reduced by the amount of previous payments, and the contract price of nonterminated work.

On reaching agreement on the claimed costs, the Department will amend the contract and make payment.

D. Disputed Settlement.

If the Department does not agree with the Contractor's claimed costs, the Department will make payment as follows, but without duplicating amounts agreed on under 108.10.C:

1. For contract work performed before the termination date, the total of:
 - a. The cost of work completed.
 - b. The cost of settling and paying termination settlement proposals under terminated subcontracts properly chargeable to the termination portion of the contract if not included in 108.10.D.1.a.

- c. Profit on 108.10.D.1.a., determined by the Department to be reasonable. The Department will exclude profit under this subsection if the Contractor's costs for work performed exceed the bid item payments made.
2. Reasonable terminated work settlement costs, including:
 - a. Accounting, legal, clerical, and other expenses reasonably necessary to prepare termination settlement proposals and support data.
 - b. Subcontract termination and settlement, excluding the settlement amounts.
 - c. Storage, transportation, and other costs incurred that are reasonably necessary to preserve, protect, or dispose of the termination inventory.
3. Except for normal spoilage and to the extent the Department accepts the risk of loss, the Department will exclude the fair value of destroyed, stolen, or damaged material.
4. The following will be deducted to arrive at the amount due to the Contractor:
 - a. Unliquidated advances or other payments under the terminated portion of the contract.
 - b. Department claims against the Contractor under the contract.
 - c. The agreed on price or the proceeds from the sale of materials, supplies, or other items acquired and sold by the Contractor, but not covered by or credited to the Department.

E. Partial Termination.

Submit a proposal for an adjustment of the price(s) of the continued portion of the contract within 90 calendar days of the effective termination date. Submit supporting information. The Department will make agreed upon adjustments. The Department may establish terms and conditions for making partial payments against costs incurred by the Contractor for the terminated portion of the contract. Provide access to contract cost records for Department audit. Request approval to maintain photographs, microphotographs, or other accurate reproductions rather than original records and documents.

Termination does not relieve the Contractor of responsibility for work completed.

SECTION 109 – MEASUREMENT AND PAYMENT

109.01 Measurement of Quantities.

The Department will measure the contract pay item quantities using the units of measure specified in the contract and the methods of measurement and calculation as specified in this subsection. U.S. customary system of weights and measures units are defined in [15 CFR](#).

For standard manufactured materials identified by gauge, thickness, unit weight, or section dimensions, the Department will consider these as nominal weights and dimensions, and accept industry established manufacturing tolerances.

The Engineer will measure contract pay item quantities by the actual quantity or by the plan quantity, as required by the contract.

A. Actual Quantities.

Where the contract specifies actual quantity as the basis of payment for a contract pay item, the Engineer will measure and calculate the actual work quantity performed, using quantities from measurements taken from the completed work in place or from measurements taken from delivery vehicles. This excludes work outside the project site as specified in the method of measurement section for the relevant contract pay item.

The Engineer will measure the actual contract pay item quantities using the following methods:

1. Area.

The Engineer will calculate area measurements from linear distances measured horizontally or vertically. The measurement will be the neat lines as specified or ordered in writing. The Engineer will not deduct for individual fixtures occupying areas less than or equal to 9 square feet.

2. Structures.

The Engineer will measure structures using the neat lines as specified or ordered in writing.

3. Linear.

The Engineer will measure linear measurements as follows:

- a. By the foot will be measured parallel to the surface on which the work is installed.
- b. By the mile will be measured using project stationing.

For materials manufactured in standard lengths, the Engineer will calculate the length measurement by multiplying the number of pieces by the nominal length.

4. Lump Sum or Each.

Consider lump sum or each payment as full payment for labor, equipment, material, and incidentals, including fittings and accessories, necessary to complete the work on a contract pay item or other work element.

5. Volumes of Excavation, Embankment, and Similar Contract Pay Items.

The Engineer will measure volume quantities using specific volumetric measurements as specified in the method of measurement section for the relevant contract pay item.

6. Volumes and Weights in Hauling Vehicles.

The Engineer will measure material delivered in trucks by the cubic yard or by weight. Haul material in approved trucks. Display a unique identification mark on each truck. Ensure loads in the truck box are empty before leaving the drop site.

a. Cubic Yard.

If the contract does not require otherwise, the Engineer will measure contract pay items with cubic yard pay units using trucks with calculated struck volumes as the method of measurement.

The Engineer will measure volume at the point of delivery. Hauling units may be of any size or type acceptable to the Engineer, provided the unit's body is shaped to enable an expeditious and accurate determination of the volume. The Engineer will calculate the struck volume of each truck to the nearest 0.1 cubic yard. This volume will not change without approval.

The Engineer will not make allowances for the material settlement in transit. For material delivered in trucks, the Engineer will not pay for material above the struck volume of the truck box and will reduce the calculated truck box struck volume by 0.5 cubic yard increments when the truck is not filled to its struck volume.

b. Weight.

[Comply with 71-113, Idaho Code](#) and [IDAPA 02.02.14.450](#).

For material measurement based on scale tickets, ensure that scales used to weigh materials include a controller capable of printing a weight ticket that indicates the project name, project number, contract pay item number, current date, current time, load number, truck number, load gross weight, load tare weight, and load net weight. Ensure the scale controller can automatically print the date, time, and weights without modification of the weight ticket. Assign sequential load numbers for each load weighed for delivery.

If paying for granular borrow or aggregate by weight, the Engineer will not pay for water over 7 percent of the material's dry weight. The Engineer will correct material weight for excess moisture content in accordance with AASHTO T 255.

Weigh empty trucks at least once a day if used to haul material paid by weight.

Ensure the scale's accuracy to within 1 percent.

Weigh materials proportioned or measured by weight on beam or springless dial scales as follows:

- (1) Ensure the scale springs do not carry any part of the load.
- (2) Provide a commercial certificate of compliance for weighing equipment before hauling operations begin. The certificate cost is incidental to the weighed material contract pay item.
- (3) Provide clearance between the scale parts and the structure to prevent scale part displacement.
- (4) Protect scale working parts to prevent material from falling on or against the parts.
- (5) The Department will allow the weighing of separate units of combination vehicles if the scale platform and approaches are at the same elevation, and can maintain units of the combination vehicles at the same elevation during the weighing operation.
- (6) When weighing each vehicle, take the tractor unit out of gear and release the brakes. Ensure plants used to proportion or batch materials by weight operate as follows:

- (a) The operator can fully view the graduated scale when operating the gate that delivers material to the weighing hopper.
- (b) Locations of hoppers and bins allow access for calibration.
- (c) Inspect and calibrate platform scales as directed.

Instead of platform scales, the Department will allow the use of conveyor weighing equipment that meets the requirements of the Idaho State Department of Agriculture, Bureau of Weights and Measures. The Contractor will inspect conveyor weighing equipment for calibration, at least every 7 calendar days, in accordance with the manufacturer's written requirements.

Obtain written approval to use automatic weighing equipment. Ensure the material weighing accuracy is within 1 percent of actual.

The Engineer will not pay for wasted or rejected material, material not delivered, material placed outside of the specified or directed project locations, and material left on hand after work completion.

7. Converting Between Weights and Volumes.

The Engineer may convert minor quantities specified for measurement by volume or weight from one measurement to the other if the Engineer and the Contractor agree to the conversions. The Engineer will determine the factors to be used for these conversions, and the Engineer and the Contractor will agree on these conversions before proceeding with the relevant work.

8. Asphalt Material.

The Engineer will measure asphalt and anti-stripping additive, at 60 °F or converted to 60 °F, by the gallon or ton. The Engineer will use certified net weights or weights based on certified volumes as the measurement basis when measuring asphalt shipped by rail, truck, or transport, corrected for material lost, foamed, wasted, or not incorporated in the work. The Engineer will measure anti-stripping additives by the percentage of additive per ton of asphalt.

9. Commercial Additives.

The Engineer will measure bulk additives by the ton and additives in sacks by the net weight on the manufacturer's label.

10. Timber.

The Engineer will measure timber incorporated in the structure by the thousand feet board measure (MFBM), based on nominal widths and thicknesses, and the longest dimension of each piece.

11. Equipment Time.

The Engineer will measure equipment time by the actual number of hours the equipment is operated to perform the work, including necessary travel time.

12. Water.

If specified as a separate contract pay item in the contract, the Engineer will measure water separately using calibrated tanks, distributors, or water meters.

13. Stockpiled Material.

The Engineer will determine stockpiled material volume using the cross-section, average-end-area method. For quantities less than 100 cubic yards, the Engineer may use trucks with calculated struck volumes as the method of measurement.

B. Plan Quantities.

If the contract requires plan quantity as the basis of payment for a contract pay item, the Engineer will base payment for the work on the quantity shown on the plans. The Engineer will not make measurements for contract pay items paid by plan quantity, except if the Engineer changes the plan quantity as specified in 104.02.

If the Engineer believes the actual contract pay item quantity to be paid by plan quantity differs significantly from the plan quantity, the Engineer will measure and pay for the actual work quantity performed at the contract unit price. If the Contractor believes the actual contract pay item quantity differs significantly from the plan quantity, submit a written request for actual quantity measurement. If the actual measured quantity value does not exceed the plan quantity value by \$2,000, reimburse the Department for the measurement cost.

109.02 Scope of Payment.

A. General.

The Department will pay the Contractor for accepted contract pay item quantities at the contract unit prices, except as otherwise specified in 104.02, 109.03, 109.06, and 109.08.

Accept this payment as full payment for providing the necessary materials, labor, tools, equipment, and incidentals to perform and complete the work as required by the contract. Assume liability for risk, loss, damage, or expense resulting from the work, subject to 107.14.

B. Price Adjustment.

The Department will consider progress estimate adjustments to applicable contract item costs as a payment to the Contractor, or a credit to the Department, when the indexes change as defined for asphalt and fuel. On the first Monday for each month, the Department will publish a current asphalt index (CAI) based on the previous 4-week average as reported by Poten & Partners, Inc. for the Boise area and a current fuel index (CFI) based on the price of ultra-low sulfur, clear, diesel #2 fuel, as reported by Oil Price Information Services. The contract base asphalt index (BAI) and base fuel index (BFI) will be the last posted index amount preceding the bid opening date. A payment to the Contractor may be applied or a credit to the Department may be deducted from monies due the Contractor for each affected progress estimate. Work performed at no expense to the Department will not be eligible for an adjustment.

1. Computing the Asphalt Price Adjustment.

A price adjustment will be made only when the CAI varies by more than 10 percent from the BAI and only for that portion of the variance in excess of 10 percent. Credits and payments are computed as follows:

- a. The tons of asphalt used during each progress estimate period will be computed for applicable contract items.

The plant mix asphalt quantity used, when the item includes asphalt and additives, will be calculated at the approved contractor job mix formula (C-JMF) percentage. Asphalt binder contained in RAP is not eligible for an asphalt price adjustment (APA). Only virgin asphalt binder in the mix will be eligible for an APA.

The APA for emulsified asphalt products will be calculated based on the percentage of asphalt in the emulsion, which is estimated at 65 percent and 32.5 percent for diluted emulsion.

- b. The total asphalt tons used for each progress estimate period will be summed for the applicable contract items.

- c. The APA credit or payment is computed from the following formula:

Contractor payment if CAI is greater than 110% of BAI:

$$\text{APA} = (\text{CAI} - 1.10 \text{ BAI}) * \text{Q}$$

Department credit if CAI is less than 90% of BAI:

$$\text{APA} = (\text{CAI} - 0.90 \text{ BAI}) * \text{Q}$$

Where:

APA = Asphalt price adjustment in dollars.

BAI = Base asphalt index.

CAI = Current asphalt index.

Q = Total asphalt tons used for the progress estimate.

If the CAI increases by 50 percent or more over the BAI, the Department will determine the feasibility of continuing project construction. The Engineer will notify the Contractor in writing if the contract will be terminated as specified in 108.10. This adjustment will be applied only for material that is accepted and allowed to be left in place.

2. Computing the Fuel Price Adjustment.

A price adjustment will be made only when the CFI varies by more than 20 percent from the BFI, and only for that portion of the variance in excess of 20 percent. Credits and payments are computed as follows:

- a. The Engineer will obtain the work quantity performed from the progress estimate for the applicable contract items based on the categories in Table 109.02-1.
- b. Compute the fuel usage for each applicable contract item by multiplying the fuel usage rate by the work quantity performed for each item.
- c. Sum the total fuel usage in gallons (Q) for the applicable contract items.
- d. Compute the fuel price adjustment (FPA) credit or payment using the following formulas:

Contractor payment if CFI is greater than 120% of BFI:

$$\text{FPA} = (\text{CFI} - 1.20 \text{ BFI}) * \text{Q}$$

Department credit if CFI is less than 80% of BFI:

$$\text{FPA} = (\text{CFI} - 0.80 \text{ BFI}) * \text{Q}$$

Where:

FPA = Fuel price adjustment in dollars.

BFI = Base fuel index.

CFI = Current fuel index.

Q = Total fuel gallons used for the progress estimate.

When the work under the contract is completed, the Engineer will determine the difference between estimated quantities and final quantities for each applicable work item. Calculate an average CFI of the CFI's from individual pay estimates to which a FPA was applied. Calculate the FPA for the fuel usage obtained from the difference between the estimated and final applicable contract item quantities based on the average CFI. The final FPA will be paid or deducted on the final estimate.

Table 109.02-1 – Fuel Usage Rates

Item Category Description	Rate: Gal/Unit
Excavation, including topsoil	0.29 / CY
Excavation – Rock (must be specifically identified in the contract)	0.39 / CY
Borrow	0.29 / CY
Base	0.63 / Ton
Surface treatments, including seal coats	0.02 / SY; 1.47 / Ton
Concrete Pavements	0.03 / SY / inch of depth
Concrete (paid by the cubic yard)	0.98 / CY
Plant Mix Pavement	2.6 / Ton
Piling Driving	0.12 / ft
Rotomilling	0.02 / SY
Pulverizing / Mixing	0.02 / SY plus 0.015 / SY / ft of depth
Pilot / Pace Car, Pipe, Guardrail	19.0 / \$1,000
MSE Retaining Wall	19.0 / \$1,000

109.03 Payment for Quantity Variations, Contract Revisions, and Delays.

A. General.

The Department will pay for quantity variations, contract revisions, and delays as specified in 104.02, 104.03, 105.07, 109.03.B, 109.03.C, and 109.03.D.

The markups specified in 109.03.C.5 pay the Contractor for field office overhead, home office overhead, and profit. The Contractor is not entitled to additional payment in excess of these markups, unless the Contractor incurs additional costs resulting from an excusable, compensable delay as specified in 108.07.D and 109.03.D.

The Department will not pay for changes to bonding costs, property damage and bodily injury insurance costs, or Tribal Employment Rights Ordinance (TERO) taxes until project completion. After project completion and Contractor’s submission of satisfactory evidence, the Department will calculate an adjustment to reconcile bonding, insurance, and TERO tax issues and execute a contract change order.

B. Payment for Quantity Variations.

If the measured contract pay item quantity varies from the quantity specified, the Engineer will only modify the contract unit price as specified in 104.02 and 104.03.

If the total pay quantity of a work item varies from the bid quantity by more than 25 percent, the Department will make an adjustment in the contract unit price on written request of the Engineer or the Contractor. The Engineer and the Contractor will agree to the adjustment before the performance of the work. The Department’s contract unit price adjustment will be the difference between the contract unit price and the actual unit cost to perform the work plus 6 percent profit.

If the Engineer and the Contractor cannot agree on a price adjustment, the Engineer will establish a price considered to be fair or have the work done on a force account basis as specified in 109.03.C.5.

If the actual unit cost includes fixed costs, these costs are recovered by the Contractor through Department payments made for 125 percent of the bid schedule quantity. The Engineer will exclude these costs in computing

the actual unit cost. The Engineer may include fixed costs when computing the actual unit cost for contract pay items that decrease by more than 25 percent of the bid schedule quantity. When the total pay quantity of a work item is less than 75 percent of the contract bid quantity, the Department payment for the work will not exceed the payment which would have been made for performance of 75 percent of the bid schedule quantity at the contract unit price.

The Engineer will not make an allowance for anticipated profit when computing the adjusted price.

C. Payment for Contract Revisions.

1. General.

If the Engineer modifies the contract under 104.02 or 105.07, the Engineer will pay the Contractor using the methods specified in this subsection. This pay will include payment to the Contractor for performing the revised work, delay costs, and other associated costs approved and not expressly precluded by the contract.

The Engineer will pay the Contractor in order of preference beginning with the use of contract unit prices, negotiated prices, or, if a price cannot be agreed upon, by force account or by a fair price as determined by the Engineer.

2. Unrecoverable Costs.

The Department will not pay the Contractor for costs not specifically allowed or provided in 109.03.C and 109.03.D, including the following:

- a. Home office overhead in excess of the allowable markups specified in 109.03, including unabsorbed home office overhead, extended home office overhead, or home office overhead calculated using the Eichleay formula or another method.
- b. Profit in excess of the allowable markups specified in 109.03.
- c. Loss of anticipated profit resulting from work not performed due to contract revisions.
- d. Consequential damages, including loss of bonding capacity, loss of bidding opportunities, insolvency, and the effects of force account work on other projects, contracts, or business interruption.
- e. Other costs not specified in 109.03.C.5.
- f. Attorney's fees, claim preparation expenses, and litigation costs.

3. Contract Unit Prices.

The Engineer will use the contract unit prices if they are representative of the work associated with the change. Contract pay items with a price per unit in the original contract are not eligible for additional overhead and profit.

4. Negotiated Prices.

The Engineer will request the Contractor to submit an estimate of the proposed contract revision unit prices or lump sum price, including the cost of performing the revised work, delay costs, other associated costs, plus a reasonable allowance for profit, and applicable overhead. The Engineer may request the Contractor justify the estimate by providing one or more of the following:

- a. Labor requirements by trade in hours for each task.
- b. Equipment costs and time requirements.
- c. Material costs.

d. Compensable delay costs analysis as specified in 109.03.D.

If the Engineer and the Contractor cannot agree on a negotiated price adjustment, the Engineer may direct the Contractor to perform revised work by force account or will use a fair price as determined by the Engineer.

Overhead and profit for the subcontractor is included in the agreed price and additional pay, above that provided for the Contractor's overhead and profit, will not be allowed.

When work is performed by an approved first or lower-tier subcontractor, pay to the Contractor for overhead and profit will be as follows:

Dollars	The Contractor's Pay
Up to \$10,000	15%
Over \$10,000	\$1,500 + 10% of excess over \$10,000

5. Force Account.

a. General.

Perform work on a force account basis, if required by the contract or as directed.

Record force account work on Department-provided forms and submit at the end of each work day to allow immediate field verification.

The Engineer will revise, as appropriate, the daily force account records and provide duplicate report sheets to the Contractor for signature. Duplicate report sheets, signed by the Engineer and the Contractor, are the true record of force account work.

b. Satisfactory Evidence/Documentation.

The Engineer will not approve force account work payment before the Contractor submits an itemized cost statement for that work. The Engineer will review the itemized statement and approve payment for the cost the Engineer deems reasonable based on experience and prevailing market rates. The Engineer may request the Contractor to submit additional evidence to support the cost.

Submit the following information in duplicate itemized statements for force account work:

- (1) For labor: name, classification, dates worked, daily hours, total hours, labor rate, and extended amount for each laborer and foreman.
- (2) For equipment: designation, dates used, daily hours, total hours of actual operation and standby, rental rate, and extended amount for each equipment unit. Include the manufacturer's name or trademark, model number, and manufacture year with the designation.
- (3) For material: quantities, cost, and extensions, including source recover fees, royalties, and use tax.
- (4) Transportation cost for material, free on board (FOB), to the project site.
- (5) Cost of property damage, liability, and workers compensation insurance premiums, unemployment insurance contributions, and social security tax.
- (6) Cost bondings.
- (7) Estimated TERO taxes (the Department will modify for final payment).

- (8) Documentation showing payment for invoiced items, including work, material, and transportation.

If providing material from the Contractor's stock for force account work, submit a signed verification of the following:

- (1) Material was provided from the Contractor's stock.
- (2) Material quantity was used for the force account work.
- (3) Material and transportation costs represent the Contractor's actual cost, excluding overhead.

The Department will pay for force account work based on the reviewed and approved Contractor itemized cost statement. This payment is full payment for performing the force account work.

c. Labor.

The Department will pay for labor and foremen performing approved force account work. The Department will pay the wage rate or scale approved in writing before beginning work. The Department will pay for the actual cost of fringe benefits paid to, or on behalf of, laborers and foremen performing the force account work. Fringe benefits include health benefits, retirement benefits, and vacation benefits, but exclude payroll burdens as described below.

The Department will pay an amount equal to 20 percent of the sum of the direct labor cost and fringe benefits. This payment is pay for field office overhead (5 percent), home office overhead (10 percent), and profit (5 percent). The Department will pay for the actual cost paid to, or on behalf of, laborers and foremen performing force account work for travel and subsistence incurred while performing force account work and as approved. If performing other work, prorate travel and subsistence cost proportionally between force account work and non-force account work. Do not exceed the current federal per diem rates as published by the U.S. General Services Administration.

The Department will pay for payroll burdens for workers' compensation insurance, unemployment insurance contributions, and social security taxes at the actual, documented cost plus 6 percent of the total documented cost as pay for field office overhead, home office overhead, and profit.

The Department will pay wages, fringes, payroll burdens, and subsistence expenses at the normal, customary, and legal rates, unless otherwise approved in writing before the work begins. The Department will not pay for costs deemed unreasonable.

d. Material.

For materials approved and used in the work, the Department will pay for material costs, including transportation costs, source recovery feeds, royalties, and use or sales tax, but excluding equipment rentals as specified in 109.03.C.5.e.4. The Department will pay the Contractor an additional 15 percent of this sum as pay for field office overhead, home office overhead, and profit.

e. Equipment.

The Department will pay the Contractor for machinery or special equipment (other than small tools) on force account work as specified in this subsection, plus those transportation costs directly attributable to this work. Obtain written approval of the rental rates established in this subsection before beginning the force account work.

(1) General.

The Department will establish rental rates for the Contractor-owned or the subcontractor-owned equipment used on force account work. The Engineer will determine the rental rates by using and modifying EquipmentWatch® Cost Recovery published by [EquipmentWatch](#) (commonly known as the Rental Rates Blue Book™) to establish rental rates. The rental rates will be set before the start of force account work.

(2) Operated Rate.

The Department will pay for Contractor-owned or leased equipment on an hourly basis for each hour the equipment is operated. Operated means the equipment is running, has an operator, and is being used to effectively accomplish the force account work. The Department will pay for nonoperated hours at the standby rate. The operated rate will be calculated, as specified in 109.03.C.5.e.3, using the following formula:

$$HR = (((MR + AT) * RA * RF)/MH) + OC$$

Where:

HR = Hourly Rate.

MR = Blue Book Monthly Base Rate.

AT = Blue Book Monthly Attachment Rate.

RA = Blue Book Rate Adjustment Factor.

RF = Blue Book Regional Adjustment Factor.

OC = Blue Book Operating Costs.

MH = 176 (hours per month).

The Department will pay the Contractor an additional 10 percent of the hourly operated rate, calculated above, as pay for field office overhead, home office overhead, and profit.

The Department will include the attachment rate in the operated rate calculation only if applicable and essential to the force account work as directed. If multiple attachments are approved for use and the attachments are used interchangeably for the work, the Engineer will only approve payment for the attachment with the highest rate.

(3) Standby Rate.

The Department will pay for standby time using the following formula:

$$HR = (((MR + AT) * RA * RF)/MH) * 0.5$$

The Department will pay up to 8 hours of standby time during a 24-hour period and up to 40 hours of standby time during a 1-week period.

The Department will pay the Contractor an additional 10 percent of the hourly standby rate, calculated above, as pay for field office overhead, home office overhead, and profit.

(4) Rental Invoices.

If Contractor-owned or leased equipment is not available and the Contractor rents equipment from other sources (e.g., an equipment rental company), the Department will pay the Contractor for the actual invoiced rental cost plus 5 percent.

Submit evidence the rental rates paid by the Contractor are the standard rates established, published, and used commercially by the rental company.

If the invoice rental rate does not include fuel, lubricants, repair, and servicing costs, the Department will pay the Blue Book published hourly cost from the "Estimated Operating Costs" column for the hours operated.

For equipment not found in the Blue Book and when the invoice rental rate does not include fuel, lubricants, repair, and servicing costs, the Department will pay an additional 15 percent of the invoice rental rate.

(5) Leased Equipment with Operator or Owner Operated Equipment.

The Department will pay on the basis of actual invoice cost plus 5 percent. Do not separate the labor and equipment cost. Submit evidence the rates paid by the Contractor are the standard rates established, published, and used commercially by the company or owner operator.

(6) Transportation Costs.

The equipment rates established in this subsection are based on the Contractor having the equipment available to perform the directed force account work. The Department will pay the cost of transporting the equipment to and from the project site as approved.

The Department will pay for transporting by common carrier at invoice cost plus 5 percent as pay for field and home office overhead, and profit. The Department will pay for transporting self-propelled equipment, other than trucks, at a rate equal to 75 percent of the rental rates established in this subsection.

(7) Equipment Condition and Job Conditions.

The rental rates established in this subsection are for equipment of modern design in good working condition. For equipment that does not meet this requirement or does not provide reasonable production rates, the Engineer will direct removal of the equipment or negotiate its use at a reduced rental rate, as proposed by the Contractor and approved.

If the Contractor encounters conditions in performing force account work that would result in an increase in normal wear and tear on the equipment, the Contractor may request an adjustment to rates established for the work. The Engineer will review and approve, if appropriate, the rental rate adjustment request.

(8) Unlisted Equipment.

If the equipment available for force account work is unlisted, the Engineer will negotiate or establish a fair rental rate with the Contractor.

(9) Shop Tools.

The Department will not pay for equipment listed in the Blue Book Section 18 Shop Tools, if the daily rate is less than \$10.

f. Professional Services.

If the force account work requires professional services, the Engineer will approve the scope of work and cost estimate, including travel and per diem, before the work begins. The Engineer will allow the Contractor a markup for field and home office overhead, and profit as specified in 109.03.C.5.h, but will not allow other markups in this payment calculation.

g. Miscellaneous.

The Engineer will not pay for the use of small tools or for other costs not specified.

h. Contractor's Overhead and Profit on Subcontractor Work.

Approved subcontractors may perform work on a force account basis and are entitled to Department payment as specified in 109.03.C.5.a, 109.03.C.5.b, 109.03.C.5.c, 109.03.C.5.d, 109.03.C.5.e, 109.03.C.5.f, and 109.03.C.5.g.

If an approved subcontractor performs work on a force account basis, the Department will pay the Contractor for field office overhead, home office overhead, and profit as follows:

Dollars	The Contractor's Pay
Up to \$10,000	15%
Over \$10,000	\$1,500 + 10% of excess over \$10,000

The Engineer will calculate the Contractor's overhead and profit based on the total amount of force account work performed, including allowable markups.

Submit receipts and invoices. The Department will approve and pay the additional amount after receipt of the invoices.

D. Payment for Delays.

1. General.

The Department will not pay for profit on delay costs, unrecoverable costs as specified in 109.3.C.2, or costs that duplicate payments made as specified in 109.03.C. The Department will not allow markups on delay costs except as specified in this subsection.

The Contractor is obligated to mitigate delay costs as specified in 108.07.A and will coordinate mitigation efforts with the Engineer as specified in 105.05.

Submit an itemized delay cost statement. After itemized statement receipt, the Department will pay the justified delay cost. Provide applicable items in this statement as specified in 109.03.C.5.b.

2. Allowable Delay Cost.

a. Extended Field Overhead.

The Department will pay the Contractor for extended field overhead costs, including the cost for general field supervision, field office facilities and supplies, and field operations maintenance.

General field supervision costs include field supervisors, assistants, security guards, clerks, and other field support staff. Calculate labor cost as specified in 109.03.C.5.c, except for salaried personnel, calculate the daily wage rate actually paid by dividing the weekly salary by 7 days per week. Do not include markups as specified in 109.03.C.5.c for field overhead, home office overhead, and profit when calculating general field supervision costs.

Field office facility and supply cost include field office trailers, tool trailers, office equipment rental, temporary toilets, and other incidental facilities and supplies. Calculate this cost on a calendar day basis using the actual cost incurred during the delay.

Field operations maintenance cost includes telephone, electric, water, and other similar expenses. Calculate this cost on a calendar day basis using the actual cost incurred during the delay.

In addition, the Department will add a markup of 5 percent to the extended field overhead costs to pay the Contractor for home office overhead.

b. Escalated Labor.

The Department will pay for escalated labor costs, excluding markups for field office overhead, home office overhead, and profit, if the Contractor can show the compensable delay caused the work to be performed with labor at higher wage rates than planned at the time of the bid opening. Submit documents supporting the cost, labor rates, and benefits as specified in 109.03.C.5.c. The Department will add a 5 percent markup for home office overhead.

c. Equipment Standby or Equipment Demobilization.

The Department will pay the standby rate for equipment, other than small tools, that must remain on the project during the delay. Calculate this rate as specified in 109.03.C.5.e.3. Do not include the specified 109.03.C.5.e markups for field overhead, home office overhead, and profit. If approved, the Department will pay the Contractor's actual transportation cost to remove and return equipment not required during the delay. To the standby cost or transportation costs, the Department will add a 5 percent markup for home office overhead.

d. Standby Labor.

If approved, the Department will pay for standby labor as specified in 109.03.C.5.c, excluding markups for field office overhead, home office overhead, and profit and for nonsalaried personnel remaining on the project. To these costs, the Department will add a 5 percent markup for home office overhead.

e. Material Escalation or Material Storage.

If approved, the Department will pay for actual increased material cost or material storage cost due to the delay and will add a 5 percent markup for home office overhead.

109.04 Increases or Decreases Due to Taxes.

The total contract amount includes applicable federal, state, and local taxes and duties.

The Department will not adjust the contract amount for increases or decreases due to taxes, unless the amount of an increase or decrease is greater than \$100 from the contract amount.

Notify the Engineer promptly of a statute, court decision, written ruling, or regulation that will result in an increase or decrease in the contract amount.

A. Increases Due to Taxes.

The Department will increase the contract amount if the following conditions exist:

1. A statute, court decision, written ruling, or regulation increases federal, state, or local excise tax or duty on the transactions or property covered by the contract and takes effect after the contract date.
2. The statute, court decision, written ruling, or regulation was unanticipated by the Department and the Contractor before the contract date.
3. The Contractor pays or bears the burden of the federal, state, local excise tax or duty, or rate increase.

The Department will increase the contract amount by the amount of the tax, duty, or rate increase paid by the Contractor. If requested by the Engineer, verify in writing the new federal, state, local excise tax or duty, or rate increase was not included in the contract amount.

B. Decreases Due to Taxes.

The Department will decrease the contract amount if the following conditions exist:

1. A statute, court decision, written ruling, or regulation decreases federal, state, or local excise tax or duty on the transactions or property covered by the contract and takes effect after the contract date.
2. The statute, court decision, written ruling, or regulation was unanticipated by the Department and the Contractor before the contract date.
3. The Contractor pays or bears a lesser burden for federal, state, local excise tax or duty, or rate decrease.

The Department will decrease the contract amount by the amount of the relief, refund, or drawback. Pay this amount to the Department as directed.

The Department will also decrease the contract amount if the Contractor, through fault or negligence or failure to follow the Engineer's instructions, is required to pay or bear the burden of a federal, state, or local excise tax or duty, or does not obtain a refund or drawback.

109.05 Partial Payments.

Partial payments are only approximate and are subject to correction in any payment following the discovery of an error. Partial payments will be made at least once each month as the work progresses and only if the Contractor performs work in accordance with the contract or as directed. Semi-monthly payments will be made upon the Contractor's written request. The Engineer will prepare estimates and partial payments will be made based on the value of the work performed and for material delivered and on hand as specified in 109.06.

The Engineer may withhold part of a pay estimate until the Contractor complies with the contract, including:

1. Submitting schedules as specified in 108.03.
2. Correcting defective, deficient, or incomplete work.
3. Maintaining completed work or correcting deficiencies resulting from the Contractor's failure to provide proper maintenance.
4. Submitting materials certifications.
5. Submitting certified payrolls.
6. Complying with stormwater management practices.
7. Making prompt payment to subcontractors or suppliers as specified in 101.04.
8. Participating in the online diversity tracking system and verifying subcontractor and supplier prompt payments by the online audit process.
9. Meeting the training special provisions, if required.
10. Submitting record drawings.

If the Engineer or the Contractor discovers defective work or material or an overpayment based on quantity or unit price, or if the Engineer reasonably doubts the integrity of the completed work before the final acceptance and payment, the Engineer will deduct an amount equal to the value of the defective work or overpayment. The Engineer will not include this amount in subsequent estimates until the Contractor corrects the defect or addresses the Engineer's doubt. The Engineer will determine the suspect or defective work value or overpayment using the quantities or unit prices in the contract.

Pay each subcontractor or supplier by the 20th day after receiving payment from the Department, provided work performed by the subcontractor or supplier complies with the contract. Return retainage to each subcontractor or supplier by the 20th day after the subcontractor or supplier satisfactorily completes work. The subcontractor may

request the Engineer to make partial acceptance of the completed work to allow release of subcontractor retainage from the Contractor. For purposes of this section, a subcontractor's work is satisfactorily completed when all the work in the subcontract has been accomplished and documented as required by the Department and as specified in 105.15. When the Department has made a partial acceptance of the subcontractor's work, the partial acceptance indicates this work satisfactorily completed and requires the Contractor to release any retainage.

The Contractor will verify payment or retainage has been released to its subcontractors or suppliers within the specified time for each partial payment or partial acceptance by the Department through entries in the Department's online diversity tracking system during the corresponding monthly audits.

Prompt payment will be monitored and enforced through the Contractor's reporting of monthly payments to its subcontractors and suppliers in the online diversity tracking system. Subcontractors, including lower-tier subcontractors and/or suppliers will confirm the timeliness and the payment amounts received utilizing the online diversity tracking system. Discrepancies will be investigated by the Contract Compliance Officer and the Engineer. Payments to the subcontractors, including lower-tier subcontractors, and including retainage release after the subcontractor or lower-tier subcontractor's work has been accepted, will be reported monthly by the Contractor or the subcontractor.

The Contractor will ensure its subcontractors, including lower-tier subcontractors, and its suppliers meet these requirements.

109.06 Payment for Material on Hand.

The Engineer may make partial payments for material that will be incorporated into the work, if the material is delivered to or stockpiled in approved storage sites. Ensure the stockpiled material quantity eligible for partial payment does not exceed the total estimated quantity required to complete the work. The stockpiled material partial payment will not exceed the value of the portion of the contract pay item in which the material will be incorporated.

The Engineer will not make partial payments on living or perishable plant materials until planted.

109.07 Allowance for Material Left on Hand.

If materials are not incorporated into the work because of contract pay item elimination, contract revisions as specified in 104.02, termination of the contract for the Department's convenience as specified in 108.09, and it is not commercially feasible for the Contractor to return the material for credit or otherwise dispose of the material, the Department will purchase the materials provided the Contractor:

1. Requests the Department purchase the unused materials.
2. Shows acquisition of the applicable materials as specified in 106.02.
3. Shows the materials meet specifications.
4. Submits receipts, bills, and other records of the cost of materials delivered to the designated delivery points.

The Department will pay the Contractor the verified materials cost plus 5 percent, unless the payment would exceed the contract unit price. If the payment would exceed the contract unit price, the Department will pay the contract unit price.

The Department may purchase surplus aggregates from the Contractor if the following conditions exist:

1. The material is stockpiled as directed.
2. The material meets specification requirements when stockpiled.

The Department will pay the Contractor for accepted material at an agreed price based on the material production cost. The Department will pay the Contractor to haul the material to the stockpile site as specified in 104.02.

109.08 Acceptance and Final Payment.

After accepting the work as specified in 105.15, the Engineer will prepare a final estimate including the following:

1. All accepted contract pay item quantities and unit prices.
2. All previous partial payment amounts.
3. Release of remaining retainage.
4. Deductions made as specified in the contract.

When the Contractor accepts the final estimate and submits consent of surety, the Engineer will process the final estimate and the Department will provide the Contractor with final payment. Submit a consent of surety letter signed by the attorney-in-fact for the surety with the wording:

“As surety for the above referenced project issued a performance bond and in accordance with [54-19, Idaho Code](#) and the Department’s Standard Specifications, the surety agrees and guarantees under the performance bond, to promptly repay the Department for overpayments made to the surety’s principal and tax claims made pursuant to [63-15, Idaho Code](#), signed by the attorney-in-fact for surety, to the Engineer.”

If the Contractor has not accepted the final estimate and submitted the consent of surety within 30 calendar days, the Engineer may process the final estimate and the Department will provide the Contractor with final payment.

The Contractor’s final payment acceptance will not prejudice pending claims filed as specified in 105.15. On final adjudication of outstanding claims, the Department will process additional Contractor payments as required.

The Department may correct prior partial estimates and payments in the final estimate and payment.

SECTION 110 – CIVIL RIGHTS

110.01 General Requirements.

For federal-aid contracts, the Contractor will comply with 110 per Special Equal Employment Opportunity Responsibilities under [23 CFR 140](#) and [23 CFR 230, Subpart A and D](#) (also refer to United States Department of Transportation (USDOT) form FHWA-1273 attached to each contract).

110.02 Equal Employment Opportunity.

The Contractor will establish and administer wages, working conditions, employee benefits, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, without regard to race, color, religion, sex, national origin, age, or disability. When advertising to hire employees, the Contractor will include in all advertisements for employees the notation: “An Equal Opportunity Employer”. All advertisements will be published in newspapers or other publications having a large circulation among women and minority groups in the project area where the work force would normally be sourced.

The Contractors will submit for a pay period in July, an electronic report indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract. The Contractor will submit workforce diversity data indicating the number of minority, women, and non-minority employees for each project worked during the calendar year. The Department will use this data to assign training goals on contracts for the following construction season. Contractors may only use the Department’s online 1391 tool which takes the place of the Federal Form FHWA-1391. Contractors will receive a link to the online tool when the submission cycle begins and will report on any last pay period in the month of July. All information must be submitted by August 31. To view the Department’s online 1391 database:

<http://apps.itd.idaho.gov/apps/eo1391form>.

110.03 Disadvantaged Business Enterprise (DBE) Program Requirements.

Failure to comply with the DBE program requirement percentage as specified in the Special Provisions or the percentage determined on the Department’s approved [ITD-2396](#) DBE Commitments form (required in 103) is a breach of contract. Whenever the Engineer determines, after investigating and obtaining evidence the Contractor has not complied with the DBE program requirement, the Engineer will take corrective action.

The Contractor or subcontractor will not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor will carry out applicable requirements of 49 CFR part 26 in the award and administration of contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the Department deems appropriate (e.g., withholding monthly progress payments, assessing sanctions, liquidated damages, disqualifying the contractor from future bidding as non-responsible).

For additional DBE Program information, see the Department’s DBE program requirements located at: <http://apps.itd.idaho.gov/apps/ocr/civil/pdf/dbepplan.pdf>.

A. Disadvantaged Business Enterprise for Race/Gender – Neutral Contracts.

In an effort to achieve the Department’s current DBE annual participation goal, the Department respectfully requests and encourages responders to consider utilizing subcontractors and suppliers listed on its DBE directory located at <https://itd.dbesystem.com/>.

Regulations and statutes require and authorize the DBE Program under Titles I (other than Part B) and V of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), Pub. L. 102-240, 105 Stat. 1914, and Titles I, III, and, V of the Transportation Equity Act for the 21st Century (TEA-21), Pub. L. 105-178, 112 Stat. 107, Titles I, III, and V of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU),

Pub. L. 109-59, 119 Stat. 1144, and Divisions A and B of the Moving Ahead for Progress in the 21st Century Act (MAP-21), Pub. L. 112-141, 126 Stat. 405, Fixing America's Surface Transportation Act (FAST Act) Pub. L. 114-113.

1. It is the Department's policy to ensure DBEs, as defined in [49 CFR Part 26](#), have an equal opportunity to receive and participate in the United States Department of Transportation (USDOT)-assisted contracts. The Contractor will include these requirements in every subcontract and modify language as necessary to make the program binding on all subcontracts.

The Contractor agrees to ensure DBE firms have the opportunity to participate in the performance of the contract. The Contractor or its subcontractor(s) will not discriminate based on race, color, national origin, sex, age, or disability in the performance of the contract. The Contractor will carry out applicable requirements of 49 CFR Part 26 in the award and administration of USDOT-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or result in the implementation of other remedy, as the Department deems appropriate.

It is required that a Contractor verify a DBE firm's certification with the Idaho Unified Certification Program (UCP). The UCP directory is located at: <https://itd.dbesystem.com>. The Contractor must use the [ITD-2396](#) form, with all supporting documentation to the Department's Office of Civil Rights within 3 calendar days of bid opening or the Contractor's bid will be deemed irregular as specified in 102.10. The Consultants must use the [ITD-2398](#) form for consultant agreements when making DBE goal commitments for contract goals. If the Department declares a DBE firm ineligible to perform work after the execution of a signed contract, then the DBE firm may complete the work, the Department will count the DBE firm's participation toward the contract goal, although the DBE participation will not count toward the overall annual Department DBE goal. If a Federal agency and/or the Department decertify a DBE before the DBE firm signs a contract, then the Contractor must replace the ineligible DBE firm with another DBE firm or demonstrate that it made a GFE to do so.

2. The Department determines the level of DBE participation on a contract-by-contract basis determined by the Department's contract goal methodology, the contract bid documentation will state the contract goal percentage. The Department will credit dollar volumes of participation toward the contract goal. The Department will base the goal attainment on actual expenditures made to DBE firms providing a commercially useful function (CUF), as adjusted as specified in 110.03.B.3. This includes only work actually performed by and paid to the DBE firm and the cost of equipment, supplies, and materials, except when the DBE purchases or leases the equipment, supplies, and materials from the Contractor.

The bidder hereby certifies that it made GFEs to seek out and consider DBE firms for work on the contract.

3. The Department will credit fees and expenditures toward to DBE goal as follows:
 - a. 100 percent of the dollar value equal to the clearly defined portion of the work of the contract that the DBE performs with its own forces in a joint venture between a DBE and a non-DBE firm.
 - b. 100 percent of expenditures to a DBE manufacturer, a DBE subcontractor, or DBE professional consultant.
 - c. 100 percent of expenditures to a trucking firm that uses trucks it owns, insures, and operates using drivers it employs or leases from another DBE firm including an owner/operator who is also certified as a DBE. A DBE firm may lease trucks from a non-DBE firm, including an owner/operator. As a result, the DBE will receive credit for the total value of the services provided by the non-DBE firm not to exceed the value of the services provided by the DBE-owned trucks. Any additional participation by non-DBE firms will receive credit only for fees or commission received.

Example: DBE Firm X uses 2 of its own trucks on a contract. It leases 2 trucks from DBE Firm Y and 6 trucks from non-DBE Firm Z. DBE credit would be awarded for the total value of transportation services provided by Firm X and Firm Y, and may be awarded for the total value of transportation services provided by 4 of the 6 trucks provided by Firm Z. In all, full credit would be allowed for the participation of 8 trucks. In respect to the other 2 trucks provided by Firm Z, DBE credit could be awarded only for the fees or commissions pertaining to those trucks Firm X receives because of the lease with Firm Z.

- A lease must indicate that the DBE has exclusive use and control over the leased truck. This does not preclude the leased truck from working for others during the term of the lease if the DBE consents, so long as the lease gives the DBE absolute priority for use of the leased truck. A leased truck must conspicuously display the name and identification number of the DBE.
- d. 100 percent of the fees for equipment leased from a DBE towards the contract goal when the Contractor leases the equipment from a DBE, provided the DBE owns or has the equipment registered in its name. If the DBE obtains the equipment from other sources, the Engineer will only credit the net fee.
 - e. 60 percent of expenditures paid out to a DBE dealer for supplies provided and the DBE is not a manufacturer. A regular dealer is a firm that owns, operates, or maintains a store, warehouse, or other facility that supplies materials, articles, or equipment for purchase or lease and regularly stocks, sells, and leases to the public during the usual course of business.
 - f. 100 percent of the net fee (if deemed reasonable) for DBE brokers, packagers, and manufacturers' representatives.
4. Regarding DBE participation on contracts, the Contractor must provide the following (also refer to required [ITD-0315](#) form to obtain subcontractor approval):
- a. The Contractor will document and maintain the identity of the solicited DBE firms and non-DBE firms or volunteer quotations. Information will be documented and made available upon request on the work and associated dollar amounts of each DBE firm and non-DBE firm.
 - b. The Contractor will provide, upon request, the identification of the DBE firms and non-DBE firms the Contractor uses in the execution of the contract.
 - c. The Contractor will maintain a description of the work and associated dollar amounts for each DBE firm and non-DBE firm used in the execution of the contract.
 - d. The Contractor will maintain and make available upon request the dollar amount of the participation of each DBE firm and non-DBE firm utilized.
 - e. The Contractor will provide, upon request the name of the Contractor's designated official responsible for administering the Contractor's DBE program.
5. The Contractor will make a documented GFE showing actions and support for reaching the Department's overall annual DBE goal.
6. Following is a list of efforts the Department will evaluate to determine if the Contractor utilized a GFE to obtain DBE participation. In addition to the efforts made, the Department will consider when the Contractor made the efforts and how intense the efforts were.
- a. Has the Contractor provided written notice to a reasonable number of specific DBEs that their interest in the contract was being solicited in sufficient time to allow the DBEs to participate effectively? The Contractor must describe efforts and submit a copy of all correspondence, including emails, soliciting bids from DBEs.

- b. Has the Contractor followed-up initial solicitation of interest by contacting DBEs to determine with certainty whether the DBEs were interested? Submit follow-up activity documentation (e.g., telephone logs, letters, emails).
 - c. Has the Contractor selected portions of the work to be performed by DBEs in order to increase the likelihood of meeting the DBE goal, including, where appropriate, breaking down contracts into economically feasible units to facilitate DBE participation? The Contractor must describe efforts in detail.
 - d. Has the Contractor provided interested DBEs with adequate information about the plans, specifications, and requirements of the contract? Describe what action was taken.
 - e. Has the Contractor negotiated in good faith with interested DBEs, not rejecting DBEs as unqualified without sound reasons based on a thorough investigation of their capabilities? Describe efforts.
 - f. Describe any other efforts not covered by items a through e above that may demonstrate the Contractor's good faith efforts to obtain DBE participation.
7. The DBE firm must perform a CUF on the contract in order for the Engineer to count expenditures toward the contract goal and annual goal. The Department defines a CUF using general industry practices and the provisions of [49 CFR Part 26](#). A DBE performs a CUF when:
- a. A DBE firm executes a distinct element of the work by actually performing, managing, and supervising the work involved in accordance with industry standard practices, except where such practices are not consistent with DBE regulations and requirements, and
 - b. The DBE firm receives due compensation as agreed upon for the work performed.

If a DBE does not perform or exercise responsibility for at least 30 percent of the total cost of its contract with its own workforce or the DBE subcontracts a greater portion of the work of a contract than would be expected on the basis of normal industry practice for the type of work involved, the Department must presume the DBE is not performing a CUF. As with all non-CUF determinations, the DBE may present evidence to rebut this presumption.

8. Reporting and confirmation of DBE participation will be performed on the Department's diversity tracking system at <https://itd.dbesystem.com> as specified in 109.05.
9. Breach of Contract/Damages. Whenever the Engineer determines, after investigating and obtaining evidence, the Contractor has not complied with 110.03.A, the Engineer will take the following actions:
- a. Inform the Contractor, in writing, that the Department staff observed specific (listed) infractions the DBE must correct within 5 or fewer business days and that failure to take corrective action will result in withholding all or part of the progress payments.
 - b. The Engineer will withhold progress payments when the Contractor does not correct deficiencies.
 - c. If violations persist, the Engineer will contact the Department's Office of Civil Rights for direction on imposing one or more of the following actions:
 - (1) Withhold all or part of any progress payments until the Department determines the Contractor is back in compliance.
 - (2) Suspend the contract completely, or in part, until the Contractor complies, with no progress payments delivered during the period, with no time extension made.
 - (3) Cancel or terminate the contract for cause as specified in 108.09.
 - (4) Deduct from the Contractor's final payment on this contract or any progress payments on

current or future Idaho federal-aid contracts of an amount equal in value of the DBE committed work items not performed by the committed DBE firm. If the Department determines the Contractor caused the failure or the failure was an unintentional error or oversight, then the amount to be deducted may be reduced to 50 percent of the value of the unattained DBE participation based on the committed work items. In addition to sanctions, willful failure by a Contractor or a DBE firm to comply with this contract or with the Federal DBE regulations may result in disqualification from further or future contracting, subcontracting, or other participation in federally funded contracts and/or Department contracts.

The Contractor has the right to appeal as specified in 105.16.

10. Record Keeping.

- a. A Contractor must maintain all records relating to the DBE program and each subcontractor during the course of the work. The Contractor must preserve the documents for a period of 5 years from the date of final payment of the contract.
- b. The Contractor or its subcontractor will make all records pertaining to the DBE program available for inspection, copying, or transcribing by authorized representatives of the Department or the FHWA and must permit the representatives to interview employees as necessary.
- c. Failure to submit the required records upon request or to make these records available can be grounds for sanctions as specified in 110.03.A.9.

11. Joint Ventures.

- a. To increase the opportunity for DBE firms to participate in contracts, DBE firms may enter into joint ventures with non-DBE firms. DBE joint venture applicants must complete the [ITD-0646b](#), Schedule B form and submit it with the required documentation with their bid.
- b. The DBE partner of the joint venture must have a separate agreement showing the DBE partner's bid items. The agreement must be able to define the DBE partner's distinct elements of it will perform with its own forces.
- c. The Contractor and the DBE firm must jointly submit a joint venture agreement and the Department will evaluate it on a contract-by-contract basis. The Contractor and DBE firm must submit the application with the bid documentation.

B. Disadvantaged Business Enterprise for Race/Gender – Conscious Contracts.

Each contract will have a specific DBE availability percentage determined jointly by the Department's design and construction staff and the Office of Civil Rights. The percentage determined will be included in the federal-aid contract bid documentation. The DBE directory is located at <https://itd.dbesystem.com>.

Regulations and statutes require and authorize the Disadvantaged Business Enterprise Program under Titles I (other than Part B) and V of the ISTEPA, Pub. L. 102-240, 105 Stat. 1914, and Titles I, III, and, V of the TEA-21, Pub. L. 105-178, 112 Stat. 107, Titles I, III, and V of the SAFETEA-LU, Pub. L. 109-59, 119 Stat. 1144, and Divisions A and B of the MAP-21, Pub. L. 112-141, 126 Stat. 405, FAST Act Pub. L. 114-113.

1. It is the Department's policy to ensure DBEs, as defined in [49 CFR Part 26](#), have an equal opportunity to receive and participate in the USDOT-assisted contracts. The Contractor will include these requirements in every subcontract and modify language as necessary to make the program binding on all subcontracts.

The Contractor agrees to ensure DBE firms have the opportunity to participate in the performance of the contract. The Contractor or its subcontractor(s) will not discriminate based on race, color, national origin, sex, age, or disability in the performance of the contract. The Contractor will carry out applicable

requirements of 49 CFR Part 26 in the award and administration of USDOT-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or result in the implementation of other remedy, as the Department deems appropriate.

It is required that a Contractor verify a DBE firm's certification with the Idaho UCP. The UCP directory is located at: <https://itd.dbesystem.com>. The Contractor must use the [ITD-2396](#) form, with all supporting documentation to the Department's Office of Civil Rights within 3 calendar days of bid opening or the Contractor's bid will be deemed irregular as specified in 102.10. The Consultants must use the [ITD-2398](#) form for consultant agreements when making DBE goal commitments for contract goals. If the Department declares a DBE firm ineligible to perform work after the execution of a signed contract, then the DBE firm may complete the work, the Department will count the DBE firm's participation toward the contract goal, although the DBE participation will not count toward the overall annual Department DBE goal. If a Federal agency and/or the Department decertify a DBE before the DBE firm signs a contract, then the Contractor must replace the ineligible DBE firm with another DBE firm or demonstrate that it made a GFE to do so.

2. The Department determines the level of DBE participation on a contract-by-contract basis determined by the Department's contract goal methodology, the contract bid documentation will state the contract goal percentage. The Department will credit dollar volumes of participation toward the contract goal. The Department will base the goal attainment on actual expenditures made to DBE firms providing a CUF, as adjusted as specified in 110.03.B.3. This includes only work actually performed by and paid to the DBE firm and the cost of equipment, supplies, and materials, except when the DBE purchases or leases the equipment, supplies, and materials from the Contractor.

The bidder hereby certifies that it made GFEs to seek out and consider DBE firms for work on the contract.

3. The Department will credit fees and expenditures toward to DBE goal as follows:
 - a. 100 percent of the dollar value equal to the clearly defined portion of the work of the contract that the DBE performs with its own forces in a joint venture between a DBE and a non-DBE firm.
 - b. 100 percent of expenditures to a DBE manufacturer, a DBE subcontractor, or DBE professional consultant.
 - c. 100 percent of expenditures to a trucking firm that uses trucks it owns, insures, and operates using drivers it employs or leases from another DBE firm including an owner/operator who is also certified as a DBE. A DBE firm may lease trucks from a non-DBE firm, including an owner/operator. As a result, the DBE will receive credit for the total value of the services provided by the non-DBE firm not to exceed the value of the services provided by the DBE-owned trucks. Any additional participation by non-DBE firms will receive credit only for fees or commission received.

Example: DBE Firm X uses 2 of its own trucks on a contract. It leases 2 trucks from DBE Firm Y and 6 trucks from non-DBE Firm Z. DBE credit would be awarded for the total value of transportation services provided by Firm X and Firm Y, and may be awarded for the total value of transportation services provided by 4 of the 6 trucks provided by Firm Z. In all, full credit would be allowed for the participation of 8 trucks. In respect to the other 2 trucks provided by Firm Z, DBE credit could be awarded only for the fees or commissions pertaining to those trucks Firm X receives because of the lease with Firm Z.

A lease must indicate that the DBE has exclusive use and control over the leased truck. This does not preclude the leased truck from working for others during the term of the lease if the DBE

consents, so long as the lease gives the DBE absolute priority for use of the leased truck. A leased truck must conspicuously display the name and identification number of the DBE.

- d. 100 percent of the fees for equipment leased from a DBE towards the contract goal when the Contractor leases the equipment from a DBE, provided the DBE owns or has the equipment registered in its name. If the DBE obtains the equipment from other sources, the Engineer will only credit the net fee.
 - e. 60 percent of expenditures paid out to a DBE dealer for supplies provided and the DBE is not a manufacturer. A regular dealer is a firm that owns, operates, or maintains a store, warehouse, or other facility that supplies materials, articles, or equipment for purchase or lease and regularly stocks, sells, and leases to the public during the usual course of business.
 - f. 100 percent of the net fee (if deemed reasonable) for DBE brokers, packagers, and manufacturers' representatives.
4. The Department requires all bidders to furnish DBE commitments on the [ITD-2396](#) form and all supporting documentation for a construction contract within 3 calendar days of bid opening. Failure to comply will result in the Contractor's bid being deemed irregular as specified in 102.10 and will not be considered further. The forms must contain:
- a. The identity of the DBE firm(s) the Contractor intends to use in the execution of the contract.
 - b. Description of the work and associated dollar amounts each DBE firm offered to perform.
 - c. Statement(s) of confirmation form signed by the committed DBE(s) on the DBE's company letterhead or on an email with a signature and contact information block, stating the DBE plans to participate in the contract as specified in the Contractor's commitment.
 - d. The name of the Contractor's designated Equal Employment Opportunity Officer responsible for administering the Contractor's DBE program.
 - e. The Contractor must use the above-mentioned forms, unless the committed DBE firm(s) is unable or unwilling to perform because of default, decertification, or other relevant factors.
5. The Department considers the Contractor's commitment to meet the specified goal as clear (prima facie) evidence it made a GFE to obtain DBE participation on the contract.
6. If the DBE commitment is below the contract goal amount, the Department will condition the award of contract to a determination made by the Contractor's DBE program coordinator on the GFEs made to attain DBE participation.

Following is a list of efforts the Department evaluates when determining the Contractor's GFEs to obtain DBE participation. In addition to GFEs, the Department will consider the timing and intensity of the undertaking.

- a. What efforts has the Contractor made to conduct outreach/advertise to Department-certified DBEs? The Contractor must describe efforts, and attach copies of screenshots, published advertisements, or proofs of publication, if applicable.
- b. Has the Contractor provided written notice to a reasonable number of specific DBEs that their interest in the contract was being solicited in sufficient time to allow the DBEs to participate effectively? The Contractor must describe efforts and submit a copy of all correspondence (including emails) soliciting bids from DBEs.
- c. Has the Contractor followed up initial solicitation of interest by contacting DBEs to determine with certainty whether the DBEs were interested? Submit follow-up documentation (e.g., telephone logs, letters, emails).

- d. Has the Contractor selected portions of the work to be performed by DBEs in order to increase the likelihood of meeting the DBE goal, including, where appropriate, breaking down contracts into economically feasible units to facilitate DBE participation? The Contractor must describe efforts in detail.
 - e. Has the Contractor provided interested DBEs with adequate information about the plans, specifications, and requirements of the contract? Describe what action was taken.
 - f. Has the Contractor negotiated in good faith with interested DBEs, not rejecting DBEs as unqualified without sound reasons based on a thorough investigation of their capabilities? Describe efforts.
 - g. Describe any other efforts not covered by items a through f above that may demonstrate the Contractor's good faith efforts to obtain DBE participation on this contract.
7. A contract award is contingent on the Department approving the Contractor's [ITD-2396](#) DBE commitment form. The commitment requires the Contractor to make continuing efforts throughout the contract to ensure that DBE participation remains at a level satisfying the following requirements:
- a. Continuing DBE participation equals or exceeds contract goals.
 - b. Continuing DBE participation equals or exceeds the approved level that is less than the contract goal as allowed under 110.03.B.6.

The Contractor cannot terminate a DBE subcontractor for convenience without the Engineer's written consent. If situations or conditions arise preventing a DBE firm from completing the originally agreed upon work, the Contractor will take affirmative action steps to re-establish DBE participation at a level needed to meet the original contract goal or demonstrate a GFE demonstrating the Contractor afforded other DBEs the opportunity to assume the original work. Afterward, the Contractor must revise the DBE participation percentages on the ITD-2396 DBE commitment form and the Engineer must approve the revised plan with concurrence from the Department's Office of Civil Rights. Failure of the Contractor to meet 110.03.B will be a violation of the contract.

The Engineer will count the value of work actually performed by and paid to the DBE firms toward the Contractor's DBE goal once the Engineer verifies payment through the Contractor's reporting of monthly payments to its subcontractors and suppliers using the Department's online tracking system.

8. The DBE firm must perform a CUF on the contract in order for the Engineer to count expenditures toward the contract goal and annual goal. The Department defines CUF by using general industry practices and the provisions of [49 CFR Part 26](#). A DBE performs a CUF when:
- a. A DBE firm executes a distinct element of the work by actually performing, managing, and supervising the work involved in accordance with industry standard practices, except where such practices are not consistent with DBE regulations and requirements, and
 - b. The DBE firm receives due compensation as agreed upon for the work performed.

If a DBE does not perform or exercise responsibility for at least 30 percent of the total cost of its contract with its own workforce or the DBE subcontracts a greater portion of the work of a contract than would be expected on the basis of normal industry practice for the type of work involved, the Department must presume the DBE is not performing a CUF. As with all non-CUF determinations, the DBE may present evidence to rebut this presumption.

9. Breach of Contract/Damages. Whenever the Engineer determines, after investigating and obtaining evidence, the Contractor has not complied with 110.03.B, the Engineer will take the following actions:

- a. Inform the Contractor, in writing, that the Department staff observed specific (listed) infractions the DBE must correct within 5 or fewer business days and that failure to take corrective action will result in withholding all or part of the progress payments.
- b. The Engineer will withhold progress payments when the Contractor does not correct deficiencies.
- c. If violations persist, the Engineer will contact the Department's Office of Civil Rights for direction on imposing one or more of the following actions:
 - (1) Withhold all or part of progress payments until the Contractor complies.
 - (2) Suspend the contract completely, or in part, until the Contractor complies, with no progress payments delivered during the period, with no time extension made.
 - (3) Cancel or terminate the contract for cause as authorized in 108.09.
 - (4) Deduct from the Contractor's final payment on the contract or any progress payments on current or future Idaho Federal-Aid contracts of an amount in equal value of the DBE committed work items not performed by the committed DBE firm. If the Department determines the Contractor caused the failure or the failure was an unintentional error or oversight, then the amount to be deducted may be reduced to 50 percent of the value of the unattained DBE participation based on the committed work items. In addition to sanctions, willful failure by the Contractor or a DBE firm to comply with this contract or with the Federal DBE regulations may result in disqualification from further or future contracting, subcontracting, or other participation in federally funded contracts and/or Department contracts.

The Contractor has the right to appeal as specified in 105.16.

11. Record Keeping.

- a. A Contractor must maintain all records relating to the DBE program and each subcontractor during the course of the work. The Contractor must preserve the documents for a period of 5 years from the date of final payment of the contract.
- b. The Contractor or its subcontractor will make all records pertaining to the DBE program available for inspection, copying, or transcribing by authorized representatives of the Department or the FHWA and must permit the representatives to interview employees as necessary.
- c. Failure to submit the required records upon request or to make these records available can be grounds for sanctions as specified in 110.03.A.9.

11. Joint Ventures.

- a. To increase the opportunity for DBE firms to participate in contracts, DBE firms may enter into joint ventures with non-DBE firms. DBE joint venture applicants must complete the [ITD-0646b](#), Schedule B form and submit it with the required documentation with their bid.
- b. The DBE partner of the joint venture must have a separate agreement showing the DBE partner's bid items. The agreement must be able to define the DBE partner's distinct elements of it will perform with its own forces.
- c. The Contractor and the DBE firm must jointly submit a joint venture agreement and the Department will evaluate it on a contract-by-contract basis. The Contractor and DBE firm must submit the application with the bid documentation.

110.04 Training.

A. General.

The Contractor will assist in locating, qualifying, and increasing the skills of minorities, women, and disadvantaged employees and applicants for employment. Consistent with the Contractor's workforce requirements and as permissible under federal and state regulations, the Contractor will make full use of training programs (e.g., apprenticeship, on-the-job training programs) for the geographical area of contract performance in accordance with [23 CFR 230 Appendix B to Subpart A of Part 230](#) when required.

The Contractor, as part of its Equal Employment Opportunity (EEO) Affirmative Action Program (AAP) will provide on-the-job training (OJT) aimed at developing full journeymen in the type of trade, craft, or job classification involved.

The number of trainees trained and hours/units will be in the contract bid schedule.

In the event the Contractor subcontracts a portion of the work, the Contractor will determine how many training hours/units the subcontractor must assume and provide. The Contractor will retain the principal responsibility for meeting the training requirements and must complete 51 percent of the assigned training requirements. The Contractor will ensure the training requirement is included in the subcontracts when required. Where feasible, 25 percent of apprentices or trainees in each occupation will be in their first year of their apprenticeship or training program(s). The minimum acceptable ratio for journeymen to trainees on Department contracts is 1:2. The ratio will not be greater than permitted under the plan approved by the U.S. Department of Labor (USDOL), Employment and Training Administration.

The Contractor will distribute the number of trainees among the work classifications underutilized by minorities and women based on the Contractor's requirements and the availability of journeymen in the various underutilized classifications within a reasonable area of recruitment. The Department considers a reasonable area of recruitment as being 160 miles from the project site, within the state of Idaho, and depending on weather conditions. The Department's Office of Civil Rights must approve the Contractor's training program before the Contractor may commence work. The Contractor will specify the starting time for training in each of the classifications. The Department will credit the Contractor for each approved trainee or future trainee approved on the contract and will reimburse the Contractor for each trainee(s).

Training and upgrading of minorities and women toward journeyman status is the primary objective of the training specification. The Contractor must make every attempt to enroll minorities, women, and disadvantaged individuals (i.e., by conducting systematic and direct recruitment through public and private sources likely to yield minority, women, and disadvantaged individuals) on the project to the extent available and within the reasonable area of recruitment. Before determining compliance with the training specification, the Department will hold the Contractor accountable for demonstrating all steps taken to meet the training specification.

Additionally, the Department does not intend for the training commitment to be used to discriminate against any applicant for training whether or not the applicant is a minority, woman, or disadvantaged individual.

The Contractor cannot employ and train an employee as a trainee in any classification where he/she has previously completed a training course leading to journeyman status or where he/she previously earned journeyman wage in that craft/trade. In addition, the Contractor must satisfy this requirement by including the appropriate questions in the employee application, hiring process, or by utilizing some other means to determine if a potential trainee received previous training or if a trainee previously attained journeyman status in the proposed craft. Regardless of the method used, the Contractor's records must document the findings in each case.

The Contractor must establish the minimum length and type of training for each classification for each training program selected by the Department and the Contractor and the FHWA must approve the program before commencing work. In addition, the Department and the FHWA will approve any program reasonably calculated to meet the EEO obligations of the Contractor and to qualify the average trainee for journeyman status in the

classification concerned by the end of the training period. The Department will accept any apprenticeship program registered with the US DOL, Bureau of Apprenticeship & Training. The Department will additionally accept any training program registered with any other state apprenticeship agency recognized by the Bureau, approved by the US DOL, Manpower Administration and/or Bureau of Apprenticeship and Training, provided the Contractor administers the program consistently with the EEO obligation required by the federal-aid contract. The Department intends for any training provided under the training specification to be for construction crafts and trades rather than clerk-typists or secretarial-type positions; however, training is permitted in lower level management positions (e.g., project engineers, estimators, timekeepers) where the Contractor orients the training for construction project applications. The Department will permit a limited amount of training in the laborer class provided the Contractor provide significant and meaningful training and the FHWA approves the training in advance. The Department will permit some offsite training as long as the training is an integral part of an approved training program and it does not comprise a significant part of the overall training. Trainees may earn apprenticeship credit on non-federal construction contracts; however, the Department will not reimburse the Contractor for training on any non-federal aid contracts.

Except as otherwise noted below, the Department will reimburse the contractor 80 cents per hour of training given to an employee on this contract in accordance with an approved training. Once the Engineer approves the training, the Department will also reimburse the Contractor for training hours in excess of the number specified. In spite of the source of training funds, the Department will reimburse the Contractor the 80 cents per hour, provided the other source(s) do not specifically prohibit the Contractor from receiving other reimbursements. The Department will only reimburse the Contractor for offsite training where he/she does one or more of the following:

1. Concurrently employs the trainee(s) on a federal-aid contract.
2. Contributes to the cost of the training.
3. Provides the instruction to the trainee.
4. Pays the trainee(s) wages during the offsite training period.

The Contractor must exhaust every attempt to provide the training according to the prescribed training program and to promote the trainee to journeyman status upon completion. During the training, the Contractor must document all GFEs made to deliver the training, the results of the training, and all efforts made to bring the trainee to journeyman standing; otherwise, the Department will not reimburse the Contractor for the required training.

It is not required that all trainees be onboard for the entire length of the contract. The Contractor will dispatch his/her responsibilities under the training specification once the Contractor delivers acceptable training and the hours/units specified in the contract.

While working on a USDOT federally funded contract, regardless of an existing collective bargaining agreement, the Contractor will follow US DOT regulations requiring the Contractor to pay the appropriate trainee wage rates (23 CFR 230, Appendix B to Subpart A-Training Special Provisions) as follows:

“Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provision.”

If a trainee enrolls in a USDOL training program, the proper approved rate(s) apply. If a trainee's wage exceeds the prevailing wage rate, then the training hours do not apply to the hours/units specified in the contract unless approved first by the engineer. Trainee wages and apprenticeship ratios will be clearly notated by the Contractor in the certified payroll. Failure to meet the ratio will result in the Contractor paying full Davis-Bacon wage in all associated trainee classifications.

The Contractor will follow the prescribed training program and must furnish the trainee with a copy before commencing training. Upon completion of the training program, the Contractor will furnish each trainee with a certification indicating the type and length of training satisfactorily completed.

When requesting approval, a completed training submittal will include:

1. Completed [ITD-2777](#) form, including names of trainees.
2. A copy of the training program for each trainee work classification.
3. If USDOL approved, a copy of all associated USDOL documents.
4. Schedule of work for the trainee on this project.

B. Reporting.

The Contractor will maintain all training records and furnish periodic reports to the Department, including the [ITD 2776](#) form in order to document the Contractor's GFEs made to meet the training specification. The Contractor must provide the number of individuals to be trained in each classification and the training program(s) he/she plans to use. The Contractor must notify the Engineer before making any payment to a trainee. The payment information must include the trainee's name, address, employee number, and any previous training completed (running tally of total training hours). The Contractor must certify the trainee has never attained journeyman status in the craft specified. The Engineer will review the information submitted and approve or disapprove the trainee. The Department will not provide training credit without the Engineer's prior approval. The Contractor must identify the trainee(s) on the Contractor's certified payrolls.

110.05 Tribal/Tribal Employment Rights Ordinances (TERO).

To comply with the CFR, Tribal Employment Rights Ordinances (TERO) applies to federal-aid highway construction contracts on a tribal reservation covered by TERO. For state-aid contracts, the Contractor and its subcontractors will comply with applicable tribal regulations when working on a tribal reservation.

SECTION 200 – EARTHWORK

SECTION 201 – CLEARING AND GRUBBING

201.01 Description. Cut and dispose of trees with diameters of less than 6 inches, brush, shrubs, logs, and windfalls and remove and dispose of stumps, including roots and debris from the designated areas.

Areas to be cleared and grubbed are described by a line drawn 5 feet outside the perimeter of the grading area. Other areas to be cleared and grubbed will be as specified or as directed.

201.02 Materials. Not specified.

201.03 Construction Requirements. Preserve and protect trees within the construction area not requiring removal. Paint retained trees or shrubs, which have been cut or scarred, with an asphaltum base paint prepared especially for tree surgery.

Merchantable timber in the clearing area, not removed from the right of way before the start of construction, is the Contractor's property.

Do not dispose of materials by open burning. The Department will allow materials and debris to be disposed of at locations off the project site and out of view from the project site. Obtain the property owner's written permission before placing the materials and debris. Submit copies of the agreements with property owners and comply with the requirements of 107.17.

Protect and preserve damaged trees, shrubbery, grass, and other vegetative ground cover outside the construction area, including median areas not to be graded that are within the construction area. The Contractor is responsible for damage resulting from the work. Take reasonable care to avoid damage by construction operations to streams and lakes adjacent to the project site.

201.04 Method of Measurement. The Engineer will measure acceptably completed work by the acre or by lump sum.

When the quantity is measured by the acre, the Engineer will measure the area cleared and grubbed in accordance with the stakes set by the Contractor.

201.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Clearing and Grubbing	Acre or LS

If a contract pay item for clearing and grubbing does not exist, the work is incidental and the cost included in other earthwork contract pay items.

SECTION 202 – SELECTIVE REMOVAL OF TREES OR STUMPS

202.01 Description. Remove and dispose of separate trees, including their stumps, and stumps designated for removal.

202.02 Materials. Not specified.

202.03 Construction Requirements.

A. Selective Removal of Trees. Remove designated trees, including their stumps, and dispose of the material as specified in 201.

B. Selective Removal of Stumps. Excavate and remove stumps and dispose of the material as specified in 201.

202.04 Method of Measurement. The Engineer will measure acceptably completed work per each and as follows:

1. For trees, the Engineer will measure the tree diameter at a point 2 feet above the ground line.
2. For stumps, the Engineer will measure the stump diameter 2 feet above the ground line or at the top of the stump if it is less than 2 feet in height.

202.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Selective Removal of Trees, including stumps.....	Each
Selective Removal of Stumps	Each

The removal of trees or stumps with diameters of less than 6 inches is incidental to other earthwork contract pay items.

If a contract pay item does not exist for selective removal of trees and stumps, the work is incidental and the cost included in other earthwork contract pay items.

SECTION 203 – MISCELLANEOUS REMOVALS

203.01 Description. Remove, wholly or in part, and dispose of buildings, fences, structures, old pavements, pavement markings, abandoned pipelines, signs, and other items that are not designated to remain, except for the items to be removed and disposed of under other contract pay items. Salvage designated materials and backfill the resulting trenches, holes, and pits.

203.02 Materials. Provide materials as specified in:

Fog Coat.....408

203.03 Construction Requirements.

A. General. Raze, remove, and dispose of buildings and foundations, structures, fences, and other obstructions within the right of way as specified, except utilities and those obstructions for which other provisions have been made. Remove salvageable material without unnecessary damage, salvage material in sections or pieces that may be readily transported and stored at specified places within the project site. Unusable material may be disposed of out of view from the project site with written permission from the property owner before placing the material. Dispose of unusable material so no unsightly appearance will result. Submit copies of property owner agreements. Fill basements or cavities left by structure removal to the level of the natural ground surface and compact as specified in 205.03.E if within the prism of the construction.

Where new work abuts existing materials, saw the edges of the existing materials to a vertical line.

Remove and dispose of asbestos.

Comply with the requirements of 107.17.

B. Removal of Bridges, Culverts, and Other Drainage Structures. Do not remove bridges, culverts, and other drainage structures in use by traffic until satisfactory arrangements have been made to accommodate traffic.

Remove the substructures of existing structures to the natural stream bottom. Remove those parts outside of the stream to 12 inches below natural ground surface. If portions of existing structures lie wholly or in part within the limits for a new structure, remove only those portions as necessary to accommodate the construction.

Salvageable materials are the Contractor's property. Remove structural steel identified as having a lead-based paint and deliver to an approved scrap metal recycler. Submit in writing the final disposition of structural steel with lead-based paint.

C. Remove Pavement Markings. Remove pavement markings, when they no longer apply, by grinding, abrasive blasting, or hydroblasting. Apply fog coat to areas where pavement markings have been removed.

D. Remove Signs. Remove signs, sign posts, and sign post foundations. If the sign is to be reinstalled, protect signs during transportation and storage to prevent damage.

E. Removal and Disposal of Asbestos.

1. Before commencing work:

- a. File the appropriate notification with the EPA's Boise office at least 10 calendar days before beginning the removal operation. See the Department's design manual Figure 334.04-02 for more information.
- b. Submit the manufacturer's certification for conformance to ANSI Z9.2-1979 when any of the following equipment is used in asbestos removal:

(1) HEPA vacuum.

- (2) Negative pressure ventilation units.
 - (3) Local exhaust ventilation equipment.
 - c. Show compliance with Occupational Safety and Health Administration (OSHA) protective clothing and personal protective equipment requirements (i.e., 29 CFR 1910.1001, paragraphs g and h can be met throughout the work [e.g., adequate numbers and quantities of replacements to provide worker coverage for clothing, respirators, filters]). Respirator selection will depend on initial and routine air samples to determine airborne asbestos levels. (See Table 1, 29 CFR 1910.1001, paragraph g).
 - d. Show the capability to perform employee monitoring (i.e., personal air samples) as required by OSHA for initial, periodic, and additional samples if required due to airborne concentration of asbestos fibers during the removal process. See 29 CFR 1910.1001, paragraph d.
 - e. Comply with OSHA requirements with respect to employee health and safety during the project, including record keeping. See 29 CFR 1910.1001, paragraphs i, k, and l.
 - f. Train employees in asbestos work and health risk as required by 29 CFR 1910.1001(J)(5).
2. During abatement activities:
- a. Provide at least 1 NESHAP certified person onsite during asbestos removal or renovation to monitor the stripping and removal of asbestos containing materials.
 - b. Institute engineering and work practice controls which would limit the exposure of workers to or below the exposure limits established in 29 CFR 1910.1001(c), 1910.1001(f)(2)(i).
 - c. Provide clean hygiene facilities for workers who are exposed to asbestos in accordance with 29 CFR 1910.1001, paragraph i.
 - d. Perform required EPA and OSHA asbestos air sampling. The analytical laboratory will use National Institute of Occupational Safety and Health (NIOSH) analytical method P&CAM 293 or 7400 or EPA's Interim Transmission Electron Microscopy Analytical Method, whichever is appropriate.
 - e. Notify the Engineer if sampling shows airborne concentrations above allowable limits.
 - f. Use a surfactant wetting agent when appropriate on the asbestos containing material to maintain a wet condition before and during removal operation until the material is containerized and sealed. Containers must be sealable, impermeable bags or containers in accordance with 29 CFR 1910.1001(k)(6).
 - g. Filter (e.g., sand filtration) asbestos containing water/surfactant liquid waste before dumping into the sanitary sewer system. The filter used for the water/surfactant waste must also be treated as asbestos waste.
 - h. Ensure all containerized waste is marked and identified as asbestos waste in the following manner:
 - DANGER
 - CONTAINS ASBESTOS FIBER
 - AVOID CREATING DUST
 - CANCER AND LUNG DISEASE HAZARD
 - i. Be responsible for ensuring site security of the areas where asbestos abatement is being done. Warning signs will be posted at all approaches to the location and entrances to all regulated areas in accordance with 29 CFR 1910.1001(e).

- j. Provide powered hand tools with local exhaust ventilation in accordance with 29 CFR 1910.1001(f)(l)(v).
 - k. Implement a compliance program when the permissible exposure limit (PEL) for asbestos is exceeded in accordance with 29 CFR 1910.1001(f)(2).
 - l. Institute a respirator program in accordance with 29 CFR 1910.1001(f)(3) where respirator protection is required.
 - m. Wet/clean or HEPA vacuum all surfaces which were exposed to the asbestos containing materials after all removal is accomplished and in accordance with 29 CFR 1910.1001(k).
 - n. Perform clearance testing for airborne asbestos by sampling the air inside and outside each homogenous abatement area. These samples will be analyzed using transmission electron microscopy (TEM). Clearance criteria will be met after 5 samples from inside and outside the abatement area have met the t-test criteria as specified by the EPA.
3. Disposal.
- a. Dispose of all containerized asbestos waste in accordance with 40 CFR, Part 61.156.
 - b. Provide a statement, signed by the Contractor, that all asbestos waste materials were packaged/contained, labeled properly for transport, and disposed of in an approved landfill, in accordance with 40 CFR, Part 61. This statement will include the location of the landfill and the quantity of material disposed.
4. Final Report of Removal Activity.
- Prepare a report containing all the chronological information gathered throughout the removal operation (e.g., sample results, Contractor disposal statement, copy of the notification form). Submit this report to the Engineer within 30 calendar days after asbestos removal/cleanup completion.

203.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum, by the foot, by the square foot, by the square yard, or per each. For asbestos related work, acceptably completed work will be measured as specified in 109.03.

203.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Removal of Miscellaneous Items.....	LS
Removal of _____	Each, ft, SF, SY
Asbestos Removal and Disposal.....	CA

The cost of the fog coat is incidental to the removal of pavement markings.

Removed signs that are to be reinstalled are paid under 616.

If a contract pay item for removal of miscellaneous items does not exist, the work is incidental and the cost included in other earthwork contract pay items.

SECTION 204 – OBLITERATION OF OLD ROAD

204.01 Description. Shape and blend abandoned roads into the surrounding area, after the pavement is removed, as specified in 203 or as directed.

204.02 Materials. Not specified.

204.03 Construction Requirements. When the old road requiring obliteration is no longer needed for traffic:
Fill ditches.

Rough grade, scarify, harrow, and blade the entire road to present a pleasing appearance with slopes rounded and flattened to blend naturally with the adjacent topography.

Break down, bury, or remove structures as specified where a contract pay item is not included in the contract.

When specified, remove pavement as specified in 203.03.A, including removal of asphaltic or portland cement concrete pavement down to unbound base or subbase material.

204.04 Method of Measurement. The Engineer will measure acceptably completed work by lump sum.

204.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Obliteration of Old Road.....	LS

If a contract pay item does not exist for pavement removal in 203, the work is incidental and the cost included in other earthwork contract pay items.

SECTION 205 – EXCAVATION AND EMBANKMENT

205.01 Description. Excavate, haul, dispose of, place, and compact specified materials necessary to construct the work.

A. Excavation. This work includes excavation performed under this contract pay item regardless of the material encountered. The Department may divide excavation into schedules.

B. Blasting. Use explosives to excavate rock. Perform the blasting operations per the Engineer-approved blasting plan.

C. Embankment. Construct embankments with soil, aggregates, rock, or other materials.

1. Soil Embankment. Embankments with materials that can be tested for in-place dry density in accordance with the WAQTC FOP for AASHTO T 310 Method B.
2. Rock Embankment. Embankments with materials that are too granular to test as specified in Table 205.03-1.
3. Embankment with other materials. Embankments constructed with other materials instead of soil or rock, if specified. These materials include wood fibers, light-weight concrete, recycled glass, and geofoam. Use recycled glass that meets the requirements of 720.05.

D. Shoulder Grading. Blade, process, and finish material on the roadway shoulders to match the typical plan section.

E. Soft Spot Repair. Excavate and repair soft spots as directed. The Engineer will identify soft spot repair locations on the project site. Additional areas beyond plan quantity may be identified. Complete all soft spot repairs before beginning any smoothness milling.

205.02 Materials.

A. Borrow. Obtain borrow from designated or approved sources.

B. Granular Borrow. Provide sand, sand and gravel, or sand and rock mixtures obtained from designated or approved sources. Select material with a sand equivalent greater than 30. The Department will not require the sand equivalent if the material has less than 5 percent passing the No. 200 sieve, in accordance with AASHTO T 27 / T 11.

The Contractor may use RAP as granular borrow when approved. Mix RAP in approximately equal proportions with material meeting the granular borrow requirements.

C. Dust Abatement. Use water for dust control.

D. Shoulder Materials. Existing shoulder materials and shoulder aggregate as specified in 703.06.

E. Soft Spot Repair. Provide materials for soft spot repair as follows:

1. Provide granular subbase backfill that meets 703.11.
2. Provide $\frac{3}{4}$ inch aggregate for untreated base, Type A or B, that meets 703.04. The Department will sample the $\frac{3}{4}$ inch aggregate for untreated base from the stockpile.
3. Provide approved Superpave HMA pavement.
4. Provide CSS-1 tack that meets 702.03.
5. Provide Type III subgrade separation geotextile that meets 718.07.
6. Provide Type II biaxial geogrid that meets 641.

7. Provide coarse aggregate for concrete that meets 703.02.

F. Acceptance.

1. Granular Subbase, Untreated Aggregate for Base and Coarse Aggregate for Concrete.
The Department will perform a single aggregate gradation for each item per source for acceptance. Document this gradation on an ITD-901 form.
2. The Department will accept Type III Subgrade Separation Geotextile and Type II Biaxial Geogrid by certification.
3. The Department will accept, granular subbase, untreated aggregate for base, coarse aggregate for concrete, and HMA including compaction by [ITD-850](#), [ITD-854](#), and/or [ITD-855](#) form(s) as applicable, documented once per soft spot.

G. Other materials. Use materials other than soils or rock in constructing embankments as specified.

205.03 Construction Requirements.

A. General. Do not work beyond the dimensions and elevations specified. Stake and cross-section areas to be worked before removing material. Maintain a well-drained roadway. Maintain the subgrade during construction as specified in 105.13 and 105.14.

Dispose of surplus or unsuitable excavated material at approved locations. Comply with 107.17. Obtain written permission to access project sites required by a stormwater pollution prevention plan (SWPPP) until final acceptance. The property owner must acknowledge, in writing, they have been made aware the contract requirements may remain active and access to the project site may be required after the contract is complete. Alternatively, the property owner, by written agreement, may take responsibility for complying with requirements, (e.g., the National Pollutant Discharge Elimination System (NPDES) permit) by becoming a third party to the notice of intent (NOI).

Do not waste material. Schedule excavation and borrow operations to avoid unauthorized waste of excavation.

Protect erodible surfaces of cut and embankment slopes as specified in 212.

Remove and dispose of material originating outside the staked lines of any cut slope that fails due to causes beyond the Contractor's control. Remove and dispose of the material and refinish the cut slopes as directed.

B. Slope Finishing. Finish slopes as specified.

Remove loosened or shattered rocks that will not remain in their natural position, as determined by the Engineer, from the slopes. Remove and dispose of any safety hazards caused by overbreak from the Contractor's operation (e.g., rocks shattered or loosened outside the staked lines of cut slopes).

C. Shoulder Grading. Place shoulder aggregate in sufficient quantities to match the plans.

Blade the shoulder aggregate back to the pavement edge to form a smooth slope with the paved roadway edge as specified or as directed. Compact the shoulder to meet Class D requirements or as directed. Do not damage the new overlay. Use appropriate traffic control to accomplish this work. Replace any delineators, mile posts, or signs damaged during this operation with new Department-approved materials at no additional cost to the Department.

Shoulder grading is not required in guardrail areas.

Broom the pavement to remove aggregate and shoulder material remaining on the overlay surface.

Grade shoulder material and vegetation to the paved surface. Remove and waste shoulder material and vegetation in an approved manner.

D. Process Old Road. Scarify the old road to full depth of the road ballast and spread to form a uniform foundation where the old road surfacing is within 5 feet of the roadbed of the new road.

E. Excavation and Repair of Soft Spot. Excavate the material from the soft spots using equipment that does not aggravate the soft spot condition or disturb the underlying soils. Waste excavated material at an approved, Contractor-furnished waste site. Excavate to the lines and grades as directed.

Line the excavated area bottom with subgrade separation geotextile, followed by biaxial geogrid, or as directed.

Verify the correct geogrid orientation (roll direction) if the geogrid axial strengths are unequal, and place the weaker axis in the traffic (longitudinal) direction. Stretch out and temporarily secure the geotextile and geogrid in place with staples, pins, sand bags, or as directed. Keep the geotextile and geogrid taut and free from wrinkles during the first backfill lift placement.

Dump and spread the backfill in uniform lifts to maintain the required thickness at all times. Place backfill over the geogrid with low ground pressure (< 5 psi) track equipment (e.g., small dozers designed for low ground pressure to avoid overstressing or disturbing the soft foundation soils). Place the first backfill lift over the geogrid at least 1 foot thick and not more than 2 feet thick (loose). Compact the first backfill lift as directed. Construct subsequent lifts in accordance with 205.

Do not operate tracked construction equipment on the geogrid until it is covered by the first backfill lift. Do not turn tracked equipment on the first backfill lift. Operate rubber-tired equipment on the geogrid at speeds of less than 5 mph and only if the underlying material is capable of supporting the load.

Overlap adjacent geotextile and geogrid edges and roll ends at least 2 feet, and lap in the same direction that the backfill will be spread. Cut the geotextile and geogrid, and diagonally overlap around corners so that all locations will have at least a 2 foot overlap and buckling or wrinkling does not occur. Ensure that the geotextile and geogrid sections do not become separated at overlaps during backfill placement.

Repair damaged geotextile and geogrid sections by placing a new piece of geotextile or geogrid over the damaged area with a minimum 3-foot overlap on all edges at no additional cost to the Department.

Backfill areas that are excavated beyond the directed lines and grades at no additional cost to the Department.

Provide positive drainage away from soft spot excavations to the fore slope by trench excavation, or as directed. Construct trenches a minimum of 0.5 foot wide, line with subgrade separation geotextile, and backfill with coarse aggregate for concrete. Construct trenches to drain by gravity to the ditch line.

Cap the soft spot repair areas with 0.5 foot (compacted thickness) of untreated aggregate for base. Finish the base top surface to allow the HMA pavement to match the existing pavement thickness.

Tack the existing pavement vertical edges before paving.

Match the existing pavement thickness.

Compact the backfill and the base per Class A. Compact the HMA with 6 roller passes, or as directed.

F. Embankment Construction. Prepare the natural ground surface as foundation for embankment by removing vegetation, topsoil, and other unsuitable materials and scarifying to provide a bond with the new embankment.

Do not place embankment material until the foundation has been approved. Do not construct embankments with frozen materials or on snow covered or frozen foundations.

Key new embankments constructed on existing slopes steeper than 3H:1V with horizontal benches having a vertical face approximately 1 foot in height. Slope each bench to drain. Incorporate material excavated from the benches in the embankment or waste the material if directed.

Drain seepage encountered from the embankment.

Construct the first lift of an embankment across swampy ground or saturated soils by end-dumping with an adequate thickness to provide a stable surface. Construct the rest of the embankment in layers as specified.

Allow embankment material containing excessive moisture to dry to the appropriate moisture content to meet compaction requirements.

Provide sufficient water to facilitate compaction and to meet the required density. This water is incidental.

1. Soil Embankments. Place soil embankments in horizontal layers 8 inches thick or less before compaction. Uniformly compact each layer at the required moisture content and to the specified compaction class.
2. Rock Embankments. Place rock embankments in horizontal layers 18 inches thick or less before compaction. The Engineer will allow the placement of isolated individual, competent rock fragments having dimensions greater than the specified layer thickness if:
 - a. The clearance between adjacent rocks provides adequate space for placement and compaction equipment to compact the materials in horizontal layers as specified.
 - b. The rocks are placed more than 36 inches below the roadbed. When a majority of the embankment materials are rocks or rock fragments, distribute the material in a manner that avoids nesting and provides spacing between the rocks to allow for filling with smaller rocks and soils. Compact rock embankments as follows:

- (1) Compaction within 18 inches of roadbed and rock backfill of over-excavated areas in rock cuts: Place rock embankment in layers of 9-inches thick or less. Uniformly compact each layer with at least 12 full coverages of a vibratory roller meeting the minimum requirements specified in this subsection. The Contractor may reduce vibratory rolling by 1 full coverage for each increase of 5,000 pounds per impact above the specified minimum. Ensure at least 6 full coverages per 9-inch lift or fraction portion.
- (2) Compaction at a depth greater than 18 inches below roadbed: Place rock embankment in layers of 18 inches thick or less. Uniformly compact the material with at least 3 full coverages for each 6 inches of lift thickness or fraction portion with rollers of the following minimum requirements:
 - (a) Vibratory rollers having a rated centrifugal force of 30,000 pounds per impact and at least 1,000 vibrations per minute. Limit the speed of vibratory rollers to less than 130 feet per minute.
 - (b) Grid rollers having a static weight of at least 20,000 pounds and 4,000 pounds per foot of drum width. Limit the speed of grid rollers to less than 350 feet per minute.

The Contractor may reduce rolling requirements 1 coverage per 6 inches, or fraction thereof, for each increase of 5,000 pounds per impact for vibratory rollers or 1,000 pounds per foot of drum width for grid rollers. Ensure at least 1 complete coverage for each 6 inches of lift thickness or fractional portion.

3. Density Determination. Determine the maximum dry density in accordance with the following applicable test methods:

Moisture-Density Relations of Soils AASHTO T 99 Method C
A block of concrete weighing at least 75 pounds and well seated on a compacted base may be substituted for the compaction base specified in AASHTO T 99.

Correction for Coarse Particles in the Soil Compaction Test AASHTO T 99

Family of Curves – One Point Method AASHTO T 272

Compaction Standard for Coarse Granular Materials
by Use of the Vibratory Spring-Load CompactorIdaho IT 74

Instead of Idaho IT 74, and when approved, determine the maximum dry density of coarse granular material using the following test method:

Moisture Density Relations of Soils AASHTO T 180 Method D

Determine in-place density and percent compaction by the following test methods:

In-Place Density and Moisture Content of Soil and Soil Aggregate
by Nuclear Methods (Shallow Depth)..... WAQTC FOP for AASHTO T 310 Method B

G. Classes of Compaction and Density Requirements. If the class of compaction is not specified, the Department will require Class A compaction.

Before placement, moisten or dry embankment material to a moisture content ranging from 4 percent under optimum moisture content to 2 percent over optimum moisture content as determined by AASHTO T 99 or AASHTO T 180.

Scarify existing materials below embankments to a depth of 8 inches, moisture condition as specified and compact to Class A compaction.

1. Class A Compaction. Compact to Class A compaction embankment and backfill material placed within an approximately 2H:1V slope. Perform the work as specified in Table 205.03-1.

Table 205.03-1 – Class A Compaction

Material Property	Required Compactive Effort	Classification
More than 10 percent retained on the 3 inch sieve; or more than 30 percent retained on the ¾ inch sieve	As specified in 205.03.E.2	Too granular to test
Less than 10 percent retained on the 3 inch sieve; and less than or equal to 30 percent retained on the ¾ inch sieve	Minimum of 95 percent of maximum dry density by AASHTO T 99 Method C	Testable material

2. Class B Compaction. Compact embankment and backfill material for the top 12 inches of subgrade to the density requirements for Class A compaction. Compact other soil embankment more than 12 inches below the top of subgrade by routing construction equipment uniformly over the entire surface of each layer. The Engineer may require additional compaction if routing of equipment does not provide satisfactory results.
3. Class C Compaction. Compact designated areas under embankments to the density requirements for Class A compaction to a depth of 8 inches. The station limits of Class C compaction will be as specified or as directed. The width of compaction is between the top of subgrade shoulders.
4. Class D Compaction. Compact the embankment and backfill material placed within median areas and on slopes that are outside the roadway prism on an approximate 2H:1V slope with at least 1 coverage using approved track-type or rubber-tired earthmoving equipment. Ensure the fill material is moist before compaction. The roadway prism is shown on the plans. Place the uncompacted embankment material in lifts 12 inches thick or less.
5. Construction of Embankment with Other Materials. Compact materials in embankments constructed with materials other than soil or rock as specified.

H. Blasting. Plan and execute the blasting operations in a safe and professional manner. The Engineer will review the blasting plan submittals solely for compliance with the contract, plans, and specifications. The

Engineer's blasting plan reviews do not relieve the Contractor of responsibility for blasting plan accuracy, adequacy, and safety when implemented in the field.

The Engineer has the authority to prohibit or halt the Contractor's test or production blasting operations if it is apparent, through the methods being employed, the excavated slopes are not being obtained in a stable condition or public safety could be jeopardized.

Perform blasting operations, including the transport, storage, handling, and loading of explosives and blasting agents, including primers and initiators, under the blaster-in-charge's direct supervision and as specified. Comply with all federal, state, and local laws, regulations, and conditional use permits.

1. Blasting Plan Submittals.

- a. General Blasting Plan. Submit a general blasting plan for review at least 14 calendar days before starting test or production drilling and blasting operations or as directed. Submit proposed drilling and blasting pattern details and the controlled and the production blasting controls. Include the following in the general blasting plan:
 - (1) Station Limits. Proposed shot station limits, including blasting limits left and right of centerline, number of holes to be drilled, and holes per blast.
 - (2) Scaled Plan and Section Views. Proposed drill pattern on a scaled plan with section views, including free face, burden, spacing, blasthole diameter, blasthole angles, lift height, and subdrill depth. Base the plan on project stationing or specific area in a materials source.
 - (3) Loading Diagram. Proposed loading diagram showing the type and amount of explosives, primers, and initiators, as well as stemming location and depth, including the stemming material description. Show explosive quantity to be used per delay and per blast.
 - (4) Initiation Sequence. A proposed blasthole-initiation sequence diagram and explanation, including delay times for each blasthole. Identify the delay system type and associated delay periods.
 - (5) Information and Bulletins. Manufacturer's product information sheets or technical bulletins for explosives, primers, delays, and initiators to be used.
 - (6) Angle or Fan-Drilled Holes. Indicate if angle-drilled holes or fan-drilled holes are expected to be used during the initial pioneering operations.
 - (7) Safety Plan. Include the following information:
 - (a) The blaster-in-charge name and telephone number. The Department will require the blaster-in-charge to be responsible for:
 - (i) Directing the day-to-day drilling and blasting operations.
 - (ii) Clearing the blast site before blasting.
 - (iii) Preparing required reports (e.g., daily blast logs, daily explosive material consumption, loss reports).
 - (iv) Checking for misfires and determining the blast site is safe to enter after each blast.
 - (b) Proposed flyrock or blast debris prevention methods. Include an acceptable method to control flyrock before firing in areas where flying rock may result in personal injury or unacceptable damage to property or the work.

- (c) Methods proposed to clear the blast area and to control blasting site access by unauthorized personnel during loading and blasting operations. Establish a method of warning for personnel of an impending blast, consisting of a 5-minute warning signal, to notify anyone in the area that a blast will be fired within a 5-minute period, and a 1-minute warning signal to notify anyone in the area that a blast is imminent. Once the post-blast inspection is completed satisfactorily by the blaster-in-charge, sound an all-clear signal so anyone in the area understands that blasting operations are finished.
 - (c) A notification plan for blasting operations. The Contractor is responsible for notifying the necessary persons (e.g., local residents, construction workers) of an impending blast.
 - (d) Methods proposed to document, assess, and correct misfires or undetonated explosives, including a recovery and disposal plan in the event that misfires cannot be re-fired.
 - (e) Methods proposed and planned to control ground vibration and air overpressure as well as calculated scaled distances to each affected structure.
 - (f) A detailed vibration and blast monitoring plan.
 - (g) A fire prevention and protection plan.
 - (h) A plan to identify potential blast site electrical hazards, including a lightning detection and protection plan.
 - (i) An emergency plan to address injuries. At least 1 blast crew member will be trained in first aid procedures.
 - (j) Include a disposal plan for explosive packing materials.
 - (k) Include a time of day for blasting operations to be conducted. Do not blast before sunrise or after sunset.
- (8) Temporary Traffic Control Plan. Submit a temporary traffic control plan for review and approval whenever blasting is planned within 1,000 feet of a roadway. Cover or remove signs when there are no explosives in the area or the area is otherwise secure. The blaster-in-charge is required to determine whether road users in the blasting zone will be endangered by the blasting operation. If there is danger, do not permit road users to pass through the blasting zone during blasting operations.
- b. Detailed Blasting Plan. After the general blasting plan has been reviewed and deemed complete, submit, for each blast site, a site-specific detailed blasting plan for review. Include the information specified in the general blasting plan supplemented by site-specific information as necessary for successful and safe blasting. Include test blasting procedure details, design, and expected results.

Show the adequacy of the detailed blasting plan by drilling, blasting, and excavating short test sections. Ensure the test blast sections are large enough to properly evaluate the detailed blasting plan's ability to achieve the expected results.

For production blasting, contain test blast areas within production blast areas. The Department will not allow test blast areas within the final excavated slope area for control blasting, except in cases where the Contractor can justify to the Engineer there is not a reasonable alternative due to space availability or other constraints. Perform test sections for variations of the detailed blasting plan and backslopes, unless space is limited and due to necessity, the first shot is the test shot. Include final backslopes excavated with or without controlled blasting. Perform the test section to show the blast will not damage the final slope, the acceptable rock fragmentation is provided, and flyrock, ground vibration,

and air overpressure are properly controlled. Do not start full-scale drilling and blasting operations until the test blasting is completed and approved.

- c. Final Blasting Plan and Supplemental Revisions. After satisfactorily completing the test blast sections, revise the detailed blasting plan to include test blast results and submit as the final blasting plan. Include supplemental revisions as necessary to document when the blasting operation differs from the parameters provided in the general blasting plan, revised detailed blasting plan, or as directed due to poor blasting results, backslope damage, or unsafe conditions.

Do not begin production drilling and blasting until the final blasting plan has been reviewed and deemed complete. If changes occur after the final blasting plan has been deemed complete, submit supplemental revisions for review. Do not resume production drilling and blasting until the supplemental revisions have been reviewed.

2. Blasting Operations.

a. All Blasting Operations.

(1) General.

Follow the final blasting plan and supplementals.

Before each blast, properly dispose of explosive packing materials and remove them from the project site.

Drill production blastholes on the patterns shown in the final blasting plan and within 2 blasthole diameters of the marked hole location. If more than 5 percent of the holes are drilled outside of this tolerance, except as approved, fill these holes with crushed stone or approved material and then re-drill them at the proper locations at no additional cost to the Department. If the re-drilling is due to changes in geology, ground conditions, or other constraints not identified in the contract, these re-drilled holes will not be calculated in the 5 percent tolerance.

Check the blastholes before explosives are loaded. If the blastholes are not drilled to the correct depth, are plugged, or are unable to be fully loaded, clean out or re-drill those holes.

If more than 5 percent of the blastholes are shallower than in the final blast plan, re-drill the shallow holes to the proper depth at no additional cost to the Department.

Prove the proposed stemming material performs as required by a test blast.

Fit blastholes with a temporary plug to keep overburden, drill cuttings, or other foreign material from falling into the holes after drilling. Fill unused drill holes with crushed stone or approved materials.

Where controlled blasting is required to form the final backslope, drilling ahead is not allowed until the test section results have been completely evaluated and, if necessary, the Contractor has made revisions to achieve the required results. Unsatisfactory test blast results include unstable slopes, fragmentation beyond the indicated lines and grade, flyrock, excessive ground vibration, air overpressure, or violation of other requirements. The Department will not pay for revised blasting methods adopted to produce an acceptable test blast.

Other requirements for controlled and production blasting operations specified elsewhere in 205 also apply to the blasting carried out in conjunction with the test blast.

- (2) Flyrock. If flyrock occurs during the blasting operations to the extent of endangering workers, equipment, or is propelled outside the project site, cease blasting operations until the Contractor reviews the final blast plan modifications and determines the cause and solution to the flyrock problem to the Engineer's satisfaction.
- (3) Scaling and Stabilization. Remove or stabilize rock on the post-blast cut face that is loose, hanging, or otherwise creating a potentially dangerous situation as determined by the Engineer. Do not drill the next lift until this work has been completed.

Scale post-blast cut slopes at the Engineer's direction and at such frequency as required to remove loose rocks, overhangs, or hazards. The scaling extent will be determined by the Engineer.

Use rock bolting, rock dowelling, or other approved stabilization techniques when in-place stabilization is required as determined by the Engineer.

- (4) Blasting Logs. Blasting records will be kept for each blast and submitted weekly. Include the time, blast date, blasting locations, patterns, blasthole number and depth, and the following information:

- (a) Blast station limits, including limits left and right of centerline.
- (b) Plan and section views of drill pattern, including free face, burden, blasthole spacing, blasthole diameters, blasthole angles, lift height, and sub drill depth.
- (c) Loading diagram showing type and amount of explosive, primers, initiators, and stemming location and depth.
- (d) Blasthole-initiation sequence, including delay times and delay system in each blasthole.
- (e) Trade names and sizes of explosives, primers, and initiators used.
- (f) Ground vibration and air overpressure (noise) records.
- (g) Blaster-in-charge signature.

The blasting logs are for quality control, record keeping, and future blast plan revisions. The Engineer's blast log review does not relieve the Contractor of the responsibility for the accuracy and adequacy of the blasting log.

- (5) Daily Explosive Material Consumption and Report of Loss Report (e.g., BATF Daily Summary of Magazine Transactions). Include the blaster-in-charge signature on all reports.
- (6) Pre-Blast Survey. Before blasting, the Contractor will provide a third-party, pre-blast survey of the interior and exterior of nearby buildings, utilities, and other structures that may be subject to damage from blast-induced ground vibration or air overpressure effects. Contact the property owner or resident to setup a pre-blast survey inspection appointment. Document the pre-blast survey, in sufficient detail, to allow the Engineer to determine if the Contractor's blasting operation has caused damage. Submit a survey copy to the Engineer and to the structure's owner no less than 7 calendar days before blasting begins. If the property owner or resident does not respond after 3 documented attempts by at least 2 different contact methods (e.g., certified mail, knock on the door) within 14 calendar days of the last attempt, the Contractor will notify the Engineer. The Engineer will determine how to proceed.

- (7) Post-Blast Survey. Within 2 weeks after blasting operations have concluded or as directed, re-examine the items inspected during the pre-blast survey. The same third-party that provided the pre-blast survey will provide the post-blast survey. For each structure, contact the property owner or resident to setup a post-blast inspection appointment. Re-examine each item using the pre-blast survey photos, audio recording, or video to confirm whether or not changes have occurred. Notify the structure's owner if changes have occurred. Obtain a signature or acknowledgement (e.g., email, certified letter return receipt) of the property owner's receipt of the post-blast survey.

Within 30 calendar days after blasting operations have concluded or as directed, submit to the Engineer and the property owner a final written post-blast survey report addressing the items inspected in the pre-blast survey as performed by the third party. Specifically note in the report damage observed or measured in the post-blast survey.

Repair damage to the public or private property caused by the use of explosives as a first order of work. The Department will not pay for damage repairs.

- (8) Vibrations. The Contractor will determine the maximum allowable peak particle velocity (PPV) and airblast to ensure structures and utilities within the blast area are undamaged.
- (9) Explosive Charge Weight. The Contractor will determine the maximum charge weight per 8 millisecond delay in accordance to industry standards and professional experience to ensure the structures and utilities within the blast area are undamaged.
- (10) Blast Monitoring. Monitor blasting operations with seismographs and/or video cameras.

b. Production Blasting.

Production blasting is rock fragmentation blasts resulting from more widely spaced production holes drilled throughout the main excavation area adjacent to the controlled blast line or from the production holes in a rock quarry.

Take necessary precautions in the production blasting to minimize blast damage to the final cut slope.

c. Controlled Blasting.

Controlled blasting refers to the controlled use of explosives and blasting accessories in carefully spaced and aligned drill holes to produce a smooth surface or shear plane in the rock along the specified final excavation backslope. Controlled blasting techniques allowed are presplitting and cushion blasting. Other controlled blasting techniques may be used, if approved.

Use controlled blasting in the excavation of rock or hard cemented materials where cut slopes are equal to or steeper than $\frac{3}{4}H:1V$ even if the rock or hard materials can be ripped, except at the Engineer's discretion based on the Contractor's demonstration the finished slope meets the slope design. Controlled blasting is typically not required for rock quarry operations.

Remove potentially dangerous boulders or other material located beyond the excavation limits before drilling controlled blastholes. Removal of material located beyond the excavation limits is extra work.

- (1) Presplitting. Presplitting is the detonation of a single line of lightly-loaded, closely-spaced drill holes before the detonation of adjacent production holes. Perform presplitting in accordance with the following requirements:
 - (a) Control drilling operations by using proper equipment and techniques to ensure that no hole deviates from the plane of the planned slope by more than 9 inches in

either parallel to or normal direction to the final excavation slope. The Engineer will allow offset benches, up to 2 feet wide, for multi-lift blasts. If shown on the plans, specified, or directed, the offset benches will be removed during excavation of the next lift to a slope of at least 45° below horizontal. The Department will not pay for presplit holes exceeding these tolerances.

- (b) Extend presplit holes at least 30 feet beyond the production hole limits or to the end of the cut as applicable.
- (c) Limit presplit blastholes to 30 feet in length for each lift of blasting. Do not exceed the specified lift height after a test blast is performed.
- (d) Begin the controlled blasthole drilling at a point that will allow for necessary offsets and adjust, at the start of lower lifts, to account for drift that may have occurred in the upper lifts. The Department will ensure the offsets are within the project site.
- (e) Determine if the hole is free of obstructions for its entire depth before placing charges. If drill-hole conditions vary from dry to wet, use appropriate explosives type(s) and/or blasting accessories to accomplish the specified results.
- (f) Do not use bulk ammonium nitrate and fuel oil (ANFO) as explosive for controlled blasting.
- (g) Use only standard explosives specifically manufactured for presplitting in presplit holes.
- (h) As long as satisfactory presplit slopes are obtained, the Contractor may either detonate the presplit blasting holes forming the slope face before drilling for production blasting or detonate the presplit blasting holes forming the slope face and the production blastholes within the same blast event, provided the presplitting drill holes are detonated at least 25 milliseconds ahead of the adjacent production blastholes.

- (2) Cushion Blasting. Cushion or trim blasting is similar to presplitting except the detonation along the cut face is performed after the detonation of the production holes. Where the horizontal distance from the cut face to the existing rock face is less than 15 feet, the Contractor may cushion blast instead of presplitting. With the exception of these criteria, the requirements specified for presplitting also apply to cushion blasting.

205.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Excavation, borrow, and granular borrow will be by the cubic yard in its original position from field survey or photogrammetric cross-sections, using the average-end-area method with no correction for curvature, or by the ton.
2. Where it is impractical to measure material by the average-end-area method or in its original position, alternate practical methods with appropriate adjustments may be used. The total will not include the volume of material used for purposes other than as directed. A measurement will not be made for rock excavation made below the roadbed, unless the excavation is required or directed. A measurement will not be made for borrow replaced by unauthorized rock or soil excavation below roadbed.
3. Channel change excavation will be measured only for excavation necessary to construct the channel or ditch from established bank elevation to flowline grade. Earthwork necessary to construct the cut or fill to bank elevation will be included in the roadway quantities. Overbreak will not be included in the measurement of excavation.

4. Water ordered for dust abatement will be measured by the thousands of gallons (MG), where 1 MG equals 1,000 gallons, by means of calibrated tanks, distributors, or accurate water meters.
5. Controlled blasting will be measured by the foot of drilled hole as shown on the blasting or driller logs. The Department will measure only those holes drilled and detonated for creating a final excavation face as controlled blasting.
6. When granular borrow is measured on the weight basis, the water in excess of 7 percent of the dry weight of the material will not be measured. The Department will correct the measured quantity for moisture content in accordance with AASHTO T 255.
7. Quantities of granular borrow replaced by other approved materials (e.g., RAP) is considered as a portion of granular borrow.
8. Acceptable shoulder grading work will be measured by the mile for each direction of travel.
9. The Engineer will measure acceptable soft spot repair by contingency amount.

205.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Excavation	CY
Excavation Schedule No. _____	CY
Controlled Blasting	Linear ft
Channel Change Excavation	CY
Borrow	CY or Ton
Granular Borrow	CY or Ton
Water for Dust Abatement	MG
Excavation and Repair of Soft Spots	CY
Shoulder Aggregate	CY or Ton
Shoulder Grading	per mile
Soft Spot Repair	CA

Embankment and backfill are incidental and the work included in other contract pay items.

The Department will pay for removal and disposal of unsuitable material from below the roadbed under excavation and repair of soft spots. Excavation and repair of soft spots includes excavation, drying, and compaction of in-place material. If approved, the Department will pay for replacement material under the applicable contract pay item or as extra work. The Department will not pay for replacement material if used for the Contractor's convenience.

The Department will pay for removal of slides, slumps, settlements, and associated work not caused directly by the Contractor's operations at the contract unit price for excavation where the slide occurred or as extra work.

The Department will pay for water the Engineer orders for controlling dust for safety of the traveling public, for the safety of people residing near the project site, to protect crops from possible dust damage, or that is applied in the public interest at the dust abatement contract unit price.

The Department will pay for excavation that must be stockpiled or stored before final placement, including topsoil, at the contract unit price for each handling approved, unless paid for as another item of work for the second handling.

The Department will pay for RAP, if used as granular borrow, at the granular borrow contract unit.

The Department will not pay for rock overbreak.

Production blasting is incidental and included in other roadway contract pay items.

Blasthole locating and depth control is incidental to the blasting work.

The Department will pay for post-blast cut slope stabilization or scaling necessitated by the rock structural geology as extra work.

The Department will not pay for post-blast cut slope stabilization or scaling made necessary because of the Contractor's blasting operations.

The Department will pay for the over-drill limits made necessary for offset benches in multi-lift cuts as described in 205.03.G.2.c.1.a.

Material removal and sweeping of the roadway surface is considered incidental to this item.

Granular subbase, $\frac{3}{4}$ inch aggregate for untreated base, HMA pavement, tack, subgrade separation geotextile, and biaxial geogrid will be paid under their respective pay items. Otherwise, pay by force account if these pay items are not in the contract.

Coarse aggregate for concrete will be paid by force account.

The Department will accept granular subbase, untreated aggregate for base, coarse aggregate for concrete, and HMA including compaction by ITD-850, ITD-854, and/or ITD-855 form(s) as applicable, documented once per soft spot.

SECTION 207 – STRIPPING DESIGNATED SOURCE MATERIAL DEPOSITS

207.01 Description. Strip earth overburden and other unsuitable material from designated source material deposits. Keep topsoil in separate stockpiles from other stripped materials.

207.02 Materials. Not specified.

207.03 Construction Requirements. Clear and grub the portion of the source necessary for the removal of the material and remove earth overburden, vegetation, or other deleterious materials. Dispose of wasted material and debris.

The Department will not pay for stripping of overburden from the Contractor-provided material sources. The Department will not pay for the development of alternate material deposits.

207.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard in its original position or in approved stockpiles, using the average-end-area method.

207.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Stripping Designated Source Material Deposits	CY

If the contract does not include a stripping designated source material deposits contract pay item, this work is incidental and the cost included in other contract pay items when a material source is designated in the contract.

Clearing and grubbing is incidental and included in the contract unit price for stripping designated source material deposits.

SECTION 208 – INTERCEPTOR DITCHES

208.01 Description. Construct interceptor ditches.

208.02 Materials. Not specified.

208.03 Construction Requirements. Construct interceptor ditches as specified or as directed.

208.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot along the centerline and profile of the completed ditch.

208.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Interceptor Ditches	ft

SECTION 209 – SMALL DITCHES

209.01 Description. Construct small ditches, which the Department defines as having an average volume of less than 0.2 cubic yard per foot of ditch.

209.02 Materials. Not specified.

209.03 Construction Requirements. Construct small ditches as specified. If a typical small ditch section is not specified, construct small ditches by sidecasting the excavated material.

Conduct the work in a manner to minimize interruption to irrigation water flows and make suitable arrangements with irrigation users to minimize claims for damage to crops or interruption to farming operations.

Construct dikes first when they are needed to construct ditches across low ground or as directed. Use approved impervious material for the dikes. Place material in horizontal layers and compact each layer to 90 percent of maximum dry density, as specified in 205.03.E.3, and then construct a small ditch in the top of the dike. Direct irrigation water, if available, into dike ditches for testing and approval before acceptance by the Engineer.

209.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot along the centerline and profile of the completed ditch.

The Engineer will measure dikes and cuts constructed to carry small ditches as specified in 205.04.

209.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Small Ditches	ft

SECTION 210 – STRUCTURE EXCAVATION AND COMPACTING BACKFILL

210.01 Description. Excavate and dispose of materials required for the construction of structures, unless otherwise specified as structural excavation. Include necessary drainage, pumping, bailing, sheeting, shoring, and the construction and removal of cribs and cofferdams. Remove old structures or parts as required. Place and compact backfill material as compacting backfill. Include sloping and cleaning up the sites.

The contract pay item structure excavation schedule no. 1 includes excavation for bridges, boxes, and stiffleg culverts. The contract pay item structure excavation schedule no. 2 includes excavation for pipe and/or other structures.

210.02 Materials. The Engineer will test material for backfill in accordance with AASHTO T 310 Method B, excluding materials too granular to test.

210.03 Construction Requirements.

A. General. Remove and dispose of unsuitable foundation material below the designed elevation as directed. Use suitable surplus excavated material in the construction of embankments. Replace material removed below the elevation as specified with approved material.

Sheet and brace trenches if necessary. Do not remove sheeting or bracing until backfill has progressed enough to prevent damage to pipelines or structures.

Remove sheeting and bracing used in supporting structure excavation.

Where rock, hardpan, or other unyielding material is encountered and a yielding material is required, remove the unyielding material below the grade specified and backfill as directed.

Do not begin structure construction until the foundation has been approved.

Place backfill consisting of suitable material in layers of 8 inches or less and compact to Class A compaction as specified in 205.03.F.

For backfill material placed within 3 feet of a concrete structure or retaining wall, uniformly distribute the backfill material in layers of no more than 8 inches and compact with lightweight compacting equipment having an impact force of 1,000 to 3,000 pounds. Compact the backfill to the density requirements for Class A compaction as specified in 205.03.F, before successive layers are placed. For backfill material determined by the Engineer as too granular to test, apply at least 5 compacting equipment passes per 8-inch lift or less.

Compact backfill in areas not within a roadway prism, or special backfill around pipe underdrains not requiring a higher degree of compaction for some other purpose, to approximately the same density as the adjacent undisturbed soil or gravel. Perform compaction by any effective means.

B. Conduit and Structural Plate Arch. Backfill pipe culverts and other conduits, with approved material, first. Carefully hand tamp under the lower $\frac{1}{4}$ of the overall pipe diameter, then compact for the balance of the pipe height and for the specified amount of cover to be placed over the pipe.

C. Structures. Level excavated rock surfaces below the structure footing elevation with Class 15 concrete before constructing bridge and box culvert foundations.

Use appropriate equipment and take precautions to ensure that the foundation soils are not distributed during excavation that may affect their bearing capacity. Remove disturbed material from the excavation and backfill to the plan elevation with approved material at no additional cost to the Department.

Take precaution when pumping water from foundation enclosure interiors to prevent the possibility of concrete materials being carried away. Do not pump during the placing of concrete or for at least 24 hours after, unless it is done from a suitable sump or well point separated from the concrete work.

Place suitable backfill material in layers through water around abutments, wing walls, and piers. Compaction is not required for this placement.

Do not place backfill against newly constructed masonry or concrete structures before meeting the requirements in Table 502.03-5.

210.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard based on planned quantity. The Engineer will measure structure excavation as the volume of material within prism-limiting planes as follows:

1. Conduit and structural plate pipe as specified.
2. Other structures:
 - a. The bottom of the foundation.
 - b. The vertical planes 2 feet outside of and parallel to the outside lines of the structure, in the case of bents with individual column footings, the entire bent are considered as 1 structure.
 - c. With upper limits as follows:
 - (1) In embankment sections, the existing ground surface as cross-sectioned.
 - (2) In roadway cut sections or channel changes, the planes of the roadway cut or channel change as excavated.

The Engineer will measure compacting backfill by the cubic yard of backfill material placed and as follows:

1. Conduit as specified.
2. Other structures:
 - a. Below the original ground surface. A volume equal to the volume of structure excavation less than the volume of the permanent structure, including the opening, contained within the limits of measurement for structure excavation.
 - b. Above the original ground surface. The volume contained between the outside walls of the structure and vertical planes 4 feet outside the original ground surface or the horizontal plane 1 foot above the top of the structure or of the subgrade, whichever is less.
 - c. Volumes of backfill placed through water around abutments, wing walls, and piers will not be included in the measurement of quantities for compacting backfill.

210.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Structure Excavation Schedule No. 1.....	CY
Structure Excavation Schedule No. 2.....	CY
Compacting Backfill.....	CY

When the contract does not include a contract pay item for structure excavation or compacting backfill, this work is incidental and included in other contract pay items.

The Department will pay for required backfill or bedding material whose source is other than structure excavation at the contract unit price for the material being used or as extra work if no unit price was established.

If the Contractor is directed to remove material below the elevation specified, the Department will pay for the excavation work at the contract unit price or as extra work.

The Department will pay for Class 15 concrete used to backfill rock excavation below the bottom of the design footing grade based on the actual quantity used, but not to exceed a prism 1 foot outside the footing neat lines with an average depth of 1 foot below the bottom of footing.

A payment will not be made by the Department to excavate, backfill, and compact material removed for safety purposes.

SECTION 211 – SOURCE RECLAMATION

211.01 Description. Reclaim land used for borrowing material or mining for aggregates in Department-controlled sources.

211.02 Materials. Provide materials as specified in:

Topsoil	213.02
Seed	711.05
Fertilizer	711.07
Mulch	711.10

211.03 Construction Requirements. Do the following where usable material has been removed from the source:

1. Salvage and replace the top 1 foot of topsoil.
2. Grade and contour the slopes and floor to a pleasing, natural appearance.
3. Replace topsoil, seed, fertilize, and mulch.
4. Perform other work required by the reclamation plan and contract.
5. Seed the area as specified in 711.05.

211.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum for each source involved.

211.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Source Reclamation	Lump Sum

When the contract does not include an item for source reclamation, the Department will consider the work incidental and the cost included in other contract pay items.

If the Contractor receives approval to use an alternate source of material, the Department will not pay for source reclamation.

The Department will provide seed to the Contractor at no cost for designated sources only.

SECTION 212 – EROSION AND SEDIMENT CONTROL

212.01 Description. This work consists of constructing, installing, maintaining, and removing when required, best BMPs during the contract to prevent or minimize erosion, sedimentation, and pollution of waters of the U.S. as covered in 107.17, including wetlands. The Contractor will coordinate the construction of temporary BMPs with the construction of permanent BMPs to ensure economical, effective, and continuous erosion and sediment control throughout the work. Control erosion and sediment using berms, dikes, dams, sediment basins, erosion blankets, netting, fiber wattles, compost socks, inlet protection, gravel, mulches, grasses, slope drains, and other approved erosion control devices or methods.

Install erosion control BMPs before sediment control BMPs.

Items not included in the contract, in the approved SWPPP, or in the PPP will be installed and maintained on a contingency basis and as approved.

Provide a qualified WPCM as a construction stormwater manager throughout the work. See 107.17 for WPCM qualification requirements.

212.02 Materials. Provide materials as specified in:

Seeding	621.02
Aggregate for Untreated Base, Treated Base, and Road Mix (9.0% or less passing the #200).....	703.04
Metal Apron	708.21
Pipe	706
Riprap	711.04
Commercial Fertilizer	711.07
Mulch	711.10
Rolled Erosion Control Product (RECP)	711.11
Turf Reinforced Mat (TRM).....	711.12
Fiber Wattle	711.20
Compost Sock	711.21
Inlet Protection.....	711.23
Gabion and Revet Mattress	715
Geotextile	640 and 718

Provide other approved materials that meet commercial grade standards.

212.03 Construction Requirements.

A. General. Submit for approval a plan and schedule as specified in 107.17 for installing temporary and permanent erosion and sediment control measures at the preconstruction conference or before the start of the applicable construction. Incorporate ground disturbing activities, including haul roads, material sources, staging areas, and excess material sites. Do not start work until the plan including the erosion and sediment control schedule and methods of operations have been approved. Refer to the Department's BMP manual and the standard drawings for appropriate selection and installation guidance.

Cease earthwork operations when erosion or sediment control BMPs are determined by the Engineer to be inadequate. Resume only after demonstrating effectiveness of erosion and sediment control BMPs. Provide temporary erosion control measures immediately when seasonal limits prohibit permanent measures.

Do not construct slopes more than 15 feet vertically, regardless of slope angle, before installing perimeter sediment control measures. For projects 5 acres or less or located in an arid, semi-arid areas during the seasonally dry period, initiate installation of stabilization measures immediately in any areas of exposed soil where construction activities have ceased. Complete installation within 14 calendar days after initiated. For projects more than 5 acres initiate installation of stabilization measures immediately in any areas of exposed soil where construction activities have ceased. Complete installation within 7 calendar days after initiated.

Incorporate erosion and sediment control measure to prevent sediment transport from cut or embankment slopes

Control measures may require the removal of sediments during maintenance operations. The Engineer may allow sediments removed to be used (e.g., topsoil). Preserve the function of control measures and prevent water pollution when disposing of sediments.

Install all BMPs in accordance with the manufacturer's written instructions, details, or as directed by the Engineer. Size and place BMPs to adequately handle the runoff water from a 2-year, 24-hour storm event.

B. Temporary Erosion and Sediment Control Measures. Refer to the Department's [BMP Manual](#) for guidance on temporary erosion and sediment control measures.

C. Permanent Control Measures.

1. Seeding, Rolled Erosion Control Products (RECP), Turf Reinforced Mats (TRM), and Mulching. Seed slopes and other ground disturbed areas. It is not necessary for slopes to be completely constructed before seeding a finished portion of the slope. Seed as specified in 621.
2. Install RECPs, TRMs, mulch, and HECPs as specified 621.03.E and 621.03.F.
3. Gabion and Revet Mattress. Provide and construct as specified in 512.
4. Stone Filter Berms/Dams. Use rock in constructing stone filter berm/dam that is graded with a minimum size of 1 inch to a maximum of 8 inches measured along the longest dimension.
5. Sediment Basins. Construct sediment basins as specified or as directed. Stabilize the inlet, outlet, and emergency spillway of the basin as approved.
6. Inlet and Outlet Protection. Protect the ground at the inlet and outlet of pipes and other water discharges.

D. Water Pollution Control Manager. Prepare, maintain, revise, and amend the Stormwater Pollution Prevention Plan (SWPPP). Ensure project compliance with the erosion and sediment control and pollution prevention installation and maintenance requirements, water quality monitoring and discharge reporting requirements. Manage all pollution control measures at the project site, including field controls, inspections, records and CGP requirements specified in 107.17 and the CGP through the life of the contract.

212.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Slope drain and open-top culvert by the foot along the length of plastic liner or pipe.
2. Inlet protection, waterbar, stabilized construction entrance, sediment trap, and sediment basin by the each.
3. Silt fence, fiber wattle, and compost sock by the foot along the ground.
4. Diversion channel, diversion ditch, dike, berm, and siltation berm by the foot along the centerline of constructed item. This measure includes the excavation and embankment required to construct the item, including the materials used to construct outlet and overflow structures.

5. Soil binder by the acre of surface treated.
6. Gabion and revet mattress by the cubic yard based on the nominal size of the units.
7. Stone filter berm and dam by the cubic yard using the average-end-area method.
8. WPCM by the lump sum. The lump sum includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals.

212.05 Basis of Payment. The Department will pay for accepted quantity at contract unit prices as follows:

Pay Item	Pay Unit
Slope Drain	ft
Sediment Trap.....	Each
Silt Fence	ft
Diversion Channel.....	ft
Diversion Ditch.....	ft
Dike.....	ft
Berm	ft
Open-Top Culvert.....	ft
Waterbar	Each
Siltation Berm.....	ft
Stabilized Construction Entrance	Each
Soil Binder.....	Acre
Gabion	CY
Revet Mattress.....	CY
Stone Filter Berm Type____	CY
Stone Filter Dam Type____	CY
Sediment Basin.....	Each
Inlet Protection	Each
Fiber Wattle.....	ft
Compost Sock.....	ft
Water and Pollution.....	CA
Water Pollution Control Manager	LS

The Department will not pay to install or repair temporary erosion and sediment control measures required due to the Contractor's negligence, carelessness, or failure to install permanent measures as part of the work.

Erosion and sediment control measures required for areas outside the project site (e.g., borrow pits, materials sources, haul roads, plant sites, and storage and disposal areas) is incidental to the work.

The Department will pay for seeding, RECPs, TRMs, mulching, HECs, and other seeding items under the appropriate contract pay items in 621.

The following work is incidental and included in other contract pay items:

1. Berm, ditch, pipe apron, rock, and excavation used to direct drainage to a slope drain or to construct a stabilized discharge area.
2. Geotextile, rock, sandbags, and plastic liner used in construction of sediment trap, diversion channel, or diversion ditch.
3. Reinforced wire fence, geotextile, and posts for silt fence.
4. Diversion channels, diversion ditches, swales, berms, and dikes constructed as a standard part of the Contractor's normal operation within the slope limits.
5. Ditches built in conjunction with dikes and berms.
6. Swale and rolling dip.
7. Geotextile and graded aggregate for stabilized construction entrance.
8. Inspection of erosion and sediment control measures.
9. Maintenance of erosion and sediment control measures.
10. Removal of compost sock.

The Department will pay for structure excavation and compacting backfill for gabion and revet mattress under 210.
The Department will pay for geotextile for gabion and revet mattress under 640.

SECTION 213 – TOPSOIL

213.01 Description. Excavate suitable topsoil from stockpiles, sources outside the roadway, or from its natural position within the right of way that will be occupied by the roadway. Place and key in the topsoil on designated constructed cut and fill slopes and other designated areas after grading operations are complete.

213.02 Materials. Obtain topsoil from approved sources from the soil profile A horizon layer that has a friable, loamy character and contains an organic matter amount normal to the region. Obtain topsoil from well-drained arable land that does not contain subsoil (from the soil profile B horizon layer), refuse, roots, heavy or stiff clay, stones larger than 1 inch, coarse sand, sticks, brush, litter, pesticides, contaminated soil, noxious weeds, or other material detrimental to vegetative growth and establishment. Ensure the county weed authority has visually inspected approved sources for presence of noxious weeds before delivery or placement. Test sources if noxious weeds are located within or adjacent to the source site, and obtain approval from the county weed superintendent or authorized personnel from the Department or Idaho State Department of Agriculture that the source is acceptable to use on the project site.

Incorporate vegetative matter into topsoil, except brush, trees, or noxious weeds. Other deleterious material (e.g., plastic, glass, metal, rocks) will not exceed 0.1 percent by weight or volume.

Provide microorganism inoculants that contain a diverse mix of regional specific mycorrhizal species for specific condition, provide macronutrients and micro-nutrients that are tolerant of chemical imbalances in the soil, produce humic compounds and binding compounds, and improve soil structure.

Soil Amendments 711.18

Remove and dispose of vegetation at topsoil sources before taking materials from the source.

Provide topsoil as specified below in Table 213.02-1 and Table 213.02-2.

Table 213.02-1 – Topsoil Gradation

Sieve Size	Percentage by Weight Required to Pass a Square Mesh Sieve
1 in	98 - 100
No. 4	95 - 100
No. 8	80 - 100
No. 200	15 - 80

Table 213.02-2 – Topsoil Chemistry

Property	Minimum	Maximum
pH ^(a)	5.5	7.8
ESP ^(b)	—	10.0
EC ^(c)	—	8.0
Organic Material	0.5	15.0

^(a) pH: Negative logarithm of the hydrogen ion concentration

^(b) ESP: Exchangeable sodium percentage

^(c) EC: Electrical conductivity, milliohms per cm at 77 °F

213.03 Construction Requirements. Remove, treat, and process all areas containing noxious weed seeds and/or plants with herbicide applications or by specific heat treatments and material rotation for composted material. Process composted material (heat and rotation) for at least 90 calendar days to kill all viable weed seed and plant material. Test topsoil to verify the topsoil is free of viable noxious weed seed or plant parts, herbicides, fungicides or other chemical residues harmful to plant or animal life.

Obtain a representative composite topsoil sample 2 months in advance of final placement and seeding applications to determine soil pH, nutrients, and organic materials present. Provide a soil analysis by an North American Proficiency Testing-Performance Assessment Program (NAPT-PAP) accredited laboratory to determine if extra nutrients (fertilizer ingredients) and organic materials (mulch or compost) are needed to amend the soil, and verify the soil does not contain noxious weeds.

The following labs are accredited to perform the required tests:

- Stukenholtz Laboratory; Twin Falls, ID.
- Western Laboratory; Parma, ID.
- Northwest Agriculture Consultants; Kennewick, WA.

Collect 15 random soil samples from a minimum of 3 different locations and thoroughly mix and homogenize the samples into a single composite sample. Sample all changes in soil (e.g., color and texture changes). Submit 1 composite sample to an accredited soil laboratory for soil testing and analysis. Obtain a soil analysis report with original soil pH, fertilizer, and organic material content, as well as recommended soil amendments to be incorporated into the topsoil before beginning subsequent revegetation activities.

Excavate to a depth of at least 6 inches, unless otherwise directed. Place topsoil excavated from the roadway directly on cut and fill slopes without use of stockpiles whenever conditions and work progress permits. Where this procedure is not possible, excavate topsoil and stockpile within the project site.

Stockpile topsoil so natural drainage is not disturbed or causes offsite sediment transport. Surround topsoil stockpile with BMP sediment controls. Treat topsoil stockpiles with temporary soil stabilization measures immediately upon stockpile completion.

For topsoil stockpiles exceeding a height of 4 feet that are undisturbed for longer than 3 months, mix the top 1 foot with the rest of the stockpile to ensure that living organisms are distributed throughout the stockpile at the time of final placement, or add microorganism inoculants after final placement in accordance with the manufacturer's written instructions. Apply microorganism inoculants as dry granular mixes, tablets, or injectable soluble.

Do not place topsoil until the areas to be covered have been properly prepared.

After final slope grading and before topsoil placement, all slopes will be roughened or cross-rippled in a horizontal direction to the slope to assist in anchoring the topsoil. Rip shank spacing will be 36 inches and a maximum 12-inch penetration depth or as directed. Topsoil placement on smooth slopes is not allowed.

Following slope preparation, distribute topsoil to all disturbed areas to be reseeded or revegetated during the specified seeding window. Place topsoil, spread, and key into the underlying material by the use of harrows, rollers, or other suitable equipment or methods.

Incorporate approximately ½ pound of the total seed mix per acre into the topsoil before placement begins. Apply the remaining seed mix over the topsoil after placement.

Ensure the minimum topsoil placement thickness is 6 inches unless otherwise specified.

A. Soil Improvements. Soil improvements consisting of fertilizer and soil amendments (e.g., soil nutrients, organic materials, or combinations) or soil conditioner will be approved by the Department, including the type and quantity for each improvement as determined by a laboratory soil analysis and recommendation.

Add and lightly incorporate soil improvements by spreading on the topsoil surface and raking into or incorporating into the top 1 to 2 inches of the topsoil before subsequent seedbed preparation activities as specified in 621.03.B.

For 2.5H:1V slopes or steeper, or where hydroseeding is specified, soil improvements may be added to the mulch mixture and applied during the hydroseeding application, if approved.

For drill seeding applications, apply soil conditioner before seeding and lightly incorporate into the soil wherever possible.

213.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Topsoil obtained from the roadway and placed directly on designated slopes or placed in stockpiles will be by the cubic yard in its original position.
2. Topsoil obtained from the roadway and construction areas and placed directly upon cut and fill slopes, ditch bottoms, and other designated areas will be measured by the square yard in its final location.
3. Topsoil measured by the square yard will be parallel to the slope.

213.05 Basis of Payment. The Department will pay for accepted quantities at contract unit price as follows:

Pay Item	Pay Unit
Topsoil	CY or SY

The Department will pay for topsoil excavated from the roadway at the excavation contract unit price as specified in 205.

The Department will pay for topsoil in its final position, which includes the cost to stockpile if necessary, and to haul to the project site where it is to be placed and finished on the slope.

The cost to provide and incorporate soil amendments, including fertilizer and/or organic materials is incidental.

SECTION 214 – ROADSIDE CLEANUP

214.01 Description. Remove and dispose of stumps, foundations, debris, and boulders and perform minor leveling and drifting of material between the limits of clearing and right of way only as specified or as directed. The Department will not pay for necessary cleanup resulting from the Contractor's operations.

214.02 Materials. Not specified.

214.03 Construction Requirements. Not specified.

214.04 Method of Measurement. The Engineer will measure acceptably completed work as specified in 109.03.

214.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Roadside Cleanup (Contingency Item)	CA

SECTION 251 – MIGRATORY BIRD TREATY ACT (MBTA) COMPLIANCE

251.01 Description. Manage the avoidance of migratory birds to comply with the Migratory Bird Treaty Act of 1918 (MBTA) and 36-11, Idaho Code.

251.02 Materials. Not specified.

251.03 Construction Requirements. Comply with the MBTA requirements, [36-11, Idaho Code](#), and 107.17.

1. Provide an approved, qualified wildlife biologist.
2. Survey and monitor for migratory bird activity,
3. Develop an avoidance plan, submit 2 sets of the plans for review and approval 30 calendar days in advance of performing any work. Show migratory bird nest location, avoidance plan, and visual markers for nest location in the plan.
4. Implement exclusion devices, bird repellent liquid, nesting prevention measures or remove and dispose of partially constructed and unoccupied nests of migratory or nongame birds on a regular basis to prevent their occupation.

251.04 Method of Measurement. MBTA compliance will be measured as specified in 109.03.C.5 or by invoice as agreed and approved before performing the work.

251.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Migratory Bird Treaty Act Compliance.....	CA

SECTION 300 – BASES

SECTION 301 – GRANULAR SUBBASE

301.01 Description. Provide, place, and construct 1 or more courses of granular subbase on a prepared subgrade.

301.02 Materials. Provide materials as specified in 703. The Engineer will accept granular subbase for quality requirements at the point of delivery.

Use the following standard methods for tests:

Compaction Standard for Coarse Granular Materials
by Use of the Vibratory Spring-load CompactorIdaho IT 74

In-Place Density and Moisture Content of Soil and Soil Aggregate
by Nuclear Methods (Shallow Depth)AASHTO T 310 Method B

Prepare and submit an Idaho IT 74 density curve for the subbase material to be incorporated into the work, before placing granular subbase on the roadway. This testing is incidental and a separate payment will not be made. RAP may be used in granular subbase when approved. Do not exceed a RAP size of 3 inches. The Engineer will visually verify the RAP daily, in place, to confirm the size requirement has been met.

301.03 Construction Requirements.

A. General. Do not exceed a maximum compacted thickness of 0.8 foot for each layer. Construct the subbase in 2 or more layers of approximate equal thickness if the required compacted thickness of the granular subbase layer exceeds 0.8 foot. The compacted thickness of a single layer of the subbase may be increased to 1 foot when vibrating or other approved types of special compacting equipment are used. The minimum compacted thickness of any course is 1.5 times the maximum particle size.

Mix the subbase as specified in 303.03.A.

After each layer has been spread, compact the layer for its full width. Continue compaction until at least 95 percent of the maximum dry density is attained as specified in 301.02.

Determine the in-place density of granular subbase in accordance with AASHTO T 310 Method B.

Maintain the surface of each layer during the compaction operations so a uniform texture is produced and the subbase is firmly keyed. Apply enough water uniformly over the base materials during compaction to ensure proper compaction is achieved.

B. Granular Subbase Material in Stockpile. Provide granular subbase material in stockpiles at designated locations. Stockpile as specified in 303.03.B.

C. Granular Subbase Material, Load, Haul, and Place. Load, haul, and place designated stockpiled granular subbase material on the roadbed.

Spread, process, distribute, shape, and compact the granular material as specified in this subsection. The Department will specify location and cost of the stockpiled subbase material.

D. Recycled Asphalt Pavement (RAP). Mix RAP in approximately equal proportions with material meeting the requirements for granular subbase. Ensure the final mix of materials is of uniform consistency.

Perform in-place density testing for RAP/subbase mixtures at the frequency specified in this subsection using the following procedure:

1. Establish the roller pattern by using in-place density from an uncorrected nuclear gauge. The required compaction is achieved and final process rolling is defined as when the final roller pass adds no more than 0.5 pounds per cubic foot to the previous in-place density.
2. Make sufficient additional roller passes to determine that a “false break” or leveling-off point is not used for compaction density.
3. Reestablish the roller pattern when mixture properties in the processed material change and at least every 7,200 square yards of finished surface for each lift.
4. Perform additional tests where soil conditions have changed or as determined by the Engineer to ensure the required compaction is achieved.

301.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Granular subbase by the ton or cubic yard. Moisture in the material in excess of 7 percent will not be paid for.
2. Granular subbase in stockpile by the ton or cubic yard.
3. Granular subbase load, haul, and place by the ton or cubic yard. Moisture in the material in excess of 7 percent will not be paid for.

RAP, if used in granular subbase, will not reduce the quantity of granular subbase but will be measured as a portion of granular subbase without additional pay.

301.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Granular Subbase	Ton or CY
Granular Subbase in Stockpile	Ton or CY
Granular Subbase Load, Haul, and Place	Ton or CY

SECTION 302 – EMULSION TREATED BASE

302.01 Description. Construct 1 or more courses of emulsion treated base.

302.02 Materials. Provide aggregate as specified in 703. The Engineer will accept aggregate for quality requirements at the point of delivery.

Provide emulsified asphalt of the type and grade as specified in 702. The Engineer will accept the material at the point of delivery.

Use the following standard test methods:

Compaction Standard for Coarse Granular Materials
by Use of the Vibratory Spring-load CompactorIdaho IT 74

In-Place Density and Moisture Content of Soil and Soil Aggregate
by Nuclear Methods (Shallow Depth)AASHTO T 310 Method B

Instead of Idaho IT 74, if approved, the maximum dry density of aggregate base may be tested with:

Moisture Density Relations of Soils..... AASHTO T 180 Method D

Prepare an Idaho IT 74 density curve or an AASHTO T 180 Method D moisture-density curve for the aggregate base and submit before placement. This testing is incidental.

302.03 Construction Requirements. Mix the aggregate, emulsified asphalt, and water in an approved stationary plant.

Mix the emulsified asphalt with water at a ratio of 1:1 and uniformly mix with the aggregate base until approximately 4 percent diluted emulsified asphalt, by weight of dry aggregate, has been added. Additional water may be required to complete the mixing of the aggregate base and to facilitate compaction.

Place the base material on the roadbed by means of an approved aggregate spreader. Do not exceed a maximum compacted thickness of 0.5 foot for each layer. Construct the base in 2 or more layers of approximate equal thickness if the required compacted depth of the base exceeds 0.5 foot. The compacted depth of a single layer of the base may be increased to 0.8 foot when vibrating or other approved types of special compacting equipment are used.

Shaping and spreading may be performed with motor graders or approved methods in areas where it is not practical to operate the spreader.

Compact for its full width after each layer has been spread and continue compaction until 100 percent of the applicable maximum density is attained.

Produce a surface for each layer with uniform texture and aggregate that is firmly keyed. Maintain the surface during the compaction operations.

302.04 Method of Measurement. The Engineer will measure acceptably completed work for emulsion treated base and emulsified asphalt by the ton. The Engineer will not use batch weights as a method of measurement.

The Engineer will use the weight of the emulsion treated base quantity in the accepted base and will include the weight of aggregate and emulsified asphalt.

The Engineer will deduct the weight of water and emulsified asphalt in excess of 7 percent of the weight of dry aggregate from the weight of the emulsion treated base.

302.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Emulsion Treated Base	Ton
Emulsified Asphalt for Emulsion Treated Base	Ton

SECTION 303 – AGGREGATE BASE

303.01 Description. Provide, place, and construct 1 or more courses of aggregate on a prepared surface.

303.02 Materials. Provide aggregate as specified in 703. The Department will accept the aggregate from the windrow or roadway. If purchased and stockpiled, acceptance will be at the crushing plant.

The Contractor may use crushed glass in base. Uniformly blend the crushed glass with the aggregate. Ensure the glass-aggregate blend meets the aggregate gradation specified.

The Contractor may use glass crushed to $\frac{3}{4}$ inch minus up to approximately 15 percent by weight of aggregate base. Place the glass-aggregate base material at least 1 foot below unpaved surfaces.

The Contractor may use glass crushed to $\frac{5}{16}$ inch minus up to approximately 15 percent by weight in aggregate base, with no restriction on location.

Use the following standard methods for tests:

Compaction Standard for Coarse Granular Materials
by Use of the Vibratory Spring-load CompactorIdaho IT 74

In-Place Density and Moisture Content of Soil and Soil Aggregate
by Nuclear Methods (Shallow Depth)AASHTO T 310 Method B

Instead of Idaho IT 74, if approved, the maximum dry density of aggregate base may be determined as follows:

Moisture Density Relations of Soils AASHTO T 180 Method D

Prepare and submit an Idaho IT 74 density curve or an AASHTO T 180 Method D moisture density curve for the aggregate base before placing. This testing is incidental.

303.03 Construction Requirements.

A. General. Do not exceed a maximum compacted thickness of 0.5 foot for each layer. Construct the base in 2 or more layers of approximate equal thickness if the required compacted thickness of the base exceeds 0.5 foot. The compacted thickness of a single layer of the base may be increased to 0.8 foot when vibrating or other types of special compacting equipment are used with approval.

Mix the base by 1 or a combination of the following 4 methods:

1. Stationary Plant Method. Mix the aggregate and water in an approved mixer. Add enough water during the mixing operation to facilitate compaction. After mixing, place the base material with an approved aggregate spreader.
2. Travel Plant Method. After the material for each layer of base has been placed through an aggregate spreader or windrow sizing device, uniformly mix the base by a traveling mixing plant. During the mixing, add enough water to facilitate compaction.
3. Road Mix Method. After material for each layer of base has been placed, mix the material by motor graders or other approved equipment until the mixture is uniform. During the mixing, add enough water to facilitate compaction.
4. Premixed Method. Mix the aggregate and water as approved before placement. Add enough water during the mixing operation to facilitate compaction. After mixing, place the base material with an approved aggregate spreader.

After each layer has been spread, compact the layer for its full width. Continue compaction until at least 95 percent of the maximum dry density is attained. Determine the density of aggregate base in place in accordance with AASHTO T 310 Method B.

Maintain the surface of each layer during the compaction operations so a uniform texture is produced and the aggregate firmly keyed. Apply enough water uniformly over the base materials during compaction to ensure proper compaction is achieved.

B. Aggregate Base Material in Stockpile. Provide aggregate base material in stockpiles at designated locations.

Before stockpiling material, clear and smooth the stockpile site and obtain the Engineer’s approval.

Provide stockpiles that are neat and regular in form and occupy as small an area as possible. Construct stockpiles by first distributing the material to be stockpiled over the entire base and building upward in successive layers not more than 3 foot in depth. Do not end dump or conveyor stack materials over the sides of the stockpile.

C. Aggregate Base Material, Load, Haul, and Place. Load, haul, and place stockpiled aggregate from designated sources on the roadbed.

Spread, process, distribute, shape, and compact as specified in this subsection. The Department will specify the location and cost of the stockpiled aggregate.

303.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Aggregate base will be by the ton or cubic yard.
2. Aggregate base material stockpiled will be by the ton or cubic yard.
3. Aggregate base load, haul, and place by the ton or cubic yard.

The Engineer will deduct the weight of water in excess of 7 percent of the weight of dry aggregate from the weight of the aggregate base.

303.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
___ Aggregate Type ___ for Base	Ton or CY
___ Aggregate Type ___ in Stockpile	Ton or CY
___ Aggregate Type ___ Load, Haul, and Place.....	Ton or CY

A separate payment will not be made for glass used in aggregate base.

SECTION 304 – RECONDITIONING

304.01 Description. Recondition the surface of an existing road, shape the shoulders, and dispose of surplus material.

304.02 Materials. Not specified.

304.03 Construction Requirements. Scarify the roadbed, including the shoulders to the depth and width specified. Pulverize the scarified material so 5 percent or less of this material, exclusive of gravel or stone, is retained on a 2-inch sieve. Moisten and compact the pulverized material to the required density. Blade and water the surface, if directed, and continue blading and watering during the rolling operations. Satisfactorily maintain the surface until the base or surface course has been placed. Apply additional water to prevent checking or raveling, if needed.

Excavation and repair soft spots as specified in 205.03.D.

304.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Reconditioning will be by the station or mile and will include blading of shoulders, scarifying and pulverizing of the existing roadbed, handling of existing asphalt mixtures, compaction of the roadbed, finishing of the surface, and maintenance of the completed surface.
2. Excavation of soft spots and soft spot repair by the cubic yard in its original position using the average-end-area method and will include excavation, drying, replacement, and compaction of the in-place soil or with Contractor's optional replacement material if approved by the Engineer.
3. Water by the thousands of gallons (MG), where 1 MG equals 1,000 gallons, transported or conveyed by means of calibrated tanks or distributors or by means of accurate water meters. Only the water used in mixing materials or ordered to keep the surface moist will be measured for payment.

304.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Reconditioning	Station or Mile
Water for Reconditioning.....	MG
Excavation of Soft Spots	CY
Soft Spot Repair.....	CY

The Department will pay for removal and disposal of unsuitable material under excavation of soft spots. The Department will pay for backfill material used to replace unsuitable material under its respective item or as extra work. The Department will not pay for the Contractor's optional replacement material.

SECTION 307 – OPEN-GRADED BASE

307.01 Description. Construct 1 or more courses of open-graded base on a prepared surface.

307.02 Materials. Provide material for open-graded base as specified in 703.

307.03 Construction Requirements. Place the first layer of open-graded base directly over Type II subgrade separation geotextile in a lift of at least 12 inches thick but less than 18 inches thick. The minimum lift thickness is 6 inches and the maximum lift thickness is 12 inches above the initial lift. Compact the first layer with at least 6 full coverages and compact subsequent layers with at least 2 full coverages for each 6-inch lift thickness with a vibratory roller meeting the following requirements:

1. A rated minimum centrifugal force of 30,000 pounds per impact.
2. At least 1,000 vibrations per minute.
3. Operate at a speed less than 130 feet per minute.

Do not allow equipment on the geotextile before placing the first lift of open-graded base. Do not dump the open-graded base directly on the geotextile. Dump the material on the previously placed lift and push ahead.

Switch off the vibrators if there is evidence of the vibrating rollers causing excess movement, depressions, or voids other than what is considered normal compaction displacement until otherwise directed. During the compaction process, keep the open-graded base visibly moist.

Keep soil, mud, or other undesirable fine material from accumulating on its surface once the open-graded base is in place. If contamination does occur during the construction operation, replace material as directed at no cost to the Department.

Place and compact open-graded base Class III as specified in 303.

307.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard, neat line measurement of the roadway section, or the ton.

307.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Open-graded base Class ____	CY or Ton

The Department will pay for geotextile under 640.

SECTION 308 – CEMENT RECYCLED ASPHALT BASE STABILIZATION (CRABS)

308.01 Description. Recycle the existing roadway pavement and a portion of the base layer to the lines, grades, and thicknesses of the typical sections. Accomplish the CRABS work in 4 steps:

1. Prepare roadbed.
2. Pulverizing the existing pavement.
3. CRABS (adding cement and mixing).
4. Shaping and compacting.

Follow the specified grade control class.

1. Class I CRABS: use field-established elevations.
2. Class II CRABS: use prescribed elevations.

308.02 Materials. Use materials conforming to the following requirements:

1. Portland Cement. Use cement as specified in 701.
2. Water. Use water that is reasonably clear and free from oil and other contaminants.
3. Testing. Perform quality control density testing using an uncorrected nuclear gauge in accordance with FOP for AASHTO T 310 Method A. Conduct a minimum of 1 compaction test for every 7,200 square yards of CRABS work.

308.03 Construction Requirements. Before mobilization, submit a plan of operations for CRABS processing, including traffic control.

A. General.

1. Weather Limitations. Construct the CRABS while the existing pavement temperature is above and is expected to remain above 40 °F for 24 hours after final completion.

Do not spread portland cement over puddled water, during rain, when rain is imminent, or when wind will not allow uniform spread on the roadway.
2. Operational Restriction. Add cement and process no more of the roadway than can be repaved in 2 days of paving production.
3. Traffic Control. Unless the approved traffic control plan requires traffic to be detoured to an alternate roadway, open the roadway to traffic at the end of each working day by either re-laying the unprocessed pulverized material and compacting firmly or adding cement and processing for a finished product.
4. Grade Control Requirements.
 - a. On Class I work, establish the final CRABS surface elevation in the field. Finish the CRABS surface to within 0.03 foot of the field-established elevation and provide the field-established or specified cross slope at 12 feet from centerline and at the edge of the CRABS surface.
 - b. On Class II work, obtain a grade book from the Department establishing grade elevations for the top of the CRABS layer. Finish the CRABS surface to within 0.03 foot plus of the elevations provided.

Do not waste material before approval of the final elevation for either class.

B. Initial Pulverization.

1. Preparation of Roadbed. Before pulverization, strip and waste any vegetation encountered inside the typical CRABS section.
2. Pulverize Existing Surface. Pulverize the pavement to the widths and depths as specified and at a minimum, to the full depth of the existing pavement. Reduce the material to a minus 3-inch size.
 - a. Document the existing pavement thickness every 0.1 mile in each lane. Submit this documentation to the Department. Ensure that the full thickness of the pavement is being pulverized.
 - b. Notify the Engineer of any poor quality subbase materials (e.g., soft spots, clays, silts, organic materials) as they are encountered.
 - c. Shape and compact the pulverized material before the CRABS mixing process.

3. CRABS Process.

- a. Proportioning. Furnish portland cement in bulk. Add the cement to the pulverized material using a mechanical spreader at the specified rate within 5 percent for the full width of the typical section. Synchronize the application rate with the machine speed to provide uniform application. Spread the cement in a dry state and do not allow blowing of the cement.

After spreading the portland cement, mix the cement with the pulverized material to obtain the required depth and width. Distribute only as much portland cement as can be mixed and compacted within the same working day.

- b. Mixing. Use a road mixing machine (pugmill, auger, or cross-shaft mixer) capable of providing a uniform homogeneous mixture. Introduce the water through the mixing machine using a metering device. Add the correct quantity of water to produce a mixture between 4 and 7 percent by weight of mixed and compacted material. Do not allow water leakage from equipment. Do not add excessive water. Mix the existing pulverized pavement, base, and cement to the full depth as specified. Shape and roll where necessary to allow the roadway to be open to traffic (i.e., approaches to businesses and residencies).

More than 1 pass of the mixer may be required. Introduce water with the final mixing pass.

Ensure and document the mixing thickness every 0.3 mile in each lane.

In superelevated curve sections, shape the material before the application of portland cement.

4. Shaping and Grade Control. Provide continuous grade and cross-slope control including surveying (blue topping or wire line control) depending on CRABS Class.

It is expected that the pulverized material will swell 15 to 30 percent before compaction. Use the centerline of the existing roadway as the typical section control line. Construct the cross slope as shown. Adjustments may be required to the existing roadway profile to provide a consistent grade and to avoid adding new material or wasting existing material. If necessary, reestablish the roadway profile and cross slopes to provide a roadway section which is consistent with the typical section. Obtain approval for transverse grades. For CRABS Class II work, the grades in the Department-provided gradebook may be adjusted to avoid adding new material or wasting existing material upon approval.

Use equipment for shaping and setting grade capable of automated (mechanical or electronic) setting of grade and cross slope angle. Account for swell in the grading operation which may leave the processed surface above the adjacent surface. Incorporate all pulverized material into the CRABS layer. Shape and finish the CRABS surface without adding new material or wasting existing material. Do not waste or use pulverized material as shoulder material.

Grade designated shoulder material to a location and elevation on the shoulder that is below the top of the CRABS layer. Do not use cement-treated material for shoulder material.

Place windrow material designated for removal adjacent to, but outside the limits of pulverization. Dispose of material following final shaping and before application of cement.

5. Compacting and Finishing. Use a motor grader, mechanical spreader, paver, or grade trimmer to shape the mixture.

For the compaction train, include at least 1 rubber-tired roller, 1 vibratory roller, and 1 vibratory pad-foot soil compactor. Use compaction equipment and/or rolling methods to produce the required compaction without damaging the work..

The vibratory soil compactor will have a minimum centrifugal force of 15 tons, minimum drum width of 60 inches, and minimum pad height of 3½ inches. Use the vibratory pad-foot soil compactor after the cement has been mixed. Cover the material with a minimum of 3 complete passes. Additional passes may be required to achieve compaction.

Perform all other final process rolling and blading after completion of the vibratory pad foot operation.

Establish a roller pattern using in-place density from an uncorrected nuclear gauge. Use the roller pattern as a standard from which to measure compaction. Compaction is achieved when additional roller passes add no more than 0.5 pound per cubic feet to the previous in-place density. Ensure a “false break” or leveling-off point is not used for compaction density. Reestablish a new roller pattern when mixture properties change and at a minimum of every 7,200 square yards of finished surface.

Perform grading and rolling without wasting material.

Accomplish all shaping, final process rolling and associated blading within 1½ hours of the initial blending of the cement and water. Do not use vibratory rollers on the CRABS surface beyond the 1½ hours after the addition of water and cement.

6. Protection. Keep the processed and compacted material visibly moist at all times until the initial lift of plant mix is applied. Use equipment that will apply the water in a fog or mist type application free of pressure on the surface being treated.
7. Paving. Pave over the CRABS as soon as possible following compaction and within 48 hours after the introduction of cement and water to the CRABS.

When the approved traffic control plan requires traffic to be detoured to an alternate roadway, the 48-hour paving requirement may be waived provided the CRABS surface is kept sufficiently moist.

Tight-blading and static rolling may be required before applying the initial lift of plant mix due to surface deformation, raveling, or other irregularities created by traffic. Ensure there is no loose material on the CRABS surface at the time of plant mix paving. After paving, dress the roadway shoulders to provide a uniform appearance.

8. Prime Coat. Immediately before placement of the initial lift of plant mix pavement, apply a prime coat full width at the rate specified or as directed. Do not apply a prime coat to the CRABS if standing water is on the surface. Apply the prime coat as specified in 402.

308.04 Method of Measurement. Pulverized existing surface and CRABS will be measured by the square yard.

Portland cement will be measured by the ton using certified weights indicating the truck and trailer number, tare weight, gross weight, net weight, and date. When the measurement of Portland cement is based on certified weight certificates, the following will apply:

1. An occasional loaded transporting vehicle will be weighed on a local certified scale and a copy of the weight certificate will be submitted before the discharge of material. The Engineer will determine when loaded transporting vehicles will be weighed.
2. Each empty transporting vehicle will be weighed before the vehicle leaves the project site.

For discrepancies between the weight certificates and weights obtained at the project site, the Engineer will be the sole judge in determining the quantity of portland cement used.

308.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Cement Recycled Asphalt Base Stabilization Class _____	SY
Portland Cement	Ton
Pulverize Existing Surface	SY

The following work is incidental and the cost included in the CRABS contract pay items including:

1. Stripping and disposing of unsuitable materials.
2. Grade control work.
3. Additional required pulverization and mixing passes.
4. Brooming.
5. Grading, rolling, and shaping.
6. Mixing water and water required to keep the CRABS surface moist for shoulder dressing.
7. Blade the shoulders to be smooth and at a uniform slope leaving no clumps or debris.

SECTION 400 – SURFACE COURSES AND PAVEMENT

Protect private property, bridges, sign posts, guardrail, and other roadway structures from being discolored by asphalt. If structures become discolored by asphalt, remove the discoloration. Repair or repaint surfaces, if required. Apply asphalt at the temperature recommended by the supplier.

SECTION 401 – TACK COAT

401.01 Description. Prepare and treat an existing surface with asphalt.

401.02 Materials. Provide asphalt of the type and grade specified. Provide asphalt as specified in 702. The Engineer will accept the asphalt at point of delivery.

401.03 Construction Requirements. Provide distributor equipment as specified in 406.03.

Patch and clean the existing surface and ensure it is without irregularities to provide a reasonably smooth and uniform surface to receive the treatment. Remove and replace unstable corrugated areas with suitable patching materials. Clean the edges of existing pavement that are to be adjacent to new pavement to permit adhesion.

Broom before applying tack coat. Provide brooms that are in good condition and capable of sweeping a path at least 70 inches wide without loosening or displacing embedded materials. Sweep the surface as directed.

Accompany each broom by a shadow vehicle if working on highways open to traffic. Equip the shadow vehicle with at least 1 roof-mounted high intensity rotating or strobe-type amber flasher that is readily visible from front and rear for 0.5 mile.

Lightly spray the surface of the roadway to be swept with enough water to prevent brooming operations from creating dust to the extent that it would violate air pollution regulations or create a safety hazard.

Do not broom from the surface onto maintained shoulder-foreslope areas where the adjacent property owner cares for the area and maintains turf or landscape.

Apply asphalt tack so the application is uniform, the limits of placement are appropriate, there is the least amount of inconvenience to traffic, and traffic will not cause pickup or tracking.

Mix approximately equal volumes of emulsified asphalt and water before application.

Do not apply asphalt if surface or weather conditions can prevent proper construction.

401.04 Method of Measurement. The Engineer will measure acceptably completed work for the tack coat as diluted emulsified asphalt by the gallon with no correction for temperature.

401.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
_____ Diluted Emulsified Asphalt for Tack Coat	gal

The Department will not pay for reapplication of the asphalt tack required due to time lag between the initial application and the paving operation.

Brooming and patching is incidental and included in other contract pay items.

SECTION 402 – PRIME COAT

402.01 Description. Prepare and treat an existing surface with asphalt and blotter as specified.

402.02 Materials. Provide asphalt of the type and grade specified in 702. The Engineer will accept the asphalt at the point of delivery.

Provide blotter as specified in 703. The Engineer will accept material at the point of delivery from the Contractor-provided sources or from designated sources.

402.03 Construction Requirements. Do not apply asphalt if surface or weather conditions can prevent proper construction.

Provide distributor equipment as specified in 406.03.

Shape the surface to be primed to the required grade and section. Ensure it is uniformly compact and without ruts, corrugations, segregated material, or other irregularities.

Obtain approval of quantities, rates of application, temperatures, and areas to be treated before prime coat application.

Apply asphalt to the width of the section to be primed with a pressure distributor in a uniform, continuous spread. Do not exceed the specified asphalt application rate at the spread overlap junction.

Correct skipped areas or deficiencies.

Provide for 1-way traffic on the untreated portion of the surface when traffic is maintained. Transfer traffic to the treated portion as soon as the asphalt has been absorbed by the surface and will not pick up, and then prime the remaining width of the section.

If a roadway must be used by traffic but the asphalt does not penetrate after application of the prime coat, spread blotter with a self-propelled aggregate spreader supported by at least 4 wheels equipped with pneumatic tires on 2 axles, as approved. Equip the aggregate spreader with positive controls so the required amount of material will be deposited uniformly over the full width required to absorb the excess asphalt.

402.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Asphalt will be by the ton.
2. Blotter will be by the ton or cubic yard.

402.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
____ Emulsified Asphalt for Prime Coat.....	Ton
Blotter.....	Ton or CY

SECTION 403 – CHIP SEAL COAT WARRANTY

403.01 Description. Construct a chip seal at a minimum of 1 layer of asphalt followed by 1 layer of aggregate. Warrant the workmanship and materials against contractor-obligated defects (COD) for the warranty period as specified in this section. Noncontractor-obligated defects (NCOD) will not count against the warranted work. Applying a fog seal over the chip sealed area is at the discretion of the Contractor unless otherwise specified. A chip seal area determined to be a catastrophic failure will be repaired and the warranty will be extended for an additional year.

The chip seal work will be evaluated using the current version of the Department’s Chip Seal Coat Warranty Guide.

403.02 Materials. Provide materials in accordance with the following:

1. Asphaltic binder. Meet the requirements of 702.03. Type, grade, and other binder characteristics (e.g., viscosity, chemical composition) of the binder is the Contractor’s option.
2. Use the specified class of aggregate, meet quality requirements in 703.01, and gradation in [Table 703.06-2](#).

Submit the following quality control tests:

Table 403.02-2 – Contractor-Provided Tests

Test	Test Method	Frequency	Point of Sampling	Specifications
Gradation	AASHTO T 27	1 test minimum per 400 tons	From crusher	Cover Coat Aggregate See Table 703.02-2
Fracture Count	AASHTO T 335	1 test minimum per 400 tons	From crusher	70% with at least one fractured face
Cleanness Value	Idaho IT 72	1 test minimum per 400 tons	At point of loading the roadway	—

3. Submit documentation of the materials (e.g., type and grade of binder) used, control tests charts, and other pertinent data.

403.03 Construction Requirements. The Contractor is responsible for determining the best method and means to construct the chip seal. Public and private property damage claim(s) will be forwarded to the Contractor for consideration.

A. Existing Roadway Conditions. Before chip sealing, the existing roadway conditions that may result in NCODs will be identified and documented in writing by the Contractor and submitted for approval. Pictures of potential NCOD areas are suggested. If approved, these preexisting conditions will be excluded and not considered CODs. In the event of a disagreement between the Engineer and the Contractor on what is expected to be a NCOD, the Contractor will put in writing the disagreement including their reasoning and any supporting documentation (e.g., pictures).

B. Preparation for and Application of Chip Seal.

1. Cover and protect existing manholes, valve casings, road weather information systems (RWIS) sensors, weigh-in-motion site sensors, expansion joints, drains, street monuments, and other items as directed before chip sealing. Retain and protect cattle guards and weigh-in-motion concrete pads. If protection of these items is not possible, inform the Engineer before chip sealing and request direction. Remove protection after chip seal is complete.
2. Clean the pavement surface before chip sealing.

3. Do not chip seal bridge decks or approach slabs. After chip seal completion, remove and dispose of asphalt, aggregate, and other material which may have spilled into deck drains and expansion joints.
4. For beginning and ending joints, mask the roadway with effective material (e.g., building paper) to create a fine and definite transverse line.
5. Meet-lines must be within 1 foot of lane lines or within 1 foot of center of lanes. Meet-lines are not allowed within a wheel path. Ensure transverse and longitudinal joints are smooth and match the adjacent surfaces.
6. Do not apply chips during the 48-hour period immediately preceding a holiday or a holiday weekend. Brooming and pilot car operations are permitted within this 48-hour period.
7. When not spreading, park the distributor to ensure the spray bar or mechanism will not drip on the surface.

C. Brooming.

1. Broom to clear the roadway of loose chips. The Department requires the Contractor to broom at least 2 complete coverages, with the second brooming approximately 24 hours after the first brooming. Additional brooming may be necessary to receive limited chip seal acceptance of the work.
2. Use a mechanical rotary type broom. Use a mechanical pickup or vacuum broom for the following conditions:
 - a. In curb/gutter sections.
 - b. In all guardrail areas.
 - c. On bridge decks.
 - d. Within 100 feet of bridges that span water channels (wet or dry).
 - e. Within 100 feet of adjacent wetlands and surface waters that reside within the right of way.
 - f. Maintained shoulder-foreslope areas where the adjacent property owner cares for and maintains turf or landscaping.
3. Provide dust control using water or other approved means during brooming.
4. Pick up and properly dispose of excess materials.
5. Broom loose chips from roadway surfaces adjacent to and at the end of chip sealed areas, at the end of each day's operation.
6. After the second brooming meets the Department's satisfaction, the Department will accept the brooming in writing before opening the road to full speed traffic, unless otherwise directed.

D. Limited Acceptance, Warranty Period, and Warranty.

After brooming has been accepted, CODs in the work will be documented. The CODs that do not exceed the COD threshold may be left to monitor or be repaired. The CODs in excess of the COD threshold will be repaired before limited chip seal coat warranty acceptance is granted. The Department will acknowledge in writing limited chip seal coat warranty acceptance along with any noted CODs or NCODs. In the event of a disagreement between the Department and the Contractor on what is expected to be a NCOD, the Contractor will put in writing the disagreement including their reasoning and any supporting documentation (e.g., measurements, pictures).

The warranty period begins upon receipt of the written limited chip seal coat warranty acceptance and continues until April 1 of the following year. If CODs are documented before warranty repair work and the CODs continue to spread or magnify after April 1, all CODs must be repaired.

It is the Department's and the Contractor's responsibility to monitor, document, and communicate the emergence of NCODs or CODs throughout the warranty period. The Department and the Contractor will evaluate and photo document the roadway before snow plow season. If NCODs or CODs are discovered during the warranty period, the Engineer and the Contractor will notify the other party in writing of their discoveries.

The Department will use its resources to handle insignificant warranty repair work (e.g., applying blotter after the limited chip seal coat warranty acceptance) at the request of the Contractor and the availability of the Department's resources. Costs incurred by the Department for roadway maintenance of the chip seal directly associated to any CODs will be deducted from subsequent progress estimates.

During the warranty period, if the Department or the Contractor determine chip loss is beyond reasonable and resulting in windshield damage or other safety concerns to traveling motorists, the Contractor will re-broom as needed, coordinate with the Department to re-broom, or submit a repair solution for approval that resolves the safety concerns as soon as practical.

E. COD Threshold Determination. The Contractor warrants that the chip seal (travel lanes, shoulders, turning lanes, and other areas as specified) will have a total COD area within the allowable limits for the warranty period.

In April following the Engineer's limited chip seal coat warranty acceptance or sooner if conditions warrant, the Contractor will arrange a meeting with the Engineer, if necessary, to conduct an onsite evaluation to review and document NCODs and CODs. The Engineer will provide in writing the final decisions on what repairs are required in accordance with the Department's current version of the Chip Seal Coat Warranty Guide and 105.03.

Warranty repair work will be required if the total COD area exceeds the specified threshold of 1.5 percent or more than 1 of the following guidelines is met:

1. If separate COD areas total approximately 50 square yards in a 0.1 mile section and there are other CODs under consideration.
2. If an individual COD area is greater than 100 square yards in total area and there are other CODs under consideration.
3. If there are regularly occurring individual CODs and there are other CODs under consideration.
4. If a COD is linear in nature, regardless of width (approximately 300 feet or more) and there are other CODs under consideration.

If the Department determines the required repair work will not benefit the traveling public, and if agreed by both parties, financial reparation will be considered in lieu of repair work at a cost of 2 times the bid amount price per square yard.

F. Warranty Repair. If it is determined that the CODs threshold is exceeded, submit a repair plan and repair schedule for approval before starting repairs. Complete repairs by August 31. If repairs cannot be made by August 31 due to events outside the control of both parties as specified in 107.11, both parties will agree to an acceptable repair by date.

Perform warranty repair work as approved in the Contractor's repair plan at no additional cost to the Department. The repair may be localized or be full reconstruction depending on the CODs identified. Utilize the same source for any localized warranty repair work as the original source. If this is not possible, the Engineer will consider other sources that have similarly colored aggregate. Warranty work includes replacing all pavement markings and any other permanent features that are damaged or obliterated due to the chip seal failure or repair process at no additional cost to the Department.

The Engineer will terminate the chip seal coat warranty when the chip seal is accepted or the required warranty repair work has been completed. The chip seal coat warranty does not apply to the warranty repair work.

G. Pavement Markings. Pavement markings will be applied in accordance with Department standards and the MUTCD.

H. Catastrophic Failure and Repair. A catastrophic chip seal failure is defined as a total COD area that equal or exceeds the specified threshold of 40 percent. If a limited acceptance chip seal coat warranty was already issued before the catastrophic failure occurred, the limited acceptance will be immediately revoked. Upon completion of the repairs, a new limited chip seal coat warranty acceptance will be made and only the catastrophic areas repaired will have an extended warranty period.

The repair plan of a catastrophic chip seal coat failure will be approved by the Engineer and may include removing the remaining chips before re-chip sealing the roadway (e.g., if there is little confidence the remaining chips will stay imbedded in the roadway) and applying a fog coat. As needed, brooming will be required until the repair is completed.

If the Department determines the required repair work will not benefit the traveling public, and if agreed by both parties, financial reparation will be considered in lieu of repair work and the extended warranty at a cost of 2 times the bid amount price per square yard.

403.04 Method of Measurement. The Engineer will utilize plan quantity of acceptably completed work by the square yard.

403.05 Basis of Payment. The Department will pay for accepted quantity at contract unit prices as follows:

Pay Item	Pay Unit
Chip Seal Coat Warranty	SY

The warranty repair work, including the necessary traffic control and striping, will be at no additional cost to the Department.

Work associated with chip sealing is incidental, including:

1. Cleaning the pavement surface.
2. Protecting existing manholes, valve casings, street monuments, and RWIS sensors. Remove and dispose materials used for protection after chip sealing is completed.
3. Restoring items that were not properly protected
4. Providing and applying materials, including asphalt, cover coat aggregates, and blotter, if necessary.
5. Water applications.
6. Brooming.
7. Maintaining the roadway surface until receipt of written limited acceptance.
8. Removing and disposing excess material.
9. All other work necessary to chip sealing.

The Contractor will supply the Department a warranty or performance bond equal to the total contract value. The Contractor is eligible to receive 100 percent of payment for work completed after limited acceptance has been issued. Maintain the entire value of the warranty or performance bond for the life of the contract. Submit proof of bond using a Department-provided form or other acceptable form before beginning work.

SECTION 404 – SURFACE TREATMENT

404.01 Description. Construct a single or multiple course surface treatment that may consist of the application of 1 or more chip seal coats or may consist of a prime coat followed by 1 or more chip seal coats as follows:

1. Type A: Apply a chip seal coats.
2. Type B: Apply a prime coat followed by the application of a chip seal coat.
3. Type C: Apply 2 chip seal coats.
4. Type D: Apply a prime coat followed by the application of 2 chip seal coats.

A fog coat may be constructed on any of the types of surface treatments, as specified.

404.02 Materials. Provide materials as specified in:

Asphalt.....	702.01
Emulsified Asphalt	702.03
Anti-Stripping Additive	702.04
Aggregate for Cover Coat Material	703.06
Aggregate for Blotter and Aggregate for Choke Sand	703.07

Provide asphalt of the type and grade specified. Provide asphalt and anti-stripping additive, if required, as specified in 702. The Engineer will accept the asphalt at the point of delivery.

The emulsified asphalt is subject to viscosity and sieve testing by the Department, in the field or at a location other than the project site. Schedule the delivery time to allow testing before usage. Expect delays up to 1 hour for this testing.

Provide cover coat material, blotter, and choke sand as specified in 703. The Engineer will accept the cover coat material, blotter, and choke sand at the point of loading for delivery to the roadway.

Submit a chip seal coat design for each stockpile using the McLeod method at least 2 weeks before construction. Field-verify the chip seal coat design for spread rate of asphalt and aggregate.

404.03 Construction Requirements.

A. Chip Seal Coat. Do not apply asphalt if the roadway surface or weather conditions can prevent satisfactory construction.

Do not start chip sealing unless the pavement surface temperatures are 80 °F and rising, and do not chip seal when pavement surface temperature exceeds 140 °F, unless authorized in writing by the Engineer. If bleeding becomes apparent on the completed chip seal, initiate immediate maintenance and traffic control, and do not continue chip sealing until corrective action has been initiated.

Do not apply chip seals when the wind velocity exceeds 15 mph without written approval from the Engineer.

Do not apply chip seals before June 15 or after September 1.

The following equipment or its equivalent is required by the Department:

1. Asphalt application equipment for applying asphalt. An asphalt distributor and equipment for heating the asphalt. Ensure the distributor is designed, equipped, maintained, and operated so asphalt can be applied uniformly on variable widths of surface at readily determined and controlled rates with uniform pressure. Provide distributor equipment that includes a tachometer, pressure gauges, accurate volume measuring

devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Equip distributors with a power unit for the pump and full-circulation, vertically adjustable spray bars.

2. Brooms. Use a mechanical rotary type broom. Use a mechanical pickup or vacuum broom for the following conditions:
 - a. In curb/gutter sections.
 - b. In all guardrail areas.
 - c. On bridge decks.
 - d. Within 100 feet of bridges that span water channels (wet or dry).
 - e. Within 100 feet of adjacent wetlands and surface waters that reside within the right of way.
 - f. Maintained shoulder-foreslope areas where the adjacent property owner cares for and maintains turf or landscaping.
3. Pneumatic-tire Rollers. Do not operate the rollers at a speed in excess of 8 mph. Include enough pneumatic-tired rollers to cover a full spread width with 1 pass. Use compaction equipment and/or rolling methods to produce the required compaction without damaging the work.
4. Self-propelled aggregate spreader supported by at least 4 wheels equipped with pneumatic tires on 2 axles, of Engineer approved design. Equip the aggregate spreader with positive controls so that the required amount of material will be deposited uniformly over the full width required.

Seal approaches before sealing the adjacent roadway.

Do not chip seal bridge decks and approach slabs. Protect drains and bridge expansion joints from the chip seal application, then remove and properly dispose of material used for this protection after completion of the chip seal. After chip seal completion, remove asphalt and aggregate that may have spilled into drains and deck expansion joint.

Do not spread asphalt until the surface has been cleaned as required and the section has been approved. Apply asphalt with a pressure distributor in a uniform, continuous spread over the section to be treated and within the temperature range specified. Design and field-verify the quantity of asphalt to be used per square yard. A preliminary asphalt application of from 0.05 to 0.10 gallon per square yard of surface may be required by the Engineer if the texture of the surface allows asphalt to penetrate too rapidly.

Use a strip of building paper at least 3 feet wide and as long as the spray bar of the distributor plus 1 foot at the beginning of each spread. Paper may be required at the end of each spread if the cutoff is not clean. Remove and dispose of the paper in a satisfactory manner. Ensure the distributor is moving forward at the proper application speed when the spray bar is opened. Correct skipped areas or deficiencies. Carefully mark junctions of spreads to ensure a smooth riding surface.

Do not expose asphalt for more than 1 minute before applying cover coat material. Limit the asphalt spread to the area that the trucks loaded with cover coat material can immediately cover.

The Department will allow meet-lines within 1 foot of lane lines or within 1 foot of center of lanes only. Meet lines are not allowed within a wheel path. Ensure transverse longitudinal joints are smooth and match the adjacent surfaces.

Do not spread asphalt more than 6 inches wider than the width covered by the cover coat material from the spreading device. Do not allow the asphalt to chill, set up, dry, or otherwise impair retention of the cover coat material.

When not spreading, park the distributor so that the spray bar or mechanism will not drip on the roadway surface when not spreading.

Spread cover coat material at the designed and field-verified rate immediately following the application of asphalt. Do not allow the tires of the trucks or aggregate spreader to contact the uncovered asphalt. Do not allow pilot car traffic control operations to cross the fresh asphalt meet-line onto newly applied cover coat material.

Moisten aggregate stockpiles with water 12 to 24 hours before placement to eliminate or reduce the dust coating of the aggregate.

Cover deficient areas with additional approved material immediately after the cover coat material is spread. Begin rolling immediately behind the spreading operation and continue until 3 complete coverages are obtained. Complete rolling within 5 minutes of spreading cover coat material and before allowing traffic to use the new surface. If choke sand is specified, the following applies:

1. Immediately after the third roller pass, apply choke sand to the entire roadway surface at a rate of 4 pounds per square yard or as directed.
2. Do not "tailgate" or use a spinner when applying choke sand.

Do not operate equipment at a speed that turns or displaces the cover coat material. The Engineer may require applying approved reject material over the surface to absorb any free asphalt before brooming. Sweep excess material from the entire roadway surface with rotary brooms. Complete the initial brooming by the morning following the previous day's chip seal application unless otherwise directed. Do not to displace embedded material when brooming. Pickup excess material in curb and gutter sections and dispose of as directed.

Perform second brooming approximately 24 hours after the first brooming and after traffic has been routed on the chip sealed roadway, when required.

Provide brooms that are in good condition and capable of sweeping a path at least 70 inches wide without loosening or displacing embedded materials.

Accompany each broom by a shadow vehicle if working on highways open to traffic. Equip the shadow vehicle with at least 1 roof-mounted high-intensity rotating or strobe-type amber flasher that is readily visible from front and rear for ½ mile.

Lightly spray the surface of the roadway with enough water to prevent dust from becoming airborne when brooming operations could create dust to the extent that it would violate air pollution regulations or create a safety hazard.

Keep the highway open to traffic. The Contractor may route controlled traffic on the surface treatment as soon as the asphalt is covered.

Maintain the first chip seal and allow it to cure for 5 calendar days if successive chip seals are to be applied.

B. Prime Coat. Apply the prime coat as specified in 402, when required

The Engineer may require a curing period of 5 calendar days between the application of the prime coat and the next application of asphalt.

Keep the primed surface in repair during the period between the application of the prime coat and the chip seal coat. Patch and repair holes, ravels, and areas deficient in the primed surface with aggregate-asphalt mixtures using penetration methods or other approved procedures. Broom off loose material before subsequent applications of asphalt.

C. Chip seal. Apply each chip seal as specified 403. Maintain the first chip seal and allow it to cure for 5 calendar days if successive chip seals are to be applied.

D. Fog Coat. Apply fog coat as specified in 408, when required.

404.04 Method of Measurement. The Engineer will utilize plan quantity of acceptably completed work by the square yard. Chip Seal Coat will be measured by the square yard.

404.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Chip Seal Coat.....	CY

Fog coat will be paid for as specified in 408.

The Department considers all work associated with chip sealing as incidental and included in the chip seal coat contract pay item, including the following:

1. Cleaning the pavement surface before chip sealing.
2. Protecting existing manholes, valve casings, street monuments, and RWIS sensors. Material used for protection is to be removed and properly disposed of after the chip sealing is completed.
3. Restoring items that were not properly protected.
4. Providing and applying materials, including asphalt, cover coat aggregates, and blotter, if necessary.
5. Water applications.
6. Brooming.
7. Removing and disposing of excess material.
8. All other work necessary to chip sealing.

SECTION 405 – SUPERPAVE® HOT MIX ASPHALT

405.01 Description. Construct 1 or more courses of Superpave hot mix asphalt (HMA) plant mix, including leveling courses if applicable, on a prepared surface. References in this section also apply to warm mix asphalt (WMA).

405.02 Materials. Provide materials as specified in:

Aggregate	703
Asphalt.....	702
Anti-Stripping Additive	702
Hydrated Lime	720.06
Recycled Asphalt Pavement (RAP)	720.07

Test materials in accordance with the following applicable standard methods:

Particle Size Distribution of Aggregate	FOP for AASHTO T 27
With Materials Finer than 75um (No. 200) Sieve in Mineral Aggregate by Washing	FOP for AASHTO T 11 Method A or B
Mechanical Analysis of Extracted Aggregate	FOP for AASHTO T 30
Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyrotory Compactor.	FOP for AASHTO T 312
Superpave Volumetric Design for Hot Mix Asphalt (HMA)	AASHTO R 35
Determining the Percentage of Fracture in Coarse Aggregate	FOP for AASHTO T 335 Method 1
Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures	AASHTO T 269
Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures	FOP for AASHTO T 209 Bowl Method
Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface Dry Specimens	FOP for AASHTO T 166 Method A
Pavement Straightedge Procedures	Idaho IR 87
In-Place Density of Asphalt Mixtures by Nuclear Methods	FOP for AASHTO T 355 Backscatter mode
Sampling Asphalt Mixtures after Compaction (Obtaining Cores)	FOP for AASHTO R 67
Determining Volume of Liquids in Horizontal or Vertical Storage Tanks	Idaho IT 120
Acceptance Test Strip for Hot Mix Asphalt (HMA) Pavement.....	Idaho IR 125
Standard Practice for Operating Inertial Profilers and Evaluating Pavement Profiles	AASHTO R 57
Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method	FOP for AASHTO T 308

Sampling Bituminous Paving Mixtures	FOP for AASHTO T 168 (See QA Manual Section 270 for sampling method)
Reducing Samples of Hot Mix Asphalt to Testing Size	FOP for AASHTO R 47
Moisture Content of Hot Mix Asphalt (HMA) by Oven Method	FOP for AASHTO T 329
Plastic Fines in Graded Aggregate and Soils By Use of the Sand Equivalent Test.....	FOP for AASHTO T 176 Alternate Method #2, Mechanical, Pre-wet
Standard Method of Test for Compressive Strength of Hot Mix Asphalt	AASHTO T 167
Standard Test Method for Effect of Water on Compressive Strength of Compacted Bituminous Mixtures (Immersion-Compression).....	ASTM D1075 (Replace ASTM D1074 and ASTM D2726 with AASHTO T 167 and AASHTO T 166)
Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage.....	AASHTO T 283
Uncompacted Void Content of Fine Aggregate, Method A	AASHTO T 304
Mixture Conditioning of Hot-Mix Asphalt (HMA)	AASHTO R 30
Sampling Asphalt Materials	FOP for AASHTO R 66
Determining Rutting Susceptibility of Asphalt Pavement Mixture Using the Asphalt Pavement Analyzer (APA)	AASHTO T 340
Superpave Volumetric Mix Design	AASHTO M 323
Evaluation of the Superpave Gyrotory Compactor (SGC) Internal angle of Gyration Using Simulated Loading	AASHTO T 344
Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate	FOP for ASTM D4791 (ratio of length to thickness equal to or greater than 5:1)
Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method	AASHTO T 331
Standard Practice for Rapid Drying of Compacted Asphalt Specimens Using Vacuum Drying Apparatus	ASTM D7227
Standard Test Method for Maximum Specific Gravity and Density of Bituminous Paving Mixtures Using Automatic Vacuum Sealing Method	ASTM D6857
Specific Gravity and Absorption of Aggregate Using Automatic Vacuum Sealing Method	Idaho IT 144
Quantitative Extraction of Bitumen from Bituminous Paving Mixtures	AASHTO T 164
Quantitative Extraction and Recovery of Asphalt Binder from Asphalt Mixtures	AASHTO T 319
Lime for Asphalt Mixtures	AASHTO T 303
Density of In-Place Hot Mix Asphalt (HMA) Pavement by Electronic Surface Contact Devices	FOP for AASHTO T 343 Method C
Determination of Recycled Asphalt Pavement (RAP) Aggregate Dry Bulk Specific Gravity (G_{sb})	Idaho IT 146

Provide Superpave HMA composed of a combination of aggregate, approved additives, mineral filler (if required), RAP (if used), WMA additives or process (if used), and performance graded (PG) asphalt binder material. Provide a job mix formula (JMF) and a Superpave HMA pavement as specified in this section, 703, and 720.

Table 405.02-1 – Superpave Mixture Requirements

Mixture Type	SP 2 (50 gyrations)	SP 3 (75 gyrations)	SP 5 (100 gyrations)
Design ESALs ^(a) (millions)	< 1	1 < 10	≥ 10
Gyratory Compaction			
Gyrations for N _{ini}	6	7	8
Gyrations for N _{des}	50	75	100
Gyrations for N _{max}	75	115	160
Relative Density, % G _{mm} @ N _{ini}	≤ 90.5	≤ 89.0	≤ 89.0
Relative Density, % G _{mm} @ N _{des}	96.0	96.0	96.0
Relative Density, % G _{mm} @ N _{max}	≤ 98.0	≤ 98.0	≤ 98.0
Air Voids, % P _a	4.0	4.0	4.0
Dust to Binder Ratio Range ^(b)	0.6 – 1.2	0.6 – 1.2	0.6 – 1.2
Voids Filled with Asphalt (VFA) Range ^(c) , %	65 – 78	65 – 75 ^(d)	65 – 75 ^(d)

^(a) pH: Negative logarithm of the hydrogen ion concentration

^(b) For No. 4 nominal maximum size mixtures, the dust to binder ratio is 0.9 to 2.0. If the aggregate gradation passes beneath the PCS control point specified in 703.05, the allowable dust to binder ratio range may increase from 0.6 - 1.2 to 0.8 - 1.6.

^(c) For 1½ inch nominal maximum size mixtures, the specified lower limit of the VFA is 64 percent.

^(d) For design traffic levels of greater than 3 million ESALS, ¾ inch nominal maximum size mixtures, the specified VFA range is 73% to 76% and for No. 4 nominal maximum size mixtures is between 75% and 78%.

Approved SP 3 mixes may be substituted for SP 2 mixes. Use the binder content corresponding to 3.5 percent air voids. Adjust the SP 3 mix binder content by selecting the binder content that achieves 3.5 percent air voids at 75 gyrations from the binder content versus air voids graph of the approved mix design and target this binder content in the C-JMF. The SP 3 mix will be tested during production and accepted as an SP 2 mix (i.e., measuring binder content and gradation) when a substitution is made and the SP 2 VFA value will be used.

Use a QPL anti-stripping additive. Use a minimum ½ percent approved liquid anti-stripping additive by weight of total asphalt or use lime as an anti-stripping additive. Determine the amount of liquid anti-stripping additive or lime required by performing stripping testing during the mix design development. If lime is used as an anti-stripping additive, the Department does not require liquid anti-stripping additive.

1. Warm Mix Asphalt (WMA). WMA is defined as HMA that is produced at a target discharge temperature of 275 °F or less using QPL WMA additives or processes. WMA is allowed for use. QPL WMA additives or processes may be used to facilitate mixing and compaction of HMA produced at target discharge temperatures above 275 °F; however, such mixtures will not be defined as WMA.

Use additives or processes from the QPL. Follow the supplier's or manufacturer's written instructions for additives and processes when producing WMA mixtures.

Use equipment and WMA technologies capable of producing an asphalt mixture that meet specifications and is workable at the minimum placement and compaction temperature desired, regardless of storage or haul distance considerations.

Produce Superpave WMA by 1 or a combination of several QPL-approved technologies including chemical, foaming, and organic processes.

The Department and the Contractor will prepare Superpave WMA field samples, as recommended by the manufacturer's representative, for WMA mixture testing.

2. Recycled Asphalt Pavement (RAP). The Department will allow RAP in the Superpave HMA. Provide RAP as specified in 720.07. Produce the mixture as specified in 405.03.A. Select the mass of RAP, the type of RAP, and the extent of RAP processing necessary to meet specifications. The Department will not change specifications or the contract unit price if RAP is used in the mixture.

If RAP material is to be used from the project, obtain a representative sample of material for the mix design.

The mass of RAP used in Superpave HMA is the mass of asphalt binder, in percent that the RAP contributes to the total mass of binder in the mixture.

RAP Binder Percentages and Binder Grade Selection. Determine the percentage of RAP used and the binder grade required to meet specifications. Select the RAP percentage in the mix by determining the contribution of the RAP binder toward the total binder in the mix, by weight.

It may be necessary to use a softer virgin PG binder than is specified to account for the age hardened binder in the RAP. Adjust the binder grade specified to account for the stiffening effect of the aged binder in the RAP resulting in a composite binder meeting requirements. The method for determining the binder grade adjustment in Superpave HMA mixtures incorporating RAP is designated as Level 1 or Level 2 as shown in Table 405.02-2. Each level has a range of percentages that represent the contribution of the RAP binder toward the total binder, by weight.

Table 405.02-2 – Grade Adjustment for RAP Usage

Level	RAP binder by weight of the total binder in the mixture, %	Binder Grade Adjustment to account for the stiffness of the asphalt binder in the RAP
1	0 to 17	No binder grade adjustment is made.
2	> 17 to 30	The selected binder grade adjustment for the binder grade specified on the plans is one grade lower for the high and the low temperatures designated. Or determine the asphalt binder grade adjustment using a blending chart. Note: See AASHTO M 323 for recommended blending chart procedure.

Table 405.02-3 identifies the typical binder grades used and the recommended binder grade adjustments for each binder grade at the RAP level described in Table 405.02-2. If the binder grade adjustment is not in Table 405.02-3, use Table 405.02-2 to determine the binder grade adjustment needed.

Table 405.02-3 – Typical Adjusted Binder Grades

	Level 2	Level 1
Binder Grade Specified in Contract	Adjusted Binder Grade	Adjusted Binder Grade
58-28	58-34	No adjustment needed
58-34	No Adjustment Needed	
64-28	58-34	
64-34	58-34	
70-28	64-34	
76-28	70-34	

Use the following equation to determine the percent of RAP by weight of mix:

$$X\% = c (a/b)$$

Where:

a = optimum asphalt content, percent in mixture to produce 4.0% air voids.

b = percent asphalt content in the RAP (from chemical extraction and/or AASHTO T 308 burn with asphalt binder correlation factor).

c = percent of RAP binder by weight of the total binder desired in the mix.

X = desired RAP percent by total weight of mix.

The following is an example of the calculation:

Total RAP binder desired equals 17% of total binder in the mixture. If RAP will contribute 5.1% asphalt content and the optimum asphalt content is 5.8%, then:

$$X\% = 17\% * (5.8/5.1) = 19.3\%$$

3. Submittals. Submit virgin and RAP material for bulk dry specific gravity of aggregate, G_{sb} determination. For Superpave mixtures designated as SP 2, the Department will not require HMA material samples to be submitted for mix design testing. Submit SP 2 mix designs for paper review only. For SP 2, submit a mix design that meets the requirements of 405.03.A, except for the material submittal requirement.
4. Recycled Asphalt Shingles (RAS). RAS is not allowed in any Superpave HMA.

405.03 Construction Requirements.

A. Mix Design. Develop a mix design that includes the JMF and is reviewed, approved, signed, and sealed by an Idaho licensed professional engineer responsible for the mix design. Use a qualified laboratory. The Department requires the mix design to be developed by an individual that is qualified by the Department as a Superpave mix design technician (SPMDT). Submit all worksheets, notes, calculations, and outputs generated by testing equipment. Include signature and WAQTC/PE license number for testers and reviewers and checked by on each sheet.

1. Mix Design Requirements. Proportion the aggregate fractions to meet the grading and physical properties of the approved JMF.

The grade of asphalt is specified on the plans. The Contractor may choose to use a PG binder that is equal to or 1 grade higher on the high temperature side and that is equal to or 1 grade lower on the low temperature side than is specified and produces a mixture that meets requirements at no additional cost to the Department.

Select the grade, brand, and source of asphalt and additives to be used in the JMF. The Contractor may need to adjust the virgin asphalt PG binder grade used in the mix to achieve the PG binder grade required when RAP is used.

The JMF represents the aggregate grading and optimum asphalt binder content that produces the desired mix criteria in the laboratory. Specify a single aggregate gradation, the optimal asphalt binder content, the theoretical maximum specific gravity, G_{mm} , and the bulk specific gravity, G_{mb} , of a specimen compacted to N_{design} . Select the optimum asphalt binder content as the asphalt binder content that results in 4.0 percent air voids at N_{design} . Submit a recommended temperature range from the asphalt binder supplier at which the mixture will be mixed and compacted for Superpave testing in accordance with AASHTO R 35. Compact G_{mb} specimens at the recommended mixing and compaction temperatures of the specified PG binder, regardless of RAP percentage used.

Establish a single percentage of aggregate passing the following sieve sizes:

2", 1½", 1", ¾", ½", ⅜", No. 4, No. 8, No. 16, No. 30, No. 50, No. 100, and No. 200 from the JMF. Report the sieve results to the nearest whole number except for the No. 200. Report the No. 200 to the nearest tenth. Ensure the single percentage passing as shown on the proposed JMF grading is within the minimum and maximum control points specified in 703.05.

Design Superpave mixes in accordance with AASHTO R 35. Use the equipment specified in AASHTO T 312 and a Department qualified Superpave mix design technician. Report the brand, model number, and serial number of the Superpave gyratory compactor (SGC). Use a SGC that meets the requirements of AASHTO T 312 and AASHTO T 344 (internal angle 1.16 degrees plus or minus 0.02 degrees). Provide Superpave mixes that comply with the gradation requirements of 703.05.

Condition the Superpave mixes in accordance with AASHTO R 30 Section 7.12, except modify so the mix designer selects a temperature to condition the mixture within the compaction temperature range as recommended by the asphalt binder supplier.

Compact the design mixture in accordance with AASHTO T 312 Section 8.1.2.1, except modify so the mix designer selects a mixing temperature within the mixing temperature range as recommended by the asphalt binder supplier and modify AASHTO T 312 Section 8.1.7.1 so the compaction temperature is determined by the mix designer and is used for AASHTO T 312 testing. The number of gyrations used is defined in Table 405.02-1 for the type of mix specified.

The Department will determine the bulk dry specific gravity of aggregate, G_{sb} , apparent specific gravity of aggregate, G_{sa} , and water absorption (by percent weight of dry aggregate) of the coarse and fine aggregate used in the mixture using AASHTO T 85 and Idaho [IT-144](#). The Department will evaluate the RAP G_{sb} , if used, by determining the RAP G_{se} in accordance with Idaho [IT-146](#).

Submit aggregate and RAP for G_{sb} testing as specified in 405.03.A.3. Report the asphalt binder/aggregate correlation factor for asphalt binder and gradation for each RAP stockpile as specified in 720. A Contractor's representative may be present during the G_{sb} testing to ensure a value the Department and the Contractor can agree upon, if requested. Use the established G_{sb} in the mix design calculation, the report, and for production paving testing. The Engineer will use the established G_{sb} during the mix confirmation process, acceptance test strip testing, and verification testing. Allow the Engineer 3 business days for testing.

Design and compact the mixture at the N_{design} gyrations specified in Table 405.02-1. Use a 4.0 percent design air void content at the design number of gyrations (N_{design}) for mixtures as in Table 405.02-1. Verify N_{max} as part of the design process by compaction of at least 2 specimens at the design asphalt content to N_{max} to ensure the number of gyrations required in Table 405.02-1 does not produce a mixture that exceeds the relative density of N_{max} given in Table 405.02-1.

Ensure the voids in the mineral aggregate (VMA) during design is at least 0.3 percent greater than the minimum value specified in 703.05 when the mixture is compacted to N_{design} . The Engineer will not accept mix designs that do not meet requirements.

Ensure the VMA of the mixture meets the specification as specified in 703.05 during production. Calculate VMA as specified in the [QA Manual](#) Section 260.

Ensure the voids filled with asphalt (VFA) criteria of the mixture meets the requirements in Table 405.02-1 at the design number of gyrations during design and production. Calculate VFA as specified in the QA Manual Section 260.

Meet the dust to binder ratio requirements in Table 405.02-1. The dust to binder ratio or dust proportion (DP) is, by mass, the ratio between the percent of aggregates passing the No. 200 sieve and the effective binder content. Calculate the effective binder content as specified in the QA Manual Section 260.

Ensure the Superpave HMA mixture has an index of retained strength (immersion compression) of 85 percent or more when tested in accordance with AASHTO T 167 and ASTM D1075, using a minimum of ½ percent anti-strip additive or a determined mass of hydrated lime.

The Department will perform asphalt pavement analyzer (APA) testing on SP 3 and SP 5 mixtures. Test in accordance with AASHTO T 340. Do not exceed a 0.2 inch (5mm) maximum rut depth in the tested mixture.

Perform 3 aggregate gradation trial blends at a single asphalt content that achieves a laboratory air void content of 3.0 to 5.0 percent in accordance with AASHTO R 35. Include additional minus No. 200 material in each blend to account for aggregate breakdown during production. Describe in the mix design, the method(s) used to maintain the minus No. 200 target value throughout the work.

Determine the aggregate gradation in the asphalt mixture by an ignition burn of the asphalt mixture from a laboratory prepared sample. Batch the laboratory sample on the basis of component percentages as shown on the proposed JMF gradation. Obtain the aggregate in accordance with the FOP for AASHTO T 308. Report the sieves specified in this subsection, beginning with the maximum size for the mix.

Conduct testing during the mix design to identify hot mix aggregate subject to breakdown in the ignition furnace. Report the aggregate gradation correction factors, determined in accordance with the FOP for AASHTO T 308, for specification sieves in the mix design. Apply aggregate gradation correction factors to the specification sieves when determining compliance with specifications, only when breakdown was determined and reported in the mix design.

Submit 4 correction factor samples produced by the laboratory producing the mix design, at the design asphalt binder content, for each ignition furnace to be used for mix design confirmation and acceptance, verification, and dispute resolution testing. Prepare 16 correction factor samples at the same time in accordance with the FOP for AASHTO T 308. Submit 12 correction factor samples when submitting mix design confirmation materials and samples.

In accordance with the FOP for AASHTO T 308, each ignition furnace to be used requires a unique asphalt binder correction factor determined using aggregate produced for the work. Determine the asphalt binder correction factor for each furnace where testing will be performed.

- a. Warm Mix Asphalt. Use the AASHTO R 35 Appendix to design WMA mixes and submit the following documentation:
 - (1) WMA technology information and/or WMA additives information.
 - (2) WMA technology manufacturer's written instructions for use.

- (3) WMA technology manufacturer's target rate for water and additives, the acceptable variation for production, and documentation showing the impact of excessive production variation.
- (4) WMA technology safety data sheets (SDS).
- (5) WMA technology laboratory and field temperature range for mixing.
- (6) WMA technology temperature range for compacting.
- (7) Asphalt binder performance grade test data over the range of WMA additive percentages proposed for use.
- (8) Laboratory test data, samples, and sources of mixture components and asphalt binder-viscosity-temperature relationships.

Use anti-stripping additives, silicone additives, WMA additives, and WMA technologies as specified. Comply with approved mix design quantities. Confirm the addition rate through quality control field tests during production.

Maintain manufacturer's written instructions on file at the asphalt mixing plant and make available for reference when producing Superpave WMA.

2. Mix Design Documentation and Test Results. Submit the following for each JMF submitted, include the following:
 - a. Legible sheets in electronic, printed, and copied forms and numbered consecutively.
 - b. Orient sheets similarly in the electronic submittal.
 - c. The name(s) of who is responsible for quality control of the mixture during production of the mix design. The name(s) of who is responsible for developing the mix design and the name(s) of who performed the tests. The name(s) of who checked the work. Provide the WAQTC or PE license number and signatures of these individuals on worksheets and summary sheets.
 - d. Gradation data for each aggregate component of 3 trial blends. Include additional minus No. 200 material to account for aggregate breakdown during production. Label this item 'Breakdown' on the mix design sheet. Describe in detail the method(s) used to maintain the minus No. 200 target value throughout the work. Show percent passing for the following sieves: 2", 1½", 1", ¾", ½", ⅜", No. 4, No. 8, No.16, No. 30, No. 50, No. 100, and No. 200. Report grading to the nearest 1 percent except for the No. 200 sieve. Report the No. 200 sieve to the nearest 0.1 of a percent.
 - e. The source, source number, and materials description (e.g., quarried or gravel). The proportion of each aggregate (in percent of total aggregate) from each source and include the specified RAP records. If multiple aggregate sources are used, identify the stockpiles with the appropriate aggregate source number on blending and batching sheets.
 - f. The design ESAL's when specified.
 - g. The composite washed gradation based on 405.03.A.2.d and 405.03.A.2.e.
 - h. The bulk (dry), G_{sb} , and apparent, G_{sa} , specific gravities and water absorption (by percent weight of dry aggregate) of coarse and fine aggregate for each aggregate component or for the total aggregates used in the mixture. Attach the Department documentation for G_{sb} determination.

Note: The Department will determine these values using AASHTO T 85 and Idaho IT 144 and provide these values to the Contractor. RAP G_{sb} , when used, will be calculated using the RAP G_{se} .

- i. The composite gradation plotted on a 0.45 power chart.
- j. The PG binder grade and percentage (in units of 0.1 percent) of asphalt binder material to be added based on the total mass of the mixture. When RAP is used, report the adjusted virgin asphalt PG binder grade and the percentage (in units of 0.1 percent) of virgin asphalt binder material to be added based on the total mass of the mixture to achieve the PG binder grade specified.
- k. The design traffic level and N_{initial} , N_{design} , and N_{max} .
- l. Report the value of the theoretical maximum specific gravity, G_{mm} and bulk specific gravity, G_{mb} of the asphalt mixture to 3 decimal places. Report optimum asphalt content, air voids, and VMA to the nearest tenth and report VFA to the nearest whole number.
- m. Plot at least 4 different asphalt binder contents (minimum 0.5 percent between each point), so there is at least 1 point above and 1 point below the estimated asphalt binder percentage. Pick the optimum asphalt binder content at 4.0 percent air voids from the plotted curve. Run 1 trial at the optimum asphalt binder content to verify the specimen values match the values from the curve and provide blending and batching worksheets for this trial, if requested.
- n. The theoretical maximum specific gravity (G_{mm}) at each asphalt binder content. The average of at least 2 specimens at each asphalt binder content. Use the G_{mm} for percent air voids determination using the [QA Manual](#) Section 260.
- o. The test results for the individual and average bulk specific gravity, density, and heights of at least 2 specimens at each asphalt binder content.
- p. The percent air voids in the mixture at each asphalt binder content.
- q. The percent VMA at each asphalt binder content.
- r. Dust to binder ratio calculated to the nearest 0.1 percent at each asphalt binder content.
- s. The immersion compression results at the optimum asphalt binder content.
- t. Ignition furnace calibration data in accordance with the FOP for AASHTO T 308, including specimen burn temperature.
- u. Ignition furnace printed ticket, if requested. Attach a copy of the "long" printed ticket that continuously records the temperature and mass each minute during the burn for the trial at optimum asphalt binder content.
- v. Graphs showing air voids, VMA, VFA, G_{mb} , and G_{mm} , versus percent asphalt binder content for each of the asphalt binder contents submitted with the trial mix. No more than 2 graphs per sheet.
- w. The test results from the composite aggregate blend at the proposed JMF proportions indicating compliance with the percentage of fracture in coarse aggregate, fine aggregate angularity, sand equivalent, and flat and elongated in accordance with Table 703.05-1. When RAP is used, report the percentage of fracture in coarse aggregate and flat and elongated of the composite blend. Test fine aggregate angularity and sand equivalent on the composite aggregate blend at the proposed JMF proportion without the RAP proportion.
- x. Report the laboratory mixing and compaction temperatures and field mixing and compaction temperature ranges by the asphalt binder supplier. Use the laboratory compaction temperature to compact gyratory specimens for acceptance and verification testing.
- y. Report the sample mass determined in the mix design process that results in a gyratory specimen target height of approximately 115 millimeters (plus or minus 5 millimeters).

- z. Label gyratory compaction tables and curves, generated by the gyratory compactor, from the trial blend.
 - aa. Submit the gyratory compactor printout that includes specimen height, force, internal angle, and shear, if available, for each gyration for each specimen compacted to N_{des} at optimum binder content.
3. Material and Sample Submittals. Submit the following materials and samples, when applicable:
- a. A 100-pound uncompact, representative sample of the JMF.
 - b. 6 gyratory briquettes for APA testing. The APA specimens must have an air void content of 7.0 plus or minus 0.5 percent air voids. Determine P_a of each specimen and clearly label the air void content for AASHTO T 340 testing (for SP 3 and SP 5 only).
 - c. 8 individually packaged aggregate specimens conforming to the JMF fabricated in accordance with AASHTO T 167 and ASTM D 1075 except do not add the binder. Provide enough binder without anti-strip added and anti-strip additive to make 8 test specimens. One of the specimens will be used as a “buttering batch”. The Department will prepare test specimens from the material and perform testing in accordance with ASTM D 1075. The PG binder provided must equal the PG binder grade used in the JMF.
 - d. A 25-pound minimum representative sample of each aggregate stockpile for G_{sb} testing and at least a 25-pound sample of the combined coarse and fine aggregate at mixture proportions. Include blend sheets for the mixture proportions.
 - e. A 25-pound minimum representative sample of the RAP and the RAP stockpile records and test data. Submit the gradation and binder contents of the RAP sample as specified in 720.07. Submit the RAP asphalt binder/aggregate correlation factor as specified in 720.07.
 - f. One thousand (1,000) gram sample of other mineral admixtures (e.g., lime or fly ash), when used.

The Department will use these samples for laboratory examination, materials properties evaluation, and to perform AASHTO T 340 on the specimens for mix design confirmation.

The Department will not begin testing until the required mix design paperwork has been received.

The Engineer will provide the Contractor with a confirmation or rejection of the mix design within 5 business days after receiving the JMF and materials. Rejection of the mix design will require an additional 5 business days for re-evaluation. Additional materials and a new mix design may be required from the Contractor. Obtain Department confirmation of the Contractor’s mix design before beginning acceptance test strip placement.

4. Previously Used Mix Designs. The Contractor may use a previously used mix design, including the JMF which the Department approved and accepted for use on other projects, if it meets the requirements of this subsection. Changes to the mix design are not allowed except as noted below:

Adjustments made as specified in 405.03.H, Table 405.03-5 to the asphalt content, and gradation of a previously approved mix design that became the contractor-job mix formula (C-JMF) are acceptable changes.

Prepare a submittal that includes:

- a. The original approved mix design that includes the confirmed JMF from the previous project. Do not make modifications to this document.
- b. Documentation supporting adjustments to the previously used mix design:
 - (1) Adjustments made to the JMF that make it the C-JMF.

- (2) Adjustments made to the C-JMF during production.
 - (3) Acceptance test reports, plant reports, records, and diaries supporting these adjustments.
 - (4) If no adjustments were made, submit acceptance test reports, plant reports, records, and diaries for the C-JMF used.
- c. Current stockpile quality control testing that includes the following to confirm the material in the stockpile is similar to the material used for the original mix design, including RAP:
- (1) Sieve analysis on the stockpiles to be used, including crusher control charts.
 - (2) Coarse and fine aggregate specific gravities and absorptions performed by the Department.

Note: Previously used mix designs that are used during the calendar year of confirmation may omit 405.03.A.4.c if the stockpiles consist of the crushed material, including RAP, from the original mix design. If more than 1 calendar year has elapsed from the time of confirmation, include 405.03.A.4.c. Changes in gradation, specific gravity, and absorption due to additional crushing may prevent acceptance of a previously used mix design.

- d. Ignition furnace correction factors as specified in this subsection using the asphalt content and gradation of the proposed JMF.
- (1) Asphalt binder content correction factor in accordance with the FOP for AASHTO T 308.
 - (2) Aggregate gradation correction factors in accordance with the FOP for AASHTO T 308.
- e. Use the C-JMF from above to run 1 trial at the optimum asphalt binder content to verify it produces specimen values that match the values from original design curves.
- f. A cover letter requesting the use of a previously used mix design stating the project identifiers (e.g., project name, key number). Include a summary sheet of the volumetric mix design test results and other appropriate information from prepared specimens using the aggregates, the PG binder, and additives verified in the previous steps.

The Engineer will send previously used mix designs submitted to the Central Laboratory for review and recommendation. The asphalt content, type and grade, aggregate materials, gradation, and anti-strip additive rate, type, and grade must be the same as previously approved to be considered acceptable as a previously used mix design.

The Department will not begin mix design evaluation until supporting documentation is received.

5. Nonstructural and Temporary Superpave HMA. Nonstructural Superpave HMA refers to paving applications that are out of trafficked areas (e.g., behind guardrails, gore areas, raised medians, asphalt curbs, other noncritical, nontraffic load applications). Temporary Superpave HMA refers to pavement that will be removed before the end of the project (e.g., detours, pavement used in construction staging). Removal of temporary Superpave HMA is incidental and the costs included in the Superpave HMA contract pay item.

For pavement designated in the contract as nonstructural (NS) or temporary (T), the class of Superpave HMA mix will be identified in the bid schedule with the initials NS or T respectively (i.e., SP-NS is Superpave HMA not in the travelled way and can be any class of Superpave HMA. whereas SP-T is Superpave HMA used for temporary pavement that must be removed before completion of the project). Superpave HMA for temporary pavement may have a class of mix designated on the plans depending on the intended use.

The Department will not require materials and samples to be submitted for mix design confirmation testing for mixtures designated as NS or T. Submit mix designs for paper review only.

6. Mix Design Tolerance. The Engineer will apply the tolerances in Table 405.03-1 to the Department's test results when evaluating the JMF. If the Department's test results are within the established tolerances and control points established in 703.05, the JMF will be confirmed by the Engineer. The Contractor has the option to proceed to the acceptance test strip or submit another JMF for examination and evaluation.

Table 405.03-1 – Quality Tolerance

Quality Characteristic	Tolerance
Gradation	
No.4 sieve and larger sieves, %	JMF value \pm 6.0 ^(a)
No. 8 to No. 30 sieves, %	JMF value \pm 5.0 ^(a)
No. 50 to No. 100 sieves, %	JMF value \pm 4.0 ^(a)
No. 200 sieve and smaller sieves, %	JMF value \pm 2.0 ^(a)
Laboratory Air Voids, %	4.0 \pm 1.5
VMA, %	703.05 minimum value – 1.0
Asphalt Binder Content, %	JMF value \pm 0.4
Dust Proportion (DP)	Table 405.02-1 range \pm 0.1
VFA	Table 405.02-1 ^(b)
Immersion Compression, % minimum	85
AASHTO T 340, in (SP 3 and SP 5 only)	0.2 maximum
G _{mm} and G _{mb}	0.02

^(a) In no case will the upper and lower specification limits be outside the control points specified in 703.05.

^(b) If the Department's VMA and P_a results are within the tolerances provided, the calculated VFA will not be used as an acceptance criteria.

B. Weather Limitations for Permanent Paving. Do not place Superpave HMA on a wet or frozen surface or when weather or surface conditions will otherwise prevent the proper handling or finishing of the Superpave HMA material. Place Superpave HMA as specified in the temperature limitations in Table 405.03-2.

Table 405.03-2 – Air and Surface Temperature Limitations

Compacted Thickness of Individual Courses	Top Course	Leveling and Courses Below the Top Course
Less than 0.10 foot	60 °F	50 °F
0.10 to 0.18 foot	50 °F	40 °F
Greater than 0.18 foot	40 °F	40 °F

Provide a paved surface for travel if the work extends into the winter. Do not start construction on the pavement surface, unless the progress schedule realistically shows the pavement can be replaced or completed within the temperature limitations listed above.

C. Mixing Plants. Operate all equipment in accordance with the manufacturer's written instructions or submit an explanation of the variations from the instructions. Use mixing plants capable of producing a uniform mixture and that comply with the following requirements:

1. Plant Scales. Provide plant and truck scales that comply with 109.01.
2. Asphalt Storage. Provide asphalt storage tanks to heat and hold the materials at the required temperatures. Store and introduce the asphalt into the mix according to the supplier's required temperatures. Submit the supplier's written instructions.

Accomplish heating so the flame is not in contact with the tank. Design the storage system for the asphalt to ensure proper and continuous circulation during the operating period. Install the tank level and provide the Engineer a calibrated measuring rod or other approved measuring device. Make provisions for measuring and sampling contents of the storage tanks.

3. Feeder. Equip plants with accurate mechanical means for uniformly feeding the aggregate into the dryer. When multiple stockpiles are required, ensure the RAP and virgin cold aggregate feed equipment is capable of providing accurate metering of individual stockpiles into the mix.

Determine the moisture content of the virgin aggregates and RAP daily during production, or as necessary, and record the moisture test results. Provide equipment that electronically injects the determined moisture content of the cold feed materials (RAP and virgin aggregates) onto the belt-weighing systems and automatically corrects wet material weights to dry material weights.

Provide positive weight control and monitoring of the aggregate feed and interlock the RAP cold feed rate and virgin aggregate cold feed rate by use of a conveyor scale or other approved device. Weigh the material to within 0.5 percent of the intended quantity. Provide a feed system capable of rapid adjustment to maintain a consistent and uniform flow throughout the range of its calibration. Accurately proportion the aggregate through control gates from each compartment. Provide positive mechanical means to adjust 1 dimension of the rectangular gate.

Do not screen or proportion after cold feed blending.

When RAP is used, use a scalping screen or other approved device installed ahead of the weight system to ensure that RAP agglomerates larger than 2 inches are not fed into the mixing plant.

Introduce RAP into the mixing plant at a location far enough downstream from the burner to be away from the flame and extremely hot gases.

Submit the following mixing plant information:

- a. Dry virgin aggregate rate in tons per hour.
- b. Dry RAP rate in tons per hour.
- c. Binder in tons per hour.
- d. Total virgin aggregates, RAP, and binder in tons per hour.

Print the mixing plant information on a ticket at an approved time interval and submit tickets at the end of each production day.

4. Dryer/Mixer. Continuously agitate the aggregates during the heating and drying process in a dryer that is capable of meeting the aggregate moisture requirements of 405.03.F. Equip dryers with automatic burner controls.

Include a mixer that may be part of the dryer or a separate unit that is capable of adequate mixing. Operate the plant only within the range of calibration.

5. Asphalt Control Unit. Interconnect the asphalt control unit with the aggregate feed control so it is capable of delivering asphalt to the mix within 0.2 percent of the intended quantity throughout the range of plant operation. Provide satisfactory means, by weighing or metering, for obtaining the quantity of asphalt delivered.

6. Thermometric Equipment. Provide adequate continuous thermometric recording equipment to show, at a minimum, the temperature of the asphalt in the storage tank, and temperature of the heated material after leaving the dryer or pug mill.
7. Sampling Devices. Equip crushing, screening, and mixing plants with approved sampling equipment operable from the ground or a platform. Construct and operate the device so it will move at a constant rate across the full width of the falling column of material from the discharge belt or chute. Construct the sampling equipment so a representative sample can be taken and conveyed to the ground by a means of a slide, chute, or other means where the sampled material can be safely and conveniently collected.

Provide a sampling device on the mixing plant's asphalt binder tank injection line and sample the asphalt binder as specified in the [QA Manual](#) Section 230.10.
8. Storage Silo Batcher. Equip the plant with a storage silo batcher that opens and closes throughout production to ensure uniform charging of the storage silo. Time the opening and closing so the material does not pass directly from the slat conveyor into the silo.
9. Discharge Hopper. Equip the plant with a discharge hopper having dump gates that will permit rapid and complete discharge of the mixture.
10. Hot Storage. Provide continuous mix plants with sufficient hot storage capacity to ensure continuous plant operation. Do not remove material below the top level of the cone of the hot storage silo except at the end of the production day.
11. Plant Calibration. Calibrate plants for accuracy requirements.
12. WMA Technology. Provide WMA metering devices that meet the WMA technology manufacturer's current written instructions for liquid or mineral additives. Document the integration of plant controls and interlocks when using WMA additive devices. Comply with the manufacturer's written instructions for incorporating additives and WMA technologies into the mix. Comply with manufacturer's written instructions regarding receiving, storage, and delivery of additives.

D. Hauling Equipment. Provide trucks used for hauling Superpave HMA materials that have tight, clean, smooth, and metal bodies equipped with a positive locking metal gate. When necessary, cover (e.g., with canvas) each truck to protect the mixture from the weather. The Contractor may apply a release agent, suitable for its intended use, to truck beds. After application, drain the truck bed. Do not use fuel oil or other petroleum oils as a release agent.

Provide an adequate platform to enable safe sampling when sampling from truck transports. Sample in accordance with the WAQTC FOP for AASHTO T 168.

E. Paver. Provide a self-propelled paver equipped with an activated and heated vibratory screed that is equal to the width of the paving being performed. Activate screed extensions and heat vibratory screeds, except for minor shoulder widening not exceeding 1 foot, and to produce a pavement equal to that produced by the rest of the screed. Equip the paver with a receiving hopper having sufficient capacity for a uniform spreading operation. Equip the hopper with a distribution system to place the mixture uniformly in front of the screed.

Provide extended screeds with corresponding auger and tunnel extensions to ensure a uniform head of fresh material across the entire screed. Install reverse screw augers with a minimum efficiency of 75 percent at the gear box for paving activities. Ensure equipment manuals for the paver and screed are always available for the operator's and Engineer's reference.

The Contractor may use alternate paver configurations provided they comply with the manufacturer's written instructions and can be demonstrated to produce an acceptable pavement. The alternate configuration must be approved in writing before use.

Equip the screed with automatic controls that will make adjustments in transverse and longitudinal directions. Provide a sensing device that is adaptable to picking up grade information from a stringline, rail, ski, laser, or other approved method. Operate the paver at a speed consistent with the delivery of Superpave HMA to provide a smooth uniform travel with the paver stopping only under unusual circumstances. Provide a paver, including when screed extensions are used, capable of producing a smooth uniform texture, dense joints, and a smooth riding surface. Provide enough trucks to maintain a continuous paving operation.

F. Mixing. Do not exceed the control point upper and lower specification limits specified in Table 703.05-2a and Table 703.05-2b when applying the applicable tolerances to the acceptance test strip JMF or C-JMF for Superpave HMA.

Do not exceed 0.3 percent moisture content in the mixture at the time of placement when tested using AASHTO T 329.

Mix material with the range specified in Table 405.03-4.

G. Superpave HMA Paving Plan. Immediately before paving, the Contractor, the asphalt supplier, the Engineer, and the Department personnel involved in the paving operation will hold a pre-operational paving meeting to discuss how to achieve the highest quality surface.

Before the pre-operational paving meeting, submit a Superpave HMA paving plan. Tailor the plan to the asphalt to be supplied, the anticipated JMF, and the Contractor's equipment and operation. Include at least the following:

1. Breakdown, intermediate, and finish rollers to be used.
2. Static or vibratory rolling for breakdown and intermediate rolling.
3. Frequency, amplitude, force/impact, and roller velocity for vibratory rolling.
4. Proximity of breakdown roller to paver with respect to horizontal displacement.
5. Proximity of intermediate roller to breakdown roller.
6. Compaction temperatures for breakdown, intermediate, and finish rolling.
7. Adjustments to paving/compaction operation with respect to temperature, amplitude, frequency, lift thickness, gradation, force/impact, and roller velocity.
8. Rubber-tired rolling with respect to pickup of pavement material.
9. Paving equipment, preheating, and vibratory settings of the screed.
10. Coordination of plant production and paving operations, climate, and haul distance.
11. Surface and air temperatures anticipated during production.
12. Temperature necessary to allow public traffic onto the new pavement surface.
13. Anticipated traffic control issues.
14. Additional equipment required.
15. Inspection, sampling and testing requirements.
16. Other paving issues, if any.

H. Acceptance Test Strip. Construct an acceptance test strip in accordance with Idaho IR 125. Construct 1 test section of the acceptance test strip using the JMF. The Department does not require acceptance test strips on projects less than 1 lane mile in length or for leveling courses, nonstructural pavement, or temporary pavement. Lane miles are the length, in miles, multiplied by the number of travel lanes.

Construct the acceptance test strip to the same placement width and thickness as the course it represents. Construct additional acceptance test strips, at no additional cost to the Department, if aggregate or asphalt binder sources change or the JMF changes.

The Contractor may elect to construct additional test sections. Submit the selected changes for each additional test section in writing. Only a qualified Superpave mix design technician or a professional engineer may make changes.

The Department will not make separate payments for construction, sampling, or testing of the initial acceptance test strip or additional test strips.

In lieu of an acceptance test strip, the Contractor may elect to perform offsite mix volumetric property verification. Do not use Department-owned or controlled sources for offsite testing.

The acceptance test strip is 1 lot.

Produce and compact WMA for the acceptance test strip at the lowest mixing and compaction temperatures that will be used during production. Do not mix or compact WMA at temperatures during production that are less than the acceptance test strip WMA temperatures.

When foaming processes are used, the Engineer may test the produced material for stripping (ASTM D1075) and rutting susceptibility (AASHTO T 340).

1. Onsite Test Strip Acceptance. Obtain 3 mix samples from each test section in accordance with Idaho IR 125, in the Engineer's presence. Place portions totaling at least 100 pounds of mix for each mix sample in multiple cardboard storage containers that comply with the [QA Manual](#) Section 220.1. Properly label the containers and immediately submit. The Department will combine the portions making up the samples and split each 100-pound mix sample at the Department's testing laboratory in accordance with AASHTO R 47, with $\frac{1}{2}$ tested for acceptance and $\frac{1}{2}$ retained for dispute resolution. See Table 405.03-3 for sampling and testing requirements.

Obtain 3 cold feed aggregate sample increments and immediately submit for testing. See Table 405.03-3 for sampling and testing requirements. Make available at the mixing plant aggregate gradation test results and running averages of stockpiles developed before the acceptance test strip.

Obtain 5 randomly located core samples from the compacted Superpave HMA placed in each test section and in accordance with Idaho IR 125. The Engineer will observe the core sampling. Immediately submit the cores for testing to determine the density of the compacted acceptance test strip and to determine the density correction factors for density equipment. The Department will determine core densities in accordance with AASHTO T 166 Method A or AASHTO T 331. The Department may use ASTM D7227 to dry the cores. The Department will determine density correction factors for density equipment in accordance with AASHTO T 355 or FOP for AASHTO T 343.

The Department will require 72 hours from the time of receipt of Superpave HMA mix samples and core samples to perform acceptance testing. Time will begin when the Engineer is in possession of the required samples and associated paperwork needed to perform the specified testing.

The Department will require an additional 48 hours to perform acceptance test strip confirmation testing if stripping and rutting susceptibility tests are not performed on laboratory produced WMA during mix design confirmation.

2. Offsite Mix Volumetric Properties Acceptance. The Engineer will allow the JMF to be verified offsite in accordance with Idaho IR 125. When offsite JMF verification is performed, obtain 3 mix samples from each test section in accordance with Idaho IR 125, in the Engineer's presence. Place portions totaling at least 100 pounds of mix for each mix sample in multiple cardboard storage containers that comply with the [QA Manual](#) Section 220.1. Properly identify the containers and immediately submit. The Department will combine the portions making up the samples and split each 100-pound mix sample at the Department's

testing laboratory in accordance with AASHTO R 47, with ½ tested for acceptance and ½ retained for dispute resolution. See Table 405.03-3 for sampling and testing requirements.

Obtain 3 cold feed aggregate sample increments and immediately submit for testing. See Table 405.03-3 for sampling and testing requirements. At the mixing plant, make available the aggregate gradation test results and running averages of stockpiles developed before the acceptance test strip.

The Department will require 3 business days from the time of receipt of Superpave HMA mix samples and cold feed samples to perform volumetric and aggregate acceptance testing. Time will begin when the required samples and associated paperwork needed to perform the specified testing are in the Engineer's possession.

3. Density Gauge Correlation. After approval of volumetrics, construct a density gauge correlation section on the prepared roadway consisting of the first 1,000 feet of the first paving day. Obtain 5 randomly located core samples in accordance with Idaho IR 125. The Engineer will determine the G_{mm} used in the density determination from the Department's 2 verification tests on the first paving day plus 1 additional random sample. The Department requires 48 hours from the time of receipt of cores to perform density acceptance testing. Time will begin when the required samples and associated paperwork needed to perform the specified testing are in the Engineer's possession.

Repair deficiencies created by the coring operation at no additional cost to the Department. Obtain approval of repair methods and materials before beginning coring.

The Engineer will base acceptance on the requirements in Table 405.03-3. Do not begin production paving until properties of the acceptance test strip are accepted.

Table 405.03-3 – Superpave Acceptance Test Strip Testing Requirements

Material	Quality Characteristic	Test Method	Number of Tests	Point of Sampling & Method	Sampled By	Tested By
Compacted Pavement	Density (Cores) ^(b)	AASHTO T 166 Method A or T 331	As specified in 405.03.H	Roadway	Contractor	Dept.
Mix	Asphalt Content ^(e)	AASHTO T 308	1 per Test Section (average of 3 samples)	AASHTO T 168 (See QA Manual Section 270) (3 random samples; locations determined)	Contractor	Dept.
	Gradation ^(c)	AASHTO T 30			Contractor	Dept.
	Air Voids, VMA, VFA, Dust to Binder Ratio ^(a)	AASHTO T 312 AASHTO T 269 AASHTO T 166 Method A or AASHTO T 331			Contractor	Dept.
	Rice Gravity	AASHTO T 209 or ASTM D6857			Contractor	Dept.
	Asphalt Pavement Analyzer ^(f)	AASHTO T 340			Contractor	Dept.
	Moisture Content	AASHTO T 329			Contractor	Dept.

Aggregate ^(d)	Fracture	AASHTO T 335 Method 1	1 per Test Strip (combination of 3 increments)	Cold Feed AASHTO T 2 (3 random increments)	Contractor	Dept.
	FAA	AASHTO T 304 (Method A)			Contractor	Dept.
	F&E	FOP for ASTM D4791			Contractor	Dept.
	Sand Equivalent	AASHTO T 176 (Alt. Method 2, Mechanical)			Contractor	Dept.

- (a) The average test results from the Superpave HMA samples for each test section must meet the requirements in Table 405.03-4; the ASTM D1075 test will not be required by the Department.
- (b) The average density of the cores for each test strip must be less than 96.0 percent and greater than 92.0 percent of the maximum theoretical density as determined using AASHTO T 209 or ASTM D6857. The Gmm value to be used for each test strip is the average Gmm calculated from each test section of the acceptance test strip.
- (c) The average AASHTO T 30 gradation of 3 randomly selected mix samples must meet the gradation requirements in Table 405.03-4 for each individual test section.
- (d) The test results from combining 3 cold feed aggregate samples must meet the requirements in Table 703.05-1. No tolerance is allowed.
- (e) The average asphalt binder content for each test section must meet the requirements in Table 405.03-4.
- (f) Samples tested in accordance with AASHTO T 340 (asphalt pavement analyzer) must meet 405.03.A.

4. Acceptance Test Strip Tolerance. The Engineer will apply the following tolerances to the acceptance test strip test properties specified in Table 405.03-4.

Table 405.03-4 – Acceptance Test Strip Tolerance

Quality Characteristic	SP 2 Mix Tolerance	SP 3 & SP 5 Mix Tolerance
VMA, %	None allowed	703.05 minimum value – 0.3
Laboratory Air Voids, %	4.0 ± 1.0	4.0 ± 1.5
Asphalt Binder Content, %	JMF value ± 0.4	Selected asphalt content ± 0.4
Dust Proportion (DP)	Table 405.02-1 range ± 0.1	Table 405.02-1 range ± 0.1
VFA, %	Table 405.02-1 range ± 5	Table 405.02-1 range ± 5
No.4 and larger sieves, %	JMF value ± 6.0 ^(a)	JMF value ± 6.0 ^(a)
No. 8 to No. 30 sieves, %	JMF value ± 5.0 ^(a)	JMF value ± 5.0 ^(a)
No. 50 to No. 100 sieves, %	JMF value ± 4.0 ^(a)	JMF value ± 4.0 ^(a)
No. 200 and smaller sieves, %	JMF value ± 2.0 ^(a)	JMF value ± 2.0 ^(a)
Density	None allowed	None allowed

^(a) The upper and lower specification limits are never allowed to be outside the control points specified in 703.05.

If the Department's average test results for each characteristic fall within the tolerances provided and the acceptance test strip is considered acceptable by the Engineer, the Contractor may proceed to production paving. If an individual test result for a characteristic fails outside the tolerance provided in Table 405.03-4, the Engineer may require another test strip. Meet specification requirements when production paving begins.

The Contractor may place a new acceptance test strip or provide a new mix design to meet specifications, instead of proceeding, when the test results fall outside the specification limits but are within the tolerance limits.

If the Department's test results fall outside the tolerances allowed, the Engineer will consider the acceptance test strip unacceptable and the Contractor will not be allowed to proceed to production paving. The Engineer will reject an unacceptable test section for SP 3 and SP 5 mixtures and require removal. The Department will not pay for the removal or the applicable contract pay item quantities. An unacceptable test section for SP 2 mixtures will be subject to rejection. If the Engineer determines the failed SP 2 test section may remain in place, the Contractor may leave the test section in place with a 50 percent reduction in price or remove the failed material and replace it with acceptable material and receive full payment. Remove the failed SP 2 test section if rejected. The Department will not pay for removal or for the applicable contract pay item quantities.

On the Contractor's request, the Engineer will evaluate the acceptance test results when the Department's average test results fall outside the tolerances provided for the listed sieves and/or asphalt content. The Engineer will not conduct an evaluation, unless the other acceptance characteristic values are within the specified tolerances. After evaluation, the Engineer will determine whether the acceptance test strip may be accepted. If the Contractor is unable to meet the requirements, the Engineer may require a new mix design to meet specifications. Place a new acceptance test strip at no additional cost to the Department.

If the Contractor's testing determines the test strip fails and the Contractor chooses to proceed with another test strip before receiving the Engineer's results, the Engineer will complete testing of the test strip in question and report the results before accepting material from the next test strip for evaluation.

Obtain the Engineer's test section acceptance before starting production paving.

After acceptance, the Department will pay for Superpave HMA pavement and asphalt binder in the test strip under their respective contract pay items.

The Engineer will allow slight adjustments to the JMF to obtain the desired air voids, density, uniformity, and constructability for SP 3 and SP 5 mixes. The Contractor may make slight adjustments to the asphalt content and gradation of the JMF of an approved acceptance test strip. If adjustments are not required, or when the Contractor's adjustments to the JMF are used, the approved JMF will become the C-JMF. For SP 2 mixes, the Contractor may select the asphalt content and gradation of a passing test section within the test strip as the C-JMF.

Submit the C-JMF intended for use during production paving in writing. Use the C-JMF to establish target values when producing control charts during production paving. Use the C-JMF to establish asphalt content and gradation target values for SP 2 mixes.

I. Tack Coat. Apply an asphalt tack coat to the following surfaces as specified in 401:

1. Existing plant mix surfaces and to the surface of each course constructed, except the final course.
2. Paint or spray a thin, uniform tack coat of asphalt before placing pavement against the surfaces of curbing, gutters, manholes, portland cement pavement, and other structures.
3. Contact surfaces of transverse joints and cold longitudinal joints just before additional mixture is placed against previously laid material.

J. Production Paving. The Contractor may request to begin production paving in accordance with the C-JMF after the acceptance test strip is approved. Superpave HMA paving acceptance is based on the requirements in the QASP Table 106.03-1.

1. Documentation/Records. Maintain documentation, including test summary sheets and control charts, on an ongoing basis. Maintain a file of gyratory specimen heights for gyratory compacted samples and test worksheets. File reports, records, and diaries developed during the progress of the work.
 - a. Number test results in accordance with the Department procedures and record on Department approved or supplied forms.

- b. Submit production test results on test summary sheets by 11 a.m. of the day following production.
- c. Include the following production test results and mixture information on a Department approved test summary sheet daily.
 - (1) Percent passing on sieves listed in 703.05.
 - (2) Theoretical maximum specific gravity, G_{mm} .
 - (3) Bulk specific gravity, G_{mb} at N_{des} .
 - (4) Percent asphalt binder content (P_b).
 - (5) Calculated production air voids (P_a).
 - (6) Calculated voids in mineral aggregate (VMA) and voids filled with asphalt (VFA).
 - (7) Aggregate proportions in use at the time of sampling.
 - (8) Tons of mix that were inspected, sampled, and tested.
 - (9) Cumulative tons of mix.
 - (10) Dust to binder ratio.
 - (11) Signature location for the Department and the Contractor representative.
 - (12) Mixture moisture content.
 - (13) Department test result, when available.
- d. Submit copies of failing test results daily.
- e. Submit the asphalt loading certificates daily.
- f. Submit a daily plant diary including a description of quality control actions taken (e.g., adjustment of cold feed percentages), changes or adjustments on the test summary sheets, and the name of the qualified person who made the changes.
- g. Submit a final hardcopy summary of quality control test summary sheets and control charts at completion of paving operations. Submit the quality control test summary sheets, control charts, and density worksheets.

Documentation/Control Charts. Record the following data on standardized control charts and make them available daily. The Contractor will generate control charts and summary sheets using approved methods. Plot individual test results for each test point. Connect individual points with a solid line. Show specification limits and tolerances on the control chart, where applicable. Document corrective actions taken on summary sheets. Include tests and plots in the project files. Plot control charts as follows:

- a. Aggregate Gradation. Test aggregate gradation in accordance with AASHTO T 30, at the frequency in the QASP Table 106.03-1, and plot the results on control charts for each sieve in 703.05. Plot the target gradation for each sieve from the C-JMF and plot the upper and lower specification limit for each sieve on the control charts. The control charts will be used by the Contractor as an aid to control the paving operation.
- b. Asphalt Binder Content, P_b . Test asphalt binder content in accordance with AASHTO T 308 at the frequency in the QASP Table 106.03-1 for Superpave HMA and plot the results on a control chart. Plot the target asphalt binder content from the C-JMF and plot the upper and lower specification limit on the control chart. The control chart will be used by the Contractor as an aid to control the paving operation.

- c. Theoretical Maximum Specific Gravity. Test G_{mm} , in accordance with AASHTO T 209 or ASTM D6857, at the frequency in the QASP Table 106.03-1 and plot the results on a control chart. Use at least 2 determinations that do not vary by more than 0.014. The average of 2 determinations constitutes 1 test result. Allow material to cool to room temperature.
- d. Bulk Specific Gravity of Compacted Mixture. Test G_{mb} in accordance with AASHTO T 166 at the frequency shown and determine G_{mb} using the average of 2 compacted gyratory specimens sampled and tested as specified in the QASP Table 106.03-1. The 2 determinations must not vary by more than 0.009. Use this value in calculations requiring a G_{mb} value. Condition loose asphalt mixture samples for at least 2 hours before testing to allow for binder absorption. Time begins when the binder is introduced to the aggregate. Condition material used for acceptance tests. Match test condition time for material used for acceptance tests to the field conditions of the field compacted mixture. The Contractor must show the Engineer that absorption is complete in less than 2 hours in the field to shorten condition time. Do not over-condition the material by keeping the samples at an elevated temperature.
- e. Production Air Voids (P_a). Calculate air voids at the frequency in the QASP Table 106.03-1 and plot the results on a control chart. Target 4.0 percent air voids during production paving. Calculate P_a by using the values of the G_{mm} and the G_{mb} determined above.
- f. Voids in Mineral Aggregate (VMA). Calculate VMA at the frequency in the QASP Table 106.03-1 and plot the results on a control chart. The Contractor will target the VMA value from the C-JMF during production paving. Calculate VMA by using the G_{mb} value determined from samples taken during production paving and the G_{sb} value determined for the mix design. Determine percent aggregate content, P_s , from the samples taken during production paving by using this equation: $100 - P_b$. The Department will not recalculate G_{sb} during the project.
- g. Voids Filled With Asphalt (VFA). Calculate VFA and plot the results at the frequency shown for VMA and P_a in the QASP Table 106.03-1 using the values for VMA and P_a . Take action to correct mixtures that do not remain within the range specified in the QASP Table 106.03-1.
- h. Dust to Binder Ratio/Dust Proportion (DP). Calculate dust to binder ratio or dust proportion using the value for P_b , the value for minus # 200, and the value for G_{mm} and plot the results at the frequency shown for VMA and P_a in in the QASP Table 106.03-1. Take action to correct mixtures that do not remain within the range specified in the QASP Table 106.03-1.
- i. Production Limits. Apply the limits in QASP Table 106.03-3 to the production paving test properties and plot on control charts.

Table 405.03-5 – Production Paving Quality Limits

Quality Characteristic	Limits
SP 2 Mixture	
No. 4 sieve and larger sieves, %	C-JMF value \pm 5.0 ^(a)
No. 8 to No. 30 sieves, %	C-JMF value \pm 4.0 ^(a)
No. 50 to No. 100 sieves, %	C-JMF value \pm 3.0 ^(a)
No. 200 sieve and smaller sieves, %	C-JMF value \pm 1.5 ^(a)
Asphalt Binder Content, %	C-JMF value \pm 0.3
SP 3 and SP 5 Mixtures	
Laboratory Air Voids, % N_{design}	4.0 \pm 1.0
VMA, % N_{design}	703.05 minimum value - 0.05 ^(b)
VFA	Table 405.02-1 value \pm 5
Dust to Binder Ratio, DP	Table 405.02-1 value \pm 0.1

^(a) The upper and lower specification limits are never allowed to be outside the control points specified in 703.05.

^(b) For purposes of quality analysis calculations.

K. Spreading and Finishing. Place the mixture on an approved surface. Use pavers to distribute the mixture over the entire width or over a partial width as practical. Do not extend partial width paving beyond one day's production. Place Superpave HMA in a single lift.

Use pavement marking tape to temporarily mark roadway centerline on pavements being used by traffic as specified in 626.03.

Unless otherwise specified, equip the paver with a shoe on the outside to provide slopes as follows:

The Engineer will allow an 18-inch-wide shoe for depths 0.2 foot or less on initial pavement placement. The shoe must be 24 inches wide for depths greater than 0.2 foot. The shoe must be 24 inches wide on pavement overlays.

L. Compaction. Compact Superpave HMA as quickly as possible after placing. Use compaction equipment and/or rolling methods to produce the required compaction without damaging the work. Provide vibratory steel-wheel or pneumatic tire type rollers, in good condition, capable of reversing without backlash and operating at speeds slow enough to avoid displacement of the mixture. Use the number and compactive force of rollers that is sufficient to compact the mixture as specified in this subsection. Do not use equipment which results in excessive crushing of the aggregate. The Engineer will reject rollers producing pickup, wash-board, uneven compaction of the surface, or other undesirable results.

Rolling equipment to be used and its relative position in the compaction sequence is the Contractor's option as long as the specification densities and smoothness are attained. Independently operate each roller used. Rolling equipment used for the acceptance test strip will be the same type and weight as will be used for subsequent pavement compaction. To accommodate full production, the Contractor may use additional rollers more than the number used in construction of the test strip.

Do not operate vibratory rollers in the vibratory mode when the internal mix temperature is less than 175 °F or when checking or cracking of the mat occurs at a higher temperature, unless otherwise allowed or because WMA is used.

Follow the paver as closely as possible with breakdown rolling. Perform intermediate rolling as near as possible to the optimum temperature for compaction as determined by written instructions of the asphalt product supplier. Perform finish rolling at as high of a temperature as practical to eliminate marks from previous rolling.

Begin rolling at the sides and proceed longitudinally parallel to the road centerline, with each trip overlapping $\frac{1}{2}$ the roller width. When paving in echelon abutting a previously placed lane, roll the longitudinal joint first, followed by the regular rolling procedure. On super elevated curves, begin the rolling at the low side and progress to the high side by overlapping the longitudinal passes parallel to the centerline.

Do not displace the line and grade of the pavement edges.

Keep the wheels properly moistened with water or water mixed with very small quantities of detergent or other approved material to prevent adhesion of the mixture to the rollers. Do not use excess liquid. Do not apply diesel fuel, kerosene, or other solvents to roller drums or tires to prevent adhesion of the mixture.

Thoroughly compact the mixture with mechanical tampers or other approved compactors along forms, curbs, headers, walls, and other places not accessible to rollers. Remove the mixture from the gutter surface before rolling.

Compact the pavement to a density between 92.0 percent and 97.0 percent of maximum theoretical density for SP 2, SP 3, and SP 5 mixes.

Following acceptance test strip approval, pavement density testing for acceptance will be performed by the Department using a gauge with the readings corrected by cores in accordance with AASHTO T 355 or FOP for AASHTO T 343. The Department will use the average G_{mm} of the test section corresponding to the Contractor's JMF to determine densities for the specified mix production paving. The Contractor is responsible for quality control testing.

When an acceptance test strip is not required, the Department will base acceptance for pavement density on the density of cores taken from the finished pavement. Obtain 5 randomly located core samples in accordance with the FOP for AASHTO R 67 from the compacted Superpave HMA in the Engineer's presence. The Engineer will determine the random core locations. Immediately submit the cores for testing. The Department will determine the density of the cores the FOP for AASHTO T 166 Method A or AASHTO T 331. In addition, obtain 3 randomly located mix samples during HMA placement, in the Engineer's presence, and immediately submit samples for testing. Obtain the samples in accordance with the FOP for AASHTO T 168 (see the QASP Table 106.03-1 Note 3). The Engineer will randomly locate the mix samples and the Department will test the mix samples to determine the G_{mm} value in accordance with the FOP for AASHTO T 209 or ASTM D6857. The Department will use the average of the 3 G_{mm} values to compute in-place density of the cores taken for density acceptance. If paving will be performed in different construction seasons (e.g., bridge approaches), obtain 5 additional cores from the compacted Superpave HMA and 3 additional mix samples for density acceptance when paving resumes. The Contractor is responsible for quality control testing.

Repair holes left in the pavement by the coring operation with non-shrink grout at no additional cost to the Department. Do not begin coring until repair methods and materials have been approved.

M. Joints. Do not roll over the unprotected end of freshly laid mixture. Form transverse joints by cutting back on the previous run to expose a vertical edge the full depth of the course.

Slope the cold transverse construction joints open to public traffic at 20H:1V. Remove the sloped surface (ramp) without damage to the base just before paving is resumed. Test the new joint for smoothness as specified in 405.03.P.

Construct end transitions between overlays and the adjoining pavement by milling a wedge out of the adjoining pavement, starting at the surface and continuing into the adjoining pavement on a 200H:1V slope or flatter until a vertical edge equal to 0.15 foot or the depth of overlay is reached. Transitions to ramps and crossroads are transverse joints. The milled wedge is a transverse joint when the adjoining pavement is concrete. Mill the wedge from the pavement to be overlaid, with the vertical edge against the concrete, when the adjoining pavement is concrete. Taper transitions between overlays and approaches to form a smooth transition while maintaining drainage.

Provide a positive bond, density, and a finish surface to the new mixture at longitudinal joints that is equal to the mixture against which it is placed. The Engineer may take density tests at longitudinal joints to ensure the integrity of material in the joint area.

Locate the longitudinal joint in the top course at the centerline of the traveled way if the roadway is two lanes wide or at the lane lines if the roadway is more than 2 lanes wide. On the lower courses, stagger the longitudinal joint and offset it 6 inches to 1 foot from the centerline of the traveled way if the roadway is 2 lanes wide or from the lane lines if the roadway is more than 2 lanes wide. Match the pavement surface across a longitudinal joint with the transverse slope shown on typical sections.

Test joints, except crowns, for smoothness in accordance with Idaho IR 87. Use an approved 10-foot straightedge. Complete the test and necessary corrections before the material temperature drops below 175 °F.

Place longitudinal joints straight and true. Use approved methods to bring back to straight and true unacceptable deviations. Make adjustments as needed to achieve the specified results.

Obtain approval for Superpave HMA mix design(s) before the start of milling operations.

N. Miscellaneous Pavement. Place miscellaneous Superpave HMA pavement in irregular areas (e.g., raised or depressed medians, gores, tapers, radii (excluding approach radii), tapered paving for guardrail terminal widening). Include areas that taper from 0 to 8 feet maximum width and gore areas from roadway shoulders to termini in this work. Do not include pavement widening for installation of guardrail in this work.

O. Leveling Course. Construct the leveling course of Superpave HMA, with a compacted thickness greater than 0.2 foot, in multiple courses.

Place the leveling course on the existing surface in quantities as approved. Use pavers and/or motor graders and a sufficient number of pneumatic tire rollers to adequately place and compact the leveling course to the required cross-section and grade. Use a steel-wheel roller for final rolling if the leveling course is to be used as a wearing course or if a seal coat is to be applied.

When blade laid leveling course is specified, place Superpave HMA in wheel ruts and other surface irregularities. Blade Superpave HMA into the low areas using a motor grader. Normally, 2 passes are required to fill depressions. Follow each pass of the motor grader with a pneumatic tired roller to provide compaction. Position the blade of the motor grader so light contact with the existing pavement surface is maintained. The Contractor may dispose of excess coarse aggregate resulting from placing the blade laid leveling course along the edge of the roadway.

When machine laid leveling course is specified, place Superpave HMA on the roadway with a paver to restore crown, super elevation, or rideability. Operate the screed close to the existing pavement surface. The Engineer will accept minor surface tears from this operation. Use pneumatic and vibratory rolling for compaction.

P. Surface Smoothness. Place pavement complying with Schedule II.

For Schedule III only, perform pre-paving, quality control, and acceptance surface smoothness testing, analyze the results of this testing, and submit the results. Submit pre-paving results. Before paving, submit a plan showing how Schedule III smoothness will be achieved.

Submit quality control results by the next working day following placement.

If the quality control testing results show surface smoothness is not within the acceptable specification limits, suspend paving operations until it can be shown the steps taken to modify operations will result in acceptable smoothness.

Perform acceptance testing on the final lift and submit the results before corrective action. Complete acceptance testing within 1 week of paving completion.

Perform quality control testing in international roughness index (IRI). Request to use quality control testing for acceptance before the start of paving.

Acceptance surface smoothness testing must be verified by the Engineer. The profile run must be witnessed by the Engineer and a preliminary copy of the report submitted immediately after the end of the run. The Engineer will not accept the testing, unless witnessed. Submit the profile data in a format suitable for evaluation using ProVAL or other industry standard software. Do not perform corrective action until approved.

The Engineer may elect to perform additional testing for verification. If the results vary from the Contractor's IRI results by more than 10 percent, the Engineer will use the Department's IRI results for acceptance.

Use Class 1 or Class 2 profilers as defined in ASTM E950. Operate profilers in accordance with the manufacturer's instructions and AASHTO R 57. Set the profiler as follows:

1. High pass or pre-filter: off or at least 200 feet.
2. Bump detection: on
3. Dip detection: on
4. Resolution: 0.01 inch
5. Low pass filter: off
6. Other filters: off

Measure the finished pavement as follows:

1. Test the surface with a 10-foot straightedge at locations determined by the Engineer. Identify the locations that vary more than $\frac{1}{4}$ inch from the lower edge when the straightedge is laid on finished pavement in a direction parallel with centerline or perpendicular to centerline. Remove the high points that cause the surface to exceed the $\frac{1}{4}$ inch tolerance by grinding.
2. Profile the surface 3 feet from and parallel to each edge of each traffic lane. The Engineer will use the average of the results for each 0.1 mile section to calculate incentive payments and determine sections requiring corrective action.

The Department requires the pavement to comply with the following surface smoothness schedule requirements:

- a. Where longitudinal grade is 6.5 percent or less, pavement on tangent alignment and pavement on horizontal curves having centerline radius of curve 1,000 feet or more must meet the surface smoothness requirements for the smoothness schedule specified. The Engineer will add consecutive 0.1 mile sections of roadway tested together to obtain the mile section. There will be no overlapping of the 0.1 mile or 1 mile sections to change cumulative test results.

(1) Smoothness Schedule using IRI:

- (a) Schedule I Projects: Target IRI values range from 60.0 to 70.0 inches per mile per 0.1 mile. Corrective action required above 9.5 inches per 0.1 mile.
- (b) Schedule II Projects: Target IRI values range from 71.0 to 80.0 inches per mile per 0.1 mile. Corrective action required above 95.0 inches per mile per 0.1 mile.
- (c) Schedule III Projects: Target IRI value range defined as one of the following:
 - i. For sections with a prepaving IRI less than 160.0 inches per mile per 0.1 mile the final index must not exceed 80.0 inches per mile per 0.1 mile.
 - ii. For sections with a prepaving IRI of 16.0 inches per 0.1 mile or greater, use the smoother of either:
 1. A 50 percent improvement of the pre-paving index.

2. A maximum final index of 100.0 inches per mile per 0.1 mile. Corrective action is required above the target IRI.
 - b. The Engineer will exclude acceptance test strips, pavement on horizontal curves having a centerline radius of curve of less than 1,000 feet and pavement within the super elevation transition of such curves, or pavement with a longitudinal grade greater than 6.5 percent from incentive/disincentive payments. Meet the corrective action requirements for the smoothness schedule specified.
3. Profile the pavement to provide continuous, uninterrupted profile data. The Department will not apply profile smoothness tolerances and incentive/disincentive payments to the following:
 - a. Pavement within 50 feet of a transverse joint that separates the pavement from a structure deck, an approach slab, or an existing pavement not constructed under the contract.
 - b. Pavement for approaches and structure decks.
 - c. Roadways with a speed limit less than 40 mph.
 - d. Interstate ramps.

Smoothness acceptance for these areas will be as specified with straightedge requirements.

Do not profile pavement for approaches.

Operate the profiler at a speed equal to or less than the manufacturer's recommended speed. Calibrate the profiler at the beginning of the work and as needed thereafter.

Grind individual high points in excess of 0.3 inch within 25 feet or less, as determined by the California Profilograph simulation, until such high points do not exceed 0.3 inch.

After individual high point grinding has been completed, perform additional grinding in sections requiring corrective action to reduce the IRI to a maximum of 80.0 inches per mile per 0.1 mile section along lines parallel with the pavement edge.

Grind parallel to centerline. Extend adjacent grinder passes, within ground area, to produce a neat rectangular area having a uniform surface appearance. Make smoothly feathered transitions at transverse boundaries between ground and unground areas. Apply a fog coat to the ground pavement surface as specified in 408 after grinding has been completed.

Use power-driven grinding equipment that is specifically designed to smooth portland cement concrete pavement with diamond blades. Use a machine with an effective wheelbase at least 12 feet and a cutting width of at least 3 feet. Instead of diamond grinding, the Contractor may use a self-propelled milling machine of the type used for removal of asphalt pavement provided a special milling head is used that is designed to provide a texture similar to diamond grinding. Use a milling head with cutting teeth that do not exceed a spacing of 0.2 inch. Restrict the machine forward speed to 5 feet per minute while milling. If the texture produced by milling is unsatisfactory, the Engineer will require diamond grinding. Provide grinding or milling equipment of a shape and dimension that does not encroach on traffic movement.

Check the pavement for smoothness after grinding as specified in this subsection and make additional corrections necessary to achieve smoothness. Submit a report and graph showing compliance of the final surface to the smoothness requirements. The Department will not pay for the cost of grinding, milling or related work (e.g., fog coat), disposal of milled material, traffic control, flagging, profiling, surface repair of ground or milled areas, or temporary striping.

If correction of the roadway as specified will not produce satisfactory smoothness results or it reduces pavement thicknesses and serviceability, the Engineer may accept the completed pavement and will deduct from monies due or may become due to the Contractor the sum of \$500 for each individual high

point or \$3,000 for each 0.1 mile section. Under these circumstances, the Engineer's decision whether to accept the completed pavement or to require corrections is final.

405.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Pavements, leveling courses, and asphalts by the ton. The Engineer will not permit batch weights as a method of measurement. The Superpave HMA quantity will be the weight used in the accepted pavement and will include the weight of the aggregate, asphalt, and additives in the mixture.
2. Anti-stripping additive by the percentage of additive per ton of asphalt.
3. Miscellaneous pavement by the square yard. Final measurement will be based on plan quantities, unless changed by the Engineer. Miscellaneous pavement measurement is in addition to the measurement of asphalt and Superpave HMA material.
4. Approaches per each regardless of width or length. Separate mailbox turnouts will be measured as an approach. Mailbox turnouts adjacent to an approach will be considered as part of the approach and no separate measurement will be made. Approach measurements are in addition to the measurement of asphalt and Superpave HMA material.
5. Wedge milling for the transition section by the square yard.
6. Tack coat will be paid for as specified in 401.

405.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Superpave HMA Pavement Class SP ____	Ton
Superpave HMA Pavement, including asphalt and additives	
Class SP	Ton
Leveling Course Class SP	Ton
Leveling Course, including asphalt and additives, Class SP	Ton
____Asphalt Binder for Superpave HMA Pavement	Ton
____Percent Anti-stripping Additive for Superpave HMA Pavement	TOA
Miscellaneous Pavement	SY
Approaches	Each
Wedge Milling.....	SY

The cost to produce the required aggregate in each stockpile to accommodate blends is incidental and included in the contract unit price for the Superpave HMA contract pay item.

When Superpave HMA includes RAP in any proportion, the Department will not include the asphalt binder contributed by the RAP in the quantity for asphalt and additives when asphalt and additives are paid for separately.

For each evaluation section, the Contractor is entitled to a payment adjustment excluding acceptance test strips and Schedule III surface smoothness work. An evaluation section is defined as a 0.1 mile per traffic lane or fraction as applicable. The Department will not pay an incentive for pavement on the roadway shoulders, center turn lanes, turn bays, crossovers, tapers, or other miscellaneous pavement. The Department will pay incentive as specified in Table 405.05-1.

Table 405.05-1 – IRI Initial inches per mile per 0.1 mile section

Payment \$ per 0.1 mi	Schedule I	Schedule II
\$500	40.0 or less	45.0 or less
\$300	41.0 to 50.0	46.0 to 60.0
\$100	51.0 to 60.0	61.0 to 70.0
\$0	61.0 to 70.0	71.0 to 80.0
-\$100	71.0 to 75.0	81.0 to 85.0
-\$300	76.0 to 85.0	86.0 to 95.0
-\$500	86.0 to 95.0	—
-\$500 and corrective action	96.0 or greater	96.0 or greater
-\$300 and corrective action	Individual high points	Individual high points

The Department will make only 1 incentive payment per evaluation section. An evaluation section runs consecutively from the point paving begins to the point paving is interrupted (e.g., at bridges, the end of lane paving areas specifically excluded by the specifications). The Department will prorate partial sections based on their percentage of a full section.

The Department will base incentive payments on initial profiles before corrective work on the top course of paving.

SECTION 406 – ROAD MIX PAVEMENT

406.01 Description. Construct 1 or more courses of road mix pavement on a prepared base or road surface.

406.02 Materials. Provide asphalt of the type and grade specified.

Provide asphalt and anti-stripping additive as specified in 702, if required. The Engineer will accept the asphalt at the point of delivery.

Provide aggregate as specified in 703. The Engineer will accept the aggregate at the point of delivery from Contractor-provided sources or the crushing plant from designated sources.

406.03 Construction Requirements.

A. Season and Moisture Limitations. Do not apply asphalt if surface or weather conditions prevent proper construction.

Do not construct road mix pavement before May 15 or after September 15.

B. Equipment. Provide scarifying, mixing, spreading, finishing, and compacting equipment, an asphalt distributor, and equipment for heating the asphalt.

Ensure the distributor is designed, equipped, maintained, and operated so asphalt can be applied uniformly on variable widths of surface at readily determined and controlled rates with uniform pressure. Provide distributor equipment that includes a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Equip distributors with a power unit for the pump and full-circulation, vertically adjustable spray bars.

Use compaction equipment and/or rolling methods to produce the required compaction without damaging the work.

C. Preparation of Roadbed. Uniformly compact the roadbed surface. Keep the prepared base in good condition before placing the bituminous surface course.

Leave the prime coat undisturbed for at least 24 hours. Spread blotter as specified in 402 in an approved quantity to absorb the excess asphalt, if the asphalt does not penetrate and the roadway must be used by traffic.

Allow the tack coat to dry until it is tacky enough to receive the road mix material.

D. Placing Aggregate. Uniformly spread aggregate on the road by the use of spreader boxes or other approved mechanical spreading devices.

E. Application of Asphalt. Uniformly distribute the asphalt in successive applications, in quantities and at intervals, as approved. Ensure the mixing equipment follows immediately behind the distributor after each asphalt application to partially mix the aggregate and the asphalt and ensure the asphalt application temperature is as specified.

F. Mixing. Windrow the entire mass of asphalt and aggregate on the road surface after the last asphalt application and partial mixing, and then mix until aggregate particles are coated with asphalt, the whole mass has a uniform color, and the mixture is without fat or lean spots, balls, or uncoated particles.

Avoid cutting into the underlying course or contaminating the mixture with earth or other extraneous matter during the mixing operations. The Engineer may require confining the mixing process to part of the width or area of the roadway to allow traffic to pass.

Add aggregate or asphalt as required and remix if the mixture shows an excess, a deficiency, or uneven distribution of asphalt. If the mixture contains excessive amounts of moisture or volatile matter, blade, aerate, or otherwise manipulate the mixture until the moisture and volatile contents are satisfactory. Do not spread the mix if the surface to be covered is in unsatisfactory condition.

Blade loose material into a windrow at the end of each day's work or when the work is interrupted by weather or other conditions, whether mixing is completed or not, and keep in a windrow until operations are resumed.

G. Spreading, Compacting, and Finishing. Spread the material by a patrol or a mechanical spreader as approved. Avoid cutting into the underlying base if spreading from the windrow.

Roll the surface after the material is spread. Use compaction equipment and/or rolling methods to produce the required compaction without damaging the work. Perform initial rolling with a pneumatic-tire roller and final rolling with a 3-wheel or tandem-type steel-wheel roller. Roll parallel to the road centerline starting at the outer edges of the road, overlapping the shoulders and progress toward the center, overlapping on successive passes by at least ½ the width of the roller, except on superelevated curves where rolling progresses from the lower to the upper edge. End each pass at least 3 feet in advance or to the rear of the end of the preceding pass. Blade the surface during compaction to fill ruts and remove incipient corrugations or other irregularities as necessary. Continue rolling until the surfacing is a uniform texture and meets the compaction specified.

H. Surfacing Approaches. Construct road mix pavement on approaches as specified or as directed.

I. Surface Smoothness. The Engineer will test the completed surface in accordance with Idaho IT 87. Ensure the surface does not vary more than ¼ inch from a 10-foot straightedge.

J. Aggregate for Road Mix Pavement in Stockpile. Provide aggregate material in stockpiles at approved locations.

Prepare the stockpile site by clearing and smoothing as directed. Construct stockpiles that are neat and regular in form and occupy as small an area as possible. Construct by first distributing the material to be stockpiled over the entire base and building upward in successive layers at least 3 feet in depth. Do not end-dump or convey materials over the sides of the pile.

406.04 Method of Measurement. The Engineer will measure acceptable work as follows:

1. Aggregate and asphalt for road mix pavement by the ton.
2. Anti-stripping additive by the percentage of additive per ton of asphalt.
3. Approaches by the each paved regardless of size.
4. Aggregate for road mix pavement in stockpile by the ton or cubic yard.

406.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Aggregate for Road Mix Pavement	Ton
Approaches	Each
Aggregate for Road Mix Pavement in Stockpile	Ton or CY
Aggregate for Road Mix Pavement, Load, Haul, and Place	Ton
Emulsified Asphalt for Road Mix Pavement	Ton
Percent Anti-Stripping Additive for Road Mix Pavement	TOA

SECTION 407 – SCRUB COAT

407.01 Description. Construct a scrub coat on the road surface.

407.02 Materials. Provide asphalt of the type and grade specified. Provide asphalt and anti-stripping additive as specified in 702, if required. The Engineer will determine acceptability of the asphalt at the point of delivery.

Provide aggregate for scrub coat as specified in 703.04.

The Contractor does not need to use multiple stockpiles. The Engineer will determine acceptability of the aggregate from the Contractor-provided sources at the point of delivery and at the crushing plant from designated sources.

407.03 Construction Requirements.

A. General. Do not place scrub coat material on wet or frozen surfaces. Ensure the ambient and surface temperature is 60 °F and rising. Clean the surface by brooming or other approved methods.

B. Mixing. Mix the plant mix scrub coat as specified in 405.03. Mix the road mix scrub coat as specified in 406.03. Produce mixtures at the lowest temperature that will produce a uniform workable mixture not exceeding 165 °F.

C. Equipment. Use compaction equipment and/or rolling methods to produce the required compaction without damaging the work.

D. Spreading, Compacting, and Finishing. Apply the tack coat as specified in 401, before applying the scrub coat.

Sufficiently aerate the scrub coat material before spreading. Spread and tight blade from shoulder to shoulder or as directed. Fill depressions, irregularities, and cracks and smooth to create a uniform surface. Roll with pneumatic-tire rollers concurrently with the spreading. Finish roll with a steel-wheel roller.

407.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Scrub coat, asphalt, and anti-stripping additive by the ton, if required. The Engineer will not accept batch weights as a method of measurement. A deduction will not be made for the weight of the asphalt or other additives in the mixtures.
2. Anti-stripping additive by the percentage of additive per ton of asphalt.

407.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
___ Plant Mix Scrub Coat	Ton
___ Aggregate for Road Mix Scrub Coat	Ton
___ Emulsified Asphalt for Scrub Coat.....	Ton
___ Percent Anti-Stripping Additive for Scrub Coat.....	TOA
___ Plant Mix Scrub Coat, including asphalt and additives.....	Ton

The Department will not make separate payment for asphalt and additives for plant mix scrub coat, including asphalt and additives.

SECTION 408 – FOG COAT

408.01 Description. Apply a fog coat and blotter, if required.

408.02 Materials. Provide fog coat material that is diluted emulsified asphalt. Provide the emulsified asphalt as specified in 702.

Mix approximately equal volumes of emulsified asphalt and water before application.

Provide blotter material as specified in 703. The Engineer will determine acceptability of material from the Contractor-provided sources at the point of delivery and at the source from designated sources.

408.03 Construction Requirements.

A. Equipment. Provide equipment for applying the fog coat as specified in 406.03.B and blotter material as specified in 402.03.

B. Application of Fog Coat. Apply fog coat material with a pressure distributor in a uniform, continuous spread. Ensure the distributor does not exceed 25 mph. Do not exceed the specified asphalt application rate at the junction of the spread overlap. Correct skipped areas or deficiencies.

Obtain approval for the quantities, rate of application, and temperature of the fog coat material before applying the fog coat.

Do not apply the fog coat if surface or weather conditions prevent proper construction.

Apply the fog coat so there is the least amount of inconvenience to traffic and to permit 1-way traffic without pickup or tracking. Apply the fog coat on the roadway in the same direction as traffic travels.

Place fog coat over a seal coat within 1 working day of the completed seal coat or as conditions allow.

C. Application of Blotter. Spread blotter at the approved rate to absorb the excess asphalt if the fog coat material does not penetrate and the roadway must be used by traffic.

408.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Diluted emulsified asphalt by the gallon after dilution with no correction for temperature.
2. Blotter by the ton or cubic yard.

408.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Diluted Emulsified Asphalt for Fog Coat.....	gal
Blotter.....	Ton or CY

SECTION 409 – PORTLAND CEMENT CONCRETE PAVEMENT

409.01 Description. Construct a portland cement concrete pavement as specified. Submit a proposed mix design. The Engineer will review the mix design for compliance with the specifications.

A. Classification. Proportion the materials for concrete to produce a workable concrete mix as specified in Table 409.01-1.

Table 409.01-1 – Basic Mix Design Parameters

Concrete Class in 100 psi (28 Day) ^{(a)(b)(g)}	Minimum Cementitious Content lb/yd ^{3(c)(d)(e)(f)}	Water to Cement Ratio	Slump in	Air Content Percent
45	660	0.42 maximum	2 maximum	4-7

- (a) The class of concrete is the specified compressive strength when using the applicable tests as specified in 409.02.
- (b) A design value of 5,600 psi is specified to achieve the specified compressive strength.
- (c) Cementitious is cement plus secondary cementitious material (SCM).
- (d) It may not always be possible to produce concrete of the required strength using the minimum cementitious contents. No separate payment will be made by the Department for additional cementitious material required to meet specified strength.
- (e) Use SCM as specified in 714.
- (f) It may not always be possible to produce concrete using the minimum SCM content that will ensure mortar bar expansion does not exceed 0.10 percent expansion when tested in accordance with ASTM C1567, AASHTO TP 110, or CRD C662. If additional SCM is needed to meet mortar bar expansion requirements, the Contractor may add it without a corresponding increase in cement provided the strength requirements are met. Obtain approval to add lithium or other mitigating measures to meet the mortar bar expansion requirement.
- (g) Concrete class designated as Class F will contain SCM. Minimum SCM content varies by product, for fly ash and slag cement (slag) minimum content is 20% by weight of total cementitious material. Fly ash will not exceed 25% of total cementitious material. Slag will not exceed 35% of the total cementitious material. Ternary and quaternary blends will contain at least 20% SCM. Total SCM content will not exceed 50%.

B. Acceptance. Concrete acceptance is based on compliance with parameters specified for paving concrete. Strength is accepted based on the results of the 28-day compressive strength tests determined in accordance with AASHTO T 22. The average strength of 3 companion cylinders is 1 test.

When the 28-day strength for a test falls below the specified strength, concrete represented by that test is subject to rejection or a price adjustment.

The Engineer may accept paving concrete at a reduced price, if the strength is within 10 percent of the specified strength. Concrete represented by tests more than 10 percent below specified strength is subject to rejection.

Remove unacceptable concrete at no additional cost to the Department.

The Engineer will use Table 409.01-2 to determine the unit price adjustment of failing paving concrete allowed to remain in place.

Table 409.01-2 – Unit Price Adjustment

Percent of Specified Strength	Pay Factor
≥ 100	1
≥ 95 < 100	0.9
≥ 90 < 95	0.8
< 90	Subject to rejection ^(a)

^(a) If allowed to remain in place, the pay factor will be 0.50.

The Department will pay for the accepted concrete quantity at the contract unit price multiplied by the price adjustment pay factor as determined from Table 409.01-2.

Core drilling, at no additional cost to the Department, is an acceptable alternative test to dispute test results for concrete subject to price adjustment or rejection. The Engineer will determine the location and number of cores and witness coring and testing. Repair holes left by the coring operation at no additional cost to the Department. Obtain approval for repair methods and materials before beginning repairs.

Cores obtained within 42 calendar days of the time of placement will be considered by the Department as representing the 28-day strength. Cores obtained after 42 calendar days will only be acceptable to the Engineer when the Contractor submits a correlation curve developed by a Department approved independent testing laboratory to relate strength at the actual test age to 28-day strength for the particular class and design mix represented by the cores.

The Department and the Contractor agree to accept the results of the tests of the drilled cores instead of the results of the test cylinders when drilled cores are approved as the method of determining strength.

Obtain and test cores in accordance with AASHTO T 24 with the following exceptions:

1. Protect cores from moisture gain or loss.
2. Test as soon as possible without further conditioning other than preparation of the ends, if needed.

Take at least 3 representative cores from each area of in-place concrete that is considered potentially deficient. Replace cores that show evidence of damage during coring or removal with a new core before testing. Tests performed by an approved independent testing laboratory on cores taken from the work may include compressive strength, cement content determined by ASTM C1084, and petrographic analysis determined by ASTM C856, including water cement ratio and air content.

Remove concrete represented by cores with an average strength less than the specified strength, unless accepted at a reduced price by the Engineer.

Make corrective changes in the materials mix portions, concrete fabrication procedures, or other corrective action before continuing to use concrete that does not comply with the specified compressive strength, at no additional cost to the Department. If results of 7-day strength tests are low or show a downward trend, predicting concrete may not meet the specified 28-day strength, make corrective changes. Changes are subject to approval.

409.02 Materials. Provide materials as specified:

Portland Cement.....	701
Aggregate	703
Joint Fillers and Sealers	704
Silicone Joint Sealant	704.05
Reinforcing Steel	708.02
Dowel Bars	708.03
Tie Bars	708.04
Membrane-Forming Curing Compound, System 2	709.01
Air-Entraining Admixtures	709.03
Set Retarding Admixtures	709.04
Water-Reducing Admixtures	709.05
Lithium Nitrate Admixtures.....	709.06
Secondary Cementitious Materials	714

Water	720.01
Epoxy- Resin- Base Bonding Systems	720.04

The Engineer will determine acceptability of aggregate at the concrete mixing plant.

Obtain approval of admixtures before use.

Determine an aggregate correction factor in accordance with AASHTO T 152 and submit with each mix design.

Test in accordance with the following standard methods:

Compressive Strength of Cylindrical Concrete Specimens	AASHTO T 22
Making and Curing Concrete Test Specimens in the Field (Use 6 inch diameter by 12 inch single use molds made of plastic.)	AASHTO T 23
Obtaining and Testing Drilled Cores and Sawed Beams of Concrete (Provisions of AASHTO T 24 relating to ASTM and American Concrete Institute (ACI) references do not apply).....	AASHTO T 24
Slump of Hydraulic Cement Concrete	AASHTO T 119
Mass Per Cubic Foot (Cubic Meter), Yield, and Air Content (Gravimetric) of Concrete Including Cement Content.....	AASHTO T 121
Making and Curing Concrete Test Specimens in the Laboratory (Use 6 inch diameter by 12 inch single use molds made of plastic.)	AASHTO R 39
Measuring Length of Drilled Concrete Cores.....	AASHTO T 148
Air Content of Freshly Mixed Concrete by the Pressure Method	AASHTO T 152
Measuring Texture Depth of Portland Cement Concrete Using a Tire Tread Depth Gauge	Idaho IT 147
Pavement Straightedge Procedures	Idaho IT 87
Standard Practice for Operating an Inertial Profiler System	AASHTO R 57
Method of Testing Thickness of Plastic Concrete Pavement	Idaho IT 130
Determination of the Rate of Evaporation of Subsurface Moisture from Concrete	Idaho IT 133
Determining the Percentage of Fracture of Coarse Aggregate	AASHTO T 335 Method 1
Sampling Freshly Mixed Concrete	WAQTC TM 2
Standard Test Method for Determining the Potential Alkali Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).....	ASTM C1567
Temperature of Freshly Mixed Portland Cement Concrete.....	AASHTO T 309
Determining the Potential Alkali Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)	CRD C 662
Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression	ASTM C469

Standard Test Method for Length Change of Hardened Hydraulic Cement for Mortar and Concrete	ASTM C157
Coefficient of Thermal Expansion of Hydraulic Cement Concrete	AASHTO T 336
Standard Method of Test for Surface Resistivity Indication of Concrete's Ability to Resist Chloride Ion Penetration	AASHTO T 358
Standard Method of Test for Potential Alkali Reactivity of Aggregates and Effectiveness of ASR Mitigation Measures	AASHTO TP 110

409.03 Construction Requirements.

A. Proportioning. The concrete mix design is the Contractor's responsibility and includes making and testing compressive strength specimens. Make and test compressive strength specimens using the Contractor's laboratory or a Department-approved independent laboratory. Uniquely identify each mix design submitted.

For work exceeding 2,500 cubic yards, submit the following at least 60 calendar days before proposed use:

1. The proposed mix design.
2. Copies of test reports.
3. Data.
4. Worksheets.
5. Samples of the proposed aggregate, cement, SCM, and admixtures.
6. "Final set" time with the mix design as measured using AASHTO T 197M / T 197.
7. Mixing water source.
8. Proposed curing compound.
9. Theoretical maximum density.
10. Rate of development of electrical resistivity to 28 calendar days.
11. Modulus of elasticity at 28 calendar days.
12. Drying shrinkage.
13. Coefficient of thermal expansion.

Do not produce concrete until the mix design is approved by the Central Materials Laboratory.

For work less than 2,500 cubic yards, submit the following at least 14 calendar days before proposed use:

1. The proposed mix design.
2. Copies of test reports.
3. Data.
4. Worksheets.
5. "Final set" time with the mix design as measured using AASHTO T 197M / T 197.
6. Mixing water source.
7. Proposed curing compound.
8. Theoretical maximum density.
9. Rate of development of electrical resistivity to 28 calendar days.

10. Modulus of elasticity at 28 calendar days.
11. Drying shrinkage.
12. Coefficient of thermal expansion.

Do not produce concrete until the mix design is approved.

Limit the fine aggregate by weight of total aggregate to 40 percent in the proposed mix designs. Use only angular coarse aggregate. Angular aggregate is defined as having greater than 40 percent fractured faces. The Department will base fracture on the aggregate particles retained on the No. 4 sieve with 1 or more fractured faces as determined by AASHTO T 335 Method 1.

The minimum mix design compressive strength is 5,600 psi when tested at 28 calendar days and is determined from the average of 3 specimens produced and cured in the laboratory. In addition to strength, report the air content and slump. Strength data is valid only if air content, slump, and water-cement ratios are within the required limits for the specified mix class.

Use the cement, SCM, and other mitigative additives proposed for use in the mix design to produce laboratory specimens in accordance with ASTM C1567 or AASHTO TP 110. If lithium nitrate is used to mitigate ASR, perform CRD C 662. When performing ASTM C1567 or CRD C 662 limit mortar bar expansion to 0.10 percent or less. When using AASHTO TP 110 limit expansion to 0.02 percent or less at 56 calendar days or 0.04 percent or less at 112 calendar days. Perform testing on the coarse and fine aggregates together or separately. If testing is performed on the coarse and fine aggregates together, report the blend percentage on the test and be within 2 percent of the blend percentage used in the mix design. If tested separately, use mitigation based on the aggregate requiring the most mitigation.

Use number 4 coarse aggregate. Establish the exact proportions from trial mixes from the materials to be used in the work and make adjustments to use the least amount of sand necessary to produce concrete with the required workability and strength.

At the Contractor's option, a combined gradation number 4C may be used. Design the proposed mix using KU Mix from the University of Kansas and submit for approval. Include documentation and worksheets in the submittal. Base the combined gradation and sand equivalent on the average of the stockpile as determined by the production quality control tests. Submit quality control charts and tests with the mix design. The Contractor may reduce minimum cementitious material contents by 20 percent if a combined gradation is used.

If the contract does not require SCM, the Contractor may submit a mix design subject to the same requirements as if the contract requires SCM. Do not vary calcium oxide (CaO) content more than 2 percent above that used for ASTM C1567 or AASHTO TP 110 testing where fly ash is used in the concrete mix for ASR mitigation. If the fly ash has a CaO content greater than 2 percent above the fly ash used for testing, additional ASTM C1567 or AASHTO TP 110 testing at the higher CaO content is required by the Department.

Wherever SCM are is used, use the same SCM source, cement source (mill), and cement type throughout the work for each mix design. Submit lab test reports to verify the revised mix design meets specification requirements.

A 3.5 inch maximum slump is allowed for hand finishing if a slipform concrete paver is not used to construct concrete pavement.

A 4.5 inch maximum slump and a 5 percent reduction in 28-day compressive strength is permissible for concrete medians and other nontraveled surfaces, excluding shoulders.

B. Equipment.

1. Mixers and Hauling Equipment.
 - a. Mixers, agitators and nonagitator hauling equipment. Mixers may be stationary mixers or truck mixers. Agitators may be truck mixers or truck agitators. Equip truck mixers and agitators with an

- accessible revolution counter for the drum, blades, or paddles to verify revolutions. Ensure a National Ready Mix Concrete Association (NRMCA) standard metal plate or plates are attached to each mixer and agitator by the manufacturer and plainly marked with the various uses for which the equipment is designed, the volume of the drum, the capacity of the drum or container in terms of the volume of mixed concrete, and the speed of rotation of the mixing drum or blades. Equip stationary mixers with an acceptable timing device that will prevent discharge until the specified mixing time has elapsed. Equip truck mixers with a calibrated water flow meter or other approved measuring device to control the quantity of mixing water added in the field.
- b. Provide mixers that, when loaded to the rated mixing capacity and the concrete is mixed for the time or revolutions prescribed, combine the ingredients of the concrete into a thoroughly mixed uniform mass and discharge the concrete with satisfactory uniformity as specified in 409.03.D.
 - c. Provide agitators that maintain the mixed concrete in a thoroughly mixed and uniform mass and are capable of discharging the concrete with a satisfactory degree of uniformity when loaded to rated capacity as specified in 409.03.D.
 - d. Provide nonagitating equipment with bodies that are smooth, mortar-tight metal containers capable of discharging the concrete without segregation.
2. Paving Equipment. Construct pavement using paving equipment that uniformly spreads at the proper thickness for the width of the area being paved, consolidates the freshly placed concrete and produces a finished surface meeting straightedge and profile index requirements of 409.03.K, before grinding. If the pavement produced does not meet these requirements, suspend concrete paving operations until the deficiencies or malfunction is corrected.

Use self-propelled paving machines that comply with the following:

- a. Placer/Spreader: Receive the concrete mixture into hopper(s) adjacent to the area to be paved.
 - b. Slipform paver: Equipped with automatic screed control mechanisms that operate from stringlines erected near the right and left side of the machine. Check the depth of placement at 50 feet intervals to achieve the design thickness between the outside edges after the stringlines are established.

Consolidate the concrete with internal vibrators. Limit the rate of vibration to less than 3,500 vibrations per minute for surface vibrators and 8,000 to 12,000 vibrations per minute for internal vibrators. Provide a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

Do not rest vibrators on new pavements or side forms. Connect power to the vibrators so the vibration will cease when the forward or backward motion of the machine is stopped.
 - c. Machine Paving with Forms: The Contractor may finish concrete pavement in small irregular areas as specified in 411.03.B instead of using slipform pavers, when approved.
 - d. Bridge Deck Machine: The Contractor may finish concrete pavement in small irregular areas with a concrete bridge deck finishing machine as specified in 502.03 instead of using slipform pavers, when approved. Finishing and surface test specifications apply.
3. Concrete Sawing Equipment. Provide at least 3 production saws, including 1 standby unit, adequately powered to perform the work. Provide saws that are multiple arbor or multiple blade gang saws. Mount saws operating on 3 to 4-hour old, nonrigid pavement on a work bridge so the machine weight is not placed on the new concrete. Provide adequate artificial lighting for night sawing. Maintain equipment in good working order and have it on the job before the first placement and continuously during concrete paving

operations. Maintain an ample supply of saw blades during the sawing operations. Do not pave until concrete sawing equipment is onsite and ready for use.

C. Handling, Measuring, and Batching Materials. Produce concrete that meets the approved mix design.

Submit the proportioned ingredients for each batch.

Request changes to the mix design and obtain approval from the Engineer for a new mix design before batching concrete. Minor adjustments due to varying moisture in the aggregates, changes in aggregate gradation when using a combined gradation, and minor adjustments of approved admixtures are not considered changes in the mix design and will not require another approval. Report the minor mix adjustments in writing to the Engineer before batching.

1. Measure cement by weight. Weigh cement in an individual hopper and keep separate from the aggregates until released for discharge. Attach the cement hopper to a separate scale for individual weighing or to the aggregate scale for cumulative weighing. Weigh cement before adding the other ingredients, if weighing cumulatively. Use a cement scale and weigh hopper that is separate and distinct from the aggregate weighing equipment. Provide cement batchers with a dust seal between the charging mechanism and hopper. Install the dust seal so it does not affect the weighing accuracy and is vented to permit the escape of air. Provide a self-cleaning hopper fitted with a means to ensure complete discharge. Provide sufficient wind protection to prevent interference with batching accuracy. Ensure the cement, as weighed, is within 1 percent of the design weight.
2. Measure aggregates by weight. Weigh individual aggregates within two percent of the required weights and the total weight of the aggregate within 2 percent of the total required weight. Handle aggregates from stockpiles or other sources to the batching plant so uniform grading and stable moisture content is maintained. Stockpile or bin aggregates to drain for at least 12 hours before batching aggregates produced or handled by hydraulic methods or washed aggregates. Verify aggregate gradation meets the requirements for the proposed mix design.
3. Measure water by volume or by weight. Arrange the measuring device so the measurements will not be affected by variable pressures in the water supply line. Do not use wash water as a portion of the mixing water. Weigh or measure water within 1 percent of the required amount.
4. Measure SCM by weight. Weigh the SCM within 1 percent of the design weight.
5. Measure dry admixtures by weight and paste or liquid admixtures by weight or volume. Dispense admixtures used in small quantities in proportion to the cement, as air-entraining admixtures, with the mixing water. Adjust the quantity of admixtures used in accordance with manufacturer's written instructions. Use admixtures that meet 709.02.

D. Mixing and Delivering.

1. Mix and deliver concrete by any of the following means:
 - a. Central mixed concrete. Mix completely in a stationary mixer and transport the mixed concrete to the point of delivery in agitating equipment or in approved nonagitating equipment.
 - b. Transit mixed concrete. Mix completely in a truck mixer at the batching plant or while in transit.
 - c. Truck mixed concrete. Mix completely in a truck mixer at the point of delivery after adding mixing water.
 - d. Shrink mixed concrete. Mix partially in a stationary mixer and complete the mixing in a truck mixer.
 - e. Mix in an approved mixer that volumetrically measures the concrete ingredients and continuously produces concrete that meets the requirements of ASTM C685.

2. Operate truck mixers and truck agitators within the rated capacity, and at a speed of rotation for mixing or agitating, as designated by the equipment manufacturer.
3. The minimum mixing time for mixers of 10 cubic yards or less capacity is 50 seconds when a stationary mixer is used for the complete concrete mixing. Obtain approval of the mixing time for mixers of 10 cubic yards or more capacity. Measure mixing time from the time cement and aggregates are in the drum. Charge the batch into the mixer so some water will enter before cement and aggregates, and water is in the drum by the end of the first $\frac{1}{4}$ of the specified mixing time.
4. The Contractor may reduce the mixing time in the stationary mixer at least 30 seconds for shrink mixed concrete. Complete the mixing in a truck mixer with between 50 and 100 revolutions of the drum or blades at mixing speed. Do not exceed a batch volume of 70 percent of the drum gross volume.
5. When a truck mixer is used for complete mixing, mix each batch of concrete with between 70 and 100 revolutions of the drum or blades at mixing speed. Use agitating speed for additional revolutions.
6. When a truck mixer or agitator is used for transporting concrete completely mixed in a stationary mixer, use agitating speed for mixing during transport.
7. When a truck mixer or agitator is used for transporting concrete, apply the following:
 - a. Deliver the concrete to the project site and complete discharge within 1.5 hours after the introduction of the cement to the aggregates or before the drum has revolved 300 revolutions, whichever comes first.
 - b. In hot weather, or under conditions contributing to quick stiffening of the concrete, a time less than 1.5 hours may be necessary.
 - c. Begin the mixing operation within 30 minutes after the cement has been intermingled with the aggregates when a truck mixer is used for the complete mixing of the concrete.
 - d. If additional mixing water is approved, at least 30 additional revolutions of the truck mixer drum at mixing speed are required before discharge of concrete. The Engineer may allow mixing water only 1 time during the discharge of the concrete.
 - e. The Engineer may require tests for consistency at approximately the beginning, the midpoint, and the end of the load. If the results vary by more than 1 inch, do not use the mixer or agitator until the condition is corrected.
8. Transport central mixed concrete in suitable nonagitating equipment. Provide covers when specified. Equip bodies with smooth, mortar-tight metal containers capable of discharging the concrete at a controlled rate without segregation. Completely discharge concrete within 45 minutes after the introduction of the cement to the aggregates.
9. Do not use aluminum pipe or aluminum truck beds to convey concrete.
10. Provide concrete at a temperature of at least 50 °F and not more than 85 °F at the time of placing.

E. Conditioning of Subgrade or Base Course. Check the base or subgrade surface and correct deficiencies before placing concrete.

Place concrete pavement on the uniformly moistened surface of the completed base or subgrade. Moisten asphalt-treated base surfaces immediately ahead of the placement of concrete pavement to ensure compliance with temperature requirements. Remove excess moisture before paving.

F. Temperature Limitations. Place concrete pavement with the following precautions:

1. During cold weather, when ambient temperature falls below 40 °F, produce mixed concrete with a temperature at least 50 °F and less than 85 °F at the time of placing. The water and/or the aggregate may

need to be heated to a temperature of between 70 °F and 150 °F. The Contractor may place concrete pavement when the air temperature is below 40 °F as specified in 409.03.M.

2. Do not place concrete on frozen subgrade or use frozen aggregates in the concrete.
3. Do not place concrete if the concrete temperature is greater than 85 °F at time of placement. Do not place concrete when the evaporation rate is greater than 0.15 pounds per square foot per hour when tested in accordance with Idaho IT 133. Night or early morning placement may be necessary to avoid excess evaporation. Ice used as a part of the mixing water must be completely melted by the time mixing is completed.
4. Do not place concrete on a surface with a temperature exceeding 90 °F.

G. Hand Placing Concrete. The following conditions allow hand placing and finishing methods:

1. Breakdown of the mechanical equipment when the concrete is already deposited on the grade.
2. Narrow widths or areas of irregular dimensions where operating mechanical equipment is impractical. Obtain approval before placing concrete in wood or metal forms.
3. Do the following when hand placing and finishing methods are allowed:
 - a. Place a test section to show the proposed operation is capable of satisfactorily consolidating and striking off the concrete to the required grade, section, and applicable smoothness requirements when Engineer requested.
 - b. Spread concrete evenly. Do not use vibrators for extensive shifting of the concrete mass. Use surface vibrators, internal vibrators, or other methods that produce equivalent results without segregation to consolidate concrete. Thoroughly consolidate concrete against and along forms or adjoining pavement so gravel pockets along the edges of the finished pavement are prevented. Repair gravel pockets found after removing the forms. Consolidate uniformly across the full pavement width. Strike off the concrete to the intended surface profile after consolidation.
 - c. Provide a screed at least 2 feet longer than the maximum width of the slab to be struck off. Use a screed constructed of metal or other suitable material clad with metal, rigid enough to keep its shape, and is approved.
 - d. Move the screed forward on the forms with a combined longitudinal and transverse shearing motion, always moving in the direction in which the work is progressing, and manipulated so neither end is raised from the side forms during the striking off process. Repeat until the surface has uniform texture, is true to grade and cross-section, and has no porous areas, if necessary.
 - e. Smooth the concrete by floating after it has been consolidated and struck off. Do not float concrete within 30 feet of consolidation and strike off. The Contractor may use long handled floats having blades at least 4 feet in length to smooth and fill in open textured areas in the pavement. The Contractor may use a full width float. Move ahead in successive advances of not more than one-half the length of the float. Continue floating until irregularities are removed. Remove free water on the pavement with the float or other suitable tool.
 - f. Float the surface transversely using a long handled float when the crown of the pavement will not permit using a longitudinal float. Do not work the crown out of the pavement.
 - g. Remove excess water and laitance from the pavement surface after floating. Use a straightedge at least 10 feet long with a long handle for operating at the edge of the pavement. Lap successive drags $\frac{1}{2}$ the length of the blade.
 - h. Finish the surface of the concrete pavement as specified in 409.03.J. Use hand methods that result in the finish as specified in 409.03.J when a self-propelled comb is not practical.

- i. Smoothness requirements apply.
- j. Do not place additional water on the concrete surface during the machine or hand finish operation.

H. Joints. Construct joints as specified. Use suitable guidelines or devices to ensure sawing the joints at the proper location.

1. **Stress Relief Joint Sawing.** Make the initial stress relief saw cuts, to control shrinkage cracking, as soon as the concrete has hardened enough to permit sawing without raveling. Saw to the depth, width, line, and spacing as specified. Continue stress relief sawing operations at night or under inclement weather conditions as required. Keep the sawing operation up to pace with the paving operation; otherwise stop paving work until the sawing operation can keep pace with the paving operation. Single cut stress relief joints will be ¼ inch wide and will be saw cut to 1/3 depth of the concrete pavement. Single cut stress relief joints will be sealed with a hot poured elastomeric joint filler meeting the requirements of 704.03. Backer rods will not be used.

When a single saw cut joint is specified, thoroughly clean the sides of the joint and the adjacent pavement surface, approximately 1 inch on each side of the joint, of scale, dirt, dust, and other foreign material by jet water blasting immediately after sawing. Remove the residue from sawing and water blasting from the pavement surface before it is blown by traffic or wind. Prevent the residue from entering lanes used by traffic.

2. **Sealant Reservoir Construction.** Allow the concrete to cure at least 72 hours and then saw the joints to the width and depth as specified to accommodate sealant placement, when a sealant reservoir is specified. Do not saw wider than specified. Thoroughly clean the sides of the sealant reservoir and adjacent pavement surface, approximately 1 inch on each side of the joint, of scale, dirt, dust, and other foreign material by jet water blasting immediately after sawing. Remove the residue from sawing and water blasting from the pavement surface before it is blown by traffic or wind. Prevent the residue from entering lanes used by traffic.

Repair damage (e.g., spalling, fracturing) to the concrete pavement. Properly cure repairs before installing the joint sealant.

3. **Tie Bars.** Place deformed tie bars of the specified length, size, and material. Place tie bars using approved mechanical equipment, rigidly secured by chairs or other supports to prevent displacement. Do not treat the tie bars; this will impair bonding with the concrete.
Locate tie bar within tolerances as specified or as directed.
4. **Load Transfer Devices.** Incorporate load transfer devices into the concrete pavement by using dowel bar assemblies or dowel bar inserters.

a. **Dowel Bar Assemblies.**

- (1) **Fabrication.** Fabricate dowel bar assemblies, or baskets, in single units for appropriate lanes before being placed on grade. Use approved dowel basket manufacturers. Submit material detail sheets with basket size and complete anchoring details, including analysis of basket strength and stability for approval.
- (2) **Anchoring.** Securely anchor dowel bar assemblies at grade to prevent displacement during concrete paving. Secure baskets with at least 8 pins to ensure they hold bars within tolerance. The Engineer will check dowel basket placement and anchorage before concrete placement. Cover dowel bar assemblies with fresh concrete immediately ahead of the paver. Properly realign and re-anchor any dowel baskets removed to accommodate delivery of concrete before the paver arrival.

- (3) Location. Check and document dowel bar location at least every 30 joints after placement of concrete. Locate the baskets and dowels in plastic concrete with a hand trowel, or other approved method, to verify location and accuracy. Note and mark the joint locations that are not acceptable and take action to determine and correct the deficiencies ahead of the paver.
- (4) Dowel Bars. Coat dowel bars in accordance with AASHTO M 254 Type A or B. Give Type B dowel bars in assemblies a thin coating of graphite grease, or approved equal, as a bond breaker.

On ramps, tapers, and widenings, use less than 2 assembly sections in a joint.

- b. Dowel Bar Inserters. As an alternative to dowel bar assemblies on grade, the Contractor may insert dowel bars into the plastic concrete by an approved mechanical device that ensures reconsolidation around the bars. Place the bars parallel to the pavement centerline and surface. Insert the bars before the passage of the final finishing beam or screed.

- (1) Approval. Do not use dowel bar inserters without prior Engineer approval. Use an approved method to detect and verify the location of dowel bars.
- (2) Location. Use ground penetrating radar (GPR), magnetic tomography (MIT-scan), pacometer, or other approved device to establish the location and to ensure compliance with the tolerances of the dowel bar placement of at least 10 percent of the joints. The Engineer will select the joints to be inspected at random. Take at least 2 cores to verify the calibration of the insertion equipment. When inspection shows dowel bars out of tolerance, inspect remaining joints with the approved device.

Repair holes left in the pavement by the coring operation at no additional cost to the Department. Obtain approval for repair methods and materials before beginning repairs.

- (3) Dowel Bars. Coat dowel bars in accordance with AASHTO M 254 Type A or B. Give Type B dowel bars to be inserted a 2 layer bond breaker coating. Use an approved dry film (e.g., 3M™ TFE) on the first layer. Apply a thin layer of form oil over the dry film. Use extra precautions to prevent form oil runoff from contaminating the fresh concrete.

Locate load transfer devices within tolerances as specified or as directed regardless of method of incorporation.

Dowel bars, whether placed in baskets or inserted, must have at least 6 inches of bar embedded in each slab. Retrofit missing dowels, or dowels out of tolerance in the wheel path area. The Engineer may accept payment in place of retrofitting bars in areas outside of the wheel path. As payment, missing dowel bars will be charged by the Department to the Contractor at the cost to retrofit the bars into the slabs.

Provide positive control and an approved method of marking dowel bar locations for correlation to sawed joints.

Dowels are required where the new concrete pavement abuts the existing concrete pavement. Drill holes into the existing concrete pavement as specified or as directed and epoxy grout dowel bars into the holes. Obtain approval of epoxy grout before use.

5. Construction Joints. Place construction joints at right angles to the centerline when there is an interruption of more than 45 minutes in the concrete paving operations.

Do not place transverse joints closer than 6 feet apart.

Place the construction joint at the same location as would be used for a transverse joint whenever possible.

6. Random Cracks. After sawing is completed, remove random cracks penetrating the full depth of the pavement, whether transverse or longitudinal, by replacing the cracked slabs. Remove and replace cracked slabs at no additional cost to the Department.

I. Tolerance in Pavement Thickness. Construct pavement as specified. The pavement thickness is subject to price adjustment in accordance with Table 409.05-1.

Once the pavement is sufficiently cured to support foot traffic, the Engineer will check the completed pavement thickness of the concrete by measuring the distance from the concrete pavement surface to the underlying surface in accordance with FOP for AASHTO T359. Provide five 2 inch diameter cores for verification of the depth, as directed. The Contractor may take cores, as approved, to dispute depth measurements taken by the Engineer. The Engineer will witness the coring. Core, test, and repair the concrete pavement at no additional cost to the Department.

The Engineer will determine pavement thickness by average depth measurements in accordance with FOP for AASHTO T 359.

An adjusted unit price for pavement is defined as a single placement width 0.1 mile long. The Engineer will determine the average thickness of the pavement in accordance with FOP for AASHTO T 359 calculated as follows:

1. When the thickness is more or less than 0.1 inch of the specified thickness, but less than 0.5 inch, that section is eligible for an incentive or disincentive price adjustment as specified in Table 409.05-1.
2. When the thickness is more than the target range of the specified thickness, no price adjustment will be made by the Engineer for the concrete left in place.
3. The average thickness applies for each section individually.

The Engineer will calculate thickness incentive or disincentive by comparing the measured average thickness to the plan thickness for the concrete paving. The Department will make an adjusted payment for the test section in accordance with Table 409.05-1.

Each depth measurement set represents the pavement thickness for a 0.1 mile segment, or in the case of a beginning or ending measurement, the distance will extend to the end of the pavement section.

J. Final Finish. Finish the surface of the concrete pavement by tining and use a self-propelled steel comb. Tining will be specified as longitudinal or transverse. Provide longitudinal tining if the method is not specified.

1. General. Give the pavement an initial and a final texturing before the curing operations. Perform the initial texturing with a burlap drag or broom device that will produce striations parallel with centerline. Use burlap that is a coarse fabric of jute or hemp. Use a single piece burlap drag extending the entire width of the paving operations.

Install burlap drags, brooms, and tine devices on self-propelled equipment having external alignment control. Maintain a constant area of burlap in contact with the pavement surface when texturing. Replace the burlap drag whenever results are unacceptable to the Engineer. Provide broom and tine devices with positive elevation control. Maintain downward pressure on the pavement surface during operation to achieve uniform texturing without measurable variations in pavement profile. Operate the self-propelled texturing machines at a constant travel speed that keeps pace with paving operations. Stop placing the concrete when the finishing equipment does not comply with these provisions. Resume when the equipment deficiency or malfunction is corrected.

Use spring steel tines on the final texturing device that have a rectangular cross-section $\frac{1}{8}$ inch wide, on $\frac{3}{4}$ inch centers, and whose length, thickness, and resilience will form grooves approximately $\frac{3}{16}$ inch deep in the fresh concrete surface. Form the grooves in the plastic concrete without tearing the surface and without bringing pieces of the coarse aggregate to the top of the surface. Produce a final texture with a

uniform appearance with the grooves having a depth $\frac{5}{32}$ inch \pm $\frac{1}{32}$ inch. Maintain a 1-inch gap between each tine strip to prevent overlapping the tined surface and producing a weak surface area.

Measure the groove depth in accordance with Idaho IT 147. Make adjustments to the tining operation when more than 3 readings in a set of 10 are outside the intended depth range.

Round the edges of the pavement along each side of each slab and on each side of transverse expansion joints, formed joints, and construction joints, to a radius of $\frac{1}{8}$ inch before the concrete has taken its initial set. Produce a well-defined and continuous radius and a smooth dense mortar finish. Do not unduly disturb the surface of the slab by tilting the tool during use.

Eliminate tool marks appearing on the slab adjacent to the joints. In doing this, do not disturb the rounding of the corner of the slab. Completely remove concrete on top of the joint filler.

Test joints with a straightedge before the concrete has set. Make correction if one side of the joint is higher than the other or if they are higher or lower than the adjacent slabs.

Correct areas of concrete pavement which are not finished as specified in these requirements by retexturing.

The Contractor may retexture by cutting transverse grooves in the concrete pavement surface by means of saw blades or other approved devices. Space the grooves $\frac{3}{4}$ inch center to center and $\frac{1}{8}$ inch in width and depth. Obtain approval to use alternative patterns. Do not polish the concrete pavement surface after cutting.

2. Longitudinal Tining. Perform final texturing with a spring steel tine device that will produce grooves parallel with the centerline.

Tine the concrete surface within 5 inches, but not closer than 3 inches, of longitudinal pavement edges and formed joints.

3. Transverse Tining. Perform final texturing with a spring steel tine device that will produce grooves parallel to the transverse joints or perpendicular to the centerline.

Repeat the grooving pattern across the pavement. Secure the tines of a double tine comb together. Do not use the comb within 1 foot of either edge when the finishing machine causes edge slump. Comb these unfinished edges by hand.

K. Surface Test. Test the finished pavement the next working day after placement as follows:

1. Use a 10-foot straightedge on the surface at locations determined by the Engineer. When the straightedge is laid on finished pavement in a direction parallel with centerline or perpendicular to centerline, locate surface areas that vary more than $\frac{1}{4}$ inch from the lower edge. Remove high points that cause the surface to exceed these tolerances by grinding.
2. Furnish and operate the profiler. Operate the profiler at the manufacturer's recommended speed. Calibrate at the beginning of the work and as needed thereafter.

Supply a profiler, calibrated, in good working condition, and ready for operation before work of any concrete pavement begins. Provide a competent and experienced operator to operate the equipment.

Profile the surface in IRI.

Make 2 profiles 3 feet from and parallel to the edge of each driving lane.

Surface smoothness testing must be verified by the Engineer. The profile run must be witnessed by the Engineer and an electronic copy of the results submitted immediately after the end of the run. Testing will not be accepted unless witnessed by the Engineer. At the Engineer's request, submit the profile data in a format suitable for evaluation using ProVAL or other acceptable software.

The Engineer may elect to perform additional testing as verification. If the results vary from the Contractor's IRI results by more than 10 percent when profiled under the same environmental conditions, the Engineer will use the Department's IRI results for acceptance.

Use Class 1 or Class 2 profilers as defined by ASTM E950. Operate profilers in accordance with the manufacturer's instructions and AASHTO R 57. Set the profiler as follows:

- a. High pass or pre-filter: off or a minimum of 200 feet.
- b. Bump detection: on.
- c. Dip detection: on.
- d. Resolution: 0.01 inch.
- e. Low pass filter: off.
- f. All other filters: off.

Apply the following IRI requirements where longitudinal grade is 4.5 percent or less, pavement on tangent alignment and pavement on horizontal curves having a centerline radius of curve 1,000 feet or more must meet the surface smoothness requirements for the smoothness schedule specified. The Engineer will add consecutive 0.1 mile sections of roadway tested together to obtain a mile section. Overlapping of the 0.1 mile or 1 mile sections to change cumulative test results is not allowed.

- a. Schedule I projects. Target IRI of 60.0 to 70.0 inches per mile or less per 0.1 mile. Corrective action required above 95.0 inches per mile per 0.1 mile.
- b. Schedule II projects. Target IRI of 70.0 to 80.0 inches per mile or less per 0.1 mile. Corrective action required above 95.0 inches per mile per 0.1 mile.
- c. Schedule III projects. Target IRI of 95.0 inches per mile per 0.1 mile.

A Schedule II project adjoining existing pavements may be revised to a Schedule I project provided the adjoining pavement is ground and maintained at the minimum specified thickness.

A profile is not required in the following areas of pavement:

- a. Pavement on horizontal curves having a centerline radius of curve less than 1,000 feet and pavement within the superelevation transition of such curves.
- b. Pavement within 50 feet of a transverse joint that separates the pavement from an existing pavement not constructed under the contract.
- c. Pavement for ramps, approaches, structure decks, city streets, or county roads.
- d. Pavement within 50 feet of a transverse joint that separates the pavement from a structure deck or an approach slab.

After individual high point grinding has been completed, perform additional grinding in sections requiring corrective action to reduce the IRI to a maximum of 80.0 inches per mile in any 0.10 mile along any line parallel to the centerline.

Perform additional grinding as necessary to extend the area ground in each lateral direction so the lateral limits of grinding are at a constant offset from, and parallel to, the nearest lane line or pavement edge, and in each longitudinal direction so the grinding begins and ends at lines perpendicular to the pavement centerline, within any one ground area. Ensure ground areas are neat, rectangular areas of uniform surface appearance.

Produce a pavement surface true to grade and uniform in appearance with longitudinal corrugations that present a narrow ridge, corduroy appearance. Produce ridge peaks approximately $\frac{1}{16}$ inch higher than the bottoms of the grooves with approximately 53 to 57 evenly spaced grooves per foot. Remove fins resulting from grinding before opening to traffic.

Use power driven, self-propelled grinding equipment specifically designed to smooth and texture portland cement concrete pavement with diamond blades. Use a machine with an effective wheel base of at least 12 feet and of a shape and dimension that does not encroach on traffic movement outside the work area. Use equipment capable of grinding the surface without causing spalls at cracks, joints, or other locations.

Smoothly feather transitions between ground and unground areas of concrete at transverse boundaries.

Do not exceed $\frac{1}{8}$ inch vertical variations in elevation between ground and unground areas of concrete. Feather out these variations with additional grinding using an appropriate cross-slope adjustment.

Grinding to obtain smoothness incentives will be allowed provided the grinding will not result in pavement thickness below the specified thickness.

If correction of the roadway as specified will not produce satisfactory results as to smoothness or it reduces pavement thicknesses and serviceability, the Engineer may accept the completed pavement and will deduct from monies due or that may become due to the Contractor the sum of \$1,000 for each individual high point or \$7,500 for each 0.1 mile section. In these circumstances, the Engineer's decision whether to accept the completed pavement or to require corrections as described is final.

L. Curing. Cure concrete pavement with a system 2 white-pigmented, membrane-forming curing compound as specified in 709.01.

Cure the concrete with 2 applications of the curing compound for a total coverage of at least 1 gallon per 75 square feet. Apply each application of the curing compound under pressure at a rate at least 1 gallon per 150 square feet on textured surfaces of concrete pavement. Apply the second coat of membrane in the opposite direction of the first coat.

Uniformly spray the entire surface of the pavement with the 2 complete applications of the membrane-forming curing compound after finishing the surface and sides and before the initial set has taken place by an approved machine method.

Thoroughly mix the membrane-forming curing compound before use. Agitate the curing compound during application to prevent settling and separation. Show the intended method for mixing and agitating the compound before each paving usage for Engineer approval. Hand spray odd widths or shapes and slab edges. Do not apply curing compound to the inside faces of joints to be sealed. If the film is damaged within 72 hours, immediately repair the damaged portion with additional compound at no additional cost to the Department.

The Engineer will sample, test, and approve each manufacturer's identified lot of curing compound before use. Allow 3 weeks for laboratory testing of the curing compound once it has been received by the Central Materials Laboratory. Quantities of curing compound over 1,000 gallons can be inspected and sampled by the Department at the manufacturer's plant for acceptance testing. Direct inspection requests to the Engineer and the Central Materials Laboratory in writing at least 30 calendar days before ordering material.

M. Cold Weather Concreting Work Plan. Submit a cold weather concreting and curing work plan for approval when there is a probability of air temperatures below 40 °F during the placing and curing periods. Detail the methods and equipment proposed to produce mixed concrete and deliver it with a temperature of between 50 °F and 85 °F at the time of placing. The water and/or the aggregate may need to be heated to a temperature from 70 °F to 150 °F. Include the methods to protect the finished concrete from freezing and cracking and address how curing will be continuously monitored to ensure the required strength is developed before opening to traffic. Detail

the methods and equipment proposed to ensure the required concrete temperatures are maintained. Include the materials and labor anticipated for the work. Do not place concrete until the plan is approved.

When the ambient temperature falls below 40 °F, meet the following concreting operations requirements:

1. Provide a supply of suitable blanketing material alongside the work, before placing the concrete pavement, in quantities sufficient to cover the anticipated area of concrete pavement placed during the expected period of cold weather protection.
2. Anytime the air temperature is expected to drop to 32 °F or less, spread the blanketing material provided over the surface and exposed sides of the concrete pavement to a depth sufficient to prevent freezing of the concrete. Immediately cover the concrete whenever the air temperature drops to 35 °F or lower.
3. Provide at least 1 approved calibrated temperature recording device for every 2,500 square yards of concrete pavement placed. Whenever the air temperature is expected to drop below 40 °F, place and operate recording thermometers. Remove and replace concrete damaged by frost action at no additional cost to the Department.
4. The Contractor may remove the protection blankets in a minimum sized area for a time not to exceed ½ hour for sawing joints.
5. Maintain a temperature at the surface of the concrete of at least 40 °F for 7 calendar days. After 4 calendar days, the cold weather protection can be suspended if it is demonstrated with field-cured cylinders or maturity method that the concrete pavement has reached a compressive strength of at least 2,500 psi.
6. When protection blankets are no longer required, remove the blankets so the temperature of the concrete does not drop more than 40 °F during the first 24 hours. Monitor the temperature with a recording thermometer attached to the edge of the concrete pavement or as approved.
7. Provide thermocouples and its associated equipment to show compliance with the cold weather plan.

N. Sealing Joints. Construct joints as specified in 625, in accordance with the sealant manufacturer's written instructions, or as otherwise specified. Install joint sealant after grinding for surface smoothness and before the pavement is opened to traffic. Perform joint sealing only when the ambient and pavement temperatures are 50 °F or higher, the pavement surface is dry, and weather conditions are dry, or in accordance with the manufacturer's written instructions.

Provide sealant material as specified in 704. Submit a copy of the sealant manufacturer's written instructions for handling, storage, and application before beginning the work.

1. Neoprene Compression Seal. When neoprene compression seal is used, install the sealant material into the joint as specified in 625, using equipment and techniques recommended by the manufacturer. Ensure the finished joint seal has the shape factor and surface recess as specified.

Install the longitudinal joint seal first and then cut at the intersections of the transverse joints. Install the transverse joint seal through the cut in the longitudinal seal to form a tight intersection.

Install the transverse seal in 1 continuous piece. Do not stretch the seal in excess of the manufacturer's written instructions. Do not twist the seal or have deformities that interfere with the seal making complete contact with the joint face.

2. Silicone Joint Sealant. Use the size backer rod as specified and the type of bond breaker recommended by the sealant manufacturer, if required. Clean the joint within 1 hour before placing the sealant by sandblasting and air blowing with compressed air at 100 psi minimum. Provide oil and moisture-free compressed air. Do not place the sealant if dust, moisture, oil, or foreign material is present on the concrete receiving the sealant. Apply the sealant material into the joint using equipment and techniques

recommended by the manufacturer. Ensure the finished joint seal has the shape factor and surface recess as specified.

Remove excess joint sealing material immediately and clean the pavement surface.

Do not use sand or similar material as a cover for the seal.

The Engineer will reject the joint material for failure in adhesion or cohesion. Repair the joint to the Engineer's satisfaction at no additional cost to the Department.

Have a technical representative of the manufacturer present at the project site for at least the first 2 days of joint preparation and sealing when silicone joint sealant or neoprene compression seal is used. Follow the manufacturer's written instructions and/or recommendations made by the technical representative as approved. A separate payment will not be made by the Department for the services of the technical representative or for implementing the approved recommendations.

O. Multiple Lane Construction. Do not place concrete in adjacent lane(s) sooner than 48 hours after finishing of the first lane(s).

The Engineer may allow the operation of equipment and trucks on newly paved concrete, due to the lack of space elsewhere, if conditions are deemed justified and meet these conditions:

1. Determine compressive strength by maturity testing in accordance with ASTM C1074. Validate the maturity curve with the first placement and every 14 calendar days or 20,000 cubic yards thereafter, whichever is greater. Cure cylinders used for validation testing using the same procedures as used in developing the initial maturity-strength relationship. When initially validating the maturity curve, validate at least 2 points on the maturity curve, at least 1 of which will be at a period of less than 7 calendar days. At least one point occurring within 7 calendar days is required for subsequent validation. A maturity curve will be considered valid if the validation points are within 10 percent of the original maturity curve.

Develop the maturity-strength relationship and provide maturity curves along with supporting data and field procedures for monitoring maturity for approval at least 10 calendar days before use. Provide equipment, including thermo or maturity meters, thermocouples, wire, and qualified personnel to monitor maturity and submit information.

2. Protect the surface of the new pavement from scarring and abrasion. Operate equipment on mats, skids, or other approved protective devices. Remove accumulation of concrete, sand, gravel, or other debris deposited on the new pavement as directed.

Replace cracked or broken panels or slabs on the new pavement, caused by operating the equipment, at no additional cost to the Department.

P. Protection of Pavement. Repair or replace pavement damaged before final acceptance at no additional cost to the Department.

Protect the edges and surface of the unhardened concrete against the effects of rain. Use metal or wood protective materials having a width of at least the thickness of the pavement at its edge for the protection of the pavement edges and covering material (e.g., burlap or cotton mats, curing paper, plastic sheeting) for the protection of the pavement surface. Have these materials available onsite while paving. When rain appears imminent, stop paving operations and begin placing forms against the sides of the pavement and cover the surface of the unhardened concrete with the protective covering.

Q. Opening to Traffic. Do not allow traffic on the pavement until a 3,500 psi or greater compressive strength is attained determined by maturity testing in accordance with ASTM C1074. Develop the maturity-strength relationship and submit maturity curves along with supporting data and field procedures for monitoring maturity for approval at least 10 calendar days before use. Provide equipment, including thermo or maturity meters, thermocouples, wire, and qualified personnel to monitor maturity and submit information.

Validate the maturity-strength relationship with the first field placement and then every 14 calendar days or 20,000 cubic yards, whichever is greater. Cure cylinders used for validation testing using the same procedures as used in developing the initial maturity-strength relationship. When initially validating the maturity curve, validate at least of 2 points on the maturity curve, at least one of which will be at a period of less than 7 calendar days. At least 1 point occurring within 7 calendar days is required for subsequent validation. A maturity curve will be considered valid if the validation points are within 10 percent of the original maturity curve. Clean the pavement before opening to traffic.

409.04 Method of Measurement. The Engineer will measure acceptably completed work for concrete pavement by the square yard. The square yard measurement will be based on the width of the top surface of the pavement as shown on the typical section on the plans and additional widening where specified or directed. The length will be measured horizontally along the centerline of each ramp or roadway. Pavement areas will be computed to the nearest 0.1 square yard.

The Engineer will not make a final measurement of the completed pavement, except for authorized changes during construction or where many errors are found in the contract quantity. The Engineer will then compute a revision or correction and add to or deduct from the contract quantity.

409.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Concrete Pavement	SY

Drilling holes for the dowels is incidental and the cost included in the contract unit price.

Verifying dowel bar location is incidental and the cost included in the contract unit prices.

The Department will not pay for field-cured cylinders.

The Department will not pay for grinding and related expenses, including disposal of ground material, traffic control, flagging, profiling, and temporary striping. The Department will not make additional payment for corrective treatment to meet smoothness requirements.

A. Thickness Price Adjustment. The Department will make the following price adjustment to the contract unit price for each evaluation section quantity exceeding the thickness specified. If thickness measurements show deficient thickness, the Contractor has the option of removing and replacing the pavement at no additional cost to the Department or leaving the pavement in place and receiving the deductions specified in Table 409.05-1.

Table 409.05-1 – Thickness Price Adjustment

Excess or Deficiency in Thickness, inch	Price Adjustment, Percent of Contract Unit Price
Over +0.50"	100
+0.35" to +0.50"	102
+0.25" to +0.34"	103
+0.11" to +0.24"	105
+0.10" to -0.10"	100
-0.11" to -0.24"	85
-0.25" to -0.34"	70
-0.35" to -0.50"	50
Over -0.50"	0

The Department will not pay an incentive for thickness in evaluation sections where pavement grinding has occurred to achieve smoothness.

The Engineer will evaluate areas of pavement found deficient in thickness by more than 0.5 inch and determine if the deficient area is sufficient to seriously impair the anticipated service life of the pavement. Remove the affected areas of pavement within the limits specified and replace it with concrete of the specified quality and thickness at no additional cost to the Department. Remove the sections of pavement the full length between transverse joints.

If, in the Engineer's opinion, a deficiency in excess of 0.5 inch will not seriously impair the anticipated service life of the pavement, the Contractor may elect to leave the pavement in place, but will not receive payment for the deficient area of pavement.

When the pavement contains no longitudinal joints, the area of such pavement for which payment will not be made is the product of the full width of the strip placed as a unit, multiplied by the distance between probes, on both sides of the deficient measurement that shows measurements within the thickness limits. Where the pavement contains longitudinal joints, the width used by the Department is the width between longitudinal joints and the edge of the pavement.

The Engineer may order the Contractor to core drill the finished pavement to determine thickness of the pavement in areas where smoothness corrections are made. The Engineer will determine the pavement thickness by coring after smoothness corrections have been completed.

B. Profile Incentive. The Contractor is entitled to a profile incentive payment for each evaluation section as determined by the smoothness schedule specified. An evaluation section is a 12 feet wide placement, 0.1 mile long or fraction as applicable, with profiles in the driving lanes only. The 0.1 mile long sections runs consecutively from the point paving begins to the point paving is interrupted (e.g., at bridges, end of lane paving, areas specifically excluded by the specifications). The profile index requirements are specified in 409.03.K. The Department will not pay a profile incentive payment for pavement on the roadway shoulders, turn lanes, or other miscellaneous pavement. The Department will pay a profile incentive as follows.

1. Schedule I Projects.

- a. For an IRI between 60.0 inches per mile per 0.1 mile and 40.0 inches per mile per 0.1 mile, use the following formula:
$$\text{Profile incentive} = (60.0 - \text{Section IRI}) \times \$85.00.$$
- b. For an IRI less than 40.0 inches per mile per 0.1 mile, the profile incentive is \$1,700 for each 0.1 mile section.
- c. For an IRI greater than 60.0 inches per mile per 0.1 mile, a profile incentive payment will not be made.

2. Schedule II Projects.

- a. For an IRI between 70.0 inches per mile per 0.1 mile and 40.0 inches per mile per 0.1 mile, use the following formula:
$$\text{Profile Incentive} = (70.0 - \text{Section IRI}) \times \$45.00.$$
- b. For an IRI less than 40.0 inches per mile per 0.1 mile, the profile incentive is \$1,350 for each 0.1 mile section.
- c. For an IRI greater than 70.0 inches per mile per 0.1 mile, a profile incentive payment will not be made.

3. Schedule III Projects.

- a. A profile incentive payment will not be made.

The Department will make only one profile incentive payment, whichever payment is greater in accordance with the initial IRI reading determined as specified in 409.05.B.

When more than 1 profile run is made in an evaluation section, the Department will use the roughest IRI to calculate the profile incentive payment.

The Engineer may reject the pavement when the initial IRI exceeds 120 inches in a 0.1 mile section.

If grinding is required as specified in 409.03.K, make a profile run after grinding to ensure minimum specifications have been met.

SECTION 411 – URBAN CONCRETE PAVEMENT

411.01 Description. Construct portland cement concrete pavements as specified in 409.01.

411.02 Materials. Provide materials and test as specified in 409.02.

411.03 Construction Requirements.

A. Proportioning. Meet the requirements as specified in 409.03.A with the following exceptions:

1. Use number 3 coarse aggregate or 3C combined aggregate gradation as specified in 703.02.
2. The Contractor may increase maximum slump to 3 inches if finishing machines that provide only surface vibration are used and 4 inches if hand methods are used.
3. The Engineer may require Type III cement where earlier pavement strengths are necessary.

B. Equipment.

1. Mixers and Hauling Equipment. Meet the requirements specified in 409.03.B.1.
2. Paving Equipment. Meet the requirements specified in 409.03.B.2.
 - a. Placer/Spreader. Meet the requirements specified in 409.03.B.2.a.
 - b. Slipform Paving. Use equipment as specified in 409.03.B.2.b.
 - c. Machine Paving with Forms. Provide forms so the constructed pavement meets the specified thickness, cross-section, grade, and alignment. Adequately support forms to prevent deflection or movement. Do not allow the top of the forms to deviate more than $\frac{1}{8}$ inch in 10 feet and do not allow the alignment of the forms to deviate more than $\frac{3}{16}$ inch in 10 feet. Allow the concrete to set sufficiently to withstand form removal without chipping or spalling when forms are removed the day after placement. Spray the edges of the concrete with curing compound if forms are removed before the expiration of the curing period. Clean, oil, and examine used forms for defects before they are used again.

Use machines, or combination of machines, capable of consolidating the concrete across the full width of the placement into a uniform and homogeneous mass, without rock pockets, and without separation of mortar and aggregates. Machines may be subject to Engineer approval. The Engineer may request a test section placed to show the equipment can satisfactorily strike off and compact the concrete to the required density, grade, and sections.

The Contractor may use internal, pan, beam, or roller type vibrating units. Do not operate the vibration equipment when the machine is not in motion.

Run machines to consolidate, finish to the established grade and cross-section, and establish a smooth even surface so only a very moderate amount of hand finishing is necessary.

Do not overwork the concrete and bring an excess of fines to the surface. Remove water or laitance from the surface with a grout rod or scraping straightedge at least 10 foot wide with a long handle and operated from the pavement edge. Perform the finishing operations as needed.

- d. Bridge Deck Machine. Use equipment as specified in 409.03.B.2.d.

Use the following sequence of operations for placing concrete with any of the methods described in this section:

- (1) Strike-off.
- (2) Consolidate.

- (3) Float.
- (4) Remove laitance.
- (5) Straightedge.
- (6) Final surface finish.

Do not add water to the surface of the concrete during this sequence of operations.

3. Concrete Sawing Equipment. Meet the requirements specified in 409.03.B.3.

C. Handling, Measuring, and Batching Materials. Meet the requirements specified in 409.03.C.

D. Mixing and Delivering. Meet the requirements specified in 409.03.D.

E. Conditioning of Subgrade or Base Course. Meet the requirements specified in 409.03.E.

F. Temperature Limitations. Meet the requirements specified in 409.03.F.

G. Hand Placing Concrete. Meet the requirements specified in 409.03.G.3. Limit hand methods to irregular areas, irregular sections, and pavement placed in confined work areas

Moisten the forms and surface of the base immediately ahead of the placement of concrete pavement.

Place concrete in a continuous operation between construction joints. Deposit concrete so rehandling is minimized. Spread concrete evenly. Do not use vibrators for extensive shifting of the mass of concrete. Use surface vibrators, internal vibrators, or other equivalent method to produce consolidation without segregation. Ensure adequate consolidation next to forms and uniformly across the full pavement width. Strike off concrete to the intended surface profile after consolidation.

Smooth concrete by floating after it has been struck off and consolidated. Do not move ahead in successive advances more than $\frac{1}{2}$ the length of the float. Continue floating until irregularities are removed. Float the concrete within 30 feet of the consolidation effort. Remove free water on the pavement with the float or other suitable tool.

Thoroughly consolidate concrete against and along forms or adjoining pavement so gravel pockets along the edges of the finished pavement are prevented. Repair gravel pockets found after removing the forms.

Place reinforcing steel around hardware (e.g., manholes, valve covers, street monuments) as specified or as directed.

Allow local traffic access by placing concrete in intermittent areas or leaving temporary gaps in the pavement.

The Engineer may request a test section to show the proposed operation is capable of satisfactorily consolidating and striking off the concrete to the required grade and section.

Scrape the surface of the concrete with a grout rod after floating. Use a grout rod at least 10 foot long with a long handle for operating at the edge of the pavement. Use the grout rod to correct irregularities in the pavement surface and remove water and laitance.

H. Joints. Transverse and longitudinal joints for urban pavement may be contraction joints or construction joints. Where possible, place longitudinal joints on lane lines except through transitions and in intersections.

For intersections and other irregular areas, place joints as specified in the joint location plan or as directed.

1. Stress Relief Joints. Form or saw transverse and longitudinal contraction joints.

- a. Construct formed contraction joints by embedding a pre-formed joint material. Cut filler to the exact sections of the joint. Extend the length of the pre-molded joint filler to within $\frac{3}{16}$ inch of both panel edges.

- i. Transverse Contraction Joints. Place transverse contraction joints (dummy joints) after consolidation and finishing of concrete have been completed and before initial set. Cut a groove into the surface at the location of the joint, using a tool provided with stops (tee iron) to prevent cutting the groove deeper than the planned depth of the joint filler. Insert joint filler into the groove until the top is flush with the pavement surface, with a deviation of not more than $\frac{1}{8}$ inch below the surface. Ensure joint filler is at right angles to the surface and always in a straight line.
- ii. Longitudinal Contraction Joints. Construct longitudinal contraction joints in true alignment with respect to their proper location on centerline or parallel to the plan joint location. If multiple lanes are constructed simultaneously, use a sawed joint instead of the preformed joint material.

Restore the surface finish of the pavement against the filler strip with hand floats after the joint filler has been embedded in the concrete. While performing this operation, maintain filler strip in a vertical or normal position, true to alignment. After finishing, ensure the entire area of the joint is true to grade and smoothness without irregularities.

- b. Meet the requirements specified in 409.03.H.
2. Sealant Reservoir Construction. Meet the requirements specified in 409.03.H.2.
3. Tie Bars. Meet the requirements specified in 409.03.H.3.
4. Load transfer Devices. Meet the requirements specified in 409.03.H.4.
5. Construction Joints. Place construction joints as follows:
 - a. Transverse Construction Joints. Make transverse construction joints at the end of each day's paving, or when placing of concrete is discontinued for more than 45 minutes. Place the construction joint at the same location as would be used for a contraction joint, if possible. If the joint occurs at other locations, construct a joint using tie bars at least 6 feet away from the nearest contraction joint.
 - b. Longitudinal Construction Joints. Locate longitudinal construction joints as specified in the joint location plan or as directed.
6. Random Cracks. Meet the requirements specified in 409.03.H.6.

I. Tolerance in Pavement Thickness. Provide as specified 409.03.I.

J. Final Finish. Float slab after screeding if necessary to produce a uniform surface without porous spots, irregularities, depressions, small pockets, or rough spots. Use a steel tine to finish the surface. Provide tines that are approximately 4 inches long and spaced at approximately $\frac{1}{2}$ to $\frac{3}{4}$ in intervals.

Use nominal tine width of $\frac{1}{8}$ inch. Ensure the depth of tined grooves is $\frac{5}{32}$ inch \pm $\frac{1}{32}$ inch. Check groove depth in accordance with Idaho IT 147. Make adjustments to the tining operation when more than three readings in a set of ten are outside depth range.

Perform the tining in such a way as to minimize surface tearing or aggregate removal. Tine with stroke transverse to the roadway centerline and full width of the roadway, except for troweled smooth strips 1 foot wide along curb faces. Do not overlap adjacent strokes.

K. Surface Test. Meet the requirements specified in 409.03.K.1 to test the pavement and applicable sections for grinding.

L. Curing. Meet the requirements specified in 409.03.L.

M. Cold Weather Concreting Plan. Provide as specified in 409.03.M.

N. Sealing Joints. Provide as specified in 409.03.N.

O. Multiple Lane Construction. Provide as specified in 409.03.O.

P. Protection of Pavement. Provide as specified in 403.03.P.

Q. Opening Pavement to Traffic. Provide as specified in 409.03.Q, except to protect curbs cast separately from the pavement for 72 hours by keeping traffic off the adjacent pavement or by placing barricades along the curb.

411.04 Method of Measurement. The Engineer will measure acceptably complete work for urban concrete pavement by the square yard. Measurement will be based on the width of the top surface of the pavement as shown on the typical cross-section of the plans with additional widening where specified or directed. The length will be measured horizontally along the centerline of the roadway. Pavement areas will be computed to the nearest 0.1 square yard.

The Engineer will not make a final measurement of the completed pavement except for authorized changes during construction, or where many errors are found in the contract quantity. The Engineer will compute a revision or correction and add to or deduct from the contract quantity.

411.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Urban Concrete Pavement.....	SY

Drilling holes for the dowels is incidental and the cost included in the contract unit prices of other concrete pavement items. Verifying dowel bar location is incidental and the cost included in the contract unit prices of other concrete pavement items. The Department will not pay for field-cured cylinders. The Department will not pay for grinding and related expenses, including disposal of ground material, traffic control, flagging, profiling, and temporary striping.

Thickness Price Adjustment. The Department will make the following price adjustment to the applicable contract unit prices for each evaluation section quantity exceeding the thickness shown on the plans and as specified in Table 411.05-1. If thickness measurements show deficient thickness, the Contractor has the option of removing and replacing the pavement at no additional cost to the Department or leaving the pavement in place and receiving deductions in payment as specified in Table 411.05-1.

Table 411.05-1 – Thickness Price Adjustment

Excess or Deficiency in Thickness, inches	Price Adjustment, Percent of Contract Unit Price
Over +0.50"	100
+0.35" through +0.50"	102
+0.25" through +0.34"	103
+0.11" through +0.24"	105
+0.10" through -0.10"	100
-0.11" through -0.24"	85
-0.25" through -0.34"	70
-0.35" through -0.50"	50
Over -0.50"	0

The Engineer will evaluate areas of pavement found deficient in thickness by more than 0.5 inch and determine if the deficient area is sufficient to seriously impair the anticipated service life of the pavement. Remove the affected areas of pavement within the limits specified and replace it with concrete of the specified quality and thickness at no additional cost to the Department. Remove the sections of pavement the full length between transverse joints.

If, as determined by the Engineer, a deficiency in excess of 0.5 inch will not seriously impair the anticipated service life of the pavement, the Contractor may elect to leave the pavement in place, but will not receive payment for the deficient area of pavement.

When the pavement contains no longitudinal joints, the area of such pavement for which no payment will be made by the Department is the product of the full width of the strip placed as a unit, multiplied by the distance between probes, on both sides of the deficient measurement that shows measurements within the thickness limits. Where the pavement contains longitudinal joints, the width used by the Department is the width between longitudinal joints and the edge of the pavement.

The Engineer may order the Contractor to core drill the finished pavement to determine thickness of the pavement in areas where smoothness corrections are made. The Engineer will determine the pavement thickness by coring after smoothness corrections have been completed.

SECTION 415 – MICROSURFACING

415.01 Description. Microsurface as specified. Provide a microsurfacing mix placed with a properly proportioned blend of fine graded aggregate, liquid admixture, polymer-modified emulsified asphalt, and water.

Use the mixture to fill ruts and as an evenly spread surface treatment. Ensure the cured slurry is homogeneous, fills cracks, and adheres firmly to the surface with a skid resistant texture.

415.02 Materials. Provide materials as specified in:

Asphalt.....	702
Aggregate	703.03

415.03 Construction Requirements.

Determine when microsurfacing is to be mixed and spread after the emulsified asphalt arrives on the project site.

Shotting. While some shotting (small beads of asphalt in suspension in the emulsion) is normal for the emulsion, an excessive amount of shotting is an indication that the emulsion is ready to break and should not be used.

A. Mix Design. The mix design is the Contractor’s responsibility. At least 2 weeks before microsurfacing, submit a complete mix design that meets the specification. Use the same component materials, aggregate and gradation in the mix design as will be provided on the project site. Submit a new mix design to the Engineer if aggregate source, aggregate blend, gradation, or asphalt emulsion source is changed. Provide the component materials within the following limits:

Residual asphalt.....	5.5% to 10.8% by dry weight of aggregate
Mineral filler.....	0.0% to 3.0% by dry weight of aggregate
Polymer-based modifier	Minimum of 3% solids based on bitumen weight content

Provide a mix design that meets the following International Slurry Seal Association (ISSA) test requirements:

ISSA Test No.	Description	Specification
ISSA TB-100 (a)	Wet Track Abrasion Loss 1-hour soak 6-day soak	50 g/ft ² maximum 75 g/ft ² maximum
ISSA TB-113	Mix Time @ 77 °F	Controllable to 120 seconds minimum
ISSA TB-147	Lateral Displacement (Loaded Wheel Test, Method A) Specific Gravity after 1,000 cycles of 125 lb	5% maximum 2.10 maximum
ISSA TB-114	Wet Stripping	Pass (90% minimum)
ISSA TB-109	Excess Asphalt by Loaded Wheel Tester and Sand Adhesion	50 g/ft ² maximum
ISSA TB-139	<u>Wet Cohesion</u> @ 30 Minutes Minimum (Set) @ 60 Minutes Minimum (Traffic)	12 kg-cm minimum 20 kg-cm minimum or near spin minimum

(a) Perform the wet track abrasion test under laboratory conditions as a component of the mix design process. Ensure the ISSA test results are signed and sealed by a professional engineer licensed in the state where the tests were performed. A list of laboratories experienced in microsurfacing mix designs may be obtained from the ISSA.

B. Mixing Equipment. Provide a machine specifically designed and equipped to allow for the application of the microsurfacing material. Mix the material by an automatic sequenced, self-propelled microsurfacing mixing machine. Use a continuous flow mixing unit, able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water in a revolving multi-blade double-shafted mixer capable of discharging the mixed product on a continuous flow basis. Provide sufficient storage capacity to maintain an adequate supply to the proportioning controls. Use of truck-mounted units is not allowed.

The microsurfacing equipment will use a computerized material monitoring system with integrated material control devices such that the amount of each material can be determined at any time. The monitoring system will be calibrated as specified in 415.03.G. The monitoring system will be capable of recording, displaying, and printing the following information:

1. Individual sensor counts for emulsion, aggregate, mineral filler, water, and additive.
2. Aggregate, emulsion, and mineral filler output in pounds per minute.
3. Percentages of emulsion, mineral filler, water, and additive.
4. Cumulative totals of aggregate, emulsion, mineral filler, water, and additive.
5. Scale factor for all materials.

C. Proportioning Device. Provide properly marked individual volume or weight controls for proportioning material to be added to the mix (e.g., aggregate, mineral filler, emulsified asphalt, additive, and water). These proportioning devices are usually revolution counters or similar devices and are used in material calibration and in determining the material output at any time and will require before approval for use.

D. Spreading Equipment. Spread the mixture uniformly by means of a conventional augured surfacing spreader box attached to the mixer and equipped with paddles to agitate and spread the material throughout the box. Provide a front seal to prevent loss of mixture at the road contact point. Provide an adjustable rear seal to act as final strike-off. Provide a spreader box that is able to side shift the box to compensate for variations in the pavement geometry.

E. Rut-filling Equipment: Where shown on the plans, microsurfacing will be used to fill ruts, utility cuts, and other depressions. When rutting or deformations allow a full width scratch course may be applied with the spreader box using a metal or stiff rubber strike-off; otherwise ruts will be filled independently with a rut box of 5 or 6 feet in width. All rut-filling material will cure under traffic for at least 24 hours before an additional course is placed.

F. Auxiliary Equipment. Provide suitable surface preparation, equipment, hand tools, and other support equipment as necessary to perform the work.

G. Calibration. Before construction, calibrate each mixing unit used to perform the work in the Engineer's presence. Notify the Engineer at least 1 working day in advance when calibration will be performed. The Engineer may accept previous calibration documentation covering the exact materials to be used, provided they were performed in the current calendar year. Ensure the documentation includes an individual calibration of each material at various settings, which can be related to the machine's metering devices. A machine is not allowed to be used until the calibration has been completed or documentation accepted.

H. Weather Limitations. Apply microsurfacing if the air temperature is less than 100 °F, and when both pavement and air temperature are above 60 °F and rising. Apply microsurfacing when there is no danger the finished product will freeze or be rained on within 24 hours. Do not apply microsurfacing during rain, when road surface moisture is present, or during other adverse weather conditions. Do not apply microsurfacing when the temperature is expected to drop below 37 °F within 48 hours of placing microsurfacing. Cease microsurfacing operations when the weather or other conditions prolong opening road surface to traffic beyond one hour.

I. Surface Preparation. Clear vegetation, loose material, dirt, mud, and other extraneous materials from the surface immediately before applying the microsurfacing. If water is used, allow cracks to dry thoroughly. Obtain

approval of the surface preparation before microsurfacing. An approved fabric material will be used to protect utility covers and street monuments before microsurfacing. Alternate methods may be used to protect utility covers and street monuments if approved.

J. Mix Stability. Prevent premature breaking of the emulsion in the spreader box. Ensure the mixture is homogeneous during and following mixing and spreading. Do not allow excess water or emulsion or segregation of the emulsion and aggregate fines from the coarser aggregate.

K. Water Application. Pre-wet all dry, locations by fogging ahead of the spreader box. Adjust the rate of application of the fog spray during the day to suit temperatures, surface texture, humidity, and dryness of the pavement. Water used in pre-wetting is an incidental cost to microsurfacing.

L. Appearance of the Mix. The microsurfacing will be of the desired consistency upon leaving the mixer. Carry a sufficient volume of material in the spreader box so a complete coverage is obtained. Maintain a coverage thickness be between $\frac{3}{8}$ inch and $\frac{5}{8}$ inch, except in ruts. Avoid overloading the spreader. Remove lumps, balls, or unmixed aggregate.

Do not leave streaks, such as those caused by oversized aggregate, in the finished surface. If streaking develops, the Engineer will stop the work until the situation has been corrected. Excessive streaking is defined as more than 4 drag marks greater than 0.5 inch wide and 4.0 inches long or 1.0 inch wide and 3.0 inches long in any 30 square yard area. No transverse ripples or longitudinal streaks of 0.25 inch in depth or greater will be permitted, when measured by placing a 10-foot straightedge over the surface.

M. Joints. Prevent excess buildup, uncovered areas, or unsightly appearance on joints. Provide a 10-foot straightedge and ensure the surface does not vary more than $\frac{1}{4}$ inch from the lower edge when the straightedge is laid flat on the pavement in a direction parallel to centerline or normal to centerline.

N. Hand Work. Hand work surface areas which cannot be reached with the mixing machine using squeegees to provide complete and uniform coverage. If necessary before mix placement, lightly dampen the area to be hand-worked to provide a uniform appearance. Produce the same type of finish as applied by the spreader box. Complete handwork during the machine application process. Repair irregularities at the locations of temporary traffic control markers.

O. Traffic and Curing. Protect the microsurfacing from traffic damage until the mixture cures and will not be damaged by vehicle tires. Repair any traffic damage at no cost to the Department.

Allow microsurfacing applied for rut filling to cure at least 24 hours before being covered by the full lane width placement. Traffic may be permitted on the rut filling material during this period under the same requirements for protection, surface preparation, and repair as for other placements.

P. Clean-up. Remove debris daily.

Q. Test Strip. Construct a test strip at least 1,000 feet in length before production placement. Initial set must be achieved within 30 minutes and must show no signs of distress when exposed to traffic action after curing for 1 hour. If the microsurfacing does not meet these conditions, remove and replace the microsurfacing at no additional cost to the Department.

Make necessary adjustments if the test strip does not perform as required. Obtain the Engineer's approval before repeating the test strip. The Engineer may require a new job-mix design and test strip if failures indicate an ingredient problem. Acceptable test strips within the project site will be paid at contract unit prices.

R. Production Microsurfacing. The Contractor will place microsurfacing mix that meets the job-mix design and the following:

1. Control the ingredient proportions with metering or measuring devices on the microsurfacing equipment. Use readings from the metering or measuring devices to determine compliance with limits stated in the approved job-mix design and specifications.

2. Limit any increase or decrease in the amount of mineral filler added to the mix during production to within 1 percent of the job-mix design, not to exceed specifications.
3. Limit the set-control agent to within 1 percent of the job-mix design.
4. Verify that the emulsion submitted with the job-mix design is the same emulsion used throughout the work.
5. Limit the emulsion content to within 1 percent of the job-mix design, not to exceed specifications.

The Engineer may require a new job-mix design and re-approval of the microsurfacing if large disparities occur between the approved mix design and production application.

S. Reporting.

1. Maintain quality control documentation and make available to the Engineer upon request or at completion of daily work.
2. Randomly calculate the percent asphalt content of the mixture from the equipment computer display readings at least three times daily.
3. Randomly calculate the yield of the aggregate being placed from the equipment computer display readings at least three times daily.
4. Provide printouts from the computerized control unit and maintain a daily report and log sheet containing the following information:
 - a. Aggregate used, ton (dry).
 - b. Microsurfacing emulsion used, ton.
 - c. Mineral filler used, pounds.
 - d. Water used in mixture, gallons.
 - e. Additive used in mixture, gallons.
 - f. Surface area completed, square yards.
 - g. Surface area application rate, dry pounds aggregate per square yard.
 - h. Percentage of emulsified asphalt based on dry aggregate.

T. Acceptance. Acceptance of the asphalt emulsion and aggregate will be based on the following:

1. Polymer-modified Emulsified Asphalt. The Engineer will accept polymer-modified emulsified asphalt, including the viscosity and residue percent obtained at the plant, by manufacturer's certification and the verification testing performed by the Department.

The Engineer will sample asphalt twice a day from a random truck or trailer onsite in accordance with AASHTO T 40 and deliver to the Central Materials Laboratory within 3 calendar days for viscosity and evaporation residue laboratory verification testing. The Department will assess a price adjustment in accordance with the Department's [Laboratory Operations Manual](#) Section 350.02.03 when test results indicate the asphalt does not meet the specifications.

Perform field testing to ensure the asphalt emulsion has not broken excessively during transportation to the project site. Before introduction to the microsurfacing machine, check each load of emulsion for shottling by sieving in accordance with AASHTO T 59 (sodium oleate solution is not required). Submit results.

2. Aggregate. Stockpile aggregate 10 calendar days before placement operations begin in an approved location. Obtain approval before using stockpile locations within the right of way. Notify the Department when production stockpiles are in place.

The Engineer will sample and test the aggregate stockpile for acceptance. The Engineer will reject aggregate material not meeting the JMF gradation tolerances or other material requirements specified above.

415.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

The printouts from the calibrated computerized monitoring will be used to measure the pay items. Microsurfacing aggregate will be measured by the ton. Polymer-modified emulsified asphalt will be measured by the ton, including mineral filler, emulsified asphalt, and additives. Submit printouts daily.

415.05 Basis for Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Microsurfacing Aggregate	Ton
Polymer-Modified Emulsified Asphalt.....	Ton

The Department considers water, cleaning the surface, and protecting the microsurfacing (until it has set sufficiently to allow traffic to run on the new surface without displacing the new material) included in the microsurfacing unit price.

SECTION 420 – CONCRETE PAVEMENT REHABILITATION

420.01 General. Perform concrete pavement rehabilitation as follows:

1. Repair the roadway 1 lane at a time with traffic being maintained on the remaining lane. Limit the work areas to 2 miles in length, with only the active work area closed within the 2-mile limit. Obtain approval for night work. Open lanes to traffic at night, except for those areas that are in the curing process. Separate work areas by at least 3 miles.
2. Schedule concrete slab replacement operations to ensure removal and replacement are completed during 1 working day. If unforeseen circumstances prevent concrete placing, temporarily fill the cavity with crushed base before leaving the project site. Crushed base used to temporarily fill cavities is considered incidental work.
3. Complete the work in the following order:
 - a) A – Slab Replacement (full or partial).
 - b) B – Repairing Spalls.
 - c) C – Subsealing – Grout Method.
 - d) D – Grinding.
 - e) E – Repairing Cracks and H – Resealing Joints.
 - f) F – Reconstruction of Plant Mix Shoulders and 606.
 - g) G – Sealing Edge Joints.

NOTE: C will not precede D by more than 30 calendar days and E/C by 60 calendar days. Grind subsealed pavement and seal crack joints the same construction season.

4. Rehabilitation work is specified in 409.

A. Slab Replacement. Remove and replace concrete pavement in failing areas

B. Repairing Spalls. Core or saw around the perimeter of the specified area, chip or sandblast the spall repair area, and patch the cavity with rapid-hardening concrete or epoxy mortar.

C. Subsealing. Provide pavement subsealing by determining a grout hole pattern, drilling holes through the portland cement concrete pavement, pumping grout through the holes into the voids, and patching the drilled holes with mortar.

D. Grinding. Grind the portland cement concrete pavement surface to eliminate joint faulting, restore proper drainage, and provide riding characteristics and skid resistance or any combination as specified.

E. Repairing Cracks. Repair cracks in concrete pavement by routing or sawing with a small diameter segmented saw, cleaning, and sealing. Complete crack repairs concurrently with joint repair work.

F. Reconstruction of Plant Mix Shoulders. Reconstruct and reseal the plant mix shoulder as specified and include cutting, joint preparation, grade control, stockpiling, and clean-up. Stockpile tailings from the milling operation at the designated location.

G. Sealing Edge Joints. Cut a sealant reservoir and seal between the existing plant mix shoulder and the concrete pavement.

H. Resealing Joints. Remove the existing joint materials and clean and reseal Portland cement concrete pavement joints to be rehabilitated.

420.02 Materials.

A. Slab Replacement. Meet materials and testing requirements as determined. Meet the requirements of AASHTO M 235, or ASTM C 881; Type I or II, Grade 2 or 3, with class selected to match field temperature of epoxy for grouting tie bars and dowels. Obtain approval to use quick setting, non-shrink mortar or other alternative materials for grouting tie bars and dowels into existing slabs.

B. Repairing Spalls. Provide rapid-hardening concrete meeting ASTM C928 modified as follows:

1. Water will be the only liquid component.
2. Calcium chloride or metallic aggregate is not allowed.
3. Minimum compressive strength of 2,500 psi at 3 hours, 4,000 psi at 1 day, and 6,000 psi at 28 calendar days.
4. Furnish certified test reports showing compliance.

OR

Epoxy binder for mortar conforming to AASHTO M 235 or ASTM C881, Type III, Grade 1 or 2 with class selected to meet field temperature.

C. Subsealing. Provide grout consisting of portland cement and water as specified in 705, and fly ash in accordance with ASTM C618 Class C or Class F. Obtain written approval to use other admixtures. Provide materials certification for fly ash as specified in 106.04.

Ensure the grout plant has a positive displacement cement injection pump and a high-speed colloidal mill. Operate the colloidal mixing machine between 800 and 2,000 revolutions per minute, with a rotor operating in close proximity to a stator, creating a high shearing action and subsequent pressure release to make a homogenous mixture. If limestone dust grout is approved for use, a paddle type mixer may be substituted for the high-speed colloidal mixer. Ensure the injection pump has pressure capability of 300 psi when pumping grout slurry mixed to a 12-second flow cone time.

Proportion grout ingredients by volume consisting of 1 part cement, 3 parts fly ash, and enough water to provide a grout efflux time ranging between 10 and 16 seconds when measured in accordance with Idaho Field Test Manual (Army Corps of Engineers Test Method CRD-C79-58). Control the flowability with time measurements at the beginning of the grouting operation and periodically throughout the injection process. Do not hold mixed material in the mixer or injection sump pump for more than 1 hour after mixing. The Department will not pay for any wasted material held for longer times.

Accurately measure dry cement and fly ash by weight, if in bulk, or provide packaged containers of uniform volume.

Introduce water into the mixing process through a meter or scale with a totalizer to measure the amount of water used during each work shift.

Use mortar to patch holes in pavement slabs that meet 705, or commercial, rapid-setting, concrete patching material meeting ASTM C928. Provide materials certification for commercial, rapid-setting mortar as specified in 106.04.

D. Grinding. None specified.

E. Repairing Cracks. Provide sealant types as specified:

Hot-Poured Sealant	704
Cold-Applied Sealant	704.05

F. Reconstruction of Plant Mix Shoulders. Meet the following requirements:

Superpave Hot Mix Asphalt405

G. Sealing Edge Joints. Provide the sealant types as specified:

Hot-Poured Sealant 704.02

Cold-Applied Sealant.....704.05

Provide heat resistant backer rod material in accordance with the manufacturer’s written instructions (e.g., cotton or cellulose upholstery cord, premolded urethane foam). Ensure the backer rod is slightly larger in diameter than the width of the sawed joint. Furnish various size backer rods to accommodate variations in joint widths.

H. Resealing Joints. Provide the sealant type as specified:

Hot-Poured Sealant 704

Cold-Applied Sealant.....704.05

Provide heat-resistant backer rod material as recommended by the manufacturer (e.g., cotton or cellulose upholstery cord, premolded urethane foam). Ensure the backer rod is slightly larger in diameter than the width of the sawed joint. Furnish various size backer rods to accommodate variations in joint widths.

420.03 Construction Requirements.

A. Slab Replacement. Remove concrete slabs designated for full or partial replacement without damaging the surrounding pavement or base. Make full depth saw cuts around the perimeter of the slab area to be removed to prevent damage to the concrete which is to remain in place. Do not use impact methods (e.g., drop hammers, hoe rams) to facilitate slab removal.

The Contractor may leave tie bars in place if they can be straightened and cleaned. If tie bars are sawed off or destroyed during slab removal, install new bars at the spacing specified by drilling and grouting them into the adjacent slabs. Grout load transfer (dowel) bars into the adjacent slabs and then lubricate before placing the concrete as specified. Obtain approval of the template when drilling holes for dowels and tie bars.

Preserve and maintain the existing base in close conformance to the original grade, except where removal of unstable materials is directed.

Load removed concrete, unstable material, and debris as it is removed and dispose in an approved location. The Contractor is responsible for determining a suitable disposal area.

Meet 409, except a 4-inch slump is allowed when hand methods are used or a 3-inch slump for when machine methods are used.

Align transverse joints with existing joints. Provide joint design and sealant as specified.

Install replacement concrete as specified in 409.03, except slipform pavers will not be required. The Engineer will not allow plastic strip joints as permanent joint filler.

Use increased concrete slab depth to fill minor irregularities below grade as directed. Where leveling or excavation and backfill of unstable areas are directed, use plant mix to provide a non-erodible base directly under the replacement slab. Provide plant mix leveling at least 1 inch thick. In reconstructed areas, place at least a 3 inch thick plant mix base. Payment will be made under applicable contract items or as specified in 109.03.

Preserve the existing transverse and longitudinal joint system when placing fresh concrete in the replacement slabs. At locations where new concrete is to be placed against existing concrete, set 2-inch strips of foam tape or other approved material in place before pouring concrete. Thoroughly remove strips by sawing when preparing the

joints for sealant. When replacing adjacent or consecutive slabs, control shrinkage cracking with stress relief joints saw cut at interim joint locations.

The Engineer will decide when the replacement slabs will be opened to traffic. The Engineer will not allow the Contractor's equipment or traffic on the new slabs until test specimens have attained a minimum compressive strength of 2,500 psi.

When using higher cement factors to achieve early strength, additional air entraining agent may be required to ensure entrained air content of the fresh concrete is within the normal range of 4 to 7 percent.

B. Repairing Spalls. Repair pavement spalls as specified or as directed. The Engineer will mark spalls to be repaired on the pavement surface. Unless otherwise specified, repair spalls in a rectangular shape, except in cored areas.

Perimeter cut the area to be repaired to a depth of 2 inches with a diamond blade saw or bit. After sawing or coring, chip the cavity out to sound concrete with a jackhammer or other suitable equipment weighing less than 40 pounds to minimize damage to the surrounding concrete. Use a small, hand held chipping hammer for final chipping. Promptly clean loose material from the pavement minimum depth. Make arrangements and use a suitable disposal area for broken concrete and other waste.

Prepare, place, and cure the patch in accordance with the manufacturer's written instructions. Restrict traffic on the patches for at least 4 hours. Maintain existing pavement joints and cracks to the full depth of the cavity by forming through the patch as necessary with a minimum of ¼ inch compressible material. Ensure patching material does not enter the joint or crack below the cavity.

C. Subsealing. Drill holes 2 inches or less in diameter through the pavement and underlying base to the depth as specified by air or hydraulic equipment. Protect the pavement surrounding each hole from damage. Limit the breakout at the bottom of the drill hole to 10 percent or less of the pavement thickness. Limit drilling operations to less than 1 work shift ahead of the grouting operations.

Locate the holes in the configuration as specified. Drill at least 2 consecutive slabs before beginning grouting operations and continue throughout each run or work period.

Pre-wet and wash the holes as necessary to obtain thorough distribution of the injected material.

Pump grout with less than 100 psi pressure, through the holes until voids under the pavement slab are filled. Limit slab movement or rising as a result of pressure grouting to 0.050 inch or less. Provide and utilize suitable devices to monitor slab movement during pressure grouting.

Inject grout into only 1 hole at a time on any slab or adjoining slabs. When grout appears at any longitudinal or transverse joint, crack, or adjacent hole, or when monitoring devices indicate slab movement, cease pressure grouting immediately at that hole. Allow water displaced from the void structure by the grout to flow out freely. Do not allow excessive loss of the grout through cracks, joints, or from back pressure in the hose or in the shoulder area.

If continued grouting is no longer feasible, cease subsealing operations at that location. The Department will pay for holes drilled at the contract unit price for materials used.

Perform pressure grouting when temperatures are above 45 °F, during suitable weather, and when the subgrade material is not frozen.

Take necessary precautions to prevent grout from being pumped or wasted into any drainage facility or other open structure.

Upon completion of the grouting operation, remove grout from the drilled holes to a depth of at least 4 inches below the pavement surface. Clean the holes and fill with mortar and finish flush with the concrete pavement surface. At the end of each work period, leave the work area in a clean, swept, and neat condition.

If cracks develop between adjacent grout injection holes, either from drilling or pumping, repair these cracks using an epoxy injection method satisfactory to the Engineer. The Engineer may require replacement of the entire panel or a designated portion. Either method will be at no additional cost to the Department.

Keep traffic off of a grouted slab for at least 1 hour after grouting.

D. Grinding. The Engineer will not require grinding on bridge decks and roadway shoulders, unless specified or required to improve drainage.

1. General. Schedule and proceed with construction operations to produce a uniform finished surface. Grind to eliminate joint or crack faults and ensure positive lateral drainage is maintained on a constant cross slope between grinding extremities in each lane. Transition auxiliary or ramp lane grinding from the mainline edge to provide positive drainage and acceptable riding surface.

Grind the area specified until the pavement surfaces of adjacent sides of transverse joints and cracks are in the same plane and the pavement surface deviations are 0.25 inch or less when tested with a 10-foot straightedge. Ensure the faulting is eliminated at joints and cracks, the overall riding characteristics are within the acceptable limits, and the depth of material removed is sufficient for the pavement surface to be textured, including the bottom of ruts. The Engineer will not require extra depth grinding to eliminate minor local depressions.

The Contractor will remove solid grinding residue before it is blown away by traffic or wind and will prevent residue from flowing across lanes used by traffic or into gutters or drainage facilities. Any damage to these facilities will be corrected at no cost to the Department. The Contractor will dispose of the grinding residual.

2. Equipment. Furnish grinding equipment meeting the following:
 - a. Self-propelled.
 - b. Designed to smooth and texture portland cement concrete pavement with diamond blades.
 - c. Effective wheel base of at least 12 feet.
 - d. Cut or plane width at least 3 feet.
 - e. Shape and dimension that does not encroach on traffic movement.
 - f. Does not causes raveling, aggregate fractures, spalls, or joint damage.
3. Surface Finish and Testing. Meet the smoothness requirements of 409.03.K.

Produce a pavement surface that is true to grade and uniform in appearance with longitudinal corrugations that present a narrow ridge, corduroy appearance. The peaks of the ridges will be approximately $1/16$ inch higher than the bottoms of the grooves with approximately 53 to 57 evenly spaced grooves per foot. Remove fins resulting from grinding before opening to traffic.

Inspect transverse joints and transverse cracks to ensure that adjacent surfaces are in the same plane. Grind areas where misalignment of the planes of the surfaces on adjacent sides of the joint or crack are in excess of $1/16$ inch until the surfaces are flush. Make smoothly feathered transitions at transverse boundaries between ground and unground areas of concrete.

Ensure vertical misalignment between ground and unground concrete surfaces at longitudinal boundaries does not exceed $1/8$ inch. If required, perform additional grinding with appropriate cross slope adjustment to feather out the misalignment.

E. Repairing Cracks. Meet 420.03.H. Repair as specified.

F. Reconstruction of Plant Mix Shoulders. Provide milling machines or grinders with the following characteristics:

1. Power operated.
2. Self-propelled.
3. Sufficient power, traction, stability, and capability for removing a thickness of asphaltic concrete to the desired profile depth and cross slope in 1 pass.
4. Capable of accurate and automatic establishing and maintaining of profile grades along each edge of the cut by reference from the existing concrete pavement by means of a ski or matching shoe, or from an independent grade control.
5. Controls dust and other particulate matter created by the cutting head.

Mill the plant mix shoulder to the depth, width, and slope as specified. The Engineer may require the pavement milling operations be referenced from an independent grade control rather than a ski in those areas where this type of control is appropriate. Obtain approval for operations to establish and maintain independent grade control.

Load and haul tailings from the milling operation to the stockpile site the same day. Remove loose material by sweeping. The Engineer may require sweeping with a pick-up type broom where milling residue cannot be satisfactorily removed otherwise. Prevent milled plant mix material from being spilled or swept onto any lanes used by traffic. Promptly remove loose material from these areas.

Schedule operations to ensure 2 miles of separation between the milling and paving operations is not exceeded. Meet 405. Apply a tack coat of diluted CSS-1 at a rate of 0.05 gallon per square yard to the milled surface before placing the plant mix surfacing.

Saw cut the sealant reservoir between the reconstructed plant mix shoulder and the existing concrete pavement to the width and depth specified. Ensure sawing removes plant mix material from the PCC slab. Where irregularities make this impractical, use hand tools to complete the removal of any remaining bituminous material not tightly bonded to the slab. Apply sealant in accordance with the manufacturer's written instructions. The Engineer requires a backer rod.

G. Sealing Edge Joints. Saw the edge joint sealant reservoir to the dimensions specified. Meet the material storage, joint preparation, and sealant application in accordance to the manufacturer's requirements.

H. Resealing Joints. Perform joint resealing in accordance with the sealant manufacturer's requirements. Place sealant when the pavement surface and weather conditions are dry.

Remove all of the existing material from the joints with a plow, ripping teeth, wire brush, saw, or other equipment as approved, to the satisfaction of the Engineer. Do not use equipment that will cause spalling of the pavement surface beyond the limits of the joint. The Engineer will not allow gang saws to remove existing material from joints formed with tape. Dispose of material removed from the joints in an approved manner.

Saw the sealant reservoir to the width and depth as specified with a power-driven saw equipped with diamond blades. Repair any damage (e.g., spalling, fractures) to the concrete pavement at no cost to the Department. Before sawing the sealant reservoir in new concrete, ensure the concrete has reached a compressive strength of 2,500 psi.

As soon as each joint is cut, thoroughly clean scale, dirt, dust, old sealant residue, and other foreign material from the sides and adjacent pavement surface for a width of approximately 1 inch on each side at the joint. Accomplish this by sandblasting or jet waterblasting. Remove sawing and sandblasting residue from the pavement surface before it is blown by traffic or wind.

Clean, repair, and cure spalls, fractures, breaks, or voids in the surface of the joint before installing the joint sealant.

Immediately before the placement of the backer rod and the sealant, clean the joints by sandblasting using at least 100 psi of compressed air. Stop work if there is oil or moisture in the compressed air, and do not resume work until suitable adjustments have been made.

Submit a copy of the manufacturer's written instructions pertaining to the storage and application of the sealant at least 7 calendar days before beginning installation of the sealant. When silicone joint sealant is used, have a technical representative onsite for at least the first 2 full days when joint preparation and sealing is taking place. Comply with the written instructions and/or recommendations made by the technical representative and approved by the Engineer. The Department considers the services of the technical representative incidental and the cost included in the contract unit price.

Apply the sealant material into the joint using equipment and techniques in accordance to the manufacturer's written instructions. Recess the finished joint seal surface as specified.

420.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. The quantity of drilled holes will be per each.
2. The quantity of grout actually used for subsealing will be by the cubic feet of grout, dry measure.

The Department considers dry measure, when using bulk material, as computed on the basis that 94 pounds of cement equals 1 dry cubic foot, and 75 pounds of fly ash equals 1 dry cubic foot. Prepackaged material will consist of 1 cubic foot sacks of the materials. The Department considers water to be incidental and will not be included in grout measurements.

The Engineer will presume cracks emanating radially from the grout injection holes to have been caused by improper injection techniques. The Engineer will reduce grout quantity for each 5 lineal feet of such crack measured by 1 cubic foot.

3. The quantity of pavement grinding, milling pavement from the existing plant mix shoulder, pavement removal and, placing and finishing pavement will be by the square yard.

The Engineer will measure pavement grinding by multiplying the finished ground width, regardless of the number of passes with the grinder, by the total ground length. Pavement removal is computed using the average squared dimensions. Measurement includes removal, disposal, replacement dowel and tie bars, base leveling, preparation, and any other work necessary to prepare the forms for replacement concrete. Placing and finishing pavement will be based on the top surface of the pavement using the average squared dimensions. Measurement includes placing, finishing, curing, and joint construction.

4. The quantity of sealing, resealing joints, crack repair, and sealing edge joints will be by the foot.
5. Plant mix surfacing will be by the ton of mix used in the accepted surface and include the weight of the aggregate, asphalt, and additives in the mixture.
6. Furnished concrete pavement and excavation of unstable material will be by the cubic yard. Concrete measurement is based on batch weights and excavation is computed using the average squared dimensions of the excavated area multiplied by the average depth. Measurement includes providing and delivering the concrete.

420.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Drill Hole, Subseal.....	Each
Grout.....	CF
Grind Concrete Pavement.....	SY

Resealing Joints.....	ft
Milling Pavement.....	SY
Plant Mix Surfacing	Ton
Sealing.....	ft
Repairing Pavement Cracks.....	ft
Repairing Spalls.....	SF
Pavement Removal.....	SY
Furnish Concrete Pavement.....	CY
Placing & Finishing Pavement.....	SY
Excavate Unstable Material.....	CY
Sealing Edge Joints	ft

The Department will consider brooming incidental work and the cost included in the milling pavement contract unit price. The Department will consider asphalt, additives, and CSS-1 tack coat as incidental and the cost included in the plant mix surfacing contract unit price. The Department will consider backer rod and sealant incidental work and the cost included in the sealing contract unit price.

The Department will consider the cost of repairing damaged or destroyed dowels, base, and plant mix shoulders and slabs as incidental to the pavement removal contract unit price.

SECTION 430 – COLD IN-PLACE RECYCLED (CIR) PAVEMENT

430.01 Description. Cold mill the existing bituminous pavement to the width and depth as specified, mix emulsified asphalt recycling agent (EARA), recycling additive (dry portland cement or hydrated lime slurry) and water with the millings, re-lay and compact the mixture in place.

Produce a hydrated lime slurry onsite. Direct application of dry quicklime to the roadway is not allowed.

430.02 Materials. The Department defines EARA as an emulsion used for CIR designed to allow acceptance of rolling traffic at 75 °F and 50 percent humidity within an optimal time of 2 hours.

1. Emulsion. Ensure EARA meets the property requirements specified in 702. Ensure additives added to the emulsion mix to provide the quick-set properties are approved by the manufacturer.
2. For cold-milled bituminous material, meet the following gradation requirement:

Sieve Size	Percent Passing
1¼ inch	100

3. Lime. Use granular quicklime (CaO) or hydrated/slaked lime (Ca(OH)₂) to produce the lime slurry. Provide quicklime as specified in 720.06.A. The Engineer will require certification the chemical composition and physical property have been met.
4. Cement. Use Type II portland cement as specified in 701.
5. Water. Provide water without harmful soluble salts and a quality that the asphalt will not separate from the emulsion before the CIR pavement is in place.
6. Materials Acceptance. Asphalt emulsion and aggregate is accepted based on the following:
 - a. EARA. A manufacturer's certification is required, including the viscosity and residue percent obtained at the plant.

Sample the EARA twice a day from a random truck or trailer onsite in accordance with AASHTO T 40 and ship to the Central Materials Laboratory within 3 calendar days for viscosity and evaporation residue verification testing. When the EARA does not meet specifications, a price adjustment will be made as specified in the Department [Laboratory Operations Manual](#) Section 350.02.03.

Perform field testing for the purpose of ensuring the asphalt emulsion has not broken excessively during transportation to the project site. Before introduction to the pug mill mixer, check each load of emulsion for "shod" by sieving as described in AASHTO T 59 (sodium oleate solution is not required). Submit the results.
 - b. Cold milling. Before starting compaction, submit the gradation test at the minimum required frequency of 1 test per lane mile.
 - c. CIR Pavement. Perform density testing for control strips and test sections in accordance with AASHTO T 355 or AASHTO T 343.

430.03 Construction Requirements.

A. General. Place the initial lift of HMA within 48 hours after curing and supplemental compaction is complete, unless reprocessing is required. The temperature limitations for plant mix paving will apply.

Plan to remove and replace the recycled material in a continuous process, one lane of the roadway at a time, which will allow the material to be compacted and finished in the same day. Before opening to traffic, roll loose material

on the newly recycled surface into the mat. Apply a fog coat full width at a rate of 0.12 gallon per square yard. After the fog coat, apply blotter as specified in 703.07 to the fog-coated area.

Obtain the Engineer's approval before the recycled roadway is opened to traffic.

Control dust at all times.

Minimize aggregate fracture during recycling.

Recycle the existing pavement with a recycling train.

Use hydrated lime slurry or dry spread portland cement.

Lime for Recycled Treated Pavement. Meet the following:

1. Lime Slurry Plant. Use mixing equipment specifically designed for production of hydrated lime slurries. Equip plants with scales and meters to accurately proportion lime and water within 0.5 percent by weight. Provide transports to convey the slurry to the roadway with sufficient agitation to prevent settlement and maintain a uniform homogeneous mixture.
2. Lime Metering. Introduce the hydrated lime slurry by a spray bar located at the mill head as required by the Engineer by weight of CIR material. Calculate the weight of the CIR material by pounds per cubic yard for volume of cut. Use metering device to accurately measure the quantity of hydrated lime slurry required to within 10 percent.
3. Lime Feed Tank. Use agitators or similar equipment to keep hydrated lime slurry in suspension and maintain a uniform homogeneous mixture when held in the lime slurry feed transport tank.

Provide hydrated lime slurry in a uniform pumpable consistency and uniformly incorporate into the CIR material at the specified percentage.

Ensure the rate of application is approximately 1½ percent of dry quicklime added by weight to the existing bituminous pavement to be recycled.

Spread dry cement in front of the recycle train no more than 100 feet in front of the cold planer so it is incorporated into the CIR material at the specified percentage.

B. Equipment.

1. Recycling Train. Provide a recycling train with the following major components: planing machine crusher, pug mill mixer, and EARA storage.
 - a. Planing Machine. Provide a self-propelled planing machine having at least a 12-foot-wide rotary cutter capable of evenly removing the existing pavement to a depth of 4 inches in a single pass.
Ensure the unit is capable of accurately establishing profile grades within a tolerance of 0.25 inch by reference from the existing pavement or from independent grade control, and have a positive means for controlling cross slope elevations and an effective means for removing material from the surface. The Engineer will not allow a heating device to soften the pavement.
Equip the unit to discharge water into the mixing chamber or at the milling head, with a fully variable control and meter capable of accurately measuring the rate of feed.
 - b. Crusher. Provide a portable type crusher capable of reducing the oversized recycled materials to the specified size. The Engineer may require additional screening and crushing.
 - c. Pug Mill Mixer. Mix the cold recycled bituminous mixture in a pug mill type plant capable of providing a mix of RAP, recycling additive EARA, and water.

Equip the pug mill with positive control for linking the RAP, EARA, and water feeds in a manner that will maintain a constant ratio of each part. Equip the plant with facilities that the Contractor can verify and calibrate the RAP, EARA, and water quantities by an acceptable method.

Measure the RAP by weight and proportion the EARA and water by weight or by volume. Ensure the equipment is capable of feeding and maintaining a constant rate of RAP within a tolerance of plus or minus 5 percent (by total weight) of the designated amount and a constant rate of EARA and water feeds within plus or minus 0.2 percent (by total weight) of the designated quantities.

Equip the mixing plant with positive displacement pumps and a computerized metering system that can accurately meter the amount of EARA and water. Interlock the pumps to the belt-weighing system that measures the quantity of RAP entering the mixing plant. Design the interlock so the EARA and water cannot be added until the RAP enters the mixer. Equip overrides of the interlock system with short duration timers to prevent their continuous use. The Engineer will allow the use of overrides only during startup periods.

Provide readouts on the belt-weighing device and computerized metering system that show the quantity in tons of RAP, water, and EARA being fed into the mixer at any given time. Provide totalizer readouts to allow determination of accumulative quantities of each part.

- d. EARA Storage Tanks. Make available accurate volume measuring devices or manufacturer's calibration charts and a thermometer for measuring the volume and temperature of the tank's contents.

The Engineer will not allow solid or semisolid particles in the EARA in the final mix.

Equip every line delivering EARA to the mix with an on/off valve and a changeable filter element.

Change filters at the rate recommended by the manufacturer. Prevent detrimental effects to the recycled material due to interruption of the operation to change filters.

The Engineer will reject loads of EARA that break prematurely in the storage tanks or haul vehicles or cause frequent plugging of the filters.

2. Cold milling. Cold mill the existing bituminous pavement to the depth specified on the plans. Do not damage the material below the plan depth of removal with the cold-milling operation.
3. Mixing. The quantity of EARA added will be as necessary to fully coat all aggregate without filling voids with excess asphalt. Mix EARA at a rate between 1.5 to 3.0 percent by dry weight of cold-milled material as specified in the mix design.

Add water to the cold-milled material to facilitate uniform mixing with the emulsified asphalt. Add water before or concurrently with adding the EARA.

Continue mixing until the EARA and water have been distributed throughout the RAP to form a uniformly coated mixture.

Ensure the temperature of the EARA before entry into the mixture is at least 90 °F and less than 120 °F.

4. Placing. Place the recycled material using a self-propelled bituminous paver.
Except for unavoidable delay or breakdown, proceed with recycling and placing material by the paving machine at a rate sufficient to provide continuous operation of the paving machine. Cold mill and recycle no more of the roadway than what can be repaved in one day's paving production. If recycling operations result in excessive stopping of the paving machine, suspend recycling and paving operations until the rate of recycle is synchronized with the capacity of the paving machine.

Restrict placing operations to the pavement temperature of 50 °F and rising. In addition, do not perform

placing operations when it is anticipated that the atmospheric temperature will drop below 40° F within 48 hours of mixing, or when rain is expected.

Ensure the final surface, including the shoulders, is within $\frac{3}{8}$ inch from the bottom of a 10-foot straightedge laid in any direction on the surface on either side of the roadway crown. When tests show that the pavement is not within the specified tolerance, take immediate action to correct equipment or procedures in the paving operation to eliminate the unacceptable pavement irregularities. Correct surface deviations within 24 hours by reprocessing the surface, abrasive grinding or micro milling. Perform corrective work, including traffic control, at no additional cost to the Department.

When a pick-up machine is used to feed the windrow into the paver hopper, pick up the entire windrow to the underlying material.

5. Compaction. Use compaction equipment and/or rolling methods to produce the required compaction without damaging the work, and the following:
 - a. Include in the compaction train at least one 10-ton minimum weight vibratory and one 25-ton minimum weight rubber-tired roller.
 - b. Provide compaction as specified in 405.03.L.

The Department has divided the CIR layer into control strips and test sections. Each control strip is defined as an area of at least 400 square yards and of the same depth to be used in the test sections. Each test section is defined as an area 6,600 square yards or less. After 2 days of production, the test section size may be increased to a maximum of 13,000 square yards, if specified densities are being obtained. If any test section fails the density requirements, the 6,600 square yards maximum will again be used.

- a. Construction of Control Strips. Construct control strips using the same procedures and on the same cold-milled material to be used in the construction of the remainder of the work. Use the same type, mass, and sequence of rollers on the control strips as the test sections.

Construct one control strip at the beginning of work of each roadway course. Construct an additional control strip when a change is made in the type or source of material or whenever a significant change occurs in the compaction of the material. The Engineer may require a new control strip after 10 test sections have been constructed without a new control strip.

Compact the control strip. The required compaction is achieved and final process rolling is defined as when the final roller pass adds no more than 1 pound per cubic foot to the previous in-place density. Make sufficient additional roller passes to determine that a “false break” or leveling-off point is not used for compaction density.

Upon completion of the rolling, The Engineer will determine the mean density of the control strip by taking 10 tests at randomly selected locations within the control strip area utilizing Test Method FOP for AASHTO T 355. The Engineer will govern compaction of successive test sections by the mean density obtained in the control strip. Leave approved control strips in place to become a section of the completed roadway. The Engineer will subject control strips to the same surface tolerance requirements as the remainder of the work.

- b. Compaction Requirements of Test Sections. The Engineer will evaluate the density of each test section based on the results of 5 tests, performed at randomly selected locations within the test section as described in Test Method FOP for AASHTO T 355. The specified mean density obtained for the 5 tests is at least 98 percent of the mean density obtained in the approved control strip and each individual test value obtained is at least 95 percent of the mean density obtained in the approved control strip.

If the mean density of a test section does not meet the 98.0 percent requirement continue the

compactive effort on the entire test section until the required mean density is obtained. If an individual test value does not meet the 95.0 percent requirement, continue the compactive effort on the area represented by that test until the required density is obtained. Report density test results to the nearest 0.1 percent.

- c. Compaction Requirements for Small Sized Areas. In cases where the test section size cannot be as specified, the Engineer will accept compaction on the basis of a single test for every 1,000 square yards of area or less. The Engineer may adjust the specified individual test density to at least 95.0 percent of the mean density of the approved control strip.
6. Finishing. If segregation occurs in the windrow or behind the paver, the Contractor may be required to make changes in the equipment or operations. These changes may include the following:
- a. Increasing the crushing effort.
 - b. Adjusting the amount of water in the mixture.
 - c. Adjusting or modifying the paver.

The Engineer will accept cold recycled pavement visually after compaction. Correct mixture not acceptably mixed or that ravel. Reprocess areas showing an excess or deficiency of EARA or not acceptably mixed. If raveling occurs, provide additional rolling. If the Engineer determines the unacceptable material is due to the Contractor's operations, perform the corrective work at no additional cost to the Department.

Before placing the initial lift of HMA, perform supplemental compaction when the moisture content of the recycled pavement is less than 2.0 percent by weight. Supplemental compaction is conducted using control strip and breakover compaction methods described above when the pavement surface temperature is at least 80 °F.

430.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

- 1. CIR pavement will be by the square yard. No separate payment will be made for dust control or changes in equipment or operation due to segregation.
- 2. EARA will be by the ton.
- 3. Emulsified asphalt for fog coat will be as specified in 408.04.
- 4. Blotter will be as specified in 408.04.
- 5. Lime will be by the ton. The Engineer will use the dry weight to the nearest 0.01 ton incorporated in the work at the rate and in the quantity specified or directed. The quantity of lime will not include lost, displaced, used in reworking, used in restoration work, or used contrary to specifications or the Engineer's direction.

The Engineer will consider water included in the CIR pavement unit contract price.

430.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Cold In-Place Recycled Pavement.....	SY
Emulsified Asphalt Recycling Agent	Ton
Lime or Cement for Treated Recycled Pavement	Ton

SECTION 431 – COLD MILLING

431.01 Description. Remove existing seal coat and plant mix pavement by cold milling to the widths and depths as specified or as directed. Transverse wedge milling will consist of cold milling a transverse wedge for the purpose of matching the profile grade of the wearing course to the lip of the gutter elevations.

431.02 Materials. Not specified.

431.03 Construction Requirements. Cold mill the pavement surface to the specified depths using sensing devices to control the depth and smoothness.

Do not damage the bridge deck or approach slab and do not leave excess pavement in place.

Taper cut ends to construct a ramp of 100H:1V slope. The ramp will consist of in-place, un-milled pavement. Square up the tapered area and mill to the specified depth and width before placing the new plant mix pavement.

When milling operations create a situation where water cannot drain transversely off the roadway, create relief cuts or other approved methods to provide drainage.

Sweep all loose material with pickup brooms. Prevent cold-mill tailings from being spilled or swept onto any lane used by traffic.

Some handwork may be required at certain locations (e.g., manholes, inlets, valve boxes, meter boxes).

Provide a power-operated, self-propelled milling machine that is capable of automatically and accurately establishing profile grades along each edge of the machine within 0.01 foot (vertical) by reference from the existing pavement by means of a 20-foot minimum ski or from an independent grade control. The equipment will be controlled by an automatic system for controlling depth and cross-section at a given cross slope rate. A 10-foot ski for cold-milling profile grade control may be used, if approved. A 10-foot ski for cold-milling profile grade control is not allowed on bridge deck areas.

Use a mill with a tooth spacing of $\frac{5}{8}$ inch or less. The surface texture depth will not be greater than 0.6 inch. The Contractor will use a fine head mill with tooth spacing of $\frac{1}{4}$ inch or less for all milling on bridge decks or areas where traffic will be driving over the surface for more than 3 days.

Provide a machine capable of controlling dust and other particulate matter created by the mill cutting action.

Do not use a heating device to soften the pavement.

The texture produced by cold milling will be a grid pattern with uniform striations or other patterns, which will provide optimum conditions for placement of plant mix pavement.

Construct a 100-foot long test section showing the machine is capable of meeting these requirements.

Do not stockpile or dispose of cold-mill tailings on the project site. The cold-mill tailings are the Contractor's property unless otherwise specified.

431.04 Method of Measurement. The Engineer will measure acceptable completed work by the square yard. Measurement will be from the cold-milled area, regardless of the depth or number of passes required to achieve depth and width.

431.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Cold Milling	SY

A separate payment will not be made for repair of damage caused by cold-milling operations to structures, guardrail, landscaping, or other features. A separate payment will not be made for brooming, loading, hauling, designated use of, or stockpiling of cold-milled materials.

SECTION 500 – STRUCTURES

SECTION 501 – STRUCTURES

501.01 Description. Construct structures.

501.02 Materials. Not specified.

501.03 Construction Requirements.

A. General. Before placing concrete, obtain approval for the excavation depth and the foundation materials.

B. Cofferdams and Cribs. Construct cofferdams and protect fresh concrete against damage from a sudden stream rise or from erosion. Do not place timber or bracing inside cofferdams or cribs that cannot be removed without damage to the concrete. Use cofferdam or crib material of sufficient length to allow a 2-foot lowering of footings.

Prevent concrete materials from being carried away when pumping from the foundation enclosure interior. Do not pump when placing concrete or for at least 24 hours thereafter, unless it is done from a suitable sump or well point separated from the concrete work.

Remove cofferdams, cribs, sheeting, and bracing down to the elevation of the original ground line or to the new stream bed elevation for a channel change or to the top of footings in dry holes. Remove so there is no damage to the new structure.

C. Foundation Seal. Construct a concrete foundation seal when specified.

Pump out the foundation enclosure and place the masonry in the dry. Ensure the seal has set sufficiently to withstand the hydrostatic pressure before pumping to dewater a sealed cofferdam.

When weighted cribs are used and the weight is used to partially overcome the hydrostatic pressure acting against the bottom of the foundation seal, provide special anchorage (e.g., dowels, keys) to transfer the entire weight of the crib into the foundation seal.

D. Drainage of Substructure. Thoroughly and effectively drain the material behind abutments, retaining walls, and wing walls by using granular backfill.

E. Bearing and Anchorage. Set bearing plates in exact position to have a full and even bearing on the masonry. Ensure that anchor bolts are in the correct location and elevation. Adjust the position of expansion bearings to correspond with the temperature at the time of installation.

F. Placing Concrete. Place the concrete in slab spans, T-beams, or deck girders in 1 continuous operation.

If continuous placement of concrete girders or decks of a multi-span continuous structure is required or approved, the Department may require a set retarding admixture. If a set retarding admixture is required, submit a placing schedule for approval showing the proposed amount of admixture to be used. Provide chemical set retarding admixtures that meet AASHTO M 194 Type B or Type D. The Department will not allow a reduction in the concrete 28-day strength.

G. Construction Joints. Make construction joints only where located on the plans or shown on the placement schedule.

Place construction joints as directed, if not detailed on the plans, or in the case of an emergency. Use shear keys where necessary to transmit shear. Extend reinforcement beyond the construction joint, at least the splice length of the reinforcing bar.

Re-tighten the forms before placing new concrete on or against concrete that has hardened.

Roughen the concrete to a depth of at least ¼ inch where shear keys are not provided. Roughen the surface of the hardened concrete so there are no loosened particles of aggregates or damaged concrete at the surface.

Thoroughly clean construction joints of foreign matter and laitance and saturate with water before fresh concrete is placed against the joint. Continuously place concrete from joint to joint. Carefully finish, true to line and elevation, the joint face edges exposed to view.

501.04 Method of Measurement. Not specified.

501.05 Basis of Payment. Not specified.

SECTION 502 – CONCRETE

502.01 Description. Provide portland cement concrete. Separate bids may be taken on Schedule no. 1 concrete placed in the substructure and Schedule no. 2 concrete placed in the superstructure.

A. Classification. Provide the classes of concrete specified in Table 502.01-1.

Table 502.01-1 – Basic Mix Design Parameters

Concrete Class in (100 psi) (28 day) ^(a)	Minimum Cementitious Content lb/yd ³ ^{(b)(c)}	Maximum Water Cement Ratio	Air Content Percent
45 and greater ^{(d)(e)(f)(g)}	660	0.44	0 - 6.0
35 to less than 45 ^{(d)(e)(f)(g)}	560	0.44	0 - 6.0
30	560	0.49	6.5 ± 1.5
Seal Concrete	660	0.60	0 - 6.0

- ^(a) Numerical part of class designation is the specified compressive strength when using the applicable tests as specified in 502.02.
- ^(b) Cementitious is cement and secondary cementitious materials (SCM).
- ^(c) It may not always be possible to produce concrete of the specified compressive strength using the minimum cementitious contents. A separate payment will not be made by the Department for additional cementitious material required to meet the specified compressive strength.
- ^(d) Concrete designated as Class A will have an air content of 6.5 plus or minus 1.5 percent.
- ^(e) Concrete designated as Class C will have a maximum water cement ratio of 0.40, water reducer required, and air content of 6.5 plus or minus 1.5 percent.
- ^(f) Concrete designated as Class F will contain SCM. Minimum SCM content varies by product; for fly ash and slag cement (slag) minimum content is 20% by weight of total cementitious material. Fly ash will not exceed 25% of total cementitious material. Slag will not exceed 35% of the total cementitious material. For silica fume, minimum content is 7.5% by weight of total cementitious material. Silica fume will not exceed 10% of the total cementitious material. Ternary and quaternary blends will contain at least 20% SCM. Total SCM content will not exceed 50%.
- ^(g) Provide SCM meeting the requirements of 714.

Table 502.01-2 – Self-Consolidating Concrete

Flow, in	J-Ring Test Value (J), in (Lab Only)	Visual Stability Index	Static Segregation Index
20-30	J < 0.75	1.5 maximum	1 maximum

Provide Class 30 concrete and use Nos. 2a, 2b, or 3 size coarse aggregate or combined gradation Nos. 2c or 3c aggregate gradations, except for Class 40, and above concrete and prestressed girders. Use Nos. 2a or 2b size coarse aggregate or No. 2c combined aggregate gradation for Class 40 concrete and above and prestressed girders. Minimum cementitious material content may be reduced 20 percent by the Contractor when using a combined gradation.

Ensure the slump does not vary more than 1 inch or that flow does not vary by more than 2 inches during placement. Ensure the flow and the J-Ring flow do not vary by more than 2 inches. Should an increase or decrease in the slump or flow be desirable for the concrete as batched, the aggregate blend or the additive dosages may be adjusted. Maintain the ratio of the weight of water to weight of cement.

The Department will not require AASHTO T 303 mitigation testing as part of the mix design and will not require the use of ASR mitigation measures for Class 22, Class 15, and seal concrete, except when used in structural foundation and bridge applications.

B. Acceptance. The Department will base acceptance of concrete on parameters specified for the given concrete class. The Department will base acceptance of strength from the results of 28-day compressive strength tests performed as specified in 502.02 on cylinders made from concrete samples being placed. The Department will consider average strength from 3 companion cylinders as one test.

Precast, Prestressed, and Cast-In-Place Post-Tensioned Concrete. Provide precast, prestressed, and cast-in-place post-tensioned concrete meeting the release strength and 28-day strength as specified.

Conventionally Reinforced Concrete. The Engineer may accept conventionally reinforced concrete provided the strength is no more than 10 percent below the specified strength.

Replace unacceptable concrete at no additional cost to the Department.

The Engineer will use the price adjustment for concrete that does not meet the intended strength, but is allowed to remain in place, as follows:

Percent of Specified Strength	Pay Factor
≥ 100	1.00
≥ 95 < 100	0.90
≥ 90 < 95	0.80
< 90	Subject to rejection ^(a)

^(a) If allowed to remain in place, as determined by the Engineer, the pay factor will be 0.50.

The Department will pay for the acceptable concrete quantities at the contract unit price multiplied by the applicable pay factor.

The Contractor may core drill concrete subject to price adjustment or rejection as an alternative test for acceptance at no additional cost to the Department. The Engineer will determine the core locations and how many and witness coring and testing. Limit the coring to 1 set of 3 if the Engineer determines that taking multiple cores will be detrimental to the integrity and quality of the work. Repair holes left by the coring operation at no additional cost to the Department. Obtain approval of repair methods and materials before beginning repairs.

The Department will consider cores obtained within 42 calendar days of placement as representing the 28-day strength. Cores obtained after 42 calendar days will only be accepted when the Contractor submits a correlation curve, developed by a Department-approved independent testing laboratory, to relate strength at the actual test age to 28-day strength for the particular class and design mix represented by the cores.

The Engineer and the Contractor will accept the test results of the drilled cores instead of the test cylinders results when the Contractor elects to submit acceptable drilled cores.

Obtain and test cores in accordance with AASHTO T 24, except protect the cores from moisture gain or loss and test as soon as possible without further conditioning other than preparing the ends, if needed. Take at least 3 representative cores from each member or area of concrete in place that is considered potentially deficient. If, before testing, 1 or more of the cores shows evidence of having been damaged subsequent to or during removal, replace with a new core. Tests by the Contractor may include compressive strength, cement content determined by ASTM C1084, and petrographic analysis determined by ASTM C856, including water cement ratio and air content.

If the average strength of the cores from conventionally reinforced concrete is less than the specified strength for the area represented, the Engineer will require the concrete be removed or accept at a reduced price, as specified in this subsection.

The Engineer may reject the member and require replacement at no cost to the Department if the average core strength is less than the required strength. In some cases, the Engineer may perform additional analysis to determine if the concrete may be allowed to remain in place and accepted at a reduced price. Tests by the

Engineer may include compressive strength, cement content determined by ASTM C1084, and petrographic analysis determined by ASTM C856, including water cement ratio and air content.

Make corrective changes in the materials mix portions, concrete fabrication procedures, or other corrective action before continuing, at no cost to the Department if the concrete used in the work fails to meet the specified compressive strength. Make approved corrective changes if 7-day strength test results are low or show a downward trend predicting concrete may not meet the specified 28-day strength.

The Engineer may accept concrete with specified strength of 3,000 psi or less, including seal concrete, from qualified aggregate material suppliers by certification. The Department requires concrete mix designs, including strength test data for acceptance by certification. For each concrete mix design regardless of the pay item in the contract, test the first load, then again before reaching 50 cubic yards. Test again before reaching 100 cubic yards and again within every 100 cubic yards thereafter. Include test results for slump, unit weight, air content, and compressive strength to verify the certification. For precast concrete products, test once within every 40 cubic yards of concrete used. Include test results for slump, unit weight, air content, and compressive strength to verify the certification.

Use only manufacturers that provide precast concrete products that hold current certification under the NPCA Plant Certification Program, the ACPA QCast Plant Certification Program, or PCI Plant Certification Program.

502.02 Materials. Provide material as specified in:

Portland Cement.....	701
Aggregate	703
Permanent Metal forms	708.31
Membrane-Forming Curing Compounds	709.01
Air-Entraining Admixtures	709.03
Set Retarding Admixtures.....	709.04
Water-Reducing Admixtures.....	709.05
Lithium Nitrate Admixtures.....	709.06
Water	720.01
Secondary Cementitious Materials	714

Obtain approval of admixtures before use.

Determine an aggregate correction factor for the concrete aggregate for each mix design in accordance with AASHTO T 152.

Conduct testing in accordance with the following standard methods:

Compressive Strength of Cylindrical Concrete Specimens.....	AASHTO T 22
Making and Curing Concrete Test Specimens in the Field (except cylinders will be molded only in single use molds made of plastic.).....	AASHTO T 23
Standard Method of Test for Surface Resistivity Indication of Concrete's Ability to Resist Chloride Ion Penetration.	AASHTO T 358
Obtaining and Testing Drilled Cores and Sawed Beams of Concrete (Provisions of AASHTO T 24 relating to ASTM and ACI references do not apply)	AASHTO T 24
Slump of Hydraulic Cement Concrete.....	AASHTO T 119

Mass Per Cubic Meter (Cubic Foot), Yield, and Air Content (Gravimetric) of Concrete including cement content.....	AASHTO T 121
Making and Curing Concrete Test Specimens in the Laboratory (except cylinders will be molded only in single use molds made of plastic.).....	AASHTO R 39
Measuring Length of Drilled Concrete Cores	AASHTO T 148
Air Content of Freshly Mixed Concrete by the Pressure Method	AASHTO T 152
Measuring Texture Depth of Portland Cement Concrete Using a Tire Tread Depth Gauge	Idaho IT 147
Pavement Straightedge Procedures	Idaho IT 87
Determination of the Rate of Evaporation of Subsurface Moisture from Concrete	Idaho IT 133
Determining the Percentage of Fracture of Coarse Aggregate	AASHTO TP 61 (Method 1)
Sampling Freshly Mixed Concrete	WAQTC TM-2
When concrete is delivered by means of a concrete pump, obtain samples at the final point of placement (discharge pipe).	
Provide a safe and accessible platform for sampling the fresh concrete in close proximity and elevation to the final point of placement.	
Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction	AASHTO T 303
Temperature of Freshly Mixed Portland Cement Concrete.....	AASHTO T 309
Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)	ASTM C1567
Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)	CRD C 662
Standard Method of Test for Potential Alkali Reactivity of Aggregates and Effectiveness of ASR Mitigation Measures.....	AASHTO TP 110
Standard Method of Test for Slump Flow of Self-Consolidating Concrete Cylinders	AASHTO R 81
Standard Method of Test for Passing Ability of Self-Consolidating Concrete Concrete by J-Ring.....	AASHTO T 345
Standard Method of Test for Visual Stability Index of Self-Consolidating Concrete	AASHTO T 351

502.03 Construction Requirements.

A. Proportioning. Submit a concrete mix design and include compressive strength data from the Contractor's laboratory or an approved independent laboratory. Uniquely identify each submitted mix design. Submit the proportion of the ingredients for each mix design for Engineer review. Submit the theoretical maximum density and "final set" time with the mix design. Measure final set using AASHTO T 197M / T 197. Proportion each batch as specified in 502.03. Test the proposed mix design in accordance with applicable listed test procedures and AASHTO T 126.

Ensure basic mix strength equals or exceeds the design mix strength calculated for the specified class of concrete.

Determine the basic mix strength by one of the following methods:

1. Average of at least 15 consecutive field production tests using the proposed mix design, provided the tests cover a period of at least 45 calendar days and during the last 12 months.
2. Average strength of 3 test cylinders from a laboratory prepared trial mix based on the proposed mix design and prepared during the last 12 months.

In addition to strength, report the air content for each test. Strength data obtained by either method is valid only if air content tests are within required limits for the specified mix class.

Determine design mix strength by one of the following methods:

- a. Method 1. Product of the specified strength (class) of concrete multiplied by the appropriate factor obtained from Table 502.03-1. Calculate coefficient of variation from at least 15 consecutive field production tests using the proposed mix design, or a similar mix design, provided the tests cover a period at least 45 calendar days and during the last 12 months. The mathematical definition of coefficient of variation appears in the ACI Manual of Concrete Practice section 214. The Department allows interpolation.

Table 502.03-1 – Strength Factor

Similar Mix, percent	5	10	15
Factor for concrete except cast-in-place girders	1.07	1.15	1.24
Factor for cast-in-place girders	1.09	1.20	1.33

Coefficient of variation is a statistical measure of the variation in strength among specimens from a given plant. If coefficient of variation is above 15 percent, review plant operations and develop an appropriate factor.

If fewer than 30 test results are available, multiply the calculated coefficient of variation by the following factor in Table 502.03-2 before using the Table 502.03-1. The Department allows interpolation.

Table 502.03-2 – Coefficient of Variation Strength Factor

No. of Tests	30 or More	25	20	15	Less than 15
Factor for Modified C.V.	1.00	1.03	1.08	1.16	Use Method 2

- b. Method 2. Sum of the specified strength (class) of concrete plus the value obtained from Table 502.03-3.

Table 502.03-3 – Strength Value

Concrete Class	Location	Design Mix Strength
Specified strength 3,000 psi thru 5,000 psi	Concrete, except cast in-place girders	Specified strength +1,200 psi
—	Cast-in-place girders	Specified strength + 1,600 psi
Specified strength over 5,000 psi	Concrete	Specified strength + 2,000 psi

The Department requires the laboratory specimens, produced in accordance with ASTM C1567, AASHTO TP 110, or CRD C 662, be prepared using the cement, fly ash, and other mitigative additives proposed for use in the mix

design. Determine the lithium nitrate dosage in accordance with CRD C 662 when using lithium nitrate for ASR mitigation. Do not allow expansion of mortar bars to exceed 0.10 percent with the addition of fly ash, slag, or other additives when tested in accordance with ASTM C1567 or CRD C6 62. Do not allow the miniature concrete prisms to exceed 0.02 percent at 56 calendar days or 0.04 percent expansion at 112 calendar days when tested in accordance with AASHTO TP 110. The Contractor may test the coarse and fine aggregates together or separately. If testing is performed on the coarse and fine aggregates together, report the blend percentage on the test and be within 2 percent of the blend percentage used in the mix design. When tested separately, base mitigation actions on the aggregate requiring the most mitigation.

Ensure the fly ash used in the concrete mix for ASR mitigation does not have a calcium oxide (CaO) content more than 2 percent above the CaO content of the fly ash used for ASTM C1567 or AASHTO TP 110 testing. If the fly ash used in the concrete mix for ASR mitigation has CaO content greater than 2 percent above the fly ash used for testing, the Department will require additional ASTM C1567 or AASHTO TP 110 testing at the higher CaO content.

If fly ash is used only as a mineral admixture, determine the dosage of lithium nitrate based on CRD C 662 testing without fly ash.

Whenever SCM is used, provide the same SCM source, cement source (mill), and cement type throughout the work in an individual mix design. The Engineer will only approve a change on submission of laboratory test reports by the Contractor to verify the revised mix design meets specification requirements.

The Contractor may use high-range water reducers (superplasticizers) meeting ASTM C494, subject to the following additional requirements:

1. Do not exceed water/cementitious materials ratio design parameters in Table 502.01-1 excluding water contained in the admixtures. Cementitious materials are the sum of cement, fly ash, silica fume, ground slag, or other pozzolans.
2. When segregation is evident, stop placement and take corrective action. Do not allow slump to exceed 8 ½ inches.

Superplasticizer redosing to maintain slump may be completed up to 2 times. Slump, concrete temperatures, and air content must remain within the specification limits after redosing. The Engineer may allow additional drum revolutions beyond the limit in a redosing situation.

When concrete is pumped to the point of placement, adjustments to basic mix proportions may be required to ensure concrete meets specifications at the placement end. Be responsible for such adjustments, at no additional cost to the Department. Notify the Engineer in writing before implementing such adjustments. The Department requires laboratory verification as a new mix design for changes other than admixture dosage adjustments.

B. Equipment.

1. Mixers and Agitators. Mixers may be stationary or truck mounted. Agitators may be truck mixers or truck agitators. Equip truck mixers and agitators with a means of counting of the drum, blades, or paddle revolutions and can be readily verified. Ensure each mixer and agitator has a metal plate or plates attached that plainly identifies the various uses the equipment is designed for, the drum volume, the drum capacity or container in terms of the mixed concrete volume, and the rotation speed of the mixing drum or blades. Ensure plates meet NRMCA standards. Equip stationary mixers with timing device that will not permit discharge until the specified mixing time has elapsed. Equip truck mixers with a calibrated water flow meter or other approved measuring device to control the quantity of mixing water added in the field.
2. Provide mixers. When loaded to the rated mixing capacity and the concrete mixed for the time or revolutions prescribed, combine the concrete ingredients into a thoroughly mixed and uniform mass and discharge the concrete with satisfactory uniformity as specified in 502.03.D.

3. Provide agitators. When loaded to rated capacity, maintain the mixed concrete in a thoroughly mixed and uniform mass and discharge the concrete with satisfactory uniformity as specified in 502.03.D.

C. Handling, Measuring, and Batching Materials. Produce concrete that meets the approved mix design. Submit the proportion of the ingredients for each batch to the Engineer at the time of batching.

Prepare a batch ticket on an acceptable form for each batch of concrete delivered. Show on the ticket the project name, project number, supplier name, mix design number, date and time batched, load number, truck number, percent moisture in aggregate, volume batched, and the weight measurement of each individual component of the mix added to the batch. Deliver the batch ticket to the Engineer at the point of discharge before incorporating the concrete into the work.

Submit changes to the mix design for approval. Minor adjustments due to varying moisture in the aggregates and minor adjustments of approved admixtures are not considered changes in the mix design and will not require approval of a new mix design. Report minor adjustments to the Engineer before batching.

1. Measure cement by weight. Weigh cement in an individual hopper, when measuring by weight, and keep separate from the aggregates until released for discharge. Attach the cement hopper to a separate scale for individual weighing or to the aggregate scale for cumulative weighing. If cement is weighed cumulatively, weigh it before the other ingredients. Ensure the scale and weigh hopper for cement is separate and distinct from aggregate weighing equipment. Provide cement batchers with a dust seal between the charging mechanism and hopper, installed in such a way as to not affect the weighing accuracy and vented to permit the escape of air. Ensure the hopper is self-cleaning and fitted with means to ensure complete discharge. Provide sufficient wind protection to prevent interference with batching accuracy. Ensure the cement, as measured, is within 1 percent of the design weight.
2. Measure aggregates by weight. Weigh aggregate within 2 percent of the required weights and the total weight of the aggregate within 2 percent of the total required weight. Handle aggregates from stockpiles or other sources to the batching plant so uniform grading and stable moisture content is maintained. Stockpile or bin aggregates for draining at least 12 hours before being batched when produced or handled by hydraulic methods or washed.
3. Measure water by volume or by weight. Arrange the measuring device so the measurements will not be affected by variable pressures in the water supply line. Do not use wash water as a portion of the mixing water. Weigh or measure water within 1 percent of the required quantity.
4. Measure SCM by weight. Weigh the SCM within 1 percent of the design weight.
5. Measure dry admixtures by weight, and paste or liquid admixtures by weight or volume. Dispense admixtures used in small quantities in proportion to the cement, as air-entraining admixtures, with the mixing water. Adjust the quantity of admixtures used in accordance with manufacturer's written instructions. Ensure admixtures used meet 709.
6. If batches must be transported to the mixer, transport cement and aggregates from the batching plant to the mixer in batch boxes, vehicle bodies, or other containers of adequate capacity and construction to properly carry the volume required.

D. Mixing and Delivery.

1. Mix and deliver concrete by any of the following means:
 - a. Central mixed concrete. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in agitating equipment or in approved nonagitating equipment.
 - b. Transit mixed concrete. Mixed completely in a truck mixer at the batching plant or while in transit.

- c. Truck mixed concrete. Mixed completely in a truck mixer at the point of delivery following the addition of mixing water.
 - d. Shrink mixed concrete. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer.
 - e. Mixed in an approved mixer that volumetrically measures the concrete ingredients and continuously produces concrete that meets ASTM C685.
2. Operate truck mixers and truck agitators within the rated capacity and at a speed of rotation for mixing or agitating as designated by the equipment manufacturer.
 3. The minimum mixing time for mixers of 10 cubic yards or less is 50 seconds for central mixed concrete. Mixing time for mixers of more than 10 cubic yards capacity requires approval. Measure mixing time from when the cement and aggregates are in the drum. Charge the batch into the mixer so some water will enter before cement and aggregates and all water is in the drum by the end of the first ¼ of the specified mixing time.
 4. For shrink-mixed concrete, the Contractor may reduce mixing time in the stationary mixer to at least 30 seconds. Complete mixing in a truck mixer with 50 to 100 revolutions of the drum or blades at mixing speed. Do not exceed a batch volume of 70 percent of the drum gross volume.
 5. When a truck mixer is used for complete mixing, mix each batch of concrete with 50 to 100 revolutions of the drum or blades at mixing speed. Use agitating speed for additional mixing.
 6. When a truck mixer or agitator is used for transporting concrete that has been completely mixed in a stationary mixer, use agitating speed for mixing during transport.
 7. When a truck mixer or agitator is used for transporting concrete, apply the following:
 - a. Deliver the concrete and complete discharge within 1.5 hours after the introduction of the cement to the aggregates or before the drum has revolved 300 revolutions, whichever comes first.
 - b. In hot weather, or under conditions contributing to quick stiffening of the concrete, a time less than 1.5 hours may be directed.
 - c. Begin mixing operation within 30 minutes after the cement has been intermingled with the aggregates when a truck mixer is used for the complete mixing of the concrete.
 - d. If additional mixing water is approved, at least 30 additional revolutions of the truck mixer drum at mixing speed are required before discharge of concrete. The Engineer may allow additional mixing water 1 time during the discharge of the concrete.
 - e. The Engineer may require tests for consistency at approximately the beginning, the midpoint, and the end of the load. If the results vary by more than the tolerance specified in Table 502.03-4, do not use the mixer or agitator until the condition is corrected.

Table 502.03-4 – Load Slump Variance

When Average Slump Is	Tolerance
4 inches or less	1 inch
More than 4 inches	1.5 inches

8. Transport central mixed concrete in suitable nonagitating equipment. Provide covers when required. Equip bodies with smooth, mortar-tight metal containers capable of discharging the concrete at a controlled rate without segregation. Completely discharge concrete within 45 minutes after the introduction of the cement to the aggregates.

9. Do not use aluminum pipe to convey concrete.
10. Provide concrete at a temperature between 50 °F and 80 °F at the time of placing.

E. Falsework and Forms.

1. General. Submit to the Engineer working drawings, loading assumptions, allowable material stresses used in design, and final design calculations for proposed falsework and formwork. Working drawings and approval for footings or walls are not required, unless either is more than 4 feet high. The Engineer will measure the wall height from the top of footing. Ensure the working drawings and design calculations are sealed and signed by an Idaho licensed professional engineer.

Submit plan sheets to the railroad for review and approval showing railroad falsework clearances, if required. When falsework crosses or is adjacent to traffic, the Department requires the design to include a positive barrier between the construction and traffic to prevent the possibility of dropping construction items into the roadway.

The approval of the falsework or formwork working drawings or Engineer inspections will not relieve the Contractor of responsibility for the falsework and forms.

Do not start the construction of falsework or formwork until the drawings for that unit are reviewed and approved.

Field-verify ground elevations at the proposed falsework footing locations for falsework design.

2. Plans. Submit falsework or formwork drawings and design calculations in PDF format. Include on each drawing and calculation sheet the key number and contract drawing number. Ensure working drawings identify materials used, including grades of lumber, in sufficient detail to permit accurate checking.

The Contractor may revise the working drawings provided at least 4 weeks are allowed for Engineer review before construction is started on the revised portions.

The Department requires working drawings to include a placing diagram showing the concrete placing sequence, rate of pour, and construction joint locations. When a schedule for placing concrete is specified, deviations will not be permitted.

Submit, with the working drawings, the manufacturer's catalog data listing the weight of construction equipment that will be supported by the falsework.

When footing type foundations are to be used, determine the bearing value of the soil and show the values assumed in the falsework design on the falsework drawings. Show assumed values for wet and dry soil conditions.

Show anticipated total settlements and/or deflections of falsework and forms on the working drawings, including falsework footing settlement, joint take up, and deflection of beams or girders. Settlement and deflection of falsework greater than 1 inch will not be accepted. Design falsework and forms supporting deck slab and overhangs on girder bridges so there is no differential settlement between the girders and the deck forms during of deck concrete placement.

3. Design.
 - a. General. Design falsework and formwork that meets AASHTO Guide Design Specifications for Bridge Temporary Works and incorporate the following exceptions:
 - (1) If in conflict with the contract specifications, the contract specifications will govern.
 - (2) Where other codes and standards are referenced in the guide, use the most current edition of that code or standard.

- (3) Show the falsework and formwork design calculations for the stresses and deflections of load supporting members.
- (4) Design, provide, and install camber strips to account for beam deflection, vertical alignment, and anticipated structure deflection if necessary.
- (5) Falsework and forms supporting concrete work on steel structures.
 - (a) Loading of Girder Webs. Construct falsework and forms supporting the concrete work on steel structures so loads applied to girder webs are within 6 inches of a flange or stiffener and distributed so no local distortion is produced.
 - (b) Lateral Loading of Girder Flanges. Provide temporary struts and ties as necessary to resist lateral loads applied to the girder flanges and to prevent relative vertical movement ($1/8$ inch maximum) between the edge of deck form and the adjacent steel girder.
- (6) Add the following procedure for determining the lateral pressure of fluid concrete, if pozzolans or admixtures are used, in the concrete mix:

For concrete made with pozzolans or admixtures and placed with normal internal vibration to a depth of 4 feet or less, formwork can be designed for a lateral pressure as follows:

p = lateral pressure, psf

R = rate of placement, foot/hour

T = temperature of concrete during placing, °F

C_c = chemistry coefficient,

1.2 for cement type I and III with a retarder

1.2 for blends containing fly ash without a retarder

1.4 for blends containing fly ash with a retarder,

Where: retarders include admixtures that delay setting of concrete.

For columns:

$$p = C_c [150 + 9000 R / T]$$

with a p between 600 and a maximum of $(3,000)(C_c)$ psf, at least 600 psf, but in no case greater than $(w) \times (h)$, where w is density of concrete times in pound per cubic foot and h is total height of concrete placement in foot.

For walls:

$$p = C_c [150 + 43,400 / T + 2800 R / T]$$

with a p between 600 and a maximum of $(2,000)(C_c)$ psf, at least 600 psf, but in no case greater than $(w) \times (h)$, where w is density of concrete in pound per cubic foot and h is total height of concrete placement in foot.

For applying the lateral pressure formulas, columns are defined as elements with no plan dimension exceeding 6.5 feet. Walls are defined as vertical elements with at least 1 plan dimension greater than 6.5 feet.

Note: This specification is a modification of the Manual of Concrete section 347 subsection 2.2.2 Lateral Pressure of Concrete published by ACI.

- b. Permanent Metal Concrete Forms. Do not use permanent metal forms for decks. Ensure materials meet 708.31.

Design permanent metal forms to meet the following criteria and the loads specified in this subsection.

- (1) The unit working stress in the steel sheet is 0.725 or less of the specified minimum yield strength of the material provided, but not to exceed 36,000 psi.
- (2) The maximum deflection under the weight of the forms, plastic concrete, and reinforcement or a load of 120 pounds per square foot, whichever is greater, will not exceed $1/180$ of the form span or $1/2$ inch, whichever is less.
- (3) Ensure the form span for computation of stress and deflection is at least the clear span of the corrugated form material plus 2 inches.
- (4) Compute physical design properties in accordance with the edition of AISI Specifications for the Design of Cold Formed Steel Structural Members published at bid opening.
- (5) Ensure reinforcement has a minimum concrete cover of 1 inch. Center bars in the bottom layer of the main reinforcement over the valleys of the forms when necessary to achieve the minimum 1-inch concrete cover.
- (6) Provide positive lateral support by the use of concrete haunches formed against the top flanges of steel beams or girders except where shear connectors are provided.
- (7) Do not locate longitudinal deck construction joints between stringers where permanent metal forms are used.
- (8) Cut off support angle legs extending into the deck concrete in excess of $1/2$ inch.

Install forms in accordance with approved detailed fabrication plans. Ensure the fabrication plans meet 502.03.E.2 and include the grade of steel used and the moment of inertia calculations for the form.

Do not rest form sheets directly on the tops of the stringer or floor beam flanges. Securely fasten sheets to form supports and provide a minimum bearing length of 1 inch at each end. Place form supports in direct contact with the stringer flange or floor beam. Attachments are to be made by bolts, clips, or other approved means. Submit the method of attachment for approval with the fabrication plan.

Thoroughly clean, wire brush, and then paint damaged galvanized coating on exposed form metal with 2 coats of zinc oxide zinc dust primer, federal specification TT-P-64ld Type II.

Locate transverse construction joints at the bottom of a flute with $1/4$ inch weep holes field drilled at least 12 inches on center along the line of the joint.

Remove at least 1 section of the forms at a location and time selected for each concrete placement on each span as directed. Remove forms for inspection as soon after placing the concrete as practical to provide visual evidence the concrete mix and the Contractor's procedures are obtaining the desired results. Remove an additional section each time the concrete mix or the Contractor's procedures are changed, if directed.

After the deck concrete has been in place for at least 2 calendar days, test the concrete for soundness and bonding of the forms by sounding with a hammer. If areas of doubtful soundness are disclosed, remove the forms from such areas for visual inspection after the concrete has attained adequate strength, at no additional cost to the Department.

At locations where sections of the forms are removed, the Department will not require replacement of forms, but will require repair of the adjacent metal forms and supports to present a neat appearance and ensure their satisfactory retention. Remove unsatisfactory concrete or repair as directed.

4. Construction.

- a. General. Provide tell-tales attached to the soffit forms that are readable from the ground in enough systematically placed locations to determine the total settlement of the entire portion of the structure where concrete is being placed.

If unanticipated events occur, including settlements that deviate more than plus or minus $\frac{3}{8}$ inch from those shown on the falsework drawings, stop placing concrete until corrective measures are provided. When directed to suspend placing concrete, construct a temporary bulkhead at a location determined by the Engineer. Remove unacceptable concrete at no additional cost to the Department.

- b. Bracing. Provide temporary bracing as necessary to withstand imposed loads during erection, construction, and removal of falsework whose height exceeds its clear distance to the edge of sidewalk or shoulder of roadway open to the public. Show provisions on the falsework drawing for temporary bracing or methods to be used to meet this requirement during each phase of erection and removal. Include wind loads in the design of temporary bracing methods. Set the falsework to give the finished structure the camber specified. In addition to the specified camber, make allowance for settlement of the falsework using $\frac{1}{8}$ inch for each contact of timbers.
- c. Expansion Joints. At the ends of bridge deck expansion joints, securely fasten joint material (or the armor angles of compression seals) to the overhang forms to prevent relative movement during concrete placement. On deck rehabilitation work, the Department may require shimming and/or tack welding new steel joint elements to existing armor angles or parts.
- d. Bridge Rail, Curbs, and Parapets. Cast the concrete portions of bridge rails, curbs, and parapets in place using conventional fixed formwork.
- e. Form Fasteners. Use form fasteners consisting of form bolts, clamps, or other devices as necessary to prevent spreading of the forms during concrete placement. Do not use ties consisting of twisted wire loops to hold forms in position.
- f. Anchor Devices. The Contractor may use anchor devices cast into concrete for supporting forms or for lifting precast members. Do not use driven types of anchorages for fastening forms or form supports to concrete. Use the type of form fasteners and anchors that can be removed without chipping, spalling, heating, or otherwise damaging the concrete surface.

Remove form bolts, metal ties or anchors, or other metal placed for the Contractor's convenience to a depth of at least 1 inch below the surface of the concrete. Clean and fill the resulting holes or depressions with mortar. Remove form bolts projecting into the cells of box girders flush with the surface of the concrete.

- g. Mortar. Provide and place mortar in recesses and holes, on surfaces, under structural members, and at other locations as specified.

Provide mortar composed of portland cement, sand, and water. Use a 1 to 2 ratio for the proportion of cement to sand, measured by volume. Provide material that meets 701.01. Ensure the maximum size of sand is not larger than $\frac{1}{2}$ the size of the recess, hole, or space where the mortar is to be placed. Use only enough water in the mortar to permit placing and packing.

Clean concrete areas to be in contact with the mortar of loose or foreign material that would prevent bond between the mortar and the concrete surfaces. Flush with water and allow to dry to a surface dry condition immediately before placing the mortar.

Completely fill and tightly pack the mortar into recesses, holes, on surfaces, under structural members, and at other locations as specified. After placing, cure surfaces of mortar by the water method as specified in 502.03.J for at least 3 days.

Ensure keyways, spaces between structural members, holes, spaces under structural members, and other locations where mortar could escape are mortar tight before placing mortar.

Do not allow loads on mortar within 72 hours.

Remove improperly cured or defective mortar and replace at no additional cost to the Department.

For exposed surfaces, add white cement to the mortar in a quantity sufficient to result in a patch that matches the surrounding concrete when dry.

- h. Forms. Clean the forms inside surfaces of dirt, mortar, and foreign material. Thoroughly coat forms, which will later be removed, with form oil before use. Use commercial quality form oil or other equivalent coating that will permit the ready release of the forms and not discolor the concrete.

Ensure concrete forms are mortar tight, true to the dimensions, lines, and grades of the structure, and of sufficient strength to prevent deflection during the placing of the concrete.

Do not discharge concrete into the forms until work connected with constructing the forms has been completed, materials required to be embedded in the concrete have been placed for the unit to be poured, and the Engineer has inspected the forms and materials. This work includes the removal of dirt, chips, sawdust, water, and other foreign material from the forms.

Control the rate of depositing concrete in forms to prevent deflections of the forms or form panels in excess of the deflections specified. The Department requires forms for concrete surfaces that are not completely enclosed, or hidden below the permanent ground surface, meet the same requirements as forms for exposed surfaces. Interior surfaces of underground drainage structures are to be completely enclosed surfaces.

Form exposed surfaces of each element of a concrete structure with the same forming material or with materials that produce similar concrete surface textures, color, and appearance.

Face forms for exposed surfaces with form panels. A form panel is the continuous section of form facing material, unbroken by joint marks, against which the concrete is placed.

Provide and place form panels for exposed surfaces in uniform widths of at least 3 feet and in uniform lengths of at least 6 feet, except where the width of the member formed is less than 3 feet. When the width of the panels is less than 3 feet, provide and place panels that are the width of the member. Arrange panels in symmetrical patterns conforming to the general lines of the structure. Place panels for vertical surfaces with the long dimension horizontal and with horizontal joints level and continuous. Place panels with the long dimension parallel to the footing for walls with sloping footings, which do not abut other walls. Precisely align form panels on each side of the panel joint, by means of supports or fasteners common to both panels, to result in a continuous, unbroken concrete plane surface.

Construct forms for exposed surfaces with triangular fillets at least $\frac{3}{4}$ inch by $\frac{3}{4}$ inch attached to prevent mortar runs and to produce smooth, straight chamfers at sharp edges of the concrete.

Do not stamp concrete (e.g., with company logo, dates, patterns).

5. Removal of Falsework and Forms.

Do not remove forms and falsework without approval. This approval does not relieve the Contractor of responsibility for the safety of the work. Remove blocks and bracing at the time the forms are removed, including the wood forms left in the concrete. Include falsework removal procedures for continuous or cantilevered structures with the working drawings. If the Contractor intends to remove falsework and forms before 28 calendar days, proportion and design the concrete mix to provide the minimum strengths required at the proposed removal time, as specified. Do not remove the falsework and forms before the minimum number of days and minimum strength for the applicable structural element. Comply with 502.03.F.

Perform maturity testing in accordance with ASTM C1074 to determine compressive strength for form removal and loading.

Validate maturity-strength relationship with the first placement and every 1,000 cubic yards thereafter. Develop the maturity-strength relationship and submit maturity curves along with supporting data and field procedures for monitoring maturity for approval at least 10 calendar days before use. Provide equipment, including thermo or maturity meters, thermocouples, wire, and qualified personnel to monitor maturity and submit information. Ensure maturity testing represents the concrete in the most unfavorable field conditions.

When using maturity testing, validate the first field placement and every 1,000 cubic yards thereafter. Cure cylinders used for validation testing using the same procedures as used in developing the initial maturity-strength relationship. When initially validating the maturity curve, validate at least 2 points, 1 of which must be at a period of less than 7 calendar days for subsequent validation. A maturity curve will be considered valid if the validation points are within 10 percent of the original maturity curve.

Loading of a member is defined as additional horizontal or vertical loads applied other than loads from formwork and reinforcing steel of further concrete placements.

For post-tensioned concrete bridges, release the falsework supports, which might continue to remain engaged after structure units are prestressed, to allow the concrete to accept its own weight and distribution of stresses uniformly and gradually. Sequence disengagements so fixed connections at tops of piers will not be subjected to damaging forces.

Sequence falsework support disengagement as specified on falsework drawings. The stressing operation in prestressed units must be completed and approved before removing supporting falsework.

Apply a membrane-forming curing compound or a water cure as specified in 502.03.J to exposed surfaces, except for construction joints if forms are removed before 7 calendar days have elapsed. Cure construction joints using a water cure as specified in 502.03.

Leave the forms in place for footings constructed within cofferdams or cribs, if their removal would endanger the safety of the cofferdam or crib, and where the forms left in place will not be exposed to view in the finished structure. Remove forms whether above or below the ground line or water level. Remove forms from the cells of box girders.

Remove forms and falsework in a manner to permit the concrete to uniformly and gradually take the stresses due to its own mass.

The Contractor may remove forms and falsework or place subsequent loads when both conditions in Table 502.03-5 for the activity involved are met.

Table 502.03-5 – Form and Falsework Removal and Loading of Concrete

Part 1: Removal of Forms and Falsework Structural Element	Minimum Days ^{(a)(b)}	Percent of Design Strength ^(e)
Side forms for: footings, abutment caps, pier caps, traffic and pedestrian barriers, and other side forms not supporting the concrete mass	1	—
Columns, abutment backwalls, and retaining walls	3	50
Cantilever bridge deck sidewalks	7	—
Bridge decks, top slabs of concrete box culverts or stifflegs	10	80
Crossbeams, caps, box girders, T-beam Girders, and flat slab superstructures ^(c)	7	80
Signal, Luminaire, and Sign Support Foundations	7	80
Part 2: Subsequent Loading ^(d) of Structural Element	Minimum Days ^(a)	Percent of Design Strength ^(e)
Footings and abutments	3	80
Approach slabs, and bottom slabs of box girders with falsework in place	5	80
Columns and walls	5	100
Bridge decks, top slabs of concrete box culverts or stifflegs and other members	10	100
Signal, Luminaire, and Sign Support Foundations	7	100
Erecting girders on pier caps	7	100

- (a) From the time of the last placement in the forms or falsework supports and excluding the days when the surrounding temperature is below 40 °F for a total of 4 hours or more. Requirements in 502.03.G still apply. The Contractor will monitor the temperature during curing time by continuous recording thermometers.
- (b) Do not remove forms until the concrete has sufficient strength to prevent damage to the surface or cause over stressing of the concrete.
- (c) Where continuous spans are involved, the time for spans will be determined by the last concrete placed.
- (d) Except loads from formwork and reinforcing steel of further concrete placements.
- (e) Standard concrete mix designs may not achieve strength in the minimum days shown.

F. Placing Concrete.

1. General. Do not place concrete until forms and metal reinforcement have been inspected. Clean the forms of debris and foreign material before concrete is placed. Avoid segregation of the concrete and displacement of the reinforcement. When placing operations involve dropping the concrete more than 5 feet, deposit concrete through sheet metal or other approved tubes. Keep tubes full of concrete during placing and their lower ends buried in the newly placed concrete, as much as practical. Control the rate of depositing concrete in forms to prevent deflections of the forms or form panels in excess of the deflections specified.

Place concrete in the forms as soon as possible after mixing. Keep the concrete plastic and workable. The concrete placement is to be continuous, with no interruption longer than 30 minutes between adjoining layers. Fill each part of the form carefully by depositing the concrete as near the final position as possible. Place and consolidate each layer before the preceding layer takes initial set. Do not jar the forms or allow strain to be placed on the ends of projecting reinforcement after initial set of the concrete.

Do not place bridge decks and other concrete flatwork when the evaporation rate is greater than 0.15 pounds per square foot per hour when tested in accordance with Idaho IT 133. Flatwork is a surface not cured in contact with a form and that is not part of a construction joint. Surfaces essentially vertical are excluded from the definition.

Use the proper mix design and combination of low shrink materials, low temperature concrete, proper curing techniques, or other procedures necessary to eliminate or minimize the development of cracks.

The Engineer will determine surface crack intensity after completion of concrete cure and before prestressing or releasing of forms or falsework. The surface crack intensity of concrete bridge decks is determined by the number and size of cracks in the top surface of the concrete. Remove equipment and material from the deck and clean the surface as necessary for the Engineer to measure the crack intensity. Fill cracks in any 60 square yard portion of deck when there are more than 50 feet of cracks whose width exceeds 0.02 inch with a 2 component modified methacrylate penetrating sealer or equal, as approved. Fill the cracks in accordance with the penetrating sealer manufacturer's written instructions at no additional cost to the Department. Decks that have excessive cracking or cracking that jeopardizes the structural integrity of the deck may be determined unacceptable by the Engineer and require removal.

Work after the placement is incidental and the cost included in the contract unit price for concrete.

2. Vibrating. Consolidate the concrete with suitable vibrators operating within the concrete. Supplement vibrating by hand-spading with suitable tools to ensure proper and adequate consolidation, especially around obstructions.

Use vibrators that operate at frequencies of at least 5,000 impulses per minute. Use vibrators in concrete containing epoxy-coated reinforcement that have a resilient covering to prevent damage to the epoxy coating.

Vibrate deck concrete with internal vibrators turning at least 10,800 revolutions per minute in air and are fully submerged. Space the vibrator in the concrete mix approximately 18 to 24 inches measured in longitudinal and transverse directions.

Work the concrete thoroughly around the reinforcement, embedded fixtures, and into corners and angles of the forms with vibrators.

Do not use vibrators to cause the concrete to flow or run into position instead of placing. Ensure vibration is sufficient to accomplish thorough consolidation, but not prolonged to the point where segregation occurs. The vibrators are not required for seal concrete or concrete in shell piles.

3. Underwater Concrete. Use seal concrete in or under water.

Carefully place concrete in a compact mass, in its final position, by means of a tremie, a bottom dump bucket, or other approved method to prevent segregation. Do not disturb concrete after being deposited.

Do not place concrete in running water. Construct the forms for underwater concrete to provide still water inside the forms. Continuously place the concrete until the required depth is reached and keep the surface of the concrete as nearly level as possible.

Comply with the following requirements for placing if a tremie is used:

- a. Use a watertight tube having a diameter of at least 10 inches with a hopper at the top.
 - b. Provide a device that will prevent water from entering while charging the tube with concrete.
 - c. Support the tremie to permit free movement of the discharge end over the entire top surface and to permit rapid lowering when necessary to slow down or stop the flow of concrete.
 - d. Use a method to fill the tremie that will prevent washing of the concrete.
 - e. Completely submerge the discharge end in concrete and maintain sufficient concrete in the tremie tube to prevent water entry.
 - f. When concrete is dumped into the hopper, induce the flow of concrete by slightly raising the discharge end, always keeping it in the deposited concrete.
4. Massive Placement. Placements thicker than 4 feet are massive placements. Take special measures to minimize the possibility of drying shrinkage cracks developing in placements while placing and curing the concrete.

The maximum temperature difference between the top surface of a placement during placing and throughout the full 7-day curing period of the concrete is 35 °F. Use approved construction methods that will achieve uniformity of temperature and if these methods prove inadequate, adopt different or additional measures as necessary to achieve the uniformity.

G. Cold Weather Concreting.

1. Heating and Placing Concrete. Obtain approval for a cold-weather concreting and curing plan detailing the methods and equipment to ensure the required concrete temperatures are maintained before placing concrete when there is a probability of air temperatures below 40 °F during the placing and curing periods. Meet the following cold-weather concreting operation requirements when the ambient temperature falls below 40 °F:
- a. Completely remove ice, snow, and frost before placing concrete.
 - b. Provide concrete that will have a temperature of at least 50 °F and less than 80 °F at the time of placing.
 - c. Do not place concrete against material with a temperature of 32 °F or less.
 - d. Heat the mix water and/or the aggregates when necessary, before batching to produce concrete of the specified temperature. Heat in a manner that is not detrimental to the mix and does not prevent the entrainment of the required amount of air. Heat the materials uniformly.
 - e. Do not heat aggregates directly by gas or oil flame or on sheet metal over fire.
 - f. Do not heat aggregates or water to over 150 °F. If either is heated to over 100 °F, mix together before adding the cement so the cement does not come into contact with materials that are in excess of 100 °F.

2. Protection of Concrete. Maintain a concrete temperature of at least 50 °F for 7 calendar days or 70 °F for 3 calendar days after placement except when steam curing is used. When SCM is used, increase the time to 10 calendar days for 50 °F and 5 calendar days for 70 °F. Maintain the temperature of uniform surfaces of concrete (e.g., decks) at the temperatures and the times shown. Do not allow the water to freeze during the curing period when water cure is required for concrete as specified in 502.03.J.

Protecting and curing concrete under water is allowed provided the temperature of the water does not fall below 35 °F and at least 6 inches of water is maintained over the concrete for at least 10 calendar days.

Block up combustion heaters off the surface of the concrete and vent to the outside of the enclosure.

Do not allow the maximum temperature within the enclosure to exceed 120 °F when the concrete is protected by means other than steam.

The maximum drop in temperature of the concrete throughout the first 24 hours after the end of protection will be 50 °F for protection methods other than the use of steam.

Meet the requirements of 502.03.J when steam is used in the protection of the concrete.

Provide calibrated temperature recording devices with a range of 20 to 212 °F for steam-cured concrete and a range of 20 to 160 °F for other concrete.

Continuously record temperatures for at least 24 hours. Provide a sufficient number of recording devices to keep adequate records of temperatures.

On small quantities used in minor structures, sign foundations, and other nonstructural placement (e.g., sidewalks, curb and gutter), protect the concrete from freeze damage by covering the concrete with suitable blanketing material. Maintain protective covering for at least 5 calendar days. Use recording thermometers to show that concrete used in minor structures was not exposed to freezing temperatures.

H. Hot Weather Concreting. Do not allow the temperature of concrete to exceed 80 °F at time of placement. Take measures (e.g., erecting sunshades, placing at night or early morning) to slow evaporation to tolerable limits when the combination of ambient air temperature, concrete temperature, humidity, and wind promotes rapid evaporation of moisture from the concrete surface. Ice may be used as a part of the mixing water if it has completely melted by the time mixing is completed.

Ensure the temperature of the surface to be covered by concrete does not exceed 90 °F.

I. Finishing Concrete. Provide formed surfaces with an ordinary surface finish, plus, if further finishing is required, a type of finish as specified. Provide a rubbed surface finish on exposed surfaces, except the soffits of superstructures and the interior faces and bottoms of concrete girders. Concrete surfaces are defined as follows:

1. Ordinary Surface Finish. Remove form bolts and tie wires immediately after the forms have been removed. If rock pockets materially affect the strength of the structure or endanger the life of the steel reinforcement, the Engineer may declare the concrete defective and require the removal and replacement of that portion of the structure affected. Clean, thoroughly wet, and fill holes and depressions with a cement mortar composed of 1 part of cement and 2 parts of sand. The Department may require an approved bonding agent. Remove fins caused by form joints and other projections above the ground line. Ensure the resulting surface is reasonably smooth and uniform in texture and color. Provide a rubbed surface finish on an ordinary surface with an unsatisfactory finish.
2. Rubbed Surface Finish. Thoroughly wet and rub the entire surface with a carborundum stone or other approved method after the pointing has set sufficiently. The Department may require an approved bonding agent. Spread the paste by rubbing uniformly over the surface and finish by floating or rubbing to attain a uniform color and texture.

Thoroughly clean concrete which has been discolored by the drip from the abrasive by using a dilute solution of muriatic acid, and then washing thoroughly with clean water.

The Engineer may waive the requirement for a rubbed surface finish if the uniformity of color and texture obtained with ordinary surface finish are essentially the equal of a rubbed surface finish when metal forms, fiber forms, lined forms, or plywood forms in good condition are used. Grinding with powered disc grinders or light sandblasting with fine sand or other approved means may be used in conjunction with ordinary surface finish.

3. Slab Finish. Finish and straightedge deck slabs and wearing surfaces as follows:

Finish deck slabs greater than 40 feet in length and other wearing surfaces subject to highway traffic that are greater than 40 feet in length by the machine method. Finish other deck slabs and wearing surfaces using machine or hand methods.

Do not use additional water on the concrete surface during machine or hand-finishing operations.

Straightedge the concrete surface, broom finish, and meet the completed surface requirements of the following in paragraphs c, d, and e after finishing by machine or hand methods.

- a. Equipment. Use an Engineer-approved, power-driven finishing machine complying with the following requirements for finishing all areas of work with a width of at least 14 feet. Have at least 2 hand-operated, spud type internal vibrators available at all times for use as directed. Submit equipment approval requests to the Engineer at least 15 calendar days before the start of the work. Do not begin placing deck concrete until the screed and placing procedure is approved by the Engineer.

Provide a self-propelled finishing machine capable of forward and reverse movement under positive control for placing, striking off and finishing the bridge deck surface, with provisions for raising screeds to clear the surface. Equip the machine with vibrating screeds designed to consolidate the modified composition. The Department requires the vibration frequency be variable with positive control between 3,000 and 11,000 vpm and the bottom face of the screeds be at least 4 inches wide and be metal covered. Provide screeds with positive control of the vertical position. Equip the finishing machine with one or more rollers, augers, and 1,500 or 2,500 vpm vibratory pans. Provide a Bid-Well 2450, or equivalent finishing machine. Modification to the Bid-Well 2450 or equivalent is subject to Engineer approval.

Texas, Allen, or Bunyan type screeds will only be permitted for small and/or irregular areas if approved by the Engineer.

Before beginning concreting operations, operate the finishing machine over the full length of the bridge segment to be finished. Make this test run with the screed adjusted to its finishing position. Check the screed rails for deflection and proper adjustment, the cover on slab reinforcement, and form alignment while operating the finishing machine in this test.

Make necessary corrections before placing concrete. Ensure the concrete carried ahead of the screed does not cause slipping of the finishing machine wheels on the rails.

Orient the transverse axis of the finishing machine parallel to the bearing centerline on prestress and steel girder spans. Ensure the concrete placement heading and the strike-off heading are parallel so equal loads are produced on each girder.

- b. Hand Method. Strike the concrete off with a template or a vibrating screed after it is placed. Finish concrete to an even surface by means of longitudinal and transverse floats. Do not use a power trowel.

- c. Straightedging. Test the surface of the concrete for trueness while the concrete is still plastic. Use an approved 10-foot straightedge. Hold the straightedge in contact with the surface in successive positions parallel to the centerline and go over the whole area from 1 side of the slab to the other. Advance along the surface in successive stages of less than 1/2 the length of the straightedge. Immediately fill depressions found with freshly mixed concrete, strike off, consolidate, and refinish. Cut down high areas and refinish. Ensure the concrete surface across joints meets the requirements for smoothness. Perform straightedging and surface correction from foot bridges resting on the side forms and spanning, but not touching, the concrete. Continue straightedge testing and surface corrections until the entire surface is without observable departures from the straightedge and the slab conforms to the required grade and cross-section.
- d. Final Finish. Float the deck slab after screeding to produce a uniform surface without porosity. Give the surface a steel tine finish if necessary. Use tines 1/8 inch wide, spaced at 1/2 to 3/4 inch intervals, and producing grooves 5/32 inch ± 1/32 inch deep. Check groove depth in accordance with Idaho IT 147. If more than 3 readings in a set of 10 are outside the intended depth range, make adjustments to the tining operation.
 Minimize surface tearing or aggregate removal when tining.
 Tine-stroke transverse to the roadway centerline and the full width of the roadway except for troweled smooth strips 12 inches wide along curb faces. Do not overlap adjacent strokes. Finish the surface without porous spots, irregularities, depressions, small pockets, or rough spots.
 The Contractor may saw cut grooves instead of the steel tine finish, if approved. Use a width and spacing of the grooves 1/8 to 1/4 inch. Do not perform saw cut grooving until after the curing duration. Continuously and completely remove residue from the grooving operation.
 Screed or float finish structures that will receive a deck membrane and asphalt overlay. Complete surface without porous spots, irregularities, depressions, small pockets, or rough spots.
- e. Surface Smoothness. The Engineer will test the slab surface for smoothness in accordance with Idaho IT 87, at the end of the curing period. Ensure the surface does not vary more than 1/4 inch in 10 feet from the lower edge of the straightedge and 90 percent of the readings do not exceed 1/8 inch in 10 feet. Grind concrete surfaces that do not meet surface smoothness requirements or replace as directed at no additional cost to the Department.

J. Curing Concrete. Keep concrete surfaces completely and continuously moist until a curing method is applied. Do not apply membrane-forming curing compound to concrete surfaces before the finishing has been accepted. Do not apply membrane-forming curing compound to construction joints or to the inside faces of joints to be sealed. Cure concrete as specified in Tables 502.03-6 and 502.03-7.

Table 502.03-6 – Concrete Placement Type

Placement No. 1	Bridge decks, including sidewalks on bridges, bridge curbs, or parapets.
Placement No. 2	Sidewalks, urban approaches, curbs, or curb and gutter. Approach slabs and concrete slope paving.
Placement No. 3	Prestressed girders. Concrete placements (e.g., beams, caps, columns, footings, catch basins, manholes, median barrier, median curbs, box girders excluding the deck portion, signal, luminaries, sign support foundations). Concrete guardrail Sound walls

Table 502.03-7 – Cure Methods

Placement Number	Method A: Water Cure	Method B: Membrane-Forming Curing Compound	Method C: Form Cure	Method D: Steam Cure
1	X	—	—	—
2	X	X-System 1	—	—
3	X	X-System 1	X	X

Cure concrete by one of the following methods:

1. Method A: Water Cure. Make a single application of a membrane-forming curing compound immediately after surface finishing is completed on each individual portion of the placement. Apply the membrane-forming curing compound under pressure at a rate of at least 1 gallon per 150 square feet. Use System 1 membrane-forming curing compound on placement numbers 2 and 3. Use System 2 membrane-forming curing compound on placement number 1. Start water curing after the concrete surface has set up enough so it will not be damaged, but not later than 4 hours following application of the curing compound.

Keep the concrete surfaces in placement 1 continuously wet for at least 10 calendar days. Keep the concrete surfaces in placement 2 and 3 continuously wet for at least calendar 5 days.

Parapet finishing may be performed during the wet cure period. The Contractor may have the burlap removed for finishing small, isolated areas of the parapet provided the surface of the concrete is not allowed to dry out.

Keep the concrete surface wet using cotton mats, rugs, carpets, burlap, laminated moisture-retaining cover, or other approved coverings as a reservoir medium. Saturate the reservoir medium before placement on the concrete surface. Ensure the reservoir medium is in a saturated state, drained of free water, when initially placed. Add water as necessary to keep it from drying out during the curing period. Cover the reservoir medium with white plastic sheeting to reduce evaporation. Do not use plastic sheeting alone as a reservoir medium. Clear the surface of reservoir mediums at the end of the curing period.

Show ability to provide the water cure as specified before placing concrete.

The Engineer will immediately suspend the concrete placing operations for failure to provide sufficient cover material or sufficient water to adequately take care of water curing and other associated requirements.

2. Method B: Membrane-Forming Curing Compounds. Apply membrane-forming curing compounds, as specified in 709.01, to the finished concrete immediately after the bleed water or free water sheen leaves the surface of the finished concrete surface.

Thoroughly mix membrane-forming curing compounds before using and agitate it during application to prevent settling or separation.

Uniformly apply the membrane.

Apply the second coat of membrane at right angles to the first coat when 2 coats are used, if possible.

Immediately apply the same type of membrane material to membrane surfaces that are marred or damaged by scuffing or wearing before completion of the curing period, or water cure the area for the remaining cure period.

Each manufacturer's identified lot of curing compound is required to be sampled, tested, and approved before use. Allow 3 weeks for laboratory testing of the curing compound once it has been received by the Central Materials Laboratory. Quantities of curing compound over 1,000 gallons may be inspected and sampled by the Department at the manufacturer's plant for acceptance testing. Request inspection from the Engineer and the Central Materials Laboratory in writing 30 calendar days before ordering material.

- (a) System 1: AASHTO M 148 Type 1 D Class B with Fugitive Dye. Prepare the concrete surface before painting if System 1 is used. Refer to 627.03.E. Provide 2 applications of the curing compound for a total coverage of 1 gallon per 150 square feet to concrete cured by this method. Apply each application of the curing compound under pressure at a rate of at least 1 gallon per 300 square feet. If the surface under the forms has dried, thoroughly wet the concrete with water and apply the curing compound just as the surface film of water disappears. Apply the first coat immediately after stripping the forms and before acceptance of the concrete finish. Apply the second application immediately after the first application has set. Keep unsprayed exposed surfaces wet with water during curing operations.
 - (b) System 2: AASHTO M 148, Type 2, Class B, White Pigmented. Apply curing compounds under pressure at a rate of at least 1 gallon per 150 square feet on surfaces.
3. Method C: Form Method. Protect concrete with forms for at least 7 calendar days. Intermittently moisten and protect forms from the sun during daytime periods of hot weather. Cure exposed surfaces by water or approved membrane cure.
 4. Method D: Steam Curing. When steam curing is used, protect the concrete for a minimum 2-hour period when the temperature is 50 °F to 100 °F. Following this initial period, increase the temperature at a maximum rate of 40 °F per hour to a temperature between 100 °F and 175 °F.

Continue curing at this temperature until cylinder strengths are above the release strength for prestressed reinforced concrete or above 80 percent of the intended 28-day strength, whichever is greater.

Cool the beam gradually by decreasing its temperature at a rate of 40 °F per hour or less until the temperature differential between the beam and outside air is 25 °F or less at the end of the cure cycle, when ambient air temperatures are below 40 °F.

Do not expose member to below freezing temperatures until at least 6 calendar days after fabrication or until the 28-day strength has been achieved.

502.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Precast stringers, prestressed stringers, and concrete parapets by the foot.
2. Approach slabs by the square yard, including the exposed finished surface of the concrete deadman.
3. Other concrete by the cubic yard with the dimensions specified or ordered, except the volume of concrete placed under water and formed Class 15 concrete may be based on batch design volumes. The volume occupied by the reinforcing steel, anchors, conduits, weep holes, H piling, or chamfers will not be deducted. The volume of concrete displaced by culverts or piles, other than H piling, will be deducted.
4. Deck concrete by the square yard or cubic yard to the dimensions specified.

502.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Concrete Class _____	CY
Concrete Class ____ Schedule No. ____	CY or SY
Seal Concrete	CY
Precast Stringers ____ (Beam)	ft
Prestressed Stringers ____ (Beam)	ft
Concrete Parapet	ft
Approach Slab	SY
Prestressed Slabs (w ____ x d ____)	ft
Prestressed T Beam (w ____ x d ____)	ft
Prestressed Box Beam (w ____ x d ____)	ft

1. Concrete. At the contract price per cubic yard or square yard for concrete of the class and schedule specified. Pay for concrete placed in the superstructure as concrete Class __ Schedule No. 2 by plan quantity as specified in 109.01.
2. Precast and Prestressed Stringers, Slabs, and T Beams. At the contract price per foot. The contract price includes reinforcing steel, epoxy coating of steel entirely or partially embedded in the precast elements, prestressing, and structural steel that is cast in and included with precast elements. Payment will be made on plan quantities, except for authorized additions.
3. Concrete Parapet. At the contract unit price per foot and include reinforcing steel and epoxy coating that is cast within the parapets in whole or in part.
4. Approach Slabs. At the contract unit price per square yard, including site preparation (e.g., excavation or other shaping), reinforcing steel, joint sealers, sleeper beams, concrete deadman, and curbs.
5. Price Adjustment. The Department will adjust the contract unit prices for strength deficiency as specified in 502.01.B. The Engineer will apply a price adjustment to the unit price of the concrete class if required for the quantity represented by the individual strength tests. The Department will apply this price adjustment provision to the contract unit price of other items of work by their respective units of measurement and payment that incorporate concrete under 502. If concrete is at incidental cost or included in the overall cost of an item, the Engineer will establish a value of the concrete proportional to the total contract price for purposes of establishing a price reduction on the concrete that does not meet specified strength, but is allowed to remain in place.
6. Surface Resistivity Price Adjustment. The Department will make the following price adjustment to the contract unit price for each lot of Schedule No. 2 concrete meeting the following surface resistivity requirements when measured using AASHTO T 358 at 28 calendar days.

Table 502.05-1 – Surface Resistivity Price Adjustment

Price/yd ³	Surface Resistivity, kΩ-cm (4X8)	Surface Resistivity, kΩ-cm(6X12)
\$2.50	> 21.0, ≤ 37.0	> 16.5, ≤ 29.0
\$5.00	> 37.0	> 29.0

SECTION 503 – METAL REINFORCEMENT

503.01 Description. Provide and install reinforcing steel.

The metal reinforcement, Schedule no. 1 pay item includes metal reinforcements placed in substructures. The metal reinforcement, Schedule no. 2 pay item includes metal reinforcement placed in superstructures. The Department will show the schedules on the plans for the structures involved.

503.02 Materials. Provide materials as specified in:

Reinforcing Steel	708.02
Epoxy-Coated Metal Reinforcement	708.02
Dowel Bars	708.03
Tie Bars	708.04

Accompany each shipment of reinforcing steel delivered with a completed [ITD-0914](#) form and a copy of the mill test report attached for each heat included in the shipment. The Engineer will obtain field samples for each heat number and bar size from material delivered. Submit proper identification with each shipment delivered to allow the Department to readily identify each bar size by heat number. The Engineer will reject reinforcing steel delivered that cannot be identified by heat number. Replace rejected material at no cost to the Department.

Order additional bars to account for the field sampling. Do not cut and splice bars to obtain samples. Complete fabricated bars are to be sampled and replaced. If the bar configuration is such that two, 36-inch long test specimens can be cut from 1 bar, then only 1 such bar constitutes a field sample. Otherwise, 2 complete fabricated bars constitute a single field sample.

Provide reinforcing steel spirals with additional length to accommodate sampling. Do not cut and splice material to obtain samples.

Replace bar from failing heat numbers at no additional cost to the Department.

503.03 Construction Requirements.

A. Bar List and Bending Schedule. The plans will show the bar list and bending schedule to arrive at an estimate of quantities. Verify the quantity, size, and shape of the bar reinforcement against the structure drawings and make necessary corrections before ordering. The Department will not adjust the contract unit price because of errors in the bar list and bending schedule.

B. Protection of Material. Protect steel reinforcement from damage. When placed, ensure the steel reinforcement does not have dirt, detrimental scale, paint, oil, or other foreign substance. Do not store epoxy-coated reinforcing steel outdoors for more than 2 months. When stored outdoors, cover the bars to protect them against the elements and against condensation forming on the bars.

C. Bending. Field bend reinforcing bars only when the bars conflict with prestressing ducts, are within anchorage recesses, or as specified.

Do not field bend:

1. Bar sizes larger than No. 7.
2. When the application of heat is required and the ambient temperature is lower than 50 °F and wind velocity at the bending site exceeds 15 mph.
3. By means of hammer blows or other impact loading.

Do the following when field bending steel reinforcing bars:

1. Make the bend gradually.
2. Apply heat in bending bars sizes No. 6 and No. 7 or in bending bar sizes No. 5 and smaller when those bars have been previously bent. Previously unbent bars of sizes No. 5 and smaller may be bent without heating.
3. Use a bending tool equipped with a bend inside diameter / bar diameter ratio of 8.
4. Limit bends to a maximum of 90 degrees.
5. Straighten by moving a hickey bar, if used, progressively around the bend.

Do the following in applying heat for field bending steel reinforcing bars:

1. Use only rosebud type torch tips, designed to give a diffused flame.
2. Insulate concrete within 6 inches of the heated bar area.
3. Ensure by means of temperature indicating crayons or other suitable means the steel temperature at the end of a heating operation will be as follows:
 - 1,200 °F to 1,250 °F for bar size No. 4
 - 1,350 °F to 1,400 °F for bar sizes No. 5 and No. 6
 - 1,400 °F to 1,445 °F for bar size No. 7
4. Heat the entire length of the bend plus a 2 inches additional length on each side of the bend.
5. Maintain the steel temperature within the required range shown above during the entire bending process.
6. Bend the bar immediately after the required temperature has been reached.
7. Never cool bars artificially with water, forced air, or by placing them on the ground or a concrete floor or other means.
8. Transport or install hot, bent bars after they have reached the ambient temperature.

Submit a field bending plan for approval including a description of the proposed methods, tools, materials, and handling of the field bent reinforcement before bending bars in the field.

D. Placing and Fastening. Firmly hold reinforcing steel in the position specified while placing concrete. Maintain reinforcement position by means of stays, blocks, ties, hangers, or other approved supports. Do not space the supports for metal reinforcement more than 4 feet apart transversally or longitudinally. If concrete blocks are used, embed the appropriate tie wires or coated tie wires during their forming stage and tie each block to the reinforcing bar it supports to hold the block in place. Ensure concrete blocks have approximately the same strength quality as the concrete placed around them. The Department requires plastic-coated tie wire and plastic-coated metal bar supports whenever they will be in direct contact with epoxy-coated reinforcing. Do not use pebbles, pieces of broken stone, broken concrete, metal pipe, or wooden blocks. Tie down top layers or mats of metal reinforcement in bridge decks to stirrups or shear studs. Locate tie downs so there is at least 1 tie down per 16 square feet of deck surface. Provide tie downs strong enough to prevent upward movement of reinforcement. Do not deviate more than plus or minus 0.25 inch in the vertical direction from the position specified for concrete deck reinforcing steel.

Do not place concrete until the Engineer has inspected the reinforcement. Repair damage to epoxy coating of reinforcing steel, occurring during installation before placing. Remove rust and contaminants from the steel surface and adjacent coating, by wire brushing, immediately before applying patching material. Use a patching material certified to meet ASTM A775 and apply it in accordance with the manufacturer's written instructions.

Tie reinforcing bars at intersections, unless spacing is less than 1 foot in each direction, then tie the alternate intersections. Where bundled bars are shown on plans, tightly tie bundles at intervals not exceeding 3 feet with No. 16 or larger black or plastic-coated steel wire. Do not weld reinforcing steel unless shown on plans or approval has been obtained. Weld in accordance with AWS D1.4 Structural Welding Code - Reinforcing Steel.

The Contractor may weld reinforcing steel assemblies if approved for precast items instead of tying, as follows:

1. Weld at locations shown on the approved shop drawings.
2. Do not weld at the casting bed when prestress reinforcement is on the bed.
3. The Contractor may tack weld design bars as specified to extra No. 4 bars for positioning. Do not exceed 1 inch weld length tack welds and locate only at the very ends of design bars. Show the extra bars on the shop drawings and identify as bars whose only function is to position the design bars. Extra bars and design bars have the same concrete cover requirement. Locate extra bars to not interfere with prestress reinforcement or other design details. The Contractor may weld positioning bars to each other.
4. Epoxy coat the positioning bars if epoxy-coated bars are specified. Clean welds and weld-damaged coating with wire brush and coat with a patching compound recommended by the epoxy supplier.

E. Splices. Provide reinforcement in the full length specified except for column spirals. Do not splice bars, except where specified and in the column spirals. Rigidly clamp or wire bars at splices in a manner approved.

Do not field splice column spirals in the lower $\frac{1}{4}$ or the upper $\frac{1}{4}$ of the spiral. At other locations in the column, the Contractor may provide welded splices in column spirals that meet AWS D1.4 or provide approved mechanical splices for field splices in column spirals.

Form mechanical splices for epoxy and non-epoxy-coated bars with an approved system, using mechanical couplers that comply with this section at locations where mechanical splices are required. Do not weld splices. Epoxy coat or protect exposed splice components used for the epoxy-coated bars from corrosion by other approved means.

Submit the following information for each shipment of splice material before splicing:

1. The type of series identification and heat treatment lot number for threaded-sleeve splices.
2. The grade and size of the bar to be spliced.
3. A manufacturer's catalog with complete data on material and procedures.
4. A written statement from the Contractor the system and materials will be used in accordance with the manufacturer's instructions and requirements of this section.

Make 1 tension test specimen splice to represent each lot of bars spliced at the project site. A lot consists of every 50 epoxy-coated or every 50 non-epoxy-coated bars spliced at the project site, of one size and by one operator. Tension test each specimen to destruction or to the specified ultimate strength, whichever is less. Perform tests in a qualified laboratory. Submit reports promptly to the Engineer. Cut out 2 production splices from the lot represented by the specimen and test for tensile strength requirements. The Engineer will accept the splices in a lot if both retests meet tensile requirements. The Engineer will reject the splices in the lot if 1 or both retests fail to meet the requirements. Remove, test, and replace at no additional cost to the Department.

Ensure mechanical splices meet the following criteria:

1. Develops at least 125 percent of the yield tensile strength specified for the unspliced bar. The ultimate tensile strength of the sleeve exceeds that of the other parts of the completed splice.
2. Slippage for AASHTO M 31 Grade 60 bars within a splice sleeve is limited to a maximum of 0.045 inch. Measure the slippage between gauge points clear of the splice sleeve. Take measurements at initial load

of 3,000 psi and again after loading to 90 percent of the minimum specified yield strength for the unspliced bar and then relaxed to 3,000 psi.

Payment. The Department will not provide separate payment for the cost of providing and installing mechanical splices or for testing where required. These costs are incidental and included in the contract unit prices for metal reinforcement.

503.04 Method of Measurement. The Engineer will measure acceptably completed work by the pound, based on the theoretical pound unit weight.

The Engineer will measure epoxy-coated metal reinforcement by the pound of reinforcing steel before coating, based on the theoretical unit weight.

503.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Metal Reinforcement	lb
Metal Reinforcement, Schedule No. _____	lb
Epoxy-Coated Metal Reinforcement	lb

No allowance will be made for clips, wire, or other material used for fastening reinforcement in place.

No allowance will be made for plastic-coated wires, supports or other material used for fastening epoxy-coated reinforcement.

The Department will include the weight of the splice bars for which payment is made, if the splice bars are specified or as directed. The Department will not pay for bars installed for the Contractor's convenience.

The Department will pay for Schedule 2 Metal Reinforcement using plan quantities as specified in 109.01.

SECTION 504 – STRUCTURAL METALS

504.01 Description.

A. General. Provide, fabricate, erect, and paint structural metals.

B. Fabricator Certification. Fabricators of structural components for vehicular bridges, other than unspliced rolled beam bridges, are to be certified under the AISC Quality Certification Program, intermediate or advanced steel bridge categories. Fabricators of structural components for unspliced, rolled beam vehicular bridges and steel pedestrian bridges are to be certified under the AISC Quality Certification Program, simple steel bridge structures category. Fabricators of fracture critical members are to hold a fracture critical endorsement in addition to the above requirements. This does not apply to incidental sub-assemblies (e.g., drainage components, expansion joints, handrails, lighting supports).

C. Notice of Rolling and Fabrication. Give a 90-day notice before beginning work at the mill or shop so the Department can prepare for inspection. Do not manufacture material or perform work in the shop before the Engineer has been notified.

D. Inspection. The Department will inspect structural steel at the fabrication site. Submit electronic copies of mill orders, certified mill test reports and shipping statements. On mill test reports, show the chemical analysis and physical test results for each heat of steel used in the work.

Submit certificates of compliance instead of mill test reports for material that normally is not supplied with mill test reports and for some items (e.g., fills, minor gusset plates, quantities are small and the material is taken from stock).

Submit certified mill test reports for steels with specified impact values that include, in addition to other test results, the results of Charpy V-notch impact tests. When fine grain practice is specified, include confirmation the material was so produced. Submit copies of mill orders at the time orders are placed with the manufacturer. Submit certified mill test reports and certificates of compliance before starting material fabrication covered by these reports. Submit the certificate of compliance signed by the manufacturer certifying the material is in compliance with the specifications to which it has been manufactured.

Make available to the Engineer material to be used so each piece can be examined. Provide the Engineer with safe access to the fabrication site where the material is stored or where work on the material is being performed.

E. Quality Control Inspection. Be responsible for quality control inspection and testing. Perform inspection and testing at least to the extent specified and in accordance with the ANSI/ AASHTO/ AWS D1.5 Bridge Welding Code, Inspection.

Include nondestructive testing in addition to visual inspection, testing to base metal, production welds, weld repairs, procedure qualification test weldments and welder, welding operator, and tacker qualification test weldments. This work is incidental and the costs are to be included in the contract unit prices for the structural steel.

Provide facilities to inspect material and work.

F. Shop Plans. Submit working drawings for fabricating the steel in PDF format. Include on each drawing and calculation sheet the project name as shown on the plans, district-county-route, bridge number, contract number, contract drawing number, and key number.

Submit welding procedures in PDF format for approval with shop drawings. Include the type of equipment and electrode to be used, preheat requirements, base materials, and joint details. When the procedures are not prequalified by AWS or AASHTO, submit evidence of qualification tests.

The Department accepts only the nature and scope of the details without validating dimensions in approving working drawings.

Do not make changes in drawings after approval.

Submit as-built shop drawings in PDF format.

G. Erection Plans. Submit the proposed erection plan for approval. The Department requires the erection procedure be reviewed by the steel fabricator before being submitted.

Include in the submittal, maximum stress calculations that each member will be subjected to during erection. Use these calculations to determine the necessity of using strongbacks or erecting the girders in pairs with cross frames installed to prevent the possibility of buckling the compression flange during girder erection. Sign and seal the calculations and plans by an Idaho licensed professional engineer. Ensure falsework or temporary structures meet the requirements of 502.03.E.

Supplement the erection procedure with necessary drawings to clearly describe the method proposed. Include details of falsework bents, bracing, guys, temporary anchors, lifting devices, attachments to the bridge members, sequence of erection, location of lifting points on the bridge members, and weights of the members. Submit the plan and drawings in detail for anticipated phases and conditions during erection.

Submit plans of temporary members or devices which affect stresses in the permanent members of the structure. Remove temporary or extra material. The Department will not pay for extra material required due to the Contractor's erection procedures or method or for material required in the permanent structure due to the Contractor's erection scheme.

Be responsible for the practicality and safety of the erection schemes used and carrying out the work as specified.

Be responsible for material ordered or shop drawings prepared before the Engineer reviews the erection scheme.

Submit the plan and drawings for approval as specified in 502.03.E.4.

H. Camber Diagram. Submit a camber diagram from the fabricator, showing the camber at each panel point of trusses or arch ribs and at the location of field splices and tenth points of span length of continuous beam and girder or rigid frames. Show calculated cambers to be used in preassembly of field connections on the camber diagram.

504.02 Materials.

A. Structural Metals. Meet the requirements shown on the plans and as specified in 708.06.

Meet the additional fabrication, inspection, and certificate requirements of the current AASHTO Guide Specifications for Fracture Critical Non-Redundant Steel Bridge Members and current interim specifications for members identified on the plans as "fracture critical member(s)."

Do not use universal mill plates for flange plates in designated tension stress or stress reversal areas.

Use structural steel classified as:

1. Structural carbon steel (use wherever the plans do not specify another classification). Meet AASHTO M 270 Grade 36.
2. Structural low alloy steel. Meet AASHTO M 270 Grade 50 and 50W.
3. Structural high-strength steel. Meet AASHTO M 270 Grade 70W.

The Department classifies the following as structural carbon steel:

1. Shims, ladders, stairways, anchor bolts and sleeves, pipe fittings and fastening used in handrails, and other metal parts, even if made of other materials, for which payment is not specified.

B. Painting. When required on the plans, paint the structural steel as specified in 627. Provide paint as specified in 707.

C. Handling, Storing, and Shipping of Materials. Apply markings at the mill to distinguish structural low alloy steel from structural carbon steel. Keep the 2 classes of steel separated.

Protect material from rust, dirt, oil, and other foreign matter. The Engineer will not accept rust-pitted material.

Ensure structural steel arrives in good condition. The Engineer may require thorough cleaning by high pressure water, flushing steel damaged by saltwater shipment, chemical cleaning or sandblasting, and repainting with the specified shop coat.

Prevent rust and loss of small parts when storing material. Do not rest piled material on the ground or in water. Use skids or platforms.

Conduct the loading, transporting, unloading, and piling of the structural steel material so the metal is kept clean and not injured from rough handling.

Keep girders and beams upright after fabrication during shipment, handling, and storage, unless otherwise approved in writing. Support long members (e.g., columns, chords) on skids placed near enough together to prevent damage from deflection.

Use methods and equipment not likely to twist, bend, deform, or otherwise injure the metal in field assembly of structural parts. Correct any member slightly bent or twisted before it is placed. The Engineer may reject members that are damaged.

Repair scratches and gouge marks caused by handling and lifting and located in tension or stress reversal regions, by grinding to a surface finish of ANSI 125 or better, and inspect by the dye penetrant or magnetic particle method. If the marks are located in an area where they will be covered or partly covered by a structural weld, grind and test before welding.

Handle girder sections to prevent damage. Laterally support girders during shipment by blocking, removable flange bracing, bolting in pairs, or other approved method. Show the method of lateral support for the girders on the shop drawings.

Mark the weight on members weighing more than 6,000 pounds and remove after erection is completed.

D. Castings. The specifications for structural steel, including painting requirements, also apply to castings.

Provide castings that are:

1. True to pattern in form and dimensions.
2. Without pouring faults, sponginess, cracks, blow holes, and other defects in places that would affect strength, appearance, or value.
3. Clean and uniform in appearance.
4. Filleted boldly at angles.
5. Formed with sharp and perfect arises.

Anneal iron, steel castings, and forgings before matching.

504.03 Construction Requirements.

A. Identification of Steels During Fabrication. Submit for approval a written plan for visibly marking the material so it can be traced. Ensure these marks remain visible at least through the fit-up of the main load-carrying tension members. Provide a marking method that allows the Engineer to verify:

1. Material specification designation.
2. Heat number.
3. Material test reports to meet special requirements.

Include the heat numbers on the reproducible copies of the as-built shop plans for steel in main load-carrying tension members and in tension components of flexural members.

B. Edge Finishing. Finish rolled, sheared, and flame-cut edges true to line and without rough corners and projections. Round corners along exposed edges to a radius of $1/16$ inch or greater. Plane, mill, grind, or thermal cut to a depth of $1/4$ inch sheared edges on material more than $5/8$ inch thick.

Do not exceed 250 micro-inches as defined by ANSI specifications for surface roughness of flange plates in designated tension stress or stress reversal areas (rolled, sheared, and flame-cut edges). The Contractor may obtain this roughness on flame-cut edges after cutting by grinding or other approved methods.

Do not exceed 1,000 micro-inches surface roughness of other rolled, sheared, and flame-cut edges.

C. Thermal Cutting. Take steps to ensure the flame-cut edges of main material are not hardened by the cutting process. The Contractor may achieve this by preheating, post heating, or control of the burning process. Edge hardness for AASHTO M 270 Grade 50 and 50W plates after flame cutting found to have a Rockwell hardness value of C30 or greater will be considered unacceptable. Determine hardness in accordance with AASHTO T 80. Test plate edges at least once for each fabrication piece. Remove unacceptably hard surfaces by grinding, machining, or heat treating procedures as approved.

Preheat to the following temperatures when flame cutting AASHTO M 270 Grade 50/50W and above, or other high-strength low alloy steels as shown in Table 504.03-1.

Table 504.03-1 – Preheat Temperature

Thickness (t) of Thickest Part at Point of Cutting, in	Temperature °F
$t \leq 0.75$	50
$0.75 < t \leq 1.5$	70
$1.5 < t \leq 2.5$	150
$t > 2.5$	225

Preheat the plate so the required temperature is obtained through the full thickness of the plate ahead of and laterally from the cut a distance of 3 inches, or the plate thickness, whichever is greater.

Show preheat temperatures on the shop drawings.

D. Fit and Bearing. Mill ends of columns that bear on base and cap plates to true surfaces and accurate bevels.

When assembled, ensure caps and base plates of columns and the sole plates of girders and trusses have full contact. Heat straighten, plane, or correct the plates in some other way to produce accurate, even contact if plates are warped or deformed. If necessary for proper contact, plane or mill bearing surfaces that will contact other metal surfaces. Rough finish surfaces of warped or deformed base and sole plates that will contact masonry.

On the surface of expansion bearings, ensure the cut of the planer is in the direction of expansion.

Face abutting ends of compression members accurately so they bear evenly in the structure. On built-up members, face or mill the end after fabrication.

Rough finish ends of tension members at splices to produce neat, close joints. The Department does not require a contact fit.

Ensure floor beams, stringers, and girders having end connection angles are flush with each other and set accurately in relationship to the position and length of the member. Unless the plans require it, do not finish end connection angles. If faulty assembly requires them to be milled, do not reduce milling thickness by more than $1/16$ inch.

Ensure the various pieces forming 1 built member are straight and close-fitting, true to detailed dimensions, and without twists, bends, open joints, or other defects.

Do not exceed $\frac{3}{8}$ inch clearance between web plates for field-bolted splices.

Mill bearing stiffeners so they will bear evenly against the flange. Fit intermediate stiffeners tightly enough to exclude water after painting.

E. Grinding. Grind plates so the direction of grinding is parallel with the direction of tensile or compressive stress. Show the direction of grinding on the shop plans.

F. Camber. Do not camber in the plane parallel to the strong axis of the girder by the use of heat or mechanical bending. For plate girders, cut the web to the prescribed camber with suitable allowance for shrinkage due to cutting, welding, and heat curving.

G. Curvature. Produce girder curvature in an axis parallel to the girder web as specified by fabrication methods that meet AASHTO Specifications for Highway Bridges Division II-Construction.

H. Pins and Rollers. Make pins and rollers of the class of forged steel specified. Turn accurately to detailed dimensions, smooth, straight, and flawless. Produce the final surface by a finishing cut.

Forge and anneal pins and rollers more than 9 inches in diameter. The Contractor may cold-finish or forge and anneal carbon steel shafting pins and rollers 9 inches or less in diameter.

In pins larger than 9 inches in diameter, bore a hole at least 2 inches in diameter full length along the axis after the forging has been allowed to cool to a temperature below the critical range and before being annealed. Cool under conditions which will prevent damage by cooling too rapidly.

Bore pin holes true to detailed dimensions, smooth and straight, and at right angles to the axis of the member. Ensure holes are parallel with each other. Always make a finishing cut.

Do not vary from detailed dimensions the distance between holes by more than $\frac{1}{32}$ inch. Measure the distance in tension members from outside to outside of holes and in compression members inside to inside.

Ensure each pin is $\frac{1}{50}$ inch smaller in diameter than its hole. Number pins after being fitted into their holes in the assembled member. Magnetic particle test pins in accordance with ASTM A275 using an independent testing laboratory. The Engineer will reject pins with inner defects.

Provide 2 pilot and 2 driving nuts for each size of pin.

I. Machine Finished Surfaces. As soon as possible and before they leave the shop, cover machine-finished surfaces on abutting chord splices, column splices, and column bases with grease. After erection, clean and paint the steel as specified.

Paint surfaces of iron and steel castings milled to smooth with the primer called for in the specified paint system.

While still in the shop, ensure machine-finished surfaces and inaccessible surfaces of rocker or pin-type bearings receive the full paint system.

Do not paint surfaces of pins and holes machine-finished to specific tolerances. Coat with grease as soon as possible.

J. High-Strength Bolt Holes.

1. General. The Contractor may punch or sub-punch and ream, drill or sub-drill and ream, or form by numerically controlled drilling operations, holes subject to the condition described in this section.

Ensure the hole for each high-strength bolt is $\frac{1}{16}$ inch larger than the nominal diameter of the bolt and less than 1 inch in diameter and $\frac{1}{8}$ inch larger for bolts with diameters greater than 1 inch.

The fabricator may drill holes full size from the solid with every thickness of material assembled in proper position in forming any connection. If the fabricator chooses not to use this method, then the following methods apply:

- a. Sub-punch or sub-drill holes, then ream full size after assembly in connections and splices in the main members of trusses, arches, continuous beam spans, bents, towers, plate girders, box girders, and rigid frames.
- b. Drill holes full size unassembled to a steel template for splices of rolled beam stringers that continue over floor beams or cross frames.
- c. Sub-punch and ream holes full size to a steel template or reamed full size while assembled for end connections of rolled beam stringers and floor beams or cross frames.

If steel templates are used to ream or drill full-size connection holes, position and angle the templates with extreme care and bolt firmly in place. Use duplicate templates for reaming matching members or the opposite faces of one member. Locate templates for connections on like parts or members with such accuracy that match-marks are not needed.

The Contractor may punch or drill bolt holes full size in cross frames, gussets, lateral braces, and other secondary members from the solid while assembled.

2. Punched Holes. For punched holes, ensure the die diameter does not exceed punch diameter by more than $1/16$ inch. Ream holes requiring enlargement to fit the bolt. Cut holes clean with no torn or ragged edges. The Engineer will reject components having poorly matched holes.

Ensure after shop assembly and before reaming, punched, sub-punched, and sub-drilled holes meet the following standard of accuracy:

- a. At least 75 percent of the holes in each connection permit the passage of a cylindrical pin $1/8$ inch smaller in diameter than nominal hole size.
- b. The pin passes through at right angles to the face of the member without drifting.
- c. Holes permit passage of a pin $3/16$ inch smaller in diameter than nominal hole size.

The Engineer will reject pieces that fail to meet these standards.

3. Reamed and Drilled Holes. Use drills for reaming and drilling, producing cylindrical holes perpendicular to the member. Reamers and drills are to be directed mechanically, not hand-held.

Assemble connecting parts that require reamed or drilled holes and hold securely as the holes are formed, then match-marked before disassembly.

Submit a diagram showing these match-marks. The Engineer will reject components having poorly matched holes.

Remove burrs on outside surfaces and mating surfaces. Disassemble parts to remove burrs.

Ensure at least 85 percent of holes in a connection of reamed or drilled holes show offsets of $1/32$ inch or less between adjacent thicknesses of metal, with no hole having an offset greater than $1/16$ inch.

Inscribe centerlines from the connection on the template and locate holes from these centerlines. Use centerlines for accurately locating the template relative to the milled or scribed ends of the members.

Insert templates with hardened steel bushings into each hole. The fabricator may omit these bushings if the template will be used less than 5 times and use will not produce template wear.

Ensure each template is at least $1/2$ inch thick. If necessary, use thicker templates to prevent buckling and misalignment as holes are formed.

4. Numerically Controlled (NC) Drilled Connections. The fabricator may use NC drilling or punching equipment in forming holes described in this subsection if it meets the following requirements:

Submit for approval a detailed outline of proposed NC procedures, including:

- a. Steps from initial drilling or punching through check assembly.
- b. The specific members of the structure to be drilled or punched, hole sizes, locations of the common index, and other reference points, make-up of check assemblies, and other information needed to describe the process fully.

The fabricator may drill or punch to size through individual pieces or through a combination of tightly clamped pieces.

Show the NC procedures consistently produce holes and connections meeting these specifications when required.

5. Fitting for Bolting. Well pin and draw firmly together parts of a member before drilling, reaming, and bolting begins. If necessary, take assembled pieces apart to permit removal of burrs or shavings produced as the holes are formed. Ensure the member is without twists, bends, and other deformation.

Blast clean contacting metal surfaces in shop-bolted connections before assembly. Blast in accordance with the Society for Protective Coatings (SSPC) SSPC-SP-6.

Ensure drifting done during assembly does no more than enough to bring the parts into place and that drifting does not enlarge the holes or distort the metal.

K. Assembly.

1. Progressive Truss or Girder Assembly. Use progressive truss or girder assembly methods described as follows:

- a. Obtain approval of the shop assembly and the erection methods before work begins.
- b. Assemble each truss or girder in stages over the full length of the superstructure.
- c. For trusses, include at least 3 contiguous panels in the first stage.
- d. For girders, include at least 3 contiguous shop sections in the first stage.

After stage one has been completed, assemble each next stage to include at least 1 panel or shop section of the previous stage, repositioned if necessary, and pinned to ensure accurate alignment, and add 2 or more panels or shop sections at the advancing end.

If the bridge is longer than 150 feet, ensure each stage is at least 150 feet long, regardless of the length of individual continuous panels or shop sections.

Perform the assembly sequence in the same order the structure will be assembled in the field.

2. Check of Shop Assembly. Check each assembly for alignment, accuracy of holes, fit of milled joints, and other assembly techniques. Do not begin drilling or reaming until approved. If the Contractor uses NC drilling, obtain approval before the assembly or stage is dismantled.
3. Blasting Cleaning. For painted structures after fabrication, blast clean structural steel, except machine-finished surfaces, to a "near white" finish in accordance with SSPC-SP10. The "near white" surface is shown in the pictorial standards of SSPC-Vis 1-67T as A Sa 2.5 and C Sc 22.5. After blasting and before painting, remove loose dust and dirt that remains on the steel. Do not use acid to remove scale or stains.

For unpainted weathering steel structures, after fabrication, blast clean steel surfaces in the shop, except those to be embedded in concrete, in accordance with SSPC-SP-6. Provide a blasted appearance that is equal to or better than BSa2 as shown in the pictorial standards of SSPC-VIS 1-89.

Blast clean after erection as specified in 504.03.N.4.b.

Blast clean faying surfaces as specified in 504.03.L and 504.03.J.5.

Comply with 503.03.N.4.

L. Bolted Connections.

1. **General.** High-strength bolted connections are slip critical. Type 1 or Type 2 bolts are required for painted structures and Type 3 bolts for unpainted structures. Type 3 weathering steel is required for Direct Tension Indicators (DTIs).

Provide bolts, nuts, hardened washers, and DTIs as specified in 708.06.

Clean metal surfaces before fitting and bolting of the connection. Ensure assembled joint surfaces, including surfaces adjacent to the bolt head and nut, are free of dirt, road oil, and other foreign material. When splices are designated class B, slip-critical on the plans, field inspect the contact surfaces of splices immediately before assembly to ensure the surfaces are free of mill scale, dirt, road oil, and other foreign material.

Remove burrs that would prevent solid seating of the connected parts in the snug-tight condition.

Do not paint the faying surfaces of slip-critical connections. Protect areas closer than 1 bolt diameter, but at least 1 inch from the edge of a hole and areas within bolt pattern from paint, including inadvertent overspray.

Provide steel material within the grip of the bolt with no compressible material (e.g., gaskets, insulation within the grip). Ensure bolted steel parts fit solidly together. Bolted steel parts may be coated or uncoated. Ensure the slope of the surfaces of parts in contact with the bolt head or nut does not exceed 1:20 with respect to a plane normal to the bolt axis.

Protect fasteners from dirt and moisture at the project site. Take only as many fasteners as are anticipated to be installed and tightened during a work shift from protected storage. Return fasteners not used to the protected storage at the end of the shift. Do not clean fasteners of lubricant that is present in as-delivered condition. Clean and re-lubricate fasteners for slip-critical connections which accumulate rust or dirt resulting from project site conditions, before installation.

Use an approved tension measuring device (e.g., Skidmore-Wilhelm calibrator) where bolts in slip-critical joints or connections subject to direct tension are being installed and tightened. Use the tension measuring device to confirm:

- a. The suitability to satisfy the requirements in Table 504.03-2 of the complete fastener assembly, including lubrication if required, to be used in the work.
- b. Calibration of the wrenches.
- c. The understanding and proper use of the method to be used by the bolting crew.

Confirm the accuracy of the tension-measuring device through calibration by an approved testing agency at least annually in accordance with AASHTO T 67/ASTM E4.

Calibrate wrenches daily in accordance with Idaho IR 12.

The Engineer will inspect bolting and testing operations to determine the approved installation procedure is used and the correct tension has been achieved. The Engineer may reject testing operations completed.

Store high-strength bolts, nuts, washers, and DTIs under cover to protect them from adverse conditions and ensure the identification of heat number or production lot number remain with each type of bolting parts. The Engineer will not accept bolting parts that are rusty, dirty, or have damaged threads.

Before bolts are installed in the field or at the shop, subject the bolts to a rotational-capacity test. Perform the rotational-capacity test on each rotational-capacity lot. Hardened steel washers are required as part of the test although they may not be required in the actual installation procedure.

Provide bolt, nut, washer, and when required, DTI combinations as installed from the same rotational-capacity lot.

Perform the rotational-capacity test as specified in 708.06.2.B.(4).

Locate nuts wherever practical, on the side of the member that will not be visible from the traveled way. Locate nuts for bolts that will be partially embedded in concrete on the side of the member that will be encased in concrete.

Turn the nut tight while the bolt is prevented from rotating. Provide each bolt with a hardened washer under the nut. An M 164 bolt may be reused 1 time if approved. The Department does not consider re-tightening a bolt loosened by the tightening of nearby bolts as reuse.

To begin bolting connections, install and tighten to snug-tight enough bolts to bring parts into full contact with each other.

After this initial tightening, install and bring to snug-tight remaining bolts in the connection. Then, beginning with bolts in the most rigid part of the joint and working out to its free edges, systematically tighten bolts to specified tension.

When bolts in a joint are tight, ensure each bolt carries at least the proof load in Table 504.03-2.

Table 504.03-2 – Bolt Tension

Minimum Bolt Tension, lb		
Bolt Size, inches	Grade A325	Grade A490
0.5	12,050	14,900
0.625	19,200	23,700
0.75	28,400	35,100
0.875	39,250	48,500
1.0	51,500	63,600
1.125	56,450	80,100
1.25	71,700	101,800
1.375	85,450	121,300
1.5	104,000	142,500

2. Tightening Methods. Tighten using the DTI method as specified.

a. Direct Tension Indicator (DTI) Tightening.

(1) Installation. Locate the DTI at the opposite end of the bolt from the part being tightened, where possible. When the DTI is used next to a slotted or oversized hole, place a hardened flat washer between the DTI and the part being tightened; do not reuse the DTI after tension has been applied to the bolt.

(2) Bolt Tension. Meet the following:

(a) Verify DTI performance before the start of installation of bolts in the bridge. Test in accordance with the procedure for verification and installation of high-strength bolts with DTIs. This procedure is in Appendix A6 of Report No. FHWA-SA-91-031 dated May 1991, revised April 1992.

(b) Ensure the measured gap for DTIs is at 0.005 inch or less. Refusal of the feeler gauge in slots is defined as a nil gap and may be cause for rejection by the Engineer. The Engineer may require bolts with nil gap to be removed from the work and the bolt thread examined at no additional cost to the Department. If no necking of the bolt thread is observed and the nut can run down the full length of the thread, then the bolt may be reinstalled with new DTIs.

b. Turn-of-Nut Method. After bolts in the joint have been brought to snug-tightness, further tighten the nuts by the amount of rotation in Table 504.03-3.

Before final tightening and after snug-tightening, match-mark with crayon or paint the outer face of each nut and the protruding part of the bolt. To ensure this tightening method is followed, the Engineer will:

(1) Observe as the Contractor installs and tightens bolts.

(2) Inspect each match-mark.

Place 3 bolts of the same grade, size, and condition as those under inspections individually in a device calibrated to measure bolt tension. Perform this calibration at least once each inspection day. Provide a washer under the part turned in tightening each bolt if washers are used on the structure. If washers are not used on the structure, provide material abutting for the part turned that is the same as specified for use on the structure. In the calibrated device, tighten each bolt to the specified tension. Apply the inspecting wrench to the tightened bolt to determine the torque required to turn the nut or head 5 degrees or approximately 1 inch at a 12-inch radius in the tightening direction. Take the average of the torque for the 3 bolts as the job-inspection torque.

In the Engineer's presence, inspect the tightened bolt using an inspection torque wrench.

Select 10 percent or at least 2 of the tightened bolts on the structure represented by the test bolts at random in each connection. Apply the job-inspection torque to each with the inspecting wrench turned in the tightening direction. If this torque turns no bolt head or nut, the Engineer will accept the connection as being properly tightened, but if the torque turns 1 or more bolt heads or nuts, apply the job inspection torque to bolts in the connection. Tighten and re-inspect bolts whose head or nut turns at this stage. The Contractor may retighten the bolts in the connection and resubmit for inspection.

Table 504.03-3 – Turn-of-Nut Tightening Method (Nut Rotation^(a) from Snug-Tight Condition)

Bolt Length ^{(a)(b)(c)} (Measured from underside of head to extreme end of point)	Both faces at right angles to bolt axis	One face at right angle to bolt axis, once face sloped no more than 1:20, without bevel washer	Both faces sloped no more than 1:20 from right angle to bolt axis, without bevel washer
< 4D	120° or 1/3 turn	180° or 1/2 turn	240° or 2/3 turn
4D to < 8D	180° or 1/2 turn	240° or 2/3 turn	300° or 5/6 turn
8D to 12D	240° or 2/3 turn	300° or 5/6 turn	360° or 1 turn

^(a) Nut rotation is relative to the bolt regardless of which element (nut or bolt) is being turned. Tolerances permitted:
 plus or minus 30° for final turns of 180° = 1/2 turn or less.
 plus or minus 45° for final turns of 240° = 2/3 turn or more.

^(b) D = nominal bolt diameter of bolt being tightened.

^(c) When bolt length exceeds 12D, determine the rotation by actual tests that a suitable tension device simulates actual conditions.

M. Welding.

1. General. The Department requires weld fabrication to meet ANSI/AASHTO/AWS D1.5 Bridge Welding Code and interim revisions published by AASHTO as of the bid opening date except as modified in the rest of this subsection or as specified.

Weld tubular members in accordance with the current edition, at the time of bid opening, of AWS D1.1 Structural Welding Code-Steel.

Weld sheet steel not exceeding 1/8 inch in thickness in accordance with current addition, at the time of bid opening, of AWS D1.1 Structural Welding Code-Steel.

Weld aluminum in accordance with to the current edition, at the time of bid opening, of AWS D1.2 Structural Welding Code-Aluminum.

Weld structural steel only to the extent specified. Do not weld, including tack and temporary welds, in the shop or field, unless the location of the welds is shown on the approved shop drawings or approved in writing.

Obtain approval of shop plans before welding as specified in 504.01. Include in the shop plans procedures for welding, assembly, and heat-straightening or heat-curving.

2. Preheating. Comply with the preheat and interpass minimum temperatures in accordance with ANSI/AASHTO/AWS D1.5 Bridge Welding Code, Section 4.

Show preheat temperatures on the shop drawings.

Preheat web and flange plates, bearing stiffeners, bearing plates, and heavy sections (restrained when welded) to at least 250 °F.

3. Welding Procedures. Perform welding on main members and attachments using only shielded metal arc, submerged arc, or stud welding. Weld butt splices and flange to web welds using the automatic submerged arc process with uninterrupted continuous passes. The Contractor may request approval to substitute flux core welding in areas where automatic submerged arc welding is not feasible. The Engineer may approve complete joint penetration groove welds made by flux cored arc welding only after submittal of performance of the joint qualification tested in accordance with ANSI/AASHTO/AWS D1.5 Bridge Welding Code, Sections 5.7 and 5.12. Perform joint qualification tests and submit on each individual project.

Submit the test coupons to an independent testing laboratory for testing. The work associated with the making of the test coupons is incidental and the costs included in the contract unit prices for other contract items.

Use low-hydrogen electrodes in shielded metal-arc welding.

Oven-dry flux for submerged-arc welding at 550 °F for at least 2 hours, then store in ovens held at 248 °F or more. If not used within 4 hours after removal from a drying or storage oven, re-dry the flux before use.

Do not:

- a. Weld with gas metal arc, electrogas, or electroslag methods.
- b. Weld when ambient temperature is below 20 °F.
- c. Use coped holes in the web for welding butt splices in the flanges.

Place tack welds so they are incorporated into the final weld. The same quality requirements apply for tack welds as the final welds except the discontinuities (e.g., undercut, unfilled craters, porosity) do not need to be removed before the final submerged arc welds. Make tack welds with electrodes meeting the requirements of the final welds and clean thoroughly. Provide multiple-pass tack welds with cascaded ends.

If groove welds (web-to-web or flange-to-flange) have been rejected by the Engineer, they may be repaired twice. If a third failure occurs, trim the members at least ½ inch, if the Engineer approves, or replace the members at no cost to the Department.

End welds at the end of the joint so sound welds are ensured. Whenever possible, do this by using extension bars and runoff plates configured to duplicate the joint detail being welded. Remove extension bars and runoff plates, on completion and cooling of the weld, and grind the ends of the welds smooth and flush to minimum surface finish of ANSI 125. Inspect 100 percent of the groove welds ends using dye penetrant or magnetic particle testing techniques and include splices in individual flanges and webs, transverse and longitudinal stiffeners, floor beams, and stringers.

The Engineer may reject a member if there are arc strikes outside the weld joint or on metal not incorporated in a weld joint. Report arc strikes on surfaces carrying tensile or reversal stress in writing and submit report. Do not repair arc strikes on surfaces carrying tensile or reversal stress without written authorization. Accomplish repair of arc strikes by grinding the area containing the arc strike to a minimum surface finish of ANSI 125. Inspect the ground area by the magnetic-particle test (yoke method) and test for heat-affected-zone hardness. If the testing specified reveals cracking and/or hardness in excess of Rockwell C23, weld repair the area in accordance with ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

4. Fillers. For multipass welds of unpainted AASHTO M 270 Grade 50W bridge steel, use filler metal meeting the requirements in the current AWS Specifications Table 4.2.

When a bolted splice is used to join plates of differing thickness, do not weld filler plates used to account for the thickness difference into place, unless otherwise approved in writing.

5. Shear Connectors. Weld shear connectors using automatically timed stud welding equipment, unless otherwise approved in writing.

For a welded shear connector longer than 8 inches, the Contractor may join 2 shorter shear connectors with full-penetration welds.

6. Welding Inspection. Comply with current ANSI/AASHTO/AWS D1.5 Bridge Welding Code for welding inspection procedures, techniques, and inspector qualification except as modified in this subsection or as specified.

Use certified welding inspectors to inspect welds as follows:

- a. Visual Inspection. Inspect 100 percent of welds.
- b. Radiographic Inspection. Inspect 100 percent of full-penetration groove welds subject to tension or reversal using radiographic inspection. Include those in the tension area of webs, inspect the greater of these two distances: 15 inches from the tension flange or $\frac{1}{3}$ of the web depth from the tension flange.
- c. Magnetic Particle Inspection. Inspect fillet welds and longitudinal butt welds in webs. Test using the yoke method only.
 - (1) Flange-to-Web Connections. Inspect 100 percent of fillet welds in flange-to-web connections of built-up members until the Engineer accepts the Contractor's record of quality control. After acceptance, inspect 30 percent of each weld with 10 percent of this inspection occurring at each end of the welds length. The remaining 10 percent will be randomly selected by the Engineer.
 - (2) Boxed Members of Trusses. Inspect 100 percent of each fillet weld in boxed members of trusses.
 - (3) End and Intermediate Pier Diaphragms. Inspect 100 percent of each fillet weld in end and intermediate pier diaphragms.
 - (4) Longitudinal Butt Weld in Web. Inspect each longitudinal butt weld in the web as specified for flange-to-web connections.
 - (5) Stiffeners and Connection Plates. Inspect 30 percent of each fillet weld in transverse and longitudinal web stiffeners and connection plates with 10 percent occurring at each end of the weld. Inspect the remaining 10 percent randomly at points selected by the Engineer.
 - (6) Miscellaneous Weldments. Inspect 100 percent of each fillet weld in miscellaneous weldments (e.g., bridge bearing assemblies).
- d. Ultrasonic Inspection. Inspect full-penetration groove welds ultrasonically.
 - (1) Transverse Flange and Web Splices. Inspect 100 percent of each transverse groove weld.
 - (2) End and Intermediate Pier Diaphragms. Inspect 100 percent of each groove weld.
 - (3) Other Weldments. Inspect 100 percent of each groove weld in other weldments.
- e. Dye-Penetrant or Magnetic-Particle Inspection. Inspect 100 percent of the end of each groove weld at plate edges.
- f. Other Inspection. Perform additional testing as specified or as directed.

N. Erection.

1. Erection Marks. The Contractor may paint erection marks on surfaces to permit identification of members in the field that are to be painted in the field. For unpainted AASHTO M 270 Grade 50W, stamp erection marks with low stress intermittent dot steel die stamp in an area visible after completion of the structure. Ensure the maximum depth of the impression does not exceed 0.010 inch and the tool meets the requirements in Table 504.03-4.

Table 504.03-4 – Tool Specification

Character Size (inch)	Minimum Character Face Radius (inch)
1/8	0.007175
3/16	0.008200
1/4	0.010250

Ensure impressions are not near the edge of tensile-stressed plate members.

2. Alignment and Camber. Before beginning field bolting:
 - a. Adjust the structure to correct grade and alignment.
 - b. Regulate elevations of panel points (ends of floor beams).
 - c. Delay bolting at compression joints until adjusting the blocking to provide full and even bearing over the whole joint.

On truss spans, the Engineer will allow a slight excess camber as the bottom chords are bolted. Correct camber and relative elevations of panel points before the top chord joints, top lateral system, and sway braces are bolted.

Submit a diagram for each truss that shows camber at each panel point and display actual measurements taken as the truss is being assembled.

Do not place forms, steel reinforcing bars, or concrete on steel spans until the girders in spans for a given stage of construction are completely erected with girder splices complete, cross frames installed, and temporary shoring released. After shoring is released and masonry plates have been grouted and before subsequent loading of the spans, measure the elevations along the tops of girders and floor beams at each tenth point of the spans. Determine and make the adjustment to the top-of-web to top-of-deck dimensions as necessary to meet the requirements of the plans and submit the adjustments and elevations for approval.

3. Field Assembling and Bolting. To begin bolting a field connection or splice, install and tighten to snug-tight enough bolts to bring parts into full contact with each other before tightening these bolts to the specified minimum tension.

Complete bolting a field connection using one of the following methods:

- a. Method A. As erection proceeds, securely drift pin and bolt field connections and splices for each member as specified before the mass of the member can be released or the next member is added. Specify on field erection drawings pinning and bolting requirements that meet or exceed the following minimums:
 - (1) Joints in Normal Structures. Fill 50 percent of the holes in a single field connection and 50 percent of the holes on each side of a single joint in a splice plate with drift pins and bolts. Pin 30 percent of the filled holes. Bolt and tighten 70 percent of the filled holes to snug-tight. Once these bolts are snug-tight, systematically tighten each bolt to the specified minimum tension. "Systematically tightened" means beginning with bolts in the most rigid part, which is usually the center of the joint, and working out to its free edges. Locate the fully tensioned bolts near the middle of a single field connection or a single splice plate.
 - (2) Joints in Cantilevered Structures. Fill 75 percent of the holes in a single field connection and 75 percent of the holes on each side of a single joint in a splice plate with drift pins

and bolts. Pin 50 percent of the filled holes. Bolt and tighten 50 percent of the filled holes to snug-tight. Once these bolts are snug-tight, systematically tighten each bolt to the specified minimum tension. Locate the fully tensioned bolts near the middle of a single field connection or a single splice plate. A joint in a cantilevered structure is defined as to be a field connection or splice that is on the unsupported or cantilevered side of a support. Joints that fit this description whether in final position or temporary position (e.g., during erection) are considered joints in cantilevered structures.

Place drift pins throughout each field connection and each field joint with the greatest concentration in the outer edges of a splice plate or member being bolted.

To complete a joint, fill remaining holes of the field connection or splice plate with bolts and tighten to snug-tight. Once these bolts are snug-tight, systematically tighten each bolt to the specified minimum tension. After these bolts are tightened to the specified minimum tension, replace the drift pins with bolts, tightened to the specified minimum tension.

- b. Method B. The Contractor may complete a field-bolted connection or splice in a continuous operation before releasing the mass of the member or adding the next member. Use drift pins to align the connection. For alignment drift pins, fill between 15 and 30 percent of the holes in a single field connection and between 15 and 30 percent of the holes on each side of a single joint in a splice plate. Once the alignment drift pins are in place, fill remaining holes with bolts and tightened to snug-tight starting from near the middle and proceeding toward the outer gauge lines. Once these bolts are snug-tight, systematically tighten these bolts to the specified minimum tension and then replace the drift pins with bolts. Tighten each of these bolts to the specified minimum tension.

Place bolts with heads toward the outside and underside of the bridge. Install and tighten high-strength bolts before the falsework is removed.

The Contractor may erect metal railings as erection proceeds, but do not bolt or adjust permanently until the falsework is released and the deck placed.

Do not begin painting until the Engineer has inspected and accepted field bolting.

4. Surface Condition. As the structure is erected, keep steel surfaces clean and without dirt, concrete, mortar, oil, paint, grease, and other stain-producing foreign matter. Clean surfaces that have become stained as follows:
 - a. Clean painted steel surfaces by methods required for the type of staining. Submit the method to be used for Engineer approval.
 - b. Weathering steel surfaces. After the deck is placed, remove concrete stains and other foreign matter from the exposed surfaces of structural steel members by power cleaning or other approved method that will provide a surface for the formation of patina (oxide coating).

504.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Structural metals will be by the pound, foot, or on a lump sum basis. Where payment is on a weight basis, the Engineer will compute the weights of rolled shapes and of structural steel plates on the basis of their nominal weights and dimensions.
2. Steel forgings will be by the pound based on the plan dimensions and the theoretical weight of 0.2833 pounds per cubic inch plan quantity.
3. Structural steel handrail, 2-tube curb mount rail, pedestrian/bicycle railing, and combination pedestrian/bicycle railing will be by the foot.

504.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Steel Bridge	LS
Structural Steel.....	lb or LS
Steel Forgings.....	lb
Structural Steel Handrail	ft
2-Tube Curb Mount Rail.....	ft
Pedestrian/Bicycle Railing.....	ft
Combination Pedestrian/Bicycle and Traffic Railing.....	ft

The Department will pay using plan quantities as specified in 109.01.

SECTION 505 – PILING

505.01 Description. Provide and drive piles, including test piles.

505.02 Materials. Provide materials as specified in:

Concrete	502
Steel H-Piles	708.08
Steel Shell Piles	708.30
Timber Piles	710.05

505.03 Construction Requirements.

A. General. Provide pile type and size as shown on the bridge plans. Drive test piles with the same pile driving hammer make, model, and size as will be used for production pile driving. Do not drive test piles with a vibratory hammer, unless specified in the contract or as directed.

Notify the Engineer at least 7 calendar days before driving each test pile. The Engineer will need up to 2 business days after receiving each test pile record and associated pile dynamic test results to evaluate each test pile result and determine the required production pile length. Drive test piles as shown in the bridge plans or as directed. If the required bearing capacity is not achieved when the test pile is driven as shown in the bridge plans, continue driving the test pile until the required bearing capacity has been achieved as determined by the Engineer.

Complete the foundation excavation before driving piles. Drive production piles as shown in the bridge plans or as directed.

If the required highest pile tip elevations or minimum penetrations cannot be achieved using a hammer with higher energy, then removing and replacing the pile, driving an adjacent pile, or predrilling may be required.

Pile restriking may be required if the pile does not have the design capacity at the end of initial driving. Restrike piles for 4 inches of penetration or as directed, with the hammer that has been warmed up by applying a minimum of 20 blows to another pile or to a timber mat placed on the ground.

Provide a suitable light for shell pile inspection.

B. Helmet Assembly. Use a helmet assembly with a suitable hammer cushion for driving piles. Fit the helmet assembly closely to the pile tops. Provide a helmet assembly design that has been proven satisfactory and is properly sized for driving the piles.

C. Hammer Cushion. Remove the hammer cushion from the helmet and inspect in the Engineer's presence before beginning pile driving at each structure or after each 100 hours of pile driving. If there is any damage to the cushion or a hammer cushion thickness reduction of 25 percent or more of the original thickness, replace the hammer cushion before continuing the pile driving.

D. Pile Tips and Cutting Shoes. Fit the piles with pile tip protectors or cutting shoes as shown on the plans or as directed. Carefully shape the pile toe to provide uniform, even bearing on the tip or shoe. Use AWS certified welders to install pile tips or shoes in accordance with the manufacturer's written instructions.

E. Steam, Air, Diesel, or Hydraulic Hammers. Provide steam, air, diesel, or hydraulic hammers as specified. Submit the hammer type and hammer operation specifications for review at least 15 calendar days before pile driving begins. Operate pile driving hammers in accordance with the manufacturer's written instructions. Ensure the hammer operator's manual is available onsite during pile driving.

Operate and maintain air/steam hammers within the manufacturer's specified ranges. Equip the plant and equipment with accurate pressure gauges which are easily accessible by the Engineer. For closed-end (double

acting) diesel hammers, provide a bounce chamber pressure gauge near the ground level that can be easily read by the Engineer. For hydraulic hammers, provide a power plant with sufficient capacity to maintain at the hammer, under working conditions, the volume and pressure specified by the manufacturer. Equip the plant and equipment with accurate pressure gauges which are easily accessible to the Engineer.

F. Vibratory Hammers. If specified or approved, use vibratory hammers to drive production piles at the beginning of the driving, but finish the pile driving with impact hammers so the pile bearing capacities can be determined. The Engineer will determine the penetration depth for piles driven by vibratory hammers.

G. Pile Bearing Capacity. To confirm the pile capacity during driving, the Engineer will develop the pile-driving criteria as the required blow count per foot or inch of pile penetration using a wave equation analysis.

The Engineer will use the following pile driving dynamic formula to determine the pile capacity when a wave equation analysis is unavailable.

$$R_u = 1.75 [E^{0.5}(\log(10N_i))] - 100$$

Where:

R_u = ultimate pile capacity (kips)

E = $W \times H$, hammer energy (foot-pounds) at the field observed ram stroke, which equals field ram stroke H (feet) multiplied by ram weight W (pounds)

N_i = number of hammer blows per inch of pile penetration

The required number of hammer blows per foot of driving (N_f) for pile to achieve the ultimate pile capacity can be determined as follows:

$$N_f = 1.2 (10^A)$$

Where:

$$A = \frac{R_u + 100}{1.75\sqrt{E}}$$

Use of the pile driving dynamic formula instead of pile-driving criteria developed using a wave equation analysis will normally require piles to be driven to a higher capacity. The Engineer will obtain the revised ultimate pile capacity from the bridge designer of record when the pile driving dynamic formula is used.

H. Splicing.

1. Timber Piles. Do not splice timber piles.
2. Steel Piles. Use AWS certified welders to make splices when splices are required for steel piles, or as directed. Do not make more than two field splices on any individual pile before driving. The minimum pile section length for pile splicing is 10 feet. Prefabricated splicers can be used as specified in the bridge plans.

I. Followers. Use followers only when approved.

J. Loading Tests. Determine pile capacities by static loading tests when required. Perform these tests in accordance with ASTM D1143.

K. Pile Dynamic Tests. Perform pile dynamic tests on test piles in accordance with ASTM D4945, when required.

L. Pile Storage and Handling. Store and handle piles so as to avoid damaging the piles. Take special care to avoid breaking the surface of treated timber piles.

M. Cutting Piles. For steel piles, neatly cut the piles on a horizontal plane at the cutoff elevation(s) shown in the bridge plans after the piles have been driven to the required capacity, inspected, and accepted.

N. Concreting. Completely fill shell piles with concrete after the cutoff has been removed, unless otherwise shown in the bridge plans. Before placing concrete in shell piles, remove debris and water from inside the pile. Do not place concrete in shell piles until all piles within a pier or abutment have been driven to the required capacity.

O. Alignment, Location, and Orientation. Drive piles with a variation in plumbness of not more than ¼ inch per foot from the vertical or from the batter shown in the bridge plans. Drive piles for trestle bents so the bent cap may be placed without inducing excessive stresses in the piles as determined by the Engineer. The Engineer will determine excessive stresses based on the loading conditions, pile type, and unsupported length. Ensure pile locations at cutoff are within 6 inches (2 inches for trestle bents) of plan location. Ensure the as-driven centroid for trestle bents is within 5 percent of the plan centroid location, as measured from any pile cap edge. Ensure H-pile orientation is within 15 degrees of that shown in the bridge plans. If the location or alignment tolerances specified in this paragraph are exceeded, and if in the judgment of the Engineer corrective measures are necessary, design and construct suitable measures at no additional cost or time to the Department.

P. Heaved Piles. Check pile heave immediately after completing installation and periodically thereafter until the Engineer determines checking is no longer required. Take level readings referenced to a fixed datum immediately after the pile has been driven to the required capacity and again after all piles within a 15-foot radius have been driven. Redrive piles that have heaved vertically more than ¼ inch to the required pile capacity, at no additional cost to the Department.

Q. Installation Sequence. Start driving individual piles in pile groups from the center of the group and proceed outwards in both directions or start at an outside row and proceed progressively across the group.

R. Defective Piles. Do not subject piles to excessive and undue abuse that may result in pile damage. Correct piles that have been damaged during driving, driven out of plan location or driven below the pile cutoff elevation at no additional cost to the Department. Make corrections to the damaged or out of position piles by one of the following methods and as approved:

1. Remove and replace the pile with a new pile and, if necessary, a longer pile.
2. Drive a new pile adjacent to the defective pile, at a minimum 1-foot separation from the defective pile or as directed.
3. Splice or build up the pile or widen a sufficient portion of the footing (including redesign of steel reinforcement, if necessary) to properly embed the pile.

Other corrective methods may also be used if approved.

S. Driving Pile Next To Concrete Less Than 28 Days Old. Do not drive piles closer to green concrete than the distance determined from the following formula:

$$D = C \times E^{0.5}$$

Where:

D = distance (foot)

E = rated energy of pile driving hammer (foot-pounds)

C = coefficient shown in Table 505.03-1 based on the number of days of curing time

Table 505.03-1 – Curing Time Coefficient

Curing Time (days)	Coefficient C	Curing Time (days)	Coefficient C
1	0.34	6	0.12
2	0.23	7-9	0.11
3	0.18	10-13	0.10
4	0.15	14-20	0.09
5	0.13	21-28	0.08

505.04 Method of Measurement.

The Engineer will measure acceptably completed work as follows:

1. Provide and drive piles and test piles will be by the foot of pile below the cutoff elevation.
2. Pile shoes or tips and pile splices will be by the each.

505.05 Basis of Payment.

The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Provide & Drive Timber Piles	ft
Provide & Drive Steel Shell Piles ____ O.D.	ft
Provide & Drive Steel H-Piles ____ x ____	ft
Provide & Drive Test Piles	ft
Provide & Install Pile Shoes or Tips	Each
Splice Steel Pile Before Driving.....	Each
Splice Steel Pile During Driving.....	Each

For splice steel pile before driving, the Department will pay for 1 splice per pile if the pile length(s) shown in the plans are longer than 60 feet. For splice steel pile during driving, the Department will pay up to 2 splices per pile if the plan pile length is less than 100 feet and up to 3 splices per pile if the plan pile length is longer than 100 feet.

For pile cutoffs and leftovers, the Department will pay 100 percent of the material purchase cost as shown on the seller's invoice, including freight charges and sales or use taxes. The Department will determine cutoff and left over lengths based on the required pile lengths determined after test piles are driven. Pile cutoffs and leftovers are the Contractor's property and must be removed from the site.

Pile-driving criteria developed by wave equation analyses, steel reinforcement, and concrete for steel shell piles are incidental.

SECTION 506 – PRESTRESSING CONCRETE

506.01 Description. Provide, place, and tension prestressing steel in precast or cast-in-place concrete.

Prestressing includes the providing and installation of appurtenant items necessary for the particular prestressing system to be used, including ducts, anchorage assemblies, and grout used for pressure grouting ducts.

For cast-in-place prestressed concrete, the term “member” means the concrete which is to be prestressed.

Perform prestressing using pre-tensioning or post-tensioning methods, unless the plans show only pre-tensioning details. If the plans show only pre-tensioning details, the Contractor may use a post-tensioning system only if complete modification details are approved.

506.02 Materials. Provide prestressing reinforcement that meets 708.05. The Engineer will reject members with failing strand or steel.

Grout and Mortar705

506.03 Construction Requirements.

A. General. Submit in PDF format complete shop drawings detailing the method, materials, and equipment proposed for use in the prestressing operations, including additions or rearrangement of reinforcing steel or prestress reinforcing strands. Outline the method and sequence of stressing and include complete specifications and details of the prestressing steel and anchoring devices, working stresses, anchoring stresses, types of ducts, and other data pertaining to the prestressing operation, including the proposed arrangement of the prestressing steel in the members, pressure grouting materials, and equipment. Submit elongation calculations based on the sequence of stressing. Do not cast members to be prestressed before shop detail drawings are approved. Submit as-built shop drawings in PDF format.

Precast, prestressed concrete manufacturing plants are required to be certified by the Prestressed Concrete Institute plant certification program, in category B2 (prestressed miscellaneous bridge products), B3 (prestressed straight strand bridge members), or B4 (prestressed draped strand bridge members), corresponding to the products specified. Submit proof of current certification to the Engineer before beginning production.

For the fabrication of precast and prestressed members, use the provisions in the current edition, at the time of bid opening, Manual for Quality Control for Plants and Production of Precast, Prestressed Concrete Products published by the Prestressed Concrete Institute with the following exceptions:

1. The contract specifications govern where there are conflicts.
2. If a wire in a pre-tensioning strand fails, the Engineer will reject.
3. If a wire in a post-tensioning tendon fails, the Engineer may reject.

Retain a professional engineer, who is experienced in post-tensioning operations and registered in at least 1 state of the United States. The Contractor’s professional engineer is to be in charge of post-tensioning operations and be present during tensioning and grouting operations. Two weeks before the start of the post-tensioning operations, submit in writing the name of the professional engineer, the state(s) in which the professional engineer is registered, including registration number(s), and the date and place of post-tensioning.

B. Sampling and Testing. Sample and test in accordance with ASTM A416 and ASTM A421 and as specified in this subsection.

Submit samples from each size and each heat of prestressing bars, each manufactured reel of prestressing steel strand, each coil of prestressing wire, and each lot of bar couplers to be used for testing. With each sample of prestressing steel wires, bars, or strands provided for testing, submit a certification stating the manufacturer’s minimum guaranteed ultimate tensile strength of the sample.

Provide materials for testing at no cost to the Department. The Department will not provide additional pay or contract time if the Contractor's work is delayed while waiting for approval of the materials.

Assign an individual lot number to each bar size from each mill heat, from each wire coil, and each manufactured reel of strand to be shipped to the site and tag so each lot can be accurately identified. Likewise identify each lot of anchorage assemblies and bar couplers to be installed. The Engineer will reject unidentified prestressing steel, anchorage assemblies, or bar couplers received.

Submit the following samples of materials and tendons, selected by the Engineer from the prestressing steel at the plant or project site, well before anticipated use:

1. For wire, strand, or bars: one, 5-foot long sample and two, 2-foot long samples. Provide samples of each size for each heat or reel.
2. If the prestressing tendon is a bar, provide one 5-foot length. If couplers are used with the bars, provide two, 2-foot lengths of bar equipped with one coupler and fabricated to fit the coupler.

Submit a calibration of the post-tensioning jacking system and provide the appropriate display settings for the Department's electrohydraulic pressure cell system. Prepare a graph showing the gauge pressure in pounds per square inch, and force in thousands of pounds plotted through the whole range of the post-tensioning calibration. The Engineer will require re-calibration of the jacking system at intervals not exceeding 3 months or when it appears the equipment is producing erratic results. For each calibration, submit a new set of charts from the calibration. The specified regular interval for re-calibration of equipment may be extended at the discretion of the Engineer on conclusive evidence there is no substantial change in the performance. However, in no case will the intervals exceed 6 months.

The approval of material does not prevent subsequent rejection if the material is damaged in transit or later damaged and found to be defective.

C. Shipment and Rust Protection. Protect prestressing steel against physical damage, rust, and other results of corrosion from manufacture to grouting or encasing in concrete. The Engineer will reject prestressing steel with sustained physical damage. The Engineer may reject prestressing steel, if visible rust or other results of corrosion develop.

Package prestressing steel in containers or other shipping forms for the protection of the steel against physical damage and corrosion during shipping and storage. Place a corrosion inhibitor, which prevents rust or other results of corrosion in the package or form and apply directly to the steel. The Department requires the corrosion inhibitor to have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Immediately replace or restore damaged packaging or forms.

The Contractor may elect to use a corrosion inhibitor carrier-type packaging material meeting the United States Department of Defense specification MIL-PRF-3420H.

Clearly mark the shipping package or form with a statement the package contains high-strength prestressing steel, the care to be used in handling, the type, kind, and quantity of corrosion inhibitor used, including the date when placed, and safety orders and instructions for use.

If directed, submit the following for the corrosion inhibitor:

1. A sample, a list of chemicals and their proportions, and instructions for use.
2. Evidence the prestressing steel will be protected from rust and other results of corrosion.
3. A certificate of materials as specified in 106.04.

If steam curing is used, do not install prestressing steel for post-tensioning until the steam curing is completed.

Where prestressing steel for post-tensioning is approved for installation in the ducts after completion of concrete curing, and if stressing and grouting are completed within 10 calendar days after the installation of the prestressing steel, the Engineer will not reject steel because of rust which may form during said 10 calendar days. The Engineer will not require the use of a corrosion inhibitor in the duct following installation of the prestressing steel if it was installed, tensioned, and grouted in this manner within 10 calendar days. Prestressing steel installed this way but not grouted within 10 calendar days, is subject to the requirements in this subsection pertaining to corrosion protection and rejection due to rust.

When prestressing steel for pre-tensioning is placed in the stressing bed and is exposed to the elements for more than 36 hours before encasement in concrete, take adequate measures to protect steel from contamination or corrosion. Do not weld or ground the welding equipment on the forms or on the steel in the member after the prestressing steel has been installed.

Clean and paint the exposed ends of pre-tensioned members that will not be encased in concrete. Cover the surfaces with 2 thick applications of zinc-rich paint that meets MIL-P-21035.

Recess the anchoring devices so the ends of the prestressing steel and parts of the anchoring devices will be at least 2 inches inside the end surface of the members.

Abrasive blast clean the surfaces of concrete against which concrete encasement over anchorage assemblies is to be placed. Clean any aggregate exposed after grouting the ducts. Fill the recesses with concrete and finish flush. Provide concrete that is the same as that specified for superstructure concrete.

D. Allowable Stresses and Losses. The Department requires the average working stress in the prestressing steel not to exceed 80 percent of the yield point stress of the prestressing steel and the maximum temporary tensile stress (jacking stress) in prestressing steel to not exceed 75 percent of the specified minimum ultimate tensile strength of the prestressing steel. Anchor the prestressing steel at stresses (initial stress) that will result in the ultimate retention of working forces specified. The Department requires the initial stress at the anchor to not exceed 70 percent of the specified minimum ultimate tensile strength of the prestressing steel.

The working force and working stress are defined as the force and stress remaining in the prestressing steel after all losses have taken place, including creep and shrinkage of concrete, elastic compression of concrete, creep of steel, losses in post-tensioned prestressing steel due to sequence of stressing, friction and take-up of anchorage, and other losses peculiar to the method or system of prestressing have been provided for or have taken place.

Ensure the stress loss in post-tensioned prestressing steel due to elastic shortening, shrinkage and creep of concrete, and relaxation of prestressing steel matches the plan details.

Use the following formula and friction coefficients to calculate friction losses in tendons:

$$T_0 = T_x * e^{(Ua + Kl)}$$

Where:

T_0 = steel stress at jacking end

T_x = steel stress at point x

e = 2.7183 (base of Napierian logarithms)

U = friction curvature coefficient (see Table 506.03-1)

a = total angular change of prestressing steel profile in radians from jacking end to point x

K = friction wobble coefficient (see Table 506.03-1)

l = length of prestressing steel from jacking end to point x

Table 506.03-1 – Steel Coefficient

Type of Steel	Type of Duct	K	U
Wire or strand	Galvanized-rigid	0.0002	0.25
Plain bars	Galvanized	0.0002	0.15
Deformed bars	Galvanized	0.0003	0.30

E. Equipment. Tension prestressing steel using hydraulic jacks to meet specifications.

The Contractor may equip each jack to stress tendons with a pressure gauge or a load cell for determining the jacking stress. Provide a pressure gauge with an accurately reading dial at least 6 inches in diameter.

Provide a load cell with an indicator that can determine the prestressing force in the tendon. Ensure the indicator's range is not in the lower 10 percent of the manufacturer's capacity when determining the jacking stress.

F. Preparation and Stressing. For pre-tensioning, accurately hold in position the prestressing elements during stressing. The Contractor may cast in 1 continuous line several units and stress at 1 time. Do not transfer bond stress to the concrete until the concrete has attained the compressive strength specified. Cut and release the elements in an order that minimizes lateral eccentricity of stress.

Before placing forms for closing slabs of box girder cells, the Engineer must verify that ducts are unobstructed.

For post-tensioning, install the prestressing steel after the concrete has been placed. The Engineer must verify the ducts are without water and debris immediately before installation of the prestressing steel. During installation, ensure the prestressing steel is laid out in an orderly manner corresponding with its final positioning in the ducts, without overlaps and kinks. After installation and before post-tensioning a member, the Engineer must verify the prestressing steel is free and un-bonded in the duct.

Do not prestress cast-in-place concrete until at least 10 calendar days after the last concrete has been placed in the member to be prestressed. Additionally, ensure the compressive strength of the last placed concrete has reached the strength specified for the concrete at the time of stressing.

Conduct the tensioning process so tension being applied and the elongation of the prestressing steel may be measured. Keep a record of gauge pressure and elongations and submit for approval.

For prestressing tendons in continuous post-tensioned members, tension by jacking at each end of the tendon. The Contractor does not need to jack both ends simultaneously.

Re-tension the unit before grout is placed if slippage of prestressing steel after tensioning is greater than 1/8 inch of the amount assumed in elongation calculations in a unit.

For post-tensioning, do not stress more than 1/2 of the prestressing force in a girder before an equal force is stressed in the adjacent girders. During the stressing operations, do not apply more than 1/6 of the total prestressing force eccentrically about the centerline of the structure.

Distribute the prestressing force with an approximately equal value in each girder and place symmetrically about the centerline of the structure. In slabs, uniformly distribute the prestressing force across the slab.

G. Ducts.

1. Size.
 - a. Provide ducts for tendons made up of multiple wires, bars, or strands that require an area of at least twice the net area of the prestressing steel.
 - b. Provide ducts for prestressing bars with a minimum inside diameter $\frac{3}{8}$ inch larger than the diameter of the bars to be used.
2. Placement. Accurately place ducts as specified or approved and securely fasten at close enough intervals to avoid displacement during concreting.

After installation in the forms, cover the ends of ducts as necessary to prevent the entry of water or debris.

3. Grout Openings. Vent ducts for continuous structures over each intermediate support. Use a $\frac{1}{2}$ inch minimum diameter standard pipe and connect to ducts. Seal vents mortar-tight and tape as necessary. Remove the ends of vents 1 inch below the roadway surface after grouting has been completed.

Install mechanical shutoff valves capable of withstanding grout pumping pressure at vents and the inlet and outlet of the ducts.

4. Forming. Use rigid galvanized ferrous metal ducts. The Contractor does not need to galvanize duct transition couplings connecting to anchoring devices.

The Contractor may fabricate rigid ducts with welded or interlocked seams. Galvanizing the welded seam is not required. Provide rigid ducts that have sufficient strength to maintain their correct alignment during placing of concrete. Provide joints between sections of rigid duct that are positive metallic connections that do not result in angle changes at the joints. Use waterproof tape at the connections.

H. Anchorage Devices. Secure post-tensioned prestressing steel at the ends by means of approved permanent type anchoring devices. Do not deviate from the equivalent anchor set more than plus $\frac{1}{8}$ inch.

Use anchorage devices for post-tensioning that hold the prestressing steel at a load producing a stress of at least 95 percent of the specified ultimate tensile strength of the prestressing steel.

Distribute the load from the anchoring device to the concrete by means of approved devices that will effectively distribute the load to the concrete. Use devices that meet AASHTO Standard Specification for Highway Bridges, Division I-Design Article 9.21 and Division II-Construction section 10.

I. Grouting.

1. Equipment. Provide grouting equipment capable of continuous mechanical mixing that will produce a grout without lumps and undispersed cement and be able to pump the mixed grout that complies with provisions of this recommended practice. Provide accessory equipment (e.g., scales, liquid measures) to accurately batch materials and a pump able to produce an outlet gauge pressure of at least 100 psi with seals adequate to prevent introduction of oil, air, or other foreign substances into the grout and to prevent loss of grout or water.

Place a pressure gauge readable in 20 psi increments having a full-scale reading of not more than 300 psi at some point in the grout line between the pump outlet and the duct inlet. Provide the system with an effective manual or automatic control to limit the buildup of excessive pressure.

Provide grouting equipment containing a screen having clear openings of 0.07 inch maximum size to screen the grout before its introduction into the grout pump. Make the screen easily accessible for inspection and cleaning.

Use gravity feed to the grouting equipment pump inlet.

Provide grouting equipment capable of continuously grouting the largest tendon in 20 minutes or less under normal conditions.

Provide standby water flushing equipment, separate from the grouting equipment, that uses a different power source than the grouting equipment, is capable of developing a gauge pressure of at least 250 psi, and has sufficient capacity to flush out partially grouted enclosures due to blockage, breakdown of grouting equipment, or inability to maintain one-way grout flow.

2. Preparation of Ducts. Clean ducts and ensure the ducts are without water and deleterious materials that would impair bonding of the grout or interfere with grouting procedures.

Use water for flushing ducts that contains quick lime (calcium oxide) or slaked lime (calcium hydroxide) at 1.5 pounds per gallon. Ensure compressed air used to blow out ducts is oil free.

3. Injection of the Grout. Fill the entire void space between the duct and the tendon with grout.

Pump the grout through the ducts by pumping continuously from one end of the duct. Ensure valves are open when pumping starts. After a continuous stream of grout emerges, close the valve at the first vent first. Close the remaining vents, in sequence, in the same manner.

Pump grout through the duct and continuously waste at the outlet until no visible slugs or other evidence of water or air are ejected and the efflux time of ejected grout is at least 11 seconds. Close the outlet pipe, hold the pumping pressure momentarily, and then close the valve at the inlet while maintaining this pressure. Do not remove or open valves until the grout has set.

4. Cold Weather. Keep ducts free of water to avoid damage due to freezing.

Concrete Temperature: Do not grout, unless the temperature of the concrete is 45 °F or higher and maintained at this temperature, until job-cured 4 inch cubes reach a minimum compressive strength of 800 psi.

Grout Temperature: Ensure grout temperature is less than 90 °F during mixing or pumping.

J. Transportation and Storage. Transport precast, prestressed stringers in an upright position and ensure points of support and directions of the reactions with respect to the stringer are approximately the same during transportation and storage as when the stringer is in its final position.

K. Camber. Check and record the vertical deflection (camber) of each girder. Girder camber is the measured variation between the girder center elevation and a straight line between the girder end elevations. Check and record the camber within 72 hours after transfer of the prestressing force, and within a 2-week period before shipment, but no less than 3 calendar days before shipment.

Perform and record each camber check when the alignment of the girder is not influenced by temporary differences in surface temperature. Compare the actual camber measured with the required camber values and the permissible tolerances.

The following are allowable tolerances from the design camber:

1. Plus or minus 1/2 inch for up to 80 feet in length.
2. Plus or minus 1 inch for over 80 feet in length.

Meet the specified girder camber values in the contract documents within the allowable tolerances when girders are erected.

Make provisions to control the camber growth. Control the vertical deflection of prestressed concrete girders by scheduling fabrication or other means. Use a method to control the vertical deflection that does not cause damage to the girders or over stress when checked in accordance with AASHTO specifications. Show the method of controlling the vertical deflection on the shop drawings.

The Department may reject girders not meeting these minimum requirements as specified in 105.03.

Make data from intermittent camber checks the Contractor performs available to the Engineer on request.

Ensure the recorded measurements of the girder camber accompany the girder to the project site to document the girder complies with the specifications.

Control girder deflection at no additional cost to the Department.

506.04 Method of Measurement. The Engineer will measure acceptably completed prestressing of cast-in-place concrete by the lump sum.

506.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Prestressing Cast-in-Place Concrete	LS

Providing and placing additional deformed bar reinforcing steel required by the particular system used, ducts, anchoring devices, distribution plates or assemblies, incidental parts, for providing samples for testing, working drawings, and for pressure grouting ducts, is incidental and the cost included in the contract unit price.

When there are no contract pay items for prestressing precast concrete, the Department considers prestressing concrete members as incidental and the costs included in the contract unit price for providing precast members as specified in 502.

SECTION 508 – CORRUGATED PLATE PIPE

508.01 Description. Provide and install a steel or aluminum corrugated plate pipe arch structure as detailed in the plans or as specified. The structure must be designed per current edition of AASHTO LRFD Bridge Design Specifications.

A. Design Computations and Shop Drawings. Submit the manufacturer's shop drawings and design computations, in accordance with 105.02, for Engineer approval before fabrication. Ensure the shop drawings and design computations are signed and sealed by an Idaho licensed professional engineer. Ensure shop drawings include a plate layout showing installation offsets and sequence from a common reference point for all stages of construction.

For single pipe arch structures with a span length equal to or greater than 10 feet measured along the centerline of roadway or a combination of pipe arches with a total out to out length equal to or greater than 10 feet measured along centerline of roadway and the distance between centerlines of pipes less than one-half the span length of the smaller pipe arch, the structure must be designed at Strength II for a standard gauge tridem axle load of 120 kips (40 kips per axle) with 4.5 foot spacing between axles.

B. Initial Load Rating. For all pipe arch structures requiring Strength II design for tridem axel as defined in 508.01.A, the supplier is required to prepare a Load and Resistance Factor Rating (LRFR) per the Idaho Manual for Bridge Evaluation and provide a Load Rating Summary (LRS) form for approval by the Department at the same time as shop drawing submittal.

508.02 Materials.

1. Provide material as specified in 708.20.
2. Meet minimum thickness for all steel plates as shown in the bridge plans.

508.03 Construction Requirements.

A. General. Curve each plate to the required radius and punch the bolt holes so the sections, except the end plates, are interchangeable in the erection process.

Fabricate bolt holes in accordance with AASHTO M 167 Section 6.

When the completed structure is to be a full-circle pipe, curve the plates so when they are bolted together they form true circles of the required diameter. When the completed structure is to be a multi-centered pipe or arch, curve the plates to the required radii.

Cut plates for forming skewed or sloped ends to give the angle of skew or slope specified on the plans. Ensure burnt edges do not have oxide or burrs and present a well-made finish.

Install the structure in accordance with, the project plans and specifications, and the manufacturer's written instructions.

B. Assembly. Assemble the pipe in accordance with the manufacturer's written instructions.

Steel Structural Plate. Apply at least 100 foot-pounds but no more than 300 foot-pounds of torque to 0.75 inch diameter high strength steel bolts (ASTM A449).

Aluminum Structural Plate. Apply at least 100 foot-pounds but no more than 150 foot-pounds torque to 0.75 inch diameter aluminum bolts (ASTM F468) or standard strength steel bolt (ASTM A307)

Exercise care in the use of drift pins or pry bars to prevent chipping or injury to the galvanized coating.

C. Backfill. Place backfill materials in symmetrical lifts on each side of the structure. Ensure the differential between the lifts on either side does not exceed 24 inches. Place each layer of soil in 6 to 8-inch loose lifts and compact to a minimum of 95 percent of the maximum dry density as determined by Idaho T 74 and/or AASHTO T 99, and AASHTO T 310, Method B.

Select equipment and methods to provide the specified backfill density without excessive movement or deformation of the structure.

508.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot.

When the ends of a corrugated plate structure are cut on a skew or slope, the length of the structure will be the bottom length measured along the structure centerline and grade.

508.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
___ Corrugated Plate Pipe Culvert ___ Thickness.....	ft
___ Corrugated Plate Pipe Arch ___ Thickness.....	ft
___ Corrugated Plate Arch ___ Thickness.....	ft

SECTION 509 – NONSTRUCTURAL CONCRETE

509.01 Description. Provide nonstructural portland cement concrete. Nonstructural portland cement concrete is concrete used in curb, sidewalk, gutter, small sign post foundations, or other applications where long term structural durability is not critical.

Submit a proposed mix design for approval.

Use the concrete class as specified.

A. Classification. Provide the following classes of concrete in Table 509.01-1 where required on the plans.

Table 509.01-1 – Basic Mix Design Parameters

Concrete Class in 100 psi (28 day) ^(a)	Maximum Water To Cement Ratio ^(b)	Air Content Percent
35 and greater ^(c)	0.45	0 - 6
30	0.50	6.5 ± 1.5
22	0.60	0 - 6
15	0.60	0 - 6

- ^(a) Numerical part of class designation is the specified compressive strength when tested as specified in the applicable test listed in 509.02.
- ^(b) Cement plus secondary cementitious materials, if used.
- ^(c) Ensure concrete designated as:
1. Class A: the air content of 6.5 plus or minus 1.5 percent.
 2. Class C: has a maximum water cement ratio of 0.38, water reducer required, and air content of 6.5 plus or minus 1.5 percent.

Use SCM for concrete use when designated with an “F.” This designation shows a mix containing SCM and meeting the requirements for an “A” or “C” mix as specified when used with the above designations.

Meet requirements of 714. If fly ash is used, do not exceed 35 percent of the total cementitious material (fly ash + cement). If ground granulated blast furnace slag (GGBFS) is used, do not exceed 35 percent of the total cementitious materials. If a combination of GGBFS and fly ash is used, ensure the combination is at least 20 percent or more than 50 percent of the total cementitious materials.

Provide Class 30 concrete and use size Nos. 2a or 2b coarse aggregate in any class of concrete. Ensure the slump does not vary more than 1 inch from the average during placement. If an increase in slump is desirable for the concrete as batched, maintain the weight ratio of water to cement by either making proportional increases of cement with increases in water or by reducing the total weight of aggregates incorporated in the mixture.

B. Acceptance. Submit certification for concrete classes of concrete required to meet 509 from qualified aggregate material supplies. For each concrete mix design regardless of the pay item in the contract, test the first load, then again before reaching 50 cubic yards. Test again before reaching 100 cubic yards and again within every 100 cubic yards thereafter. Test for slump, unit weight, air content, and compressive strength for acceptance.

Acceptable concrete is based on compliance with parameters specified for the given concrete class. The Engineer will determine acceptable strength from the results of 28-day compressive strength tests performed on cylinders made from samples of the concrete being placed, as specified in 509.02. The average strength from 3 companion cylinders is 1 test.

If the 28-day strength falls below the specified minimum strength, the Engineer may reject the concrete represented by the test or require a price adjustment if allowed to remain in place. Concrete subject to rejection or price adjustment is represented by the test that falls below the specified strength.

Replace unacceptable concrete at no additional cost to the Department.

If the concrete does not meet the intended strength or air content, and the Engineer allows the concrete to remain in place, the price will be adjusted as follows:

Percent of Specified Strength	Pay Factor
≥ above 90 to < 100	0.75
< 90	Subject to rejection ^(a)

^(a) If allowed to remain in place, as determined by the Engineer, the pay factor will be 0.50.

Above or Below Specified Air Content	Pay Factor
Less than 0.25%	0.99
0.50 to 0.25% to 0.50%	0.90
Above 0.50%	Subject to rejection ^(a)

^(a) If allowed to remain in place, as determined by the Engineer, the pay factor will be 0.50.

Acceptable quantities will be paid at the contract unit price multiplied by the pay factor as determined above. The Department will apply the larger price adjustment if air content and strength do not meet requirements.

If concrete used in the work fails to meet the specifications, make corrective changes in the materials mix portions, concrete fabrication procedures, or other corrective action before continuing, at no additional cost to the Department. Obtain approval to make corrective changes if the 7-day strength test results are low or show a downward trend predicting concrete may not meet the requirements. Manufacturers providing precast concrete products must hold current certification under the NPCA plant certification program, the ACPA QCast Plant Certification Program, or the PCI Plant Certification program.

509.02 Materials. Provide materials requirements as specified in 502.02 and 714 and test as specified in 502.02.

509.03 Construction Requirements. Ensure proportioning, equipment, handling, measuring, batching, mixing, delivery, forming, placing, finishing, and curing of concrete are as specified in 502.03, except as modified by this subsection.

A. Proportioning. For aggregates with an AASHTO T 303 expansion less than 0.30 percent, low alkali cement is adequate for alkali silica reactivity (ASR) mitigation.

For aggregates having an AASHTO T 303 expansion between 0.30 and 0.50 percent, a mix containing at least 20 percent fly ash meeting the requirements for fly ash as a mineral admixture, as specified in 714, is adequate for ASR mitigation.

For aggregates with an AASHTO T 303 expansion greater than 0.50 percent, do one of the following:

1. Test in accordance with ASTM C1567, AASHTO TP 110, or CRD C 662, using the cement, fly ash, and other mitigative additives proposed for use in the mix design. Determine the lithium nitrate dosage in accordance with CRD C 662 when using lithium nitrate for ASR mitigation. Do not allow expansion of

mortar bars to exceed 0.10 percent with the addition of fly ash, slag, or other additives when tested in accordance with ASTM C1567 or CRD C 662. Do not allow the miniature concrete prisms to exceed 0.02 percent at 56 calendar days or 0.04 percent expansion at 112 calendar days when tested in accordance with AASHTO TP 110. The Contractor may test the coarse and fine aggregates together or separately. If testing is performed on the coarse and fine aggregates together, report the blend percentage on the test and be within 2 percent of the blend percentage used in the mix design. When tested separately, base mitigation actions on the aggregate requiring the most mitigation.

2. Use a concrete mix containing 30 percent Class F fly ash approved for use in mitigating ASR. Class 22 and Class 15 concrete will not require ASR mitigation measures.

B. Discharge. If a set stabilizer meeting ASTM C494 is used, the Contractor may extend discharge time to 3 hours, but not exceed 500 total revolutions.

C. Temperature. Provide concrete with a temperature of at least 50 °F and not more than 90 °F at the time of placement.

509.04 Method of Measurement. The Engineer will measure acceptably completed concrete work by the cubic yard or by the square yard using the dimensions specified or as directed. The volume occupied by the reinforcing steel, anchors, conduits, weep holes, H piling, or chamfers will not be deducted. The volume of concrete displaced by culverts or piles, other than H piling, will be deducted.

509.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Nonstructural Concrete Class _____	CY or SY

SECTION 510 – CONCRETE OVERLAY

510.01 Description. Provide and place a latex-modified concrete or a silica concrete overlay.

510.02 Materials. Provide materials as specified in:

Aggregate	703
Portland Cement.....	701
Water for Concrete	720.01
Air-Entraining Admixtures	709.03
Water-Reducing Admixtures.....	709.05
Silica Fume.....	714
Fly Ash.....	714

A. Certification. Provide certification of the silica fume or latex modifier, taken during production or transfer, stating the test results made on the material samples meet this specification. Submit certification and test reports, indicating typical values, before use of the material.

B. Sampling and Testing. The Engineer will sample the material proposed. The Engineer will test concrete as specified in 502.02.

C. Acceptance. The Engineer will reject portland cement, latex modifier, or silica that does not meet this specification. The Engineer will report the rejection to the Contractor promptly. In cases of dissatisfaction with the test results, the Engineer will allow the Contractor additional sampling and retesting.

The Engineer’s acceptance of the concrete overlay will be based on compliance with parameters specified. The Engineer will determine acceptance of strength from the results of 28-day compressive strength tests, performed in compliance with 502.02, on cylinders made from samples of the concrete being placed. The average strength from 3 companion cylinders is 1 test.

If the 28-day strength falls below the specified minimum strength, the Engineer may reject the concrete represented by the test or require a price adjustment if allowed to remain in place. The Engineer will base acceptance on an evaluation of the necessary durability requirements of the concrete overlay.

The Engineer may accept concrete, which does not meet the specified minimum strength, at a reduced price if the strength is not more than 10 percent below the specified minimum strength. The Engineer will reject concrete represented by tests falling more than 10 percent below the specified minimum strength. Remove rejected concrete at no additional cost to the Department.

The Engineer will adjust the price for the concrete overlay, which does not meet the specified strength, but is allowed to remain in place as presented in Table 510.02-1.

Table 510.02-1 – Price Adjustment

Percent of Specified Strength	Pay Factor
≥ 95 to < 100	0.90
≥ 90 to < 95	0.80

The Department will pay for the quantity of acceptable concrete overlay at the contract unit price multiplied by the pay factor.

D. Storage. Store the material to permit easy access for proper inspection and identification of each shipment. Allow the Engineer to access every facility, at the source and at the project site, for sampling and inspection. Protect material from freezing and from prolonged exposure to temperatures in excess of 75 °F. Cover containers stored at the bridge site completely with suitable insulating blanket material to avoid excessive temperatures.

E. Packaging. When material is delivered, plainly mark the name and brand of the manufacturer and the material weight on each container. Identify shipments by source and lot number. Only 1 manufacturing source is acceptable. Submit similar information on the shipping invoices accompanying the material shipment. Ensure containers are in good condition at the time of inspection.

Provide size No. 1 coarse aggregate for latex-modified concrete.

Ensure the latex modifier contains at least 46 percent solids. Determine the percent solids by tests using Idaho IT 121. Submit certification from the producer indicating the material provided is identical to that provided to the FHWA Fairbanks Highway Research Station.

Provide latex-modified concrete that meets the following properties:

Mix Design Item	Requirement
Cement content	660 lb/yd ³
Latex emulsion admixture	25 gal/yd ³
Approx. added water ^(a) , including free moisture in the FA & CA	150 lb/yd ³
Air content, percent of plastic mix	0 - 6.5
Slump ^(b)	4 - 6 in
Percent fine aggregate as percent of total aggregate by weight (rounded CA)	55 ± 5
Percent fine aggregate as percent of total aggregate by weight (crushed CA)	60 ± 5
Weight ratio of cement-FA-CA- (rounded CA) ^(c)	1:2.5:2.0 dry basis
Weight ratio of cement-FA-CA- (crushed CA) ^(c)	1:2.7:1.8 dry basis
28-day compressive strength (Minimum)	4,000 psi

^(a) This is in addition to the latex. Adjust the water added to control the slump and to produce net water-cement ratios of 0.35 to 0.40 by weight.

^(b) Measure the slump 4 to 5 minutes after discharge from the mixer or immediately ahead of the finisher.

^(c) The Contractor may adjust the dry-weight ratios within limits as approved. The Contractor may increase the FA ratio by as much as 0.2 if the CA is reduced by an equivalent amount.

Provide silica fume concrete with the following properties:

Mix Design Item	Requirement
Cement Content (Minimum)	560 lb/yd ³
Water/(Cement + Silica Fume) Ratio (Maximum)	0.40
Course Aggregates	Size No. 1
Slump	5 in plus or minus 2 in
Air Content	6% plus or minus 2%
High-Range Water Reducers (rounded CA)	ASTM C494
7-Day Compressive Strength (Minimum) ^(a)	3,500 psi
28-Day Compressive Strength (Minimum) ^(a)	4,500 psi
Percent Silica Fume by Weight of Cement	7.5% minimum
Percent Fly Ash (if used) of total cementitious	15% minimum
Fibrillated fibers (ASTM C1116)	1.5 lb/cy minimum

^(a) Overdesign is limited to a maximum 6,500 psi when produced in a laboratory. Cementitious material content may be reduced to meet the overdesign limits. The Engineer will waive the overdesign if the Contractor reduces the cementitious materials content by at least 10 percent.

Provide the silica fume admixture as a densified powder.

510.03 Construction Requirements.

A. General. The Department will require the Contractor and a technical representative from the silica fume/latex-modified concrete supplier to meet with the Engineer for a pre-placement conference at a time mutually agreed upon. At or before this conference, present the mix design and methods of accomplishing the concrete overlay work. Allow the Engineer 15 calendar days to review the mix design.

Ensure technical representatives from the latex admixture manufacturer/silica fume supplier and high-range water reducer are present during the proportioning, mixing, placing, and finishing of the concrete overlay. One person may perform both of these functions. Ensure this technical representative has expertise in the proper installation of the materials and is available to the Engineer for consultation. Adhere, at no cost to the Department, to the written instructions and/or recommendations made by the technical representative and as approved. The services of these technical representatives are incidental and the cost included in the unit price of contract items.

Before placement, prepare, place, and cure a trial batch of at least 3 cubic yards to verify the mix design, show ability to perform curing operations, and check quality control. Make additional trial batches as necessary to verify changes in design or procedure at no additional cost to the Department.

Provide rails for the finishing machine to travel on that are sufficiently rigid so they do not deflect under the weight of the machine. Attach the rails to the surface so they may be removed without damage to the edge of the new overlayment. Provide rails that are vertically adjustable (not shimmed) and adjust using a level and level rod to ensure proper depth and matching of joints.

Set the screed control to obtain the nominal overlay thickness specified as well as finished surface smoothness requirements. Verify the thickness before the placement of the concrete by attaching a filler block to the bottom of

the screed. With the screed guides in place, pass the finishing machine over the surface to be overlaid. After the overlay thickness has been verified, adjust the profile grade as directed or approved. Do not change the finish machine elevation controls.

B. Equipment. Use an approved power-driven finishing machine for finishing areas with a width equal to or greater than 14 feet complying with the following requirements:

1. Have at least 2 hand-operated, spud type internal vibrators available for use as directed. Submit a request for approval of the specific equipment to be used at least 15 calendar days before the start of work. Do not begin placing deck concrete until the screed and placing procedure is approved.
2. Provide a self-propelled finishing machine capable of forward and reverse movement under positive control for placing, striking off, and finishing the bridge deck surface with provisions for raising screeds to clear the surface. Equip the machine with vibrating screeds designed to consolidate the modified composition. The Department requires the vibration frequency be variable with positive control between 3,000 and 11,000 vibrations per minute and the bottom face of the screeds be at least 4 inches wide and be metal covered. Provide screeds with positive control of the vertical position. Equip the finishing machine with 1 or more rollers, augers, and 1,500 or 2,500 vibration per minute vibratory pans. Provide a Bid-Well 2450 or equivalent finishing machine. Modification to the Bid-Well 2450 or equivalent is subject to approval.
3. "Texas", "Allen", or "Bunyon" type screeds will not be permitted unless otherwise approved for small and/or irregular areas.

C. Deck Preparation. Remove the concrete deck surface as specified in 632 before placing the concrete overlays. Use approved temporary bridge drain plugs during preparation and placement to prevent waste materials from entering drainage systems. Protect expansion joints and barrier curbs by approved means from damage due to construction operations. Remove the concrete deck by hydrodemolition.

Not more than 24 hours before placing the overlay, clean surfaces the overlay is to bond to, including exposed reinforcing and structural steel, the work face of the previously placed material, and the faces of curbs and barriers up to a height of at least 1 inch above the proposed overlay surface, by abrasive blasting or an approved method of waterblasting with 7,000 psi minimum pressure. Blow the deck with compressed air to remove excess water and debris. After the deck has been airblasted, cover the deck with unused, 4 mil plastic sheeting. Clean steel surfaces to meet the requirements of 708.01. Ensure concrete surfaces are made without spalls, laitance, and contaminants detrimental to achieving adequate bond. Provide water and oil traps on the compressors. After the surface is properly prepared, do not allow vehicular traffic other than equipment required to place the overlay. Do not exceed construction loads of 8,000-pound wheel load or 16,000-pound axle load. Combination of axles placed closer than 4 feet center-to-center is evaluated as 1 axle.

Operate equipment required on the deck for placing the overlay on plastic sheeting or diaper the equipment to prevent dripping fluids from contaminating the prepared surface.

D. Mixing.

1. Latex-Modified Concrete. Use continuous-mixing type mixers complying with the following:
 - a. The mixer carries sufficient cement, fine aggregate, coarse aggregate, latex modifier, and water to produce at least 6 cubic yards of concrete.
 - b. The mixer is capable of positive measurement of cement being introduced into the mix. A visible recording meter equipped with a ticket printout to show the quantity accurately is required.
 - c. The mixer provides positive control of the flow of water and latex emulsion into the mixing chamber. Water flow is shown by flow meter and is readily adjustable to provide for minor variations in aggregate moisture.

- d. The mixer is calibrated to automatically proportion and blend components of shown composition on a continuous or intermittent basis as required by the finishing operation, and discharges mixed material directly in front of the finishing machine.
- e. At least 2 mixers are used for each placement if the total volume of concrete to be placed exceeds the material storage capacity of a single mixer. The Engineer may require additional mixers if conditions require materials be stockpiled away from the project site. Have sufficient mixers on hand to ensure a consistent and uniform delivery and placement of concrete.
- f. The mixer is equipped with a bypass valve to enable calibration of the water valves or flow meters.
- g. Verify the fine aggregate bin vibrators are operating satisfactorily.

Calibrate mixers to accurately proportion the specified mix. The Engineer will accept certification of the calibration by an approved testing authority as evidence of this accuracy if the yield is shown to be true within a tolerance of 1.0 percent using the following test:

- a. With the cement meter set on zero and controls set for the desired mix, activate the mixer, discharging mixed material into a 0.25 cubic yard container.
- b. When the container is level-struck full, making provision for settling the material into corners, the Department requires the cement meter to show a discharge of 1.75 sacks of cement for latex-modified concrete, 7 sacks per cubic yard.

Ensure the concrete discharged from the mixer is uniform in composition and consistency. Provide mixing capability so that finishing operations can proceed at a steady pace with final finishing completed before the formation of the plastic surface film.

2. Silica Fume. Calibrate mixers to accurately proportion the specified mixture. Provide a visible recording meter equipped with a ticket printout to show the quantity accurately. Ensure the silica fume manufacturer's technical representative advises the Engineer in writing of proper batching sequence, mixing time, mixing speed, and other handling procedures necessary for a uniform, homogeneous mixture meeting the requirements of this subsection. Include procedures relating to the high-range water reducer. Follow the written instructions.

Do not exceed 6 cubic yards of silica fume concrete in the truck mixer.

If a truck mixer or agitator is used for transporting silica fume concrete, complete discharge within 1 hour and 45 minutes or before the drum has revolved more than 325 revolutions, whichever comes first, after introduction of cement and water. Obtain approval to use a set stabilizer if haul times exceed 1 hour and 15 minutes. If a set stabilizer is used, the mixing revolutions may be increased to 500 revolutions and discharge time increased to 3 hours.

If a slurry is used, adjust mix water to account for the water in the silica fume slurry and store the product in a tank with an agitator so the product can be mixed in accordance with the manufacturer's written instructions. If placement is done during cold weather, insulate or protect the tank against freezing.

E. Placing and Finishing. During placement of the overlay, ensure the surface of base concrete is in a saturated surface dry condition. Achieve this by thoroughly wetting the surface at least 12 hours before placement and maintaining it in a moist condition until placement. Maintain a moist condition by covering with visqueen and/or using fog spray or soaker hoses provided that complete moisture coverage is attained. Blow out standing water in depressions, holes, or low areas with compressed air before the application of the bonding coat.

Promptly deliver and deposit on the deck a bonding coat consisting of a portion of the overlay mix on the deck then scrub by brooming onto the wetted, prepared surface. Do not use separately mixed bonding coats. Exercise care to ensure vertical and horizontal surfaces receive a thorough, even coating. Limit the rate of progress to no more than 6 feet ahead of the screed so the brushed material does not become dry before it is covered with the finish

course. Dispose of materials intended for brushing that have started initial set, dried, or show evidence of loss of paste from the sand. Dispose of coarse aggregate remaining after the brushing operation.

Manipulate the material and strike off to approximately $\frac{1}{4}$ inch above final grade. Consolidate the material and finish at final grade with the vibrating screeds.

Hand-finish with a wood float along the edge of the pour or on small areas of repair. In areas requiring hand finishing and areas adjacent to curbs and joint bulkheads, use vibrators to ensure proper consolidation.

Install a construction dam or bulkhead in case of major delay in the placement operation. During minor delays of 1 hour or less, protect the end of the placement from drying with several layers of wet burlap.

Construct longitudinal joints at or within 1 foot of lane lines. When concrete is to be placed against concrete in a previously placed lane or strip, saw the previously placed concrete back the necessary distance to provide a straight and vertical edge. The Contractor may omit sawing of the joint if bulkhead produces a straight, smooth, and vertical surface. Sandblast, clean, and apply a bonding coat before placing new concrete. Do not place concrete against the edge of an adjacent lane or strip that is less than 24 hours old.

Take adequate precautions to protect freshly placed material from sudden or unexpected rain. The Engineer may order removal of material damaged by rainfall.

Do not place the concrete overlay when the evaporation rate is greater than 0.15 pounds per square foot per hour when tested in accordance with Idaho IT 133, unless the Contractor can show by reducing the spread width or by other means that a satisfactory surface finish can be obtained. Do not place the concrete overlay at ambient temperatures lower than 45 °F or higher than 75 °F.

When a tight uniform surface has been achieved, texture the surface of the concrete perpendicular to the longitudinal centerline of the structure with an approved grooving tool. Ensure nominal groove width is $\frac{1}{8}$ in, with spacing of $\frac{1}{2}$ to $\frac{3}{4}$ inch and the depth of tined grooves is of $\frac{5}{32}$ inch plus or minus $\frac{1}{32}$ inch deep. Check groove depth in accordance with Idaho IT 147. If more than 3 readings in a set of 10 are outside the intended depth range, make adjustments to the tining operation. The Contractor may apply an approved wire tine texture providing it leaves a finish comparable to the groove depth and spacing specified and causes only minimal surface tearing or aggregate removal. Finish the surface adjacent to the curb to a smooth-troweled texture approximately 1 foot from the face of the curb.

F. Curing. Promptly cover the surface with a single layer of clean, wet burlap. Exercise care so the burlap is not dragged or dropped on the fresh surface. Ensure the burlap is drained free of water and that it is placed as soon as the surface will support the covering without deformation. Do not wait until the surface will support foot traffic. The concrete overlay forms a plastic film at the surface on drying, usually within 20 minutes in hot, dry weather. Protect the plastic film from over-drying and cracking by promptly covering with the wet burlap. Maintain the burlap in a wet condition throughout the duration of the wet cure. Unplug the deck drains to allow drainage to pass through.

Place a layer of 4 mils polyethylene (PE) film on the wet burlap for the required wet-cure period within $\frac{1}{2}$ hour of covering with wet burlap. The Contractor may substitute approved burlap-PE sheets for the PE film.

Wet-cure the latex-modified concrete for at least 48 hours. Remove the curing material for an additional 72-hour dry-cure period. Extend the dry curing period in case of rainfall or dampness to ensure the surface of the concrete has a total of 72 hours of dry curing.

Wet-cure the silica fume concrete for at least 4 calendar days.

Use a work bridge to place the burlap and PE. Do not walk on the overlay during placement of these items.

Do not allow traffic on the silica fume concrete surface until the 4-day wet cure is complete and the silica fume has a minimum compressive strength of 3,500 psi. Do not allow traffic on the latex concrete surface until completion of the dry-cure period. The Engineer may require a longer curing period at temperatures below 55 °F.

On completion of the wet cure of the last section overlaid, immediately treat visible cracking with a 2-component modified methacrylate penetrating sealer. Spread sand over areas on surface where sealer has puddled in an amount to ensure adequate skid resistance. The SikaPronto 19 and Transpo Sealate T70-X are acceptable sealers or others as approved.

Meet the smoothness requirements specified in 409 for the finished concrete overlay surface.

After the concrete overlay has cured, the Engineer will use a chain drag or other appropriate tool or device to determine if delaminations exist between the new overlay and the mating concrete surface. Remove and replace delaminated areas. The Department will require vertical edges and rectangular-shaped patching if removal is necessary.

When smoothness grinding is enforced, seal the ground areas with an approved sealer.

510.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard as recorded on approved batch tickets. The Engineer will reject batch tickets for unacceptable material or excessive waste quantities.

510.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Concrete Overlay	CY

If the volume used exceeds the neat line volume by more than 10 percent, the Department will pay for the volume exceeding 10 percent of the neat line volume at 50 percent of the contract unit price.

The Department will pay for concrete overlay that does not meet the specified minimum strength and is allowed to stay in place by the Engineer as specified in 510.02. The Engineer will deduct from the contract unit price of the concrete overlay and apply the adjusted contract unit price to the quantity of concrete overlay represented by the individual strength test.

SECTION 511 – CONCRETE WATERPROOFING SYSTEMS

511.01 Description. Provide concrete waterproofing systems and install on bridge decks or other designated surfaces.

A. System Types. Use one of the following system types:

1. Type C Penetrating Water System. Sealant that penetrates the bridge deck surface and forms a water-repellant layer within the concrete.
2. Type D Precoated, Preformed Membrane Sheet System. Prefabricated sheets that are self-adhesive or require a separate bonding agent.
3. Type E Spray-Applied Waterproofing System. Suitable for concrete or miscellaneous metal surfaces to prevent corrosion from soluble salts on the bridge deck and approach slabs that are to be overlaid with asphalt.

B. Qualifications.

1. Manufacturer Representative. Provide the services of a manufacturer's representative authorized to observe the installation of each membrane system, including the asphalt concrete wearing course. The manufacturer's representative must be an employee of the membrane system manufacturer. Do not begin membrane work until the manufacturer's representative is onsite and authorizes the work to begin.

Follow the manufacturer's written instructions when installing the spray membrane system, as provided in this specification. Instruct the manufacturer's representative to alert the Contractor and the Engineer of anything that could affect the performance of the spray waterproofing membrane or the warranty.

Submit a daily written report that has been prepared by the manufacturer's representative and details all membrane-related activities, test results, observations, repairs, postspray survey results, tack coat timing issues, and contaminated tack repairs. Submit the daily written report by the end of each day until the work is complete.

2. Applicator Qualifications. Provide a manufacturer-authorized applicator. Applicators must be re-certified annually by the manufacturer.
3. Submittals. Begin work no earlier than 1 week after the following items are approved:
 - a. The manufacturer must provide independent laboratory test illustrating each component's conformance to the physical property requirements listed in Tables 511.02-1, 511.02-2, and 511.02-3. All testing must be current (i.e., conducted within the past 3 years).
 - b. The manufacturer's safety data sheet (SDS) for each of the components.
 - c. The manufacturer's current product data sheets and installation details for the product. Provide all membranes and primers from the same manufacturer.
 - d. Two sample coupons (3"x6") that are representative of the finished membrane surface, texture, and color. Approved samples will serve as a basis for acceptance of the work for the duration of the contract.
 - e. Service record showing that the membrane has a satisfactory record of at least 10 years, before the date of submission, for similar applications with names of specific structures and owner contact information.
 - f. List of projects similar in nature and complexity completed in the last 10 years.

511.02 Materials. Provide materials that meet the following requirements:

Precoated Preformed Membrane Sheet ... Type D System Tapecoat M860, Phillips Petrotac,
Polyguard nw-75, or PavePrep GeoTac

Penetrating Water Repellent..... Type C System as follows:

A. Precoated Preformed Membrane Sheet Type D.

Sand..... Membrane Protection Blanket.....see 703.02.B

1. Tapecoat M860.
2. Phillips Petrotac.
3. Polyguard nw-75.
4. PavePrep GeoTac.

B. Penetrating Water Repellent Type C System. Provide penetrating water repellent that is an emulsion, solution of silane, siloxane, or approved generic equivalent that when applied, does not stain, discolor, darken the concrete surface, or form a coating on concrete surfaces. Ensure the repellent material complies with the following minimum testing requirements:

1. Maximum Water Absorption.
 - a. Water immersion: ASTM C642.
 - b. Duration: 48 hours.
 - c. Maximum absorption: 1 percent by weight.
2. Percent Reduction of Water Weight Gain.
 - a. Water immersion/(15% NaCl): NCHRP Rep. #244 Series II.
 - b. Duration: 21 Days.
 - c. Minimum percent reduction of water weight gain versus control: 75 percent.
3. Chloride Ion Penetration.
 - a. Test No. 1.
 - (1) Chloride ion absorbed at 1 inch depth: NCHRP Rep. #244Series II.
 - (2) Duration: 21 days.
 - (3) Minimum percent reduction based on untreated 75 percent.
 - b. Test No. 2
 - (1) Chloride ion absorbed @ 1 inch depth: NCHRP Rep #244 Series IV.
 - (2) Duration: 24 weeks.
 - (3) Minimum percent reduction based on untreated: 90 percent.
4. Penetration Depth (Department Test): $\frac{5}{32}$ inch minimum.
5. Alberta Transportation Waterproofing Test BT001.
 - a. Waterproofing before sandblast: 82.5 percent minimum.
 - b. Waterproofing after sandblast: 75.0 percent minimum.

Use an independent testing laboratory for tests 2, 3, and 5 at no cost to the Department. Submit certified laboratory reports for tests 2, 3, and 5 at least 30 calendar days before intended product application. Submit

a certification statement the sealer used has the same formulation as the material previously tested by laboratory reports.

Tests 1 and 4 are the Department’s responsibility and may be waived based on previous testing or product acceptance by other states.

Project samples may be taken to verify the certification.

C. Spray-Applied Waterproofing System Type E System. The coating system must be a spray-applied, 100% solids, fast-cure, high-build polymer system. Primer is required.

The membrane must pass ASTM C836-00. ASTM C836-00 must be conducted on the neat membrane and aggregated top coat.

1. Base Membrane. The thickness to be tested must be a minimum of 80 mils or the minimum thickness required to pass ASTM C836-00. The thickness used to pass the test must be the minimum thickness required for all field base membrane application.
2. Composite Base Membrane and Aggregated Top Coat. In addition to the base membrane, the complete composite base membrane and aggregated top coat system must be subjected to ASTM C836-00. Use part “1” above to determine minimum thickness of the base membrane. The top coat material must be 30 to 40 mils with aggregate broadcast at a rate of 0.33 to 0.50 pounds per square foot to achieve a minimum 95 percent coverage rate.
3. Primer. Provide a multi-component, polymer primer that is fast-setting with the material properties shown in Table 511.02-1.

Table 511.02-1 – Multi-Component Primer

Physical Property	Test Method	Value
Gel Time	—	> 5 minutes
Tack-Free Time, max @ 77°F	—	< 2.5 hours
Mixing Ratio	—	Per manufacturer’s written instructions
Adhesion to Concrete	ASTM D4541	> 150 psi

4. Spray-Applied Waterproofing Membrane (Base Coat). Provide a spray-applied base membrane that is solvent-less, fast-setting, and 100 percent solids coating formulated to be used for applications requiring a seamless, flexible, waterproof, abrasion, and impact resistant surface that may be applied on multiple substrates in low temperature and high humidity. The membrane must have the material properties specified in Table 511.02-2.

Table 511.02-2 – Spray-Applied Waterproofing Membrane (Base Membrane)

Physical Property	Test Method	Value
Solids Content	—	100%
Gel Time	—	< 10 seconds
Cure Time	—	< 30 seconds
Tack-Free Time	—	< 30 minutes
Shore Hardness	ASTM D2240	> 40D
Water Vapor Transmission	ASTM E96	< 0.94 perms (wet cup)
Adhesion to Concrete	ASTM D4541	> 150 psi
Tensile Strength	ASTM D638	> 2,000 psi
Elongation at Break	ASTM D638	> 150%
Crack Bridging Ability	ASTM C836	Pass @ 10 cycles

Table 511.02-2 – Spray-Applied Waterproofing Membrane (Base Membrane)

Physical Property	Test Method	Value
(80 Mills Neat – 1/8" Opening @ -15°F, 10 cycles)		

5. Spray-Applied Waterproofing Membrane (Aggregated Top Coat): Provide a spray-applied top coat membrane that is 100 percent solids, rapid curing, and specially formulated to accept and hold broadcast aggregate with the material properties specified in Table 511.02-3.

Table 511.02-3 Spray-Applied Waterproofing Membrane (Aggregated Top Coat Membrane)

Physical Property	Test Method	Value
Solids Content	—	100%
Gel Time	—	> 30 seconds
Tack-Free Time	—	> 5 minutes
Open to Traffic	—	1 Hour
Shore Hardness	ASTM D2240	> 40D
Tensile Strength	ASTM D638	> 2,000 psi
Tear Strength (pli; Die C)	ASTM D638	> 350
Elongation at Break	ASTM D638	> 150% at break
Crack Bridging Ability (80 Mills Neat + 40 Mills with Aggregate – 1/8" Opening @ -15°F, 10 cycles)	ASTM C836	Pass @ 10 cycles

6. Tack Coat.
 - a. Emulsified Tack Coat. Provide a tack coat that is a polymer modified emulsion that is a CRS-2P product.
 - b. Manufacturer-Recommended Tack Coat. Waterproofing manufacturer may recommend an alternative tack coat. If an alternative tack coat is recommended, waterproofing manufacturer must also provide test results from an independent AASHTO-accredited laboratory illustrating that the proposed tack coat provides adequate shear and tensile adhesion between the waterproofing membrane and asphalt overlay.

511.03 Construction Requirements.

A. Surface Preparation. For new construction, clean, dry, fully cure, and finish the concrete surface as specified in 502.03.1.3. Sandblast new concrete surfaces where penetrating water repellent is to be applied. The Contractor may clean the surface with a hydroblast unit using water with a minimum nozzle pressure of 7,000 psi as an alternative to sandblasting.

For rehabilitation of a structure, ensure the concrete surface to receive the membrane application is free from foreign materials, sharp concrete edges are corrected to the Engineer's satisfaction, and repairs and patches are fully cured. Sandblast the entire surface and the sides of curbs for a height of 1 inch above the thickness of the overlay before application of the membrane.

B. System Application Requirements.

1. Type C Application of Penetrating Water Repellent System. Type C, penetrating water repellent consists of a sealant which penetrates the deck surface and forms a water repellent layer within the concrete. Uniformly apply the penetrating water repellent material over surfaces to receive this treatment. Apply the penetrating water repellent compound on a completely cleaned and sandblasted surface. Ensure concrete moisture is as recommended by the manufacturer of the water repellent material.

Apply the repellent using equipment and application pressure recommended by the manufacturer. Treat bridge deck and horizontal surfaces using a spray bar system approved by the manufacturer.

Apply and use the sealing penetrant in accordance with the manufacturer's written instructions, except do not apply the material when ambient or surface temperature is below 40 °F or above 100 °F or when wind exceeds 15 mph. On surfaces exposed to foot or vehicle traffic, ensure the application rate is not lighter than that used to pass the Alberta sandblast test. On other surfaces, the Contractor may use the manufacturer's normal recommended application rate.

2. Type D Application of Precoated Pre-formed Membrane Sheet System. Type D, precoated pre-formed membrane consists of prefabricated sheets which may be self-adhesive or may require a separate bonding agent. Apply precoated, pre-formed membrane sheets to the surface receiving the membrane.

Ensure application, surface preparation, and if required, primer is in accordance with the manufacturer's written instructions.

Lap joints between sheets of the membrane at least 2 inches. Ensure the membrane sheet system does not have wrinkles.

3. Type E Spray-Applied Waterproofing System. Type E, spray-applied waterproofing system suitable for concrete or miscellaneous metal surfaces to prevent corrosion from soluble salts on the bridge deck and approach slabs that are to be overlaid with asphalt.

The manufacturer's representative must be on the project site at all times and, upon consultation with the Engineer, may suspend any item of work that does not meet this specification. Resume work only after the manufacturer's representative and the Engineer are satisfied that appropriate remedial action has been completed.

- a. Quality Assurance.

- (1) Provide membranes, primers, and under coats from the approved manufacturer supplying the principal materials for the work.
- (2) Before commencing the installation, with Engineer's approval, install a mutually agreed upon sample ("mock-up") to show final color and texture. This mock-up will serve as a work standard for the final installation.

- b. Material Delivery and Storage. Store sufficient quantities of materials at the project site to perform the entire application before starting the deck surface preparation.

Deliver materials to the project site in the manufacturer's original unopened containers bearing manufacturer's name, product, color, and batch numbers.

Include a SDS with each product shipment.

Store materials in a clean, dry, weather-protected storage facility. Ensure the storage facility has a recording thermometer. Replace the materials at no cost to the Department if the temperature exceeds the range of 50 °F to 120 °F.

Protect from damage, moisture, and direct sunlight.

Do not store drums directly on the concrete substrate.

- c. Surface Conditions and Preparation. Ensure the environmental and project site conditions are suitable for application and curing of the waterproofing system. Ensure the temperature of the surface meets the temperature required by the manufacturer for all components of the waterproofing system to properly cure. The surface temperature should be 5 °F above the dew point temperature of the air and rising. Check dew point in accordance with ASTM E337 or by

using an approved digital instrument. Inspect surfaces for contamination and other critical factors at the time of installation. Surfaces to receive the waterproofing system must be structurally sound and thoroughly dry.

Do not proceed with installation until unsatisfactory conditions have been corrected. Shot blast surfaces in accordance to ASTM D4259 using self-contained, recirculating blast equipment.

Clean surfaces must be free of any visible oil, grease, curing compounds, or other surface contaminants. If required, perform cleaning process in accordance with ASTM D4258.

Remove all unsound concrete. Patch holes or spalled areas with Five Star Structural Concrete®, Rapid Set® DOT Mix, or as recommended by the waterproofing manufacturer.

Clean and repair the entire concrete deck, approach slabs, and sides of curbs for a height of 2 inches above the finished asphalt grade line.

- d. Installation. The manufacturer's representative must be on the project site at all times, and upon consultation with the Engineer, may suspend any item of work that does not meet this specification. Resume work only after the manufacturer's representative and the Engineer are satisfied that appropriate remedial action has been taken.

Concrete surfaces must be dry. Test surfaces to receive coating system using a concrete moisture meter. Moisture content of the concrete surface must be 5.0 percent or less.

Spray, squeegee, brush, or roll primer at 130 to 200 square feet per gallon (or at the manufacturer's written coverage rate) over surfaces to receive coating system. If an adequate chemical bond between the primer and membrane systems cannot be achieved, small size aggregate may be lightly broadcasted onto the primer to promote interlayer adhesion in accordance with the manufacturer's written instructions. Allow primer to become tack free before spraying base waterproofing membrane.

Reapply primer if allowed to set for more than 24 hours.

After becoming tack free, test primed surface using Elcometer adhesion testing in accordance with ASTM D4541. Minimum pull strength is 150 psi or failure in the concrete substrate.

Apply the base membrane in accordance with the supplier's instructions and detail drawings to a total thickness of at least 80 mils (20 square feet per gallon) or the thickness used to pass the ASTM C836-00. Mechanical application equipment (MAE) that makes automated spray passes and is proven for use with plural component deck membranes may be used. If used, MAE must:

- (1) Be capable of installing membrane in a monolithic single layer.
- (2) Be capable of containing overspray when applicable.
- (3) Be capable of installing at least a 4 foot-wide pass.
- (4) Install the lap areas no greater than 75 percent of the diameter of the spray pattern.
- (5) Be capable of spraying 1,000 square feet an hour.

Spray additional base coats to achieve the specified thickness. Retouch as required.

Spray a second top coat membrane on top of the base coat at a thickness of 30 to 40 mils and immediately broadcast basalt aggregate at a rate of 0.33 to 0.50 pounds per square foot to achieve at least 95 percent coverage.

Apply tack coat as directed by the manufacturer's representative in accordance with the manufacturer's written instructions.

Place required asphalt overlay surfacing after membrane and tack coat have cured according to manufacturer's written instructions. Deposit, spread, and roll asphalt material so the membrane is not damaged or compromised.

Remove and dispose of waste materials, rubbish, and debris in accordance with local regulations. Clean adjacent surfaces of spillage or overspray, if any.

Leave work area in a clean condition.

- e. Field Quality Control. The field quality control work will be completed by the waterproofing manufacturer's onsite representative. The representative must record all readings and test results. Complete a "quality control daily report" form and submit a copy to the Engineer.

Record environmental conditions readings at least once every 4 hours, when ambient conditions significantly change, or immediately before the Contractor performs new tasks (e.g., before installing primer, before installing base membrane), whichever is more frequent.

Perform dry film thickness tests of base membrane in accordance with SSPC-PA2 or SSPC-PA9. Destructive or stroke-per-gallon methods are also suitable methods of thickness assurance on most projects, if approved by the Engineer.

- (1) If the onsite representative uses magnetic test equipment, testing must be performed in accordance with SSPC-PA2.
- (2) If onsite representative uses ultrasonic test equipment, testing must be performed in accordance with SSPC-PA9.
- (3) Spray equipment is calibrated and tested to a stroke count per gallon of product sprayed. This is suitable for thickness assurance on most projects, if approved by the Engineer.
- (4) Ultrasonic testing is usually accurate to within 5 percent.
- (5) Repair destructive areas by respraying or filling with special 2-component gun grade material provided by manufacturer.

Other system components may be tested for thickness using wet film or stroke per gallon methods.

Perform tensile adhesion bond testing of the primer and base membrane in accordance with ASTM D4541. On concrete surfaces, the minimum adhesion value is 150 psi. For the concrete on metal surfaces, the minimum adhesion value is 300 psi.

The manufacturer's onsite representative will perform visual inspections throughout the installation process. Holidays or other defects in the waterproofing membrane must be marked and repaired.

Maintain spray and other installation equipment in proper operating condition throughout the installation. Provide reserve equipment as required.

- f. Manufacturer Quality Control. Spray two 12 inch by 12 inch samples of base membrane and top coat membranes, once at the beginning of the day and once at the end of the day. Record the time and date, product batch numbers, and equipment processing settings. Samples must be sent to the manufacturer's laboratory or a third party laboratory for physical property testing. The physical properties of field samples must be in accordance with the material properties listed in Table 511.02-2 and Table 511.02-3.

The manufacturer must submit a physical properties report to the Engineer upon completion. The manufacturer must provide certificates of analysis (COA) and infrared spectroscopy scans of all materials used. The COAs must illustrate conformance of each batch of liquid material to known manufacturing standards.

- g. Limitation of Operations. Obtain the Engineer's approval before performing work. Unless otherwise approved, the following conditions govern work on each portion of a structure:
- (1) Ensure the environmental and project site conditions are suitable for application and curing of the waterproofing system.
 - (2) Temperature of the surface should be at least 5 °F above the dew point temperature of the air and rising. Check dew point in accordance with ASTM E337 or by using an approved digital instrument.
 - (3) Inspect surfaces for contamination and other critical factors at time of installation. Surfaces to receive waterproofing system must be structurally sound and thoroughly dry. Do not proceed with application until unsatisfactory conditions have been corrected.
- h. Repair Procedure. If cores are taken to test the asphalt overlay and the membrane is damaged, the following repair procedure must be followed:
- (1) Expose additional sound and well-bonded membrane up to a perimeter width of at least 3 inches beyond the periphery of the damaged area, removing contaminates.
 - (a) If using a 4-inch hole saw to take the asphalt core, use at least a 10-inch hole saw to expand the area of exposed membrane.
 - (b) If using a 6-inch hole saw to take the asphalt core, use a 12-inch hole saw to expand the area of exposed membrane.
 - (c) When drilling a secondary core:
 - i. Measure the depth of the asphalt in at least 4 areas around the initial core.
 - ii. Drill the secondary core $\frac{1}{4}$ inch less than the lowest reading.
 - (d) Remove the asphalt between the primary and secondary core using hand tools, taking care not to damage the waterproofing membrane. If using a chipping hammer, exercise extreme caution.
 - (2) In the event the membrane becomes delaminated, the area must be cut back to sound, well-bonded materials.
 - (3) The surface of the exposed membrane must be cleaned of all loose dirt, dust, debris, contaminates, and/or other deleterious material that could interfere with the adhesion of the repair membrane.
 - (4) Existing asphalt, tack coat, and other difficult to remove contaminates must be completely removed using dry abrasive blast equipment, hand tools, or power tools.
 - (5) Any exposed substrate must be prepared in accordance with SSPC-SP13/NACE No. 6 for cementitious substrates or SSPC-SP10 for steel substrates.
 - (6) Wipe the exposed membrane with acetone using clean, lint-free rags. Allow acetone to flash off.
 - (7) Wipe the exposed membrane with a single component cleaner and surface activator specifically designed to reactivate the surface of bridge deck membranes using clean, lint-free rags.
 - (8) Apply a waterproofing membrane patch coat or waterproofing membrane material in a continuous layer over the prepared substrate with at least a 2-inch overlap onto the existing sound membrane. The final thickness of the repair material must be at least 80 mils. Allow to dry to the touch.

- (9) Apply an additional waterproofing membrane patch coat or waterproofing membrane top coat in a continuous layer over the newly installed membrane at a minimum thickness of 40 mils.
- (10) Immediately broadcast aggregate into the wet material to a final coverage rate of 85-95 percent.
- (11) Ensure the repair material is only applied to the prepared substrate and existing prepared membrane. Do not apply any repair material to the inside face of the asphalt.
- (12) Clean out any excess aggregate, loosely adhered asphalt, dirt, dust, debris, or other deleterious material.
- (13) The asphalt may be repaired using asphalt or other Department-approved materials 1 hour after installation of the final coat.
- (14) Submit a repair procedure and proposed materials for approval before performing the work. All required repairs must be performed by the waterproofing membrane installers.

C. Protection and Overlaying. Only use rubber-tired vehicles necessary for construction of overlays on the completed membrane system. Do not allow public traffic. The Contractor may place a thin dusting coat of portland cement by hand to prevent paver or truck tires from sticking to the membrane during overlay work.

Uniformly place 1 to 2 inches of sand over the membrane surface if a base aggregate or borrow course is to be placed on the waterproof membrane.

Construct plant mix overlays as soon as practical after completing the membrane and as specified in 405, except the minimum plant mix temperature when compaction begins is 234 °F. Roll using steel-wheel rollers with no vibration. Use special compactors or rollers to achieve adequate compaction adjacent to curbs or deck drains.

511.04 Method of Measurement. The Engineer will measure acceptable work by the square yard in place as determined from the plans and include horizontal and vertical surfaces.

The Engineer will measure the placement of pavement overlays under their respective contract pay items.

511.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Concrete Waterproof System	SY

The Department will pay for the placement of pavement overlays under their respective contract pay items.

SECTION 512 – GABION STRUCTURE

512.01 Description. Construct gabion structure consisting of rock-filled wire gabion baskets. Gabion structure can be a concept design or a plan detailed design.

A. Concept Design. Submit a detailed design of the gabion structure based on the information provided in the concept design. Submit a design in accordance with the latest version, at the time of design, of the AASHTO LRFD Bridge Design Specifications which is signed and sealed by an Idaho licensed professional engineer. Construct as specified in the design.

512.02 Materials. Provide gabion materials as specified in 715.

Provide riprap/erosion control geotextile as specified in 718.06.

Provide granular borrow as specified in 205.02.B.

512.03 Construction Requirements.

A. Preparation of Foundation. Excavate the foundation materials for gabion structure to the lines and grades as specified.

Where soft, yielding material is encountered, remove the material below the structure foundation to a depth of at least 2 feet or as directed. Ensure the width of the excavation is at least 1 foot greater than the bottom width of the gabion structure. Backfill the excavated area below the structure bottom with granular borrow and compact in layers not to exceed 6 inches in uncompacted depth to form a uniform and stable foundation. Repair slipouts caused by the Contractor's operations to the Engineer's satisfaction and at no additional cost to the Department.

B. Assembly, Erection, and Filling Gabion Baskets. Submit a detailed, step-by-step construction procedure prepared by the gabion structure manufacturer for approval 15 calendar days before the construction begins. Do not start the gabion structure construction until the submitted procedure is approved in writing.

C. Backfilling the Gabion Structure. Backfill the area behind the gabion structure with granular borrow.

Spread riprap/erosion control geotextile uniformly at the bottom and over the back of the gabion structure, if required. Overlap joining edges of the geotextile at least 1 foot and anchor in position with approved anchoring devices. Place the backfill material so the geotextile does not tear, puncture, or shift.

Place the granular borrow backfill material in layers and compact until a uniform density of at least 95 percent of the maximum density is attained as determined by AASHTO T 99 Method C. Do not exceed 1 foot thickness before compaction. Decrease this lift thickness, if necessary, to obtain the specified density.

512.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard based on plan quantity.

512.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Gabion Structure	CY

The Engineer will measure and the Department will pay for structure excavation and compacting backfill as specified in 210. The Engineer will measure and the Department will pay for geotextile, when used as specified in 640. Backfill for the gabion structure is incidental.

SECTION 520 – PREDRILLING FOR PILING

520.01 Description. Drill and backfill holes in soil and rock to allow piles to be driven to the highest pile tip elevations and minimum bearing capacities specified or as directed.

520.02 Materials. Provide temporary steel casings of sufficient strength to resist damage and deformation during installation, extraction, and all soil pressures on the casing.

Coarse Aggregate for Concrete, Size No. 1 703.02.C.

520.03 Construction Requirements. Submit a work plan for predrilling at least 4 weeks before pile driving. The work plan must include descriptions of the following:

1. Equipment.
2. Materials.
3. Sequence of operations, including:
 - a. Removal or replacement of piles that do not reach the required penetration.
 - b. Measures to ensure stability during excavation and backfilling (e.g., prevention of caving and bottom heave).
 - c. Hole cleanout methods.
 - d. Coarse aggregate placement.
 - e. Pulling temporary casing.

Do not perform this work without approval of the work plan.

Drill holes into soil or rock to the highest pile tip elevation(s) specified and with a diameter that is at least 4 inches greater than the pile diagonal dimension of steel H-pile or outside diameter of steel shell pile.

After drilling, fill the hole to the top with coarse aggregate to make it ready for pile driving.

Remove the temporary casing in accordance with the approved work plan during coarse aggregate placement, maintaining the coarse aggregate top above the casing bottom. Fill any remaining voids with coarse aggregate after completing pile driving.

520.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot.

520.05 Basis of Payment. The Department will pay for accepted work as follows:

Pay Item	Pay Unit
Predrilling for Piling in Soil	ft
Predrilling for Piling in Rock	ft

The Department will not pay for predrilling that extends below the depth specified. Casing is incidental to this item.

SECTION 521 – DYNAMIC PILE TESTING AND CAPWAP ANALYSIS

521.01 Description. Retain a pre-approved consultant to perform dynamic pile testing and signal matching analyses using the case pile wave analysis program (CAPWAP) program as specified or as directed. The Engineer will use this information to confirm or modify pile-driving criteria developed by the wave equation analysis for the planned hammer-pile-soil combination.

521.02 Materials. Provide equipment for dynamic pile testing in accordance with the following:

High Strain Dynamic Testing of Piles..... ASTM D4945-12

Provide access to the pile in the leads with a personnel lift or basket that can be raised to the pile top or by other safe methods to attach instrumentation.

For access to the test pile on the ground, provide at least 3 feet of clear access to opposite faces of the pile to allow drilling holes for instrumentation.

Provide sufficient time for installing instrumentation on the pile in the leads. Short interruptions during driving may be necessary due to instrument malfunction.

521.03 Construction Requirements – Testing.

A. General. Perform dynamic pile testing on each test pile as specified or as directed. If the required bearing capacity is not achieved during initial driving, restrike the test pile as directed. Perform dynamic pile testing during the pile restrike. Perform a CAPWAP analysis on the pile restrike data, or as directed. An additional dynamic pile test and CAPWAP analysis will be required for each pile restrike performed.

B. Testing and Reporting. After each test, the Engineer will provide the following information to the Contractor's consultant:

1. Blows per foot of pile penetration.
2. Stroke heights for single acting hammers or blows per minute for other hammer types.
3. Preconstruction wave equation analyses results, upon request.

The consultant will monitor the pile driving from the beginning to the end or as directed. In addition, the consultant will continuously monitor the test piles for potential damage and for the occurrence of non-axial driving, and inform the Engineer and the Contractor immediately if there is any indication that pile damage has occurred during driving.

The consultant will submit preliminary test results to the Engineer and the Contractor within 24 hours of the dynamic testing completion for each test pile and before leaving the project site. The consultant will include the following information with the preliminary test results:

1. Energy transfer from the pile-driving hammer to the pile (EMX or "Enthru") and rated transfer efficiency.
2. Peak force (FMX) and stress (CSX) at the pile dynamic analyzer (PDA) sensor location near the pile top.
3. Ultimate pile bearing capacity computed in the field with a suitable case method calculation and preliminary test results using CAPWAP analysis.

The consultant will sign and submit a final CAPWAP analysis report containing the required information and the CAPWAP analysis results to the Engineer and the Contractor within 2 working days after the test(s) completion for each project site visit. The report must include information on the test pile, soil conditions, pile driving hammer, field test results (including hammer stroke and blow counts), and CAPWAP analysis with any comments that the consultant may have on the results.

Before submitting the report, the consultant will send the Engineer and the Contractor the CAPWAP analysis results by telephone, fax, or email as soon as possible.

The Engineer may request more than 1 CAPWAP analysis per dynamic pile test.

Schedule additional site visits for dynamic pile testing as requested by the Engineer.

Retain only the following Department preapproved consultants for performing the dynamic pile testing and CAPWAP analyses:

Preapproved Consultant Information		
Company	Address	Phone number
PDA Engineering	PO Box 25065 Salt Lake City, UT 84125	801-908-7664
GRL Engineers, Inc.	23015 SE 270 th St Maple Valley, WA 98038	425-381-9690
Geodesign, Inc.	15575 SW Sequoia Pkwy, Ste 100 Portland, OR 97224	503-968-8787
SK Geotechnical	2611 Gabel Rd Billings, MT 59108	406-652-3930
Intermountain GeoEnvironmental Services (IGES), Inc.	4153 Commerce Dr Salt Lake City, UT 84107	801-270-9400
Strata	8653 W Hackamore Dr Boise, ID 83709	208-376-8200
	2815 Garrett Way, Ste C Pocatello, ID 83201	208-237-3400
	W 280 Prairie Ave, Ste 2 Coeur d'Alene, ID 83815	208-772-2428
Lachel & Associates	16300 Christensen Rd, Ste 304 Tukwila, WA 98188	206-244-3593
Gerhart Cole Inc.	668 E. 12225 S, Ste 203 Draper, UT 84020	801-849-0055
Robert Miner Dynamic Testing, Inc.	PO Box 340 2288 Colchester Dr East Manchester, WA 98353	360-871-5480

521.04 Method of Measurement. The Engineer will measure acceptably completed work by each test and each CAPWAP analysis.

521.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Dynamic Pile Testing	Each
CAPWAP Analysis	Each

The Department considers standby time for consultants, contractor personnel, or equipment due to scheduling errors, instrument malfunction, or equipment breakdowns to be incidental.

SECTION 522 – CONTROLLED DENSITY FILL (CDF)

522.01 Description. Furnish all labor, materials, equipment, and incidentals necessary to provide, load, haul, place, and consolidate the controlled density fill (CDF) to the lines and grades specified.

522.02 Materials. Provide CDF using concrete aggregates, fly ash, cement, and water. Guideline mix proportions are presented below:

Portland Cement.....ASTM C 150 or AASHTO M 85
 Fly Ash..... Class F or Class C
 Aggregates ASTM C 33
 WaterPotable
 Admixtures..... AASHTO M 194 or ASTM C 494 or ASTM C 260

Ensure CDF mixture meets the acceptable properties in Table 522.02-1.

Table 522.02-1 – CDF Mixture Properties

CDF Mix Property	
Minimum 28-day compressive strength, psi	100
Maximum 28-day compressive strength, psi	300
Maximum gallons of mixing water per cubic yard	50
Pounds of cement per cubic yard, approximate	50
Pounds of fly ash per cubic yard, approximate	250
Pounds of dry aggregate per cubic yard, approximate (an assumed specific gravity of 2.67)	3,200
Slump, inches	6 - 8

Submit the CDF mix design with the backup data for approval. Do not install CDF until after the CDF mix design has been approved.

Provide a mix design from an approved laboratory.

Provide CDF verification test results from 3 compressive strength testing cylinders.

522.03 Construction Requirements. Batch, transport, and place CDF as specified in 502.

522.04 Method of Measurement. CDF will be measured by the cubic yard. Measurement will be based upon batch delivery tickets submitted at the time of placement.

522.05 Basis of Payment. Payment for the accepted work will be as follows:

Pay Item	Pay Unit
Controlled Density Fill	CY

SECTION 551 – POLYESTER POLYMER CONCRETE (PPC) OVERLAY

551.01 Description.

A. General. Provide a polyester polymer concrete (PPC) overlay system on the prepared concrete surface as specified. The overlay system is defined as the furnished material necessary to complete the PPC overlay, including high molecular weight methacrylate (HMWM) resin primer, PPC resin binder, combined aggregate, and abrasive finish sand. Prepare the surface by shot blasting.

B. Submittals. Do not begin the deck preparation operations or begin placing PPC until receiving Engineer approval.

Submit the following items for approval:

1. Overlay Placement Plan. Submit an overlay placement plan that includes the following:
 - a. Schedule of overlay work and testing for each bridge.
 - b. Anticipated concrete deck repair locations and repair method.
 - c. Staging plan describing overlay placement sequence, including:
 - (1) Construction joint locations. Construct longitudinal joints between passes along the centerline or edge of travel lanes.
 - (2) Sequence of placement.
 - (3) Placement widths.
 - (4) Anticipated placement lengths.
 - (5) Placement direction.
 - (6) Joint work.
 - (7) Location of proposed trial overlay(s).
 - d. Description of equipment and method for:
 - (1) Surface preparation, including grinding and/or shot blasting.
 - (2) The method and materials used to blow, contain, collect, and dispose of concrete debris generated by the deck preparation process, including provisions for protecting adjacent traffic from flying debris.
 - (3) Mixing and applying HMWM resin primer.
 - (4) Measuring, mixing, placing, and finishing the PPC.
 - (5) Applying surface finish sand.
 - e. The method and materials used to contain HMWM resin and PPC components within the deck area receiving the overlay, including protecting and finishing inlets, bridge drains, and expansion joints.
 - f. The method, materials, and equipment used to protect, clean, isolate, and replace expansion joints.
 - g. Method for measuring and maintaining overlay thickness and profile.
 - h. Cure time for PPC.
 - i. Storage and handling of HMWM resin and PPC components.
 - j. Procedure for disposal of excess HMWM resin, PPC, and containers.
 - k. Procedure for cleanup of mixing and placement equipment.

2. Overlay System. Submit copies of the system provider’s material and polyester mix design information, written installation instructions, safety data sheets, independent test results, and certificate of compliance for approval.
3. System Provider Qualifications. Install an overlay system with all components provided through a single system provider with documented experience successfully supplying at least 2 PPC overlay projects of similar size and scope within the past 5 years. Submit documentation of the system provider’s project experience including the following:
 - a. The name of the system provider of the PPC overlay system materials, including the name and phone number of the system provider’s technical representative.
 - b. Project location.
 - c. Owner agency.
 - d. Project construction dates.
 - e. Overlay quantities.
4. Contractor Qualifications. See 551.03.B for contractor qualification requirements.
5. Mixing Equipment. Submit documentation verifying the mixing equipment is calibrated (Caltrans California Test CT 109 or similar accepted).

551.02 Materials.

A. Primer. Apply a wax-free, low odor, HMWM prime coat consisting of a resin, initiator, and promoter to the prepared surface. Ensure HMWM resin complies with the following requirements:

Table 551.02-1

Property	Requirement	Test Method
Volatile Content ^(a)	30%, maximum	ASTM D2369
Viscosity ^(a)	0.025 Pa-s, (25cps) maximum (Brookfield RVT with UL adaptor, 50 RPM at 77 °F)	ASTM D2196
Specific Gravity ^(a)	0.90, minimum, at 77 °F	ASTM D1475
Flash Point ^(a)	180 °F, minimum	ASTM D3278
Vapor Pressure ^(a)	1.0 mm Hg, maximum at 77 °F	ASTM D323
Tack-Free Time	400 minutes maximum at 77 °F	ASTM C679

^(a)Perform test before adding initiator.

Ensure the prime coat promoter/initiator system for the methacrylate resin consists of a metal drier and peroxide. If supplied separately from the resin, do not mix the metal drier with the peroxide directly or a VIOLENT EXOTHERMIC REACTION will occur. Do not store contaminated materials (e.g., containers, measuring devices, rags) in a manner that allows leakage, spillage, or other contact of these materials with the other.

B. Polyester Resin Binder. The polyester concrete consists of polyester resin binder and dry aggregate. Ensure the resin is an unsaturated isophthalic polyester-styrene co-polymer and complies with the following requirements:

Table 551.02-2

Property	Requirement	Test Method
Viscosity ^(a)	0.075 to 0.200 Pa-s (75 to 200 cps) (RVT No. 1 Spindle, 20 RPM at 77 °F)	ASTM D2196
Specific Gravity ^(a)	1.05 to 1.10 at 77 °F	ASTM D1475
Elongation	35%, minimum Type I at 0.45"/min. Thickness = 0.25" ± 0.04"	ASTM D638
	Sample Conditioning: 18 hours/77°F/50% + 5 hours/158 °F	ASTM D618
Tensile Strength	2,500 psi, minimum Type I at 0.45"/min. Thickness = 0.25" ± 0.04"	ASTM D638
	Sample Conditioning: 18 hours/77°F/50% + 5 hours/158 °F	ASTM D618
Styrene Content ^(a)	40% to 50% by weight	ASTM D2369
Silane Coupler	1.0%, minimum (by weight of polyester-styrene resin)	NMR

^(a) Perform test before adding initiator.

The silane coupler must be an organosilane ester, gamma-methacryloxypropyltrimethoxysilane. The promoter must be compatible with suitable methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxide (CHP) initiators.

C. Combined Aggregate. Ensure the aggregate for polyester concrete complies with one of the following combined aggregate gradings:

Table 551.02-3

Sieve Size	Percent Passing	
	3/8" Max.	No. 4 Max.
1/2"	100	100
3/8"	83 – 100	100
No. 4	65 – 82	62 – 85
No. 8	45 – 64	45 – 67
No. 16	27 – 48	29 – 50
No. 30	12 – 30	16 – 36
No. 50	6 – 17	5 – 20
No. 100	0 – 7	0 – 7
No. 200	0 – 3	0 – 3

Ensure that aggregate retained on the No. 8 sieve has a maximum of 45 percent crushed particles when tested in accordance with AASHTO T 335.

Ensure the Mohs scale hardness is at least 6.0 and fine aggregate consists of natural sand only.

Ensure that the combined aggregate absorption does not exceed 1 percent as determined by AASHTO T 84 and T 85.

At the time of mixing with the polyester resin binder, ensure that the moisture content of the aggregate, as determined by AASHTO T 255, does not exceed ½ of the aggregate absorption.

D. PPC Composite. Testing must be performed by an independent testing laboratory. The following tests are required to verify PPC composite properties.

Table 551.02-4

Property	Requirement	Test Method
SSD Bond Strength ^(a) – with a HMWM primed surface	700 psi, minimum at 24 hours and 70 °F	California Test 551
SSD Bond Strength ^(a) – with an unprimed surface	500 psi, minimum at 24 hours and 70 °F	California Test 551
Abrasion Resistance	2 grams weight loss, maximum	California Test 550

^(a) Perform test at 12% resin content.

For SSD bond strength, test 1 sample each of the composite material with and without prime coat to be used during overlay construction. Submit a representative sample to the testing laboratory and submit test results to the Engineer at least 21 calendar days before work begins.

This requirement may be waived if historical laboratory data shows consistency of testing results from the same mix design.

E. Sand for Abrasive Finish. The sand for abrasive finish must comply with the following gradation:

Table 551.02-5

Sieve Size	Percent Passing
No. 8	95 – 100
No. 20	0 – 5

Ensure that the sand for abrasive finish is commercial-quality blast sand. Ensure that absorption does not exceed 1 percent as determined by AASHTO T 84 and T 85.

F. Certification of Materials. Submit, from the system provider, a certificate of compliance stating that the materials meet the requirements listed in Tables 551.02-1, 551.02-2, 551.02-3, 551.02-4, 551.02-5. Ensure the system provider’s Certificate of Compliance states that the HMWM resin is compatible with the polyester resin binder.

Submit test reports from the independent testing laboratory verifying that the test requirements, in Table 551.02-4, have been met.

Submit the certificate of compliance and test reports at the time of the mix design review.

G. Storing and Handling. Deliver materials in their original containers bearing the system provider’s label, specifying date of manufacturing, batch number, trade name brand, quantity, and mixing ratio. Accompany each shipment of polyester resin binder and HMWM resin with a SDS.

Store the material to prevent damage by the weather and to ensure the preservation of their quality and fitness for the work. Keep the storage space clean and dry, and provide a high-low thermometer. The temperatures of the storage space must not fall below or rise above the system provider written instructions. Take every precaution to avoid contact with flame.

Inspect stored materials before use and ensure compliance with these requirements at the time of use.

Immediately replace rejected material at no cost to the Department.

Store a sufficient amount of material to perform the entire PPC overlay application at each location before starting any deck preparation to avoid delay in procuring the materials for each day's application.

Issue appropriate protection equipment to personnel working with the polyester concrete. Appropriate impermeable protective garments must be used by workers who may contact the resin or initiators. Immediately wash off the resins or initiators if skin contact occurs. Immediately remove clothing that becomes saturated with resin.

551.03 Construction Requirements.

A. General. The polyester overlay system provider must have a representative on the project site at all times to consult with the Engineer and the Contractor regarding work that does not meet this specification. The Engineer may suspend any item of work that does not meet this specification. Resume suspended work only after the Engineer is satisfied that appropriate remedial action has been completed. Work will not be allowed to proceed and materials will not be accepted if the system provider's technical representative is not onsite.

The system provider of the PPC overlay resin binder and HMWM resin will furnish technical service relating to the application of material and health and safety training for personnel who are to handle the PPC overlay and the HMWM resin prime coat.

Hold a pre-placement conference before any overlay operations begin. Attendees must include representatives from all parties involved in the work. If necessary, teleconferencing of attendees may be approved.

B. Contractor Qualification and Trial Overlay.

The PPC overlay company must meet one of the two requirements below:

1. Experience. The PPC overlay company must provide a project reference list of at least 2 successful PPC overlay projects with a 50 cubic yards minimum PPC quantity completed within the last 5 years and that use the same PPC overlay system and materials as specified in this contract. Provide the name and location of each project, quantity of overlay placed, the project contracting agency, and the name and current phone number of the contracting agency's contact person.

Onsite supervisors and personnel operating the mobile mixer and finishing machines must have equivalent work experience in mixing and placing PPC overlay as the Contractor. Provide documentation of project experience with PPC overlay, including the name and location of the project, the project Contracting Agency, the quantity of overlay placed, and the name and current phone number of the Contracting Agency's contact person.

The Engineer may suspend the overlay work if the Contractor substitutes unapproved personnel. Additional costs resulting from suspension of work due to the changing of personnel is the Contractor's responsibility, and adjustment in contract time will not be allowed.

- a. Trial Overlay. Place a trial overlay of PPC using Engineer-approved equipment and procedures. Follow the construction requirements sections as specified in 551.03.A through 551.03.G. Notify the Engineer of the time and location of the trial overlay at least 7 calendar days before the scheduled trial overlay.

Select a location and place the trial overlay on a previously cast and cured concrete pad (i.e., not on the bridge receiving the PPC overlay). The minimum plan dimensions of the concrete pad and the trial overlay are 12 feet in width and 15 feet in length. Provide a trial overlay at the same thickness as the project overlay.

Perform 3 pull-off tests on the trial overlay in accordance with ASTM C1583. The pull-off tests must have minimum tensile bond strength of 250 psi or a failure area, at a depth of $\frac{1}{8}$ inch or more into the base concrete, of no greater than 50 percent of the test area. Record the pull-off test results

and failure value into the base concrete and provide written documentation of the test results. The Engineer will designate the location of the pull-off tests.

The Engineer will accept the trial overlay after completing the following:

- (1) Specified surface preparation.
- (2) Proper sequence of PPC overlay placement.
- (3) Submittal of mixing readouts at proper mix ratios at required intervals.
- (4) Passing values for all specified tests.

After receiving approval of the completed trial overlay, the concrete pad and trial overlay becomes the Contractor's property. Remove and dispose of material as specified in 203.

The Engineer must approve the completed trial overlay before beginning any surface preparation operations at the project site.

2. No Experience. If the PPC overlay company does not have the required previous PPC overlay experience outlined in 551.03.B.1, they must demonstrate competence with the process and material with a trial overlay as described below.
 - a. Trial Overlay. Meet all the requirements for a trial overlay given in 551.03.B.1 and the following additional requirements:
 - (1) Prepare the concrete surface and demonstrate to the Engineer that the final surface texture of the trial overlay meets the International Concrete Repair Institute (ICRI) concrete surface profile numbers 5 through 7.
 - (2) Record the aggregate and resin volumes at no greater than 5-minute intervals during the trial overlay placement. After placing the trial overlay, submit to the Engineer a printout of the recordings.
 - (3) Test 1 sample of the trial PPC overlay for compressive strength. Follow the testing requirements for compressive strength in AASHTO T 22.
 - (4) Test 1 sample of the trial PPC overlay for consolidation to a relative compaction of at least 97 percent. Follow the testing requirements in California Test 552.
 - (5) Demonstrate to the Engineer how the minimum overlay thickness has been achieved and maintained through the length of the trial overlay.
 - (6) Demonstrate to the Engineer how the finish sand is applied and how the specified application rate is achieved.
 - (7) Demonstrate to the Engineer how a minimum of 3,000 psi compressive strength of the trial overlay has been verified using the rebound number determined in accordance with ASTM C805.
 - (8) Perform 5 pull-off tests on the trial overlay in accordance with the requirements of 551.03.B.1.
 - (9) The Engineer will accept the trial overlay after completing the following:
 - (a) Specified surface preparation.
 - (b) Proper sequence of PPC overlay placement.
 - (c) Submittal of mixing readouts at proper mix ratios at required intervals.
 - (d) Passing values for all specified tests.

After receiving approval of the completed trial overlay, the concrete pad and trial overlay becomes the Contractor's property. Remove and dispose of material as specified in 203.

The Engineer must approve the completed trial overlay before beginning any surface preparation operations at the project site.

C. Equipment.

1. Shot Blasting Machine. Use a shot blasting machine to obtain the specified surface texture on the concrete surfaces receiving the PPC overlay. The use of a rotary milling or hydro-demolition machines will not be allowed.

Provide a shot blasting machine that consists of a self-contained mobile unit using steel abrasive to texture the sound concrete to achieve the specified surface profile. Provide a machine that is capable of blasting a minimum width of 2 feet per pass. The shot blasting machine must vacuum and store all material removed from the blasted concrete surface into a self-contained unit.

2. Mobile Mixer for PPC. Mix polyester concrete in a continuous volumetric mixer with an auger screw/chute device.

Calibrate the mixer to automatically proportion and blend components of the specified mix on a continuous or intermittent basis, as required by the finishing operation, and discharge mixed material directly into the finishing machine.

Equip the continuous mixer with a metering device that automatically measures and records the aggregate volumes and the corresponding resin volumes. Ensure that the metering device has a readout display gauge visible at all times and can print the recorded volumes for each material.

3. Finishing Machine. Furnish slip-form finishing equipment for the placement of PPC overlay with an automatic grade control device to strike off the PPC mixture to the established grade and cross-section. Fit the finishing equipment with vibrators or other means of consolidating the PPC. The slip form finisher must be able to move forward and backward under its own control (e.g., an Allen Slip Form Paver, which is controlled by string line or ski).

Any PPC overlay placement method that cannot use a slip form paver must be addressed in the overlay placement plan and be approved.

D. Surface Preparation. Repair minor potholes and delamination in the deck surface by removing the damaged concrete and patching with an Engineer-approved patching material before installation of the overlay. Strike off patches so they are level with the existing deck using common concrete-finishing tools. PPC is an approved patching material. All cementitious substrates require submittal and approval before use. Cementitious patching materials require a minimum curing period of 28 days before application of the overlay.

Before placing the overlay, obliterate all pavement markings and thoroughly texture the entire concrete deck by steel shot blasting to ensure proper bonding between the overlay and the concrete substrate. Achieve final surface texture meeting concrete surface profile numbers 5 through 7 as defined in ICRI Guideline No. 03732 and as shown by surface profile samples available from ICRI, or ASTM E965 pavement macrotexture depth of 0.04 to 0.08 inch. Shot blasting is meant to expose the coarse aggregate. The prepared surface must be free of asphalt material, oil, dirt, rubber, curing compounds, paint carbonation, laitance, weak surface mortar, and other potentially detrimental material which may interfere with the bonding or curing of the overlay.

Remove and repair loosely bonded patches. Thoroughly clean the concrete surface and expansion joints of dust and debris adhering to it by blowing off with moisture and oil-free compressed air. After completion of the initial compressed air removal, blow the surface again to remove any residual dust.

E. Mixing PPC. Mix PPC in mobile mixers as specified and in accordance with the approved mix design. Use calibration checks on the aggregate, resin, and initiator to verify the mix will produce ratios and be placed within the ranges established in the mix design.

The polyester resin binder in the PPC must be 12 percent plus or minus 1 percent by weight of the dry aggregate.

Provide a sufficient amount of initiator used in polyester concrete to produce an initial set time between 30 and 90 minutes. The set time can be determined in the field when the in-place PPC overlay cannot be deformed by pressing with a finger, indicating that the resin binder is no longer in a liquid state. If the initial set time is not within 30 to 90 minutes, remove and replace the material.

Accelerators or inhibitors may be required to achieve proper set times and will be used as recommended by the polyester resin binder system provider and as approved.

Record the aggregate and resin volumes at no greater than 5-minute intervals along with the date of each recording. Print out the recordings, along with the dimensions of placed PPC overlay, at the end of each work shift.

Prevent cleaning chemicals from reaching the polyester concrete mix during mixing operations.

F. Placement of PPC. Do not begin applying the HMWM prime coat and the PPC overlay if rain is expected. The prime coat area must be dry and received no rain for at least 24 hours. Immediately before applying the prime coat, blow the receiving surface according to 551.03.D.

The concrete bridge deck surface temperature must be between 50 °F and 100 °F and the relative humidity must be less than 85 percent when the prime coat is applied.

The prepared concrete surface will receive 1 coat of HMWM resin primer. Saturate the deck surface with promoted/initiated HMWM and push excess resin primer forward to ensure uniform primer coverage and penetration of the area to receiving the polyester concrete.

If the primed surface becomes contaminated, remove the contaminated area by abrasive blasting and reprime at no additional cost to the Department.

Cure the prime coat for at least 15 minutes before placing the PPC overlay.

Cover the HMWM prime coat with the PPC overlay within 2 hours of placing the prime coat. Place PPC before gelling and within 15 minutes following initiation, whichever occurs first. Discard PPC that is not placed within this time.

If the PPC is not placed over the prime coat within 2 hours, suspend work and propose remedial action.

Under no circumstances will any HMWM resin primer or PPC be allowed to run into drains and expansion joints, or otherwise escape the collection and containment system.

Isolate and/or blockout expansion joints before placing the overlay as specified or directed.

The surface temperature of the area receiving the PPC overlay and the relative humidity must be the same as specified for the HMWM prime coat.

Consolidate the PPC overlay to a relative compaction of no less than 97 percent in conformance with California Test 552.

G. Finishing PPC. Using the Engineer-approved finishing machine, strike off the PPC to the established grade and cross-section and consolidate to the required compaction.

As the finishing machine progresses along the pour, give the surface a final finish by texturing with a comb of spring steel tines pulled parallel to the centerline of the bridge. The texture may be applied by finishing machine-mounted tines or manually. If machine-applied, mount the tines to the machine at a point immediately behind the extruded overlay. Equip the comb so that it is adjustable to ensure proper depth longitudinally and transversely.

The comb must consist of a single row of metal tines capable of producing $\frac{1}{8}$ inch wide striations approximately $\frac{3}{16}$ inch in depth at approximately 1 inch spacing. Perform this operation in a manner that will minimize the displacement of the aggregate particles. Terminate the texture within 2 feet of the curb line.

Ensure that the PPC overlay receives an abrasive sand finish. Apply the sand finish before gelling occurs; before hand tining or immediately after paver-mounted tining. Uniformly broadcast at approximately 2 pounds per square yard of sand onto the surface.

Some areas may require finishing by hand tools (e.g., termination edges). Follow hand finishing with surface texturing and broadcast sand finish while the overlay is still wet.

The Engineer will determine acceptable surface smoothness in accordance with Idaho T 87 immediately after the overlay has hardened. Acceptable surface will not vary more than $\frac{1}{4}$ inch 10 feet from the lower edge of the straightedge and 90 percent of the readings must not exceed $\frac{1}{8}$ inch in 10 feet.

Grind unaccepted surfaces at no additional cost to the Department. Grind surfaces until smoothness requirements are met and according to the following requirements:

1. Grind the specified bridge deck areas in the longitudinal direction. Equip the grinding equipment with diamond-tipped saw blades mounted on a power-driven, self-propelled machine that is specifically designed to texture concrete surfaces.
2. Equip the grinding equipment with a blade spacing that provides grooves as close as possible to match the spacing provided by the texturing comb. Provide grooves that are between 0.10 and 0.15 inches wide.
3. Ensure that the grinding procedure does not damage the existing bridge deck. Rotary milling machines are not allowed.
4. Demonstrate, to the Engineer's satisfaction, the method and equipment for grinding the PPC overlay are adequate for the intended purpose and will provide satisfactory results.
5. Do not commence removal without approval of the grinding equipment. Contain, collect, and dispose of debris generated by the grinding operation.

Before opening the overlay area to vehicular traffic, power sweep the finished overlay to remove excess or loose aggregate and abrasive sand. Demonstrate, to the Engineer's satisfaction, the power broom equipment will not damage the finished overlay. Repair any damage to the finished overlay caused by the power broom at no additional cost to the Department.

H. Testing PPC. Testing for compressive strength, bond pull-out strength, and relative compaction must be performed by an independent testing laboratory. Test the placed PPC overlay as described below.

Polyester Concrete Composite Testing		
Property	Requirement	Test Method
Cure (compressive strength for opening to traffic)	3,000 psi, min before opening to traffic	ASTM C805
Compressive Strength (4 by 8 or 6 by 12 cylinders are acceptable) (every 20 CY placed)	4,000 psi at 7 days	AASHTO T 22
Bond Pull-out Strength (every 20 CY placed)	250 psi, min or substrate failure whichever occurs first	ASTM C1583
Relative Compaction (1 per day's placement)	97% min	California Test 552

1. Cure. Traffic and equipment is not permitted on the PPC overlay for at least 2 hours after finishing and not until the overlay has reached a minimum compressive strength of 3,000 psi as verified by the rebound number in accordance with ASTM C805.

Protect the PPC overlay from moisture until traffic and equipment is permitted.

Cure time depends upon the ambient and deck temperatures as well as initiator/accelerator levels.

Remove and replace areas in the polyester concrete that do not fully cure, or that fail to attain the minimum compressive strength as verified by the rebound number in 6 hours with new PPC overlay material, at no additional cost to the Department.

2. Compressive Strength. Test 1 sample for each 20 cubic yards of PPC overlay placed during overlay construction. Record the date and location for each 20 cubic yards represented.
3. Bond Pull-Out Strength. Test 1 location corresponding to each 20 cubic yards of PPC overlay placed during overlay construction. Record the date and location for each 20 cubic yards represented.
4. Relative Compaction. Test 1 sample for each shift's placement of PPC overlay construction. Record the date or and location for each shift represented.
5. Remove and Replace. Remove and replace areas in the PPC overlay that correspond to failed test for compressive strength, bond pull-out strength, and relative compaction at no additional cost to the Department.

I. Checking PPC for Bond. After the requirements for curing have been met, use a chain drag or other appropriate tool or device, in the Engineer's presence, to determine if any un-bonded areas exist between the new overlay and the mating concrete surface. Remove and replace PPC in unbonded areas with PPC at no additional cost to the Department.

J. Checking PPC for Thickness. The Department may perform random checks of PPC overlay thickness. Remove and replace areas found deficient at no additional cost to the Department.

551.04 Method of Measurement. The Engineer will measure accepted prepare and place PPC overlay work by the square yard.

The Engineer will measure accepted furnished PPC overlay material by the cubic yard as recorded by PPC proportioning printouts. The Engineer will correct proportioning printout quantities for unacceptable material or excess waste.

All surface preparation is considered incidental.

The trial overlay is considered incidental.

Expect minor surface irregularities on the prepared deck surface to receive PPC overlay. Ensure a minimum 3/4 inch overlay depth.

551.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Prepared & Placed PPC Overlay	SY
Furnished PPC Overlay Material.....	CY

Payment for prepared and placed PPC overlay will be made on plan quantity as specified in 109.01B.

Payment for furnished PPC overlay material will be calculated on a per shift basis from the Contractor-submitted PPC proportioning printouts and placement dimensions. Any PPC overlay material placed exceeding the contract quantity will be paid for at $\frac{1}{2}$ the unit price for furnished PPC overlay material.

Obliteration of pavement markings is incidental.

SECTION 553 – EPOXY OVERLAY

553.01 Description. Prepare and apply an epoxy and aggregate overlay on the concrete bridge deck surface area between the curb faces and from the beginning to the end of the bridge as specified. Submit the following:

- A. Submit the name and phone number of the epoxy material manufacturer’s technical representative at the preconstruction meeting.
- B. At least 10 calendar days before the epoxy overlay placement, submit:
 - 1. The epoxy materials manufacturer’s written mixing instructions, safety data sheets, independent test results, and a certificate of compliance stating the epoxy materials meet the requirements listed in Table 553.02-1.
 - 2. Independent test results and a certificate of compliance stating the aggregates meet the requirements listed below in Tables 553.02-2 and 553.02-3 and that it is compatible with the epoxy material.

553.02 Materials. Provide an epoxy resin base and hardener that is a modified Type III, two-component system that meets the requirements of ASTM C881, Grade 1, Classes B and C. Store the epoxy in accordance with the manufacturer’s specifications. Ensure epoxy properties meet Table 553.02-1:

Table 553.02-1 – Epoxy Requirements

Property	Requirement	Test Method
Gel Time	≥ 15 to ≤ 45	ASTM C881, Paragraph 11.2 modified
Tensile Strength (neat)	≥ 2,000 psi to ≤ 5,000 psi at 7 days	ASTM D638
Tensile Elongation (neat)	≥ 40% to ≤ 80% at 7 days	ASTM D638
Viscosity	> 7 to < 25 poises	ASTM D2393, Brookfield RVT Spindle No. 3 at 20 rpm
Minimum Compressive Strength at 3 hours	1,000 psi at 75 °F	ASTM C579 modified (with plastic inserts), mixed with aggregate
Minimum Compressive Strength at 24 hours	5,000 psi at 75 °F	ASTM C579 modified (with plastic inserts), mixed with aggregate
Minimum Adhesion Strength at 24 hours	250 psi at 75 °F	ACI 503R, Appendix A, VTM 92
Permeability to chloride ion at 28 days	100 coulombs maximum	AASHTO T 277

Pack materials in puncture, rupture, and leak proof containers. Label each container as Part A or Part B and clearly mark the name and address of the manufacturer, name of the product, mixing proportions and instructions, lot and batch numbers, date of manufacture, and quantity.

Provide aggregate topping that is clean, dry, and free from deleterious matter. Ensure the aggregate is compatible with the epoxy material. Furnish aggregates in appropriate packaging that is clearly labeled (i.e., showing the name of the manufacturer and location of processing) and protects the aggregate from contaminates, rain, and other moisture. Provide aggregate that meet the requirements of Tables 553.02-2 and 553.02-3.

TABLE 553.02-2 – Aggregate Requirements

Properties	Test Method	Specifications
Color	—	Buff or grey
Surface Friction using British Pendulum Tester	AASHTO T 278 or ASTM E303	70 BPN minimum
Resistance to Degradation - LA Abrasion Test	AASHTO T 96	20% maximum
	AASHTO T 96 “C” Grading (on parent aggregate)	20% maximum
Moisture Content	AASHTO T 255	0.2% maximum
Aluminum Oxide	ASTM C25	80% minimum
Mohs Scale Hardness	—	7 minimum

Table 553.02-3 – Aggregate Gradation AASHTO T 27

Sieve Size	Total Percent Passing
No. 4	100
No. 6	95 – 100
No. 16	0 – 5

553.03 Construction Requirements.

Ensure the epoxy overlay manufacturer’s representative is on the project site at all times and who, upon consultation with the Engineer, may suspend work items that do not meet specification requirements. Work may resume only after taking appropriate remedial action to satisfy the manufacturer’s representative and the Engineer. Plan and perform the work to allocate the specified minimum curing periods, or other longer curing periods prescribed by the manufacturer, before opening to public or construction traffic.

A. Equipment. For mechanical applications, provide equipment with a minimum of an epoxy distribution system, aggregate spreader, application squeegee, moisture and oil-free compressed air, and a source of lighting if work will be performed at night. Ensure the epoxy distribution system accurately blends the epoxy materials in accordance with the manufacturer’s written specifications and distributes epoxy at the specified application rates to cover 100 percent of the work area. Propel aggregate spreader to uniformly and accurately apply the aggregate.

For manual applications, provide equipment with calibrated containers for measuring epoxy volumes, a paddle-type mixer, squeegees, shovels, and brooms that are suitable for mixing the epoxy and applying the epoxy and aggregate at the specified application rates.

B. Preparation of Concrete Surfaces. Repair minor potholes and delamination in the deck surface by removing the damaged concrete and patching with an Engineer-approved cementitious patching material before installation of the overlay. Epoxy overlay material is an acceptable patching material. Strike off patches so they are level with the existing deck and finish with wooden floats. Portland cement concrete patches require a minimum cure period of 28 calendar days before application of the overlay.

Before placing the overlay, obliterate all pavement markings and thoroughly clean the entire concrete deck by steel shot blasting to ensure proper bonding between the epoxy and the concrete substrate. Achieve a final surface texture meeting numbers 5 through 7 as defined in ICRI Guideline No. 03732 and as shown by surface profile samples available from ICRI, or ASTM E965 pavement macrotexture depth of 0.04 to 0.08 inches. Shot blasting is meant to expose the coarse aggregate and ensure the surface is cleaned of asphalt material, oil, dirt, rubber, curing compounds, paint carbonation, laitance, weak surface mortar, and other potentially detrimental materials which may interfere with the bonding or curing of the overlay. Remove and repair loosely bonded patches and remove traffic

marking lines. Use moisture and oil-free compressed air or high volume leaf blowers to remove dust that adheres to the prepared surface.

In order to determine the adequacy of the surface preparation, perform at least 1 bond test per lane of each bridge. For each test, apply palm-sized patties of binder aggregate, ¼ to ¾ inch thick at 3 locations. After the samples have cured, remove the patties with a hammer and chisel to examine the fracture and delamination plane. Verify concrete with fractured aggregate has attached to the entire underside of the patty. If only lattice or small particles of concrete are attached, further deck preparation is required.

C. Overlay Application. Handle and mix the epoxy resin and hardening agent in a safe manner to achieve the desired results in accordance with the specifications and the manufacturer's written instructions. Only apply epoxy overlay materials when weather or surface conditions allow the material to be properly handled, placed, and cured within the specified requirements for project sequencing, traffic control, or when rain is imminent within the manufacturer's recommended cure times. Completely dry the prepared surface when applying epoxy. The Engineer may allow moisture and oil-free heat sources or torches to dry the surface. Ensure the temperature of the deck surface, epoxy, and aggregate components are at least 55 °F and rising at the time of application. Do not apply epoxy if the gel time is less than 5 minutes or if pavement temperatures exceed 115 °F. In situations where road closures are not under strict time constraints, obtain the Engineer's approval to apply epoxy at lower temperatures.

Apply the epoxy overlay and aggregate using a double pass method. The double pass method applies the epoxy and aggregate in 2 separate layers at the corresponding application rates specified in Table 553.03-1.

Table 553.03-1 – Double Pass Method – Epoxy & Aggregate Application Rates

Double Pass Method	Epoxy Rate - gal/yd ²	Aggregate - lb/yd ² (a)
1st course	At least 0.22	10
2nd course	At least 0.45	14.5

(a) Application of aggregate must be of sufficient quantity to completely cover the epoxy.

Mix the epoxy at a volume ratio of 1 Part A to 1 Part B and mechanically stir with a paddle-type mixer for 3 minutes or according to the epoxy manufacturer's written instructions. After the epoxy has been properly mixed, immediately and uniformly apply to the pavement surface with a 3/16 to ¼ inch V-notched squeegee. Apply the aggregate to cover the epoxy material while the epoxy is still fluid. Remove and replace first course applications that do not receive enough aggregate before gelling.

Ensure each course of epoxy overlay cures before removing the excess unbonded aggregate to prevent tearing or damaging of the surface. Use moisture and oil-free compressed air, high-volume leaf blowers, or vacuum broom to remove excess aggregate. After loose aggregate is removed, remove remaining dust using moisture and oil-free compressed air, high-volume leaf blowers, or vacuum broom. Obtain the Engineer's approval before opening the first course to traffic. Begin application of the second course only after removing dust. The Department prohibits traffic on the overlay until it has cured sufficiently to prevent damage from wheel loads as specified in Table 553.03-2.

Table 553.03-2 – Typical Curing Times

Average Temperature of Deck, Epoxy, and Aggregate Components in °F						
Course	60-64	65-69	70-74	75-79	80-84	Above 85 (a)
1	4 hr	3 hr	2.5 hr	2 hr	1.5 hr	1 hr
2	6.5 hr	5 hr	4 hr	3 hr	3 hr	less than 3 hr

(a) Refer to manufacturer's written instructions

Apply the second course at the rates specified in Table 553.03-1. Apply epoxy to ensure the wet epoxy does not coat the wear (top) surface of the aggregate. Once the epoxy is cured, remove loose aggregate from the surface with moisture and oil-free compressed air, high volume leaf blowers, or vacuum broom. After removing loose aggregate, if there are any areas where epoxy has coated the top surface stone, remove the excess epoxy using a light shot or sandblast.

Protect the bridge deck expansion joints with a bond breaker (e.g., duct tape) that can adequately seal the joints from the epoxy. The Contractor may also use duct tape to delineate application areas. The Department recommends taped areas or bond breakers be removed before epoxy starts to harden. The Contractor may also remove epoxy by scoring the overlay before gelling or by saw cutting after cure. Feather the overlay out at the end of the bridge or approach slab and at expansion joints (edge of armor angle) per the manufacturer's written instructions.

If the Contractor's operations or actions damage or mar the overlay, remove the damaged areas and reapply the overlay to the Engineer's satisfaction. In the event that part of the epoxy mixture does not cure, completely remove the overlay from the affected area and discard. Completely remove residual epoxy remaining on the pavement by mechanical means (e.g., steel shot, abrasive blasting, or scarifying) before reapplying the overlay.

Maintain and provide records for each batch provided, including:

1. Number of batches mixed and volume per batch.
2. Location of batches as placed on deck, referenced by stations.
3. Batch time.
4. Gel time (50 milliliter sample).
5. Temperature of the air, deck surface, and epoxy components.
6. Loose aggregate removal time.
7. Time open to traffic.

553.04 Method of Measurement. The Engineer will measure acceptably completed work by the square foot of deck surface.

553.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Epoxy Overlay.....	SF

Surface preparation, including obliteration of pavement markings, is incidental.

Patch and repair of concrete will be paid under 582.

SECTION 560 – DEWATERING FOUNDATION

560.01 Description. Provide, install, maintain, and remove dewatering system necessary for removing and/or diverting water around foundations to allow excavation, pile installation, construction of footings, columns, and riprap placement as specified or as directed. Water removal may be accomplished by draining, pumping, bailing, stream diversion, construction of cribbing, or cofferdams. Earthen cofferdams are not permitted.

A. Submittals.

1. Submit the materials, installation, maintenance, and removal information of the dewatering system for approval as specified in 105.02. Submit a dewatering plan including drawings and written descriptions of the proposed procedures for dewatering, pumping, and disposal of fluidized materials.
2. Design temporary retaining structures that meet the most recent AASHTO Guide Specifications for Bridge Temporary Works. Calculations for the proposed configuration of the dewatering system must be signed and sealed by an Idaho licensed professional engineer.

560.02 Materials. Not specified.

560.03 Construction Requirements. Secure and comply with all permits and Idaho Department of Water Resources requirements for this work as specified in 107.02. Meet the environmental protection requirements as specified in 107.17.

Construct as specified in 210 and 501.03.

Select and design a dewatering system that isolates anticipated stream flows from construction areas.

Ensure the dewatering method will accommodate seal concrete placement to the elevations specified. Vent cofferdam walls to prevent excessive hydrostatic pressure from developing below the seal concrete during probable flooding at the time of construction.

Any suspended sediment and turbidity resulting from streambed dewatering activities must not violate applicable in-stream turbidity criteria. Once the dewatering system is installed, in-stream turbidity levels must not exceed ambient background water quality for the duration of use.

All sediment and erosion control measures must be in place before the commencement of the dewatering system construction.

Maintain a safe, clean, and accessible project site and repair any damage caused by failure of the dewatering system.

Provide adequate clearances in all directions as required for the execution of the work to be performed in the dewatered area. This must include room for the dewatering pumps, installation, and removal operations.

A. Seal Concrete. Place seal concrete within the dewatered area at the pier after pile driving is completed and accepted. Place seal concrete as specified in the applicable provisions of 502.03. Before dewatering, cure the seal concrete at least 3 calendar days and until concrete reaches minimum compressive strength of 2,500 psi.

B. Dewatering. After the dewatering system is in place and has been adequately sealed and before any other in-stream construction activities have started, the water behind the in-stream barrier may be pumped directly back into the stream if the pumped water meets applicable in-stream turbidity criteria. After starting in-stream construction, deposit all pumped water into an upland temporary dewatering sediment basin and treat the water to within acceptable levels before reentering the stream.

Temporary sump holes may be installed to create a more suitable pumping area. Pumps must be capable of dewatering at a faster rate than water enters the area. Pumps must be kept in a workable condition and a spare pump must be available for breakdowns or emergency conditions.

Construct a temporary dewatering sediment basin at an approved location. The sides of the dewatering basin must be constructed of substantial materials designed for the prevention of siltation. The siltation-prevention screening must extend at least 2 feet above normal high water. Before removal of the screening, remove the accumulated silt and dispose of it offsite.

After dewatering, clean the top of seal concrete surface of all scum, laitance, and sediment. Remove local high spots as necessary to provide required clearance for footing reinforcement.

C. Removal. Remove dewatering system upon completion of in-stream construction, cleanup, inspection, and acceptance of the internal dry work. Do not remove dewatering system before placement of the riprap. Flood the enclosed area before removing the dewatering system.

560.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

560.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Dewatering Foundation	LS

Excavation within the cofferdams will be paid under 210. Seal concrete within the cofferdams will be paid under 502.

SECTION 565 – ASPHALTIC PLUG EXPANSION JOINT SYSTEM

565.01 Description. Provide and install expansion/contraction joints as specified and in accordance with the manufacturer's written requirements. Provide and install the new bridge expansion joint system after paving on the bridge has been completed. Obtain the services of one of the following applicators or an Engineer-approved equal:

1. Product: SA Bridge Bond
Supplier-Installer: Maxwell Products Incorporated
650 South Delong Street
Salt Lake City, UT 84104
Telephone No. (801) 972-2090
Fax No. (801) 972-5536
2. Product: Matrix 502™ Asphaltic Expansion Joint System
Supplier-Installer: The D.S. Brown Company
300 E. Cherry Street
North Baltimore, OH 45872
Telephone No. (419) 257-3561
Fax No. (419) 257-2200
3. Product: WABO® Expandex Joint System
Supplier-Installer: Watson Bowman ACME Corporation
95 Pineview Drive
Amherst, NY 14228-2166
Telephone No. (800) 677-4922 or (716) 691-7566
Fax No. (716) 691-9239
4. Product: Thorma Joint System by Dynamic Surface Applications Ltd.
Supplier-Installer: Roger Langeliers Construction
7145 NW Progress Court
Hillsboro, OR 97124
Telephone No. (503) 533-5709
5. Product: Deery Flexible Joint System by Deery American Corp.
Supplier-Installer: Deery American Corp.
420 Roosevelt Ave.
Chandler, AZ 85226
Telephone No. (800) 528-8242
Fax No. (480) 961-0513

565.02 Materials.

A. Binder Material. Provide polymer-modified asphalt expansion joint binder material that meets the requirements in Table 565.02-1.

Table 565.02-1 – Expansion Joint Binder Material

Parameter	Test Method	Requirements
Softening Point	ASTM D36	179.6 °F (82 °C) minimum
Tensile Adhesion	ASTM D5329	700 % minimum
Ductility @ 77 °F (25 °C)	ASTM D113	40 cm minimum
Penetration: @ 77 °F (25 °C), 150g, 5 sec @ -4 °F (-18 °C), 200g, 60 sec	ASTM D5329 ASTM D5329	90 dmm maximum 10 dmm Minimum
Flow 5 h @ 140 °F (60 °C), 150g, 5 sec	ASTM D5329	3.0 mm maximum
Resiliency 77 °F (25 °C)	ASTM D5329	40% minimum
Asphalt Compatibility	ASTM D5329	Pass
Recommended Pouring Temperature	—	370 °F – 390.2 °F (188 – 199 °C)
Specific Gravity	—	1.10 plus or minus 0.05

- B. Aggregate.** Provide crushed, double-washed and dried granite, basalt, or orthoquartzite prepackaged aggregate. Ensure aggregate gradation variation is in accordance with the manufacturer’s written instructions for the system being used.
- C. Backer Rod.** Provide backer rod that is a closed cell, foam expansion joint filler capable of withstanding the polymer-modified asphalt placement temperature.
- D. Bridging Plate.** Provide a bridging plate that is 10-gauge galvanized steel 6 to 8 inches wide and 24 inches long or per joint system manufacturer’s written specifications. Furnish plates with holes along the longitudinal centerline for location spikes at approximately 12-inch spacing.
- E. Location Spikes.** Use 16D common nails for location spikes.
- F. Test and Materials Acceptance Requirements.** Submit certification that the binder, backer rod, and bridging plate meet the requirements specified when tested using the required test method in Table 565.02-1. Submit the certification at least 4 weeks before expansion system installation.

565.03 Construction Requirements.

- A. Technical Representative.** Ensure the asphaltic plug joint manufacturer’s representative is present during joint installation.
- B. Sawing and Surface Preparation.** After paving operations are complete, transversely saw cut the full depth of the overlay centered over the joint opening, unless otherwise specified. Remove material, including waterproofing material, between saw cuts to form the blockout. Thoroughly clean and dry exposed concrete, steel, and cut surfaces within the blockout using compressed air and a hot-compressed air lance. If there is an interruption due to weather or other causes, repeat the operation with the lance immediately before the binder coat operation. Dry 6 inches of road surface on each side of the joint blockout to obtain a suitable surface for bituminous adhesion.
- C. Binder.** Heat the binder to a minimum of 390 °F in a double oil-jacketed melter. Ensure melter is equipped with a continuous agitation system, temperature controls, and calibrated thermometers to maintain the binder at the manufacturer’s recommended temperature. Prevent binder from being heated above 410 °F or allowed to exceed 390 °F for more than 1 hour. Provide a system for accurately measuring the binder and aggregate weights.
- D. Backer Rod Placement.** Seal the expansion joint gap with a backer rod. Seal gaps less than ¼ inch wide by pouring hot binder into the gap without the use of the backer rod.

First fill gaps of ¼ inch or wider with a backer rod and cut to approximately 25 percent greater in diameter than the existing gap. Install the backer rod to an optimum 1 inch below the top of the existing gap.

Overfill the gap with the heated binder material to allow the binder to flow out onto the floor of the blockout. This will form a flexible bond breaker between the floor of the joint blockout and the bridging plate.

E. Bridging Plate. Center the bridging plate over the existing joint and bed into the hot binder. Butt joint the bridging plates to accommodate the entire joint length. Secure the bridging plate with location spikes through the drill holes in the plate. Seal butt joints with hot binder and allow binder to setup before the next operation.

F. Binder Coat. Seal prepared, exposed surfaces within the joint blockout with heated binder. Pour the hot binder over the floor area of the joint bridging plate and spread to coat exposed joint cavity areas. Ensure binder is at least 1/8 inch thick on the bottom of the joint cavity with areas of greater thickness where surface irregularities exist. The binder application temperature must be between 350 °F and 390 °F.

G. Aggregate Preparation. Heat the aggregate to a temperature between 275 and 325 °F in a rotating drum mixer with attached heat source or hot air lance to remove dust and moisture.

H. Aggregate Proportion and Layer Thickness. Mix the aggregate with the binder such that the final proportions by weight will be 74 percent aggregate and 26 percent binder, plus or minus 2 percent. Place the combined heated aggregate and binder in layers, unless patented installation states otherwise. Each intermediate layer can vary in thickness in order to achieve the required joint thickness, but each layer must not be less than 3/4 inch or more than 2 1/2 inches. Ensure that each stone is coated and voids are filled while avoiding an excess of binder. Rake the mixture and level.

The Engineer may allow the top layer thickness to vary 1/2 to 1 inch. In preparing the top layer, control the ratio of aggregate to binder to approximately 6 to 1 by weight. Overfill the top layer and compact to the level of the adjacent surfaces using a roller or vibratory plate compactor. Immediately after completion of the compaction, pour sufficient binder over the joint to fill the surface voids and coat the surface stone. Dust the finished joint with a fine, dry aggregate to prevent tackiness.

I. Maintenance of Traffic. Facilitate traffic maintenance by installing the joint in 2 half-width phases. During phase 1, install approximately half the total joint. During phase 2, remove at least 2 inches of the phase 1 joint at or near the centerline, with the remainder of the joint installed. Schedule operations so all lanes can be open to traffic during non-working hours.

J. Testing. Submit certification showing binder compliance with the required material properties.

565.04 Method of Measurement. The Engineer will measure acceptably completed work for asphaltic plug expansion joint system by the cubic foot.

565.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Asphaltic Plug Expansion Joint System	CF

SECTION 566 – COMPRESSION SEAL EXPANSION JOINT

566.01 Description. Provide and install neoprene seals as specified. Prepare all surfaces in contact with new neoprene seals.

566.02 Materials. Provide neoprene seals as specified on the plans or an approved equal and as specified in 704.04 or an approved equal. Provide lubricating, elastic adhesive for installing the neoprene seals that meets ASTM D4070 or in accordance with the manufacturer's written specifications and Engineer approval.

566.03 Construction Requirements. Before installing joint seal, clean joints of asphalt filler, old expansion materials/devices, bituminous material, dirt, grease, and other deleterious material. Clean joints over the total area of the blockout or opening to receive the seal. During cleaning operations, prevent debris, cleaning materials, and solutions from entering waterways. Ensure the joints are sound, clean, dry, and frost free.

All components and materials will be in accordance with the manufacturer's written instructions and Engineer approved. Each neoprene seal will be one continuous piece between face of curbs and installed as specified and in accordance with the manufacturer's written instructions. Sandblast clean expansion joint surfaces immediately before seal installation.

566.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot.

566.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Compression Seal Expansion Joint.....	ft

SECTION 567 – STRIP SEAL EXPANSION JOINT

567.01 Description. Provide and install a strip seal expansion joint with the movement ratings specified.

567.02 Materials.

A. Metal. Provide extruded steel sections and anchorage gusset plates fabricated from structural steel that meets AASHTO M 270, Grade 36 or other approved steel used in a system. Provide steel reinforcing bars used in anchorage that meets AASHTO M 31, Grade 60.

B. Neoprene Seals. Provide preformed neoprene extrusions fabricated from polychloroprene (neoprene) that is resistant to heat, oil, jet fuel, ozone, and UV rays and meets ASTM D5973. Provide a 1-piece seal full length of the expansion joint.

C. Adhesive. Provide lubricating, elastic adhesive for installing the neoprene seals in the steel extrusions that meets the requirements of ASTM D4070 or in accordance with manufacturer's written specifications and Engineer approved.

567.03 Construction Requirements.

A. Working Drawings. Submit working drawings as specified in 504.01.F.

B. Installation. Install the expansion joint as specified in the plans, approved shop drawings, and manufacturer's written instructions. Supply special tools or materials required for the joint installation.

The expansion joint manufacturer must have a qualified technical service representative on the project site to supervise the installation, review the supporting steel details, and inspect the interface surfaces.

Ensure welding meets current AASHTO specifications and 504.

Deliver and install the neoprene extrusions as continuous elements along the full length of the joint. Ensure shop-welded splices in steel extrusions are as specified on the shop drawings. The Engineer will only allow field splices in steel extrusions at locations specified on the plans.

Thoroughly clean the metal surfaces in direct contact with the neoprene seal and concrete to provide a high-strength bond between the mating steel surfaces with the neoprene seal and concrete.

Properly position and attach the joint assembly to the structure before placing concrete in the adjacent deck or back wall. Provide for smooth ride when positioning the deck joint. Ensure the steel joint extrusions on each side of the joint are straight, parallel, and in proper vertical alignment. If the joint extrusions are not properly aligned, adjust or replace at no additional cost to the Department.

Cover bridge deck joints with protective material after installation until final cleanup of the bridge deck.

C. Testing and Inspection. After the joints are installed, flood with water and inspect from below the joint for leakage. If leakage is observed, repair the joint at no additional cost to the Department.

567.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot.

567.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Strip Seal Expansion Joint	ft

SECTION 568 – ELASTOMERIC CONCRETE HEADER

568.01 Description. Provide and install elastomeric concrete headers in prepared blockout areas as specified. Include the collection and disposal of waste debris.

568.02 Materials. Provide elastomeric concrete that consists of a field-mixed, 2-part polyurethane material and pre-graded aggregate mix (the Department does not allow epoxy-based materials).

Provide a manufacturer’s certification that attests the proposed materials are pre-tested and meets this specification.

A. Elastomeric Concrete. Provide ambient cure material, 100 percent solids, 2-component polyurethane with pre-graded aggregate mix exhibiting the physical properties listed in Tables 568.02-1 and 568.02-2. When properly mixed and poured, the elastomeric concrete cures rapidly, flows and fills voids, spalls, or irregularities to form a monolithic unit.

Table 568.02-1 – Elastomeric Cured Binder

Physical Properties	Test Method	Requirement
Tensile strength	ASTM D638	≥ 750 psi
Hardness, Durometer D	ASTM D2240	30 – 49
Compression set, 22 hr @ 158 °F	ASTM D395 Method B	≤ 50%
Tear resistance	ASTM D624	≥ 80 lb/in
Water absorption	ASTM D570	≤ 3%
Heat shrinkage, %	ASTM D1299	≤ 1.6
Oven aging @ 158 °F for 72-hr tensile	ASTM D638	750
Elongation	ASTM D638	≥ 150%

Table 568.02-2 – Elastomeric Cured Binder and Aggregate

Physical Properties	Test Method	Requirement
Compressive Strength	ASTM D695	≥ 2,200 psi
Resilience @ 5% deflection	ASTM D695	≥ 90%
Slant Shear Bond Strength to concrete	—	≥ 250 psi
Impact Resistance	ASTM D3029	
@ 32 °F	—	no cracks
@ -20 °F	—	no cracks
@158 °F	—	no cracks

B. Bonding Agent. Provide manufacturer’s 2-component, 100 percent solids bonding agent. Apply bonding agent to the sides and base of the preformed concrete blockout before elastomeric concrete placement. Store, mix, and apply in accordance with the manufacturer’s safety data sheet and written instructions.

Identify liquid components by the following information:

Part A – Resin Color: Clear

Part B – Activator Color: Tan

Submit certified test results meeting the requirements in Tables 568.02-1 and 568.02-2 for the proposed products for approval before use.

The Engineer will accept the following products or an Engineer-approved equal:

1. Wabocrete® II elastomeric concrete by Watson Bowman Acme.
2. Delcrete® elastomeric concrete by D.S. Brown Company®.
3. Ply-Krete® FS by Polyset Company.

568.03 Construction Requirements. Meet with the Engineer and discuss the method of installation before performing the work pertaining to the elastomeric concrete headers.

Ensure a manufacturer's representative is onsite during the initial installation to meet with the Contractor and the Engineer, to train the Contractor in mixing and placement procedures, and to ensure the installation procedures are in accordance with the manufacturer's warranty requirements.

If untrained personnel are substituted, the Engineer may suspend the installation until they receive appropriate training. The Department will not adjust contract time or pay for additional costs resulting from the work suspension.

Sandblast and vacuum the blockout surfaces and immediate surrounding concrete area to remove dirt, dust, sand, oil, grease, paint, corrosion deposits, laitance, and bond-inhibiting materials immediately before placing the elastomeric concrete.

Prime the substrate surface as specified by the manufacturer and ensure joint gap is as specified on the plans before placing the elastomeric concrete. Mix and place the elastomeric concrete in accordance with the manufacturer's written instructions and as specified. Provide the Engineer with 1 set of the manufacturer's written instructions at least 1 week before the placement begins. Install the elastomeric concrete when the temperature is at least 45 °F and rising.

568.04 Method of Measurement. The Engineer will measure acceptably completed work by the cubic yard.

568.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Elastomeric Concrete Header	CY

Removal of existing expansion joint material within designated blockout areas and expansion joint seal installation are covered in other contract pay items.

SECTION 569 – REMOVAL OF EXPANSION JOINT

569.01 Description. Remove existing joint material consisting of elastomeric concrete, steel armor angles, and concrete within the removal limits specified.

569.02 Materials. Not specified.

569.03 Construction Requirements. Before starting work, obtain approval for the appropriate joint removal methods and equipment.

Remove steel armor angles and concrete within the proposed blackout so the concrete is not damaged beyond the limits.

Use jackhammers with a nominal rating of 15 pounds or less and held at an angle 45° or less from the surface of the slab to remove the existing concrete within the new nosing limits specified. Notify the Engineer immediately if unsound concrete is encountered beyond the removal depth. Repair concrete overbreak or other damage outside the limits specified at no additional cost to the Department.

569.04 Method of Measurement. The Engineer will be measure acceptably completed work by the foot.

569.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Removal of Expansion Joint.....	FT

Removed materials are the Contractor's property and must be properly disposed.

SECTION 575 – TEXTURED CONCRETE SURFACE

575.01 Description. Texture exposed concrete surfaces with plastic form liner patterns specified or other Engineer-approved methods.

575.02 Materials. Not specified.

575.03 Construction Requirements. Provide plastic form liner patterns bonded to the forms or alternate texturing methods for Engineer approval at least 2 weeks before concrete placement. Alternate texturing methods will require a field mock-up panel to ensure uniformity. Ensure inside form dimensions provide for full plan dimensions plus the texturing thickness.

Attach and treat plastic form liners with a release agent and then remove in accordance with the manufacturer's written instructions.

Align the grooves in the form liner panels at construction joints. Conceal construction joints in the textured concrete surface.

575.04 Method of Measurement. The Engineer will measure acceptably completed work by the square yard.

575.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Textured Concrete Surface	SY

The cost for materials, form placement, removal, and finishing work is incidental.

SECTION 576 – GLASS FIBER REINFORCED POLYMER (GFRP) REINFORCEMENT

576.01 Description. Provide and place glass fiber reinforced polymer (GFRP) as specified. Utilize conventional casting procedures for concrete bridge slabs and approach slabs as specified.

576.02 Materials. Provide GFRP reinforcement meeting the AASHTO LRFD Bridge Design Guide Specifications for GFRP Reinforced Concrete Bridge Decks and Traffic Railings and as described in this specification. Provide deformed or sand coated GFRP reinforcement.

A. Fibers. Provide fibers in the form of unidirectional rovings of a given size and mass. Provide fiber sizings and coupling agents compatible with the resin system used to impregnate them.

B. Matrix Resins. Commercial grades of vinyl ester and epoxy resin systems are permitted if the finished product meets the physical and durability requirements. The base polymer in the resin system must not contain polyester. Blending of vinyl ester and epoxy resins is permitted.

Styrene may be added to the polymer resin during processing. Added styrene must be less than 10 percent by mass of the polymer resin. Report the amount of styrene, as a mass percentage of the polymer resin, added during processing.

Determine constituent content of resin in accordance with ASTM D3171.

C. Fillers and Additives. Commercial grade inorganic fillers (e.g., kaolin clay, calcium carbonate, alumina trihydrate) must not exceed 20 percent by mass of the polymer resin constituent.

Commercial grade additives and process-aids (e.g., release agents, low-profile shrink additives, initiators, promoters, hardeners, catalysts, pigments, fire-retardants, ultra-violet inhibitors) are permitted but depend on the processing method. Any shrink additives must be less than 20 percent by mass of the polymer resin.

Commercial grade inorganic or organic non-woven surfacing mats or veils are permitted.

D. Manufacturing Process. Produce GFRP bars using any variation of the pultrusion process. Document the process used and report the date of production and production lot size.

Provide GFRP reinforcement conforming to the requirements in Table 576.02-1:

Table 576.02-1

Material Property	Minimum or Nominal	Maximum
Fiber Content (% by volume)	55	NA
Design Nominal Diameter (inches)	0.500(#4)	NA
Design Nominal Area (in ²)	0.20(#4)	NA
Tensile Strength (ksi)	100(#4)	NA
Tensile Modulus of Elasticity (ksi)	5,700	NA
Shear Strength (perpendicular to the bar fibers) (ksi)	18	NA
Tensile Strain (%)	1.2	NA
Bond Strength (psi) (ACI 440.3R Test Method B.3)	1,400	NA
Longitudinal Coefficient of Thermal Expansion (per degree °C)	6.0E-06	10.0E-06
Glass Transition Temperature (per °F)	212	NA
Moisture Absorption (%)	NA	1.0
Longitudinal Wicking (continuous voids) (5 consecutive 1" cuts; a continuous void is one appearing in all 5 cuts)	—	0

E. Testing. Provide 2 copies of documentation showing the composition, testing procedures, and typical test values for the type of GFRP reinforcement being provided for review and acceptance. Submit the documentation, along with representative samples (two 1 foot sections for each size to be provided). Before shipment, test representative samples (as agreed upon between the GFRP reinforcement manufacturer and the Department) for all GFRP reinforcement produced for the contract for the properties listed in Table 576.02-1.

F. Documentation. For GFRP reinforcement, provide 2 copies of written certifications that the GFRP reinforcement meets this specification. In addition, list the test values and test procedures used to determine the physical properties of the GFRP reinforcement in the certification. Provide certifications bearing the notarized signature of an authorized representative of the bar manufacturer. Identify each bundle of GFRP reinforcement with a durable tag displaying the corresponding lot numbers.

G. Repair Material. Comply with the requirements established by the bar manufacturer for the material used to repair the cut ends of GFRP reinforcement. Perform all repairs of cut ends at the GFRP reinforcement manufacturer's plant unless otherwise approved.

576.03 Construction Requirements. Unless otherwise specified, use any one or combination of conventional forming systems. Provide the Engineer a written proposal detailing the forming systems to be used on GFRP-reinforced bridge structures.

A. Material Handling. Provide padded contact areas for systems handling GFRP reinforcement. Provide padded or suitable banding for bundling bands to prevent damage to the bars. Lift bundles of GFRP reinforcement with a strong back, spreader bar, multiple supports, or a platform bridge. Do not drop or drag the GFRP reinforcement.

B. Storage and Placement. Store GFRP reinforcement above the ground surface on platforms, skids, or other supports as close as possible to the point of placement. Cover the bars with opaque plastic or other types of cover to protect the bars from the external environment. Prevent exposure of GFRP reinforcing bars to temperatures above 120 °F during storage.

Hold the GFRP reinforcement firmly in place before and during concrete placement by means of ties and bar supports, adequate in strength and number to prevent displacement and to keep the reinforcing at the proper distance from the forms and as specified in 503.03.D. Provide adequate vertical restraint of GFRP reinforcement to prevent upward movement in the fresh concrete due to buoyancy.

When placed in the work, reinforcement must be free from dirt, paint, grease, oil, or other foreign materials. Before placing concrete, remove foreign materials by cleaning the bars using methods and materials recommended by the bar manufacturer and Engineer approved.

Shear cutting is not permitted on the GFRP reinforcement. High-speed grinder cutting or hack saw cutting may be permitted with Engineer approval. Coat cut ends. Repair all surface damage to GFRP reinforcement as described below or replace the bar with an undamaged bar.

C. Repair of Bar Damage. Repair all visible damage to the accepted GFRP reinforcement. Repair damaged areas using materials and procedures specified by the GFRP manufacturer.

D. Concrete Placement. If the reinforcement is not adequately supported or tied to resist settlement, floating upward, or movement in any direction during concrete placement, halt concrete placement until corrective measures are taken.

E. Bending. If bending of GFRP reinforcement is required, the bends must be pre-fabricated. Field bending of GFRP reinforcement is not permitted.

576.04 Method of Measurement. The Engineer will measure GFRP reinforcement by the foot.

576.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Glass Fiber Reinforced Polymer (GFRP) Reinforcement.....	ft

Ties, bar chairs, supports, or clips used for fastening GFRP reinforcement in place are incidental.

SECTION 577 – PILE SLEEVES

577.01 Description. Provide and install steel sleeves around the columns or piles to be embedded in the backfill of the MSE walls as specified.

577.02 Materials. Provide galvanized corrugated metal pipe sleeves meeting 706.06. Provide the size and gauge of pile sleeve as specified.

A. Concrete Columns. Provide galvanized metal spacers. Galvanize according to the requirements of ASTM A123. Provide size as shown on the plans.

B. Shell or H-piles. Provide course aggregate for concrete, size No. 1 in accordance with 703.02.

577.03 Construction Requirements.

A. Concrete Columns. Position pile sleeves around completed columns before MSE backfill placement. Install spacers in the annular space between the column and pile sleeve. Install spacer sets the top, bottom, and at intervals of 6 feet or less along the column.

B. Shell or H-Piles. Fill the lower 5 feet of the sleeves with coarse aggregate before placing and compacting the MSE backfill and before pile driving. Ensure the inside sleeve is not closer than 2 inches from the steel pile.

After pile driving, finish placing the course aggregate in the annular space between the sleeves and piles in lifts not to exceed 3 feet for the remaining sleeve length. Rod or vibrate each lift to prevent voids.

577.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot.

577.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Pile Sleeves	ft

Metal spacers and coarse aggregate are incidental.

SECTION 578 – PRECAST CONCRETE CULVERT

578.01 Description. Provide a precast concrete culvert, including the design, fabrication, transportation to the project site, and installation. The precast culvert includes the precast culvert sections and precast components for edge beams, wing walls, cut-off walls, and apron slabs as required. Cut-off walls, edge beams, footings, wing walls, and apron slabs may be cast-in-place at no additional cost upon approval.

Upon approval of the shop drawings, prepare and submit a structure load rating in accordance with the Idaho Manual for Bridge Evaluation.

A. Qualifications. Provide current documentation that ensures the precast concrete manufacturer holds current certification under the NPCA Plant Certification Program, the ACPA Q-Cast Plant certification program, or PCI Plant Certification Program.

B. Submittals. Submit the precast manufacturer's shop drawings and design computations, as specified in 105.02, for approval before fabrication of the precast concrete culvert and components. Follow the requirements of 578.01.C. Ensure the shop drawings and design computations are sealed and signed by an Idaho licensed professional engineer. Ensure shop drawings include the following:

1. Layout.
2. Station/offset reference points for installation.
3. Precast unit locations.
4. Fabrication details.
5. Lift locations.
6. Reinforcement.
7. Connection details.
8. Dimensions.
9. Details of future utility conduits.

Ensure each drawing and computation sheet includes the structure name and route number as shown on the plans, along with the bridge drawing number, project number, key number, district number, and county name. Submit shop drawings electronically in PDF format as specified in 504. Submit electronic as-built shop drawings in PDF format before contract completion.

Ensure the plan view layout of the precast culvert and culvert components for edge beams, wing walls, cut-off walls, and apron slabs closely resembles the plan view layout shown on the plans. Submit proposed culvert or component layout changes for approval. Submit connection details for approval.

Do not begin the construction of any precast units until the design calculations and shop drawings have been approved.

C. Design. Design the precast concrete culvert and components in accordance with the current edition of the AASHTO LRFD Bridge Design Specifications and the Department's Bridge Design LRFD Manual. Design all portions of this culvert for the design loads specified. Determine design loads related to fill depth. Footing resistance is included in the Phase IV report.

578.02 Materials. Meet the requirements specified in 502.

Meet the reinforcing steel requirements specified in 503. Provide reinforcing steel meeting AASHTO M 31, Grade 60. Welded wire reinforcement is allowed if it meets the requirements of 708.02 or ASTM A497. Welded wire reinforcement will be accepted based on the manufacturer's certification.

Provide grout for precast joints as specified in 705.02, Type B, Class 1.

Provide drainage geotextile for wing wall connection to culvert barrel as specified in 718.05, Type II.

578.03 Construction Requirements. Design and provide plans and details for a precast concrete culvert as specified.

If different sections are designed to accommodate varying depths of fill along the length of the culvert, use the same interior opening dimensions so the interior faces of adjacent segments are smooth and flush. Acceptable culvert shapes and dimensional requirements are specified on the plans.

Construct concrete and metal reinforcement as specified in 502 and 503.

Precast culverts include an edge beam and may include a cut-off wall at each end of the barrel section. The edge beam may be cast-in-place as a secondary cast on the end-precast segment or it may be cast monolithically with the end-precast segment.

Wing walls may be precast or cast-in-place. If precast wings are used, a leveling course of granular material at least 2 inches thick must be placed under the footing where rock is encountered.

Provide future utility conduits through the top slab as shown on the plans. Install the conduits in the same general location as specified on the plans. Conduits must be polyvinyl chloride (PVC) pipe, schedule 40 or heavier. Solvent-weld PVC joints. Cap open ends of conduits. Prove conduits by blowing a pull string from end-to-end of each conduit. Leave the pull strings in place unless otherwise directed.

Provide a minimum of 4 inches of fill over the top of the slab for buried culverts.

Apply a waterproof membrane (Type A or D) as specified in 511 to the top slab of all buried culverts regardless of the fill depth. A waterproof membrane is not required when there is no fill on the top slab.

Construct precast culvert joints soil-tight in accordance with the manufacturer's written requirements. Provide 12-inch wide joint wrap material that meets ASTM C877. Ensure joint sealant meets ASTM C990.

Include joint sealant and joint wrap with each culvert joint. For box culverts, install joint sealant on all 4 sides of the joint. For stiffleg culverts, install joint sealant on all 3 sides of the joint. Wrap the outside face of the joint continuously from the bottom of one wall, up and over the top slab, and down the opposite wall with a single length of wrap. The Engineer will not allow splices in joint wrap. If required by the manufacturer to produce a watertight joint, fill joint gaps with non-shrink grout.

Connect stiffleg culvert barrel sections using weld plates as specified on the plans.

Connection of precast components to the barrel section of culverts must not be done using welded plates.

Store the precast culvert at the precast manufacturer until delivery to the project site.

Install the precast culvert to the lines and grades as shown on the plans and approved shop drawings.

Connect the precast elements together as specified on the approved shop plans.

578.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

578.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Precast Concrete Culvert	LS

SECTION 579 – BOND REINFORCING STEEL

579.01 Description. Drill and bond reinforcing steel as specified using an epoxy-resin based bonding system.

579.02 Materials. Provide adhesive as specified in 720.04. Use Type IV, Grade 3 bonding system classification. Meet AASHTO M 31, Grade 60 requirements for reinforcing steel.

Submit certified test results for the proposed product for approval before use.

The Department has verified and approved the following products meet the requirements of bond reinforcing steel:

1. Unitex® Pro-Poxy™ 300 from Dayton Superior.
2. Hilti HIT-RE 500® from Hilti, Inc.
3. Simpson Set Pac Epoxy from Simpson Strong-Tie Company, Inc.

Other products will need to be approved before use.

This list is for information only and other products may be submitted for approval. Time associated with testing and verifying additional product(s) meet the requirements are not compensable.

579.03 Construction. Follow the manufacturer's written instructions regarding mixing, drill-hole diameter and depth, application, and curing temperatures and conditions. Size the holes to fully develop the deformed bar. Clean and clear the holes of debris before adhesive placement. If necessary, adjust the reinforcing steel embedment depth specified to meet development length requirements of the bonded bar. Ensure the pullout strength of the bonded reinforcing steel exceeds the yield strength of the deformed bar. Adjustments to embedment depth will be at no additional cost to the Department.

579.04 Method of Measurement. The Engineer will measure acceptably completed work as a lump sum.

579.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Bond Reinforcing Steel	Lump Sum

SECTION 580 – REMOVING ASPHALT OVERLAY

580.01 Description. Remove the existing asphalt overlay from the bridge deck using power-operated diamond-grinding machinery or hydro-demolition methods with Engineer approval. Use small, power-operated curb diamond cutting or curb diamond-grinding machinery at the curbs, drains, and armored joints where the power-operated diamond-grinding machinery cannot access.

580.02 Materials. Not specified.

580.03 Construction Requirements. Plug existing deck drains by Engineer-approved methods to prevent waste materials from the removal operations entering the drains and falling under the bridge. Remove asphalt from the bridge deck without damaging the existing deck drains, concrete parapets, concrete curbs, and metal railing. Repair damage caused by removal operations at no cost to the Department.

Protect adjacent traffic from debris by means of an Engineer-approved positive barrier system. Prevent debris from entering waterways.

The Engineer will designate a trial area for the Contractor to demonstrate the equipment, personnel, and methods of operation produce satisfactory results. Begin removal operations only after the Engineer accepts the trial area results.

The Engineer will inspect the deck during and after completion of the removal process to determine the need for further removal or repair of damaged areas.

Removed materials are the Contractor's property and must be properly disposed of.

580.04 Method of Measurement. The Engineer will measure acceptably completed work by the square yard of the deck surface.

580.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Removal of Asphalt Overlay.....	SY

SECTION 581 – CONCRETE CRACK REPAIR

581.01 Description.

A. Preparation. Prepare concrete surface cracks to inject with an epoxy resin adhesive. Repair cracks wider than 0.016 inch measured at the concrete surface including the finishing and cleaning of girders, pier caps, columns, and abutments as specified and as directed.

B. Injection. Inject epoxy resin adhesive into prepared concrete cracks.

581.02 Materials.

A. Preparation. Use the following material to prepare the cracks for injection:

Epoxy Resin for Surface Sealing. Provide a troweling-grade epoxy paste adhesive conforming to ASTM C881, Type I, Grade 3, Class B and C for the surface seal material capable of being applied to vertical and overhead surfaces and capable to confine the injection adhesive in the cracks during injection and curing. Ensure the surface seal material has adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection. The Department will not allow material that contains asbestos.

Ensure properties meet Table 581.02-1.

Table 581.02-1

Property	Requirement	Test Method
Tensile Strength	≥ 3,000 psi at 14 days	ASTM D638
Flexural Strength (Modulus of Rupture)	≥ 3,700 psi at 14 days	ASTM D790
Total Water Absorption	1.0% max at 7 days	ASTM D570 (2-hour boil)
Bond Strength – dry cure	≥ 1,500 psi at 2 days	ASTM C882 hardened concrete to hardened concrete
Bond Strength – moist cure	≥ 1,500 psi at 14 days	ASTM C882 hardened concrete to hardened concrete

B. Injection. Use the following material for injection:

Epoxy Resin for Injection: Provide epoxy adhesive for crack injection as an epoxy resin, 2-component, low viscosity adhesive containing no solvents or nonreactive dilutives conforming to ASTM C881, Type I and IV, Grade 1, Class B and C.

Ensure properties meet Table 581.02-2.

Table 581.02-2

Property	Requirement	Test Method
Tensile Strength	≥ 7,000 psi at 14 days	ASTM D638
Initial Viscosity	> 150 to <450 centipoise	ASTM D2393, Brookfield RVT Spindle No. 2 at 100 rpm
Flexural Strength (Modulus of Rupture)	≥ 1200 psi at 14 days	ASTM D790
Total Water Absorption	1.5% max at 7 days	ASTM D570 (2 hour boil)
Bond Strength – dry cure	≥ 1500 psi at 2 days	ASTM C882 hardened concrete to hardened concrete
Bond Strength – moist cure	≥ 1500 psi at 14 days	ASTM C882 hardened concrete to hardened concrete

581.03 Construction Requirements.**A. Preparation.**

1. General. Apply epoxy resin adhesive for surface sealing in accordance with the manufacturer's written instructions.

Provide injection ports along the crack at intervals less than the thickness of the member. Set entry ports in accordance with epoxy injection material manufacturer's written instructions. Apply surface seal material to the surface of the crack and adjacent areas of application between the injection ports as needed.

Drill port holes using a hollow core drill bit with a vacuum retention system for debris removal or otherwise cleaned out before injecting. Drill holes to a minimum $\frac{5}{8}$ inch depth and recess the ports a minimum of $\frac{1}{2}$ inch with a $\frac{1}{8}$ inch reservoir at the bottom of the port.

For cracks open on both sides of the member, provide porting devices on opposite sides at staggered elevations when practical. Apply an adequate seal and allow sufficient time for the surface seal material to gain adequate strength to prevent the escape of the epoxy resin adhesive for the injection grouting.

2. Preparation. The Engineer will mark all areas and cracks that require repair. Clean cracks and adjacent application surfaces to remove loose concrete, dirt, dust, grease, oil, efflorescence, or other foreign matter detrimental to the epoxy injection bond and surface seal system. The Department will not allow acids and corrosives for cleaning.

Pressure point spacing depends on size and overall area thickness containing cracks.

3. Finishing. When the cracks are filled, allow the epoxy adhesive to cure for sufficient time to allow surface seal removal without draining or run back of the epoxy material from cracks.

Remove surface seal material and injection adhesive runs or spills from the surfaces. Finish surface area flush to the adjacent concrete showing no indentations or protrusions caused by the entry ports placement and blend with the existing concrete surface.

B. Injection.

1. General. Apply epoxy resin adhesive for injection in accordance with manufacturer's written instructions.
2. Equipment. Inject 2-component, epoxy resin adhesive using a positive displacement pump equipped to control exact proportions with a nozzle-mounted interlock. Provide electric or air-powered pumps and an

in-line mixing and metering system. Ensure automatic pressure-control injection equipment is capable of discharging the mixed adhesive at any pre-set pressure up to 200 psi.

Ensure equipment is capable of maintaining the volume ratio for the injection adhesive prescribed by the adhesive manufacturer within a tolerance of 5 percent by volume at any discharge pressure up to 200 psi.

Provide injection equipment with auto-stop sensors on both A and B component reservoirs that will stop the machine when only 1 component is being pumped to the mixing head.

Test equipment after every 4 hours of use and at the beginning of each shift for the proper injection ratio of components. Disconnect the injection mixing head equipment and pump the 2 adhesive components simultaneously through the ratio check device. Control backpressure in the ratio check device with 2 independent valve nozzles by opening or closing the valve. Provide a pressure gauge for sensing the backpressure behind each valve. Adjust the discharge pressure to 160 psi for both adhesive components. Simultaneously discharge both adhesive components into separate calibrated containers then compare the amounts discharged to determine if they are within the manufacturer's recommended ratio for the appropriate material.

Keep complete and accurate pressure and ratio test records and make them available to the Engineer.

3. Execution. Spacing of pressure points depends on size and overall thickness of area containing cracks. Start injection work at the lowest point and continue pumping until there is an appearance of epoxy adhesive at the next adjacent entry port. When epoxy adhesive travel is indicated by appearance at the next adjacent port, discontinue injection on the entry port being pumped and transfer epoxy injection to next adjacent port where epoxy adhesive has appeared. Completely fill cracks by continuous epoxy adhesive injection. If port-to-port epoxy adhesive travel is not evident, stop work immediately and notify the Engineer. The Engineer may elect to core the injected areas to confirm full crack penetration. Rectify areas not receiving full penetration at no additional cost to the Department.

581.04 Method of Measurement. The Engineer will measure acceptably completed work for crack repair preparation by the foot along the exposed surface of cracks. The Engineer will measure acceptably completed work for crack repair injection by the gallons of epoxy used.

Cracks that penetrate a concrete member at full depth, sealed on both sides of the member with injection/inspection ports installed on both sides of the member verifying full penetration of epoxy adhesive, will be measured and paid for on both sides of the member.

581.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Concrete Crack Repair Preparation	ft
Concrete Crack Epoxy Injection	gal

SECTION 582 – PATCH AND REPAIR OF CONCRETE

582.01 Description.

A. Concrete Surface. Repair and patch spalls, scaling, delaminations, honeycombing, and other deteriorated concrete on the surface of the girders, deck underside, pier caps, columns and abutments, including removal of debris from pier cap seats and abutment seats as specified and directed.

B. Concrete Deck. Repair spalls and delaminations in the bridge deck including determining the working areas by chain dragging or other approved method, preparing the concrete surface, repairing metal reinforcement, and applying the patching material.

582.02 Materials.

A. Concrete Surface. Use material for patching and repairing the concrete surfaces that is cementitious, fast setting, non-sag, non-metallic repair mortar containing a corrosion inhibitor and meets the following requirements:

1. Compressive strength: 4,500 psi minimum at 28 days, per ASTM C109.
2. Bond strength: slant shear: 1,500 psi minimum at 28 days, per ASTM C882.
3. Coefficient of thermal expansion: between $5.3 \times 10^{-6}/^{\circ}\text{F}$ and $6.4 \times 10^{-6}/^{\circ}\text{F}$ per ASTM C531.
4. Drying shrinkage: Less or equal to 0.10 percent per ASTM C157.
5. Suitable for vertical and overhead applications.

Submit certified test results from an independent lab for products not on the QPL showing the proposed products meet the specifications. Obtain the Engineer's approval before use.

B. Concrete Deck. Use material for patching and repairing the concrete surfaces that is cementitious, fast setting, non-sag, non-metallic repair mortar, and meets the requirements of ASTM C928, Type R3. Extend repair mortar as required using thoroughly washed and cleaned pea gravel.

The Engineer will accept materials meeting the specified criteria with a manufacturer's certification as specified in 106.04.

582.03 Construction Requirements. Meet the manufacturer's written instructions for application of mortars. Removed materials are the Contractor's property and must be properly disposed of.

A. Concrete Deck. Mark out and score removal areas to a depth of $\frac{1}{2}$ inch with a dry concrete saw. Exercise care to prevent damage to the existing reinforcement. Remove deteriorated, loose, or unsound concrete to a minimum depth of $\frac{1}{2}$ inch or whatever additional depth is required to reach sound concrete using jackhammers with a nominal rating of 15 pounds or less and held at an angle of 45° or less from the concrete surface. Sandblast the cavity and the immediate surrounding concrete area to remove dirt, oil, grease, paint, corrosion deposits, dust, laitance, and bond-inhibiting materials. Prepare surface of cavity by mechanical scarification or sandblasting to provide a minimum surface profile of plus or minus $\frac{1}{8}$ inch.

B. Existing Reinforcing Steel. If any reinforcement is or becomes exposed during the removal of unsound concrete and the bond between concrete and reinforcement has been destroyed, remove at least $\frac{3}{4}$ inch of concrete from around that reinforcement. Patch material bonds to the entire periphery of the exposed steel reinforcing bars.

If any exposed reinforcement is damaged, broken, or has lost more than 25 percent of its section, remove at least $\frac{3}{4}$ inch of concrete from around that reinforcement to allow replacement of the damaged bar or splicing a new bar to the damaged bar as directed. Properly embed or splice replacement or supplemental bars.

C. Inspection. Complete final surface preparation sufficiently in advance of the mortar placement to allow the Engineer to inspect areas before repair. Sound the repaired areas with a sounding bar or hammer, after sufficient setting time and correct hollowness, by removing and replacing the unbonded patch at no additional cost to the Department. The Engineer must be present during the sounding inspection.

D. Finish. Match the texture of the existing surface and ensure the finished surface is flush with the existing surface.

582.04 Method of Measurement. The Engineer will be measure acceptably completed work by the square foot of the repaired concrete area.

582.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Patch and Repair of Concrete Surface.....	SF
Patch and Repair of Concrete Deck.....	SF

The cost of replacement or supplemental bars is incidental.

SECTION 583 – SUPERSTRUCTURE JACKING

583.01 Description. Furnish materials, labor, tools, equipment, and incidentals necessary to jack the superstructure for repairing girder ends and abutments or piers directly below the girder as specified and as directed.

Design the jacking system and temporary shoring, shims, and any other incidentals. Construct the jacking system, monitor the girder displacements, maintain the jacking system, and remove all temporary supports upon completion.

583.02 Materials. Not specified.

583.03 Construction Requirements. Submit plans and design calculations for the proposed jacking system, temporary shoring, and shims in PDF format for approval before beginning this work. The plans and calculations must be prepared, signed, and sealed by an Idaho licensed professional engineer. Approval requires up to 15 calendar days starting from the date of receiving the submittals or re-submittals to the date that they are returned. Design the jacking system and temporary shoring for the loads as shown on the plans. Ensure that superstructure components and attachments can freely move to accommodate the full range of the anticipated vertical movement. Prepare separate submittals for each bridge.

Provide a hydraulically-operated jacking system capable of simultaneously raising all girders of a superstructure element by an equal amount and at a uniform rate. Supply each jack with a gauge for monitoring the jacking load applied to the superstructure.

Support the superstructure on temporary shoring and shims so the hydraulic fluid does not support the weight of the superstructure when the girders are in the raised position.

The maximum difference in lift between adjacent girders is not to exceed $\frac{1}{8}$ inch. Repair any damage to the superstructure or substructure elements resulting from the jacking operation at no cost to the Department.

Do not lower the girders back down on the pier cap or abutment seat until the repair concrete has reached 80 percent of compressive strength.

Maintain the jacking equipment in a good state of repair. Equipment must not have damaged hoses, fittings, lines, or tanks that may release pollutants into the work area.

583.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

583.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Superstructure Jacking	LS

SECTION 584 – TEMPORARY SHORING

584.01 Description. Provide temporary shoring as required for the support of the existing and the new roadway adjacent to the construction area, including designing, furnishing, constructing, inspecting, testing, and monitoring the temporary shoring system and removing the temporary shoring after the work is complete.

584.02 Materials. Determine materials for temporary shoring and obtain Engineer approval before use.

584.03 Construction Requirements. Select, and submit before construction, the proposed materials and the temporary shoring type, shop drawings, and design calculations prepared, signed, and sealed by an Idaho licensed professional engineer for approval. Ensure shop drawings meet the requirements of 105.02. Include a live load surcharge where vehicular load is expected to act on the backfill surface within a distance equal to ½ the shoring height behind the back face of the shoring. The increase in horizontal pressure due to live load surcharge is equivalent to that produced by a minimum of 2 feet of soil. Ensure the clear distance between temporary shoring and temporary guardrail is 2 feet or more. Design the temporary shoring in accordance with the AASHTO Guide Design Specifications for Bridge Temporary Works.

The Department will not allow gravity walls (e.g., specific gravity block walls) to be used as temporary shoring when the excavation depth is greater than 10 feet.

Include the following in the shop drawings:

1. Location and limits of the temporary shoring with respect to an existing or established survey line.
2. Plan, elevation, and section views including necessary dimensions and elevations.
3. Excavation limits adjacent to shoring.
4. Type and size of materials and shoring components being used.
5. Erection, excavation, and removal sequence of the temporary shoring.
6. Location and limits of temporary guardrail.
7. Design notes including design criteria, loads, material specifications, and inspection, testing, and/or monitoring requirements.
8. Show temporary shoring installed in stages, if necessary, to accommodate other work activities.

The Department advises the Contractor to review the Phase IV Materials Report and the existing structure drawings for information on the soils and the existing foundation in the shored area.

584.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

584.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Temporary Shoring	LS

Predrilling required for the selected shoring system is incidental.

SECTION 586 – UTILITY CONDUIT

586.01 Description. Install utility conduits across the bridge and under the approach roadway to the termination point outside the structure, including threaded inserts cast in the concrete deck, PVC pipe sleeves as required, and utility conduit.

586.02 Materials. Meet the following requirements:

1. Utility conduit.
 - PVC pipe, schedule 40, if encased in concrete.
 - PVC pipe, schedule 80, if not encased in concrete.
2. Deck inserts.
 - Provide a minimum safe working load of 1,000 pounds.
3. Standard weight steel pipe.
 - ASTM A53 Grade B or A501.

586.03 Construction Requirements. Install the threaded inserts and utility conduit as specified, unless otherwise directed.

Solvent-weld PVC joints, except expansion couplings.

Prove conduits by blowing a pull string from end-to-end of each conduit. Leave the pull strings in place unless otherwise directed.

Verify the location of existing utilities and structures before starting construction and immediately notify the Engineer of discrepancies found on the plans.

Install the deck inserts for the utility conduits at the spacing specified.

586.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

586.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
Utility Conduit.....	LS

Structure excavation and compacting backfill are incidental.

SECTION 587 – PAINTING STRUCTURAL STEEL

587.01 Description. Prepare and paint the structural steel within the limits as specified. This work will consist of surface preparation by solvent cleaning, power washing, blasting, testing of blast surface for salts, full containment, proper disposing of debris, furnishing and applying paint, shielding adjacent areas from unwanted paint, and cleaning up after painting is complete. The Contractor or its subcontractor(s) will furnish labor, materials, equipment, services, and incidentals necessary to prepare and paint the steel. The work includes full removal of paint and rust from the steel, construction of any required containment facilities, debris collection, site storage, disposal, cleaning of the steel by water jetting, and painting of the steel structure. This work will be done in accordance with this specification and as directed.

The existing paint may contain lead-based paint. The Contractor is required to conduct their own monitoring at the beginning of the work, in accordance with federal regulations, and adjust worker protection and work practices according to the monitoring results.

The Contractor must have current certification in accordance with SSPC Qualification Procedure No. 1 (QP 1) and No. 2 (QP 2).

587.02 Materials Requirements. The coating system must incorporate single-component, moisture-cured polyurethanes for all priming and intermediate operations. Single-component, moisture-cured aliphatic polyurethane or polyester modified, aliphatic, acrylic polyurethane will be used for all top-coating operations. All coating products furnished for this contract must be manufactured by the same manufacturer and be compatible with one another. All coatings will be free of lead or chromates.

Paints and certification must meet 707.

Pre-approved paint systems specified are as follows:

1. System I: Sherwin Williams™.
 - a. Primer: Corothane I Galva-Pac One Pack Zinc Primer (B65G11).
 - b. Intermediate: Corothane I Ironox B (B65A11).
 - c. Topcoat: Acrolon 218 HS (B65-650).
2. System II: Wasser® High-Tech Coatings.
 - a. Primer: MC-Zinc.
 - b. Intermediate: MC-Ferrox B.
 - c. Topcoat: MC-Luster.

The paint system will be as preapproved or be an Engineer-approved equal. An approved equal must be a standard, regularly produced product and submitted for approval based on the manufacturer's published literature that states instruction for use, solids by volume, application rates, VOC content, environmental considerations, and chemical components of vehicles and solids. This literature must include a referenced list of bridge projects where the paint systems were successfully used and name the contractor who applied them. The Contractor must furnish paint manufacturer's certifications and show that the paint and thinners comply with the paint system requirements. Should the proposed equivalent manufacturer's literature require a higher degree of surface preparation or a greater film thickness than specified, that degree of surface preparation and film thickness will apply, and the contract price will not be changed to reflect these increases. Equivalent paint systems must have demonstrated 2 years of successful field exposure on bridge structures for evaluation.

The Contractor must have the coating manufacturer furnish 1 unopened quart container of each paint, coating material, accelerator, and thinner to the Central Materials Laboratory for testing. The samples will be taken at the

manufacturer's plant or store outlet. Contact the Central Lab Manager about sampling at the manufacturer plant or store outlet. SDS and product data sheets must accompany the paint samples sent to the Central Materials Laboratory for testing. The products will be tested against the manufacturer's product specifications and these specifications for compliance. The manufacturer must supply a quality control test report showing the results of the paint for each batch supplied at the time of sampling. Allow 2 weeks for paint testing after the Central Materials Laboratory has received the paint.

All paint ready for application must be prepared at the factory. Do not add thinner or other material to the paint after it has been shipped, unless recommended by the manufacturer and approved by the Engineer. Add all tinting materials at the time of paint manufacture; field tinting is not allowed.

Do not paint until the Engineer receives and approves all product data sheets, certifications, QC test reports, and the Central Materials Laboratory test results.

All containers must be labeled showing the manufacturer's name, product name, date of manufacture, date of expiration, and the manufacturer's batch number.

Paints must meet the following requirements:

1. System I: Sherwin Williams.

a. Primer.

Generic Type: Zinc-rich, single-component, moisture-cured polyurethane.

Vehicle Type: Moisture-cured polyurethane.

Volume Solids: 65% minimum.

Pigment Type: Zinc dust, ASTM D 520 Type II.

Zinc Content in Dry Film: 80% Minimum.

Coverage: 3.0 - 5.0 mils DFT (dry film thickness).

VOC: 2.8 lb/gal maximum.

Weight Per Gallon: 28.0 lb/gal minimum.

Color: Contrast to the intermediate.

b. Intermediate.

Generic Type: Micaceous iron oxide, single-component, moisture-cured polyurethane.

Vehicle Type: Moisture-cured polyurethane.

Volume Solids: 62% minimum.

Pigment Type: Micaceous iron oxide.

Coverage: 3.0 - 5.0 mils DFT (dry film thickness).

VOC: 2.8 lb/gal maximum.

Weight Per Gallon: 13.2 lb/gal minimum.

Color: Contrast to the topcoat.

c. Topcoat.

Generic Type: Aliphatic, polyester modified, acrylic polyurethane.

Vehicle Type: Polyester modified, acrylic polyurethane.

Volume Solids: 63% minimum.

Coverage: 3.0 - 5.0 mils DFT (dry film thickness).

VOC: 2.8 lb/gal maximum.

Weight Per Gallon: 11.0 lb/gal minimum.

Finish: Semi-gloss.

Color: Gray, Federal standard color chip 26492

2. System II: Wasser High-Tech Coatings.

a. Primer.

Generic Type: Zinc-rich, single-component, moisture-cured polyurethane.

Vehicle Type: Moisture-cured polyurethane.

Volume Solids: 60% minimum.

Pigment Type: Zinc dust, ASTM D520 Type II.

Zinc Content in Dry Film: 80% minimum.

Coverage: 3.0 - 5.0 mils DFT (dry film thickness).

VOC: 2.8 lb/gal maximum.

Weight Per Gallon: 23.0 lb/gal minimum.

Color: Contrast to the intermediate.

b. Intermediate.

Generic Type: Micaceous iron oxide, single-component, moisture-cured polyurethane.

Vehicle Type: Moisture-cured polyurethane.

Volume Solids: 60% minimum.

Pigment Type: Micaceous iron oxide.

Coverage: 3.0 - 5.0 mils DFT (Dry Film Thickness).

VOC: 2.8 lb/gal maximum.

Weight Per Gallon: 12.5 lb/gal minimum.

Color: Contrast to the topcoat.

c. Topcoat.

Generic Type: Aliphatic, single-component, moisture-cured polyurethane.

Vehicle Type: Moisture-cured polyurethane.

Volume Solids: 60% minimum.

Coverage: 3.0 - 5.0 mils DFT (dry film thickness).

VOC: 2.8 lb/gal maximum.

Weight Per Gallon: 10.5 lb/gal minimum.

Finish: Semi-gloss.

Color: Gray, Federal standard color chip 26492.

The Contractor must store all flammable materials in approved storage containers at approved locations.

The Contractor must store all paint, thinners, and solvents in accordance with OSHA regulations and the paint manufacturer's requirements. Store the paint and solvents under cover, out of direct sunlight. Maintain the storage temperature between 40 °F and 100 °F, unless the requirements of the manufacturer are more restrictive.

Keep all containers of paint unopened until required for use.

587.03 Construction Requirements. The Contractor must submit a copy of current certification in accordance with The Society for Protective Coatings Qualification Procedure No. 1 and No. 2 (SSPC-QP 1 and QP 2). Before work begins, the Contractor must submit a containment plan, a current medical surveillance plan, a lead removal plan, an environmental compliance plan, and a hazardous waste plan. The Engineer will review the plans and approve them before work commences. The Contractor will conduct the work in compliance with all applicable federal, state, and local laws, codes, rules, and regulations regarding lead removal.

The Contractor must take all necessary precautionary measures to ensure workers and work areas are adequately protected from fire and health hazards resulting from handling, mixing, and applying materials.

All damage to sound paint on areas not designated on the plans or authorized by the Engineer will be recoated at no additional cost to the Department and as directed.

A. Surface Preparation. Surface cleaning will be conducted using the following methods:

1. SSPC-SP 1 solvent cleaning to remove oil and grease or other contaminants before blasting.
2. Waterjet according to SSPC-SP WJ-4 or better to remove debris and salts.
3. Abrasive blasting the steel to an SSPC-SP 10 "Near White" before painting, SSPC-VIS 1 will be used in determining the quality of cleaning.

All water jetting and blasting operations must be done within containment that prevents release of materials or waste.

All wash water and debris from water jetting must be filtered through a filter fabric capable of collecting all loose debris and particles. The Contractor will filter visible paint chips and particulates from the water before placing it into the containers. Before disposal, test the water for total toxic metals and provide sample filtration (e.g., through a multi-stage filtration system ending in 5 microns or better if needed) until the water is not classified as hazardous.

Do not abrasive blast until the surfaces are thoroughly dry. Ensure adjacent work areas are protected from abrasive blasting.

Blasted bare steel must have an average surface profile of 2.5 to 3.5 mils. The blast profile must be angular or jagged rather than peened. The prepared surface profile must be verified using ASTM D4417, Method C. A record of all measurements must be logged and available for the Engineer's inspection.

The Contractor must provide compressed air that is free from moisture and oil contamination for operations in which the air may impinge upon the surface.

The Contractor will use the white blotter test in accordance with ASTM D4285 to verify the cleanliness of the compressed air. Conduct the test at least once per shift for each compressor system. Sufficient freedom from oil and moisture is confirmed if soiling or discolorations are not visible on the paper.

If air contamination is evidenced, the Contractor will examine the work completed since the last satisfactory contamination test and conduct any necessary cleanup or repair. The Contractor will change filters, clean traps, add moisture separators or filters, or make other adjustments as necessary to achieve clean, dry air.

The Contractor will not conduct final surface preparation that exposes bare steel under damp environmental conditions or when the surface temperature of the steel is less than 5 °F greater than the dew point temperature of the surrounding air.

The Contractor must conduct soluble salt testing as one of the final acceptance tests of the prepared steel surfaces before coating. Test steel surfaces for chloride, sulfate, and nitrate salt contamination before coating. Perform tests on metal loss areas when present. Metal loss areas are areas with evidence of corrosion or pitting. When metal loss areas are not evident, perform tests adjacent to weld areas, if present. Otherwise, select test sites to be representative of the surface as a whole. Test at the rate of 1 test per 1,500 square feet minimum or as Engineer directed in suspected areas. Results must be recorded and submitted for review and compliance. Chloride measurements greater than 5 micrograms per square centimeter are evidence of excessive chloride contamination. Sulfate measurements greater than 20 micrograms per square centimeter are evidence of excessive sulfate contamination. Nitrate measurements greater than 10 micrograms per square centimeter are evidence of excessive nitrate contamination. Areas that are not to specification will be considered non-compliant and must be cleaned by water jetting, allowed to dry, and then retested for compliance. The addition of a soluble salt remover (e.g., CHLOR*RID) may need to be added to achieve final acceptance. The addition of a soluble salt remover to the water jetting must meet the approval of the paint manufacturer. After cleaning with a soluble salt remover, the area must be rinsed with potable water to remove any residue. Technical representatives from the paint supplier and soluble salt remover must provide written acceptance before using the product to reduce salt concentration. Testing of the steel must be conducted with a CHLOR*TEST "CSN" Test Kit, Elcometer 134 CSN Chloride, Nitrate, Sulfate kit or an approved equal..

Do not clean in areas adjacent to areas that are being painted. Protect freshly painted surfaces from contamination. Contaminated surfaces must be cleaned to the Engineer's satisfaction before any subsequent application of paint is made.

Thoroughly clean corners, angles, and bolted or riveted joints.

The surface must meet the specified degree of cleaning immediately before painting. Deficient areas must be recleaned.

B. Containment. Meet the containment specifications of Class 1A and 1W as outlined in SSPC-Guide 6. The Contractor is responsible for containing and disposing waste material generated from paint removal and surface preparation operations within the work area. Do not allow removed or applied coatings to fall into a waterway or contaminate the environment. Make every effort to prevent the escape of any dust or paint which will create an EPA or OSHA violation or may create a nuisance to businesses, residents, and/or vehicular traffic near the structure.

Provide and maintain adequate ventilation during surface preparation, coating application, and the curing phases of work to adequately remove dust and fumes, prevent injury to workers, and/or accumulate volatile gases.

Supply all equipment and materials (e.g., ground covers, rigging, scaffolding, planking, containment screens or tarpaulin materials, HEPA-filtered vacuums) needed to contain all paint chips, abrasive blast media, overspray, drips, and spills.

Use materials that are free of loose dust and debris when brought onto the project site.

Protect the surrounding environment from all debris or damage resulting from the work. Contain and recover debris generated during cleaning, preparation, and coating operations. Design, construct, and maintain containment systems for operations in accordance with BMPs.

The containment system must not cause any damage to the existing structure. Enclose all portions of the structure to be blasted as specified.

The containment system must be able to be removed rapidly in case of high winds. Cease abrasive blasting operations if wind conditions prevent capture of blast rebound and paint residue by the containment system. If there is a question on wind conditions, the Engineer will make the final determination on whether blasting operations will cease and the containment system removed.

The containment system must not endanger the safety and health of the workers. Design access to the containment system to prevent any confined materials from escaping.

To prevent the weight of the confined materials from causing failure to the containment system, all confined materials must be collected and secured in sealed containers at the end of each daily shift, at a minimum. Confined materials must not escape during transfer from the containment systems to the sealable containers. All confined materials within the containment system must be removed and secured in sealable containers before relocation or removal of the containment system.

If the containment system fails or if signs of failure are present, the Contractor must stop work immediately. Work will not resume until the failure has been corrected to the Engineer's satisfaction.

If the containment structure is removed after the abrasive blasting operations and before the coating operation, the Contractor will install a drip tarp to prevent spillage of paint into the waterway and ground surface below.

Levels of air, soil, and water contamination resulting from surface preparations must meet acceptance standards established by the applicable local, state, and federal regulations.

During the operation, all portions of the structure (i.e., superstructures, substructures), slope protection, highway and appurtenances, traveling public, and public and private property must be protected from cleaning operations and paint splatter and overspray by using protective coverings or other approved methods. The Contractor is responsible for all damage the operations cause to persons, vehicles, or property.

Provide containment for all paint chips, abrasive blast media, airborne dust, overspray, drips, and spills.

Use approved impermeable or impenetrable cover materials (e.g., tarpaulins, drop cloths) on or above the ground and other surfaces as required. The Contractor is responsible for the recovery of debris from the covering materials. All areas used for containment and recovery, including all areas over which cover material is placed, must be thoroughly cleaned of all debris before work begins. All containment and recovery areas will be closed to the public and signed appropriately.

The Contractor must protect vehicles, structures, buildings, equipment, hardware, fixtures, and other materials from abrasive blast media, paint spillage, overspray, and other damage. In addition to containment materials, the Contractor must use protective coverings, shields, or masking as necessary to protect surfaces that are not designated to receive surface preparation or coating.

Maintain all protective coverings during the entire period the work is being performed and remove all coverings upon completion of the work.

Do not allow removed material to fall on the ground or in the water.

The Contractor will be responsible for the cleanup of any spills of removed material. All cleanups will be done to the Engineer's satisfaction and at no additional cost to the Department.

Immediately suspend cleaning and/or surface preparation operations if the Engineer deems the containment measures to be inadequate. Alter the cleaning and/or surface preparation operations or containment methods to satisfy the specified requirements.

Follow all applicable OSHA regulations regarding the installation and daily inspection of scaffolding, platforms, and wire cables. Maintain a daily log of the results of the inspections made each shift and after any occurrence that could affect the structural integrity of the scaffolding or wire ropes.

Do not remove the containment structure or begin painting until all abrasive blasted surfaces have been inspected and approved by the Engineer.

C. Painting Structural Steel. The structure must receive a stripe coat of the primer, a full primer coat, an intermediate coat, and a topcoat application.

All painting must be in conformance with the written instructions of the coating manufacturer, and with applicable portions of SSPC-PA 1, when those requirements are not in conflict with the Standard Specifications.

In the event of a conflict between the manufacturer's technical data and this specification, the Contractor will comply with this section unless the manufacturer's requirements are more restrictive. When the manufacturer's requirements are more restrictive, the Contractor will advise the Engineer of the discrepancies in writing and comply with the more restrictive requirement. The Engineer's decision will be final.

The surface must be thoroughly dry and free of moisture, dust, grease, or any other substance that would prevent the bond of subsequent paint applications. All protective coatings require certification from the manufacturer, including that the primer coat can be applied at a relative humidity up to 98 percent and a temperature as low as 20 °F. Do not paint when the temperature of the air, paint, or metal is below that described in the product technical data sheet, when the air is misty, or when conditions are otherwise unsatisfactory. Only apply paint when the surface temperature is greater than 5 °F above the dew point.

If condensation is observed on the steel, heat or dehumidify until the condensation is removed and conditions are acceptable to begin painting.

After the surface is prepared, apply a brushed-on stripe coat of the primer on all areas (e.g., edges, corners, seams, crevices, interior angles, junctions of joining members, rivets or bolt heads, nuts and threads, weld lines, similar surface irregularities). This stripe coat must be of sufficient thickness to completely hide the surface and must be followed as soon as practical by the application of the full primer coat to its specified thickness. The Contractor must extend the stripe coat a minimum of 1 inch from surface edges. All bare steel must be primed within 12 hours of being blast cleaned and within 24 hours if the steel has been washed. If any flash rusting occurs, it will be removed by blasting to meet the specification before painting.

Paint will be applied to the clean surfaces as follows:

Coating	Dry Film Thickness (mils)
Stripe (Primer)	2 - 3
Prime	3 - 5
Intermediate	3 - 5
Top	2 - 4

The Contractor will thoroughly clean the surface of each coat before the application of the next coat to remove dirt, dust, and other interference material. Ensure the removal of detrimental residue from surfaces (e.g., corners, pockets).

Clean the surfaces by brushing, vacuuming, or blowing down with compressed air. Remove any grease or oil deposited on the surface of any of the applied coats by solvent cleaning, in accordance with SSPC-SP 1, before the application of the next coat.

Remove and replace any paint that is exposed to unacceptable conditions (e.g., rain, dew) before adequate curing.

D. Methods of Application. The Contractor will apply all coats by the methods shown below, unless the methods recommended by the paint manufacturer are more restrictive. Take steps to control paint overspray, drips, splashes, and spills.

1. Airless or Conventional Spray Application. Use airless or conventional spray as appropriate for the coating material. If conventional spray is approved for use, verify that the compressed air supply is clean and dry as determined by the blotter test in accordance with ASTM D4285.
2. Brush Application. Use round or oval brushes. Brush apply the paint using a series of small circles to thoroughly fill in all surface irregularities, and end with a series of parallel strokes to smooth the finish. On vertical surfaces, brush the final strokes vertically.
3. Roller Application. Select a nap size and roller quality that will properly wet the substrate and produce a smooth, uniform film and finish. Apply the coating in such a manner as to achieve complete and thorough coverage of the surface.
4. Daubers. On surfaces that are inaccessible for paintbrushes, use sheepskins or daubers especially constructed for the purpose.

Apply each coat only after the previous coat has been allowed to dry as required by the manufacturer's written instructions, but as soon as possible, to minimize the length of time that the coating is exposed to dust and contamination.

Do not allow any coat to remain exposed for longer than the manufacturer's written instructions for maximum recoat time before recoating.

If a coat exceeds the manufacturer's maximum recoat times for any reason, remove and replace the coating. As an alternative to removing and replacing the coating, the Contractor may use a specialized surface preparation method. If so, the Contractor must provide written instructions from the coating manufacturer (e.g., scarifying the surface) to properly prepare the surface to receive the next coat. The specialized steps must be approved by the Engineer in writing. The Contractor will perform the specialized cleaning or removal and replacement of the coatings at no additional cost to the Department.

Apply each coat at the proper consistency to ensure thorough wetting of the substrate or underlying coat and to achieve a smooth, streamlined surface free of dry spray, overspray, and orange peel. Shadow-through, pinholes, bubbles, blisters, fish eyes, skips, misses, lap marks between applications, runs or sags, or other visible discontinuities in any coat are unacceptable and must be repaired.

Thoroughly coat all surfaces, especially hard-to-reach areas and irregular surfaces. When coating configurations (e.g., bolts, rivets), apply the material from multiple directions to ensure complete coverage.

Use wet film thickness gauges in accordance with ASTM D1212 or ASTM D1414 to verify the thickness of each coat at the time of application.

Apply each coat to the specified thickness. Notify the Engineer of any conflicts between the manufacturer's recommended dry film thickness and the thickness shown. The Engineer's decision will be final.

Ensure uneven surfaces (e.g., edges, corners, crevices, welds, bolt heads, rivets, fasteners) receive a dry film thickness equivalent to that of flat surfaces.

Measure the dry film thickness of each coat using nondestructive magnetic dry film thickness gauges. Comply with SSPC-PA 2 for the calibration and use of the gauges, and the frequency of thickness measurements.

The dry film thickness must be measured for acceptance using ASTM D1186, Method A or B.

If a discrepancy arises about an individual coat thickness or coverage, it will be verified using ASTM D4138, Method A (i.e., Tooke Gauge) when authorized and witnessed by the Engineer. The Tooke Gauge readings will be final in determining the dry film thickness of the coating(s). On areas where the Tooke Gauge is used to determine coating thickness, the test area must be repaired according to the approved repair procedure. Repair to the test area will be done at no additional cost.

Apply additional coating of the same type to areas of insufficient thickness. Ensure all repairs blend in with the surrounding surfaces.

Unless otherwise directed by the Engineer in writing, remove excessive coating thickness and reapply the affected coat(s).

Utilize an approved wet film thickness gauge during application of each individual coat in conjunction with an approved dry film thickness gauge following subsequent minimum cure times. Paint film thickness measurements must be made and documented after each application. Where thickness measurements fall below the specified minimum, additional applications of paint must be made to meet the thickness required.

All coatings must be inspected and approved by the Engineer before the next coating is applied.

Apply all coats in such a manner to ensure that they are well adhered to each other and to the substrate. If the application of any coat causes lifting of an underlying coat or there is poor adhesion between coats or to the substrate, remove the coating in the affected area to adjacent sound, adherent coating, and reapply the material.

If adhesion is questionable, conduct adhesion tests in accordance with ASTM D3359 or ASTM D4541 as directed and repair all test areas. The Engineer will establish the acceptance criteria for the testing. Replace all defective coating that is revealed by the testing.

Repair of damage and unacceptable coatings will be repaired according to the manufacturer's written guidelines and these minimum standards.

Feather the existing coating surrounding each repair location. Feather for a distance of 1 to 2 inches to provide a smooth, tapered transition into the existing intact coating. Verify the edges of coating around the periphery of the repair areas are tight and intact by probing with a putty knife in accordance with the requirements of SSPC-SP 3. Roughen the existing coating in the feathered area to ensure proper adhesion of the repair coats.

When the bare substrate is exposed in the repair area, properly prepare the surface and apply the coating system to the specified thickness.

When the damage does not extend to the bare substrate, repair according to the manufacturer's written instructions and the Engineer's approval.

Maintain the thickness of the system in overlap areas within the specified total thickness tolerances.

E. Waste Collection and Disposal. Wastes contained in accordance with these Standard Specifications must be disposed of in accordance with SSPC-Guide 7.

The Contractor must obtain and provide EPA hazardous waste identification numbers, assigned through DEQ, required for collection, transportation, and disposal of the hazardous waste. The Contractor is fully responsible for proper transport to the designated location. Provide the Engineer all necessary information related to the manifesting, transporting, treatment, or disposal of classified hazardous waste. The Engineer must approve the process and the tracking of the material. It is the Department's responsibility to ensure proper handling and disposal of this material.

Waste materials must be contained and collected in an approved area. Temporary storage on the project site, before transport and disposal, will be as if the spent material was hazardous. Storage facilities and containers must meet all state and federal requirements for the storage of hazardous material.

The Contractor must institute procedures to prevent spilling of all paint materials. Spills must be cleaned up immediately. All contaminated material, including soil, will be tested and disposed. All trash generated during the Contractor's operation that becomes contaminated in any way with hazardous substances will be disposed of as a hazardous material.

All spent materials and waste debris will be cleaned up within the containment enclosure daily or before any prolonged work stoppage (e.g., weather interruptions).

All spent materials and waste debris will be placed in suitable waste storage containers located on the project site. The waste containers and storage arrangement must be reviewed by the Engineer and must be located to avoid potential traffic or environmental hazards. The Contractor will perform weekly inspection of the stored hazardous waste to ensure storage security.

Within 90 calendar days of the removal of waste material from the project site, the Contractor must submit a certificate to the Engineer stating that the material has been disposed of in accordance with SSPC-Guide 7. The Contractor will also provide the Engineer with documentation verifying compliance. The documentation must include information on manifesting, traceability, storage, sampling, testing, shipping, or treatment.

F. Quality Control Inspections. QC is the Contractor's responsibility. Perform and document all inspection and testing as necessary to ensure conformance with this specification. QC documentation must include the salt concentrations, surface profile, coating thickness, and paint batch numbers for each coating applied. All documentation must be made available to the Engineer for review before conducting the next step of the operation.

A representative from the paint manufacturer must be present at the beginning of painting to ensure proper application techniques are being adhered to and to establish the proper painting parameters.

G. Quality Assurance Inspections. QA is the Department's prerogative. The Department will perform inspection and testing necessary to verify that an acceptable product is being furnished in accordance with this specification. All cleaning and painting will be subject to quality assurance inspection and approval. Inspections will be made as determined by the Department and the Contractor will provide the necessary means to perform proper inspections.

587.04 Method of Measurement. Painting structural steel will be measured by lump sum.

587.05 Basis of Payment. Payment for accepted work will be made as follows.

Pay Item	Pay Unit
Painting Structural Steel.....	LS

Costs associated with furnishing the impermeable or impenetrable cover materials, drapes, anchors, supports, and other materials necessary for the containment enclosures, and installing and removing of the containment enclosures are considered incidental and will be performed at no additional cost to the Department.

A separate payment will not be made for hazardous waste disposal of materials from contamination due to spills.

SECTION 600 – ANCILLARY CONSTRUCTION

SECTION 601 – CONDUITS, GENERAL

601.01 Description. Construct culverts, siphons, irrigation lines, sewers, underdrains, and embankment protectors.

601.02 Materials. Meet the joint requirements of AASHTO PP 63 for silt-tight and leak-resistant joints.

Determine the strength and thickness of the pipe required based on the cover over the pipe (see Standard Drawings).

Provide the specified type of pipe, including gaskets, if required.

Provide pipe extensions of the same material type or class as the existing pipe.

Provide materials as specified in:

Concrete Sewer Pipe	706.02
Concrete Pipe for Irrigation or Drainage	706.03
Reinforced Concrete Pipe	706.04
Corrugated Metal Pipe	706.06
ABS Composite Sewer Pipe	706.13
Class PS 46 Polyvinyl Chloride (PVC) Pipe	706.14
Ribbed Polyvinyl Chloride (PVC) Pipe	706.15
Steel Reinforced Ribbed Polyethylene (SRRPE) Pipe	706.18
Polypropylene Pipe	706.19

601.03 Construction Requirements.

A. General. Anchor exposed culvert ends with headwalls or standard metal or concrete end sections.

The Contractor may bore or jack to cross under cross walks, house drives, or service pipes.

B. Concrete Pipe. Install concrete pipe to meet ASTM C1479.

Provide mastic joints for elliptical concrete pipe or gasketed joints for round concrete pipe. Mastic pipes are classified as silt tight, while gasketed joints are classified as watertight.

Lay concrete pipe beginning at the lower end with the receiving end upstream, with the ends fully and closely joined. Construct joints using one of the following methods:

1. **Mastic Joints.** Clean the bell and spigot joint surfaces. Remove any dirt, debris, flashing, or concrete high points, which could keep the joint from coming together. Place mastic on the leading outside edge of the spigot, all the way around the circumference of the spigot. Join the sealant into 1 continuous strand by kneading the ends together where they meet. Do not stretch or overlap the sealant. Once the sealant is installed, do not step on the sealant or allow dirt or debris to fall on to the sealant.
2. **Gasketed Joints.** Three types of gaskets are common to concrete pipe: O-ring, profile, and self-lubricating. The Contractor will coordinate with the manufacturer to properly install the gaskets and lubricate, if necessary.

Test the line for leakage in accordance with ASTM C969. Substitute reasonable procedures for other materials where necessary if a similar ASTM specification does not exist for the material being tested.

The Engineer will not accept the sewer line if the water loss exceeds 200 gallons per inch of pipe diameter per mile per day. Locate and correct any leaks if the loss exceeds the volume allowed.

The Contractor may use the low-pressure air method as an acceptable alternate to hydraulic testing per ASTM C1214.

Construct manholes, catch basins, inlets, sediment and oil trap manholes, and sediment control catch basins as specified in 609.

C. Corrugated Metal Pipe. Install corrugated metal pipe to meet ASTM A798.

Lay the corrugated metal pipe with the outside laps of the circumferential joints pointing upstream and with the longitudinal laps on the sides. Place the lugs on the coupling metal pipe bands to 1 side of the pipe top centerline so they will not extend above the pipe.

Install silt-tight coupling bands for corrugated metal pipes. Corrugated metal pipe should not be used in locations where a leak-resistant conduit is required.

D. Plastic Pipe. Submit a certificate of compliance for plastic pipe, including the average pipe stiffness, resin material cell classification, and manufacture date.

Install plastic pipe to meet ASTM D2321 and the manufacturer's written instructions.

All plastic pipe will be inspected with a mandrel, not sooner than 30 calendar days after the final backfill has been placed and compacted. The mandrel will be set at 5 percent less than the actual inside diameter of the pipe. The diameter of the mandrel will be verified with a proving ring or other method according to the manufacturer's written instructions. The mandrel must contain at least 9 equally spaced runners (40° angles). The mandrel inspection will be performed in the Engineer's presence. Failure to pass the mandrel test with less than 5 percent deflection will result in rejection and installation of new pipe. Testing for original sections and retesting of replaced sections will be repeated until 100 percent of the pipes can pass the test.

Use fittings that meet ASTM D3212.

Use gaskets that meet ASTM F477.

Do not use couplings unless Engineer approved.

Test lines for leakage in accordance with ASTM F2164. No leakage rate is allowed.

The Contractor may test by the low-pressure air method as an acceptable alternate to hydraulic testing in accordance with ASTM F1417.

601.04 Method of Measurement. The Engineer will measure acceptably completed work as specified in the contract pay items. The Department will list pipe by diameter and total estimated length in the bid schedule. Each diameter category may include 1 or a combination of types, thickness, or class of material.

601.05 Basis of Payment. The Department will pay for accepted quantities of pipe by type at the contract unit price shown on the bid schedule. The Department will not adjust the contract unit price because of normal minor adjustments in length of individual kinds of pipe.

SECTION 602 – CULVERTS

602.01 Description. Provide and install culverts.

602.02 Materials. Provide materials as specified in 601.

Provide pipe joints that are either silt-tight or leak-resistance as specified in 601.02.

602.03 Construction Requirements. Install pipes as specified in 601.03.

602.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot along pipe centerline. The Engineer will allow an additional 1 foot for each connecting band used in making an authorized extension of existing corrugated metal pipe. The Engineer will include culvert sections attached to aprons in the measurement of culverts.

Pipe aprons required only because PVC or PE pipe is used will not be measured or paid for separately when other pipe material is acceptable.

602.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
_____ Pipe Culverts	ft
_____ Pipe Arch.....	ft

The Department will pay for structural excavation and compacting backfill, including the removal of unsuitable material below the established grade as specified in 210.

SECTION 603 – PIPE SIPHONS

603.01 Description. Provide and install pipe siphons.

603.02 Materials. Provide materials as specified in 601.

Provide pipe joints that are leak-resistant with a maximum working pressure of 10 psi as specified in 601.02.

603.03 Construction Requirements. Install metal pipe siphons as specified in 601.03.

Completely fill the siphon with water and repair leaks that develop before backfilling, using approved methods. If there are leaks around joints in rubber-gasketed concrete pipe, encase the joint using an approved reinforced concrete collar. Only 2 collar and joint repairs are allowed for each 150 feet of pipe. Empty the siphon of water before making repairs and then refill, retest, and obtain approval before backfilling.

603.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot along pipe centerline. The Engineer may calculate the length from the dimensions of the approved siphon layout.

603.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
___ Pipe Siphon.....	ft

The Department will pay for structural excavation and compacting backfill, including the removal of unsuitable material below the established grade, as specified in 210.

SECTION 604 – IRRIGATION PIPELINES

604.01 Description. Provide and install irrigation pipelines.

604.02 Materials. Provide materials as specified in 601.

Provide pipe joints that are leak-resistant with a maximum working pressure of 10 psi as specified in 601.02.

604.03 Construction Requirements. Install pipe as specified in 601.03.

Test for leaks by closing off a section with suitable water bulkheads, filling the line with water, and applying pressure to the line equal to the maximum static head the finished line will be subjected to at the point of testing. Locate and repair leaks as approved.

604.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot along pipe centerline. The Engineer will allow an additional 1 foot for each connecting band used in making an authorized extension of existing corrugated metal pipe.

604.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
___ Irrigation Pipe	ft

Structure excavation and compacting backfill is incidental and the cost included in the contract unit price for irrigation pipe.

SECTION 605 – SEWERS, MANHOLE AND VALVE COVERS

605.01 Description. Construct sewers with manholes, inlets, connections, and other appurtenances to carry stormwater or sewage. Adjust and repair manhole and valve covers.

605.02 Materials. Provide materials as specified in:

Gaskets for Concrete Pipe.....	706.11
Rubber Gaskets for Corrugated Metal Pipe.....	706.12
Manhole Covers and Rings, Grates, Catch Basins, Inlets, etc.....	708.22
Portland Cement.....	701
Aggregate.....	703
Metals.....	708
Concrete Curing Compounds and Admixtures.....	709
Concrete.....	509
Reinforcing Steel.....	708.02

Provide pipe joints that are silt-tight or leak-resistant as specified in 601.02.

Provide other materials as specified in 601.

Corrugated PE pipe may only be used for storm sewers as specified in 706.16 and with the following additions:

1. Use Type S pipe.
2. Do not subject a pipeline with couplings to pressure flow.

Use only precast concrete manufacturers that hold current certification under the NPCA Plant Certification Program, the PCAA Plan Certification Program, the ACPA QCast Plant Certifications Program, or the PCI Plant Certification Program.

605.03 Construction Requirements. The Contractor may tunnel or jack to cross under cross walks, house drives, or service pipes. Excavate and compact backfill as specified in 210.

Lay concrete pipe for sanitary sewer lines beginning at the lower end with the receiving end upstream and with ends fully joined using suitable means to prevent air circulation within the pipeline. Provide and install rubber-gasketed joints as specified in 601.03.

Install pipes as specified in 601.03.

Test the line for leaks before accepting the sewer line as specified in 601.03.

Install spiral rib corrugated steel pipe and ABS pipe in accordance with the manufacturer's written instructions.

Test the line for leaks before accepting the sewer line as follows:

1. Close off a section with suitable watertight bulkheads.
 - a. Fill the line with water.
 - b. Apply 4 feet of head pressure to the line measured from the top of the pipe at the upstream end and supplying water to the section under test so the water loss may be measured.

The Engineer will not accept the sewer line if the water loss exceeds 200 gallons per inch of pipe diameter per mile per day. Locate and correct any leaks if the loss exceeds the volume allowed.

The Contractor may test by the low pressure air method as an acceptable alternate to hydraulic testing as follows:

1. Test installation on runs or sections. The Department will allow preliminary testing before backfilling. Test when the pipe is in a wet condition.
2. Use an approved apparatus and method recommended by the pipe manufacturer.
3. Prepare the installation being tested, between its plugged ends, by pressurizing it to an internal pressure of 4 psi. Air pressure is defined as the pressure in excess of back pressure on the installation that would occur if the pipe were submerged in water. Hold an air pressure of 4 psi for at least 2 minutes or as long as needed for the pressure to stabilize.
4. The tested section, when tested on the air pressure drop method, will be if the time required for the pressure to drop from 3.5 to 2.5 psi coincides with ASTM C924.

The Contractor may test connections to inlet and outlet structures by blocking off a pipe section of the outlet, filling the structure with water, and observing the water surface drop. To be acceptable, water loss must not exceed 0.002 gallons per inch of inside perimeter of connection per foot of structure height or length per hour with no outside back pressure.

Construct manholes, catch basins, inlets, sediment and oil trap manholes, and sediment control catch basins as specified in 609.

A. Adjusting Manhole and Valve Covers.

Adjust the existing manhole and valve covers to conform to the new finished pavement grade. Exercise care in all operations in order to not damage the structures, equipment, or utilities (e.g., water, gas, power). Any damage occurring to the utilities due to the Contractor's operation will be repaired at no additional cost to the Department. Make any masonry adjustment by using bricks, concrete blocks, or placed concrete.

Coordinate with the utility owner 5 business days before lowering the manhole or valve covers. Locate and lower the manhole or valve covers before excavation and adjust to match the finished pavement grade. Where excavation is necessary to adjust to the design elevation, place backfill in 3-inch lifts and tamp by hand.

Place concrete collars around manholes and valve covers as specified. The concrete collar will be 1 foot wide, measured from the metal cover edge to the cut pavement edge. A 10-foot straightedge will be used to determine the completed installation surface smoothness. Place concrete collars $\frac{1}{4}$ inch below the finished grade. Adjust any high points by grinding.

B. Manholes, Valves, Catch Basins, and Inlets.

Construct manholes, valve frames and covers, catch basins, and inlets.

Adjust existing manhole and valve frames and covers to the finished pavement grade. Coordinate with the utility owner 5 business days before making adjustments. Replace damaged manhole or valve frames and covers.

Install concrete collars around manhole and valve frames. Use Idaho IR 87 to test surface smoothness.

605.04 Method of Measurement. The Engineer will measure the acceptably completed work as follows:

1. By the foot along pipe centerline, excluding the distance across catch basins, manholes, inlets, and other structures where the pipe, or a portion of pipe, is not actually incorporated in the finished product.
2. Manholes, catch basins, and inlets by the each.
3. Manhole and valve frame and cover adjustment replacement by the each.

The Engineer will not measure structure excavation and backfill.

605.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
_____ Storm Sewer Pipe	ft
_____ Sanitary Sewer Pipe.....	ft
Manholes, Type ____.....	Each
Catch Basins, Type __	Each
Inlets, Type ____.....	Each
Sediment and Oil Trap Manhole.....	Each
Sediment Control Catch Basin	Each
Adjust Manhole Covers	Each
Adjust Valve Covers.....	Each
Replace Damaged Manhole Frame	Each
Replace Damaged Valve Risers	Each

Structure excavation and compacting backfill are incidental and included in the sewer contract unit prices.

SECTION 606 – PIPE UNDERDRAINS AND URBAN AND RURAL EDGE DRAINS

606.01 Description. Provide, place, and inspect pipe underdrains, rural edge drains, and urban edge drain pipes.

606.02 Materials. Provide materials as specified in:

Coarse Aggregate for Concrete (Drain Rock) (Coarse Aggregate Size 1, 2a, 2b).....	703.02.C
Subgrade Separation Geotextile, Type III.....	718.07
Corrugated PE Drainage Tubing, Perforated and Unperforated	706.10
Fittings for PE Drainage Tubing	706.20
Grout (Mortar).....	705.04
Metallic-Coated Corrugated Steel Underdrains	706.07
Corrugated Aluminum Pipe for Underdrains	706.08
PVC Pipe, Perforated and Unperforated.....	706.14
Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains	AASHTO M 36
Rodent Protection Devices for Trench Drain	706.21
Edge Drain Markers.....	712.10

Provide drain rock that is clean angular quarried or crushed rock.

The Department will accept drain rock by certification. Submit quality control test results that represent each 500 tons of drain rock placed, with at least 1 test per contract, including gradation (AASHTO T 27 with no wash required) and sand equivalent (AASHTO T 176) to verify the certification. Perform quality control sampling and testing using a qualified independent laboratory and submit the test results.

The Contractor may provide a grout product that is on the QPL or submit a proposed mix design for approval. Submit a completed certification [ITD-0851](#) form.

606.03 Construction Requirements.

A. General. Line the trench with geotextile. Lay perforated pipe with the perforations down. Place drain rock around the pipe and to the elevation over the pipe. Fold geotextile over the drain rock and overlap at least 2 feet on the top and at the drain ends. Place approved backfill material to the top of the trench and compact.

Install geotextile, drainage pipe or tubing, and aggregate backfill as specified or as directed.

Place the materials as specified over pipe underdrains, urban edge drains, and rural edge drains.

B. Urban Edge Drains. Field-verify locations of urban edge drains in the Engineer's presence.

At locations where a storm sewer exists or is to be constructed, the following applies:

1. Place the edge drains on the low side of the roadway.
2. Install edge drains to discharge into stormwater sewer catch basins.
3. Cap edge drain inlets in stormwater sewer catch basins and make their outlet pipes drain to a stormwater sewer catch basin.
4. Construct the edge drain slope to follow the grade of the roadway except where side street grades will not allow.

5. Slope side street edge drains as specified or as directed.
6. Where the plans show edge drain pipe connecting to stormwater sewer catch basins, make the connection by coring the concrete wall of the catch basin, place the end of the edge drain pipe in line with the inside wall of the catch basin.
7. Seal the gap between the edge drain and the concrete wall of the catch basin with grout (mortar) and ensure a watertight connection.

C. Rural Edge Drains and Pipe Underdrains. Excavate for rural edge drains and pipe underdrains as specified in 210.

Install rodent protection devices for outlet pipes and mark them with a witness post as specified in 618 bearing the letters UD on white reflective sheeting.

Place the outlet pipes in 10-foot long corrugated steel pipe sleeves extending from the rodent protectors and with the diameter of the corrugated steel pipes just large enough to allow the outlet pipes to fit through.

Ensure the maximum depth of trench excavation for pipe underdrains is less than 5 feet.

D. Drain Rock. Place drain rock within designated areas.

E. Inspection. Before final acceptance of the work, demonstrate to the Engineer the drains and outlet pipes are in good condition and have not been damaged during or after installation. Use video inspection equipment to record the drains condition and submit copies of the videos in an approved format. Notify the Engineer at least 24 hours before the video inspection so the Engineer may witness the videotaping. Provide video inspection equipment capable of superimposing the date, time, and location on the picture at the time of inspection. If the video inspection shows damage, repair the damage at no additional cost to the Department.

606.04 Method of Measurement. The Engineer will measure acceptably completed work by the foot.

606.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Pipe Underdrain	ft
Urban Edge Drain	ft
Rural Edge Drain.....	ft

Concrete coring, grout (mortar), or other items necessary to complete the installation are incidental and the cost included in the urban edge drain contract unit price.

Video inspection is incidental and included in the contract unit prices for other items. The Department will pay for materials placed over pipe underdrains, urban edge drains, and rural edge drains under their respective contract pay items.

SECTION 607 – EMBANKMENT PROTECTORS

607.01 Description. Provide and install corrugated metal embankment protectors.

607.02 Materials. Use entrance and exit sections that meet the requirements of AASHTO M 36 or AASHTO M 196.

Provide the discharge pipe as specified in 706.06. Use all steel or all aluminum for each assembly.

607.03 Construction Requirements. Install the entrance device to prevent water from percolating under or around the structure.

Install discharge pipe as specified in 602.03. Securely anchor the pipe to the ground surface where it is not possible to provide a trench for the installation.

607.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Embankment protectors will be by each unit. An entrance and an exit section is 1 unit.
2. Discharge pipe will be by the foot.

607.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Embankment Protector, Type _____	Each
Discharge Pipe.....	ft

The Department will measure and pay for materials necessary to pave the inlet area as specified in 405 or 406. Excavation, backfill, outlet protection, and anchorage are incidental.

SECTION 608 – PIPE APRONS

608.01 Description. Provide and install aprons as specified to the inlet and outlet ends of pipe culverts.

608.02 Materials. Provide material aprons as specified in:

Concrete Aprons.....	509
Metal Aprons	708.21

Use galvanized or stainless steel bolts, nuts, and washers. Galvanize other material to meet AASHTO M 232. Fabricate safety, longitudinal, and optional bars from steel pipe meeting the requirements of ASTM A53 Schedule 40 and hot-dipped galvanize the bars after fabrication for metal safety aprons.

Use galvanized steel that meets AASHTO M 111.

Use Class 30 concrete for apron cutoffs.

Use concrete aprons that meet the reinforced Class III concrete pipe.

Provide metal or concrete aprons for installation. Attached aprons are required to use the same material as the aprons used for the pipe material.

608.03 Construction Requirements. Shape area occupied by the apron to conform to the bottom of the structure and to provide a firm and uniform support over its entire area. Backfill cutoff walls and areas adjacent to the apron to prevent undercutting or erosion.

608.04 Method of Measurement. The Engineer will measure acceptably completed work by the each. The Engineer will include the culvert sections attached to aprons in the measurement of the culverts.

608.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
___ Aprons for Pipe	Each
___ Metal Safety Apron (Parallel)	Each
___ Metal Safety Apron (Cross Drainage).....	Each

Structure excavation and compacting backfill are incidental and the cost included in the pipe apron unit price. Concrete for the cutoff is incidental and is included in the aprons contract unit price.

SECTION 609 – MINOR STRUCTURES

609.01 Description. Construct minor structures (e.g., drops, weirs, checks, diversion boxes, culvert and siphon headwalls, and inlet and outlet structures for canals and pipes).

609.02 Materials. Provide materials as specified in:

Concrete	509
Reinforcing Steel	708.02
Timber	710

Use Class 30 concrete.

Accompany each shipment of reinforcing steel delivered with a completed [ITD-0914](#) form with a copy of the mill test report attached for each heat number included. The Department will take field samples for each heat number and bar size from material delivered. Ensure the supplier submits proper identification with each shipment to readily identify each bar size by heat number. The Engineer will reject reinforcing steel delivered that cannot be identified by heat number. Replace rejected reinforcing steel at no cost to the Department.

Sample complete fabricated bars and order additional bars to account for the field sampling. Do not cut and splice bars to obtain samples. The Engineer will accept the following for field samples:

1. If the bar is configured so two 36-inch long test specimens can be cut from 1 bar, then only 1 bar constitutes a field sample.
2. Otherwise, 2 complete fabricated bars constitute a single field sample.

Fabricate reinforcing steel spirals with additional length to accommodate sampling. The Engineer will not allow cutting that would require splicing to obtain samples.

The Engineer will reject bars with failing heat numbers. Replace rejected material at no additional cost to the Department.

Provide metal grates that meet the requirements of ASTM A36. Meet the requirements of the American Welding Society D1.1 when welding the grates. Use grates for the inlet headwalls only when specified. Grates do not need to be painted or galvanized.

609.03 Construction Requirements. Excavate and backfill as specified in 210.

Construct minor structures as specified in 503 and 509.

609.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Concrete by the cubic yard as specified in 509.
2. Metal reinforcement by the pound of reinforcing steel as specified in 503.
3. Timber and lumber by the thousand feet board measure (MFBM).
4. When minor structures are by each, material is incidental.

609.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Concrete	CY
Metal Reinforcement	lb
Timber, Treated.....	MFBM
Timber, Untreated	MFBM
Minor Structures.....	Each

Structure excavation, compacting backfill, grates, and other related hardware cost is incidental and included in the contract unit prices for other contract pay items.

SECTION 610 – FENCES

610.01 Description. Provide and erect wire fence and gates. Comply with 107.19.

610.02 Materials. Provide materials as specified:

Nonstructural Concrete.....	509
Barbed Wire.....	708.09
Woven Wire.....	708.10
Hardware for Barbed or Woven Wire Fence.....	708.11
Metal Fence Posts.....	708.12
Chain Link Fence.....	708.13
Wood Fence Posts.....	710.08

610.03 Construction Requirements. Remove trees, brush, and other obstacles along the fence line. Remove and dispose of material as specified in 201.

See standard drawing notes for additional construction requirements for each specific fence and gate type.

Set posts plumb to the spacing and depth as specified, backfill, and firmly tamp. Set posts for chain-link fence in concrete. After the posts are set, stretch and fasten the wire fencing to wooden posts with staples or to steel posts with wire clamps.

Use Class 22 concrete for post and brace bases. Crown the surface of the concrete to drain.

When drilling into rock is required to set a post, the Contractor may shorten the post if at least 12 inches of post is grouted in the rock.

Consider the air temperature when stretching wire. In hot weather stretch the wire just tight enough to eliminate sags, and in cold weather stretch the wire very tight. In either temperature condition, do not stretch the woven wire so tight the pre-formed kinks in the horizontal wires are straightened.

Provide 4 inch by 4 inch No. 2 Common Douglas Fir or Larch horizontal and inclined wood braces. Dap posts to receive the braces and anchor the ends of the brace with three 16-penny nails or a $\frac{3}{8}$ inch by 4 inch steel dowel. Apply a coat of pentachlorophenol solution, chromated copper arsenate (CCA), or ammoniacal copper zinc arsenate (ACZA) to daps on the posts and the ends of the braces before assembly. Provide brace wires consisting of 2 loops of 9-gauge wire twisted to form a taut cable. Lightly notch the posts to position the wire and drive 3 staples at each notch to secure the wire.

When using metal braces, securely splice the tie wires to the fence on both sides of the posts so there are 2 loops behind the post and 1 loop in front, or wrap the fence wires around the post and tie off. Locate the concrete blocks for the angle braces so at least 6 inches of the angle brace are embedded in the concrete.

610.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Fence will be along the slope of the bottom wire by the foot, excluding the length between gateposts except for Type 1 Gates.
2. Gates will be by the each for the size and type specified except for Type 1 Gates.
3. Type 1 Gates will be per each, including the braces and fasteners. The Engineer will include the length of Type 1 Gates in the measurement for wire fence.
4. Two (2) Type 2 Gates installed in a single opening will be measured as 2 gates.

5. Braces will be per each and include line, corner, and terminal braces constructed of metal or wood.

Gate braces are included in the gate item cost. Sag braces are included in the fence item. Braces for chain-link fence will not be measured separately and are included in the fence unit price.

610.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Fence, Type ____	ft
Gates, Type 1.....	Each
Gates, Type ____.....	Each
Braces.....	Each

Clearing for the fence is incidental and the cost included in the fence contract unit prices.

When barb arm/security attachment for Type 4 fence is specified, the work is incidental and included in the fence contract unit price.

SECTION 611 – CATTLE GUARDS

611.01 Description. Construct cattle guards.

611.02 Materials. Use Class 30 concrete. Provide material as specified in:

Metal Reinforcement.....	503
Structural Metals.....	504
Nonstructural Concrete.....	509
Culverts	602
Fences	610

611.03 Construction Requirements. Complete roadway grading at the location of the cattle guard before excavating for the cattle guard. Backfill the structure with granular material as specified in 210.

611.04 Method of Measurement. The Engineer will measure acceptably completed work by the each, including the wing braces and posts. The distance between the posts will be excluded from measurement for fence.

611.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Cattle Guard, Type ____	Each

Structural excavation and compacting backfill are incidental and the cost included in the cattle guard contract unit price. The Department will pay for culverts as specified in 602.

SECTION 612 – GUARDRAIL

612.01 Description. Provide and install guardrail and concrete barrier.

612.02 Materials. Provide materials as specified in:

Concrete	502
Nonstructural Concrete	509
Metal Reinforcement.....	503
Guardrail and Hardware	708.14
Wood Guardrail Posts and Wood Blockouts.....	710.03
Steel Guardrail Posts.....	708.07

612.03 Construction Requirements.

A. Guardrail. Provide galvanized steel w-beam or thrie-beam guardrail.

Set posts plumb. Backfill around posts with native soil or pea gravel. Place backfill material in layers and thoroughly tamp. The Contractor may drive the posts if it can be done without damage to posts, pavement, shoulders, or adjacent slopes.

Drill timber posts before treating. Field drilling is allowed provided the hole is treated with a wood preservative as specified in 710.09 before installing the bolts.

Remove, replace, or reinstall misaligned, loose, or damaged posts and repair damage to the existing pavement, shoulders, or adjacent slopes at no additional cost to the Department.

B. Concrete Barrier. Cure concrete barrier as specified in 502.03.

Finish the concrete on precast and cast-in-place concrete barrier with an ordinary surface finish as specified in 502.03. Set concrete barrier to the line and grade as specified.

612.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. W-beam guardrail, thrie-beam guardrail, concrete barrier, and cast-in-place concrete barrier will be by the foot, including the length of anchors, terminals, and transitions.
2. Guardrail anchors, terminals, transitions, concrete barrier terminals, and concrete connectors will be per each.

612.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
W-beam Guardrail	ft
Thrie-beam Guardrail	ft
Guardrail Anchor	Each
Guardrail Terminal Type	Each
Guardrail Transition.....	Each
Concrete Barrier.....	ft
Concrete Terminal.....	Each

Concrete Parapet Connector..... Each
Concrete Barrier Connector Each
Cast-in-place Concrete Barrier..... ft

Miscellaneous guardrail or barrier components are incidental and the cost included in the guardrail or barrier contract unit prices.

SECTION 613 – CRASH CUSHIONS

613.01 Description. Provide and install crash cushion.

613.02 Materials. Provide crash cushion with pad or foundation as shown on the crash cushion and roadside terminal categorization charts. Provide materials as specified:

Nonstructural Concrete	509
Reinforcing Steel	708.02

613.03 Construction Requirements. Assemble and install crash cushion and pad or foundation as specified and in accordance with the manufacturer's written installation instructions. Submit an installation and repair manual specific to the installed crash cushion. Provide and install self-adhesive object marker sheeting to the nose of the crash cushion or provide an object marker for each crash cushion.

613.04 Method of Measurement. The Engineer will measure acceptably completed work per each installation.

613.05 Basis of Payment. The Department will pay for acceptable quantities at contract unit prices as follows:

Pay Item	Pay Unit
Crash Cushion, Sacrificial - Sand	Each
Crash Cushion, Sacrificial - Water Filled	Each
Crash Cushion, Sacrificial - Metal	Each
Crash Cushion, Partially Reusable	Each
Crash Cushion, Low Maintenance	Each

Crash cushion pad, transitions, and object marker are incidental and the cost included in the crash cushion contract unit prices.

SECTION 614 – SIDEWALKS, DRIVEWAYS, AND CURB RAMPS

614.01 Description. Construct sidewalks, driveways, and curb ramps.

614.02 Materials. Provide materials as specified in:

Nonstructural Concrete.....509

Use detectable warning surfaces consisting of truncated domes aligned in a square or radial pattern as specified. Ensure the color of detectable warning surfaces contrast visually with adjacent curb and gutter, street, or sidewalk, either light-on-dark or dark-on-light.

614.03 Construction Requirements. Grade and compact the subgrade to 90 percent of the maximum dry density as determined by AASHTO T 99. Compact aggregate base with at least 2 passes of a lightweight mechanical tamper, roller, or vibratory system.

Provide portland cement concrete as specified in 509 with the following exceptions:

1. Float-finish the concrete so the surface is slightly rough, but uniform. Work the slab edges and joints with a ¼ inch radius edging tool. Correct honey-combed or rough spots using mortar consisting of 1 part cement and 2 parts approved sand immediately after removing the forms.
2. Place, shape, and compact earth or other approved material against the edge of the sidewalk or driveway.
3. Construct joints as specified.
4. Cure as specified in 502.03.J.
5. Protect the concrete from damage during freezing weather as specified in 502.03.G.

Ensure the detectable warning surface is securely embedded in the concrete and installed in accordance with the manufacturer's written instructions.

614.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Sidewalks will be by the square yard.
2. Driveways will be by the square yard.
3. Curb ramps will be by the square yard.

614.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Sidewalk	SY
Driveway	SY
Curb Ramp	SY

Aggregate base will be paid as specified in 303 when an item is included.

Detectable warning surfaces are incidental and the cost included in the contract unit price.

When the contract does not include contract pay items for curb ramp related work, this work is incidental.

SECTION 615 – CURB AND GUTTER

615.01 Description. Construct curb, gutter, combination curb and gutter, or traffic separators.

615.02 Materials. Provide materials as specified in:

Nonstructural Concrete.....	509
Superpave Hot Mix Asphalt.....	405
Aggregates.....	703
Reinforcing Steel.....	708.02

Use Class 30 concrete or use ½ inch nominal maximum aggregate size (NMAS) SP 2 or SP 3 nonstructural mixture as specified in 405.

615.03 Construction Requirements.

Curb, gutter, curb and gutter, and traffic separators may be cast-in-place portland cement concrete. Curb and traffic separators may be precast portland cement concrete. Curb may be asphalt concrete.

Construct contraction joints in portland cement concrete at 10-foot intervals to a minimum depth of 2 inches. Provide a light broom finish. Cure concrete immediately after finishing as specified in 502.03.J.

When precast, cast curb in pieces at least 5 feet, but no more than 10 feet in length. Provide a smooth, glassy finish. Install precast curb on a smooth, compacted surface.

Tack the roadway surface where asphalt concrete curb will be constructed.

Place approved backfill material in layers behind curbs and compact.

615.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Curb and curb and gutter will be by the foot along the face of the curb.
2. Gutter and traffic separator will be by the foot along the centerline of the units.

Deductions in length will not be made for embankment protectors, catch basins, inlets, driveways, or curb ramps installed in the curb, gutter, or curb and gutter.

615.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Curb, Type ____	ft
Gutter, Type ____	ft
Curb and Gutter, Type ____	ft
Traffic Separator, Type ____	ft

The Department will pay for the asphalt mix and base under the appropriate contract items.

Excavation, backfill, reinforcing steel, and diluted emulsified asphalt for tack coat are incidental and the cost included in the curb and gutter contract unit prices.

SECTION 616 – SIGNS AND SIGN SUPPORTS

616.01 Description. Provide and install signs and sign supports or reinstall signs.

1. Type B Signs: sheet aluminum
2. Type C Signs: extruded aluminum panels
3. Type E Signs: HDO plywood

616.02 Materials. Provide materials as specified in:

Structure Excavation and Compacting Backfill	210
Concrete	502
Structural Metals.....	504
Nonstructural Concrete.....	509
Steel and Aluminum Sign Supports	708.17
Hardware for Signs	708.18
Extruded Aluminum	708.26
Sheet Aluminum	708.27
Wood Sign Posts	710.02
Plywood for Type E Signs.....	712.01
Retroreflective Sheeting	712.02
Silk Screen Opaque Inks	712.07
Silk Screen Transparent Inks.....	712.08
Direct Applied Nonreflective Sheeting and Transparent Films.....	712.09

Use Class 40A concrete for overhead sign bridges, overhead cantilever sign structures, and tee sign structures as specified in 502. Use Class 30 concrete for other sign support foundations as specified in 509.

Submit a list of proposed materials for installation for approval.

616.03 Construction Requirements.

A. Sign Types. Construct signs as follows:

1. Type B: 0.080 inch minimum thickness sheet aluminum with retroreflective sheeting background and a digitally printed, silk screened ink, direct applied retroreflective sheeting, or direct applied nonreflective sheeting legend and border. Remove burrs and sharp edges after fabrication.
2. Type C: Extruded aluminum panels with retroreflective sheeting background and a direct applied retroreflective legend and border. Use on multiple post signs, overhead sign bridges, cantilever sign structures, or tee sign structures.
3. Type E: ½ inch or ⅝ inch HDO plywood with retroreflective sheeting background and a digitally printed, silk screened ink, direct applied retroreflective sheeting, or direct applied nonreflective sheeting legend and border. Use ½ inch thickness for signs smaller than 96 inches by 48 inches. Use ⅝ inch plywood for signs 96 inches by 48 inches or larger. Fill and sand voids in edges with wood filler then apply edge sealer.

B. Sign Sheeting. Apply sheeting and screen printing as follows:

1. **Cleaning.** Clean substrates, background sheeting, and film as recommended by the manufacturer before application of additional sheeting and films. Do not use cleaners that damage the surface.
2. **Butt Splices.** Use a maximum of 1 butt splice placed vertically or horizontally with a $\frac{1}{32}$ inch or smaller gap on signs larger than 24 inches wide or on 12-inch extruded aluminum panels. Ensure the color and orientation of the sheeting match.
3. **Pop Rivets.** Pop rivets may be used to attach logo sign panels to a specific service sign. Pop rivets may be used to attach route shields to an existing highway sign.
4. **Orientation.** Orient retroreflective sheeting as recommended by the manufacturer.
5. **Adherence.** Ensure that sheeting is free of cracks, discoloration, air pockets, or other nonadherence.
6. **Screen Printing.** Screen print sign legends using transparent inks in conformance with the sheeting manufacturer's matched component system (MCS). Provided screen printed items with a uniform, smooth regular outline.
7. **Cutting and Plotting.** Provide letters, numbers, borders, and symbols with a smooth regular outline.
8. **Finish.** Trim sheeting flush with the sign edges. Ensure the sheeting on extruded aluminum is wrapped into the sheeting groove.
9. **Storage and Transport.** Store and ship finished signs with separation paper between the sign faces. Ensure no more than 2 signs are stacked horizontally. Vertically store and ship when there are more than 2 signs.
10. **Retroreflectivity.** Ensure the sheeting meets minimum retroreflectivity requirements. Repair or replace devices found to be damaged or defective.

C. Sign Supports.

1. **Ground Mounted Signs.** Construct ground mounted signs and as follows:
 - a. Risk Category: Low.
 - b. Fatigue Category: Not Applicable.
2. **Overhead Sign Bridges, Cantilever Sign Structures, and Tee Sign Structures.** Submit plans and design calculations that are sealed by an Idaho licensed professional engineer. Ensure the sign structure is designed as detailed in the AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals as follows:
 - a. Risk Category: Typical.
 - b. Fatigue Category: 1.

Before fabrication, submit shop drawings and design calculations in PDF format for approval. Allow 10 business days for review and approval.

Submit as-built shop drawings in PDF format.

Ensure that welds are performed as specified in 504.03.M.

D. Foundations. Construct foundations and place, grade, and compact backfill and surface material. A formed cylindrical or square foundation may be used where a foundation hole cannot be augured. If solid rock is encountered, drill and grout reinforcing steel into the rock when approved.

1. **Ground Mounted Sign Foundations:** Construct foundations for ground mounted signs.

- Overhead Sign Bridges, Cantilever Sign Structures, and Tee Sign Structures. Install anchor bolts plumb within 1 degree. Use 3 nuts and 2 washers on each anchor bolt, 1 leveling nut and 1 washer below the base plate, and 2 nuts and 1 washer above the base plate. Ensure leveling nuts with washer bear against the underside of the base plate before tightening the top nuts. Tighten the lower top nut beyond snug-tight as specified in Table 616.03-1.

Table 616.03-1 – Nut Rotation Beyond Snug-Tight

Anchor Bolt Diameter (in)	F1554 Grade 36	F1554 Grades 55 and 105
< or = 1.5"	1/6 turn	1/3 turn
> 1.5"	1/12 turn	1/6 turn

Tighten the upper top nut against the lower top nut snug-tight. Ensure at least 3 threads of the anchor bolt are visible above the second nut.

Tighten bolts as specified in 504.03.L.2.

Place and compact backfill as specified in 210.

E. Reinstall Signs. When indicated, store and reinstall or relocate signs that were previously removed under 203. Protect signs during removal, transport, and storage to prevent damage. Ensure that no more than 2 signs are stacked horizontally. Vertically store and ship when there are more than 2 signs. Repair or replace damaged signs.

Reinstall signs with new hardware and posts. Install sign brackets and brace angles if applicable.

616.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

- Signs will be by the square foot to the nearest 0.1 square foot. The sign area is the rectangular shape that encompasses the sign panel, except for triangular signs, which will be by a triangular shape.
- Breakaway steel sign posts will be by the pound, exclusive of galvanizing.
- Breakaway wood sign posts will be by the thousand feet board measure (MFBM), installed.
- Sign brackets and brace angles are measured by the pound, exclusive of galvanizing.
- Breakaway steel sign post installation, including foundations, hardware, and breakaway base assembly, will be per each.
- Overhead sign bridges, cantilever sign structures, and tee sign structures, including foundations, will be per each.

616.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Signs, Type ____	SF
Breakaway Steel Sign Posts, Type ____	lb
Sign Brackets and Brace Angles.....	lb
Breakaway Wood Sign Posts, Type ____	MFBM
Breakaway Steel Sign Post Installation Type ____	Each

Overhead Sign Bridge, Cantilever Sign Structure,
or Tee Sign Structure..... Each
Reinstall Signs Each

Covering and uncovering signs will be at no additional cost to the Department.

When reinstalling signs, pay for new posts, post installation, and new sign brackets and brace angles with the respective pay items.

SECTION 617 – DELINEATOR AND MILEPOST ASSEMBLIES

617.01 Description. Provide and install delineator and milepost assemblies.

617.02 Materials. Provide materials as specified in:

Nonstructural Concrete.....	509
Rigid Posts for Delineators, Snow Poles, and Mileposts	708.16
Sheet Aluminum	708.27
Retroreflective Sheeting	712.02
Silk Screen Opaque Inks	712.07
Silk Screen Transparent Inks.....	712.08
Flexible Posts for Delineators	712.10

Delineators may have rigid or flexible posts. Use rigid posts if snow poles will be installed.

Use Class 30 concrete.

617.03 Construction Requirements. Set delineators and mileposts plumb. Submit the manufacturer’s written installation instructions for flexible delineator posts.

If the milepost location is within 50 feet of an established delineator, remove the delineator.

A. Delineator Assemblies. Delineator types 1, 2, 3, or 4 consist of a delineator post and a delineator.

Delineator types 5, 6, 7, or 8 consist of a stub post and a delineator for installation on concrete barrier.

Delineator type 9 assemblies vary in shape and may be attached to concrete barrier, to guardrail posts, or to W-beam guardrail. Attach in accordance with the manufacturer’s written installation instructions. Submit the manufacturer’s written instructions before installation.

Attach sheet aluminum with retroreflective sheeting to rigid posts. Attach retroreflective sheeting to flexible posts. Use Type IV or higher retroreflective sheeting.

B. Milepost Assembly. A milepost assembly consists of a concrete foundation, post, and milepost sign. If a precast foundation is used, dig the foundation hole to a dimension larger than the concrete foundation and then backfill and tamp using approved material.

617.04 Method of Measurement. The Engineer will measure acceptably completed work per each.

617.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Delineators, Type ____	Each
Mileposts, Type ____	Each

SECTION 618 – MARKER POSTS, WITNESS POSTS, AND STREET MONUMENTS

618.01 Description. Provide and place posts for right of way, reference and project markers, witness posts, and street monuments.

618.02 Materials. Provide concrete for the posts and street monuments as specified in [509](#). Use white portland cement for project markers.

After the project markers have dried thoroughly, add the letters using 2 coats of an approved black paint. Allow the first coat to dry thoroughly before applying the second coat.

If light weight aggregates are used, provide aggregates in accordance with ASTM C330.

Provide brass caps as specified in 708.28.

Provide steel witness posts as specified in 708.16, except the holes may be omitted.

Provide cast iron casings that meet the requirements of AASHTO M 306. An approved equal for the cover and casting is acceptable.

Provide wood witness posts of cedar or fir that are well seasoned, straight, and sound. Treat the posts as specified in 710.

Paint wood witness posts white with 1 coat of Formula No. 6 and 2 coats of Formula No. 11 as specified in 627.03.

Provide fiberglass witness posts that are single piece markers capable of simple, permanent installation by 1 person using a manual driving tool, and resist displacement from wind and vehicle impact forces when properly installed. Provide posts that are a constant “T” cross-section design, which provides a flat surface for sheeting application, and a reinforcing rib incorporated longitudinally along the back midsection to provide structural rigidity. Put a point on the bottom end of the markers for easier ground penetration.

Provide fiberglass witness posts complying with the properties in Table 618.02-1.

Table 618.02-1 – Fiberglass Post Criteria

Property	ASTM Test Method	Minimum Value
Ultimate Tensile Strength	D638	20,000 psi
Specific Gravity	D792	1.7
Weight Percent Glass Reinforcement (Ignition Loss)	D2584	50 percent
Barcol Hardness	D2583	47

Fabricate fiberglass witness posts of a durable, UV light resistant, continuous glass fiber and marble reinforced, and thermosetting composite material that is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40 °F to 140 °F. Color the posts uniformly throughout the entire cross-section. Incorporate ultraviolet resistant material to inhibit fading or cracking of the markers on field exposure. Ensure the markers exhibit negligible color fading after 2,000 hours in accordance with ASTM G26.

618.03 Construction Requirements. Set right of way markers, reference markers, witness posts, and street monuments as specified. Make markings and file recordings under the supervision of an Idaho licensed PLS when required by [55-19 Idaho Code](#), [55-16 Idaho Code](#), or [IDAPA 10.01.03](#). Separate payment will not be made for endorsements or filing fees when work is specified for contract surveying. Mark right of way and centerlane monuments with station and offset.

Excavate hole of sufficient size to permit adjustment of the marker post to the lines required. Align the posts as directed and backfill the hole with suitable material. Carefully tamp in place.

Give the upper 3 feet of the posts for project markers and the upper 12 inches of the posts for right of way markers a rubbed surface finish as specified in 502.03.I. Cure for a minimum period of 14 days before use.

Place the brass cap in a casing with cover in heavy traffic areas.

618.04 Method of Measurement. The Engineer will measure acceptably completed work per each.

618.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Project Markers	Each
Right of Way Markers.....	Each
Reference Markers.....	Each
Witness Posts	Each
Street Monuments.....	Each

SECTION 619 – ILLUMINATION

619.01 Description. Provide and install illumination of one of the following types:

1. Type 1. Multiple circuit, LED sign lighting.
2. Type 2. Multiple circuit, LED street lighting.

Installations may include electrical conduit, wiring, luminaires, poles, pole foundations, and electrical equipment necessary for the construction of a complete lighting system.

619.02 Materials. Provide materials that bear the seal of approval of the Underwriters Laboratories, Inc. (UL), National Electrical Manufacturers Association (NEMA), or other approved testing organizations. Materials must also meet the NEC and local codes and requirements of the connecting utility.

Provide materials as specified in:

Concrete	502
Nonstructural Concrete	509
Illumination Poles and Bases	708.19
Service Poles for Illumination	710.06
Pole Keys	710.07
LED Luminaires	713.01
Rigid Steel Conduit	713.03
Plastic Conduit	713.04
Concrete Junction Boxes	713.05
Composite Junction Boxes	713.06
Electrical Conductors	713.07

Illumination pole foundations require structural concrete as specified in 502.

Electrical service pedestal foundations require nonstructural concrete as specified in 509.

Submit a list of proposed equipment and materials for approval. For each item listed, include manufacturer's name, size, and catalog number.

Submit nonstandard pole design for approval before use.

619.03 Construction Requirements. Provide work that meets the NEC and local codes and requirements of the connecting utility.

Where soil conditions allow, excavate for pole foundations to the neat lines of the foundation, and place the concrete directly against the sides of the excavation. Where soil conditions prohibit this, form the foundations and place the concrete as specified in 502.

Place backfill and compact as specified in 210.

A. Conduit Installation. Resurface with material equal to that removed.

Place underground conduit at least 24 inches below the finished surface. Ensure underground conduit does not conflict with poles, guardrail or posts, sign foundations, other underground utilities.

Provide rigid steel conduit for exposed service conduit.

Attach conduit to utility company poles as directed by the utility company.

Use standard factory fittings (e.g., elbows, bends, tees, couplings) throughout the conduit runs.

Make turns in conduit runs by bending the conduit without kinking or flattening by using the largest radius practical or by using standard factory fittings.

Obtain approval of conduit installation before backfilling.

Separate conduit runs with at least 3 inches of sand or soil cushion.

Place underground hazard tape in the fill 12 inches above conduits. Provide tape for AC electrical circuits that is red in color, 6 inches wide and has the legend "Caution Caution Caution Electrical Line Buried Below" imprinted in black. Provide tape for low voltage or fiber optic cable that is orange in color, 3 inches wide, and without legend.

1. Rigid Steel Conduit. Cut conduit ends square and ream well to remove burrs and rough edges. Thread and cap conduit ends with standard conduit caps until wiring installation is started. When the caps are removed, provide the threaded ends with insulated metallic conduit bushings.

Install expansion fittings with at least 4 inches of expansion per fitting, where conduit crosses an expansion joint in a structure.

When the trench bottom consists of unsuitable material (e.g., rock, hardpan), place conduit on at least a 3-inch bedding of tamped sand or soil.

Provide backfill that passes a 3-inch screen.

2. Plastic Conduit. Securely fasten conduit joints together by solvent welding. Bend conduit carefully to avoid damage and without using an open flame. The Department requires elbows, risers, and bends greater than 45° to be rigid steel.

To allow for expansion and contraction of plastic conduit during installation of long runs, leave 1 end unconnected, or insert an O-ring expansion coupling near 1 end of the run until final covering of the conduit is in progress.

Cap free ends of conduit to prevent the entry of moisture, dirt, or rocks.

Place conduit on at least a 3-inch bedding of tamped sand or soil. Backfill with sand or soil, without rocks or hard lumps, to a compacted depth of 6 inches above and 6 inches to each side of the conduit. The remaining cover over the conduit will pass a 3-inch screen.

B. Junction Boxes. Place at least 6 inches of clean sand and gravel, $\frac{3}{4}$ inch maximum, under junction boxes for drainage.

Place junction boxes subject to traffic loads on a concrete base.

Ensure the outside dimensions of the concrete base is 6 inches larger than the outside dimensions of the junction box with at least a thickness of 4 inches and a drain hole approximately 4 inches in diameter through the center of the base.

Do not install the concrete base until conduits under the base have been installed, backfilled, and compacted as specified in 210.

Ensure the top of the box is 1 inch above the surrounding ground elevation or is flush with the surrounding surface when located in a sidewalk or roadway.

C. Conductors. Before proceeding to pull wire in underground conduit runs, clean dirt or accumulations of moisture from conduit runs. Use powdered soapstone, talc, or other approved lubricants when inserting conductors in conduit.

Splice conductors using approved connectors. Do not splice conductors except in pole bases or junction boxes.

Interconnect poles on an underground service system and attach to the service ground by means of a No. 8 American wire gauge (AWG) THWN soft-drawn stranded copper wire.

D. Poles. Fit each anchor bolt with 1 leveling nut and 1 washer below the base plate and 2 nuts and 1 washer above the base plate. Ensure leveling nuts with washer bear against the underside of the base plate before tightening the top nuts. Tighten the lower top nut beyond snug-tight as presented in Table 619.03-1.

Table 619.03-1 – Nut Rotation Beyond Snug-Tight

Anchor Bolt Diameter (in)	F1554 Grade 36	F1554 Grades 55 and 105
< or = 1.5 inch	1/6 turn	1/3 turn
> 1.5 inch	1/12 turn	1/6 turn

After the lower top nut has been tightened, tighten the upper top nut against the lower top nut snug-tight.

Attach slip base breakaway devices to the foundation anchor bolts with hex nuts and flat washers. Connect the lighting standard to the slip base with high-strength bolts with hexagon nuts and plate washers. Use a plate to keep the bolts in the proper position. Torque the bolts in accordance with the manufacturer’s written instructions.

Install the support coupling device in accordance with the manufacturer’s written instructions. Plumb each pole after pole-mounted items and service conductors are in place. Level luminaires in accordance with the manufacturer’s written instructions after the pole has been placed.

Surround the support couplings with an aluminum skirt fastened with stainless steel sheet metal screws.

If it becomes necessary to drill a hole or if the galvanizing is damaged before or during installation, thoroughly wire brush the exposed metal to remove loose and cracked spelter coating, then paint the cleaned area with 2 coats of Formula No. 14 as specified in 707.

E. Field Testing. The Department will require field testing for 14 consecutive days of normal operation. Give written notice to the Engineer when the lighting system is complete and before starting the field test.

619.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

619.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Illumination, Type ____	LS

Excavation, backfilling, surfacing, and materials are incidental and the cost included in the illumination contract pay items.

SECTION 620 – PLANTING

620.01 Description. Provide and plant live cuttings, seedlings, and container plants including trees, shrubs, vines, and ground cover as specified.

620.02 Materials. Provide an equal mix of live cuttings, seedlings, container plants, or combinations of and obtain plants except live cuttings, from a local or regional Idaho vendor. The supplier must hold a current and valid Idaho seller/dealer's license. Certify plants are true to genus and species. Substitutions of other genus or species will not be approved. Match the existing species composition of the surrounding vegetation for species to be planted within wetland areas. Provide materials as specified in:

Topsoil.....	213.02
Plants.....	711.06
Commercial Fertilizer.....	711.07
Soil Conditioner.....	711.08
Mulch.....	711.10
Irrigation Water.....	711.13
Seeding and Vegetation Special Guaranty.....	107.21

620.03 Construction Requirements. Perform planting operations between September 15 and May 15, when ground is not frozen and take advantage of favorable planting conditions unless otherwise approved.

Clear and remove only vegetation as necessary for construction operation. Grade and level area(s) to be planted before staking or marking planting locations. Mark out and stake tree locations and the general planting area layouts for shrubs, vines, and ground cover. Do not begin planting until the tree locations and planting site general layouts are approved.

Cultivate planting areas for shrubs and vines to at least 4 inches deep. Remove and dispose of weeds and other vegetative growth, rocks larger than 1 inch, and other debris encountered in the cultivating work.

When excavating holes for planting, keep topsoil separate from subsoil and make loose and friable. Remove and dispose of soils containing a pH greater than 8 or less than 5, stones greater than 1 inch, or other detrimental material encountered in the excavation. A soil auger may be used if approved. Adequately barricade excavated planting holes that are left open when the work is not in progress with appropriate warning devices. Sufficiently roughen glazed surfaces inside planting holes before backfilling.

Have the Engineer inspect all plants before planting and determine if plants are acceptable.

Install plants approximately 6 feet on-center in a random pattern as specified after completing final grading and seedbed preparation requirements. Install plants during their dormant stage and allow container plants to remain dormant through the winter. Provide adequate and proper care of plant materials. Adequate and proper care includes keeping plant materials in a healthy, growing condition by appropriate handling, storing, watering, cultivating, pruning, and spraying.

If planting during other seasons is permitted, apply approved organic wetting agents or antitranspirants in accordance with the manufacturer's written instructions at no additional cost to the Department. Do not apply wetting agents or antitranspirants after April 15.

A. Containerized Plant Requirements. Remove soil equal to the dimensions of the container and remove the plant from the container without damaging roots, stems, or leaves. Mix soil conditioner into 6 inches of loose topsoil in the bottom of planting holes, but do not mix with the soil to be used in backfilling. Use approximately 1 cubic foot

of soil conditioner per tree and 0.5 cubic feet of soil conditioner per shrub or vine, or as directed. Place the plant in the hole with soil just above the root crown, and firm the ground around the plant.

Bare-Root Plant Requirements. Mix soil conditioner into 6 inches of loose topsoil in the bottom of planting holes, but do not mix with the soil to be used in backfilling. Install bare-root plants before the leaves open or new needles have started forming. Place the plant in the hole and spread out their roots in a natural position, without bunching, kinking, or circling. Carefully place soil in the hole, filling in over the root system to just above the root crown, and firm the ground around the plant.

B. Backfilling and Finishing. Fill holes and cavities between plantings and the surrounding soil with topsoil. In their final position, plant the plants to the depth of the root collar or to the depth of the finished grade when grown in the nursery or container. After planting is completed, re-cultivate the soil surface to a depth of 2 inches or more. Finish grading planting areas after the soil has settled.

Incorporate commercial fertilizer uniformly into the soil surface around trees and shrubs in accordance with the manufacturer's written instructions.

Apply mulch around the newly planted plants immediately after planting work in each area is complete and the ground is smooth and clean. Place mulch 2 to 3 inches thick. Cover the entire area of shrub and vine root systems as well as around trees.

Promptly clean up and dispose of soil, discarded branches, rejected plants, or other debris (e.g., twine, rope, transit guards, wrappings). Remove mulch from plants, structures, roadway areas, and grassed areas not to be covered.

Thoroughly water trees, shrubs, vines, and ground cover during and immediately after planting. Repeat watering as often as necessary until the work is accepted. Prevent areas from puddling on top of the soil surface and avoid compaction around the plants after watering.

Obtain water without charge from state-owned or state-controlled water supply systems, if such exist; otherwise obtain water at no additional cost.

Prune trees and shrubs when planting and remove broken or damaged twigs, branches, or roots in a manner that retains or encourages natural growth characteristics. Paint cut surfaces with a diameter of 1 inch or greater immediately with approved tree wound dressing.

If herbicides are used to control weeds, replace and maintain plants and lawn damaged by its use at no additional cost.

At completion of the original planting, the Engineer will perform an inspection with the Contractor of plant material to note and correct discrepancies. Remove and replace dead plants. Leave plants that do not show expected growth, but have green leaves, stems, or buds and the Engineer will inspect again during the plant establishment period.

After the original planting, the Engineer will periodically inspect the condition of plants and planting areas and identify apparent defects, faults, conditions, and dead plants discovered by the inspection. Correct apparent defects, faults, conditions, and remove, dispose and replace dead plants within 10 calendar days after notification or as directed.

If infestation by insects or disease occurs, treat plants using effective remedial measures that are good horticultural practices and in accordance with BMPs.

Install temporary fence material around wetlands and areas to be protected from wildlife as specified in 610.

Ensure planting establishment by watering, cultivating, replacing plants or mulch, and other work necessary to maintain the plants in a healthy condition, throughout the 1-year plant establishment period.

If immediate replacement of dead or rejected plants is impossible due to seasonal conditions or the lack of specified plants, place a marker at the plant replacement location and replace plants during next planting season.

The Department will require a plant establishment period of 1 year for replacement plants. Ensure the establishment of the new plantings as specified.

Submit a contingency spill and prevention plan with emergency actions to be taken in the event of a spill. Prevent petroleum products, chemicals, or waste materials from dumping or entering waterways and wetlands.

620.04 Method of Measurement. The Engineer will measure accepted and completed work as follows:

1. Plants, trees, shrubs, vines, or ground cover of the specified sizes and kinds will be by each.
2. Fertilizer will be by the ton or hundred-pound weight (cwt).
3. Soil conditioner will be by loose cubic yard, using the manufacturer’s certification of loose cubic yard when bagged or balled.
4. Topsoil will be by the cubic yard.
5. Mulch will be by the cubic yard or ton.

620.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Topsoil	CY
Mulch	CY or Ton
Planting Trees (Seedlings or Container)	Each
Planting Shrubs (Bare-root or Container)	Each
Planting Vines (Bare-root or Container)	Each
Planting Ground Cover.....	Each
Fertilizer (Commercial).....	Ton or cwt
Soil Conditioner.....	CY

The cost of temporary irrigation water and temporary fence material are incidental.

The Department will make progress payments for plants at 80 percent of the contract unit price at original planting completion. The Department will pay the remaining 20 percent at plant establishment period completion and after defective plants have been replaced, if applicable.

SECTION 621 – SEEDING

621.01 Description. Apply seed, including seed bed preparation, fertilizing, seeding, mulch mixtures, mulching, mulch anchoring (mechanical or tackifiers), HECPs, erosion blankets, and watering in the areas.

The Department may require seeding operations in conjunction with 212.

621.02 Materials. Provide materials as specified in:

Topsoil	213.02
Seed	711.05
Commercial Fertilizer	711.07
Mulch	711.10
Rolled Erosion Control Product (RECP)	711.11
Turf Reinforced Mat (TRM)	711.12
Water	711.13
Mulch Tackifier	711.16
Mulch plus Tackifier	711.17
Mulch Mixture	711.19
Hydraulically Applied Erosion Control Product (HECP)	711.22
Seeding and Vegetation Special Guaranty	107.21

621.03 Construction Requirements.

A. General. Perform seeding operations as specified.

Perform seeding during the season(s) specified, except for seeding used as a temporary erosion and sediment control measure.

Inspect areas within the project site and identify noxious weeds present or which weeds are most likely to be found on the project site and include treatment recommendations. Treat material used as specified throughout the growing season, and up to 2 weeks before transporting to the project site and seeding applications. Obtain approval for all products before use.

Use mechanical (drill) seeding on areas with 3H:1V slopes or flatter and areas without excessive rock, gravel, or hardpan soil. Apply fertilizer, seed, and mulch in separate operations, one following the other in this order, with the exception that fertilizer may be applied with a fertilizer attachment at seeding time or with water when watering is specified, or as otherwise approved. Perform cultivating, tilling, and drill seeding operations in a cross-slope direction (horizontal) and ensure furrows remain open.

Use broadcast seeding or hydroseeding applications on areas with slopes steeper than 3H:1V or areas where a mechanical seeder cannot reach. Perform hydro-applications with approved combinations of seed, fertilizer, soil amendments, mulch mixtures, mulching, mulch anchoring (tackifier), and hydraulically applied mulch with hydro-application equipment and equipped with appropriate centrifugal pump and engine size, paddle-type mechanical agitation, and independent liquid bypass circulation capable of handling and applying a thick homogenous slurry.

Perform seeding and placement of soil conditioner, mulch, fertilizers, tackifiers, or other soil amendments between March 15 and April 30, October 15 and November 15, or as approved. When seed application during autumn does not establish well, reseed the area after April 1 and when the soil is not frozen.

Perform seeding before mulch, tackifiers, or erosion control blanket product installation. Seeding may occur after conduit work progresses and the topsoil is in final placement within the seeding time period, provided the soil is not frozen.

All mulch and soil conditioners are required to be certified noxious weed-free by the Idaho State Department of Agriculture (ISDA) or other state accredited laboratory.

B. Seedbed Preparation. Maintain areas to be seeded visibly free of weeds throughout the growing season using mechanical or hand-pulling methods, or by applying appropriate chemicals, or combinations until seeding time. Keep weeds from going to seed. Apply chemicals for treating weeds by a current licensed applicator and as specified in 107.20.

Minimize ground disturbance using the least intrusive construction techniques practicable. Cultivate areas to be drill-seeded at least 3 inches deep. Work the soil to obtain a surface that permits proper operation of drill seeding equipment.

Leave slopes in a rough condition after final grading and before seeding, or mulch or soil amendment applications. Seedbed preparation (e.g., raking, mechanical roughening) is required as specified or as approved. Do not apply the mulch, mulch mixture, or soil amendment to smooth slopes.

In all areas to be broadcast or hydroseeded, rake or mechanically roughen the soil at least 2 inches deep and leave in a rough condition immediately before applying seed, mulch, or soil amendments, similar to that obtained by walking a cleated-crawler tractor up and down the slopes. Where slopes are benched or serrated, the Department will not require additional preparation.

In areas subject to severe erosion, ensure the seedbed preparation limits do not exceed the area on which the entire seeding and mulching can be applied within 1 day. If conditions occur that prevent seeding at specified furrow depths, or if the roughened condition is destroyed, prepare the seedbed again at no additional cost.

C. Fertilizing (Commercial). Provide the fertilizer type and application rate as specified. Apply fertilizer by the most appropriate of the following methods:

1. Fertilizer drill.
2. Broadcast.
3. Water applied.

Collect random samples from a minimum of 3 different locations and thoroughly mix and homogenize the samples into a single composite sample. Sample all changes in the soil (e.g., color, texture).

Obtain a representative composite sample and submit for testing 2 months before final placement and seeding application to determine soil pH, nutrients, and organic materials present. Provide a soil analysis by an NAPT-PAP-accredited laboratory to determine fertilizer and organic materials (e.g., mulch, compost) required to amend the soil.

Obtain a soil analysis report with recommended soil amendments to be added to the soil before beginning subsequent revegetation activities.

Apply approved fertilizers, soil amendment products, and organic material as listed on the QPL, at seeding time and applied in accordance with seeding plans or at the manufacturer's written rate. The application rate and timing of fertilizer application will be as specified or as recommended and approved.

Add and lightly incorporate the specified fertilizer ingredients, soil amendments, and organic material as recommended into the top 6 inches of the topsoil and uniformly distribute to the areas to be seeded before subsequent revegetation activities as specified in this section and 621.03.B.

For slopes steeper than 3H:1V or where hydroseeding is specified, uniformly distribute the specified ingredients and organic material onto the soil surface by hydroseeding method. Fertilizer components and/or organic materials may be added to the mulch mixture and applied during the hydroseeding application.

For slopes 3H:1V or flatter, dry fertilizers may be applied directly to the soil and lightly incorporated into the soil surface, followed by the seed application. Apply fertilizer when average noontime temperatures are 60 °F or lower on established stands.

Wherever physically possible, place fertilizer with the seed when mechanical (drill) seeding using a fertilizer attachment. Fertilizer may be broadcast (wet or dry) or with a fertilizer drill attachment. Fertilizer may be applied with irrigation water as approved.

D. Seeding. The Contractor will provide seed unless otherwise specified. Apply seed using hydroseeding or a mechanical seeding method on all disturbed areas.

Before seeding begins, take steps to mechanically break up materials previously placed for the purpose of temporary soil stabilization and erosion control to the Engineer's satisfaction. If seed is applied using broadcast seeding or hydroseeding methods, rake the soil before applying seed, fertilizers, mulch, and soil amendments.

The Department will provide seed at no cost to the Contractor unless otherwise specified. Use the specified seeding mix and application rate. Apply native shrub and forb species separately from grass species. In separate applications, apply seed, fertilizer, and mulch. Do not mix fertilizer with the seed in the hydro-seeder unless otherwise approved. Apply seed to the seeding area first, followed by the fertilizer and mulch application second.

Apply seed uniformly by the most appropriate method (as determined by slope, soil, or site conditions) using one of the following methods:

1. Mechanical seeding (no-till drill, double disc with agitator or spinning disc) for 3H:1V slopes or flatter.
 - a. Set drill rows according to the seed species size and dimension. Ensure drill spacing does not exceed 9 inches. Set drill depth according to the seed size and dimension, not to exceed 1-inch depth, and place seed on the furrow bottom.
 - b. Regulate the seed drill speed and spring pressure so ½ inch of soil covers the seed and the furrows are left open. Do not use drag chains.
 - c. When mulch is applied or used after mechanically seeding, place seed just below the soil surface and cover well.
 - d. Do not perform seeding when soil is too wet or too dry, frozen or otherwise untiltable, or when wind or rain interferes with mulch or seed placement.
 - e. Broadcast native seeds immediately ahead of the drill or seed separately. Seed legume seed through a separate box from the grass seed, with seed spouts out, or broadcast ahead of the drill. Thoroughly mix seed before placing in the drill or seeder box.
 - f. If area is impractical for mechanical seeding, broadcast the seed using a hydroseeder or dry broadcast equipment.
 - g. Do not allow trucks or equipment to drive on the area after seed is in place.
2. Broadcast seeding.
 - a. Dry (whirlwind or hand broadcast) for embankment slopes or cut slopes steeper than 3H:1V or as approved.
 - b. Hydroseeder. Perform hydroseeding in 2 steps:

- (1) The Contractor may incorporate up to 5 percent of the total hydroseeding mixture with the seed to allow for easy application. Add all seed including grass and forb species to the hydroseeding mixture within 10 to 12 minutes of completing the hydroseeding application.
- (2) Apply the remaining mulch mixture, fertilizer, and soil amendments to the entire area. Uniformly apply the mulch mixture in a thick, homogenous slurry by hydro application equipment. Apply the mulch mixture at a rate of 1,000 gallons of water per acre or as approved. Apply the hydroseeding mixture from opposite directions to achieve complete coverage.

When seeding areas greater than 1 acre, use appropriate equipment including a tank size with a minimum working capacity of 800 gallons. Use pump capable of pumping the specified mulch mixture at the full mix rate recommended by the manufacturer. The pump should provide a minimum discharge capacity of 105 pounds per square inch and 275 gallons per minute. The engine should be capable of handling, mixing, and discharging a thick slurry up to 100 feet. Equip the mixing tank with a paddle-type agitation system designed for maximum mixing extending the full length of the tank and supported at each end with an independent liquid bypass circulation.

Ensure seed agitation time in the hydroseeder does not exceed 12 minutes.

Do not apply hydroseeding mixture if rainy conditions are anticipated or outside the manufacturer's written application instructions. If unanticipated rainy conditions occur, re-apply the hydroseeding mixture to uncured areas as directed and at no additional cost.

Hydraulically apply seed to the soil surface. Spray each application from 2 opposing directions to achieve complete coverage. Do not perform seeding or mulching applications when wind interferes with seed placement.

The Engineer and the Contractor will inspect the finished seeded and mulched slopes to ensure complete coverage has been met. If adequate coverage has not been achieved, re-seed and re-apply soil amendments, tackifiers, and mulch on the inadequately covered areas.

E. Mulch, Mulch Anchoring, and Hydraulically Applied Erosion Control Products.

Apply weed-free organic mulch, soil amendment, and soil binder (tackifier) to disturbed areas on slopes 3H:1V and steeper after seed has been applied to the soil surface within 14 calendar days as specified. Supply supported documents including proof of equivalent revegetation abilities in the form of test results obtained by independent peer-reviewed research efforts for similar landforms, soil types, aspect, climate, and elevation. Do not perform mulching when wind interferes with mulch placement. Apply straw, grass hay, wood fiber, soil amendments, mulch mixture, or any combination of these materials as directed. Ensure material applied to the ground allows for the absorption and percolation of moisture.

Apply mulch so the underlying soil is not visible.

1. Mulch. Do not use hydro-mulch applications on slopes flatter than 3H:1V or in conjunction with drill seeding applications. Do not perform mulching when wind interferes with mulch placement. Apply straw, grass hay, wood fiber, soil amendments, mulch mixture, or combination of these materials as directed. Ensure material applied to the ground allows for moisture absorption and percolation.

Apply at the following rates:

- a. Straw or grass hay (air dry).....2 Ton/Acre
- b. Wood fiber.....1 Ton/Acre
- c. Soil amendments.As specified

2. Mulch Anchoring.

- a. Mechanical. Use mechanical mulch anchoring on 3H:1V slopes or flatter as directed. Use a heavy disc with flat scalloped discs approximately ¼ inch thick, having dull edges, and spaced at least 9 inches apart to anchor mulch into the soil. Ensure anchoring to a depth of at least 2 inches with no more than 1 equipment pass on the same surface.

Install mechanical anchoring in a horizontal direction to the slope.

- b. Tackifier. Supply an organic, biodegradable, non-polluting, non-volatile, and non-toxic tackifier that is transparent, flexible, water soluble, retains flexibility after curing, and makes a porous lattice-like membrane structure within the upper soil layer. Obtain tackifier products listed on the QPL.

Apply tackifier to stabilize slopes 3H:1V and steeper. Anchor mulch using a tackifier applied in accordance with the manufacturer's written instructions and at a rate appropriate for the material, soil types, conditions, and degree of slope. Apply tackifier and mulch with seed as specified or as directed.

Ensure tackifier product does not inhibit water, oxygen or seed growth, or leave undesirable residues in the soil. Ensure tackifier does not re-emulsify once cured (by drying) and is effective with acidic or alkaline soils.

If applied separately, incorporate a method to differentiate between the tackifier and mulch material, by color or tracer material, during tacking operations. Do not apply tacking when wind interferes with tackifier placement.

3. Hydraulically Applied Erosion Control Product (HECP). Hydraulically apply mulch and tackifier that contains a qualified protein-rich nutrient source, weed-free organic mulch, biological soil stimulant, and humic substance on slopes steeper than 3H:1V during the seeding time period.

Apply seed as specified in 621.03.D or as otherwise directed.

Provide a mixture that is nontoxic to animals, soil microorganisms, and aquatic and plant life, and that does not interfere with or impede seed germination or vegetative growth and establishment.

Apply mulch so the underlying soil is not visible.

The application rate for the mulch, tackifier, or mulch and tackifier mix will be as specified by the manufacturer for the slope gradient and soil conditions.

- a. Hydraulic Mulch. Mix and apply the mixture in accordance with the manufacturer's written instructions and at a rate for the soil type, surface roughness, conditions, and slope steepness.
- b. Stabilized Mulch Matrix. Mix and apply the mixture in accordance with the manufacturer's written instructions and at a rate for the soil type, surface roughness, conditions, and slope steepness.
- c. Fiber Reinforced Matrix. Mix and apply the mixture in accordance with the manufacturer's written instructions and at a rate for the soil type, surface roughness, conditions, and slope steepness.
- d. Bonded Fiber Matrix. Apply a hydraulic mixture of a qualified protein-rich nutrient source, weed-free organic mulch, biological soil stimulant, and humic substance soil amendment, and soil binders to 3H:1V and steeper slopes after seed has been applied. Mix and apply the mixture in accordance with the manufacturer's written instructions at a rate for the soil type, surface roughness, conditions, and slope steepness.

Furnish a QPL-qualified hydraulic mixture, with a cover factor meeting large scale testing of less than 0.01 coverage (not to exceed 0.05 percent coverage), meeting ASTM D7322 (600%-800%) and having a functional longevity of 6 to 12 months (minimum of 12 months for 2H:1V slopes or

steeper). Submit testing documentation, including proof of equivalent revegetation abilities, in the form of test results by independent peer-reviewed research efforts for similar landforms, soil types, aspect, climate, and elevation. Thermally process wood fiber products (within a pressurized vessel) within 3 percent of 80 percent.

Provide a QPL-listed tackifier or an approved tackifier that is transparent, flexible, retains flexibility after curing, water soluble, and makes a porous lattice-like membrane structure within the upper soil layer. The tackifier product cannot inhibit water, oxygen, or seed growth and must be able to stabilize 2H:1V slopes or steeper. The tackifier will be organic, biodegradable, non-polluting, non-volatile, non-toxic, and leave no undesirable residues in the soil. The tackifier is not allowed to re-emulsify once cured (by drying) and will be effective in acidic or alkaline soils. Apply tackifier and mulch with seed as specified or as directed.

F. Erosion Blankets.

1. Rolled Erosion Control Products (RECP). Install RECPs on slopes in vertical direction and in accordance with the manufacturer's written instructions or as approved.
2. Turf Reinforced Mat (TRM). Install TRMs in accordance with the manufacturer's written instructions or as approved.

G. Watering. Provide a temporary water delivery system by using sprinklers or trucks.

Apply water by the acre unit (AU). Keep pipe connections tight to avoid leakage and washing. Maintain sprinklers in proper working order. If runoff begins, stop watering and apply the balance after earlier water has penetrated the soil. The standard application rate is 16,000 gallons per acre, which constitutes the estimated water quantity that will saturate the soil to a 4-inch depth under average conditions.

The Engineer will inspect for the 4-inch saturation depth by excavating to a depth of 4 inches and observing wetness. The wetness inspection locations will not be in "slick spots" or in unrepresentative areas.

Apply water on seeded and stabilized areas until vigorous growth is established as determined by the Engineer. Ensure there is no damage to plantings or seeded areas. Obtain method and equipment approval before applying water to any plantings, seeded areas, or mulching applications.

Apply water using tanker or water tank with pump, hose, and approved nozzle apparatus (water dispersion). The spray head must deliver a fine mist which will not damage plants or the mulch and tackifier.

Seeding performed between May 30 and September 15, whether for permanent or temporary erosion control, will require irrigation until growth has been established.

If the project has a mitigation area, install irrigation systems before seed and mulch are applied.

Obtain approval before use of irrigation water by tanker, pump, hose, and spray head. The spray head must provide a fine mist that does not damage plants or the erosion control blanket.

H. Performance Standard and Acceptance. Revegetated areas will be inspected at installation completion. If adequate coverage was not achieved, the Contractor will be required to re-seed and re-apply soil amendments and/or tackifier on seeded areas. The Engineer will make a final inspection and acceptance 1 year following seeding completion. The Contractor will request the inspection at least 10 calendar days in advance.

621.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. For determining areas, measurements will be taken parallel to the slope.
2. Seedbed preparation will be by the acre.

3. Seeding, mulching, mulch anchoring, soil amendment, mulch mixture, and fertilizing will be by the acre for each time this work is performed. Provide weight measurements to verify appropriate rates were applied.
4. Mulch plus tackifier will be by the acre or by the square yard for each time this work is performed.
5. HECs will be by the acre or by the square yard for each time this work is performed.
6. Rolled erosion control products and turf reinforced mats will be by the square yard.
7. Water delivery system will be by lump sum.
8. Watering will be by the acre unit. An acre unit (AU) is the water quantity required to saturate a 1 acre area to at least 4 inches deep.

621.05 Basis of Payment. The Department will pay for acceptable quantities as follows:

Pay Item	Pay Unit
Seedbed Preparation	Acre
Seed.....	Acre
Seeding.....	Acre
Mulching.....	Acre
Mulch Anchoring (Mechanical)	Acre
Mulch Anchoring (Tackifier).....	Acre
Soil Amendments	Acre
Mulch Mixture.....	Acre
Mulch plus Tackifier	SY or Acre
Hydraulically Applied Erosion Control Products	SY or Acre
Rolled Erosion Control Products	SY
Turf Reinforced Mat	SY
Fertilizing.....	Acre
Water Delivery System.....	LS
Watering.....	AU

Weed control is the Contractor's responsibility and is incidental.

If seeding is performed between May 1 and October 14, watering is incidental to seeding, and the cost included in the seeding contract unit price.

SECTION 622 – PRECAST CONCRETE HEADGATES

622.01 Description. Provide and install precast concrete headgates.

622.02 Materials. Provide material as specified in 509.

622.03 Construction Requirements. Shape the area to be occupied by the headgate to conform to the structure and to provide a firm and uniform bearing over its entire area. Backfill and compact the dike or ditch around the structure to avoid undercutting or erosion.

622.04 Method of Measurement. The Engineer will measure acceptably completed work per each, including 1 length of pipe in addition to the pipe cast in the headwall.

622.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
_____ Precast Concrete Headgate	Each

Structure excavation, backfill, and compacting backfill are incidental and the cost included in the precast concrete headgate contract unit price.

SECTION 623 – CONCRETE SLOPE PAVING

623.01 Description. Construct concrete slope paving around structures and on embankments.

623.02 Materials. Provide materials for concrete slope paving as specified in 509. Provide No. 5 coarse aggregate for those portions of slope paving designated as exposed aggregate. Provide Class 22 concrete for slope paving with 4 to 7 percent entrained air.

When colored concrete is specified, provide colorants and submit a color panel for approval.

Where exposed aggregate slope paving is specified, submit the method of obtaining the finish and an exposed aggregate panel for approval.

Provide preformed-expansion joint fillers as specified in 704.01. The Contractor may use sound cedar or redwood.

623.03 Construction Requirements. Construct as specified in 509.

Grade the slope paving area and compact to 90 percent density as specified in 205.

As soon as the desired exposed aggregate surface has been attained and washed, cure the concrete surface as specified in 509.

623.04 Method of Measurement. The Engineer will measure acceptably completed work by the square yard of finished surface, measured in the plane of the finished surface.

623.05 Basis of Payment. The Department will pay for the accepted quantities as follows:

Pay Item	Pay Unit
Concrete Slope Paving	SY

SECTION 624 – RIPRAP

624.01 Description. Provide and place riprap. The Department will specify riprap size and placing method.

624.02 Materials. Provide material as specified in:

Riprap..... 711.04

624.03 Construction Requirements. When required, excavate the toe trench for riprap below probable scour elevation or to the elevation specified. Excavate the trench 2 feet below channel grade where scour elevation cannot be determined and elevation is not specified. Start by placing a course of the largest stones in the toe trench. Do not lay stone until the toe trench and slopes are approved. Place riprap so the larger stones are in contact with each other and the voids are filled with the finer materials, producing a well-graded compact mass. Place the stone on the slope in a way that ensures the specified thickness in 1 operation. Do not disturb the underlying material when placing the riprap. Do not place in layers parallel to the slope.

624.04 Method of Measurement. The Engineer will measure acceptably completed work by the ton or cubic yard of riprap.

624.05 Basis of Payment. The Department will pay for the accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Loose Riprap.....	Ton or CY

The Department will pay for excavation of toe trenches below the level of the intersection of the slope to be riprapped and the adjacent final ground or channel floor as specified in 210.

Riprap/control geotextile will be paid for as specified in 640. Preparation of the slope to receive riprap above the level of the intersection of the slope to be riprapped and the adjacent final ground or channel floor is incidental and the cost included in the riprap contract unit price.

SECTION 625 – JOINTS

625.01 Description. Provide and install joint material.

625.02 Materials. Provide materials as specified in:

Pre-formed Expansion Joint Filler	704.01
Joint Sealer for Asphalt and Concrete Pavements	704.02
Hot Poured Elastomeric Type Concrete Joint Sealer.....	704.03
Neoprene Compression Seal.....	704.04
Silicone Sealant.....	704.05

625.03 Construction Requirements. Place pre-formed expansion joint filler accurately in the positions and to the lines and elevations specified. Firmly anchor the pre-formed expansion joint filler to the surface of the concrete on one side of the joint with 30-penny wire nails or 9-gauge wire cast into the concrete.

Mix and apply hot poured sealers as specified in the manufacturer's written instructions. Apply silicone sealant in accordance with the manufacturer's written instructions.

Clean Joints. Properly repair spalls or breaks before sealing. Install neoprene compression seals by first coating the sealer and/or the sides of the joint with the adhesive lubricant. Push the sealer down so it is at least ¼ inch and no more than ¾ inch below the surface of the bridge deck at the edge of the joint and at least ⅛ inch and no more than ¼ inch below the surface of concrete pavement at the edge of the joint. Install the joint material to extend from edge to edge of the slab in one continuous length. Do not stretch the sealer more than 8 percent of its original length during installation.

625.04 Method of Measurement. Not specified.

625.05 Basis of Payment. Providing the material and performing the specified work is included in the structure or pavement contract items.

SECTION 626 – TEMPORARY TRAFFIC CONTROL

626.01 Description. Provide, install, maintain, remove, and relocate temporary traffic control devices.

626.02 Materials. Provide material as specified in:

Guardrail and Concrete Barrier.....	612
Crash Cushions	613
Signs and Sign Supports	616
Pavement Markings.....	630
Retroreflective Sheeting	712.02

Ensure temporary traffic control devices are in acceptable or marginal conditions as defined in American Traffic Safety Services Association’s (ATSSA) Quality Guidelines for Temporary Traffic Control Devices and Features.

A. Temporary Traffic Control Signs. Provide temporary traffic control signs meeting 616.

B. Channelizing Devices. Provide weighted base tubular markers, surface-mounted tubular markers, vertical panels, drums, barricades, or other channelizing devices.

Provide weighted base or surface-mounted tubular markers that are at least 36 inches high and have at least 3 inches width when facing traffic.

Attach surface-mounted tubular markers with an adhesive in accordance with the manufacturer’s written installation instructions. Do not nail or bolt tubular markers to the pavement.

Provide barricades that have the following minimum lengths:

1. Type 1: 2 feet.
2. Type 2: 2 feet.
3. Type 3: 7 feet.

C. Temporary Pavement Markings. Provide temporary pavement marking tape or temporary waterborne paint pavement markings. When used, ensure temporary pavement marking tape is retroreflective, white or yellow, adheres to concrete or asphalt pavements with precoated with pressure-sensitive adhesive, 4 inches wide, and is capable of conforming to the pavement surface. When used for broken-line pavement markings, use 2-foot long line segments.

Provide 2-sided temporary flexible raised pavement markers when used on undivided highways. Install in accordance with the manufacturer’s written installation instructions.

Provide reflectorized rigid raised pavement markers for temporary applications. Provide 2-sided markers when used on undivided highways. Install in accordance with the manufacturer’s written installation instructions. Ensure that markers are removable without the use of heat, grinding, or blasting.

D. Floodlights. Provide floodlights capable of illuminating flagger stations, work areas, and equipment crossings with at least 5 foot-candles or greater. Ensure floodlights are equipped with a meter that records hours of operation.

E. Arrow Boards. Provide arrow boards with a meter that records hours of operation.

F. Portable Changeable Message Signs (PCMS). Provide portable changeable message signs with message sign, control system, power source, and mounting and transporting equipment components. Ensure that PCMS are equipped with a meter that records hours of operation.

G. Temporary Concrete Barrier. Provide temporary concrete barrier meeting 612.

Remove and Reset Temporary Concrete Barrier. Remove, store, and reset temporary concrete barrier. Store the removed barrier outside of the highway clear zone. Replace damaged sections of temporary concrete barrier. Provide temporary traffic control as specified in 626 until the temporary concrete barrier is reset.

H. Temporary Crash Cushion. Provide temporary crash cushions meeting 613. Provide test-level 2 or 3 temporary crash cushions when the highway posted speed is less than 45 mph. Provide test-level 3 temporary crash cushions when the highway posted speed is greater than or equal to 45 mph.

I. Truck Mounted Attenuator. Provide a truck mounted attenuator attached to a shadow vehicle. Provide test-level 2 or 3 truck-mounted attenuators when the highway posted speed is less than 45 mph. Provide test-level 3 truck mounted attenuators when the highway posted speed is greater than or equal to 45 mph.

J. Miscellaneous Temporary Traffic Control Items. Provide miscellaneous temporary traffic control items.

K. Flagger Equipment. Ensure flaggers wear high-visibility safety apparel and are provided a STOP/SLOW paddle.

L. Pilot Car. Provide a vehicle with a PILOT CAR FOLLOW ME sign mounted on the rear of the pilot vehicle. Show the company name of the pilot car contractor on both sides of the vehicle.

626.03 Construction Requirements. Do not use devices for purposes other than those for which they are intended. Cover or remove temporary traffic control devices when not applicable.

Ensure temporary traffic control devices are in acceptable or marginal condition, or repair or replace unacceptable devices, as defined in the ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features. Repair or replace devices that are unacceptable as defined in the ATSSA guidelines.

Ensure temporary traffic control devices remain in place and serviceable during the time their use is required. Provide weighted bases when necessary to ensure that channelizing devices remain in place.

Install temporary markings as soon as practical on newly placed pavements. For temporary pavement markings, omit the test strip when waterborne paint is used. Repair damaged markings.

Use temporary flexible raised pavement markers or temporary rigid pavement markers to supplement or as a substitution for other pavement markings. Use 2 markers placed side by side to mark double-width lines. The Engineer may require additional markers placed at a reduced spacing.

Remove surface-mounted tubular markers, temporary paving market tape, temporary raised pavement markers, and rigid raised pavement markers without damaging pavement surface.

Obtain approval before removing temporary traffic control. Return temporary traffic control devices provided by the Department.

Illuminate flagger stations, work areas, and equipment crossings when nighttime work is being performed. Provide floodlights 30 minutes before sunset and up to 30 minutes after sunrise when workers or operational equipment are present. Ensure floodlighting does not produce a glare condition for approaching road users, flaggers, or workers.

Provide an extra floodlight onsite for backup. When a flagger station is moved, use the backup floodlight to illuminate the new station.

Secure the PCMS control system with a lock and change the default control system password to prevent tampering.

Perform flagger control with certified flaggers. Certified flaggers have completed a flagger training course from a Department-approved source and carry a current certificate of training. Certifications issued by other state Departments of Transportation that have a reciprocity agreement with the Department are acceptable.

626.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Temporary traffic control signs will be by the square foot of sign.
2. Weighted based tubular markers, surface-mounted tubular markers, vertical panels, drums, and barricades will be per each.
3. Temporary pavement marking tape and temporary pavement marking waterborne paint will be by the foot and will include removal when applicable.
4. Temporary flexible raised pavement markers and temporary rigid raised pavement markers will be per each.
5. Floodlights will be by the hour or lump sum.
6. Arrow boards will be by the hour or lump sum.
7. Portable changeable message signs will be by the hour or lump sum.
8. Temporary concrete barrier and removing and resetting temporary concrete barrier will be by the foot.
9. Temporary crash cushions and truck-mounted attenuators will be per each.
10. Miscellaneous traffic control items will be by the lump sum.
11. Traffic control maintenance will be by the hour.
12. Flagger control will be by the hour and is limited to the actual number of hours flagging stations are staffed. If allowed by the Engineer, flagger control for the Contractor's sole convenience will be at no additional cost.
13. Pilot car operation will be by the hour.

Maintain a daily record of hours for traffic control maintenance, flagger control, and/or pilot car usage. Provide the records weekly for approval of hours recorded.

626.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Temporary Traffic Control Signs	SF
Weighted Base Tubular Markers	Each
Surface-Mounted Tubular Markers.....	Each
Vertical Panels	Each
Drums	Each
Barricade, Type ____	Each
Temporary Pavement Marking Tape	ft
Temporary Flexible Raised Pavement Markers	Each
Temporary Rigid Raised Pavement Markers.....	Each
Temporary Pavement Marking – Waterborne	ft
Floodlights.....	Hour or LS
Arrow Board, Type ____	Hour
Portable Changeable Message Sign (PCMS)	Hour or LS

Temporary Concrete Barrier.....	ft
Remove and Reset Temporary Concrete Barrier	ft
Temporary Crash Cushion	Each
Truck Mounted Attenuator.....	Each
Miscellaneous Temporary Traffic Control Items	LS
Traffic Control Maintenance	Hour
Flagger Control	Hour
Pilot Car	Hour

SECTION 627 – PAINTING

627.01 Description. Prepare surfaces and apply paint to specified surfaces. Provide protective devices to prevent damage to the work, facilities, or traffic. Dispose of waste.

627.02 Materials. Provide materials as specified in 707 for selected paint systems.

Use the following structural steel paint systems:

1. System A: application to newly fabricated girders and bearings.
2. System B: application to newly fabricated railing, immersion service (2 coats of epoxy below waterline and one coat of urethane above the waterline), and repair of System A.
3. System C and D: spot, zone, or encapsulation of existing paint, including lead based paint.
4. System E: selected immersion service based on water quality conditions.

Each system for structural steel paint is described in Table 627.02-1.

Table 627.02-1 – System Descriptions

System	Application	Layer - Formula	Composition	Dry Film Thickness
A	Shop only	Primer - 1 Intermediate - 5 Top Coat - 8	Inorganic Zinc Epoxy Polyurethane	3 - 5 mils 4 - 6 mils 2 - 4 mils
B	Shop or Field	Primer - 2 Intermediate - 5 Top Coat - 8	Organic Zinc Epoxy Polyurethane	3 - 5 mils 4 - 6 mils 2 - 4 mils
C	Shop or Field	Primer - 3 Intermediate - 6 Top Coat - 9	Moistures Cured Urethanes Moistures Cured Urethanes Moistures Cured Urethanes	3 - 5 mils 3 - 5 mils 3 - 5 mils
D	Shop or Field	Primer - 3 Intermediate - 6 Top Coat - 8	Moisture Cured Urethanes Moistures Cured Urethanes Polyurethane	3 - 5 mils 3 - 5 mils 3 - 5 mils
E	Shop or Field	Primer - 4 Intermediate - 5 Top Coat - 8	Epoxy Epoxy Polyurethane	4 - 6 mils 4 - 6 mils 3 - 5 mils

627.03 Construction Requirements.

A. General. Comply with applicable environmental protection and occupational safety and health standards, rules, regulations, and orders. Failure to comply is sufficient cause for painting contractor suspension or disqualification.

Contain waste materials (e.g., used blasting material, old paint) classified as hazardous and dispose in accordance with the applicable federal, state, and local laws.

Provide protective devices (e.g., tarps, screens, covers) as necessary to prevent damage to the work and to other property or persons from cleaning and painting operations.

Assume responsibility for damage to vehicles, persons, or property resulting from the painting operations.

Remove or obliterate paint or paint stains that result in an unsightly appearance on surfaces not designated to be painted.

Protect the prepared surface from weather and contamination before and during the application process. Protect the work against disfigurement by splatters, splashes, and smirches of paint materials. Protect painted surfaces from weather, contamination, and damage until the paint has dried.

Repair painted surfaces that are marred or damaged during the operation to a condition equal to that of the coating specified.

Sprinkle the adjacent roadbed and shoulders with water or dust abatement for a sufficient distance on each side when traffic causes an objectionable amount of dust.

After painting operations are complete, thoroughly clean the painted surfaces of other work that would cause dust, grease, or other foreign materials to be deposited on the painted surfaces.

Ensure the dry film thickness of each coat and total thickness of the finished product is as specified. Determine the thickness of previously applied coatings, or an existing coating that is to be top-coated on steel, in accordance with SSPC-PA 2 before applying the next coat.

Separately apply each coat of paint to ensure complete coverage. Hide the previous coat by a single coat of the next application.

Apply paint only on clean and dry surfaces and only during periods of favorable weather and as follows:

1. The atmospheric temperature, paint, and surface to be painted are between 45 and 100 °F when metal surfaces are 5 °F above the dew point.
2. The humidity is less than 85 percent. Determine the dew point with the use of a psychrometer and psychrometric tables.
3. Do not paint when the temperature of the air, paint, or metal is below that described in the product technical data sheet, when the air is misty, or when conditions are otherwise unsatisfactory.
4. Do not paint damp or frosted surfaces or surfaces hot enough to cause the paint to blister, to produce a porous paint film, or to cause the vehicle to separate from the pigment.
5. Do not apply paint coat if the anticipated atmospheric temperature will not remain above 45 °F during the drying period.

Provide a suitable enclosure to allow painting during inclement weather. Control atmospheric conditions inside the enclosure throughout the painting operation. Remove the enclosure when the paint is dry or weather conditions allow open exposure.

Perform painting in a neat and skillful manner. Ensure the application is without runs, sags, skips, and other defects. The Contractor may apply a subsequent coat only when the previous coat is dry and clean.

Provide rollers, when used, of a type that does not leave a stippled texture in the paint film.

If air spray is used, provide suitable traps or separators to exclude oil and water from the air. Keep the paint thoroughly mixed by continuous mechanical agitation. Keep paint thoroughly mixed so the pigments stay suspended during its application.

Thin the paint in accordance with the manufacturer's written instructions and product data sheets.

The same manufacturer will provide coatings for the complete system.

Store paint materials in the manufacturer's original containers, in a weather tight space, and where the temperature is maintained within the paint manufacturer's recommended storage temperature range. Monitor the paint material storage facility with a high-low recording thermometer device. Ensure paint storage facility is separate from the storage facilities used for storing painting equipment, storing contaminated waste, or construction generated waste.

Warrant coatings for 1 year after acceptance.

B. Painting of Existing Structural Steel. Apply coating systems on existing structural steel.

C. Painting New Structural Steel.

1. Surface Preparation. References (e.g., SSPC-SP 10, SSPC-PA 1) refer to Volume 2, Systems and Specifications, of SSPC's Steel Structures Painting Council Manual. SSPC-Vis 1 refers to SSPC's Visual Standards for Abrasive Blast Cleaned Steel.

Blast clean new steel structure surfaces to be coated in accordance with SSPC-SP 10 Near-White Blast. Use methods specified in SSPC-SP 1, SSPC-SP 2, and SSPC-SP 3 as necessary to supplement blast cleaning. The near-white blast surface is shown in the pictorial standards of SSPC-Vis 1. If a conflict between the pictorial standard and the written SSPC definition, follow the written definition.

Prepare contaminated surfaces to the Engineer's satisfaction before application of coating material. Ensure the surface covered with a coating is free of moisture, dust, grease, or other substance that prevents bonding.

Perform blast cleaning using an abrasive that will uniformly produce a surface profile of 1.5 to 3.5 millimeters deep, in a dense, uniform pattern of depressions and ridges but not greater than that recommended by the paint manufacturer. Verify the surface profile obtained on the prepared surface using ASTM D4417 Method A or C. Grind laminations raised by the blasting operation to a flush surface and reblast the ground area to obtain the specified anchor pattern. Submit a written record of surface profile measurements.

Grind the edges of flame-cut steel that will receive paint until the hardened edge accepts the abrasive blast imparted during the blasting procedure. Verify the surface profile obtained on this prepared surface using ASTM D4417 Method A.

Prepare edges of plates of main stress carrying members, except bearing stiffeners and girder webs, in accordance with ANSI/AASHTO/AWS D1.5M Section 3.2.9.

Meet the welding requirements of ANSI/AASHTO/AWS D1.5M Bridge Welding Code before painting.

2. Materials. Meet the materials requirements as specified, with an inorganic zinc primer, epoxy intermediate, and a polyurethane topcoat.

Paint the structural steel as specified using paint System A as specified in Table 627.02-1.

Ensure the coated steel final dry film thickness is 9 to 15 millimeters.

Submit a manufacturer's certification stating the coating materials meet the specifications and the coatings are compatible.

The Engineer will not allow application of coating materials until the product certifications have been provided and the materials have been tested and accepted by the Central Materials Laboratory. Notify the Engineer at the preconstruction meeting which manufacturer's products will be used along with the paint supplier's name and telephone number. The Central Materials Laboratory will set up the inspection of the products at the manufacturer's plant or supplier's facility on notification. The Department will inspect, sample, test, and approve the products before being released for shipment to the fabricator or the field painter. Allow a minimum of 14 calendar days for the testing of the paint samples in the Central Materials Laboratory after the products are received.

Submit the paint manufacturer's current product data sheets, mixing and thinning directions, recommended spray nozzle types and sizes, spray pressures, minimum drying times, temperature and humidity data for curing, and other appropriate product information, for approval.

3. Coating of New Structural Steel. When not in conflict with these specifications, perform coating application using trade best practices, coating manufacturer's written instructions, and those applicable portions of SSPC-PA 1.

Prepare surface of the structural steel specified to receive the paint system, apply finish, protect shop and field-applied paint coatings, and complete other work specified.

Apply in the shop the prime, intermediate, and topcoat coatings in accordance with the manufacturer's written instructions and this subsection.

The steel fabricator applying the shop coats and the Contractor performing the field painting will be certified in accordance with the Steel Structures Painting Council (SSPC) Painting Contractor Certification Program or approved equal. Approved equal can be documentation by the fabricator and/or the Contractor, provided they have been successful in applying bridge paint systems for at least the past 5 years.

Clean the surfaces prepared for painting for approval. The Engineer will observe and inspect the first applications of the 3 paint coats. Ensure the first members painted with the 3-coat system meet the Engineer's satisfaction and approval. Once approved, this application of coatings will be the standard the Engineer will judge the remaining paintwork.

Only apply a prime coat in the shop to faying surfaces and the exposed bolted connection areas where bolt heads, washers, and nuts are exposed to the steel. The design of bolted faying surfaces is for a Class B Slip Coefficient. Ensure the faying surfaces are painted to the correct paint dry film thickness to provide a Class B Slip Coefficient. Mask other coats from the faying surface. Supply a paint manufacturer's testing certification that shows the paint to be used will provide the required resistance at the proposed thickness when tested in accordance with the requirements of the Research Council on Structural Bolting Test Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints.

Apply coatings in an enclosed shop with a controlled environment to match best conditions for application and curing as recommended by the paint manufacturer.

Apply the prime coat the same day the steel is blasted. If the steel shows flash rusting before being primed, blast clean the steel again to meet the specifications. If material, other than rust, contaminates the prepared surface, clean the surface to meet the specifications and the Engineer's approval before making the succeeding application.

Apply each coat in a uniform layer, completely covering the preceding coat. Tint the individual coats sufficiently different so skips and holidays can be easily detected. Correct runs, sags, skips, mud cracking, holidays, or other deficiencies before application of succeeding coats. The Engineer may require corrective work (e.g., re-cleaning, application of additional coating) at no additional cost to the Department.

Precede each specified coat by a strip coat on edges, corners, seams, crevices, interior angles, joining members junctions, rivet or bolt heads, nuts and threads, weld lines, and similar surface irregularities. Ensure a sufficient thickness of strip coat completely hides the surface being covered; follow as soon as practical by the application of the full prime, intermediate, or finish coats to its specified thickness. Application of this strip coat may require special techniques in accordance with the manufacturer's written application specifications.

For steel surfaces inaccessible to painting after erection, paint surfaces before erection. Discuss inaccessible areas with the Engineer before painting.

Make and record coating thickness measurements and a visual inspection for complete coverage after each coat application and before succeeding coat application. If dry film thickness measurements or visual inspections of coverage do not meet the specified minimum, make additional applications. Measure dry film thickness above the average magnetic surface profile of the anchor pattern in the steel substrate.

The Engineer will measure the dry film thickness for acceptance using ASTM D1186 Method A or B (magnetic gauge or magnetic flux gauge). If a question arises about an individual coat thickness or coverage, the Engineer will verify using ASTM D4138 Method A (Tooke Gauge). If the Tooke Gauge shows a prime coat thickness to be less than the specified minimum thickness or a missing intermediate coat, the Engineer will reject the total coating system on that member even if the thickness of the total system equals or exceeds total thickness specified. The Contractor or the fabricator will reclean and recoat the steel at no additional cost to the Department. On areas where the Tooke Gauge is used to determine coating thickness and the prime coat is determined to be of the correct thickness, repair the destructive test area in accordance with the approved repair procedure. Repair the test area at no additional cost to the Department.

In areas where dry film thickness measurements are impractical, the Engineer will measure wet film thickness in accordance with ASTM D1212 or ASTM D4414.

4. Field Painting and Repair. Supply the approved steel fabricator field and repair procedures plan to the field personnel. Ensure field repairs include the application of the complete 3-coat system (primer, intermediate, and finish coats). Use Formula 2 – Organic Zinc Rich with a dry film thickness of 3 to 5 millimeters in the field for minor primer damage.

Clean the erected exposed bolted areas and areas with exposed primer with intermediate and topcoat application.

Make field painting and repairs in accordance with the coating manufacturer's written instructions, the field painting, and repair plan. The Engineer will review the field painting areas for approval before final acceptance.

Prevent damage with temporary attachments or supports for scaffolding or forms to the coating system. Repair damage that may occur in accordance with the prescribed procedure at no additional cost to the Department.

5. Protection of the Work. Adequately protect the work until final acceptance. Protect surfaces not to be coated under this contract from overspray and drippings. Repair painted surfaces that are marred or damaged with materials to a condition equal to that required for the finished surface.

Replace or repair damaged coatings at no additional cost to the Department.

6. Environmental Control. Apply coating materials as specified and in accordance with the manufacturer's written specifications. Adhere to the manufacturer's written specifications for uniform temperature and humidity for the curing of the inorganic zinc.

The Engineer will not allow application if conditions are not favorable for the proper application and performance of the coating.

7. Transportation and Erection. Exercise extreme care in handling the steel in the shop, during shipping, during erection, and during subsequent erection of the bridge. Insulate the steel from the binding chains by approved softeners. Pad hooks and slings used to hoist steel. Space the diaphragms and similar pieces so rubbing damage to the coating will not occur during shipment. Store the steel on pallets at the project site or by other approved means so the steel does not rest on the dirt or so steel components do not fall or rest on each other. Before shipping the steel, present shipping and project site storage details for approval at the prefabrication meeting.

8. Sealing. Fill and seal crevices and gaps between structural shapes and plates, around bolt heads or nuts, and similar areas that would retain moisture with the following:
 - a. Coating materials where possible.
 - b. Sealant if the crevice or gap cannot be bridged with coating materials. Apply the sealant after complete application of topcoat.
 - c. Backing material and sealant to fill crevices and gaps the sealant alone cannot bridge. Apply sealant over the backing material to form a watertight seal.
9. Stenciling. Stencil the month and year of application and the type of coating used in 2-inch high block letters at 2 locations on the structure being coated. The Engineer will determine the exact stenciling location. Color the stenciling flat black.
10. Quality Control and Assurance Inspection. Be responsible for quality control (QC) of the surface preparation and painting. Submit a QC plan for approval before starting work. Perform inspection and testing in accordance with the QC plan.

Ensure the QC plan includes at least the following information:

- a. Paint manufacturer brand and type of paint proposed for each coat.
 - b. A copy of the manufacturer's certification, as specified in 707.03, showing the paint meets the contract requirements, including the VOC limitations.
 - c. Curing timetable with temperature and humidity requirements for the specified thickness of the applied inorganic zinc.
 - d. Masking plans and diagram for bolted and faying surface areas.
 - e. Testing frequency and acceptance criteria for surface profile and dry film thickness measurements of each coating. Include the type of measurement instrument and calibration standards by which the instrument will be calibrated.
 - f. A copy of the QC sheet that will be used to maintain the written records of the date and time of blasting, measured surface profile of the steel, date and time of coating applications, cure times, dry film thickness of each coating, batch numbers of coatings, air temperature, relative humidity, and steel temperature at the time of coating.
 - g. Shop paint repair procedures (e.g., for scratches, gouges, holidays, mud cracking, runs, sags).
 - h. Field painting and repair procedures.
 - i. Equipment maintenance procedures (e.g., moisture traps, cleanliness check on recycled abrasive, paint nozzle tip replacements).
 - j. Designate a QC officer responsible for ensuring the above procedures are maintained.
11. Quality Assurance. The Engineer will perform inspection and testing as necessary to verify that an acceptable product is provided as specified. The Engineer will perform QA inspection on cleaning and painting for approval.

The Engineer may inspect cleaned surfaces before painting. Provide the necessary means for inspections.

D. Painting Timber.

1. Preparing Surfaces. Remove cracked or peeled paint, loose chalky paint, dirt, and other foreign material by wire brushing, scraping, or other means immediately before painting. Ensure the moisture content of the timber is less than 20 percent at the time of the first application.

2. Paint. Paint Formula 11 and Formula 12. Use 3 applications to paint new timber requiring painting. Paint is intended for use in covering previously painted surfaces. Use white or tinted paint as specified.
Apply paint by brush, air spray, or roller, spread evenly, and work thoroughly into seasoning cracks, corners, and recesses. Apply another coat when the full thickness of the previous coat has dried.
3. Application. After the first application has dried and the timber is in place, putty cracks, checks, nail holes, or other depressions flush with the surface.

E. Painting Concrete.

1. Preparing the Surface. Remove laitance and curing compounds from the surface before painting the concrete surfaces. Use abrasive blast cleaning.
At the time the paint is to be applied, ensure the surface is thoroughly dry and dust free.
2. Paint. Use Formula 13 tinted paint as specified.
3. Application. Apply paint in 2 separate coats, at a minimum finished application rate of 100 to 150 square feet per gallon. Apply the second coat in a direction perpendicular to the first coat. Allow the first coat to dry thoroughly before applying the second coat. Ensure final appearance is even with uniform color acceptable to the Engineer.

Paint only when the ambient temperature is 50 °F or above for the application and drying of the paint.

627.04 Method of Measurement. The Engineer will not measure the work.

627.05 Basis of Payment. The Department considers painting as incidental work for the items requiring paint.

SECTION 628 – SNOW POLES

628.01 Description. Provide and install snow poles.

628.02 Materials. Provide materials as specified in:

Rigid Posts for Delineators, Snow Poles, and Mileposts	708.16
Retroreflective Sheeting	712.02
Flexible Snow Poles	712.11

628.03 Construction Requirements. Install snow poles as follows:

1. Rigid Snow Poles. Assemble rigid snow poles, delineator, and reflectors.
2. Flexible Snow Poles. Attach flexible snow pole to rigid delineator post and attach reflectors in accordance with the manufacturer's written instructions.

628.04 Method of Measurement. The Engineer will measure acceptably completed work per each.

628.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Snow Poles, Type _____	Each

The Department will not make separate payment for delineators where rigid snow poles are installed.

SECTION 629 – MOBILIZATION

629.01 Description. Mobilization consists of preparatory work and operations, including those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site, for the establishment of offices, buildings, and other facilities necessary for work, for premiums on bond and insurance, and for other work and operations which must be performed or costs incurred before beginning production work on the various contract items. Mobilization cost for subcontracted work is included in the subcontract unit price.

629.02 Materials. Not specified.

629.03 Construction Requirements. Not specified.

629.04 Method of Measurement. The Engineer will measure accepted work by the lump sum.

629.05 Basis of Payment. The Department will pay for accepted quantities and as follows:

Pay Item	Pay Unit
Mobilization	LS

The Department will pay 60 percent of the contract unit price or 6 percent of the total contract amount, whichever is less, on the first monthly progress payment estimate.

The Department will pay 40 percent of the contract unit price or 4 percent of the total contract amount, whichever is less, on the second monthly progress payment estimate providing the Contractor has initiated productive work.

On completion of work, the Department will pay the remaining mobilization bid amount in excess of 10 percent of the total original contract amount.

SECTION 630 – PAVEMENT MARKINGS

630.01 Description. Prepare pavement surface and apply waterborne or preformed thermoplastic retroreflective pavement markings.

630.02 Materials. Provide waterborne paint materials as specified in 707. Provide preformed thermoplastic meeting AASHTO M 249. Provide glass beads meeting AASHTO M 247, Type 1.

Provide paint and beads in original packaging showing the lot numbers. Sample paint materials in accordance with Idaho IR 7 and submit the samples for testing to the Central Materials Laboratory. Provide a sample 50 pound bag of glass beads for testing by the Central Materials Laboratory. Receive lab approval before using the paint or glass beads. Allow 2 weeks for laboratory testing.

630.03 Construction Requirements.

A. Waterborne Paint.

1. Each paint application will be 17 mil wet film. Additional applications must be placed 10 or more days apart. The Department's standard practice is 2 paint applications for permanent pavement markings and 1 paint application for temporary traffic control pavement markings. The total quantity specified is the total linear feet to be painted (e.g., a quantity of 9,000 linear feet is needed, the plans will specify the Contractor to place 1 coat for temporary and 2 coats for permanent).
2. Place at least 7 pounds of glass beads per gallon of applied paint.
3. Apply pavement markings to clean and dry pavement when the pavement temperature is between 50 °F and 140 °F, and the relative humidity is less than 80 percent.
4. Limit the deviation of longitudinal pavement markings to less than 2 inches per 100 feet. Provide longitudinal pavement markings with a width tolerance of 5 percent. Limit broken line overlap to 1.5 feet.
5. Use glass beads to provide a minimum retroreflectivity of 225 millicandelas per square meter per lux for white pavement markings and 150 millicandelas per square meter per lux for yellow pavement markings.
6. Do not thin paint.
7. Repair tracking marks and spilled or damaged material.
8. Test Strips. Place a paint (no glass beads) test strip onto a clean, smooth ferrous metal panel to determine pavement marking uniformity and thickness. Measure pavement marking thickness in accordance with ASTM D7091. Calculate the applied wet film thickness using the percent volume of solids provided by the manufacturer as follows:

$$M = (\text{measured dry film thickness}) \div (\text{percent volume of solids})$$

Where:

$$M = \text{Wet film Thickness (mils) of paint placed.}$$

Place test strip 2 to determine glass bead application and retroreflectivity. Test in accordance with ASTM E1710.

Place test strip 3 when broken line or dotted pavement markings are used. Demonstrate the broken line or dotted line patterns before marking the roadway.

Present test strips for Engineer approval before placing pavement markings on the roadway.

9. Reporting. Provide the results of retroreflectivity testing, paint and glass bead quantities applied, and paint and glass bead material invoices daily.

The wet film thickness verification will be calculated using the following equation:

$$M = (G \times 19,248) \div (D \times W)$$

Where:

M = wet film thickness (mils) of paint placed.

G = gallons of paint applied.

D = distance (feet).

W = width of line (inches).

Measure and record temperature and humidity at the start of work and 4 to 8 hours after starting. Discontinue work during precipitation events.

B. Preformed Thermoplastic.

1. Apply pavement markings in accordance with the manufacturer's written installation instructions.
2. Provide a minimum pavement marking thickness of 125 mils.
3. Provide a minimum retroreflectivity of 325 millicandelas per square meter per lux for white pavement markings and 200 millicandelas per square meter per lux for yellow pavement markings. Test in accordance with ASTM E1710.
4. Provide a minimum skid resistance value of 45 British Pendulum Number (BPN) when tested in accordance with ASTM E303.

C. Testing. Test the retroreflectivity of installed pavement markings daily. Test in accordance with ASTM E1710. Provide documentation the retroreflectometer has been calibrated within the last year. Take 1 or more readings per mile for each line pattern installed. Where less than 1 mile of markings are placed, take 1 set of readings for each line pattern installed.

630.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Longitudinal pavement markings will be measured by the foot. Subtract the length of gaps in broken and dotted line pavement markings from the measured length.
2. Transverse, word, symbol, and arrow pavement markings will be measured by the square foot.

630.05 Basis of Payment. Payment for accepted work will be made as follows:

Pay Item	Pay Unit
Longitudinal Pavement Marking – Waterborne	ft
Longitudinal Pavement Marking – Preformed Thermoplastic	ft
Transverse, Word, Symbol, and Arrow Pavement Markings –	
Waterborne	SF
Preformed Thermoplastic	SF

A separate payment will not be made for glass beads.

Waste disposal, cleanup, and other items not specifically identified are incidental.

For permanent pavement markings, a payment will be made for each application of waterborne paint. Temporary pavement markings will be paid for under 626.

SECTION 631 – RUMBLE STRIPS

631.01 Description. Construct rumble strips.

631.02 Materials. Not specified.

631.03 Construction Requirements. Construct a 500-foot rumble strip test section within the project site for approval before proceeding.

Limit the longitudinal rumble strip deviation to less than 2 inches per 100 feet.

Immediately remove debris.

631.04 Method of Measurement. The Engineer will measure acceptably completed rumble strips by the mile.

631.05 Basis of Payment. Payment for the accepted work will be made as follows:

Pay Item	Pay Unit
Rumble Strips.....	Mile

Debris removal, waste disposal, and emulsified asphalt are incidental to rumble strip installation.

SECTION 632 – REMOVAL OF BRIDGE DECK CONCRETE

632.01 Description. Remove defective concrete and/or contaminated concrete from the upper portions of bridge decks as specified. Removal does not include full depth deck removal, unless required as Class B or surface preparation beyond that which is incidental to the removal process. On completion of removal, the Engineer will inspect the deck to determine if further removal is required.

Temporarily plug bridge drains to prevent waste materials from entering the drainage system. Protect expansion joints and barrier curbs from damage.

Class A removal is the removal of concrete from the deck top surface specified and to the mean depth limits specified. Use hydrodemolition or mechanical means after the seal coat has been removed. If the hydrodemolition removal extends beyond the mean removal depth where unsound concrete is encountered, the Department will still consider the work Class A removal at no additional cost to the Department. Remove concrete, not removed to specified limits during hydrodemolition, by mechanical means. If less than an entire continuous slab is to undergo Class A removal, saw cut the line separating where it is required and the section where removal is not required, before removal of concrete, to a depth of approximately 75 percent of the planned removal depth.

Class B removal is the removal of concrete after completion of Class A removal and as directed.

632.02 Materials. None specified.

632.03 Construction Requirements. Before starting deck removal, obtain Department approval of the concrete mix design for the new deck

A. Class A Removal.

1. Mechanical Removal. Perform mechanical removal using power-operated diamond grinding machinery or by the use of 30-pound maximum jackhammers operated at a 45° angle or less from the surface of the slab. If reinforcing steel is exposed in the course of this class of removal, immediately stop work and request instructions from the Engineer.
2. Hydrodemolition Removal
 - a. Concrete Removal. The Engineer will designate a trial area for the Contractor to show the equipment, personnel, and methods of operation are capable of producing satisfactory results. The Engineer will set parameters for the removal of the concrete. Begin work upon Engineer acceptance of the trial results area.
 - b. Completely clean exposed steel of rust, scale, and corrosion. Repair reinforcing steel that is damaged or broken with an approved procedure at no additional cost to the Department as specified in 502.03.E.
 - c. Equipment. Use hydrodemolition equipment that is self-propelled with a high-pressure water jet stream capable of removing concrete to the specified depth and capable of removing rust and concrete particles from reinforcing steel. Use hand-held, high-pressure wands or 30-pound maximum jackhammers operated a 45° angle or less from horizontal in areas that are inaccessible to the self-propelled machine.
 - d. During the start-up of hydrodemolition, have a qualified full-time employee of the hydrodemolition equipment manufacturer onsite until the removal operation is progressing satisfactorily. Ensure the representative remains available for the hydrodemolition work. Adhere to the manufacturer's written instructions and/or recommendations made by the representative, on or off the project site, at no additional cost to the Department. The cost of the manufacturer's representative is incidental.

- e. Provide documentation to show that only qualified personnel, trained by the equipment manufacturer, operate equipment. Provide sufficient spare parts and service to maintain the equipment operation.
- f. Provide shielding to ensure containment of dislodged material within the removal area. Protect the public from flying debris on and under the project site.
- g. Runoff. Collect runoff water and residual material within existing roadway slopes, then dispose by land application offsite. Line temporary collection ponds with a separation geotextile. Do not allow runoff water or residual material to flow into the vehicular or pedestrian traffic areas or nearby waterways. Obtain required permits and comply with applicable regulations concerning water disposal.
- h. Cleaning. Perform cleaning, before debris and water dry on the surface, with a vacuum system or other method capable of removing wet debris and water in the same pass. Blow-dry the deck with air to remove excess debris and water. Adequately support exposed reinforcing steel that is left unsupported by the hydrodemolition process and protect the steel from construction operations.

B. Class B Removal.

After the Class A removal has been completed, the Engineer will check for delamination in accordance with ASTM D458 and resound or chain the deck to verify unsound material has been removed.

Perform additional removal, designated as Class B, with the hand-held hydro-wand, or 30-pound maximum jackhammer operated at an angle of 45° or less from horizontal, or by the use of hand tools. If the bond between concrete and reinforcing steel has been destroyed, remove the adjacent concrete to a depth that will provide a minimum ¾ inch clearance around the steel.

Clean before debris and water dries on the surface. Adequately support exposed reinforcing steel that is left unsupported and protect the steel from construction operations.

As with Class A removal, exercise control of debris and wash residual. Protect areas below the bridge and as directed.

632.04 Method of Measurement. The Engineer will measure acceptably completed work by the square yard based on planned quantity for Class A and measured quantity for Class B.

632.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Concrete Bridge Deck Removal Class A.....	SY
Concrete Bridge Deck Removal Class B.....	SY

SECTION 634 – MAILBOX

634.01 Description. Remove the existing mailbox assembly and provide and install mailbox assembly.

634.02 Materials. Provide mailboxes that are approved by the U.S. Postmaster General.

Fabricate the platform, shelf, and brackets in accordance with ASTM A568. Galvanize the supports, platform, shelf, locking wedges, anti-twist plates, bolts, bracket, nuts, screws, washers, and miscellaneous hardware in accordance with ASTM A153 Class C/D or ASTM B695 Class 40.

Provide mailbox support posts that meet 708.16 and 710.02.

634.03 Construction Requirements. Remove the existing mailbox assembly and snow shield and return it to the owner. Provide and install a new mailbox assembly and mailbox snow shield as specified or as directed. Verify the number and size of the mailbox, mailbox snow shield, and type of assembly before ordering.

Place the name and address as shown on the existing mailbox on the new mailbox or as directed.

Maintain continuous access to the mailbox and do not interrupt mail service. The Engineer may approve an acceptable temporary mailbox assembly installed during construction operations before the installation of the new mailbox assembly.

634.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Mailbox will be per each assembly, regardless of the type or size.
2. Mailbox snow shield will be per each.

634.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Mailbox.....	Each
Mailbox Snow Shield.....	Each

Post, platform, shelf, brackets, and other hardware are incidental and the cost included in the mailbox contract unit price.

SECTION 635 – ANTI-SKID

635.01 Description. Provide and stockpile anti-skid material at designated locations.

635.02 Materials. Provide materials as specified in 703.10. The Engineer will accept material at the point of delivery from the Contractor-provided sources or the Engineer will accept the aggregate at the crushing plant from designated sources.

635.03 Construction Requirements. Prepare the stockpile site by clearing and smoothing the area as directed. Construct stockpiles neat and regular in form and occupy as small an area as possible.

635.04 Method of Measurement. The Engineer will measure acceptably completed work by the ton or cubic yard.

635.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Anti-Skid Type_____	Ton or CY

SECTION 640 – CONSTRUCTION GEOTEXTILES

640.01 Description. Provide and install geotextile.

640.02 Materials. Provide materials as specified in 718.

640.03 Construction Requirements.

A. Shipment and Storage. Place the geotextile in a dry place off the ground and protected from damage and maintain in an opaque, heavy-duty protective covering during periods of shipment and storage.

B. Placement. Grade the area to be covered to a smooth, uniform condition without obstructions, depressions, and debris. Spread the geotextile immediately ahead of the covering operation. Do not drag the geotextile on the ground or mishandle it. Place the geotextile loosely and without wrinkles so the placement of the overlying material will not tear the geotextile. Hold the geotextile in place with pins, staples, or small piles of fill or rock. Lap or sew the geotextile, as specified, at the ends and sides of adjoining sheets. Place the cover material on the geotextile so at least 6 to 18 inches of material is between the vehicle or equipment tires or tracks and the geotextile, depending on the survivability of the geotextile and the weight of the construction equipment.

Cover the geotextile with the specified cover material as soon as possible. Do not allow the geotextile to be exposed to the elements for more than 30 calendar days for ultraviolet stabilized geotextiles and 7 days for geotextiles that have not been ultraviolet stabilized.

C. Soft Ground. Limit construction vehicle size and weight so rutting in the initial lift above the geotextile is 3 inches or less deep when geotextile is placed over soft ground. Do not turn vehicles on the first lift above the geotextile. Do not end-dump the cover material directly on the geotextile. Limit compaction of the first lift above the geotextile over soft ground to routing of placing and spreading equipment only. Do not allow sheep-foot type equipment on the first lift. Closely observe subsequent lifts during compaction, and if foundation failures occur during compaction operations, use lightweight compaction equipment. Use pegs, pins, or the manufacturer's recommended method as needed to hold the geotextile in place until the specified cover material is placed. Do not drop cover material on unprotected geotextile from a height greater than 3 feet above the geotextile surface.

D. Seams. Use sewn seams that consist of 2 parallel rows of stitching. Ensure the 2 rows of stitching are $\frac{1}{2}$ inch apart with a tolerance of $\frac{1}{4}$ inch and do not cross, except for restitching. Provide a lock-type stitch. If a flat or prayer seam is used, the minimum seam allowance (i.e., the minimum distance from the geotextile edge to the stitch line nearest to that edge) is $1\frac{1}{2}$ inches. Ensure the minimum seam allowance for other seam types is 1 inch. Obtain approval of the seam, stitch type, and the equipment used to perform the stitching before work start begins. Use a "J" seam with 2 passes of a lock-type stitch with at least 3 stitches per inch. The Contractor may use the prayer seam (flat) for repair of damaged in-place geotextiles.

Sew the seams with high-strength polyolefins, polyester, or Kevlar thread that is as resistant to deterioration as the geotextile being sewn. Provide thread color that contrasts with the geotextile color. Do not use nylon threads. Ensure the strength of the seam is at least 90 percent of the minimum required tensile strength for the intended application as specified in 718.05, 718.06, 718.07, 718.08, and 718.09. Obtain approval before production field stitching or seaming.

E. Repairs. If the geotextile is torn, punctured, or the overlaps or sewn joints disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or roadbed distortion, remove the backfill around the damaged or displaced area and repair or replace the damaged geotextile at no cost to the Department. Place a patch of the same type geotextile over the damaged area and overlap the existing geotextiles at least 2 feet from the edge of the damaged area, except for pavement overlay geotextiles. Patch overlay geotextiles as specified in 640.03.I. Where geotextile seams are required to be sewn, repair damaged sheets by sewing. Sew seams as specified in 640.03.D.

F. Underground Drainage. Construct underdrains. Place the geotextile to conform loosely to the shape of the trench.

Overlap the geotextile at least 12 inches at longitudinal and transverse joints, or sew the geotextile joints. In trenches less than 12 inches wide, overlap the width of the trench.

Type I installations refer to protected conditions and Type II installations refer to unprotected conditions as defined in 718.05.

When drainage geotextiles are placed under or over a horizontal or sloping surface (e.g., subgrade, in conjunction with drain blankets) use the geotextiles that meet the construction survivability requirements of subgrade separation geotextiles.

G. Riprap/Erosion Control. Construct geotextiles under riprap or rock buttresses as specified. Overlap the geotextile at least 2 feet at longitudinal and transverse joints or sew the geotextile at joints at the time of manufacture to form geotextile widths as specified. If overlapped, place the geotextile so the upstream strip of geotextile is on top of the next downstream strip. Where placed on slopes, lap each strip over the next downhill strip.

Key the geotextile at the top and the toe of the slope. Secure the geotextile to the slope loose enough the geotextile will not tear when the riprap is placed. Do not key the geotextile at the top of the slope until the riprap is in place to the top of the slope.

Start placement of aggregate and/or riprap on the geotextile at the toe of the slope and proceed upwards. Show the combination of the rock-fill drop height and the aggregate cushion thickness are adequate to not puncture or damage the geotextile when placing the riprap or rock-fill. Where an aggregate cushion is required, place it at least 6 inches thick. The limits specified in Table 640.03-1 apply.

Table 640.03-1 – Riprap Drop Criteria

Size of Riprap Material	Maximum Drop	
	Directly onto Geotextile	Onto Aggregate Cushion Blanket
≤ 200 lb Rock	3 feet	5 feet
> 200 lb Rock	0	3 feet

After placing the riprap, backfill voids in the riprap face so the geotextile is completely covered.

Do not grade slopes after riprap placement if grading results in stone movement directly on the geotextile. Do not allow stones weighing more than 110 pounds to roll down the slope. The Engineer may reduce drop heights if geotextile damage from the stones dropping is evident. When geotextile is placed on slopes steeper than 2H:1V, place the stones on the slope without free-fall.

Type I geotextiles are low to moderate survivability and Type II geotextiles are higher survivability as defined in 718.06.

H. Subgrade Separation. Prepare the subgrade as specified in 205 or as directed.

Overlap adjacent geotextiles at least 2 feet at longitudinal and transverse joints or sew the geotextiles to form the widths specified.

Type I refers to moderate survivability conditions and Type II refers to high survivability conditions as defined in 718.07.

I. Pavement Overlays. Construct pavement overlays as follows:

1. **Weather Limitations.** Do not place sealant and geotextile when the roadway surface or weather conditions would prevent proper construction. Do not place paving grade asphalt sealant until the minimum air temperature is at least 50 °F.
2. **Initial Surface Preparation.** Prepare the pavement surface before the sealant is applied as specified in 401.03. In addition, clean cracks exceeding 1/8 inch width and fill with suitable bituminous crack filler. Allow the crack filling material to cure in accordance with the manufacturer's written instructions before placing the geotextile. Place leveling courses before placing the geotextile.
3. **Asphalt Sealant Application.** Provide asphalt sealant that is the type and grade specified. Spread the sealant material using a pressure distributor as specified in 406.03. Uniformly spray-apply the asphalt sealant to the prepared dry pavement surface at the rate recommended by the geotextile manufacturer and as approved. Do not allow the distributor tank temperature to exceed 320 °F for paving grade asphalt cements.

Spray the asphalt sealant 6 inches wider than the paving geotextile. Apply the sealant only as far in front of the geotextile installation as is appropriate to ensure a tacky surface at the time of geotextile placement. Place the geotextile on the sealant while it is hot. Do not allow traffic on the sealant.

4. **Geotextile Placement.** Protect the geotextile from moisture. Place the geotextile using mechanical or manual laydown equipment capable of providing a smooth installation with minimal wrinkling or folding. Slit wrinkles or folds larger than 1 inch and lay flat. Shingle-lap transverse joints and slit folds or wrinkles in the direction of the paving operation. Provide overlap sufficient to ensure closure, but not more than 6 inches. Use brooms or pneumatic rollers to maximize geotextile contact with the pavement surface. Apply additional hand-placed sealant material at laps. Limit traffic on the placed geotextile to necessary construction equipment and emergency vehicles. Avoid abrupt starts and stops. Remove and replace damaged geotextile with the same type of geotextile, and shingle lap the overlaps in the direction of paving at no cost to the Department.
5. **Overlay Placement.** Ensure overlay placement closely follows geotextile placement. Do not allow windrow asphalt on the geotextile ahead of the paving machine. Avoid abrupt starts or stops and keep turnings of paver and other equipment to the minimum to avoid geotextile damage.

640.04 Method of Measurement. The Engineer will measure acceptably completed work to the nearest square yard of surface area covered. A separate measurement will not be made for construction of laps, seams, joints, or patches unless the Engineer orders more than the specified lap, in which case the added lap width will be measured.

The Engineer will compute the square yards of drainage geotextile in the trench by multiplying the length of the trench where geotextile is used by the average perimeter of the constructed trench's typical section.

640.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Drainage Geotextile	SY
Riprap/Erosion Control Geotextile	SY
Subgrade Separation Geotextile	SY
Pavement Overlay Geotextile.....	SY

If the Engineer directs geotextiles with properties more stringent than specified, the Department will allow price adjustments for difference in material cost only.

SECTION 641 – BIAXIAL GEOGRID

641.01 Description. Provide biaxial geogrid and all accessories, equipment, and labor necessary to reinforce subgrade or subbase, or similar applications as specified or as directed.

641.02 Materials. Provide the geogrid manufacturer’s certified test results attesting the geogrid meets the specifications.

Provide geogrid certifications signed by the manufacturer’s authorized agent, including the following information about each geogrid to be used:

1. Manufacturer’s name, address, and phone number.
2. Full product name.
3. Style or product code number.
4. Geogrid roll and/or lot number.
5. Geogrid polymer type.
6. Testing agency name, address, and phone number.
7. Certified test dates and results.
8. Published physical dimensions.

Provide the test dates on the certification. As a means of identification, provide the manufacturer’s name, full product name, style or product code number, and lot and/or roll number, which will permit field determination the product delivered to the project site is covered by the certification.

Ensure the certified copy of the test results includes each test result and each mean average roll value. The Department will not accept the certification without the certified test results.

The Engineer will obtain geogrid samples for testing. Each sample will be taken beyond the first wrap and will be at least 6 feet long and extend across the full geogrid roll width. The samples will be labeled with the manufacturer and full product name, style or product code number, lot and roll number, and sampling date.

A. Geogrid Property Requirements. Provide biaxial geogrid and associated components that meet the requirements in Table 641.02-1. Ensure the biaxial geogrid consists of a regular network of connected longitudinal and transverse polymer elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding materials. Construct in single or multiple layers meeting the requirements in Table 641.02-1.

Table 641.02-1 Geogrid Property Requirements

Property	Test Method	Minimum Value ^(a)		
		Type I	Type II	Type III
Tensile Strength @ 5% strain, (lb/ft)	ASTM D6637	550	800	1200
Tensile Strength @ 2% strain, lb/ft	ASTM D6637	275	400	550
Flexural Rigidity lb-mil (mg-cm)	ASTM D7748	215 (250,000)	660 (750,000)	1,730 (2,000,000)
Junction Strength, lb	GRI-GG2 (2000)	25	35	45
Aperture Size Range, in	ID Caliper	0.8-2.0	0.8-2.0	0.8-2.0
Open Area, %	COE CW-02215	70	70	70

^(a) Minimum average roll values in the weakest direction. The geogrid type is shown on the plans. When the geogrid type is not shown, use Type II.

B. Transportation and Handling Requirements. Inspect geogrid deliveries to ensure the proper material is received.

During all periods of shipment and storage, do not expose the geogrid to temperatures above 140 °F or to any deleterious materials that might adversely affect its performance. Follow the manufacturer’s written instructions regarding storage, handling, and protection from sunlight.

Provide clear identification on every geogrid roll as required above, including product designation identification, manufacturer’s name, lot number, and material quantity, which clearly differentiates between rolls of different geogrid types.

641.03 Construction Requirements. Place fill material over the geogrid with low ground pressure (i.e., less than 5 psi) track equipment (e.g., small dozers designed for low ground pressure work). Compact fill material to Class A or as directed. Do not turn track equipment on the first lift of material over areas supported by geogrid.

Install geogrid at the locations specified or as directed. Temporarily stretch and secure geogrid in place with staples, pins, sand bags, or backfill as required by fill properties, fill placement procedures, or as directed. Keep the geogrid taut and free from wrinkles during first the fill lift placement. Remove slack in the geogrid as required by the Engineer.

Provide a minimum overlap width of 2 feet or as directed. At transverse joints, install the preceding roll so it overlaps the following roll in the direction that the fill will be placed and spread. Ensure that geogrid sections do not separate at overlaps during fill placement. Cut geogrid placed at corners or curves so there is always a minimum 2 feet overlap.

Operate rubber-tired equipment on the geogrid at 5 mph or less and only if the underlying material is capable of supporting the load.

Dump and spread the backfill in uniform lifts to maintain the required thickness at all times.

Do not operate track vehicles on the geogrid until there is a minimum of 6 inches of fill material between the geogrid and the tracks. If ruts are created in the fill material due to construction traffic, fill them with additional fill material. Do not blade adjacent material into the ruts.

Repair any geogrid sections that are damaged by construction activity at no cost to the Department. Ensure all repaired sections contain a minimum 3 feet overlap in all directions.

641.04 Method of Measurement. The Engineer will measure acceptably completed work by the square yard. A separate measurement will not be made for overlaps.

641.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Biaxial Geogrid.....	SY

SECTION 645 – FIELD LABORATORIES

645.01 Description. Provide and maintain the specified class of field laboratory at an approved location for the Engineer's exclusive use for this contract. Field laboratories previously approved by the Department before implementation of the 2017 Standard Specifications may be approved for use in accordance with the Department's previous approval, provided the equipment has passed the Department's laboratory qualification program, can perform the required tests, and remains in a safe operating condition.

1. Class I Field Laboratory – Aggregate and Soils.
2. Class II Field Laboratory – Aggregate, Soils, and Superpave HMA SP 2.
3. Class III Field Laboratory – Aggregate, Soils, and Superpave HMA SP 3 and SP 5.
4. Class IV Field Laboratory – Superpave HMA SP 3 and SP 5.

645.02 Materials.

A. All Field Laboratories. Provide field laboratories meeting these requirements:

1. Certified in accordance with the Department's laboratory qualification program.
2. Single trailer, 2 separate trailers, or onsite building.
3. Exterior door(s) meeting applicable requirements for egress. At least 1 door will have a nominal width measuring not less than 36 inches.
4. Minimum of 3 exterior windows, not smaller than 3 feet by 3 feet.
5. Weather tight.
6. Lockable windows and doors.
7. Minimum ceiling height of 7 feet 6 inches.
8. Minimum total interior floor space of 192 square feet.
9. Meet all applicable federal and state safety codes.
10. Equipped with adequate ventilation, meeting all state and federal regulations for the evacuation of fumes created by heating or testing of hot mix asphalt.
11. Hardware necessary to allow the Engineer to secure the field laboratory with Department locks on all doors.
12. Adequate electric heating and electric air conditioning, capable of maintaining a room temperature within 5 to 70 °F continuously, with lights, furnaces, and ovens operating.
13. Steps of nonskid metal, with metal handrails and level landing platform secured to the field laboratory.

Maintain and repair field laboratory and all equipment.

Field laboratory trailers will be situated in a manner to reduce vibration and excessive movement. Additional measures may be required to promote a stable facility for ignition oven scales to perform properly (e.g., screw jacks, adjustable jack stands).

The field laboratory will be furnished with the following items or their approved equivalent:

1. Lighting and Electrical. Provide exterior and interior lighting with sufficient 115 and 220 VAC wall outlets to power all necessary test apparatus with a minimum of 2 extra 115 VAC outlets.
2. Counter. A minimum of 66 square feet of counter space measuring 24 to 30 inches wide. Metal clad counters are required for Class II, III, and IV field laboratories. Sharp edges will be rounded. The counter

must be equipped with a stainless steel sink, with minimum dimensions of 15 inches by 20 inches by 8 inches deep, and will include a faucet, flexible hose type sprayer, and drain.

3. Furniture. Office desk and chair.

B. Class I Field Laboratory – Aggregate and Soils.

1. Scales. One (1) electronic scale with digital readout sensitive to 0.1 grams and a minimum range of 25 kilograms. 1 electronic scale with digital readout sensitive to 0.1 pound and 200 pound capacity.
2. Quartering Canvas. One (1) vinyl coated canvas with an approximate size of 6 feet by 8 feet, 1 with approximate size of 3 feet by 3 feet.
3. Mechanical Sieve Shaker. Permanently fixed to floor or with approved stabilized base, leveled, with a minimum tray size of 14 inches by 14 inches equipped with screens and pan.
4. Rocker Screen Set. Manual screen set, 1 foot by 1 foot with the following screens: 4 inch, 3 inch, 2 inch, $\frac{3}{4}$ inch, and No.4.
5. Sieve Shaker with Sound Enclosure. Motor driven shaker capable of handling 12 inch diameter, half height brass wire U.S. standard sieves. Sieves will meet ASTM E11 standards. Sieve sizes will be 1", $\frac{3}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{8}$ ", No. 4, No. 8, No. 16, No. 30, No. 50, No. 100, No. 200, and a pan with lid.
6. Deep Frame Wet Washing Sieves. A 12 inch diameter, half height No. 10, and full height No. 200 brass wire, or stainless steel sieve.
7. Laboratory Oven. One (1) oven with a minimum 7.5 cubic foot chamber with 2 or more shelves.
8. Hot Plate. A 2-burner electric or propane hot plate.
9. Sand Equivalent Shaker. Electrically operated with electronic timer.
10. Sample Splitters. One (1) adjustable sample splitter with adjustable chute width of $\frac{1}{2}$ inch to 3 inches and 3 sample pans. One (1) fixed width sample splitter with fixed chute width of 1 inch and 3 sample pans.
11. Microwave Oven. Microwave oven with a minimum chamber size 1.55 cubic feet and a minimum of 900 watts with 3 microwave pans.
12. Safety Equipment. Fire extinguisher, first aid kit, eyewash kit, and other safety equipment required by law.
13. Miscellaneous Equipment. Additional equipment (e.g., oven mitts, brushes water squeeze bottle, mixing spoons, disposable gloves) to perform the following tests:
 - a. Idaho IT 72.
 - b. AASHTO T 99 Method C.
 - c. AASHTO T 180 Method D.
 - d. AASHTO T 176.
 - e. AASHTO T 27.
 - f. AASHTO T 11.

C. Class II Field Laboratory – Aggregate, Soils, and Superpave SP 2.

Same as Class I field laboratory plus the following:

1. Laboratory Oven. Add a second oven with a minimum 10 cubic foot chamber with 2 or more shelves.
2. NCAT Ignition Furnace. Including the equipment and personal protection gear necessary to perform AASHTO T 308 Method A internal balance and AASHTO T 30.

3. Miscellaneous Equipment. Additional equipment (e.g., oven mitts, brushes water squeeze bottle, mixing spoons) to perform the following tests:
 - a. Idaho IT 99.
 - b. AASHTO T 304.
 - c. ASTM D4791.
 - d. AASHTO T 329.
 - e. AASHTO R47.

D. Class III Field Laboratory – Aggregate, Soils, and Superpave SP 3 and SP 5.

Same as Class II field laboratory plus the following:

1. Scales. Two (2) (electronic), with digital readout, sensitive to 0.1 grams with a minimum range of 0 to 20,000 grams.
2. Gyratory Compactor. Pine Instrument Gyratory Compactor Models AFG1 or AFG2 (105-125 VAC), 12 Amp 60 Hz., including manuals and software. Included with the gyratory compactor will be 2 molds and the equipment to perform AASHTO T 312.
3. Specific Gravity Station. Including the necessary equipment and accessories to perform the AASHTO T 209 (bowl method) and AASHTO T 166.

E. Class IV Field Laboratory - Superpave SP 3 and SP 5.

The Class IV laboratory does not require aggregate or soils testing. Equip with the following:

1. Scales. Two (2) (electronic), with digital readout, sensitive to 0.1 grams with a minimum range of 0 to 20,000 grams.
2. Quartering Canvas. Vinyl coated fabric with an approximate size of 4 feet by 4 feet.
3. Sieve Shaker with Sound Enclosure. Motor driven shaker capable of handling 12 inch diameter, half height brass wire U.S. Standard sieves. Sieves will meet ASTM E11. Sieve sizes will be 1", $\frac{3}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{8}$ ", No.4, No. 8, No. 16, No. 30, No. 50, No. 100, No. 200, and a pan with lid.
4. Deep Frame Wet Washing Sieves. A 12 inch diameter, half height No. 10, and full height No. 200 brass wire, or stainless steel sieve.
5. Laboratory Oven. Two (2) ovens with minimum 10 cubic foot chambers with 2 or more shelves.
6. Gyratory Compactor. Pine Instrument Gyratory Compactor Models AFG1 or AFG2 (105-125 VAC), 12 Amp 60 Hz., including manuals and software. Included with the gyratory compactor will be 2 molds and the equipment to perform AASHTO T 312.
7. NCAT Ignition Furnace. Including the equipment and personal protection gear necessary to perform AASHTO T 308 Method A internal balance and AASHTO T 30.
8. Specific Gravity Station. Including the necessary equipment and accessories to perform the AASHTO T 209 (bowl method) and AASHTO T 166.
9. Safety Equipment. Fire extinguisher, first aid kit, eyewash kit, and other safety equipment required by law.
10. Additional Equipment. Additional equipment to perform the following tests as necessary:
 - a. Idaho IT 99.
 - b. AASHTO T 27.
 - c. AASHTO T 11.

- d. AASHTO T 304.
- e. ASTM D 4791.
- f. AASHTO T 329.
- g. AASHTO R 47.

645.03 Construction Requirements. The field laboratory will be operational for at least 10 working days before start of testing and will only terminate 14 working days after completion of paving, or as directed. Material requiring testing will not be accepted until the field laboratory is properly equipped, operational, and approved. The field laboratory will not be moved without written approval.

An all-weather parking area for the field laboratory will be provided and maintained as directed. The parking area will be approximately 15 feet wide and 35 feet long, leveled across its length and width, cleared of vegetation and debris, and sloped to drain. The Contractor will be responsible for restoring the area after the field laboratory is removed.

The field laboratory is the Contractor’s property and will be removed as directed.

Provide electrical service or electric generator installed by a licensed electrician. The electrical contractor will file for an electrical inspection permit with the Idaho Department of Labor and Industrial Services, and the field laboratory electrical service approved by a licensed electrical inspector before turning over to the Engineer. The Contractor will furnish the following:

1. Trash Containers. Appropriate trash containers with bags. Haul trash as necessary.
2. Water. An adequate supply of potable water will be provided at all times for testing purposes. The water supply will be plumbed into the field laboratory sink and will have sufficient pressure to wash samples. The Contractor will control the discharge of waste water from the field laboratory in an approved manner. Waste water will not be allowed to create muddy conditions around the field laboratory.
3. Portable Toilet. A portable toilet for use by the field laboratory personnel will be provided. The portable toilet will be serviced weekly or as directed.
4. Cleaning Equipment. Broom, dustpan, 5 gallon wet/dry vacuum, mop, and pail.
5. Printer. Provide 1 printer with toner and paper capable of connecting to a laptop computer via a USB port.

645.04 Method of Measurement. The field laboratory will be measured as a lump sum.

645.05 Basis of Payment. The Department will pay for the accepted field laboratory as follows:

Pay Item	Pay Unit
Class I Field Laboratory – Aggregate and Soils	LS
Class II Field Laboratory – Aggregate, Soils, and Superpave SP 2	LS
Class III Field Laboratory – Aggregate, Soils, and Superpave SP 3 and SP 5.....	LS
Class IV Field Laboratory – Superpave SP 3 and SP 5	LS

The Department considers furnishing, maintaining, and repairing the field laboratory, parking area, equipment, other costs related to the field laboratory’s operation, and restoration of the field laboratory site as incidental and the cost included in the contract unit price.

Electrical inspection permits will be obtained at no additional cost to the Department.

Costs associated with the field laboratory operation, including insurance and utilities, will be paid by the Contractor.

SECTION 647 – TEMPORARY TURBIDITY CURTAIN

647.01 Description. Provide and install a geosynthetic barrier which totally encloses construction within watercourses to confine sedimentation within the work area. The turbidity curtain must be a pre-assembled system, including the geotextile/geomembrane, connection, securing mechanisms, flotation devices, stakes, and ballast chain. Provide a system of adequate capability, appropriate for the site conditions (e.g., current, wind/waves, depth [stream bottom elevation to normal water surface elevation]). Construct the turbidity curtain according to this specification, the plan details specified, or as directed. The work includes continued performance inspection, maintenance, and removal of the turbidity curtain and all accessories upon completion of the work within the turbidity curtain area.

Before delivery to the project site, submit manufacturer's cut-sheets and shop drawings detailing the materials, installation, maintenance, and removal of the temporary turbidity curtain for approval. This submittal must include a minimum of 3 examples of projects where the manufacturer's turbidity curtain was used.

647.02 Materials. Ensure that the turbidity curtain is a bright color (i.e., yellow or international orange) that will attract the attention of boat traffic. Turbidity curtain installation must include navigation warning lights along the curtain at least every 20 feet and at each corner. Use 22 ounces per square yard PVC-coated fabric with a minimum grab tensile strength of 500 pounds for the turbidity curtain.

Provide the geosynthetic material, anchoring system, flotation, and other necessary hardware to meet a Type 3 turbidity curtain installation for the anticipated construction conditions. Provide certifications and written specifications from the manufacturer to confirm compliance.

Turbidity curtain will be accepted in accordance with the applicable procedures specified in subgrade separation geotextile Type II in 640 and 718.

647.03 Construction Requirements. Securely place, orient, and anchor the turbidity curtain according to the specified locations and depths, and according to the manufacturer's written installation guidelines or as directed before work commences. Design the turbidity curtain system to handle site-specific drainage or flow conditions. Provide and maintain sufficient anchors, tie-downs, or other mechanisms to ensure proper position and performance of the turbidity curtain in accordance with the manufacturer's written directions. Connect individual segments of curtains together using the manufacturer's end-to-end attachments. Attach anchor lines to the flotation device as described in the manufacturer's written installation instructions. Any visible plume of cloudy water outside the protected construction area constitutes inadequate turbidity curtain performance. Immediately modify, adjust, or repair any portion of the turbidity curtain to correct inadequate performance.

Design the anchor system to maintain adequate shape and barrier integrity of the curtain system under the construction conditions. Ensure the anchor system does not impede construction operations.

Ensure that the turbidity curtain maintains continuous contact with the bottom. Excess curtain must lie without wrinkles on the bottom, away from construction activity.

Maintain the turbidity curtain until the construction activity within the watercourse is complete and the turbidity is reduced to approved levels. Maintenance includes inspecting the turbidity curtain, flotation, and ballast to ensure the work area is securely partitioned from the waterway.

When the turbidity curtain is no longer required, carefully remove the curtain and related components to minimize immediate turbidity. Before removing the curtain, turbidity must not exceed preconstruction levels.

647.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum complete in place.

647.05 Basis of Payment. The Department will pay for acceptable quantities at the contract unit price as follows:

Pay Item	Pay Unit
Temporary Turbidity Curtain.....	LS

Maintenance, proper alignment, and removal of the turbidity curtain and all accessories upon completion of the work within the turbidity curtain area are incidental.

SECTION 650 – TIME-LAPSE CAMERA

650.01 Description. Furnish and install a stationary time-lapse camera system at a location to view the work of each stage of construction. Move the camera to new locations, as necessary, to view the construction of the subsequent stages of construction. Upload images from the camera and ensure a fully-functional website is viewable by the public. The camera system will monitor work on the project site as well as capture images for the production of a time-lapse movie.

650.02 Materials. Provide a stationary high resolution, wide lens time-lapse camera capable of capturing each stage of construction. Video and audio capabilities are not required. The camera system must be able to capture high resolution images of at least 6 megapixels for use in producing a high resolution Ultra HD 4K and 1080p time-lapse movie generated from the still images taken during the work.

The camera system must be able to operate in typical Idaho weather conditions (e.g., 10 to 120 °F, 40 mph winds) for the time of year the construction is occurring.

The camera system must be able to store data onsite (e.g., solid state hard drive) and communicate the data via a data connection (e.g., LTE cellular connection) to transmit the data to the Engineer. The camera system requires a website, viewable by the public, any time the project site is illuminated.

Provide all necessary hardware, software, data transmission, data storage, mounting hardware, 24/7 technical support, monitoring, maintenance, lens cleaning, and power interruption alerts by email for the duration of the work.

650.03 Construction Requirements. Install the stationary camera system in accordance with the manufacturer's written instructions, requirements, or as directed.

Digital still images will be taken every 20 minutes or otherwise directed. Each image must include the year, month, date, and time that the image was taken. Submit all original digital still images without alternation, manipulation, editing, or modifications using image-editing software. Submit a professionally produced high-resolution Ultra 4K and high-definition (1080p) time-lapse movie of the work. Editing will include image stabilization, color correction, removal of inclement weather footages and images outside the desired daily time range determined by the Engineer.

Submission must include high-resolution still images captured at the increments required above. File naming must include the year, month, date, and time that each high resolution still image was taken.

650.04 Method of Measurement. Camera systems will be measured by the each and the service for the camera (e.g., cellular LTE data) will be measured monthly.

650.05 Basis of Payment. Payment for accepted work will be made under:

Pay Item	Pay Unit
Time-Lapse Camera	Each,
Time-Lapse Camera Service	Monthly

Any additional items necessary to provide a fully-functional camera system are incidental (e.g., equipment, setup, installation, maintenance, support, removal, time-lapse movie).

SECTION 651 – LAWN CONSTRUCTION

651.01 Description. Prepare site, construct and install sod or turf, or apply seed, and maintain designated lawn areas.

Ensure construction work and lawn area are established to the specified condition at the end of the specified establishment period.

651.02 Materials. Ensure plant materials conform to the current edition of American Standard for Nursery Stock.

A. Turf Seed. Provide turf seed that consists of drought-tolerant, fine-textured, turf-type grasses that are specific for the project site. This may include fescue, bluegrass, perennial ryegrass, or a combination of the type suitable for the designated turf area. Refer to 711.05 for further seeding requirements.

B. Sod. Provide sod that consists of drought tolerant, fine textured, turf-type grasses that are specific for the project site. This may include fescue, bluegrass, perennial ryegrass, or a combination of the type suitable for the designated sod area.

Provide grass species true to type and name in accordance with the standard plant names, current edition, by the Editorial Committee of the American Joint Committee on Horticultural Nomenclature.

Provide grass sod less than 10 months old, free of weeds and undesirable plants, and not frozen or dormant. Obtain the Engineer's prior approval of the supply source before cutting and delivering to the planting site. Ensure sod has been properly handled and cared for, has natural color, is in healthy condition, and properly stored, watered, and cultivated. The Engineer will reject sod showing evidence of improper handling or discoloration due to prolonged storage before delivery and placement.

C. Fertilizers and Soil Conditioners. Refer to 711.07 and 711.08.

D. Soil Amendment. Refer to 711.18.

E. Mulch. Refer to 711.10.

651.03 Construction Requirements. Amend the soil with fertilizers, soil conditioners, soil amendments and mulch or combinations to the specified condition, as per seed and sod nutrient requirements, and as recommended by a contractor-supplied soil analysis.

A. Lawn Bed Preparation. Till the lawn areas to at least 4 inches deep by means that will loosen the soil and bring it to a condition suitable for seeding, sodding, and fine grading. Before and during this operation, make the surface free of vegetative growth. Remove weeds, stones larger than 1 inch, hard clods, roots, sticks, debris, and other matter encountered during tilling that is detrimental to good seed bed preparation, or that is toxic to grass.

Provide soil amendment for sodding that consists of organic soil, coarse sand (100 percent passing the No. 10 sieve and 100 percent retained on the No. 4 sieve), decomposed sawdust, flexible flax fibers, sphagnum peat moss, compost, and other biological additives or combinations. Uniformly spread and incorporate soil amendments, conditioners, and fertilizer applications into the upper 4 inches of lawn bed.

Ensure the volume percentage of the top 4 inches of the lawn bed after mixing consists of approximately 65 percent native topsoil, 25 percent coarse sand, and 10 percent organic soil conditioner. After fertilizers, soil conditioners and soil amendments are incorporated, work the areas as necessary to provide a smooth, firm but friable lawn bed at the required finish grades.

After cultivation, carefully fine grade and roll the area to the required finish grade and provide a fine textured, smooth and firm surface, without any foot prints, undulations or irregularities. Provide good drainage by smoothing irregularities on the surface that form pockets where water will sit or accumulate.

Finish grading lawn seeding area adjacent to walks, driveways, and pavements to approximately 1 inch below the adjacent walk, driveway, and pavement finish grades.

Finish grading the sod bed to 1¼ to 1½ inches below the adjacent walk, driveway, and pavement finish grades.

B. Turf Seed & Sod Application. Apply turf seed uniformly to lawn areas by one of the following methods:

1. With an approved double roller landscape seeder.
2. In a slurry with a hydroseeder (for slopes steeper than 3H:1V).
3. Hand broadcast and raked or covered with a drag.

Plant seed 1/8 inch deep or less, ensure the ground surface is true to grade, and free from ruts, foot prints, or other irregularities.

Do not apply slurry mixture during windy conditions (winds in excess of 15 mph), when the ground is excessively wet (standing or pooled water on surface) or frozen, or if rainy conditions are anticipated within 24 hours of application. In the event of unanticipated rainy conditions, re-apply the mixture to all uncured areas. Ensure hydroseeded mixture has at least 48 hours before a rain event for soil binder to cure. The Engineer may reduce curing time.

Apply the slurry mixture within 30 minutes of adding the seed to the slurry mixture. Mix and apply the slurry mixture products in accordance with the manufacturer's written instructions. Submit a copy of the manufacturer's written instructions to the Engineer at least 10 calendar days before beginning application.

Do not install the sod if the soil has pooled or puddled water accumulation on the surface, or when the ground is excessively wet, frozen, or otherwise un-tillable. Cut individual sod pieces to a uniform size with square corners at a uniform depth of 1 to 1¼ inches. Lay the first row of sod in a straight line and subsequent rows placed parallel to and tightly against each other. Stagger lateral joints. Ensure butt joints between strips are tight without any gaps. Exercise care to ensure that the sod is not stretched or overlapped.

After placing the sod, roll the lawn with a sod roller in a diagonal direction then water sod and allow water to soak into the root system. Ensure sod is moist but do not allow water to puddle or pool on the surface. Ensure the finished sod surface is smooth and uniform.

C. Establishment Period. The soil may need more than 1 fertilizer and soil conditioner application during the establishment period. Contact the Engineer for final acceptance and to determine whether additional fertilizers and/or soil conditioners are needed.

1. Seeded Areas. The seeded lawn establishment period begins at completion of initial grass sowing. The establishment period ends when each lawn area has been mowed a minimum of 5 times, and presents a healthy and well cared for appearance with a uniform color, texture, and condition without weeds.

Seeded area establishment consists of:

- a. Protecting the planted area from trespass and other damage hazards.
- b. Promoting seed germination and grass growth.
- c. Mowing.
- d. Removing clippings, weeds, litter, and debris.
- e. Reshaping, reconditioning, and reseeded areas which become eroded, washed out, flooded, or which for any reason fail to show healthy specified grass growth.

Water lawn areas in accordance with good horticultural practices for the prevailing or existing conditions. Provide water for the establishment period unless a Department-owned or Department-controlled water supply system is available.

Mow the first time when the grass has attained a height of approximately 3 inches, and when the ground is sufficiently firm to prevent rutting. Mow the grass to a height of 2 inches, subject to the approved modification relative to the kind of grass and the season. Provide subsequent mowing when the grass attains a height of 3 inches.

Contain grass clippings in a bag or grass catcher, or remove clippings from mowed areas within 2 hours after mowing for the first 2 mowings. Do not allow clippings to smother or retard grass growth. Provide individual or blanket treatment weeding and noxious vegetation removal in accordance with accepted lawn care practices.

The Department will conduct an evaluation at the end of the establishment period and identify any areas that have not met the requirements. Reseed the areas identified by the Department as not meeting the contract at no additional cost. Supply the same grass seed type in accordance with the original work requirements, including the establishment period.

2. Sodded Areas. The establishment period ends 2 weeks after lawn completion and acceptance or when the Engineer accepts the completed work, whichever comes first, and when sodded areas present a healthy and well cared for appearance with a uniform color, texture, and condition without weeds.

D. Extension of Establishment Period. Bring areas not acceptable at the end of the normal establishment period to the specified condition before final acceptance. The Engineer may extend the establishment period.

651.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Seeded lawn by the acre to the nearest 0.01 acre constructed and established.
2. Sodded lawn by the square foot of lawn constructed and established.

Fertilizer, soil conditioner, soil amendment, and mulch will be by force account as specified in 109.03.C.5.

651.05 Basis of Payment. The Department will pay for accepted quantities as follows:

Pay Item	Pay Unit
Lawn Construction – Seeded	Acre
Lawn Construction – Sodded	SF
Fertilizer and Soil Conditioner	CA
Soil Amendment.....	CA
Mulch	CA

Topsoil will be paid for as specified in 213. The soil analysis cost is incidental.

SECTION 652 – UNDERGROUND SPRINKLER SYSTEM

652.01 Description. Provide, install, and test an underground sprinkler system.

652.02 Material Requirements. Incorporate new materials and equipment in the system with performance test certifications when requested.

A. Water Pipe and Fittings. Provide PVC plastic water pipe and fittings. Use standard design fittings appropriate for the type of pipe and pressure rating. Ensure pipe and fittings meet the requirements of ASTM D2241 for SDR 26, PR 160 pipe and stamped N.S.F. approved. Use only standard fittings designed for their specific use, selected and installed to provide the least friction loss of water. Use only the appropriate materials (e.g., cements, solvents, thinners, joint compounds) accepted for use with the kind of pipe used.

B. Sprinkler Heads. Provide sprinkler heads of the sizes, capacities, and types as specified to ensure uniform coverage at the operating water pressure.

Provide sprinkler heads with working parts made of sturdy durable materials. Ensure nozzles, orifices, and working parts are precision machined and highly resistant against wear.

1. **Stationary.** Provide stationary, non-pop-up sprinkler heads for lawn and shrub areas with orifices or nozzles that spray in a full-circle or part-circle, as specified.

Provide spray heads with removable and interchangeable orifices or nozzles that can adjust water volume and coverage area.

2. **Pop-up Non-Revolving.** Provide pop-up, non-revolving sprinkler heads with orifices or nozzles that adjust water volume and coverage area. Ensure the pop-up portion of the head returns freely to its closed position when it is set to an angle of 30 degrees.

Provide sprinkler heads that are accessible from the top without disturbing the sprinkler housing. Ensure orifices and nozzles are removable and interchangeable from the top of the head without disturbing the sprinkler housing or ground.

3. **Pop-up Rotary.** Provide pop-up rotary sprinkler heads and working parts that operate smoothly without ceasing under the specified operating pressure.

Provide a sprinkler assembly with nozzles that are interchangeable and replaceable without disturbing the sprinkler assembly or the ground.

Provide pop-up rotary sprinkler heads that are water jet or impulse motivated. Ensure a heavy retractor spring provides positive plate closing when in the off position.

Ensure the complete working assembly is removable from above the ground as a unit to permit adjustment and servicing. Ensure part-circle heads are adjustable to any part of a circle from 90 to 360 degrees.

C. Vacuum Breakers. Provide pressure type or atmospheric type vacuum breakers (i.e., anti-siphon valves) with machined valve seats, and a working pressure rating of 150 psi. Ensure the vacuum breaker make and design(s) meets Idaho and local sanitary requirements.

D. Gate Valves. Provide heavy duty gate valves meeting the requirements of ASTM B62 (85-5-5) or approved equal. Provide valves with a service rating of 300 psi (for non-shock cold water) and a hydrostatic shell test rating of 450 psi. Ensure the manufactured valve contains a printed or cast identification.

E. Quick-Coupling Valves, Valve Couplers, and Hose Swivels. Provide quick coupling valves with self-closing type caps made of a heavy-duty irrigation material that have a service rating of at least 150 psi, and are designed for connection to the water supply lines.

Ensure quick-coupling valves are watertight before and after the coupler is inserted. Ensure the valve seat mechanism is designed to close before the coupler is removed.

Provide couplers or keys for quick-coupling valves, portable sprinkler heads, or hose swivel attachments. Provide bayonet type couplers or keys made of highly corrosion-resistant metal, designed for quick-coupling valves.

Provide hose swivels with a 90 degree swivel elbow that is free turning and covers a 360 degree swing. Provide watertight washers and seals when in service.

F. Electric Automatic Controllers. Provide automatic electronic controllers designed to operate on 115-volt, 60 Hz single-phase AC.

Provide a controller with a master switch able to shut off irrigation operation without disturbing the timing sequence. Provide a manual setting for each station within the controller to permit independent operation of each station.

Provide a controller that controls and operates each station independently within a 14-day cycle. Provide a controller that contains variable and adjustable watering times and separate adjustments for each station that does not affect the timing cycles of other stations.

Provide controllers for outdoor installation, when specified. Install a weatherproof cabinet or housing designed specifically for each individual controller. Provide a cabinet that is made from corrosion-resistant metal with a high quality paint or enamel. Provide a cabinet that allows easy removal or part replacement without the use of special tools and that is lockable to prevent tampering and vandalism.

Design, install, and adjust the controller to work efficiently with the remote control valves and set watering cycles as designated.

G. Section (Zone) Control Valves and Master Valves. Provide control valves having a service rating of at least 150 psi (for non-shock cold water), designed for underground installation and operating with standard keys. Ensure valves have removable bonnet and stem assembly, adjustable packing gland, rising stem to ensure full valve opening, renewable disc-type washer seating, and hex-nut brass union. Furnish them with an integral union or separate union for adjacent installation or in the pipeline.

Provide automatic control valves that are normally closed with electric actuation operated by the controller. Provide a 24-volt, 60 Hz AC wire conductor system or as specified. Protect solenoids or other actuating mechanisms from moisture damage.

1. Automatic Master Valves. Provide automatic master valves for use with automatic controllers within the main water supply line. Ensure the valves operate at the pressure rating set for the irrigation lines, without creating excess surge pressure.
2. Drain Valves. Provide manual-type drain valves used in waterlines at locations so water can drain out by gravity.

H. Electrical Conductors. Provide solid conductors that can be installed underground, as specified.

I. Water and Power Sources. Supply electrical power for testing water and power sources required in flushing and balancing the system at no additional cost. If a Department-owned or Department-controlled water supply system is available at the project site, it may be used without charge.

652.03 Construction Requirements.

A. Site Preparation. Excavate pipeline trenches and areas to be occupied by controllers, bases, valves, protective valve sleeves, drain sumps, and other required facilities. Install pipelines at least 12 inches deep in areas outside the roadways. Under roadways, place the pipe at the ballast bottom. The Engineer will measure pipe cover depth from the pipe top to the finished ground surface. Excavate at least 12 inches square and 12

inches below the drain valve sumps. Hold excavations to the least width practicable and work without fouling the adjacent topsoil. Dispose of excavated materials not acceptable for backfilling in a satisfactory manner.

Ensure trench bottoms and other excavations are true to grade and free from protruding stones, roots, or other debris. Construct plastic pipe bedding of earth or sand with at least 2 inches on all sides of the pipe.

Protect the pipe with backfill material without stones, clods, or other injurious matter. Place topsoil as required in the upper part of the backfill. Place backfill in layers 8 inches or less in compacted thickness and thoroughly tamp, roll, or puddle each layer. If sufficient acceptable backfill material is not available from required excavations, make up deficiency with acceptable material in a satisfactory manner. Correct backfill settlement as required during the life of the contract.

Where pipelines are run under curbs, walks, pavements, and other such improvements, which are to remain in place, preserve such structures from disturbance or damage to the extent practicable and install the line by jacking, whenever possible. Repair structures that are disturbed or damaged at no additional cost. Encase all pipes under roadways in a suitable galvanized iron or other approved conduit.

B. Sprinkler System Installation and Adjustment. Layout the sprinkler system as specified. The Engineer may allow minor alterations to distribute adequate water coverage. Before proceeding with the installation of any system section, verify the specified measurements with the available water supply and pressure. If there are apparent discrepancies, obtain approval before making changes.

1. Pipe, Valves, and Fittings. Lay pipe, valves, and fittings to drain by gravity with a minimum number of drain valves.

The Engineer will inspect installations that have been tested and are ready to be accepted for compliance with contract requirements before being covered by backfill material.

Do not move or install plastic pipe when the pipe is wet or the ambient temperature is below 40 °F. Join plastic pipe and plastic fittings with solvent cement, except put threaded joints together with an approved non-hardening, putty-type joint compound. Make cuts square and clean. If pipe is chucked or clamped, protect it from nicks and scarring by wrapping in canvas, emery paper, or other suitable material.

In making solvent cemented joints, the procedures are as follows:

- a. Cut pipe square and deburr the ends.
- b. Wipe off fitting and pipe with a clean cloth.
- c. Coat fitting with primer.
- d. Quickly coat pipe with primer to fitting socket depth.
- e. Quickly coat fitting again with primer.
- f. Quickly coat pipe liberally with the approved cement.
- g. Quickly coat fitting lightly with the approved cement.
- h. Quickly coat pipe again with the approved cement.
- i. Quickly insert pipe into fitting until it bottoms.
- j. Twist pipe at least 1/4 turn.
- k. Hold tightly at least 30 seconds.
- l. Wipe off excess cement and primer.
- m. Allow it to set at least 12 hours before testing.
- n. Backfill trench in the cool morning hours.

In making joints with threaded fittings, exercise care to avoid undue strain on plastic material. On plastic-to-iron connections, make the iron connections first, using a non-hardening joint putty type. Tighten threaded joints about 1 turn past hand-tight with a strap wrench.

Place plastic pipe in continuous contact with the trench bottom and lay the lines alternating from side-to-side of the trench to provide for possible length contraction due to temperature changes. When testing the lines for water tightness, center load the pipe between joints with backfill material as necessary to prevent pipe arching or whipping under pressure. Before installing sprinkler heads and valves, thoroughly flush pipelines and blow out dirt and foreign matter.

Install quick-coupling valves 4 inches above the planting bed finished grade.

Assemble gate valves with a union.

2. Flushing and Testing Lines. Test pipelines, valves, and fittings, other than those leading from section control valves to sprinkler heads, for water tightness by sections at the highest operating pressure obtainable for each system section, in the Engineer's presence, before trenches are backfilled. Ensure pipe, fittings, joints, valves, and other appurtenances are watertight during the test, with valves tested in open and closed positions. Repair and remedy leaks or defects. Make tests and repairs on each unit or system section, repeating the process until the pipelines and valves are completely watertight and leak proof. Correct damage to existing facilities caused by the testing, by leakages, or by repairs to the system at no additional cost.

3. Sprinkler Heads. Set sprinkler heads other than shrubbery heads to finish grade.

Except for shrubbery heads, set sprinkler heads 4 inches away from curbs, walks, and pavements and flush with the lawn finished grade. Set shrubbery sprinkler heads on risers above finished grade at the heights as specified or as directed, and 12 inches away from curbs, walks, and pavements.

4. Automatic Controller and Valve Controls. Install the controllers at the locations specified, which may consist of 1 or more controllers working as a unit. The controllers and cabinets are to be firmly mounted on a substantial and firm concrete pedestal or base, on a heavy, galvanized iron pipe stanchion set in concrete, or on faces of walls or structures. When wall-mounted, ensure bottom of controller is at least 4 feet above the floor. Adjust and set controllers to provide specified station cycles and timing.

Install meter bases at the power source. Contact the local utility company to determine their requirements before performing any electrical installations. Ensure power source connections meet the requirements of the company or agency providing the power supply, and their representative is contacted and given sufficient notice before making such connections. Ensure wiring is in accordance with the schematic wiring diagram as specified or as approved. Ensure the wire sizes (AWG) of common return or ground wires and control wires are as specified or as approved.

The Engineer may allow placing the electrical conductors in the same trench as the water pipe as long as contact with the pipe is avoided. If allowed, protect wires by placing the conductors under the pipelines. Place a 2-inch soil cushion without rocks or hard lumps in the trench bottom before placing the conductors and then firmly tamp and backfill with the same material.

Twist and solder wire connections. Ensure wire splices are watertight and to the Engineer's satisfaction.

Provide a U-loop approximately 12 inches wide and deep in the direct burial conductor at each conduit entrance bushing to prevent the conductor from pulling on conduit due to settling subgrade material. Conductors through conduit are to be separate runs and not twisted, braided, or banded in a group or groups. At section control valves, the conductor may be placed under the protective sleeve with clearances of at least 3 inches below the sleeve.

5. Protective Valve Boxes, Sleeves, and Drains. Protect manual drain valves with non-corrosive metal sleeves with lock caps, furnished in lengths sufficient to enclose and clear the bonnet portion of the valve as installed. Provide protective sleeves with integral flanges to resist sleeve removal or with 12-gauge copper wire for fastening the sleeve to valve or pipe.

Protect automatic control valves with 12-inch concrete sewer pipe with concrete plug cover, standard cast iron sleeves and covers, or approved equal. Provide sufficient lengths to enclose the valve assembly and extend to the water supply line top.

A concrete or cast iron box may be substituted with a suitable cover and large enough to house grouped valves and couplings when more than 1 valve is installed at 1 location.

Use crushed or uncrushed rock or gravel for drain sumps below drain valves that is free draining, well graded, and containing material retained on a 3/4 inch sieve.

Set boxes, sleeves, pipe covers, and caps at valves with the tops flush with the final finished grade.

6. Valve Keys, Tools, Accessories, Data, and Warranties. Furnish 2 of each valve key type for manual valve operation. Provide keys with T-handles and shafts of sufficient length to permit the operator to work from a standing position.

Provide tools and accessories necessary for irrigation system adjustment, normal field repair, and operation.

Also provide manufacturer's or dealer's written installation instructions, parts lists, maintenance, and operation manuals and instructions, and similar available data.

7. System Adjusting, Balancing, and Final Inspection. Adjust and balance each completed section or irrigation system unit to provide uniform coverage and adequate service. Adjust and balance each section or unit at the normal water pressure and with fully open valves.

The Engineer will use the following criteria for final inspection:

- a. There is uniform and effective coverage and service to all areas to be irrigated for all zones.
- b. Every zone is able to be completely drained by gravity.

652.04 Method of Measurement. The Engineer will measure accepted work quantities for an underground sprinkler system by lump sum.

652.05 Basis of Payment. The Department will pay for accepted work as follows:

Pay Item	Pay Unit
Underground Sprinkler System	LS

SECTION 654 – COMPOST

654.01 Description. Provide and apply compost on disturbed areas, which include areas within the right of way where existing vegetation has been removed or new construction areas, including haul roads. Contact the Engineer before applying compost.

Apply as a temporary and permanent erosion control measure meeting all applicable portions of 212.03.

654.02 Materials. Provide compost homogeneous in color (e.g., dark loam), with an earthy smell (i.e., not odiferous), and that contains no visible straw or organic or inorganic trash (i.e., maximum of 0.5 percent plastic and less than 1 percent for other trash). Completely decomposed material will be evidenced by total breakdown of raw ingredients and lack of odor or heat generations (i.e., mature and stable exhibiting no anomalous hot-spots).

1. Solvita maturity testing: ammonia (NH₃) and carbon dioxide (CO₂) respiration or temperature self-heating tests (may not reheat to 66 °F (20 °C) above ambient temperature).
2. Combination evolution rate is greater than 6.
3. Conductivity testing is less than 5 mmhos per centimeter and no greater than 15 mmhos per centimeter.
4. PH of 5.5 to 8.2.
5. Sieve testing requirements: must be friable and pass through a minimum 1 inch-screen.
6. Maximum nutrients allowable:
 - a. Nitrogen, total (TKN): 1.8 percent dry weight.
 - b. Phosphorus total: 3.3 percent dry weight.
7. Maximum physical contaminants (i.e., manufactured manmade inerts):
 - a. Plastic: 0.5 percent dry weight.
 - b. Concrete: 1 percent dry weight.
 - c. Ceramics: 1 percent dry weight.
 - d. Metal: 1 percent dry weight.
 - e. Other: 1 percent dry weight.
8. Percent moisture allowable: 0 to 35 percent.
9. Must be certified noxious weed free.

The supplier or the Idaho State Department of Agriculture (ISDA) Seed Laboratory will sample every 500 tons of compost. Compost tests will be completed and certified by a NAPT-PAP or an independent Seal of Testing Assurance Program-certified laboratory.

The following labs are accredited to perform the required tests:

- Stukenholtz Laboratory; Twin Falls, ID.
- Northwest Agriculture Consultants; Kennewick, WA.
- University of Idaho, Analytical Science Laboratory; Moscow, ID.

Certifications. The supplier will provide records of row temperature, turning schedules, and noxious weed free certification by the ISDA.

Provide a copy of the production schedule and noxious weed free certification. The compost portion will meet the chemical, physical, and biological properties outlined.

654.03 Construction Requirements. For slopes up to 3H:1V, distribute compost evenly to all areas to be seeded at the rate of 110 to 140 cubic yard per acre, and incorporate the compost into the soil in preparation for drill seeding.

For slopes steeper than 3H:1V, apply compost to the soil surface at the rate of 140 to 300 cubic yards per acre using a pneumatic blower with a calibrated seed and tackifier injection system. For areas less than an acre, the compost may be hand placed and lightly incorporated into the soil before seeding begins.

Any site with erosion problems, especially due to wind may require compost more than 2 inches thick, and may take more than 2 applications as directed. The Engineer will evaluate the erosion potential and discuss with the Contractor before the first application. These applications will take place within 5 calendar days following the work within the designated area, unless otherwise specified or directed. This time limit may be shortened if wind or precipitation cause erosion or sediment problems.

654.04 Method of Measurement. The Engineer will measure acceptably completed compost by the acre parallel with the slope based on planned quantity for each time this work is performed.

654.05 Basis of Payment. Payment for accepted work quantities will be made as follows:

Pay Item	Pay Unit
Compost.....	Acre

SECTION 656 – TRAFFIC SIGNAL INSTALLATION

656.01 Description. Provide and install fully functional permanent traffic signals. Operate and maintain temporary signalization as required.

656.02 Materials. Provide materials as specified in:

Concrete	502
Nonstructural Concrete	509
Traffic Signal Materials	713

Use Class 40 concrete for pole foundations.

Cabinet foundations, pads, and electrical service pedestal foundations require nonstructural concrete specified in 509.

Provide materials that bear the seal of approval of the UL, NEMA, or other approved testing organizations. Materials must also meet the NEC requirements, local codes, and connecting utility requirements.

Submit a list of equipment and materials proposed for installation. For each item listed, include manufacturer's name, size, and catalog number.

Obtain approval of the submitted shop drawings before fabrication begins for the following items:

1. Steel signal poles (nonstandard poles only).
2. Concrete junction boxes.
3. Composite junction boxes.

Only use listed catalog numbers to identify material and equipment type and configuration required for use in the traffic signal installation.

656.03 Construction Requirements. Construct as specified in this section and 619. Provide work that meets the NEC, local codes, and connecting utility requirements.

The Contractor may use existing signalization equipment to aid in the control of traffic during construction. Salvage existing signalization equipment and remove in a neat, skillful manner and deliver to the Department. The Department will not pay for removal and salvage of this equipment separately.

Submit the cabinet wiring schematic and the application programming for the control equipment for approval before fabrication begins.

Submit the specified or preapproved controller, cabinet, and auxiliary equipment to be installed in the cabinet assembly to the Department for inspection, compliance with specifications, and operational testing before installation. Make the cabinet assembly submittals or re-submittals available to the Department for at least 30 business days. When there are multiple cabinet assemblies per contract, add an additional 5 business days per assembly.

If the Contractor proposes to furnish cabinet assembly equipment other than the makes and models specified or preapproved, provide the complete control equipment and cabinet assembly for evaluation and testing for 45 business days. The Department may accept or reject such alternates depending on the evaluation to determine if the proposed alternate equipment is equal to or better than that specified. Resubmittals of nonspecified or non-preapproved equipment requires 45 business days for testing and evaluation. When there are multiple cabinet assemblies per contract, add an additional 5 business days per assembly.

When components do not comply with the specifications or fail during testing, the Engineer will reject the components, notify the Contractor of the rejection, and provide the date the components are available for pickup. The Department is not responsible for costs and contract delays associated with rejected components and resubmitted components.

Deliver the equipment submitted for inspection and testing to:

Idaho Transportation Department
Signal Shop
8150 Chinden Boulevard
Boise, Idaho 83714

After the Department's evaluation and testing is complete, the Department will ship the approved equipment to the appropriate district office on the Department's regular delivery schedule. Submit requests for alternative shipping methods, locations, or delivery schedules in writing for approval. If approved, the Department will deduct expenses incurred by the Department from the next progress payment estimate.

Ensure that vehicle and pedestrian signal heads are installed with faces completely covered. Securely attach covers to prevent accidental removal or from being dislodged. Ensure covers remain in place and can only be removed during testing or temporary operation until the intersection has been permanently opened and the signal is operational. The Contractor may use opaque covers with a transparent center section or port for viewing of individual lens indications for testing that remain in place until the signal is placed in full operation.

The Department will not allow covers with a transparent section or viewing port on a signal head that is in operational display. The Department requires full opaque covers for blanking out or restricting the visibility of an unwanted signal display.

Nonapproved signal covers and attachment methods include cardboard, trash bags, burlap sacks, plywood, electrical tape, and duct tape.

Ensure the neutral wires are white and the wires are identified by attaching wire markers at terminal points. Mark the wires in accordance with the number on the field signal wiring diagram. Attach wire identification that is a one-piece marker and is the required size for the size of conductors installed.

Use powdered soapstone, talc, or other approved lubricants when inserting conductors in conduit. Before proceeding to pull cable in the underground conduit runs, clean dirt or accumulations of moisture from conduit runs.

Do not use winches or other power-actuated equipment not specifically designed for pulling wire.

Ensure cable runs are continuous between the terminal blocks, as specified on the field signal wiring diagram. Do not splice between terminal blocks.

Neatly arrange wiring within controller cabinets in bundles in a squared corner pattern, and lace or tie wrap. Provide at least 4 feet of slack cable in the cabinet base for each cable. Ensure cable shielding or jacket remains in place except the last 4 inches measured from the termination of the shortest wire in each cable.

Use approved connectors on conductors at the terminal points.

The Contractor may use cable with more conductors than called for in the wiring diagram. When this is done, tape off the extra conductors and label as spares.

Install, direct, and veil optical programmed signals in accordance with the manufacturer's written instructions. Mask each section of the signal with specified materials in an acceptable manner. The Engineer may require onsite help of the equipment manufacturer's company representative for directing and veiling in accordance with the visibility requirements.

Install detector loops as specified. Cut the slot approximately $\frac{1}{16}$ inch wider than the loop cable and of sufficient depth to provide at least 1 inch of cover over the top wire if located in the top pavement course and $\frac{1}{2}$ inch of cover if located in the bottom course.

Cut the slot corner on a diagonal or chamfered to prevent sharp cable bends. Remove sharp edges that might damage the loop cable jacket. Hydro clean and dry the slot with pressurized air to remove loose material before inserting the loop wire.

Provide 1 continuous length of cable from the junction box around the loop area and back to the junction box. Splice loop conductors in the junction box.

1 turn is once around the saw slot with the same cable. 2 turns are twice around the slot with the same cable, and so forth.

Place the loop cable in the sawed slot in the same direction (clockwise or counter-clockwise) for loops on the same lane.

Use a blunt instrument to seat the loop cable at the bottom of the sawed slot. Do not use a screwdriver or similar sharp tool that could damage the cable jacket.

A loop system is defined as 2, 3, or 4 loops in 1 lane that is connected to a detector loop amplifier.

Test each loop after installation in the roadway and again after the slot has been sealed.

After the loop cable is installed in the cut slots and tested, fill the slot with an approved polyurethane resin sealant.

Test the loop cables in the junction box with a permanent type wire marker indicating approach, loop number, and input or output (e.g., Loop No.1, Lane a, the north approach, input = Na1+ and output = Na1-).

Connect the lead-in cable to the loop wire only in a junction box with a soldered, waterproof splice. Make the splice insulating package so it includes loop leads and loop lead-in cable as 1 unit and extends at least 1 inch onto the outside jacket of the lead-in cable.

Ground the lead-in cable shield at the cabinet end to the system ground. Solder the cable shield at the junction box so the cable shield is continuous throughout the intermediate junction boxes included in the insulated splice to prevent grounding.

Run the test conductor continuous from the farthest junction box in each loop system to the controller cabinet. Do not splice in the test conductor.

Do not install electrical conductors carrying over 50 volts in the loop detection conduits or junction boxes.

Comparative inductance test each loop system. Test each loop, as well as the system, the loop is associated with, as follows:

1. Ground Fault Test:

Before splicing to the lead-in cable, test individual loops between the loop conductor and an approved ground point with a 500-volt hand-charged megohm meter. Biddle Model 212159CL, AEMC Corporation Model 1250, or approved equal.

Test loop systems, with their leads un-terminated, at the control cabinet between 1 of the 2 lead-in conductors and approved ground point with a 500-volt hand-charged megohm meter. Biddle Model 212159CL, AEMC Corporation Model 1250, or approved equal.

Ensure the minimum reading for the loop system test is at least 100 megohms. For the individual loop test, ensure the minimum reading on the hand-charged meter is infinity. Correct discrepancies before signal turn on.

2. Comparative Inductance Test:

Check each loop system with an approved loop testing meter.

Record and certify the values for the above tests, using Department-provided forms.

Field test the system for 14 consecutive calendar days of normal operation without a failure. Give written notice when the signal system is complete before starting the operational test. Correct the signal equipment that fails during the test period or before final project acceptance at no additional cost to the Department.

Signal equipment items provided by the Department and installed by the Contractor that fail, due to no fault of the Contractor, before final project acceptance will be corrected by the Department at no expense to the Contractor.

Submit manufacturer’s warranties, guarantees, instruction sheets, and parts lists for materials used in the signal installation upon project completion.

656.04 Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

656.05 Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
Traffic Signal Installation	LS

Excavation, backfilling, surfacing, and materials are incidental work.

SECTION 675 – SURVEYING

675.01 Description. Surveying includes scheduling, coordinating, and providing construction surveying, field and plan measurements, confidence point checks, grade verification point checks, calculations necessary for completing the work and to properly control the work in its entirety, and quantity computations for pay items requiring area, volume, and linear measurement. Measurement of all other pay quantities is excluded from this item of work. Perform work as specified and in accordance with standard engineering and surveying practices under the responsible charge of a professional engineer or an Idaho licensed PLS. Any work that falls under [54-1202\(11\), Idaho Code](#) (e.g., setting centerline control, resetting land corners, locating property lines, setting right of way monuments, creating authoritative control positions) is required to be completed by an Idaho licensed PLS. Select the PLS for work required under this subsection from the survey firms currently listed under the Department's consultant term agreement list (i.e., category C-1a, C-2, or C-3).

A. General. The Contractor is responsible for survey and control. Correcting errors made by the Contractor will be at no additional cost to the Department, whether the errors are discovered during the actual survey work or in subsequent phases of the work. The Engineer has the right to communicate directly with the surveyor.

B. Personnel. Furnish technically qualified survey crews and a crew supervisor experienced in highway and bridge surveying and layout. The qualified crew supervisor will be on the project site whenever surveying or staking is in progress.

C. Equipment. Furnish survey instruments and supporting equipment capable of achieving the specified tolerances. Check survey equipment for accuracy before beginning survey work and as required.

D. Submittals. Submittals for any work that falls under [54-1202\(11\), Idaho Code](#) must be signed and sealed by an Idaho licensed PLS. All other work under this item may be signed and sealed by an Idaho licensed engineer or PLS. Resubmittals may be required depending on completeness and correctness of the work. Initial ground disturbing activities or bridge deck construction is not permitted until the Contractor is notified in writing to proceed. Notification will be provided within 7 calendar days after receipt of the applicable submittal or any resubmittals. Notification to proceed does not relieve the Contractor of its responsibility to maintain the survey work and to correct errors, regardless if the errors are discovered during the actual survey work or in subsequent phases of the work. Full payment will not be made on the surveying contract pay item until all survey submittals are received and accepted.

E. Department-Provided Information. The Department will furnish the following data:

1. Plans showing locations of control points at the beginning and the end of the project (e.g., point of intersection of tangents, point of curvature, point of tangency of horizontal curves, point on curve, point on tangent) that have been collected in the development of the plans, if any.
2. Plans showing locations of benchmarks, if any.
3. Cross-sections developed during design, if any.
4. Digital terrain model (DTM). Pre-design/original surface and design surface, if any.
5. Design survey notes, if any.
6. Finished grade book, if any.

Copies of Department-provided survey data will be available for the bidder's inspection. Verify survey data provided by the Department and as specified on the plans before use.

F. Pre-survey Conference. The Contractor, subcontractors, PLS, survey crew leader, and all surveying personnel involved in surveying will meet with the Engineer 2 weeks before beginning survey work. The pre-survey conference is to allow the discussion of methods and practices of accomplishing the required survey work (e.g., survey and staking methods, stake marking, grade control, confidence and grade verification point reporting, referencing, structure control, project documentation).

G. Automated Machine Guidance (AMG). In lieu of setting stakes, the Contractor may elect to use AMG if the Contractor:

1. Informs and receives Engineer approval before using AMG.
2. Discusses the AMG work during the pre-survey conference or 21 calendar days before its use.
3. Demonstrates capabilities, accuracy, and reliability of the intended AMG procedure, if required.
4. Performs any supplemental staking as directed at no cost to the Department.
5. Provides confidence points verifying DTM models used for the work per 675.03.H.

H. Directed Surveying. Directed surveying includes field surveying and office computations necessary for changes made by the Department and for extra work. Directed surveying does not include any quantity calculations. Prior written authorization, including the work to be performed, is required. Clearly mark all field work completed under directed surveying in the daily diary and total hours directed daily. All requirements of 675 will apply to directed surveying.

I. Monument Survey Work. Complete tasks required as specified in 107.19.1, 107.19.2, and 107.19.3 before other construction surveying tasks.

675.02 Materials.

A. General. Furnish acceptable tools, supplies, and stakes of the type and quality normally used in highway survey work. Furnish stakes and hubs of sufficient length to provide a solid set in the ground with sufficient surface area above ground for necessary legible markings.

Remove and dispose of construction flagging, lath, stakes, and other staking material after the work is complete.

B. Flagging. Mark the top 2 inches of stakes with fluorescent paint and/or plastic flagging with the following fluorescent colors:

Type	Stake with	Color
Centerline	Hub w/ tack or PK nail in pavement	White
Centerline Reference Point	Hub w/ tack and lath	Red, White, and Blue
Benchmark	Solid permanent point w/ lath	White and Blue
Slope Stake	Stake and lath	White
Reference to Slope Stake	Hub w/ tack and lath	Red and White
Grade (Finish) Stake	Grade stake w/ stake chaser	Blue
Right of Way Limit	Lath	Orange
Clearing Limits	Lath or flagging	Orange and White
Gas Lines; Petroleum	Hub w/ guard stake and lath	Yellow
Drain Lines; Sewers	Hub w/ guard stake and lath	Green
Waterlines; Irrigation	Hub w/ guard stake and lath	Blue
Conduit	Hub w/ guard stake	Red

Note: Color standards may vary when utilities have been located by the utility marking service. Mark reference stakes with the color of the referred item (e.g., red for conduit).

675.03 Construction Requirements.

A. General. Establish construction survey points, elevations, and grades as necessary to control, layout, and complete the work. Clear the survey line to facilitate surveying and remove clearing slash from the travel or work areas. Cut brush and trees flush to the ground. Minimize removal unless area is to be cleared and grubbed during construction. Check control surveying and staking to ensure specified tolerances are met before use.

Calculate grades, elevations, offsets, and alignment data necessary for staking and/or setting items. Submit copies of the calculated grades. The Contractor may request approval for alternate methods of establishing grade control with wire lines, computer or laser-controlled grading equipment, or other suitable methods.

The Contractor is responsible for protecting the survey and control work provided. Stakes and information damaged or removed will be replaced by the Contractor at no additional cost to the Department.

The Department may spot check the work for accuracy and unacceptable work may be rejected. The Contractor will resurvey rejected work and correct work that is not within the specified tolerances at no additional cost to the Department.

For work being controlled by a 3D design model, submit the following:

1. A detailed outline and list of the pay items and work that will be controlled by the 3D design model.
2. A narrative outlining any changes made to the Department's prepared 3D design model.
3. A copy of the data files that will be loaded into the Contractor's equipment for machine guidance or verification prepared by the Contractor that include and represent the Department's prepared 3D design model with changes identified in the narrative. Provide files in LandXML format or as directed.

B. Discrepancy Notification. Complete a preliminary check of the plans and specifications before beginning construction. Immediately notify the Engineer of any discrepancies or deficiencies (e.g., in grade, elevations, alignment, locations, dimensions).

Compare staked cut and fill depths with the plans. Refer to the Engineer differences found between the horizontal or vertical alignment data shown on the plans and the alignment observed on the ground during progress of the work not immediately correctable or requiring interpretation.

C. Recordkeeping. Comply with [55-19, Idaho Code](#), if a record of survey is required.

Keep a neat and legible diary, signed daily, and listing for each day's work including the date, weather, crew, equipment, location, and type of work performed. List by serial number measurement equipment (e.g., distance meters, total stations, scanners, GPS receivers, levels) that require calibration for correct operations and document calibration at the time of use. Delete errors by lining out. The daily diary is in addition to and complementary to any electronic data collection technology used by the Contractor. Keep a separate field book containing data on vertical and horizontal control. Keep diaries containing a log of office work. Keep a separate diary for directed surveying office computations.

Keep field notes, diaries, and books according to standard surveying practice. Loose leaf books in any form will not be accepted. Make available the field notebooks and forms used upon request. Submit weekly copies of diaries, books, and notes.

D. Computations and Plots. Use prismatic and geometric formulas for volume computations to calculate pay items requiring more precise volume measurements (e.g., in-place volumes of concrete, quantities of earth cut or fill, material stockpiles). Submit calculations supporting the method used. Measure the original and design surface for comparison and submit documentation. Calculate preliminary quantities from this data, using the average-end-area method, and submit plots and calculations for approval. When work is complete, superimpose final design surface with original surface and calculate final quantities using the prismatic method. Alternate methods for

calculating quantities may be approved.

Submit measurements and calculations for quantity computations, including a copy of grade calculations, cross-sections plots, and computer print outs in an approved format. Submit 2 copies of grade sheets. Submit a horizontal and vertical control base map showing primary and secondary control points annotated with x, y, and z coordinate data. Plot the base map at a legible scale and update and resubmit as new control is added.

E. Cross-Sections. Develop cross-sections from field measurements taken at even 100-foot station intervals. Take cross-section measurements before and after excavation and before backfill. When the centerline curve radius is less than or equal to 500 feet, take cross-sections at a maximum centerline spacing of 25 feet. When the centerline curve radius is greater than 500 feet, take cross-sections at a maximum spacing of 50 feet. Take additional cross-sections at breaks in terrain and at changes in typical sections. For each cross-section, measure and record points at breaks in terrain, but at least every 10 feet, unless otherwise approved. Measure and record points to at least the anticipated slopes and reference locations. Reduce cross-section distances to horizontal distances from centerline. Take cross-sections at right angles to tangents and normal to curves. Include in cross-sections grades, locations, and existing ground line profiles.

Cross-sections may be developed from digital terrain models, provided the ground survey measurements do not exceed 100 feet in any direction, major breaks in terrain are included, and the horizontal and vertical control for the work is used.

F. Length Verification. Field-verify lengths of pipe, pipe culvert, barrier, pipe siphon, and sign posts at an appropriate time and as specified in 106.02. Report final lengths to the Department and the Contractor for inclusion in record drawings as specified in 677.

G. Stake Maintenance and Marking. Maintain reference stakes, benchmarks, slope stakes, slope reference stakes, clearing limits, culvert reference stakes, grade stakes, curb, curb and gutter, radii, and other stakes necessary for the work until the construction has been accepted. Legibly mark survey stakes with station, elevation, and offset referenced to their respective control line. Renew illegible stakes at no additional cost to the Department. Mark slope, reference, and guard stakes with station.

H. Confidence Points. Confidence points are used to verify the accuracy of the natural ground DTM, to provide evidence just before construction to ensure the DTM is a reasonable representation of the original natural ground for computation of volumes and pay quantities and for any other application that fits the concept of confidence points.

1. Collect confidence points to validate and check the original ground DTM. Confidence point locations will follow these guidelines:
 - a. Be collected with survey-grade theodolite (total station) and/or survey-grade GPS.
 - b. Be randomly selected without regard for the location of DTM points or triangles.
 - c. Be evenly distributed over the entire DTM area to be validated.
 - d. Be proportionately distributed between confidence point classifications as applicable.
 - e. At a density sufficient to validate the surface:
 - (1) Generally ten (10) per instrument location as used in collecting DTM data.
 - (2) Ten (10) confidence points for each roughly 1,500-foot strip.
 - (3) Ten (10) confidence points within any roughly 800-foot radius.
 - (4) In the case of data collected photogrammetrically, 2 percent of DTM points.

2. Generate a report showing the test results that include a status for each point indicating whether the DTM is within tolerance at that location, outside of tolerance, or exceeds that value by 3-times. Plot the locations of confidence points by type and result to support visual analysis of the results.

Investigate all confidence points that exceed the tolerance. Examine the area surrounding each failing confidence point and try to resolve the failure even if it passes the 3-times test. Employ techniques (e.g., drawing tight contours, rotating the view, conducting a drive-through or fly-through) as needed. Overlay the feature mapping with the triangles and look for features (e.g., ditch bottoms, edges of pavement, roadway crowns) that are not properly represented by the triangles. Try to identify triangulation errors (e.g., triangles crossing breaks in grade or extending across areas not intended for modeling). Densify or replace portions of the original ground DTM where clusters of confidence points exceed tolerances.

Look for patterns (e.g., a distinct area with increased density of failures, repeating pockets of failing points). Look for any systematic error that these patterns may be suggesting.

3. Original Ground Confidence Point Vertical Tolerances Values.

Type	Surface Represented	Feet
Surfaced	Paved or Concrete Surface	± 0.10
Graded	Machine Graded and Compacted Surface	± 0.30
Natural	Irregular Natural Ground	± 0.60
Rugged	Extremely Rugged & Rock Surface	± 1.50

4. Original Ground Acceptance Criteria.
 - a. Two-thirds of all errors fall within the confidence point error tolerances.
 - b. All of the errors fall within 3-times of the respective tolerances.
5. Failing Results. Remedy or justify every 3-times failure and accept up to one-third of the confidence points exceeding the respective tolerance values. Each digital terrain model used for detail design or for earthwork payment must have a passing confidence point analysis.
6. Confidence Point Documentation. Keep a record of all original confidence point observations as well as a record of the final confidence point analysis report showing the test results. Include an explanation for accepting 3-times failures.
7. Confidence Point Deliverables. Submit the following information for a topographic mapping survey:
 - a. Intelligent digital terrain model (current version of Bentley® InRoads .dtm file) containing all the tied topographic features.
 - b. Confidence point report on the intelligent digital terrain model in a PDF.
 - c. Original notes taken in the field and 1 PDF of the original field notes.
 - d. Coordinate the file of all confidence points containing point number, northing, easting, elevation, and point code.

I. Grade Verification Points. Grade verification points are to be collected such that they provide a reasonable record of the grade as constructed and are used to verify the accuracy of the constructed grades relative to the design. Provide grade verification point data in the approved coordinate file format to the Engineer for analysis. The Engineer may request additional grade verification points if quantity, distribution, or placement does not meet the criteria stated below. The Engineer may choose to collect additional grade verification points using Department personnel.

1. **Collection of Grade Verification Points.** Collect grade verification points with a total station. Alternative survey equipment may be used with approval. The Engineer may require validation of the accuracy of the selected collection method. If hubs/stakes are used to control the grade for construction, grade verification points will not be taken within 5 feet from any grade control hub/stake.
2. **Grades Outside the Subgrade Area.** Measure and record grade verification points upon completion of trimmed and finished areas outside of the subgrade area (e.g., ditches, waterway channels, roadbed side slopes, embankment areas). Location and spacing of these grade verification points will provide a reasonable record of the constructed roadbed side slopes and ditches and placed at a nominal rate of 1 grade verification point for every 1,000 square feet of roadbed side slopes and ditches.
3. **Grades Within the Subgrade Area.** Measure and record grade verification points upon completion of the subgrade and each course and before the placement of the next course. Location and spacing of these grade verification points will be to provide a reasonable record of the grade as constructed and placed at a nominal rate of 1 grade verification point for every 500 square feet of grade.
4. **Construction Tolerances.** In constructing the work, the Contractor will meet the appropriate construction tolerances for the material as specified in the contract, regardless of any surveying or staking tolerances specific to the work item.

- a. **Areas with Specified Tolerance Values.**

For areas with specified tolerance values the Contractor will meet the tolerances when constructing the work given in 675.03.M.

- b. **Areas without Specified Tolerance Values.**

For areas outside of the subgrade area (e.g., ditches, side slopes, detention ponds) with a tolerance specified as "line and grade," "line, grade, and cross-section," or no defined numeric tolerance given in the specifications, the Engineer will hold work to a tolerance based on the design requirements, material size, construction method, or other factors as determined by the Engineer.

The Engineer will use the verification point data to evaluate the grade using any industry-standard technique or method and will provide acceptance or rejection of the grade before the end of the first full business day following receipt of the grade verification point data. Do not begin placement of the next course until the Engineer has accepted the grade and approval is given to proceed.

J. Centerline Reestablishment. If requested by the Engineer or the Contractor, reestablish centerline, from instrument control points, at even 100-foot station intervals. The maximum spacing between centerline points is 25 feet when centerline curve radius is less than or equal to 500 feet. When the centerline curve radius is greater than 500 feet, the maximum distance between centerline points is 50 feet. Reestablish centerline as many times as necessary to construct the work. Points (horizontal and vertical) to be reestablished include, but are not limited to:

1. Point of curvature.
2. Point on curve.
3. Point of tangency.
4. Point on tangent.
5. Reference point.

K. Control Points. Relocate initial horizontal and vertical control points in conflict with construction to areas not to be disturbed by construction operations. Furnish the coordinates and elevations, as specified in 675.03.C, for the relocated points before the initial points are disturbed. Set additional control outside limits of construction, suitable for use during machine control operations, as necessary.

L. Establish and Check Benchmarks. Protect benchmarks during the work. Check benchmarks to ensure specified tolerances are met before use. Benchmarks must allow a level rod to stand vertically and squarely on the mark and will be referenced to centerline and horizontal measurements. Include any benchmarks established in control base map as specified in 675.03.C.

M. Establish Alignment Points. Establish alignment points at horizontal and vertical points of curvature, points of tangency, and stations on the alignment spaced within 50 feet at significant breaks in the ground, at drainage structure locations, and at approaches. Mark stakes on the side facing the initial station.

N. Survey Tolerances. Survey and establish controls within the following tolerances:

Description	Horizontal	Vertical
Control (absolute position, independent of provided control)	+/- 0.03 ft	+/- 0.03 ft
Control (relative to nearest provided control)	+/- 0.01 ft	+/- 0.01 ft
Centerline points including offsets	+/- 0.05 ft	—
Cross-sections, slope stakes, and references	+/- 0.30 ft	+/- 0.05 ft
Walks and bike paths	+/- 0.03 ft	+/- 0.02 ft
Curb and gutter	+/- 0.02 ft	+/- 0.01 ft
Culverts, ditches and minor drainage structures	+/- 0.10 ft	+/- 0.03 ft
Walls (e.g., retaining, MSE, sound)	+/- 0.10 ft	+/- 0.05 ft
Bridge substructure	+/- 0.02 ft	+/- 0.02 ft
Bridge superstructure components	+/- 0.02 ft	+/- 0.02 ft
Clearing and grubbing limits	+/- 1.0 ft	—
Right of way limits	+/- 0.10 ft	—
Roadway subgrade finish stakes	+/- 0.20 ft	+/- 0.05 ft
Roadway finish grade stakes	+/- 0.10 ft	+/- 0.02 ft
Paving reference line	+/- 0.04 ft	+/- 0.02 ft

At the pre-survey conference, coordinate with the Engineer to determine the survey tolerances for items not listed above.

O. Clearing and Right of Way Limits. Stake clearing limits on both sides of centerline at each established station. Locate the clearing limit on the ground as specified. Stake right of way limits every 100 feet on tangents, every 50 feet on curves, and at right of way breaks.

P. Slope Stakes and References. Slope stakes and stakes for setting other items will have reference stakes. Maintain the reference stakes until approved for removal. Establish and set slope stakes and references on both sides of centerline at cross-section locations, at terrain breaks, and changes in typical sections. Establish slope stakes in the field at the actual point of intersection of the design slope with the natural ground line. Record the following information on the slope stake: cut or fill from catch to subgrade shoulder, distance to subgrade shoulder, distance to centerline, and design slope (e.g., 4H:1V). Set slope stake references outside the clearing limits. Include slope stake information on the reference stakes, including the horizontal and vertical distance from the reference stake to the catch (slope stake). Record the station on the back side of the slope and reference stakes. Record the actual as staked (three dimensional) position of the slope and reference stakes. Prepare field notes showing slope stake and reference information, and provide to the Engineer.

Direct staking of the theoretical (computer-generated) slope stake catch point requires prior approval.

If an automated slope staking routine is intended to be used, the system will be able to perform the proper super-elevation, lane transitions, and benching, as well as duplicate other details in the design surface. The system will record field modifications made to the final catch slopes. Any modifications will be recorded and provided to the Engineer and the Contractor and included on the record drawings as specified in 677.

Q. Grade Finishing Stakes. For grade elevations and horizontal alignment, set grade-finishing stakes on centerline, at the edge of each travel lane, on each shoulder at roadway cross-section locations, at each grade break line, and between centerline and shoulder with maximum spacing not to exceed the width of the grading equipment. Set stakes at the top of subgrade and the top of each aggregate course.

For turnouts, set stakes on centerline, each normal shoulder, and the turnout shoulder. In parking areas, set hubs at the center and along the edges of the parking area. Set stakes in ditches to be paved.

The maximum spacing between rows of stakes is 50 feet. Use brushes or guard stakes at each stake. Reset grade finishing stakes as many times as necessary to construct the subgrade and each aggregate course. Special situations or conditions may require tighter spacing of grade stakes to ensure grade and alignment as directed.

R. Stockpile Sites. Perform the work necessary for the initial layout and measurement of the stockpile site by one of the following methods:

1. **Cross-Section Method.** Establish a reference baseline, project site limits, and clearing limits. Survey and record original ground cross-sections before placement of stockpile material. Take cross-sections at maximum 25-foot intervals, grade breaks in the existing ground, and at locations anticipated to be grade breaks in the completed stockpile. Survey and record final cross-sections after completion of the stockpile. Take cross-sections at all previous locations plus any additional locations necessary to accurately reflect size and shape of stockpile.
2. **Digital Terrain Model (DTM) Method.** Establish instrument control stations, project site limits, and clearing limits. Survey and record original natural ground measurements. Use the proper placement of breaklines and regular terrain points. Record a minimum of 10 confidence points on original ground per stockpile surveyed. Verify instrument setup by recording elevation and backsight checks.

Survey and record the stockpile surface measurements. Use the proper placement of breaklines and regular terrain points. Record a minimum of 10 confidence points on stockpile surface per stockpile surveyed. Verify instrument setup by recording elevation and backsight checks when using a total station or heights of the base and rover antenna before and at the end of the session when using survey-grade GPS systems.

S. Structure and Process Specific Requirements.

1. **Concrete Paving.** Unless the Contractor uses automatic machine control systems, concrete paving requires stringline on each side of the screed for each placement. Set stringline control with vertical and horizontal control points as needed, but placed in at least 50-foot intervals. Set stringline on both sides of the roadway. Profile surface at each edge of placement and adjust grades for smoothness as approved. Check pavement thickness every 25 feet and adjust as needed. Stake concrete joint locations.

If automatic machine control systems are utilized by the Contractor for concrete paving, then the Department, the Contractor, and the PLS will discuss and agree upon the methodologies needed to meet specifications.

2. **Drainage Structures.** Stake drainage structures to fit field conditions as approved. The location may differ from the plans. Perform the following:
 - a. Survey and record the ground profile along centerline of structure.

- b. Determine the slope catch points at inlets and outlets.
 - c. Set reference points and record information necessary to determine structure length and end treatments.
 - d. Stake ditches or grade to make the structure functional.
 - e. Plot the profile along centerline of the structure to show the natural ground, the flowline, the roadway section, and the structure.
 - f. Before installation, submit the plotted field-design, profile cross-section, final structure length, and alignment.
 - g. Mark guard stakes with the following, when applicable:
 - (1) Diameter, length, and type of culvert (e.g., 18 inch diameter by 36-foot long corrugated metal pipe).
 - (2) The vertical and horizontal distance from the hub to the invert at the end of the culvert or any intermediate point as needed or as directed.
 - (3) Flowline grade of the pipe.
 - (4) Pipe camber.
 - (5) Station.
 - (6) Elevation.
 - h. Provide a reference at a maximum spacing of 50 feet for storm sewers and waterlines, and reference pipe inverts at manholes.
3. Bridges. Set horizontal and vertical control and reference points for bridge substructure and superstructure components. Establish, reference, and submit the following:
- a. Bridge chord or the bridge tangent.
 - b. Abutments and bridge piers.
 - c. Elevations for footings, pile cutoffs, pile layouts, pier caps, bridge seats, bridge beam profiles, and screed elevations.
 - d. Cross-sections, structure excavation sections.
 - e. Deck grades and profile.
 - f. Bridge approach grades and profile.

Set intermediate slope stakes at bridge abutments to establish transitions. Place finish grade stakes on the centerline of abutment bearing and at the top of slope of bridge berms. Place finish grade stakes on each side at top, mid-point of slope, and toe of bridge berm.

- 4. Box Culverts. Set horizontal and vertical control and reference points. Establish and reference the centerline, back of parapet, and the skew and flowline elevations at inlet, outlet, and breaks.
- 5. Paving Near Bridges and Box Culverts. All paving within 250 feet of a bridge or box culvert requires stringline grade control. Set grade finishing stakes for grade elevations and horizontal alignment: on centerline, the center of each travel lane, on each shoulder at roadway cross-section locations, and between centerline and shoulder with a maximum spacing of 15 feet. Set stringline control with vertical and horizontal control points as needed, but placed at no more than a maximum of 10-foot. As a minimum, set

stringline grade control on both sides of the roadway and at centerline. Before paving, profile each stringline at each edge of placement and adjust grades for smoothness as approved.

6. Retaining Walls. Survey and record profile measurements along the face of the proposed wall and 5 feet in front of the wall face. For each cross-section, measure and record points every 15 feet and at major breaks in terrain. Set adequate references and horizontal and vertical control points.
7. Borrow Sites. Perform the work essential for initial layout and measurement of the borrow site. Establish a referenced baseline, project site limits, and clearing limits. Survey and record initial and final cross-sections and calculate and submit end area volume quantities.
8. Curb and Gutter. Set curb and gutter staking at 25-foot intervals on tangent and 10-foot intervals on curve radii. Set line and grade for curb and gutter to the nearest 0.01 foot of the proposed or established grade line. Set radius points.
9. Guardrail. Stake barrier vertical and horizontal control at a maximum spacing of 25 feet on tangent sections and 10 feet on curved sections unless otherwise approved.
10. Scales. Perform the initial level check of scales and subsequent level checks weekly. Document the level checks and submit the documentation.

675.04 Method of Measurement. Survey will be measured on a lump sum basis based on a percent complete as determined in consultation with the Engineer and the Contractor. Full payment will not be made on the survey contract pay item until all survey submittals are received and accepted.

Directed surveying office computations will be measured and paid by force account as specified in 109.03.C.5. Only hours documented in the diary as specified in 675.03.B and 675.01 will be paid on this item.

Directed surveying crew will be measured and paid by force account as specified in 109.03.C.5. Only hours documented in the diary as specified in 675.03.B will be paid on this item. Travel time to and from the project site is incidental.

675.05 Basis of Payment. Payment for accepted work will be made as follows:

Pay Item	Pay Unit
Survey	LS
Directed Surveying Office Computations	CA
Directed Surveying Crew	CA

SECTION 676 – RECORD OF EXISTING PAVEMENT MARKINGS

676.01 Description. Record the existing pavement markings in order to sufficiently replace them in the same location, type, and form after they are covered or removed by the work. Replacing the pavement markings will be as specified in 626 and/or 630.

676.02 Materials. Provide materials as specified in 626 and/or 630.

676.03 Construction Requirements. Conduct field measurements, record data with survey-grade equipment and standard survey methods, and produce a complete, accurate, legible, and to-scale diagram of the existing pavement markings. Include on the diagram(s) all skip lines, no-passing barriers, tapers, gores, curves (e.g., circular, reverse, compound, spiral), turn lanes, stop bars, crosswalks, lane text, hash/chevron marks, wheel off-tracking locations, transitions, tapers, roundabout markings, and any other existing standard or special pavement markings (e.g., yield bars, bicycle boxes, route shields, arrows, ADA markings, symbols), miscellaneous messages, pavement logos, mile post pavement marks, and permanent tubular marker locations. Measure linear markings on the long centerline of the mark. Measure double parallel line markings on the long centerline of the space between the marks. Dimension the width of lanes, shoulders, tapers, transitions, intersections, and skip line intervals. Label pavement markings with dimensions and color. Where centerline and lane lines are parallel to the project alignment, annotate lane widths from the alignment. When pavement markings are not parallel to the project alignment, annotate project stationing and offset each item included on the diagram(s).

Include on the diagram(s) the location and coordinates of at least 2 control points per mile of pavement markings as well as the coordinate system, datum, and project combination factor used.

Submit diagram(s) for approval and paint reference location(s) at least 1 week before commencing any work that will alter, remove, or eliminate existing pavement markings. Work which will alter, remove, or eliminate existing pavement markings is prohibited until the record of existing pavement markings is approved.

Use a produced diagram(s), survey-grade equipment, and standard survey methods to re-establish temporary and permanent pavement markings as approved or as directed.

It is the Contractor's responsibility to ensure the pavement markings are correct and accurate.

Reestablish the temporary pavement markings on each course layer of each day before allowing the traffic to travel on the roadway or as approved.

676.04 Method of Measurement. Record of existing pavement markings will be measured by lump sum.

676.05 Basis of Payment. The Department will pay for accepted record of existing pavement markings at the contract unit price as follows:

Pay Item	Pay Unit
Record of Existing Pavement Markings	LS

Work by the Department to reestablish the pavement markings when the record is inadequate to sufficiently replace all the pavement markings will be charged to the Contractor and deducted from the Contractor's next progress payment.

SECTION 677 – RECORD DRAWINGS

677.01 Description. This work is for the preparation of record drawings. Revisions, when applicable, will include:

1. Horizontal and vertical roadway and bridge alignments, typical ballast, and slope sections.
2. Modifications to any dimensions, lines, grades, locations, or incorporated materials.
3. Drainage installations, including materials and inlet and outlet locations and elevations.
4. Horizontal ties on lighting, signalization and sign standards and controls, as well as any modifications to materials and installations.
5. Any modification to materials or variation of bridge or other structure construction.
6. Utility installation and service access locations and depths.
7. Any changes to the demolition and removal items.
8. Final public and private driveway/approach locations and types and ADA access standards.
9. Work of any kind that encroaches upon the limits of the project right of way.
10. All added or deleted work.

The intent is to capture all modifications of every kind made in the field during construction that otherwise would not be reflected in the original published design plans.

677.02 Materials. Use 1 clean, complete set of Department-published plans.

677.03 Construction Requirements. The record drawings will document a complete accounting and detail of all approved modifications, revisions, and design changes from the published plans.

On the record drawings, use these abbreviations and markings to denote deviations from the original plans as follows:

1. ASB for as-built. The actual horizontal, vertical, dimension, or quantity measured by survey or otherwise after it has been constructed.
2. F.C. for field change. Revision or change from the original design made in the field.
3. DELETED for not constructed.
4. Make profile changes with elevations or stationing only. The profile line is not required to be re-drawn unless the change is significant.
5. Mark as-constructed work in red ink or red pencil to clearly identify the changes to the original design. Locate all as-constructed marks logically and clearly on the respective drawings. Keep work neat, legible, and true to scale, line thickness, and line type.
6. Show a change, deletion, or omission with a straight line drawn through stationing, elevations, and notes followed with the appropriate symbol.
7. Crosshatch storm sewer, water, sanitary sewer, gas lines, or construction that has been deleted or relocated.
8. Record drawings will meet the survey tolerances listed in 675.03.M.
9. Ensure crossed-out information is legible.

Consolidate markings for all revisions and modifications onto 1 clean, complete set of Department-published plans by an individual fluent in standard drafting practices. This individual will work in conjunction with the subcontractors for obtaining documented modifications, but will be under the Contractor's sole direction and responsibility. Keep the set of record drawings up-to-date throughout the entire duration of the construction phase from the time of contract award until substantial completion.

Label or stamp in red ink "As-Constructed" in the upper right hand corner of the title page upon completion. Annotate date of submission under the words "As-Constructed." Submit the completed record drawings, along with any necessary additional pages required for completeness and clarity, within 30 calendar days following the substantial completion. The record drawings must be complete and be approved before the project will be accepted and before the final payment will be made.

677.04 Method of Measurement. Record drawings will be measured by lump sum.

677.05 Basis of Payment: The Department will pay for accepted record drawings as follows:

Pay Item	Pay Unit
Record Drawings.....	LS

SECTION 700 – MATERIALS

SECTION 701 – PORTLAND CEMENT

701.01 General Requirements. Provide portland cement as specified.

Portland Cement..... AASHTO M 85 Type I, II, or III

Blended Hydraulic Cement..... AASHTO M 240 Type IP, IL, IT, or IS(20)

Do not use portland cement containing more than 0.6 percent total alkali. Obtain approval before using Type III cement other than for precast stringers.

Use the product of only 1 mill or other brand and type of portland cement in a single structure component (e.g., abutments, columns, stringers, deck).

The Contractor may use limestone additions of up to 5.0 percent by mass of the cement, provided the chemical and physical requirements of the finished cement meet AASHTO M 85. Use naturally occurring limestone, consisting of at least 70 percent by mass of 1 or more of the mineral forms of calcium carbonate (CaCO_3). Include the CaCO_3 content of the limestone, the carbon dioxide (CO_2) content, and calculated limestone content of the cement in the manufacturer's mill test report. Calculate the limestone content in portland cement in accordance with ASTM C150 and tested in accordance with ASTM C114.

701.02 Acceptance Requirements. The Engineer will accept portland cement materials for use based on the manufacturer's certification as specified in 106.04 and 106.05.

SECTION 702 – ASPHALT

702.01 Asphalt. Provide asphalt binder that meets AASHTO M 320, except as follows:

1. When polymer modification is specified or when the sum of the grade designation values exceed 90, perform the AASHTO T 301 test at 77 °F (25 °C) on residue from the rolling thin film oven test (RTFOT). The binder must have at least 50 percent elastic recovery.

Provide asphalt for a specified use from 1 supplier. If a change of supplier for asphalt binder is proposed or if blending of asphalt binder from more than 1 supplier is proposed, the Engineer will require mix design testing and verification before approved for use.

702.02 Polymer-Modified Emulsified Asphalts. Meet the following:

1. Provide AASHTO M 140 quick-set polymer-modified CQS-1HP emulsion.

Test	Method of Test	Requirement
Viscosity, SF, at 77 °F	AASHTO T 59	20 – 100 seconds
Residue by evaporation	AASHTO T 59	62% minimum
Residue softening point	AASHTO T 53	135 °F minimum
Residue penetration at 77 °F	AASHTO T 49	50 – 80

Before starting the emulsification process, mill or blend the polymer material into the asphalt or emulsifier solution.

Ensure water has no harmful soluble salts and is of a quality that will not cause the asphalt to separate from the emulsion before microsurfacing is in place.

Require the emulsion manufacturer to supply the additives. Add the additives as approved by the manufacturer to the emulsion mix or any component materials to provide the quick-set properties and increase adhesion. The Department will consider the additives included as part of the mix design and must be certified as to their compatibility with the other mix components.

702.03 Emulsified Asphalts. Meet the following:

1. AASHTO M 140.
2. AASHTO M 208.
3. Ensure rapid setting emulsion grades are homogenous after thorough mixing within 15 calendar days after delivery.
4. Polymer modified cationic emulsified asphalts (CRS-2R and CRS-2L) are an emulsified blend of asphalt, polymer, water, and emulsifiers.
5. AASHTO M 316 for CRS-2L emulsified asphalt.
6. Table 702.03-1 for CRS-2R emulsified asphalt including asphalt binder thoroughly blended with at least 1.5 percent total rubber solids.
7. Table 702.03-2 for CRS-2P polymerized cationic emulsified asphalt. Mill the polymer into the asphalt or emulsion during the manufacturing of the emulsion.
8. Table 702.03-3 for special tack emulsion (STE – 1).

Table 702.03-1 – CRS-2R Requirements

Property	Specifications		AASHTO Test
	Minimum	Maximum	Number
Tests on Emulsion:			
Viscosity, Saybolt Furol at 122 °F, seconds	150	400	T 59
Storage stability test, 24 hours, percent	—	1.0	
Demulsibility 35 ml, 0.8% Dioctyl Sodium Sulfosuccinate, percent	40	—	
Particle charge test	—	Positive	
Sieve test, percent	—	0.10	
Distillation:			
Oil distillate by distillation:	—	—	—
Oil distillate by volume of emulsion, percent	—	3.0	T 59
Residue by evaporation, percent	65		T 59 Method B
Test on Residue from Distillation:			
Penetration, 77 °F (25 °C), 100 g, 5 seconds	80	150	T 59 or T 49

Table 702.03-2 – CRS-2P Requirements

Property	Specifications		AASHTO Test
	Minimum	Maximum	Number
Tests on Emulsion:			
Viscosity, Saybolt Furol at 122 °F, seconds	100	400	T 59
Storage stability test, 24 hours, percent	—	1.0	
Demulsibility 35 ml, 0.8% Dioctyl Sodium Sulfosuccinate, percent	40	—	
Particle charge test	—	Positive	
Sieve test, percent	—	0.30	
Distillation:			
Oil distillate by volume of emulsion, percent	0	3.0	T59 ^(a)
Residue by evaporation, percent	65	—	T 59 Method B
Test on Residue from Distillation:			
Penetration, 77 °F, 3.5 oz., 5 seconds	100	250	T 59, T 49
Torsional Recovery (percent) ^(b)	18	—	—
or			
Elastic Recovery (percent) at 77 °F (25 °C)	45	—	T 301

^(a) Distillation modified to use 300 grams of an emulsion heated to 350 °F plus or minus 9 °F and maintained for 20 minutes.

^(b) The torsional recovery test will be conducted in accordance with the California Department of Transportation Test Method 332. The Torsional Recovery test may be used instead of elastic recovery based on type of modifier used, at the option of the supplier. If the torsional recovery method is used for acceptance, the supplier must supply test data verifying specification conformance.

Table 702.03-3 – STE-1 Requirements

Property	Specifications		AASHTO Test
	Minimum	Maximum	Number
Tests on Emulsion:			
Viscosity @ 77 °F SFS	—	30	T59
Storage Stability, 1 day, %	—	1	
Demulsibility 35 ml 0.8% dioctyl sodium sulfosuccinate, percent ^(a)	25	—	
Particle Charge	Positive	—	
Sieve Test, percent	—	0.10	
Distillation:			
Oil distillate by volume of emulsion, percent	—	5	T59
Test on Residue, percent	45	—	T59
Penetration 77 °F	100	200	T59
Ductility, 77 °F, 5 cm/minute, cm	40	—	T59
Solubility in Trichloroethylene (percent)	97.5	—	T59

^(a) Perform the demulsibility test within 30 days from date of shipment.

702.04 Anti-Stripping Additive. Use liquid anti-strip additive or hydrated lime as follows:

1. Treat PG binder products with a heat-stable anti-stripping additive. Use 0.5 percent or 1.0 percent of anti-stripping additive per ton of asphalt. Test samples of the treated asphalt in accordance with Idaho IT 99. Remove material that does not show the presence of anti-strip additive.

Submit samples of the proposed liquid anti-strip additive and asphalt for approval before use. The Engineer will test the material in accordance with Idaho IT 137 for acceptance.

2. Use hydrated lime as a plant mix additive that meets 720.06.

702.05 Loading Certificate. Accompany each shipment of asphalt with a copy of the loading certificate providing the following information:

1. Contractor and project number.
2. Refinery.
3. Supplier, if other than refinery.
4. Car or delivery ticket number.
5. Type and grade of asphalt.
6. Specific gravity.
7. Temperature when loaded.
8. Shipment:
 - a. Truck. Individual certified weights of each loaded truck and trailer and the tare weight of each vehicle. Individual compartment asphalt weight must be certified for multiple compartment hauling units.
 - b. Railroad Car. Certified volume of asphalt load. Compute the weight from the volume corrected as specified in 109.01.A.7.

9. Consistency of material:
 - a. Saybolt viscosity of emulsified asphalt.
 - b. Performance Graded Binder. With each lot change, attach a copy of the [ITD-966](#) form for PG binder supplier's certification as required by 702.08.
10. The authorized refinery or supplier representative's signature.
11. When an anti-stripping additive is specified, the percentage of additive by weight of asphalt and the brand, grade, or type of additive.
12. Lot number for PG binders.

702.06 Sampling and Testing. Sample asphalt in accordance with AASHTO R 66. Test asphalt in accordance with appropriate AASHTO and ASTM test methods for the type of asphalt. Check the presence of anti-stripping additive in accordance with Idaho IT 99.

702.07 Temperature Viscosity Curve. Accompany each shipment of asphalt with a copy of the temperature viscosity curve.

702.08 Asphalt Certification. The Department requires the Contractor's supplier to:

1. Annually submit a process control plan (quality control plan) to the Central Materials Laboratory for review.
2. Certify the performance graded (PG) binder supplied meets the specified grade when tested in accordance with AASHTO M 320 and 702.01 and emulsified asphalts supplied meet 702.03.
3. Perform QC testing for large bulk tanks of PG 58-28 at least monthly.
4. Perform at least 1 complete set of quality control tests for each storage tank of polymerized PG binder produced.
5. For polymerized PG binder produced by in-line blending, outline consistency and specification compliance testing frequency in the supplier's quality control plan for the Central Materials Laboratory's approval.
6. Perform complete specification testing for PG binder at least monthly and submit a copy of each test report to the Central Materials Laboratory.

Base the testing frequencies on consistent raw materials and production processes. If a change occurs to the raw materials or the production process, the Department requires a new set of complete specification testing.

Use only supplier blended polymerized PG binders. Do not introduce modifiers/polymers at the asphalt mix plant, unless a QC/QA program has been submitted by the supplier and approved by the Central Materials Laboratory.

SECTION 703 – AGGREGATES

703.01 General Requirements. Provide aggregates that are reasonably without wood, roots, bark, soft or disintegrated pieces, or other detrimental matter. Aggregate sources must meet the requirements of 106.09. Round the percent passing gradations to the nearest whole number, except report the percent passing the No. 200 sieve to the nearest tenth of a percent.

703.02 Concrete Aggregate. Meet the following requirements for concrete aggregate:

A. General. Use a fine and coarse concrete aggregate that meets the requirements in Table 703.02-1.

Table 703.02-1 – General Concrete Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho IT 15	5.0% maximum loss
Ethylene Glycol	Idaho IT 116	90% minimum retained
Sodium Sulfate Soundness ^(a)	AASHTO T 104	Maximum 10% loss for fine aggregate and 12% loss for coarse aggregate after 5 cycles

^{a)} Perform sodium sulfate soundness testing when directed.

Do not use limestone or fine or coarse aggregate in concrete wearing surfaces.

Perform AASHTO T 303, AASHTO TP 110, ASTM C1293, or ASTM C295 testing to determine the potential alkali silica reactivity. The Department will require mitigating measures for aggregates found to be potentially reactive in accordance with AASHTO T 303, AASHTO TP 110, ASTM C1293, or ASTM C295. Potentially reactive aggregates are those with expansion greater than 0.10 percent as determined by AASHTO T 303 or greater than 0.04 percent as determined by ASTM C1293 or AASHTO TP 110. If ASTM C295 indicates an aggregate composition containing a percentage of the following materials greater than shown in Table 703.02-2, the Engineer will consider the aggregate potentially reactive.

Table 703.02-2 – Aggregate Reactivity

Mineral	Limit
Optically strained, microfractured, or microcrystalline quartz	5.0% (max)
Chert or chalcedony	3.0% (max)
Tridymite or cristobalite	1.0% (max)
Opal	0.5% (max)
Natural volcanic glass	3.0% (max)

Submit mitigation measures for approval. The Contractor's mitigation measures may include the use of fly ash, lithium admixtures, or other approved material. Submit test results from ASTM C1567, AASHTO TP 110, or CRD C 662 that show the proposed mitigation used with the cement and aggregates will control the potential expansion. Do not use an aggregate source for concrete before approved.

B. Fine Aggregate for Concrete. Meet the fine aggregate gradation requirements in Table 703.02-3.

Table 703.02-3 – Fine Aggregate Gradation

Sieve Size	Percent Passing
3/8 in	100
No. 4	95 - 100
No. 16	45 - 80
No. 50	10 - 30
No. 100	2 - 10
No. 200	0 - 4.0 (a)

(a) 0 to 2.0 for concrete wearing surfaces (pavements, approach slabs, and bridge decks), except when the sand equivalent is at least 80, then 0 to 3.0 is acceptable.

Use fine concrete aggregate that meets the requirements in Table 703.02-4.

Table 703.02-4 – Fine Concrete Aggregate Criteria

Characteristic	Test Method	Requirements
Sand Equivalent	AASHTO T 176 Modified Alternate Method No. 2 Pre-Wet	70 minimum
Organic Impurities	AASHTO T 21	Reject a color darker than the standard
Deleterious Substances (Percent by Mass)	AASHTO M 6	Clay Lumps..... 1.0 max Coal & Lignite... 1.0 max Others (Shale, Alkali, Mica, Coated Grains, Soft and Flaky Particles)..... 5.0 max

Do not use recycled concrete in fine concrete aggregate.

Perform Idaho IT 13 only when the samples meet requirements for fine concrete aggregate. When aggregates are tested for mortar making properties, apply the criteria in Table 703.02-5.

Table 703.02-5 – Mortar Properties

Cement	Type I and II	Type III
Age at Testing	7 days and 28 days	3 days and 7 days
Comparative Strength, Minimum	90 percent	90 percent

C. Coarse Aggregate for Concrete. Meet the following gradation requirements for coarse aggregate for concrete in Table 703.02-6.

Table 703.02-6 – Coarse Aggregate Size No. and Gradation

Percent Passing						
Sieve Size	1	2a	2b	3	4	5
2 1/2 in	—	—	—	—	—	100
2 in	—	—	—	—	100	95 - 100
1 1/2 in	—	—	—	100	95 - 100	—
1 in	—	100	100	95 - 100	—	35 - 70
3/4 in	100	90 - 100	80 - 100	—	35 - 70	—
1/2 in	90 - 100	—	—	25 - 60	—	10 - 30
3/8 in	40 - 70	20 - 55	10 - 40	—	10 - 30	—
No. 4	0 - 15	0 - 10	0 - 4	0 - 10	0 - 5	0 - 5
No. 8	0 - 5	0 - 5	—	0 - 5	—	—

Use size No. 2a or 2b when coarse aggregate size No. 2 is required.

Combine 2 or more coarse aggregates for Sizes 4 and 5.

Provide a coarse concrete aggregate that meets the requirements in Table 703.02-7.

Table 703.02-7 – Coarse Concrete Aggregate Criteria

Characteristic	Test Method	Requirements
Los Angeles Abrasion	AASHTO T 96	35% maximum
Deleterious Substances	AASHTO M 80	—
	Coal & Lignite	1.0% max by mass
	Clay Lumps	0.5% max by mass
	Clay Lumps & Friable Particles	2.0% max by mass
	Material Passing No. 200 Sieve	1.0% max by mass
	Flat and Elongated Aggregate Particles (Length to Thickness Ratio Greater Than 5)	15.0% maximum

E. Combined Aggregate Gradation for Concrete. As an option to using coarse and fine graded aggregates for concrete, aggregate gradation may consist of a combined gradation. Meet the material requirements for coarse and fine aggregates for concrete. Meet the following additional requirements:

Table 703.02-8 – Combined Aggregate Size No. and Gradation

Sieve size	Individual Percent Retained				
	1C	2C	3C	4C	5C
2½ in	—	—	—	—	0
2 in	—	—	—	0	0 - 10
1½ in	—	—	0	0 - 10	4 - 18
1 in	—	0	0 - 10	4 - 18	6 - 20
¾ in	0	0 - 10	4 - 18	6 - 20	6 - 20
½ in	0 - 10	4 - 18	6 - 20	6 - 20	6 - 20
⅜ in	5 - 18	6 - 20	6 - 20	6 - 20	6 - 20
No. 4	4 - 20	6 - 20	6 - 20	6 - 20	6 - 20
No. 8	4 - 20	0 - 16	0 - 16	0 - 16	0 - 16
No. 16	4 - 20	0 - 16	0 - 16	0 - 16	0 - 16
No. 30	4 - 20	6 - 20	6 - 20	6 - 20	6 - 20
No. 50	4 - 20	6 - 20	6 - 20	6 - 20	6 - 20
No. 100	4 - 20	4 - 18	4 - 18	4 - 18	4 - 18
No. 200	0 - 6.0	0 - 6.0	0 - 6.0	0 - 6.0	0 - 6.0
pan	0 - 3.0	0 - 2.0	0 - 2.0	0 - 2.0	0 - 2.0

The Engineer will not accept material with more than 3 sieve sizes outside the above gradations or with adjacent failing sieves, excluding the percent retained in the pan. The amount retained in the pan cannot exceed the amount specified in Table 703.02-8.

Provide aggregate with a sand equivalent on the blended gradation meeting the following requirements:

1. Seventy (70) for all concrete or for concrete wearing surfaces (e.g., bridge decks, pavements, approach slabs) with less than 1 percent passing the No. 200 sieve.
2. Eighty (80) for concrete wearing surfaces with between 1.0 percent and 1.5 percent passing the No. 200 sieve.
3. Ninety (90) for concrete wearing surfaces with greater than 1.5 percent passing the No. 200 sieve.

The fineness modulus as calculated in the FOP for AASHTO T 27 on the combined gradation will be within 0.20 of the gradation proposed in the concrete mix design.

703.03 Microsurfacing Aggregate. Provide aggregate of 100 percent crushed stone, without organic material, clay balls, or other deleterious materials.

Provide aggregate meeting 703.01 and the following:

Test	Method of Test	Requirement
L.A. Abrasion	AASHTO T 96	30% maximum
Sand Equivalent	AASHTO T 176	65 minimum

When tested by AASHTO T 27/T 11, ensure the mix design gradation meets the following:

Sieve Size	Percent Passing	Stockpile Tolerances
3/8 inch	100	0
No. 4	70 - 90	+/- 5
No. 8	45 - 70	+/- 5
No. 16	28 - 50	+/- 5
No. 30	19 - 34	+/- 5
No. 50	12 - 25	+/- 4
No. 100	7 - 18	+/- 3
No. 200	5 - 15	+/- 2

Quality control testing during production is the Contractor's responsibility. Quality control test reports for gradation and sand equivalent will be furnished.

703.04 Aggregate for Untreated Base, Treated Base, and Road Mix. Meet the following aggregate gradation requirements in Table 703.04-1:

Table 703.04-1 – Nominal Maximum Size

Sieve Size	Percent Passing						
	3/8 in	1/2 in	3/4 in A	3/4 in B	1 in A	1 in B	2 in
2 1/2 in	—	—	—	—	—	—	100
2 in	—	—	—	—	—	100	90 - 100
1 1/2 in	—	—	—	—	100	—	—
1 in	—	—	100	100	90 - 100	90 - 100	55 - 83
3/4 in	—	100	90 - 100	90 - 100	—	—	—
1/2 in	100	90 - 100	—	—	60 - 80	65 - 100	—
3/8 in	85 - 100	—	—	—	—	—	—
No. 4	55 - 75	50 - 70	30 - 60	40 - 65	35 - 60	40 - 80	30 - 60
No. 8	40 - 60	35 - 55	—	30 - 50	25 - 50	30 - 60	—
No. 30	20 - 40	12 - 30	8 - 30	—	10 - 30	15 - 35	10 - 25
No. 200	3.0 - 9.0	3.0 - 9.0	0 - 7.0	3.0 - 9.0	2.0 - 9.0	6.0 - 18.0	0.0 - 8.0

Note: Use the "B" gradation, unless otherwise specified.

Use aggregate that meets the requirements in Table 703.04-2.

Table 703.04-2 – Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho IT 15	8.0% maximum loss
Ethylene Glycol	Idaho IT 116	90% minimum retained
Sand Equivalent	AASHTO T 176 Modified Alternate Method No. 2 Pre-Wet	30 minimum If 5.0% or more of the material passes the No. 200 sieve. Sand equivalent is not required if less than 5.0% passes the No. 200 sieve or for aggregate to be used for lime or cement-treated base.
Los Angeles Abrasion	AASHTO T 96	35% maximum
R-Value	Idaho IT 8	75 or more

Retained Asphalt Film	AASHTO T 182	Above 95% for road mix aggregate
Fractured Face	AASHTO T 335, Method 1	Untreated base – at least 60% of the material retained on the No. 4 sieve has at least 1 fractured face. Treated base and road mix – at least 75% of the material retained on the No. 4 sieve has at least one fractured face.

703.05 Aggregate for Superpave HMA Pavement. Provide aggregate for mixes, except SP 2, in at least 2 separate stockpiles. Use aggregate consisting of crushed stone or crushed gravel. Combine with other required aggregate fractions and fillers in the proper proportion so the resulting mixture meets the gradation required.

Screen the aggregate used for Superpave HMA so 10 percent or less of the naturally occurring minus ½ inch material remains in the material used to produce the stockpile(s). Crush the plus ½ inch material to produce the required gradation. This requirement does not apply to SP 2 mixes or mixtures designated as nonstructural or temporary mixtures.

Size, grade, and combine the fractions for the mixture in proportions so the resulting blend conforms to the grading requirements as defined in Table 703.05-2a and Table 703.05-2b.

Use aggregate that meets the requirements in Table 703.05-1.

Table 703.05-1 – Superpave Mixture Requirements

Mix Type	SP 2	SP 3	SP 5
Design ESALs ^(a) (millions)	< 1	1 < 10	≥ 10
Idaho Degradation, maximum loss, %	5.0	5.0	5.0
Ethylene Glycol, minimum retained, %	90	90	90
R-Value	80 or more minimum	80 or more minimum	80 or more minimum
LA Wear, Maximum % loss	35	30	30
Sodium Sulfate Soundness ^(b) Maximum loss after 5 cycles, %	12	12	12
Fractured Face, Coarse Aggregate ^(c) % Minimum	65/-	75/60	98/98
Uncompacted Void Content of Fine Aggregate, % Minimum	40	40	45
Sand Equivalent, Minimum	35	40	45
Flat and Elongated ^(d) , % Maximum	10	10	10

^(a) The anticipated project traffic level expected on the design lane over a 20 year period. Regardless of the actual design life of the roadway, determine the design ESALs for 20 years.

^(b) Perform sodium sulfate soundness testing when directed.

^(c) 75/60 denotes that 75 percent of the coarse aggregate has 1 fractured face and 60 percent has 2 or more fractured faces.

^(d) This criterion does not apply to No. 4 nominal maximum size mixtures.

Table 703.05-2a – Nominal Maximum Aggregate Size-Control Points (Percent Passing) and VMA Requirements PCS Control Points for Mixture Nominal Maximum Aggregate Size ^(b)

Sieve Size	1½ in		1 in		¾ in	
	Restricted Zone	Control Points	Restricted Zone	Control Points	Restricted Zone	Control Points
2 in	—	—	—	—	—	—
1½ in	—	90 to 100	—	100	—	—
1 in	—	90 max	—	90 to 100 ^(a)	—	100
¾ in	—	—	—	90 max	—	90 to 100 ^(a)
½ in	—	40 to 70 ^(a)	—	—	—	90 max
⅜ in	—	—	—	42 to 70 ^(a)	—	52 to 80 ^(a)
No. 4	34.7	—	39.5	—	—	—
No. 8	23.3	15 to 41 ^(a)	26.8	19 to 45 ^(a)	34.6	23 to 49 ^(a)
No. 16	15.5	—	18.1	—	23.1	—
No. 30	11.7	—	13.6	—	16.7	—
No. 50	10	—	11.4	—	13.7	—
No. 100	—	—	—	—	—	—
No. 200	—	0.0 to 6.0 ^(a)	—	1.0 to 7.0 ^(a)	—	2.0 to 8.0 ^(a)
VMA	11.0		12.0		13.0	
Primary Control Sieve	¾ in		No. 4		No. 4	
PCS Control Point (% passing)	47		40		47	

Table 703.05-2b – Nominal Maximum Aggregate Size-Control Points (Percent Passing) and VMA Requirements PCS Control Points for Mixture Nominal Maximum Aggregate Size ^(b)

Sieve Size	½ in		¾ in		#4	
	Restricted Zone	Control Points	Restricted Zone	Control Points	Restricted Zone	Control Points
2 in	—	—	—	—	—	—
1½ in	—	—	—	—	—	—
1 in	—	—	—	—	—	—
¾ in	—	100	—	—	—	—
½ in	—	90 to 100 ^(a)	—	100	—	100
⅜ in	—	90 max	—	90 to 100 ^(a)	—	95 to 100 ^(a)
No. 4	—	—	—	90 max	—	90 to 100
No. 8	39.1	28 to 58 ^(a)	47.2	32 to 67 ^(a)	—	—
No. 16	25.6	—	31.6	—	—	30 to 55 ^(a)
No. 30	19.1	—	23.5	—	—	—
No. 50	15.5	—	18.7	—	—	—
No. 100	—	—	—	—	—	—
No. 200	—	2.0 to 10.0 ^(a)	—	2.0 to 10.0 ^(a)	—	6.0 to 13.0 ^(a)
VMA	14.0		15.0		16.0	
Primary Control Sieve	No. 8		No. 8		No. 16	
PCS Control Point (% passing)	39		47		42	

(a) Denotes the sieves that will be used for mix design control points and quality analysis sieves for a Class SP 2 mix.

(b) The combined aggregate gradation will be classified as coarse-graded when it passes below the primary control sieve (PCS) control point as defined in Table 703.05-2a and Table 703.05-2b. Other gradations will be classified as fine graded. This classification is based on the Contractor's job mix formula and not individual gradation tests. Coarse graded mixtures will not pass through the restricted zone.

703.06 Aggregate for Cover Coat Material. Meet the following aggregate gradation for class specified in Table 703.06-1.

Table 703.06-1 – Gradation Table

Sieve Size	205	403		404	
	Percent Passing by weight	Class A	Class B	Class A	Class B
1 1/2	100	—	—	—	—
1/2 in	—	100	100	100	100
3/8 in	—	95 - 100	40 - 70	95 - 100	40 - 90
No. 4	30 - 50	0 - 30	0 - 15	0 - 6	0 - 6
No. 8	—	—	—	0 - 3	0 - 3
No. 200	—	—	—	0 - 2.0	0 - 2.0

Use aggregate that meets the requirements in Table 703.06-2.

Table 703.06-2 – Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho IT 15	5.0% maximum loss
Ethylene Glycol	Idaho IT 116	90% minimum retained
Cleanness Value	Idaho IT 72	80 or more
Los Angeles Abrasion	AASHTO T 96, Grading C	30% maximum
Retained Asphalt Film	AASHTO T 182	Above 95%
Fractured Face	AASHTO T 335, Method 1	At least 70% of the material retained on the No. 4 sieve has at least 1 fractured face.

703.07 Aggregate for Blotter and Aggregate for Choke Sand. Use secondary rejects that meet the aggregate gradations specified in Table 703.07-1.

Table 703.07-1 – Aggregate Gradation

Sieve Size	Percent Passing	
	Blotter	Choke Sand
3/8 in	100	100
No. 4	40 - 100	—
No. 200	0 - 16.0	0 - 5.0

Use aggregate that meet the requirements in Table 703.07-2.

Table 703.07-2 – Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho IT 15	Not required
Ethylene Glycol	Idaho IT 116	90% minimum retained

703.08 Aggregate for Open Graded Base. Meet aggregate gradation requirements specified in Table 703.08-1 in accordance with AASHTO T 27, excluding washing. Provide clean, angular, crushed quarry rock, free of clay coatings, lumps, and soft or flaky particles material for rock cap.

Table 703.08-1 – Aggregate Gradation Requirements

Screen/Sieve Size	Percent Passing (by weight)		
	Class I (Rock Cap)	Class II	Class III
3 in	100	—	—
2 in	—	100	—
1½ in	55 - 85	90 - 100	—
1 in	—	—	100
¾ in (a)	10 - 35	40 - 75	80 - 98
½ in	5 - 15	20 - 40	60 - 85
⅜ in	—	—	30 - 65
No. 4 (a)	0 - 5	0 - 10	—
No. 8	—	0 - 5.0	0 - 10
No. 200 (a)	—	—	0 - 5.0

(a) Denotes the sieves that will be used for quality acceptance.

Use aggregate that meet the requirements in Table 703.08-2.

Table 703.08-2 – Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho IT 15	8.0% maximum loss
Ethylene Glycol	Idaho IT 116	90% minimum retained
R-Value	Idaho IT 8	80 or more
Los Angeles Abrasion	AASHTO T 96	40% maximum loss for Class I 35% maximum loss for Class II & III
Flat & Elongated	FOP for ASTM 4791	15% for Class II & III
Fracture Face, % fractured faces	AASHTO T 335	90% retained on #4 with 2 fractured faces for Class II 90% retained on #4 with 2 fractured faces and 75% retained on #8 with 1 fractured face for Class III

703.09 Not Specified.

703.10 Aggregate for Anti-Skid. Meet the applicable aggregate gradation specified in Table 703.10-1.

Table 703.10-1 – Gradation Table

Sieve Size	Percent Passing				
	Type 1	Type 2	Type 3	Type 4	Type 5
3/8 in	100	100	100	100	100
No. 4	0 - 40	—	—	0 - 70	—
No. 8	0 - 10	0 - 40	—	—	—
No. 30	—	—	0 - 25	0 - 30	—
No. 100	—	0 - 2	—	—	—
No. 200	0 - 5.0	—	0 - 5.0	0 - 10.0	—

Use aggregate with the characteristics specified in Table 703.10-2.

Table 703.10-2 – Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho IT 15	5.0% maximum loss for Type 2 (Not required for others)
Ethylene Glycol	Idaho IT 116	90% minimum retained
Los Angeles Abrasion	AASHTO T 96	45% maximum loss for Type 2 (Not required for others)

703.11 Aggregate for Granular Subbase. Meet the aggregate gradation specified in Table 703.11-1 in accordance with AASHTO T 27, excluding washing.

Table 703.11-1 – Gradation Table

Sieve Size	Percent Passing
4 in	100
3 in	90 - 100
No. 4	30 - 75
No. 200	0 - 15.0

Use aggregate with the aggregate criteria specified in Table 703.11-2.

Table 703.11-2 – Aggregate Criteria

Characteristic	Test Method	Requirements
Idaho Degradation	Idaho IT 15	8.0% maximum loss
Ethylene Glycol	Idaho IT 116	90% minimum retained
R-Value	Idaho IT 8	60 or more
Los Angeles Abrasion	AASHTO T 96	40% maximum loss
Sand Equivalent	AASHTO T 176 Modified Alternate Method No. 2 Pre-Wet	30 minimum If 5.0% or more of the material passes the No. 200 sieve. Sand equivalent is not required if less than 5.0% passes the No. 200 sieve.

703.12 Sampling and Testing. Sample and test aggregates in accordance with these standard methods:

Sampling of Aggregates	AASHTO T 2
Sieve Analysis of Fine and Coarse Aggregates.....	AASHTO T 27
with Amount of Material Finer than No. 20 Sieve	AASHTO T 11 Method A or B
Organic Impurities in Sands for Concrete	AASHTO T 21
Dry Preparation of Disturbed Soil and Soil-Aggregate Samples for Test.....	AASHTO R 58
Effect of Organic Impurities in Fine Aggregate on Strength of Mortar.....	AASHTO T 71
Determining the Percentage of Fracture in Coarse Aggregate	AASHTO T 335 Method 1
Evaluating Cleanness of Cover Coat Material	Idaho IT 72
Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.....	AASHTO T 96
Clay Lumps and Friable Particles in Aggregate.....	AASHTO T 112
Lightweight Pieces in Aggregate	AASHTO T 113
Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test	AASHTO T 176 Modified Alternate Method No. 2-Pre-Wet
Methods of Chemical Analysis of Limestone, Quicklime, and Hydrated Lime.....	ASTM C25
Uncompacted Void Content of Fine Aggregate	AASHTO T 304 Method A
Standard Test Method for Flat Particles Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.....	FOP for ASTM D4791 (ratio of length to thickness equal to or greater than 5:1)
Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars due to Alkali Silica Reaction ^(a)	AASHTO T 303

(a) Low alkali cement may be used. Modified AASHTO T 303 procedures are required for expansion mitigation testing using fly ash, lithium, or other additives.

703.13 Aggregate Source Material Quality. Investigate sources in accordance with Idaho IR 142. Perform Idaho IT 15 on all sources and Idaho IT 116 on basalt sources. Perform the remaining applicable tests specified in this subsection and the cited tests for specific products on samples resulting from the investigation. Prepare a materials source plan for aggregate sources.

Submit the materials source plan and include data from the testing for use by the Department in determining the acceptability of aggregate sources and borrow sources when applicable.

For aggregate source approval purposes, sample and test the material at the frequency indicated in Idaho IR 142. To ensure the material meets the contract quality and design requirements, the Contractor may be required to maintain and verify the quality of the material by completing the following testing:

Idaho Degradation	Idaho IT 15
Method of Test for Disintegration of Quarry Aggregates (Ethylene Glycol)	Idaho IT 116
Investigation of Aggregate and Borrow Deposits.....	Idaho IR 142
Specific Gravity and Absorption of Fine Aggregate	AASHTO T 84
Specific Gravity and Absorption of Fine Aggregate Using Automatic Vacuum Sealing (CoreLok) Method	Idaho IT 144

Specific Gravity and Absorption of Coarse Aggregate	AASHTO T 85
Specific Gravity of Soils	AASHTO T 100
Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate (Use Sodium Sulfate)	AASHTO T 104

Perform the tests below on the following categories of material:

1. Base Course and Granular Subbase Material:

Compaction of Soils and Soil Mixtures for the Expansion Pressure and Hveem Stabilometer Tests (R-value)	Idaho IT 8
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2. Asphalt-Treated Material:

Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyrotory Compactor	AASHTO T 312
Superpave Volumetric Design for Hot Mix Asphalt (HMA)	AASHTO R 35
Coating and Stripping of Bitumen-Aggregate Mixtures	AASHTO T 182
Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures	AASHTO T 269
Maximum Specific Gravity of Bituminous Paving Mixtures	AASHTO T 209
Bulk Specific Gravity of Compacted Bituminous Mixtures	AASHTO T 166
Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method	AASHTO T 331
Resistance of Compacted Hot Mix Asphalt (HMA) to Moisture-Induced Damage (Replace D 1074 and D 2726 with AASHTO T 167 and AASHTO T 166)	ASTM D1075
Compressive Strength of Hot Mix Asphalt (HMA)	AASHTO T 167

3. Borrow and Granular Borrow:

Compaction of Soils and Soil Mixtures for the Expansion Pressure and Hveem Stabilometer Tests (Idaho R-value)	Idaho IT 8
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4. Fine Aggregate for Concrete:

Fine Aggregate for Hydraulic Cement Concrete	AASHTO M 6
Measuring Mortar-Making Properties of Fine Aggregate	Idaho IT 13
Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali Silica Reaction	AASHTO T 303
Low alkali cement may be used. Baseline testing, with cement and aggregate only, is required.	

5. Coarse Aggregate for Concrete:

Coarse Aggregate for Hydraulic Cement Concrete	AASHTO M 80
Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali Silica Reaction	AASHTO T 303
Low alkali cement may be used. Baseline testing, with cement and aggregate only, is required.	

SECTION 704 – JOINT FILLERS AND SEALERS

704.01 Pre-formed Expansion Joint Filler. Meet AASHTO M 33, AASHTO M 153, AASHTO M 213, or ASTM D8139.

704.02 Joint Sealer for Asphalt and Concrete Pavements. Meet ASTM D6690 Type II.

704.03 Hot Poured Elastomeric Type Concrete Joint Sealer. Meet ASTM D6690 Type III.

704.04 Neoprene Compression Seal. Meet AASHTO M 220 for concrete pavement and AASHTO M 297 for bridges. Provide adhesive lubricant that meets ASTM D4070 for bridges and ASTM D2835 for concrete pavement.

Submit a manufacturer's certification stating material meets the requirements and the manufacturer's written requirements.

Submit shop drawings and installation procedures for review as specified in 105.02.

Install the compression seal in accordance with the manufacturer's written instructions, using the proper size of installation tool as recommended by the manufacturer. Clean metal surfaces that will contact the seal in accordance with SSPC-SP6.

704.05 Silicone Sealant. Meet ASTM D5893.

Sample and test each lot of silicone sealant before use. The Department requires an independent laboratory perform sampling and testing. Do not place material from a given lot evaluated for compliance with typical properties listed in the manufacturer's design information bulletins and approved for placement. Allow at least 30 days for testing.

Perform the following specific tests:

1. Tensile stress at 150 percent elongation^(a).
2. Total elongation^(a) and tack-free time^(b).

^(a) ASTM D412 Method A Die C, 7 day cure at 77 °F plus or minus 2 °F and 45 to 55 percent relative humidity.

^(b) ASTM C679.

Testing is incidental and the cost included in the contract unit price.

Deliver silicone sealant in the manufacturer's original sealed container. Each container must have an intact, original manufacturer's label with the following:

1. Legibly marked manufacturer's name.
2. Trade name of the sealer.
3. Production lot number.
4. Expiration date of the manufacturer's shelf life warranty.

Retest expired sealant at no additional cost to the Department and obtain approval before use. Do not use sealant if more than 6 months has elapsed since such retesting.

704.06 Elastomeric Sheet. Fabricate the elastomeric sheet with nylon fabric embedded in a high quality vulcanized elastomeric compound using polymerized chloroprene as the only basic elastomer. Use a smooth elastomeric sheet that is without pinholes and surface blemishes, shows no evidence of ply delamination, and meets the physical requirements in Table 704.06-1. Provide methods and materials to install a leak-proof sheet to the required length.

Accompany elastomeric sheet with a manufacturer's certificate attesting compliance with the contract.

Table 704.06-1 – Elastomeric Requirements

Physical Property	Test Method	Performance Requirements
Hardness, Durometer A	ASTM D2240	60 ± 10 points
Tensile strength	ASTM D412	2,000 psi, minimum
Elongation at break	ASTM D412	300%, minimum
Brittleness temperature	ASTM D746	- 40 °F
Tear resistance	ASTM D624 (Die C)	150 lb/in minimum
Flame resistance	ASTM C542	must not propagate flame
Resistance to heat aging change in original properties after 70 hr at 212 °F (100 °C) Hardness Elongation Tensile strength	 ASTM D573 ASTM D573 ASTM D573	 + 10 points, maximum - 40%, maximum - 15%, maximum
Resistance to oil aging change in volume after 70 hr immersion in ASTM oil No. 3 at 212 °F (100 °C)	ASTM D471	+ 80%, maximum
Resistance to ozone condition after exposure to 100 pphm ozone in air for 100 hr at 100 °F (sample under 20 percent strain)	ASTM D1149	No cracks
Resistance to permanent set compression set after 22 hours at 158 °F (70 °C)	ASTM D395 (Method B)	30%, maximum
Resistance to water change in weight after 7 days immersion at 158 °F (70 °C)	ASTM D471	+ 5%, maximum

704.07 Bridge Deck Joint Seals, General. Fabricate the elastomeric portion of each bridge deck joint seal in a single piece or have the individual pieces factory-vulcanized and the entire elastomeric element shipped as a single unit.

SECTION 705 – GROUT AND MORTAR

705.01 Grout, Type A. Type A grout is portland cement and water, containing an approved expansion admixture or compound.

The 28-day compressive strength of grout cubes must be at least 4,000 psi when cured and tested in accordance with AASHTO T 106, except confining cover plates are to be clamped on the molds immediately after filling and left on the molds for at least 20 hours.

A. Portland Cement. Provide portland cement as specified in 701. Ensure cement used for grouting does not contain lumps or other indication of hydration or “pack set.”

B. Water. Use water that is potable, clean, and without injurious quantities of substances known to be harmful to portland cement, aggregate, or prestressing steel as specified in 720.01.

C. Admixtures. Use admixtures that impart the properties of low water content, good flowability, and minimum of bleed and expansion properties. The grout must expand at least 5 percent but less than 10 percent as determined by expansion of grout above the mold during cure as measured at the center of the specimen. Make a separate, unconfined specimen for this purpose. Use formulations that do not contain chemical in quantities that may have harmful effects on the prestressing steel or cement. Do not use admixtures containing chlorides, fluorides, sulphites, and nitrates.

D. Mixing of Type A Grout. Add water to the mixer first, followed by portland cement.

Mix the grout until a uniform, thoroughly blended grout is obtained without excessive temperature increase or loss of expansive properties of the admixture. Continuously agitate the grout until it is pumped.

Do not add water to the grout to increase flowability which has been decreased by delayed use of the grout.

Base proportions of materials on tests made on the grout before grouting. The water content must produce a flow time of at least 11 seconds as determined by ASTM C939. Provide test reports from a commercial laboratory confirming properties of grout made with materials supplied.

705.02 Grout, Type B. Provide class as specified.

Class I, Nonmetallic, Nonshrink. Obtain approval of the grout material before use and meet the following criteria:

1. Pre-blended, commercial product with a 28-day compressive strength of at least 5,800 psi.
2. Nonmetallic, nonshrink, water mixing compound containing portland cement, silica sand, or other agents (e.g., water reducers, plasticizers, fillers).
3. Does not use chlorides, fluorides, sulphites, or nitrates.
4. Meet ASTM C1107 Grade B or C and the following:
 - a. When dried in air at 50 percent relative humidity for 28 days after standard 28-day moist cure, present 0.3 percent or less expansion from beginning of cure.
 - b. Zero percent shrinkage.
 - c. Submit test data report to verify compliance.

Strictly observe the manufacturer’s written instructions regarding mixing, maximum water content, application, curing temperatures, and curing conditions.

Sandblast grout areas.

Class II, Metallic, Non-shrink. Obtain approval before use and meet the requirements of Type B Class I, except the Engineer may allow metallic aggregates.

Do not use for pumping applications or where discoloration would be objectionable. Do not vibrate metallic aggregate grouts.

705.03 Grout, Type C. Obtain approval before use. Type C grout is a 2 component, 100 percent reactive epoxy system that is volumetrically stable.

Minimum required compressive strength in 24 hours is 5,800 psi.

Strictly observe the manufacturer's written instructions as to mixing and blending, aggregate gradation and dryness, and application and curing temperatures.

Sandblast grout areas.

705.04 Grout, Type D. Type D grout is 1 part portland cement and 2 parts fine concrete sand by volume containing only enough water to permit placing and packing.

Provide materials that meet 701 and 703. The Engineer may waive the gradation requirements of 703.02.B to allow a finer-textured grout.

Clean grout surfaces of loose or foreign material that would prevent a bond between the grout and the base concrete. Flush grout areas with water and dry surface before placing the mixture. Cure using water or other approved method as specified in 502.03. Remove defective grout and replace at no additional cost to the Department.

SECTION 706 – PIPE

706.01 General Requirements for Concrete Pipe. Provide test results for strength, absorption, and hydrostatic pressure for concrete pipe from the manufacturer.

Only use manufacturers of precast concrete products that hold current certification under the NPCA Plant Certification Program, the ACPA QCast Plant Certification Program, or the PCI Plant Certification Program.

706.02 Concrete Sewer Pipe. Meet AASHTO M 170 for the strength classes specified for round concrete pipe. Meet AASHTO M 207 for the strength classes specified for elliptical concrete pipe.

706.03 Concrete Pipe for Irrigation or Drainage. Meet AASHTO M 170 for the strength classes specified for round concrete pipe. Meet AASHTO M 207 for the strength classes specified for elliptical concrete pipe.

706.04 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe. Meet AASHTO M 170 for the strength classes specified for round concrete pipe. Meet AASHTO M 207 for the strength classes specified for elliptical concrete pipe.

Add to AASHTO M 170 Table 4 (Wall A):

Internal Diameter	Wall Thickness A	Area Steel ^(a)	Reinforcement Type
33 in	2 ⁷ / ₈ in	0.38 in ² /ft	Elliptical
36 in	3 ¹ / ₈ in	0.42 in ² /ft	Elliptical
42 in	3 ³ / ₄ in	0.49 in ² /ft	Elliptical
48 in	4 ¹ / ₈ in	0.60 in ² /ft	Elliptical

^(a) Per unit length of pipe wall.

Add to Table 5 (Wall A) of AASHTO M 170:

Minimum concrete strength is 6,000 psi.

Internal Diameter	Wall Thickness A	Area Steel ^(a)	Reinforcement Type
12 in	2 in	0.11 in ² /ft	Circular
15 in	2 in	0.21 in ² /ft	Circular
18 in	2 ¹ / ₄ in	0.30 in ² /ft	Circular
21 in	2 ³ / ₈ in	0.39 in ² /ft	Circular
24 in	2 ¹ / ₂ in	0.54 in ² /ft	Circular
27 in	2 ⁵ / ₈ in	0.50 in ² /ft	Elliptical
30 in	2 ³ / ₄ in	0.55 in ² /ft	Elliptical
33 in	2 ⁷ / ₈ in	0.63 in ² /ft	Elliptical
36 in	3 ¹ / ₈ in	0.70 in ² /ft	Elliptical
42 in	3 ³ / ₄ in	0.80 in ² /ft	Elliptical
48 in	4 ¹ / ₈ in	0.98 in ² /ft	Elliptical

^(a) Per unit length of pipe wall.

706.05 Gaskets for Concrete Pipe. Meet AASHTO M 198 Type A or B.

706.06 Corrugated Metal Pipe and Pipe Arches. Meet AASHTO M 36 or M 196 with the following additions:

1. Provide special sections that are the same thickness as the conduit they are joined to and that meet AASHTO M 36 or M 196.
2. Repair the damaged zinc or aluminum coatings on pipe with a repair compatible with AASHTO M 36 or M 196.
3. Provide close-riveted pipe with the rivets on circumferential seams placed on approximate 2.5 inches centers with a maximum spacing of 3 inches.
4. Provide asphalt-coated pipe that meets AASHTO M 190 Type A. Do not coat coupling bands.
5. Provide polymer-coated pipe with one of the following:
 - a. Meet AASHTO M 245, except coating thickness will be 10 mils minimum on each side.
 - b. Meet AASHTO M 36, which has additionally been coated with material meeting polymer coating requirements of AASHTO M 246.
6. The Engineer will waive the provisions of AASHTO M 36 Section No. 13.1 requiring testing of helical-welded seam corrugated metal pipe in accordance with AASHTO T 241 for pipe with the ends successfully re-rolled into annular corrugations.
7. Provide spiral rib corrugated steel pipe that meets AASHTO M 36 Type IR, with the following exceptions:

Fabricate each pipe end with at least 2 annular corrugations for joining pipe sections with coupling bands. Provide coupling bands at least 12 inches wide having 2 corrugations, spaced to seat in the second corrugation of each pipe without creating a gap greater than $\frac{1}{2}$ inch between pipe ends. Provide gaskets that meet ASTM C361 Section 6.9 or AASHTO M 198 Section 4.1.
8. The Engineer may approve coupling devices other than the standard configurations provided the Contractor's supplier submits test data confirming the device complies with joint performance criteria of AASHTO Standard Specifications for Highway Bridges, Division II Section No. 23.

706.07 Metallic (Zinc or Aluminum) Coated Corrugated Steel Underdrains. Meet AASHTO M 36.

706.08 Corrugated Aluminum Pipe for Underdrains. Meet AASHTO M 196.

706.09 General Requirements for Plastic Pipe. All plastic pipe will meet a minimum pipe stiffness of 46 pii as determined by ASTM D2412.

706.10 Corrugated PE Drainage Tubing. Meet AASHTO M 252.

706.11 Not specified.

706.12 Rubber Gaskets for Corrugated Metal Pipe. Meet ASTM D1056 Grade 2C3.

706.13 Acrylonitrile Butadiene Styrene (ABS) or PVC Composite Sewer Pipe. Meet ASTM D2680. ABS pipe is acceptable for drain laterals 4 inches and smaller.

706.14 Class PS 46 PVC Pipe. Meet AASHTO M 278. Limit size of PS 46 PVC to 15 inches maximum diameter.

706.15 Ribbed PVC Pipe. Meet ASTM F949 or ASTM F794. Limit size of Ribbed PVC to 36 inches maximum diameter.

706.16 Corrugated PE Pipe. Meet AASHTO M 294 for corrugated PE pipe nominal size of 12 to 60 inches in diameter. Limit size of corrugated PE to 60 inches maximum diameter. Use Type S PE pipe.

706.17 Ribbed PE Pipe. Meet ASTM F894.

706.18 Steel Reinforced Ribbed PE Pipe. Meet AASHTO MP 20 for SRRPE pipe nominal size of 12 to 60 inches in diameter. Limit size of SRRPE to 60 inches maximum diameter.

706.19 Polypropylene Pipe. Meet ASTM F2736 for double wall pipe up to 30 inches in diameter. Limit double wall pipe to 30 inches maximum diameter. Meet ASTM F2881 for triple wall pipe from 30 inches to 60 inches in diameter. Limit triple wall pipe to 60 inches maximum diameter. Triple wall pipe can be substituted for double wall pipe in diameters below 30 inches, when available.

706.20 Fittings for PE Drainage Tubing. Meet ASTM F405.

706.21 Rodent Protection Devices for Trench Drain. Meet ASTM F449.

SECTION 707 – PAINT

707.01 General. Provide homogenous paint, without contaminant, and of a consistency suitable for use. Do not allow pigment to settle excessively, cake or thicken in the container, and become granular or curdled during the pigment dispersion in vehicle.

707.02 Paint Formula. Follow formulations in accordance with federal paint specifications (TT) or the Steel Structures Painting Council (SSPC).

Tint coatings sufficiently different to provide a contrast between coats. Match the topcoat colors as specified or according to color chip numbers in Federal Standard No. 595. The Engineer will not allow field tinting.

Submit technical data sheets, safety data sheets, and specific application instructions for coatings. Submit the manufacturer's quality control test results for each paint batch component used. Submit the weight per gallon, viscosity, percent solids by weight, and finish coat color chips for the selected color. Submit the percent of metallic zinc by weight in the cured zinc primer coat and percent of metallic zinc by weight in the zinc pigment component for zinc rich primers.

The Engineer will accept the applicable National Transportation Product Evaluation Program (NTPEP) and the North East Protective Coating Committee (NEPCOAT) QPL paint formulations for products applied to structural steel specified formulations and paint systems. The Engineer will still test QPL paints from these programs as specified in this subsection and/or the manufacturer's specification for acceptance in accordance as specified in quantities listed in the [QA Manual](#).

Paints with volatile organic compounds (VOC) of 3.5 pounds per gallon maximum are acceptable.

<u>Formula No. 1</u>	Primer, Inorganic Zinc Rich
Specification:	AASHTO M 300 Type I or SSPC Paint 20 Type 1-C, Zinc Dust - ASTM D520 Type II. Meet Class B requirements for slip coefficient and creep resistance.
<u>Formula No. 2</u>	Primer, Organic Zinc Rich
Specification:	SSPC Paint 20 Type II, Zinc Dust – ASTM D520. Meet Class B requirements for slip coefficient and creep resistance when specified.
<u>Formula No. 3</u>	Primer, Zinc Rich Moisture-Cure Polyurethane
Specification:	SSPC Paint 40, Zinc Dust – ASTM D520 Type II. Meet Class B requirements for slip coefficient and creep resistance when specified.
<u>Formula No. 4</u>	Primer, High Solids Polyamide Epoxy
Specification:	SSPC Paint 22
<u>Formula No. 5</u>	Intermediate, High Solids Polyamide Epoxy
Specification:	SSPC Paint 22
<u>Formula No. 6</u>	Intermediate, Moisture-Cured Polyurethane, Micaceous Iron Oxide Reinforced, Performance-Based
Specification:	SSPC Paint 41
<u>Formula No. 7</u>	Topcoat, High Solids Polyamide Epoxy
Specification:	SSPC Paint 22
<u>Formula No. 8</u>	Topcoat, High Solids Aliphatic Polyurethane
Specification:	SSPC Paint 36

<u>Formula No. 9</u>	Topcoat, Aliphatic Moisture-Cured Polyurethane
Specification:	SSPC Paint 38
<u>Formula No. 10</u>	Micaceous Iron Oxide–Aluminum, Moisture-Cured Polyurethane
Specification:	Volume Solids – 60 percent Minimum Weight Solids – 70 percent Minimum Pounds/Gallon – 10.0 Minimum Gloss – Flat
<u>Formula No. 11</u>	Primer, Latex, Exterior
Specification:	TT-P-1984. The Engineer will not accept paint containing lead, chromium or cadmium pigments, or lead driers.
<u>Formula No. 12</u>	Paint, Latex, Exterior, Semi-Gloss
Specification:	TT-P-19. The Engineer will not accept paint containing lead, chromium or cadmium pigments, lead driers, or mercurial compounds for fungicide.
<u>Formula No. 13</u>	Concrete Stain, Flat
Specification:	Provide pigmented sealer that is semi-opaque colored toner containing methyl methacrylate-ethyl acrylate copolymer resins, toning pigments, and solvent. Suspend toning pigments in solution with a chemical suspension agent. Provide toning pigments that consist of laminar silicates, titanium dioxide, and inorganic oxides. The Engineer will not allow lead or chromium compounds, settling, or color variation. Do not use vegetable or marine oils, paraffin materials, stearates, or organic pigments in the coating formulation. Volume Solids – 20 percent Minimum Weight Solids – 25 percent Minimum Pounds per Gallon – 9.0 Minimum Gloss – Flat
<u>Formula No. 14</u>	Highway Traffic Line Paint, Latex
Specification:	The Department’s QPL for waterborne traffic line paint formulations.

707.03 Certification. Submit a manufacturer’s certificate and quality control test data of each batch or lot as specified in 106.04.

707.04 Identification and Marking. Plainly mark each container with the following information:

1. Color.
2. Product or formula number.
3. Quantity.
4. Batch or lot number.
5. Date of manufacturing.

SECTION 708 – METALS

708.01 General. When metal is placed in the work, ensure it is without dirt, detrimental scale, paint, oil, or other foreign substance. Thin powdery rust and tight rust is not detrimental except in the case of prestressing reinforcement.

708.02 Reinforcing Steel. Provide welded wire fabric for reinforcement that meets the requirements of AASHTO M 55. Provide other reinforcing steel meeting AASHTO M 31 Grade 40 or 60. The Contractor may substitute deformed steel-welded wire reinforcement that meets AASHTO M 221 for AASHTO M 31 reinforcing steel or AASHTO M 55 welded wire fabric with approval.

Provide epoxy-coated metal reinforcement in accordance with ASTM A775. Do not use colors in shades of brown that inhibit visual detection of rust spots and damage.

Coat reinforcing steel, which is required to be epoxy-coated, in a plant certified by the Concrete Reinforcing Steel Institute (CRSI) as a fusion-bonded epoxy applicator.

708.03 Dowel Bars. Provide smooth dowel bars meeting AASHTO M 254, except the steel material meeting AASHTO M 31 as an alternative may be provided by the Contractor.

Coat epoxy-coated dowel bars in a plant certified by the CRSI as a fusion bonded epoxy applicator.

708.04 Tie Bars. Meet AASHTO M 31 Grade 40 or 60. Ensure tie bars are deformed and epoxy-coated.

708.05 Prestressing Steel. Use high-tensile wire strand for prestressing steel meeting with ASTM A416 or uncoated high-strength steel bars meeting with ASTM A722.

The Department requires prestressing steel in the same direction, transverse or longitudinal, in individual members be of the same type.

Ensure the assembled units have a tensile strength of at least the manufacturer's minimum guaranteed ultimate tensile strength if bars are to be extended by the use of couplers. Failure of the sample to meet this requirement is cause for rejection of that heat of bars and/or lot of couplers depending on the nature of failure. Obtain approval for the location of couplers in the member.

Whenever threaded studs, bolts, nuts, and washers are specified with ASTM A307, ASTM F3125, ASTM A449, or ASTM A563 and when galvanizing is required, use hot-dip zinc-coated or mechanically zinc-coated requirements.

708.06 Structural Steel and Related Materials.

1. Structural Steel.

Provide structural carbon steel in accordance with AASHTO M 270 Grade 36.

Provide structural low alloy steel in accordance with AASHTO M 270 Grade 50.

Provide structural low alloy weathering steel in accordance with AASHTO M 270 Grade 50W.

Provide structural high-strength steel in accordance with AASHTO M 270 Grade 100.

Provide structural high-strength weathering steel in accordance with AASHTO M 270 Grade 100W.

Fabricate structural steel rolled shapes and plates of structural carbon steel.

Do not use rimmed or capped steel for structural carbon steel, structural low alloy steel, or structural low alloy weathering steel.

Submit proof of weldability before fabrication when using steel manufactured in accordance with AASHTO M 270 Grade 50W.

Cut plates so the rolling direction is approximately parallel with the direction of tensile or compression stress. Show the rolling direction on the shop drawings.

Provide base materials for fracture critical members (FCMs) in accordance with AASHTO M 160 Article 9, except replace paragraphs 9.2.1, 9.2.2, 9.2.2.1, 9.2.2.2, and 9.2.3 with the following:

- 9.2.1 Do not use welding to correct plate surface defects. The Contractor may condition plates by complete removal of imperfections or depressions on the top and bottom surfaces by grinding. Condition by grinding as follows:
- a. Flare 1:5 without abrupt change in contour.
 - b. Ensure the depth of the depression after grinding does not exceed 10 percent of nominal plate thickness or $\frac{1}{8}$ inch, whichever is greater.
 - c. Ensure areas removed by grinding do not exceed 2 percent of the surface area of the face of the plate where the imperfections are found.
 - d. After grinding the net plate, ensure cross-sectional area is 90 percent or more of the nominal cross-sectional area of the plate.
- 9.2.2 The Contractor may condition the edges of plates to remove injurious imperfections in accordance with the current ANSI/AASHTO/AWS D1.5 Bridge Welding Code paragraph 3.2.3.

Longitudinal Charpy V-Notch (CVN) tests are mandatory for acceptance on plates and shapes used for flanges and webs of main girders, including their splice plates, transverse, and longitudinal stiffeners, floor-beams, and plate or shape identified as fracture critical.

Submit sampling procedures in accordance with AASHTO T 243. Use the heat (H) frequency of testing for structural steels in accordance with AASHTO M 270 Grades 36, 50, and 50W. Use the piece (P) frequency for steels in accordance with AASHTO M 270 Grade 100/100W and any plate or shape identified as fracture critical. Test in accordance with AASHTO T 244. The testing cost is incidental to the cost of the structural steel and included in the contract unit prices for structural steel.

Provide CVN impact values in accordance with the zone requirements specified.

2. Bolts.

- a. General. Provide unfinished bolts (ordinary machine bolts) in accordance with ASTM A307. Use Grade A.

Use turned bolts or other special bolts made from structural carbon steel or as specified.

Provide high-strength bolts in accordance with ASTM F3125. Do not galvanize Grade A325 Type 3 and ASTM A490 bolts.

Provide anchor bolts in accordance with ASTM F1554 Grade 36, 55, or 105. If the grade is not specified, use Grade 36.

Ensure the maximum tensile strength is 150 ksi for bolts 1 inch or less in diameter and 120 ksi for larger bolts.

Provide Type 3 bolts when Grade A325 bolts are used unpainted and nongalvanized. Ensure nuts and washers used with Type 3 bolts have comparable atmospheric corrosion resistance and weathering characteristics.

When Grade A325 bolts are to be galvanized, ensure the steel is in accordance with the AISI 10XX series with a maximum yield strength of 105 ksi. Do not galvanize Grade A325 anchor bolts which are 1 inch in diameter or smaller and have a yield stress greater than 105 ksi. Grade A325 anchor bolts may be used if painted with 2 coats of specified formula zinc rich paint consisting of 2 mils (0.002 inch) minimum dry thickness per coat. For galvanized fasteners, overlap the nuts to the minimum amount required for the fastener assembly. Provide the amount of overlap in the nut that will allow free assembly on the bolt in the coated condition and meet the mechanical requirements of AASHTO M 291. The rotational-capacity test for overlapping requirements in AASHTO M 291 paragraph 7.4 are maximum values instead of minimum values.

Mark bolts, nuts, and washers with a symbol identifying the manufacturer as required in ASTM F3125 Section 5, ASTM A194 Section 12, and ASTM F436 Section 14. The Contractor's supplier must provide the symbol and address of each manufacturer for the bolts, nuts, and washers supplied.

b. Testing.

- (1) Bolts. Test proof load in accordance with ASTM F606 Method 1. Test minimum frequency in accordance with ASTM F3125 Section 9.

Wedge tests full-size bolts in accordance with ASTM F606 paragraph 3.5. If bolts are galvanized, perform tests after galvanizing. The minimum test frequency will be in accordance with F3125 Section 9.

If galvanized bolts are supplied, measure the thickness of the zinc coating. Take measurements on the wrench flats or top of the bolt head.

- (2) Nuts. Proof load tests in accordance with ASTM F606 paragraph 4.2. The minimum test frequency will be in accordance with in AASHTO M 291 paragraph 9.3 or AASHTO M 292 paragraph 7.1.2.1. If the nuts are to be galvanized, perform tests after galvanizing, overlapping, and lubricating.

If galvanized nuts are supplied, measure the zinc coating thickness. Take measurements on the wrench flats.

- (3) Washers. If galvanized washers are supplied, perform hardness tests after galvanizing. Remove coating before taking hardness measurements. Measure the zinc coating thickness.

- (4) Assemblies. Perform rotational-capacity tests on black or galvanized bolt, nut, and washer assemblies by the manufacturer or distributor before shipping. The Department requires washers as part of the test even though they may not be required as part of the installation procedure.

Apply the following:

- (a) Except as modified, perform the rotational-capacity test in accordance with ASTM F3125.
- (b) Test each combination of bolt production lot, nut lot, and washer lot as an assembly. Where washers are not required by the installation procedures, do not include in the lot identification.
- (c) Assign a rotational-capacity lot number to each combination of lots tested.
- (d) The minimum frequency of testing is 2 assemblies per rotational-capacity lot.

- (e) Construct the bolt, nut, and washer assembly in a Skidmore-Wilhelm calibrator or an acceptable equivalent device. For bolts too short to be assembled in the Skidmore-Wilhelm Calibrator see ASTM F3125, Annex 2, paragraph A2.7.
- (f) Use the minimum rotation value in Table 708.06-1 from a snug-tight condition (10 percent of the specified proof load).

Table 708.06-1 – Rotational Value

Bolt Length	Nut Rotation
< 4D	240° or 2/3 turn
> 4D and < 8D	360° or 1 turn
> 8D	480° or 1 1/3 turn
D is nominal bolt diameter	—

Note: These values differ from ASTM A325 Section 6.3 values.

- (g) Ensure the tension reached at the above rotation is 1.15 times or more of the required installation tension. The installation tension and the tension for the turn test are in Table 708.06-2.

Table 708.06-2 – Installation Tension

Diameter (in)	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Required Installation Tension (kips)	12	19	28	39	51	56	71	85	103
Turn Test Tension (kips)	14	22	32	45	59	64	82	98	118

- (h) After the required installation tension listed has been exceeded, take 1 reading of tension and torque and record. Ensure the torque value meets the following:

$$\text{Torque} \leq 0.25 \text{ PD}$$

Where:

Torque = measured torque, foot-pound

P = measured bolt tension, pound

D = bolt diameter, foot

- (i) The Contractor may test bolts in a steel joint when they are too short to test in a Skidmore-Wilhelm calibrator. Do not apply the tension requirement specified in 708.06.2.(4).g. Compute the maximum torque requirement as specified in 708.06.2.(4).h using a value of P equal to the turn test tension in Table 708.06-2.

(5) Reporting.

- (a) Record the results of tests, including zinc coating thickness, and in the appropriate AASHTO specifications on the appropriate document, and submit 6 copies.
- (b) Report location where tests are performed and date of tests on the appropriate document.

- (6) Witnessing. The manufacturer or distributor performing the tests must certify the results recorded are accurate.

Submit 3 complete bolt, nut, and washer assemblies from each lot and size to the Engineer for QA testing.

c. Documentation.

- (1) Mill Test Report (MTR). Submit a MTR for mill steel used in the manufacture of the bolts, nuts, or washers and where the material was melted and manufactured.
- (2) Manufacturer Certified Test Report (MCTR). The manufacturer of the bolts, nuts and washers must submit a MCTR for the item provided.

Report the relevant information on each MCTR as specified in this subsection.

Include the following with the MCTR rotational-capacity test:

- (a) The lot number of each item tested.
 - (b) The rotational-capacity lot number.
 - (c) The results of the tests required in 708.06.2.B.(4).
 - (d) Appropriate information required as specified in this subsection.
 - (e) A statement that MCTR for the items are in compliance to this subsection and the appropriate AASHTO specifications.
 - (f) The location where the bolt assembly components were manufactured.
- (3) Distributor Certified Test Report (DCTR). Include the MCTR in the DCTR for the various bolt assembly components.

Report the rotational-capacity test performed by a distributor or a manufacturer on the DCTR.

Show the results of the tests required in 708.06.2.B.(4).

Show the appropriate information required in 708.06.2.B.(5).

Show the rotational-capacity lot number.

Verify the MCTR complies with this specification and the appropriate AASHTO specifications.

d. Shipping.

- (1) Ship bolts, nuts, and washers (where required) from each rotational-capacity lot in the same container. If there is only 1 production lot number for each size of nut and washer, the nuts and washers may be shipped in separate containers.

Permanently mark each container with the rotational-capacity lot number that can be identified before installation.

- (2) The appropriate MTR, MCTR, or DCTR must be applied to the Contractor or the owner as specified.

e. Lubrication. Check galvanized nuts to verify that a lubricant is visible on the threads.

Ensure black bolts are "oily" to the touch when delivered and installed.

Clean and lubricate weathered or rusted bolts or nuts before installation. Retest recleaned or relubricated bolt, nut, and washer assemblies as specified in 708.06.2.B.(4) before installation.

3. Direct Tension Indicators (DTI). Fabricate DTIs in accordance with ASTM F959 and the following:

- a. Mechanically galvanize DTIs for unpainted structures in accordance with ASTM B695 Class 50. After galvanizing, coat the DTI with a PPG Power Prime 500 °F epoxy. Electrodeposit the DTI with

- the epoxy, rinsed, and baked at 350 °F to 500 °F for 20 minutes. Ensure the final thickness of epoxy is 1 millimeter and black in color.
- b. Galvanize and epoxy coat the DTI by the manufacturer or under their direct supervision.
 - c. The Contractor may use Type 3 DTIs that meet ASTM F959 for weathering steel structures. In addition, manufacture these DTIs from steel in accordance with the chemical requirements of ASTM F436 Type 3.
4. Stud Connectors. Provide stud connectors made by cold heading, cold rolling, or cold machining. Ensure finished stud connectors are of uniform quality and without injurious laps, fins, seams, cracks, twists, bends, or other defects. Ensure studs do not have cracks or bursts deeper than ½ the thickness from the periphery of the head of the shaft. Determine tensile strength of stud connectors by test of bar stock after drawing or of full diameter finished studs. Comply with the following strength requirements as specified in Table 708.06-3.

Table 708.06-3 – Strength Requirements

Tensile Strength	Elongation	Reduction of Area
Minimum = 60,000 psi	Minimum = 20% in 2 inches	Minimum = 50%

Provide stud connectors with arc shields (ferrules) of resistant ceramic or other suitable material for welding.

Comply with qualifications, welding, and test procedures specified in ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

5. Steel Castings. Provide steel castings in accordance with AASHTO M 103 Grade 70-36. Heat-treat castings by normalizing and tempering after the castings have been allowed to cool from the pouring temperature to below the transformation range.

Determine Charpy impact properties on each heat from a set of 3 Charpy V-notch specimens made from a test coupon in accordance with ASTM A370 methods and definitions and tested at 70 °F and have at least 25 foot-pounds of energy.

An independent testing laboratory must inspect the entire base plates, webs, and pin sockets by radiographic and magnetic particle examinations. Perform magnetic particle examination in accordance with ASTM E709. Judge radiographic examination in accordance with ASTM E94 and judge types and degrees of discontinuities in accordance with ASTM E186. Submit copies of radiographic negatives.

Ensure the acceptable surface discontinuities and finish is in accordance with ASTM A802. Remove unacceptable visual discontinuities and verify the resultant cavities by visual examination.

Defects that, as determined by the Engineer, cannot be removed without adversely affecting the casting will be grounds to reject the entire casting. The Contractor may repair defects that can be removed without injury to the casting by welding in accordance with ASTM A488. Submit a complete weld procedure for approval before starting repair work. Include the weld procedure for base metal preparations, preheat, electrode, postheat, and procedure qualifications. The Engineer may perform radiographic and magnetic particle examination on repair welding.

6. Steel Forgings. Use steel forgings for pins, rollers, trunnions, or other forged parts. Accurately turn forgings to the detailed dimensions, smooth, straight, and flawless. Produce the final surface by a finishing cut. Machine final surfaces to a finish of ASA 3 micrometers (125 micro inches) or better.

708.07 Wide-flange Guardrail Posts. Manufacture wide-flange w-beam and thrie-beam guardrail posts in accordance with AASHTO M 270 Grade 36. If corrosion-resistant steel is required, manufacture in accordance with AASHTO M 270 Grade 50W steel. Match the cross-section dimensions of a W6.8.5 or W6x9 post in accordance with AASHTO M 160.

After the section is cut and holes are drilled or punched, zinc-coat the component in accordance with AASHTO M 111. If corrosion-resistant steel is used, zinc-coat the portion of the post to be embedded in soil in accordance with AASHTO M 111 and do not zinc-coat, paint, or otherwise treat the portion above the soil.

708.08 H-Beam Piles. Provide H-beam piles of structural steel in accordance with ASTM A572 Grade 50 or as specified. Submit 2 certified copies of ladle analysis and physical test records.

708.09 Barbed Wire. Provide barbed wire in accordance with AASHTO M 280.

708.10 Woven Wire. Provide woven wire in accordance with ASTM A116, except wire size and strength options are limited to the following subsections of ASTM A116 Table 1:

1. No. 12¹/₂ Grade 60, No. 12¹/₂ Grade 125, or No. 14¹/₂ Grade 125. Ensure fence height, wire spacing, and stay spacing are as specified.

708.11 Hardware for Barbed or Woven Wire Fence. Provide 9-gauge staples with a minimum length of 1.5 inches, except 1-inch staples may be used in locust posts. Provide 9.5-gauge stay wire, 9-gauge brace wire, and 12.5-gauge tie wire and wire clamps. Provide stay wire, brace wire, tie wire, and wire clamps in accordance with ASTM A116. Galvanize the wire if no coating class is specified.

708.12 Metal Posts for Barbed or Woven Wire Fences. Provide painted or galvanized metal fence posts in accordance with AASHTO M 281 or ASTM A702. The Engineer will not accept punched lug-type posts.

708.13 Chain-Link Fence. Provide 2-inch diamond mesh woven chain link fabric from 11-gauge coated (0.12 inch) wire. Ensure the weight of coating for galvanized fabric is 1.2 ounces per square foot. Provide posts, braces, tension wire, fittings, and other hardware as specified in Table 708.13-1.

Table 708.13-1 – Chain Link Posts and Braces

	Fence Height	Pipe Section	C-Section (Class does not apply)	
		Minimum Size, OD inch-od	Minimum Size, inch	Minimum Weight, lb/ft
Line Posts	≤ 6 ft	1.9	1.875 x 1.625	1.85
	> 6 ft but ≤ 8 ft	2.375	1.875 x 1.625	2.28
Corner and End Posts	≤ 6 ft	2.375	—	—
	> 6 ft but ≤ 8 ft	2.875	—	—
Braces	All Heights	1.660	1.625 x 1.25	1.35

Pipe lengths longer than those shown must comply with the weights relative to minimum outside diameter in accordance with ASTM F1043 Group 1A or Group 1C. The Engineer will allow interpolation of the weights in accordance with in ASTM F1043.

Pipe sections will meet ASTM F1043 Group 1A or Group 1C.

Use Group 1A or Group 1C posts and braces.

Ensure C-sections have minimum yield strength of 45,000 psi. Ensure coating of C-sections are the same as Group 1A or Group 1C.

Provide tension wire $\frac{3}{16}$ inch in diameter and 1.2 ounces per square foot of zinc coating. For fencing, fittings, and hardware meet AASHTO M 181.

708.14 Guardrail Components. Provide galvanized w-beam or thrie-beam that meet AASHTO M 180 Class A or B Type 2, except galvanizing the rail occurs after fabrication, with fabrication to include forming, cutting, shearing, punching, drilling, bending, welding, and riveting. Ensure the minimum average mass of zinc coating is 2 ounces per square foot of surface (not sheet). Galvanize anchor cables in accordance with AASHTO M 30.

Provide bolts, nuts, and washers used with guardrail in accordance with AASHTO M 180, A 307, A 325, or A 449 as specified. Rail splice bolts must be shoulder “button” head bolts per AASHTO M 180. Provide galvanized bolts, nuts, washers, and other hardware used with guardrail in accordance with ASTM A153.

708.15 Not specified.

708.16 Rigid Posts for Delineators, Snow Poles, and Mileposts.

1. Provide posts for delineators and snow poles weighing 1.12 pounds per foot and that meet ASTM A499. Galvanize in accordance with ASTM A123 or provide with green baked enamel finish.
2. Provide steel posts for mileposts that meet ASTM A1011 Grade 45 minimum, ASTM A653 G 90, and ASTM A513.

708.17 Steel and Aluminum Sign Supports.

A. General. Galvanize structural steel in accordance with ASTM A123. Zinc coat miscellaneous steel hardware in accordance with ASTM B633 Class No. Fe/Zn 25 Type III coating. Galvanize steel square tubes (Type E sign posts) in accordance with ASTM A653 G 90.

Provide anchor bolts with 3 nuts and 2 washers. Galvanize the nuts, washers, and at least 10 inches of the threaded end of the anchor bolts in accordance with ASTM A153.

Ensure the anchor bolt threads accept galvanized nuts without tools or causing removal of the protective coating after galvanizing.

B. Ground-Mounted Sign Supports. Provide ground-mounted sign supports as follows:

1. Steel for Type A sign posts will meet ASTM A709 Grade 50.
2. Steel for Type B sign posts will meet ASTM A500 Grade B.
3. Steel posts for Type E sign posts will meet ASTM A1011 Grade 45 minimum, ASTM A653M G 90, and ASTM A513. E1 posts are 12 gauge. E2 posts are 10 gauge.
4. Structural steel for brace angles and brackets will meet ASTM A36.
5. High-strength bolts, nuts, and washers for sign posts will meet ASTM F3125.
6. Anchor bolts, nuts, and washers will meet ASTM F1554.

Finish shop fabrication of steel supports, brace angles, and brackets with galvanizing. The Engineer will not allow field modification that damages the galvanization.

C. Overhead Sign Structures. Provide overhead sign structures.

Fabricate sign structure components from material meeting the specifications in Table 708.17-1.

Table 708.17-1 – Overhead Sign Structure Components

Steel Structure	Aluminum Structure
ASTM A36 (except ASTM A283)	ASTM B308, Alloy 6061-T6
ASTM A53 Types E & S Grade B	ASTM B429, Alloy 6063-T6
ASTM F3125	ASTM B209, Alloy 2024-T4
ASTM F1554 (anchor bolts)	—

Provide end poles, mastarms, or truss assemblies formed into a continuous shaft. Provide pole shafts uniformly straight, with a permissive variation not to exceed $\frac{3}{4}$ inch, measured at the midpoint of the pole in place and unloaded.

Provide aluminum bolts with an anodic coating 0.0002 inch minimum thickness, with a dichromate or boiling water seal, coated with a suitable lubricant.

Provide overhead sign structures fabricated entirely from steel, or aluminum, providing only 1 type. Manufacture structures alike.

The Engineer will only approve splices for the overhead steel sign structure.

Finish shop fabrication of overhead steel sign structures, posts, and brackets before galvanizing. Repair damaged galvanized surface as follows:

1. Thoroughly clean the damaged area and remove traces of welding flux and loose or cracked spelter.
2. Paint the cleaned area with 2 coats of zinc dust-zinc oxide paint.

708.18 Hardware for Signs. Provide zinc-coated steel, aluminum bolts, nuts, and washers, and other hardware items used for fabrication and mounting of signs as follows:

Electrodeposited Coatings of Zinc on Iron and Steel	ASTM B633
Class No. Fe/Zn 25, Type III Coating	
Low or Medium Carbon Steel Externally or	
Internally Threaded Standard Fasteners	SAE J429 or SAE J995 both Grade 2
Alloy-Steel Bolting Materials for Low-Temperature Service	ASTM A320
Aluminum-Alloy Sheet and Plate	ASTM B209
Flat washers	ASTM B221, Alloy Alclad 2024-T4
Aluminum-Alloy Bars, Rods, and Wires	ASTM B211
Lock nuts	Alloy 2017-T4
Bolts and screws	Alloy 2024-T4 or 6061-T6
Nuts $\frac{1}{4}$ inch tap and under	Alloy 2024-T4
Nuts $\frac{5}{8}$ inch tap and over	Alloy 6061-T6 or 6262-T9
Spring lock washers.....	Alloy 7075-T6
Aluminum-Alloy Rivet and Cold-Heading Wire and Rods	ASTM B316
Blind rivets	Alloy 2017-F, 2117-F, or 5056-F

708.19 Illumination Poles and Bases. Manufacture lighting poles, bases, and appurtenances alike. Submit shop drawing for approval before fabrication begins. Use materials for fabricating poles in accordance with the applicable test methods as follows:

High-Strength Bolts and Nuts	ASTM F3125
Anchor Bolts	ASTM F1554
Mild to Medium-Strength Carbon-Steel	
Castings for General Application	ASTM A27
Cast Steel Parts.....	Grade 65-35
Structural Steel Sheet.....	ASTM A659, ASTM A572, and ASTM A1011
Sheet Steel for Fabricating Shafts, Anchor Bars, and Nuts	
Welded and Seamless Steel Pipe	ASTM A53
Steel Pipe for Lighting Bracket Arms	
Galvanizing Steel Poles	
Zinc (Hot-Galvanized) Coatings on Products Fabricated from	
Rolled, Pressed, and Forged Steel Shapes,	
Plates, Bars, and Strips	ASTM A123
Gray Iron Castings for Valves, Flanges, and Pipe Fittings.....	ASTM A126
Cast Iron Parts	
Zinc (Hot-Dip) on Iron and Steel Hardware	
Galvanizing Anchor Bolts and Bracket Arms	ASTM A153
Aluminum-Alloy Sand Castings or Permanent Mold Castings	ASTM B26 M or B 108
Aluminum Base Flanges and Transformer Bases.....	Alloy A 357.0-T6
Aluminum Die Castings	ASTM B85
Alloy 380	
Aluminum-Alloy Bars, Rod, and Wire	ASTM B211
Aluminum Pole Shafts and Aluminum Lighting Bracket Arms.....	Alloy 6063-T6

Specified catalog numbers are provided only to show general dimensions and configurations. Poles and appurtenances must be capable of supporting design loads within allowable stress ranges as set forth in the AASHTO latest version of Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and weld in accordance with these AASHTO specifications.

Form the pole into a continuously tapered shaft having uniform taper of approximately 0.14 inch per foot. Provide pole shafts straight with an allowable variation of 1 inch or less measured at the midpoint, in place, and unloaded. Cover the top of the pole shaft with a removable waterproof pole cap. The maximum pole deflection allowed after loading, excluding wind load, is equal to 1 percent of the pole shaft length.

Secure a removable anchor bolt cover or covers to the base plate.

Provide a handhole in the pole shaft with a reinforcing frame and cover. Locate the handhole 90 to 270 degrees from the bracket arm. Provide a bonding device in the lower half of the handhole reinforcing frame for grounding purposes.

Ensure materials, components, and hardware for each pole assembly is compatible with the type of pole used.

Fabricate steel pole shafts from sheet steel. Permanently show the pole wall thickness on each pole near the base.

Galvanize poles after welding is complete.

Provide aluminum poles with a natural finish and without defects. Form anchor bases for aluminum poles from aluminum alloy secured to the bottom of the shaft so the full strength of the shaft is developed.

Galvanize at least 10 inches of the threaded end of the anchor bolts, nuts, and washers. Ensure the anchor bolt threads accept galvanized nuts without requiring tools or causing the removal of the protective coating after galvanizing.

Provide threaded hubs for steel poles made of forged steel in accordance with ASTM A105. Ensure the end of the hub inserted into the pole shaft has a minimum $\frac{1}{4}$ inch round beveled end or edge to prevent insulation stripping during wire pulling operations. Do not use half pipe coupling, tank spud, or similar material.

Provide 4-bolt configuration safety slip bases. Design the base to meet necessary design loading requirements and as a minimum meet the current breakaway requirements of the AASHTO LRFD Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

Design breakaway support couplings to meet necessary design loading requirements and as a minimum meet the current breakaway requirements of the AASHTO LRFD Standard Specifications for Highway Signs, Luminaires, and Traffic Signals. Limit use of the couplings to pole assemblies weighing less than 900 pounds and poles providing 40 feet or less nominal luminaire mounting heights.

Surround the support coupling with a $\frac{1}{16}$ inch aluminum skirt fastened with No. 10 by $\frac{5}{8}$ inch stainless steel sheet metal screws.

708.20 Structural Plate Pipe, Pipe Arches, and Arches.

A. Aluminum. Aluminum for corrugated metal pipe and pipe-arches must comply with the requirements of AASHTO M 196 or ASTM B745. Aluminum for structural plate pipe, pipe-arch, and box structures must meet the requirements of AASHTO M 219 or ASTM B746.

The Engineer will accept aluminum bolts meeting ASTM F468 or standard strength steel bolts meeting ASTM A307.

B. Steel. Steel for corrugated metal pipe and pipe-arches must comply with the requirements of AASHTO M 36 or ASTM A760. Steel for structural plate pipe, pipe-arch, and box structures must meet the requirements of AASHTO M 167 or ASTM A761.

Steel for deep corrugated structural plate must comply with the requirements of AASHTO M 36 or ASTM A760.

The Engineer will accept high strength steel bolts meeting ASTM A449.

The Engineer will accept hot-dipped or mechanically galvanized bolts and nuts provided they meet AASHTO M 111 or ASTM A153.

Provide polymer-coated pipe that meets AASHTO M 246, ASTM A762, or ASTM A762M, except the coating may be shop or field applied after corrugation, and coating thickness must be at least 0.01 inch on each side of the sheet. After tightening, coat exposed portions of bolts and nuts on soil side and water side of pipe, with the same material used on the pipe.

The Contractor may substitute polymer-coated pipe for bituminous-coated pipe.

When yielding seam (keyhole slotted) pipe is specified to be bituminous-coated or polymer-coated, do not coat mating surfaces in the overlap portion of the joint, unless authorized in writing by the pipe manufacturer.

708.21 Metal Aprons. Meet AASHTO M 36 or M 196.

708.22 Manhole Covers and Rings, Grates, Catch Basins, and Inlets. Meet AASHTO M 306 Class 35 for gray iron.

708.23 to 708.25. Not specified.

708.26 Extruded Aluminum. Meet ASTM B221 Alloy 6063-T6 for reflective sheeting backgrounds. Ensure extrusions are flat and true within a tolerance of 1/4 inch per 8 feet of panel length. Prevent deviation from flat surface across the width of the panel before coating from exceeding 0.005 inch per inch of width. Provide continuous extruded sections for the length of the signs.

708.27 Sheet Aluminum. Meet ASTM B209 Alloy 6061-T6 or 5052-H38 with an alodine 1200 finish.

708.28 Caps for Right of Way and Street Markers. Cast caps from brass or bronze.

Ensure the top of the finished casting is without blowholes, pits, cracks, corrugations, or other surface roughness to render completely legible the standard identification and other letters or numerals which may be subsequently stamped.

Stamp each cap or cast as specified.

708.30 Steel Shell Piles. Provide cylindrical, cylindrical with a taper, or step-tapered steel shell piles. Provide cylindrical shell piles with an outside diameter as specified. Provide tapered piles with outside tip diameter at least 8 inches and the outside butt diameter at least as what is specified.

Provide steel shell piles driven without a mandrel of sufficient strength and rigidity to permit driving to the specified resistance without distortion. Ensure the steel minimum yield strength is 30,000 psi. Submit an electronic copy of a certified test report showing compliance with yield strength requirements. Ensure the minimum wall thickness is 1/4 inch. Ensure steel shell piles in exposed pile bents in water have a minimum wall thickness of 5/16 inch. Equip shells driven without a mandrel with driving points, flat plates, or other suitable end closures adequately fixed, and of sufficient thickness and strength to permit driving without distortion and remain watertight or as specified.

Provide steel shell piles that when driven with a mandrel of sufficient thickness the pile will hold its original shape after the mandrel is withdrawn and shows no harmful distortion after it and the adjacent piles have been driven.

708.31 Permanent Metal Concrete Forms. Meet ASTM A653 M SS designation with coating designation Z500 and meet requirements relevant to steel permanent metal forms and the placing of concrete as specified.

SECTION 709 – CONCRETE CURING MATERIALS AND ADMIXTURES

709.01 Membrane-Forming Curing Compound. Meet:

System 1. ASTM C309 Type 1-D Class B with Fugitive Dye.

System 2. ASTM C309 Type 2 Class B, White Pigmented.

709.02 Concrete Admixtures – General. If more than 1 admixture is used, use the same brand from the same manufacturer and ensure it is compatible and can be dispersed in accordance with the manufacturer's written instructions. Do not use admixtures containing chlorides, flourides, sulphites, and nitrates.

709.03 Air-Entraining Admixtures. Meet AASHTO M 154.

709.04 Set Retarding Admixtures. Meet ASTM C494.

709.05 Water-Reducing Admixtures. Meet ASTM C494.

709.06 Lithium Nitrate Admixtures. Provide lithium nitrate admixture consisting of a 30 percent aqueous lithium nitrate solution. Use the same brand and from the same manufacturer in the mix design and used in the concrete alkali silica reaction mitigation testing for the lithium nitrate admixture used in the concrete. Follow the manufacturer's written instructions.

SECTION 710 – TIMBER AND PRESERVATIVES

710.01 Structural Timber and Lumber. Provide Douglas Fir or Larch structural timber and lumber of the grade specified. Ensure grade of structural timber and lumber is determined using the current version of the Western Wood Products Association (WWPA) standard grading rules of western lumber. Ensure wood is incised and treated to meet the American Wood Preservers Association (AWPA) Standard U1, Commodity Specification A: Sawn Products.

710.02 Wood Sign Posts. Provide sign posts surfaced four sides (S4S) and free of wane and decay. Ensure ends are cut square and the post incised on all 4 sides before treating. Checks will not be more than 1/4 inch in width. The Engineer will not accept twisted pieces. Ensure sweep is limited to 1 inch per 10 feet. Incise in accordance with AWPA U1, Commodity Specification A: Sawn Products, and pressure treat as specified in 710.09.

Provide treated and graded Douglas Fir or Hem-Fir sign posts. Use the current version of the West Coast Lumber Inspection Bureau (WCLIB) or the WWPA to meet the following grades and requirements:

Species	Grade
Douglas Fir	
4" by 4"	85 percent of the sign posts free of heart center. Structural light framing, No. 2 grade in accordance with WCLIB paragraph 124c or WWPA paragraph 42.12.
4" by 6"	85 percent of the sign posts free of heart center. Structural joists and planks, No. 2 grade in accordance with WCLIB paragraph 123c or WWPA paragraph 62.12.
6" by 6" or 6" by 8"	Posts and timbers, No. 1 grade in accordance with WCLIB paragraph 131b or WWPA paragraph 80.11.
Hem-Fir	
6" by 6" or 6" by 8"	Posts and timbers, select structural in accordance with paragraph 131a WCLIB or paragraph 80.10 WWPA.

Provide posts inspected and certified in accordance with the designated current grading and dressing rules of the WCLIB or the WWPA. Submit a certificate of inspection executed by the WCLIB, the WWPA, or the Pacific Lumber Inspection Bureau (PLIB) at the time of delivery. Ensure certificates of inspection identify the destination or FOB for which the material is intended and each piece is inspected, certified, and stamped with an inspection mark. Such certification or grade marking does not constitute final acceptance of the material and the Engineer may reject lumber or timber that does not meet specifications.

710.03 Timber Guardrail Posts and Timber Blockouts. Provide rough surfaced 2 sides (S2S) or 4-sided (S4S) wood guardrail posts and wood blockouts. Do not exceed the size tolerance of plus or minus 1/4 inch for rough sawed blocks. Provide incising that meets AWPA U1, Commodity Specification A: Sawn Products, and pressure treat as specified in 710.09.

Grade guardrail post and blockouts using WWPA standard grading rules for western lumber and the following:

Species	Grade
Douglas Fir or Larch	No. 1 Grade
Hem-Fir	No. 1 Grade
Pine (Lodgepole, Ponderosa, Idaho White, and Southern)	No. 1 Grade
Western Red Cedar	No. 1 Grade

The Engineer will reject an otherwise acceptable guardrail post with a thorough check, shake, or end split in the same plane or parallel plane as the bolt hole and extending from the top of the post to within 3 inches of the bolt hole, unless it is provided with a tight fastening across the separation centered 2 inches below the top of the post. Use a galvanized bolt fastener 1/2 inch in diameter with a galvanized washer under the bolt head and the nut. Treat holes for fastening in accordance with AWPA M4.

710.04 Service Poles for Power. Meet ANSI No. 05.1. The Contractor may use all species of Douglas Fir, Larch, Hemlock, and Pine. Treat poles as specified in 710.09.

710.05 Timber Piles.

1. Provide first quality timber piles Douglas Fir or Western Larch that meet ASTM D25.
2. Treated Piles. Treat as specified in 710.09.
3. Untreated Piles. Provide untreated piles with a high heartwood content and a diameter of heartwood at least eight-tenths of the diameter at the butt.
4. Dimensions. Provide piles with a diameter at a section 3 feet from the butt and at the tip as specified in Table 710.05-1 below.
5. Material used in or over aquatic environments will be produced in compliance with the Western Wood Preservers Institute’s (WWPI) “Best Management Practices for the Use of Treated Wood in Aquatic and Wetland Environments”. Material produced in compliance with the WWPI’s BMPs will require certification by an independent third party inspection agency as specified in the BMPs.

Table 710.05-1 – Bolt Diameter

Length of Piles, feet	Butt Diameter, inch	Tip Diameter, inch, minimum
Under 40	12-18	8
40-60	13-18	7
Over 60	14-20	6

The Engineer will measure the diameter of the piles after peeling. When the pile is not exactly round, the Engineer will use the average diameters or the circumference divided by pi (3.14159) to determine the diameter. For structures, provide pile with the butt diameters and length as uniform as practical.

710.06 Service Poles for Illumination. Provide poles thoroughly seasoned and treated, 35 feet long, rated Class 4, machine peeled, and that meet ANSI 05.1, except the number and size of knots and the sweep of the pole can be two-thirds that allowed by the ANSI specification. Provide treated poles as specified in 710.09.

710.07 Pole Keys. Provide thoroughly seasoned and treated pole keys, 5 feet long, have a 4-inch minimum dimension, and a minimum cross-sectional area of 25 square inches.

Treat pole keys as specified in 710.09.

710.08 Posts for Barbed or Woven Wire Fence. Provide line posts with a minimum post circumference of 10 inches and install a minimum distance between opposite faces or between faces and an opposite corner of 3 inches. Provide posts for corner, terminal, or braces with a minimum circumference of 17 1/2 inches and install a minimum distance between opposite faces or between faces and an opposite corner of 4 inches.

Pressure treat wood posts as specified in 710.09. The Contractor may use any species of Douglas Fir, Western Larch, Cedar, or Pine.

710.09 Preservative Treatment. Provide treated timber and lumber requiring preservative treatment that meets the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requirements as registered preservatives, AASHTO M 133, and AWPA standards and specifications. These specifications include the following:

1. Storing and curing the timber and lumber.
2. Wood preservatives.
3. Preservative treatment process.
4. Documenting the results of the treatment.
5. Inspection.
6. Testing.
7. Identification of properly treated timber.

Treat timber and lumber in accordance with AWPA C14.

Perform cutting, boring, chamfering, routing, surfacing, and trimming before treating. Treat with 2 liberal applications of a compatible preservative after field drilling or cutoff in accordance with AWPA M4.

Charges must consist of pieces of the same species that are similar in form, size, moisture content, and receptivity of treatment. The pieces in the charge must be separated to ensure contact of treating medium with surfaces. Test to determine the retention of the preservatives.

Include the following information in the certificate of treatment:

1. Name and location of the wood preserving company.
2. Customer identification.
3. Date of treatment and charge number.
4. Type of chemical used and the amount of retention.
5. Treating process and identification of the specifications used.
6. Description of material that was treated.
7. Signature of a responsible plant official.

Chemically treat timber and lumber to be used in aquatic environments using BMPs. The producer of the chemically treated products must supply a written certification the BMPs were used, including a description and appropriate documentation of the BMPs used. Include this information with or on the certificate of treatment record.

Pressure treat sign posts and fence posts with ammoniacal copper zinc arsenate (ACZA), chromated copper arsenate type C (CCA-C), copper naphthenate, or pentachlorophenol in accordance with AWPA standards, but ensure the minimum preservative retention in the wood meets the AWPA standards.

Provide pressure treated guardrail post and blockouts with ACZA, chromated copper arsenate (CCA), copper naphthenate or pentachlorophenol in accordance with AWPA P5, P8, P9, and C4, but ensure the minimum preservative retention in the wood as determined by AWPA standards.

SECTION 711 – ROADSIDE IMPROVEMENT MATERIAL

711.01 to 711.03. Not specified.

711.04 Riprap. Material for riprap consists of natural or quarry stones from an approved source, which are durable, angular, sound, hard, without seams and other structural defects, resistant to weathering and water action, and meet the testing requirements of either set of criteria in Table 711.04-1.

Table 711.04-1 – Rip Rap Quality Testing Criteria

Nonapproved Source			Approved Source		
Property	Test Method	Requirement	Property	Test Method	Requirement
Apparent Specific Gravity	AASHTO T 85	2.5 Minimum	Idaho Degradation	Idaho IT 15	8% Max Loss
Absorption	AASHTO T 85	4% Maximum	Los Angeles Abrasion	AASHTO T 96	40% Maximum
Coarse Durability Index	AASHTO T 210	52 Minimum	Ethylene Glycol	Idaho IT 116	90% Minimum Retained

711.05 Seed. Provide seed collected or harvested within 2 years of the targeted seeding date. Provide all seed in pure live seed (PLS) unless otherwise directed.

Submit current certification documents and seed test results, including seed purity, germination/viability, and free of noxious weeds.

Seed will be true of genus and species, and will meet all provisions of the state of Idaho's pure seed law and noxious weed rules, [22-4 Idaho Code](#) and [IDAPA 02.06.22](#) respectively, and the [Federal Seed Act, 7 CFR Part 201](#).

Test all seed for prohibited and restricted noxious weed seed before delivery. The supplier must hold a current and valid Idaho seed dealer's license. The Engineer will review requests for species or cultivar substitution(s); genus substitution is not allowed. Substitution requests need to be submitted a minimum of 60 calendar days in advance of delivery.

Ensure each bag or container of individual seed species has labeling indicating seed classification (genus and species), lot number, purity, germination, percentage of weeds found, percentage of noxious weeds found, and test date. Provide a seed analysis report for each species issued from the Idaho State Department of Agriculture (ISDA) or Association of Official Seed Certifying Agency (AOSCA).

The seed analysis report will include:

1. Test Date.
 - a. Seed germination tested within 8 months of the target seeding date.
 - b. Seed purity and noxious weed tested within 15 months of the target seeding date.

2. PLS. Seed germination percentage and purity percentage.

Minimum Allowable Rates for Seed by Species

Material	PLS Rate ^(a)
All grass seed	0.800
All legume seed	0.785
All native wildflower and forb seed	0.765
Big sagebrush	0.160
Antelope bitterbrush	0.665
Rabbitbrush	0.160
Oregon Grape	0.500
Snowberry	0.580
Woods Rose	0.500

^(a) Contact the Engineer for the minimum seed testing requirements for other shrub species.

For certified or non-certified seed:

1. Noxious weed seeds prohibited.
2. Less than 1 percent by weight weed seeds including restricted noxious weed seed.
3. Less than 3 percent by weight of allowable cheat, chess, or downy brome seed.

To obtain the PLS rating, use this formula:

$$\text{PLS rating} = \frac{(\text{purity \%}) \times (\text{germination \%})}{100}$$

To obtain the bulk seed needed:

$$\text{Bulk pounds of seed needed per acre} = \frac{\text{PLS lb/acre required}}{\text{PLS rating}}$$

A. Approval. The Engineer will verify that all seed test results and laboratory reports are valid and comply with certification tags for each species before approval. Once approved, deliver seed to the project site unopened, in original and individually packaged bags or containers according to species type (i.e. one species per bag or container). If seed is received in opened packages, packages without certification tags, or packages or containers containing multiple species, the seed will not be approved for use.

B. Random Sampling. The Engineer may conduct random onsite sampling to verify species, purity percentage, germination percentage, and restricted and prohibited noxious weed seeds. The Engineer will weigh seed according to size, approximately 125 gram samples of mostly native seed (550 gram samples of grain or similar size seed) from unblended and individually packaged seed containers of each species. Samples will be submitted to the ISDA for analysis and verification. The Engineer will reject seed not meeting specifications. Do not plant until the seed is accepted and the application method is approved. Measure and mix individual unopened seed packages onsite in the Engineer's presence at the specified proportions.

711.06 Plants. Provide plants that meet the applicable requirements of the current American Standard for Nursery Stock. Ensure plants are true to type and name in accordance with Standardized Plant Names prepared by the

American Joint Committee on Horticultural Nomenclature. Ensure plants are grown from seed or stock collected within 500 feet elevation of the project site.

Provide plants that are sound, healthy, vigorous, well branched, and densely foliated when leaves are present, and without disease or insects, including adult eggs, pupae, or larvae. Provide plants without damaged root systems, disfigured limbs, or containing knots, limb scars, sun scald, abrasions of the bark, wind or freezing damage, or other disfigurements. Do not cut back plants from larger sizes to meet specified sizes. The Engineer will reject plants with noxious weeds in the containers or at the source.

Provide nursery grown plants unless collected plants are specified. Provide plants that are grown or conditioned to an environment similar to the project site, including elevation, annual precipitation, soil conditions, and climate.

The term "nursery grown" consists of plants collected in the forest or natural seedling trees and shrubs, provided these trees and shrubs have been growing continuously in one nursery for the minimum time periods specified in Table 711.06-1.

Table 711.06-1 – Plant Age

Plant Material	Time in Nursery
Trees	2 Growing Seasons
Shrubs, Evergreens	2 Growing Seasons
Shrubs, Deciduous	1 Growing Season
Wetland Plants	2 Growing Seasons
Vines	1 Growing Season

Provide trees with straight trunks, well-branched with symmetrical tops and no unhealed scars more than $\frac{3}{4}$ inch in diameter.

Provide well established containerized plants with a root system sufficiently developed to keep its shape and hold together when removed from the container. The Engineer may reject plants that are pot bound or have kinked, circling, or bent roots. Provide plants in pots or containers of sizes specified.

Deciduous plants may be supplied bare-root unless specified otherwise. Provide bare-root plants that are one size group larger than the sizes specified before pruning and packed in moisture-retaining material.

Provide broadleaf evergreen plants and conifers balled and burlapped (B&B) or in suitable containers. Provide B&B plants, except seedlings, in firm, natural earth balls of standard size in accordance with the American Standard for Nursery Stock, with the root collar located within the top 2 inches of the soil ball, and wrapped with burlap firmly held in place by a cord or wire wrapping. Handle B&B plants by the earth ball only and protect against drying and freezing. The Engineer will reject broken or loose earth balls or plants without an adequate root system.

Do not dig collected plants until they have been inspected. Dig collected plants with a greater earth ball or root spread for the applicable plant type in accordance with the American Standard for Nursery Stock.

Pack and ship the plants in accordance with the American Standard for Nursery Stock.

Submit required state and federal plant shipment inspection certificates.

Notify the Engineer in writing within 6 weeks of target planting date if any specified plant is not obtainable or available. The Engineer will evaluate the plant availability and may consider allowing the nearest available size and similar variety, with corresponding adjustment to the contract unit price.

Provide plants labeled in accordance with size and scientific plant name with durable and legible tags. Deliver plants with labels securely attached to plants, bundles, and plant material containers. Submit the actual or a copy

of the inspection certificate for injurious insects, plant diseases, and other plant pests for each plant material shipment or delivery. Write the name, address, and stock source on the certificate.

Leave the labels on at least 1 plant of the same species for each group plantings and on each plant for individual plantings during and after planting operations within the same area.

Acceptable antitranspirants include polymer gels, wetting agents, spray on chemicals, or natural products.

711.07 Commercial Fertilizer. Provide natural organic commercial fertilizer products that include nitrogen, phosphorus, potassium, natural nutrients and micronutrients, or combinations that improve soil structure and have a salt index of 4 or less. Materials may also consist of Class A biosolids, plant nutrients derived from plant or animal residue, byproduct or natural material deposits (lime and gypsum), organic waste-derived material, or combinations that are currently registered in Idaho by the Idaho State Department of Agriculture.

Provide fertilizer that is safe for the environment and does not infiltrate or pollute water sources including ground water, lakes, ponds, rivers and wetlands.

Provide fertilizer in containers or packages marked with the weight and/or volume along with the product label listing all ingredients and the manufacturer's guaranteed content analysis.

Ensure dry fertilizer products do not have material lumps or clumps.

711.08 Commercial Soil Conditioner. Provide natural, organic mineral material, nutrients and micronutrients, or combinations that improve soil structure, enhance vegetative growth, increase plant's ability to take in nutrients and have a salt index of 4 or less. Materials may include organic acids, compost, peat moss, vegetative waste material, sedge peat, gypsum, lime, diatomaceous earth, clay, vermiculite, wetting agents, absorbent polymers, biosolids, or other approved natural or organic materials that are free of wood substances and contain 50 percent organic matter by weight. Waste-derived products will have certification and product label stating the concentration of metals or metalloids.

Provide a laboratory report or other documentation verifying the levels of the metals or metalloids in the soil or plant amendment product.

Provide soil conditioner certified in the state of Idaho by an authorized or approved state agency and declared noxious weed free.

Submit a product inspection certificate from an approved commercial or state laboratory, or manufacturer's certification. Ensure the source is approved before shipping.

711.09 Not specified.

711.10 Mulch. Provide mulch material made from natural or organic based material consisting of grain, straw, grass, hay, wood fiber, coir or coconut fiber, or other certified natural and organic plant material.

Provide mulch products that have been evaluated and meet testing specifications through NTPEP.

Provide mulch products that have approximately 50 percent of the material exceeding 9 $\frac{1}{8}$ inches in length where they are to be anchored by mechanical crimping.

Provide mulch products listed on the QPL.

Provide mulch that is water soluble and contains defibrated organic fibers. Provide mulch with a life expectancy and functionality of a minimum of 3 months and up to a maximum of 24 months, as specified.

Ensure mulch is certified in the state of Idaho by an authorized or approved state agency and declared noxious weed free. Ensure the mulch source is approved before shipping.

Ensure bark mulch (granular and ornamental type) is reasonably free of strips and splinters.

Provide manufacturer certification or documentation that the materials used are nontoxic to animals, soil microorganisms, aquatic and plant life, and will not interfere with or impede seed germination or vegetative growth and establishment.

Provide shredded bark with a shredded or stringy texture.

Apply wood and paper fiber to form a blotter-like ground cover.

711.11 Rolled Erosion Control Products (RECP). Provide RECPs that have been evaluated and meet testing specifications through NTPEP. Ensure RECPs are certified noxious weed free in the state of Idaho by an authorized or approved state agency.

Ensure compliance with the specifications for rolled erosion control products as outlined by the Erosion Control Technology Council (ECTC). Provide RECP products listed on the QPL.

Submit manufacturer certification or documentation that the materials used in RECPs are nontoxic to animals, soil microorganisms, and aquatic and plant life, and will not interfere with or impede seed germination or vegetative growth and establishment.

Provide RECPs in premanufactured rolls made from 100 percent biodegradable materials. Provide RECPs with longevity appropriate for the work construction schedule, desired slope protection, and specifications. Ensure material, including netting, has a life expectancy of approximately 1 year.

711.12 Turf Reinforcement Mats (TRM). Provide TRMs that have been evaluated and meet testing specifications through NTPEP. Provide TRMs that consist of geotextiles, plastic, or durable synthetic materials. Ensure compliance with the specifications for TRM products as outlined by the Erosion Control Technology Council (ECTC). Provide TRM products listed on the QPL.

Submit manufacturer certification that the materials are nontoxic to animals, soil microorganisms, aquatic and plant life, and will not interfere or impede seed germination or vegetative growth and establishment.

711.13 Irrigation Water. Provide an approved source for irrigation water that is without oil, acid, salt, pesticides or chemicals, or other substances harmful to plants.

711.14 and 711.15. Not specified.

711.16 Mulch Tackifier. Mulch tackifiers are natural or organic based material consisting of cross-linked hydro-colloidal polymers, cross-linked tackifiers, guar gum, cellulose gum, xanthan gum, polyacrylamide, starch, psyllium, or other natural fiber blends that create a physical bond of fibers or matrix with polymer application when added to mulch. Tackifiers physically bind to mulch and soil, and do not allow the mulch to wash or blow away after application.

Use organic, biodegradable, non-polluting, non-volatile, and non-toxic tackifier that is transparent, flexible and retains flexibility after curing, water soluble, and makes a porous lattice-like membrane structure within the upper soil layer.

Use tackifier that is mixable in water and nontoxic to animals, soil microorganisms, aquatic and plant life, and does not interfere with or impede seed germination, vegetative growth and establishment, and is non-staining to concrete or painted surfaces.

Use tackifier products listed on the QPL.

Ensure the tackifier is not re-emulsifiable when cured.

711.17 Mulch Plus Tackifier. Mulch plus tackifier or mulch with tackifier is a hydraulically applied blend of natural fibers, natural or manufactured organic materials, or other natural ingredients or combinations combined with a natural or organic-based tackifier or binding agent.

Provide organic, biodegradable, non-polluting, non-volatile, and non-toxic mulch and tackifier that is transparent, flexible and retains flexibility after curing, water soluble, and makes a porous lattice-like membrane structure within the upper soil layer. Obtain mulch and tackifier or mulch with tackifier products listed on the QPL.

Use a mulch plus tackifier as a premixed, prepackaged wood fiber mulch with a tackifier blended before application. Mix in accordance with the manufacturer's written instructions. Provide mulch plus tackifier as specified in 711.10 and 711.16.

711.18 Soil Amendments. Soil amendments are natural or manufactured organic materials.

Provide a soil amendment that is a commercially available, pre-packaged, hydraulically applied blend of natural fibers, regional specific mycorrhizal species, growth stimulants, and other biologically active material designed to improve seed germination and vegetation establishment.

Soil amendments will be processed thermally and mechanically from straw and flexible flax fibers, sphagnum peat moss, and other biological additives at the following volumes:

1. 40 percent by volume of thermally and mechanically processed straw and flexible flax fibers.
2. 57 percent by volume of professional grade sphagnum peat moss.
3. 1.26 percent by volume of other biological additives, including trace minerals, sugars, starches, proteins, folic acid, vitamin A, triacontanol, and triacontanol growth stimulants/regulators.
4. Less than percent by volume of fungal mycorrhizal and plant beneficial bacteria.

Provide a pre-packaged commercially available powder tackifier specifically designed and manufactured for use with the specified hydraulically applied soil amendment. The tackifier will be formulated from long chain and cross-linking molecules in conjunction with a hydrocolloid vegetable gum.

Provide a continuous and uniform cover a minimum of 0.20 inches thick over seeded areas. Supplement thin or bare soil areas with additional soil amendment at no additional cost.

711.19 Mulch Mixture. Mulch mixture is a hydraulically applied blend of qualified weed-free organic mulch, natural or manufactured organic fibers, qualified protein-rich nutrient source, biological soil stimulant, soil microorganisms, humic substance, other plant nutrient ingredients or combinations combined with a natural or organic, light-duty tackifier, a heavy-duty soil binder, or tackifier/binder reinforcing fibers as a complete package. Each product is specified based on its own ability to perform in combination with the other specified products.

Provide mulch mixture that is a commercially available, pre-packaged, hydraulically applied blend of natural fibers, growth stimulants, biological soil stimulants, soil microorganisms, bonding fibers, tackifiers, reinforcing fibers, or combinations as specified.

Provide organic, biodegradable, non-polluting, non-volatile, and non-toxic mulch, biological soil stimulants, protein-rich nutrient source, and binding agents and tackifier that is transparent, flexible and retains flexibility after curing, water soluble, and makes a porous lattice-like membrane structure within the upper soil layer.

Obtain mulch mixture products listed on the QPL.

711.20 Fiber Wattles. Provide fiber wattles that consists of certified noxious weed free material and is manufactured from natural straw, coir (coconut), composted material, wood fibers, or a combination of these, and wrapped in approved degradable netting made of plastic or natural fiber (e.g., jute, sisal, cotton, hemp, burlap). Ensure material, including netting, has a life expectancy of approximately 1 year.

Provide fiber wattles with a minimum 8 inch diameter. Ensure fiber wattles that are 8 to 11 inches in diameter have a minimum weight of 1 pound per linear foot. Ensure fiber wattles with a diameter greater than 11 inches have a minimum weight of 3 pounds per linear foot. Secure ends tightly with degradable twine.

711.21 Compost Socks. Provide compost socks with a minimum 8 inch diameter that is without preservative. Provide a clean, evenly woven compost sock made of a mesh tube, oval to round in cross-section, and free of encrusted concrete or other contaminating materials. Ensure sock is without cuts, tears, broken or missing yarns, and does not have thin, open, or weak places. Provide sock with a minimum tensile strength of 44 psi. Provide sock composed of degradable plastic or polyester netting, or is composed of biodegradable jute, sisal, burlap, or coir fabric. Ensure sock has at least a 1 year durability after installation.

Ensure compost products used in compost socks meet the compost requirements in 711.18.

711.22 Hydraulic Erosion Control Products (HECP). HECPs are hydraulically applied blends of erosion control mixtures that consist of certified hydraulic mulch, stabilized mulch matrix, bonded fiber matrix, and fiber reinforced matrix.

Provide HECPs made of certified straw, cellulose fiber, wood fiber, coir or coconut fiber, or other certified natural and organic materials that meet certified life expectancy or longevity requirements. Provide HECPs that have been evaluated and meet testing specifications through NTPEP or other authorized third-party laboratories.

Ensure HECPs are certified noxious weed free in the state of Idaho by an authorized or approved state agency. Ensure compliance with the specifications for rolled erosion control products as outlined by the Erosion Control Technology Council (ECTC).

Obtain HECP products listed on the QPL.

Submit a manufacturer certification that the materials are nontoxic to animals, soil microorganisms, aquatic and plant life, and will not interfere with or impede seed germination or vegetative growth and establishment.

711.23 Inlet Protection. Use approved inlet protection.

SECTION 712 – SIGNING MATERIALS

712.01 Plywood for Type E Signs. Meet U.S. Product Standard for Construction and Industrial Plywood.

712.02 Retroreflective Sheeting. Supply retroreflective sign sheeting meeting ASTM D4956 standards for classification, color, and performance.

1. Sheet Aluminum and Plywood Signs. Provide Type IX (minimum) direct applied retroreflective sheeting. If legend is retroreflective, it must be of the same “Type” as the background sheeting.
2. Extruded Aluminum Sign Panels. Provide Type IX (minimum) direct applied retroreflective sheeting for the background and legend.
3. Temporary Traffic Control Devices. Provide Type IV (minimum) direct applied retroreflective sheeting.
4. Delineators and Snow Pole Reflectors. Provide Type IV (minimum) direct applied retroreflective sheeting.

712.03 to 712.06 Reserved.

712.07 Silk Screen Opaque Inks. Apply opaque silk screen inks in accordance with the manufacturer’s written instructions, waterproof for outdoor use, and dry within 18 hours to a film without running, streaking, bubbling, or sagging.

Visually match opaque colored silk screen inks within the limits of the current color tolerance charts prepared by the FHWA.

712.08 Silk Screen Transparent Inks. Apply transparent silk screen inks of the desired color onto reflective sheeting background meeting the requirements of 712.02.

712.09 Direct Applied Nonreflective Sheeting and Direct Applied Transparent Films. Direct applied nonreflective sheeting consists of flexible, glossy sheeting. Direct applied transparent films consist of transparent, acrylic colored films. Use solvent resistant sheeting and films that are precoated with Class 1 pressure sensitive, tack-free adhesive on the back side.

Ensure the sheeting and films are applied in accordance with the manufacturer’s written instructions, to form a durable bond with the background enabling it to withstand severe weather conditions.

712.10 Flexible Posts for Delineators. Provide flexible posts for delineators as follows:

1. White or as otherwise specified.
2. Drivable with a steel stub or sleeve.
3. Flexible, nonwarping, nonmetallic, durable composite material.
4. Resistant to damage due to impact, ultraviolet light, ozone, hydrocarbons, and other effects of atmospheric weathering.
5. Resistant to overturning, twisting, and displacement from wind and impact forces.
6. Maintain flexibility for a 5-year minimum design life.

712.11 Flexible Snow Poles. Provide orange poles meeting the following:

- a. One and one quarter (1¼) inches wide by ¾ inch thick and a length as specified.
- b. Nonwarping, nonmetallic, and durable fiber reinforced composite material.

- c. Resistant to impacts as a result of snow plowing or twisting.
- d. Resistant to displacement from wind, ultraviolet light, ozone, hydrocarbons, and other effects of atmospheric weathering. Maintain flexibility for a 5-year minimum design life.

SECTION 713 – ILLUMINATION AND TRAFFIC SIGNAL MATERIALS

713.01 LED Luminaries. Provide LED luminaries for roadway, underpass, and sign lighting meeting the following requirements:

A. Testing and Compliance by the Manufacturer.

1. Listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) as being suitable for use in wet locations.
2. Restriction of hazardous substances (RoHS) compliant light source and drivers.
3. Compliance with electromagnetic interference (EMI) requirements as defined by the Federal Communications Commission (FCC) regulation in [47 CFR Chapter 1, Subchapter A, Part 15](#).
4. Manufactured in an ISO 9001 certified facility or the manufacturer must submit a copy of the manufacturer's workmanship standards and/or quality manual.
5. Manufacturer must have a website with downloadable specification sheets and photometric data, Illuminating Engineering Society (IES) files. Photometric files must be per IES LM-79-08 specifications and requirements.

B. Fixture Construction.

1. Housing and heat sink constructed out of aluminum.
2. All hardware will be corrosion resistant.
3. Finish will withstand at least a 1,000-hour salt spray test per ASTM B117.
4. Fixture will not weigh more than 50 pounds when fully assembled.
5. Design will not trap water when installed.
6. When installed, provide access to internal components (e.g., terminal block, driver surge protector) with hand tools.
7. Mounting for roadway fixture. 2 or 4-bolt slip fitter type mounting on nominal 2 inch diameter ($2\frac{3}{8}$ outside diameter) pipe brackets. Slip fitter mount will allow 4 inches of the pole bracket to be inserted in the luminaire mounting assembly and allow for any necessary adjustment.
8. Mounting for underpass fixture, as specified.
9. Mounting for sign fixture. Capable of top or bottom mounting to sign structure. If provided, angle adjustment should be clearly labeled and able to be locked in place.
10. Compliant with ANSI/IEEE C136.31-2001, Table 2 Roadway Lighting Equipment, Luminaire Vibration for Bridge and Overpass Applications (3G rated).
11. Only passive cooling method can be used to manage thermal output of the LED light engine and power supply.
12. A label must be clearly visible on the inside of the luminaire stating the operating voltage, current range, part number, and unique identifier to allow traceability in the event of failure.
13. A completely sealed optical system with an IP rating of 66 or greater.

C. Electrical Requirements.

1. Luminaire will fully operate in an ambient temperature range of negative 40 °F to 104 °F.
2. Power supply(ies) (electronic driver) will be mounted inside the fixture.

3. The power supply(ies) (electronic driver) will operate within the following voltage range: 120 to 277 plus or minus 10 percent VAC (rms) at 50/60 Hz.
4. The power supply(ies) (electronic driver) will have a power factor of 0.90 or greater and a total harmonic distortion of 20 percent or less at full load.
5. Power supply(ies) (electronic driver) with a rated life of 100,000 hours with a luminaire operated at an average ambient temperature of 77 °F.
6. The power supply(ies) (electronic driver) will have thermal overload protection.
7. The power supply(ies) (electronic driver) will have self-limited short circuit protection.
8. The power supply(ies) (electronic driver) will have an International Protection (IP) 66 rating or greater.
9. A surge protection device that is separate from the power supply (electronic driver) but still contained within the luminaire housing and meeting these requirements:
 - a. Matched to driver voltage requirements.
 - b. Fail to an open state.
 - c. Meets ANSI/IEEE C62.41.2 Category C High requirements (10kV/10kA).
10. A terminal block that will accommodate #6 through #18 AWG wire for terminating pole wiring to the luminaire is required.
11. A NEMA 7-pin twist lock photoelectric control receptacle with shorting cap.

D. LED Performance Requirements.

1. Correlated color temperature (CCT) between 4,000 and 4,500 K.
2. Nominal color rendering index (CRI) of 70 or greater.
3. Intensity and chromaticity must be confirmed by a National Voluntary Laboratory Accreditation Program (NVLAP) photometric laboratory.
4. The average of all possible distributions and driver currents for the luminaire must equal 100 lumens per watt or better.
5. Capable of a minimum lumen output range from 12,000 to 30,000 lumens.
6. Will deliver an average 90 percent of initial lumens after 36,000 hours of operation based on IES TM-21 data at an average ambient temperature of 77 °F.

E. Warranty. The entire luminaire assembly including material, workmanship, finish, photometrics, power supply(ies), and LED modules will have a minimum of a 10-year manufacturer's warranty from the date of purchase.

713.02. Not specified.

713.03 Rigid Steel Conduit. Galvanize or sherardize conduit to protect against corrosion.

713.04 Plastic Conduit. Provide Schedule 40 PVC or HDPE smoothwall suitable for direct burial as a minimum for plastic conduit. The conduit can be rigid or coiled and have a solid wall. The manufacturer will certify the conduit meets the minimum requirements of the applicable UL, NEMA, or ASTM specifications for direct burial electrical conduit.

713.05 Concrete Junction Boxes. Construct bottomless concrete junction boxes of vibrated concrete. Provide a 3/8 inch minimum thickness steel diamond plate lid, with a locking device to hold the lid securely in place and painted

with corrosion preventive type paint, gray in color. Weld a $\frac{3}{8}$ inch by 1 inch plated bolt to the bottom of the steel lid. Place a 36-inch section of #10 AWG Green THWN wire with ring connector on the bolt and attached with a $\frac{3}{8}$ inch nut. Size junction boxes as follows:

1. Size A has inside dimensions of 9 inches by 5 inches by 10 inches deep and a nominal wall thickness of 2.5 inches.
2. Size B has inside dimensions 13 inches by 9 inches by 10 inches deep and a nominal wall thickness of 2 inches.
3. Size C has inside dimensions of 18 inches by 13 inches by 15 inches deep and a nominal wall thickness of 2 inches.
4. Size D has inside dimensions of 36 inches by 32 inches by 28 inches deep with a nominal wall thickness of 3 inches and will be reinforced by a $\frac{3}{8}$ inch round reinforcing bar hoop 2 inches below the top of the box and No. 10 welded wire mesh continuously within the walls.

Provide A, B, and C junction boxes with metal tops and reinforced walls with continuously welded wire. Submit detailed shop drawings for approval of a Size D junction box.

713.06 Composite Junction Boxes. Provide composite junction boxes meeting the following requirements:

1. Polymer concrete, reinforced by a fiberglass weave.
2. Constructed bottomless.
3. Nondeliberate traffic junction boxes and covers tested and certified to the provisions of the ANSI/SCTE 77 2010, by a nationally recognized third party independent test firm (e.g., UL, Intertek (ETL)).
4. 1-year minimum manufacturer's warranty.
5. Nondeliberate traffic junction box covers rated for a Tier 22 application. Emboss Tier 22 rating in the top surface of the cover.
6. Secure cover to junction box using stainless steel hex head with self-cleaning threads (e.g., coil bolt or $\frac{3}{8}$ - 7 lag thread).
7. Type PGD junction box is to have a 2-piece box cover.
8. Embed a "General Purpose" Electronic Marker System (EMS) marker in the junction box cover.
9. Mold logos in the junction box cover.
10. A minimum applied force of 2,000-pound rating for the pull slots.
11. Color junction boxes and covers concrete gray.
12. Size junction boxes as follows:
 - a. Size PGB has nominal inside dimensions of 11 $\frac{1}{2}$ inches by 21 $\frac{1}{4}$ inches by 16 inches deep.
 - b. Size PGC has nominal inside dimensions of 15 $\frac{1}{2}$ inches by 28 $\frac{1}{2}$ inches by 16 inches deep.
 - c. Size PGD has nominal inside dimensions of 20 $\frac{3}{4}$ inches by 29 $\frac{3}{4}$ inches by 22 inches deep.

713.07 Electrical Conductors and Cables. Provide electrical conductors and cables, UL listed and labeled, AWG or equivalent, stranded copper, meeting the requirements of the Insulated Power Cable Engineers Association (IPSEA) Publication S-61-402 or current NEMA Publication WC5 Section 7.4 Type B, and the following:

A. Multiple Conductor Signal Cable.

1. The number of conductors per cable as specified.

2. Conductors are 600-volt, No.14 uncoated annealed stranded copper wire with PE insulation.
3. Cable labeled as meeting the requirements of International Municipal Signal Association Specifications No. 19-1 for polyvinyl chloride sheath or No. 20-1 for PE sheath.

B. Multiple Conductor Loop Cable.

1. No. 18 AWG stranded 4 conductor waterproof instrumentation cable.
2. Provide color coding of the 4 conductors in accordance with the published IPCEA or NEMA standards.
3. High density PE jacket with a water blocking filler between conductors, suitable for direct burial, equal to Canoga Controls 20002, Clifford of Vermont 4C18B7NS-F, Independent PDS-078506, or Atlas Wire and Cable Corp. A953.

C. Multiple Conductor Loop Lead-in Cable.

1. No. 18 AWG shielded stranded 4 conductor wire with a PE jacket.
2. Provide color coding of the 4 conductors that is in accordance with the published IPCEA - NEMA standards.
3. High-density PE jacket with a water blocking filler between conductors, is suitable for direct burial, equal to Clifford of Vermont 4C18 B7 OS-F or Canoga Controls 30003.

D. Video Detection Cable.

1. UL listed and labeled.
2. Meeting the requirements of the video equipment manufacturer.

713.08 Signal Poles. Provide poles that have a 4 inch by 6.5 inch frame and cover located 90 degrees to the right of the mastarm location. Permanently display the signal mastarm shaft (gauge) thickness in inches on each mastarm near the attachment plate (nonstandard poles only).

Provide signal poles that meet the requirements for standard or nonstandard mastarm traffic signal poles, pedestal signal poles, and pedestrian pushbutton poles with materials as specified in 708.19 and the following additional requirements:

1. Standard mastarm traffic signal pole requirements:
 - a. Maximum nominal pole height, including luminaire extension, of 40 feet.
 - b. Maximum luminaire mastarm length of 15 feet.
 - c. Maximum signal mastarm length of 55 feet.
 - d. Use Department approved signal pole designs.
 - e. Meet additional standard mastarm traffic signal pole criteria as specified.
 - f. Provide 4 steel anchor bolts of the manufacturer's recommended size with each pole. Fit each bolt with 3 nuts and 2 washers.
 - g. Submit shop drawings and calculations for approval before fabrication.
2. Nonstandard mastarm traffic signal pole requirements:
 - a. Designed in accordance with the current AASHTO LRFD Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.
 - b. Design life is 50 years.

- c. Design wind speed is 90 mph.
 - d. For signal mastarm length greater than 55 feet or luminaire mastarm length greater than 20 feet, use fatigue category I design criteria (fatigue design will include natural wind gust, periodic galloping forces, and truck-induced wind gust loads based on a truck speed of 65 mph).
 - e. Provide 4 steel anchor bolts of the manufacturer's recommended size with each pole. Fit each bolt with 3 nuts and 2 washers. Include 1 extra anchor bolt per batch for destructive testing.
 - f. Submit shop drawings and calculations for approval before fabrication.
3. Pedestal signal pole requirements:
- a. A 4-inch rigid galvanized conduit with national pipe tapered (NPT) threads.
 - b. A square, frangible cast aluminum base that is:
 - (1) Fifteen (15) inches high.
 - (2) Nominal dimension of 14 inches by 14 inches.
 - (3) Four (4) slotted holes for anchor bolts.
 - (4) Heat treated to industry standards.
 - c. 4 anchor bolts, washers, and nuts supplied by the base manufacturer.
4. Pedestrian pushbutton pole requirements:
- a. A 4-inch rigid galvanized conduit with NPT threads.
 - b. A round cast iron pipe flange that is:
 - (1) Nominal flange thickness of 1 inch.
 - (2) Nominal outside diameter of 9 inches.
 - (3) Bolt circle diameter of 7½ inches.
 - (4) Minimum of four, 5⁄8 inch diameter holes for anchor bolts.
 - (5) Cold zinc treated.
 - c. 4 anchor bolts, washers, and nuts.
 - d. Galvanized pipe cap.

713.09 Illumination Poles. Provide standard and nonstandard poles that meet the requirements of 708.19 and:

- 1. Standard illumination pole:
 - a. Nominal luminaire mounting heights of 30, 40, and 50 feet.
 - b. Maximum luminaire mastarm length of 15 feet.
 - c. Use Department approved luminaire pole designs.
 - d. Anchor base design to use steel necked breakaway couplers meeting NCHRP 350 requirements, unless the lighting unit (pole, mastarm, and luminaire) exceeds 1,000 pounds.
 - e. Provide 4 steel anchor bolts or 4 base breakaway devices of the manufacturer's recommended size with each pole. Fit each bolt with 3 nuts and 2 washers.
 - f. Meet additional highway lighting on traffic detail criteria as specified.
 - g. Submit shop drawings and calculations for approval before fabrication.

2. Nonstandard illumination pole:

- a. For luminaire mounting heights greater than 50 feet or for luminaire mastarm lengths greater than 15 feet or multiple mastarms.
- b. Designed in accordance with the current AASHTO LRFD Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals:
 - (1) Design life is 50 years.
 - (2) Design wind speed is 90 mph.
 - (3) Importance factor is 1.00.
 - (4) Fatigue category I design criteria (natural wind gust and vortex shedding only).
- c. Anchor base design to use base breakaway device meeting NCHRP 350 requirements, unless the lighting unit (pole, mastarm, and luminaire) exceeds 1,000 pounds.
- d. Provide steel anchor bolts or base breakaway device of the manufacturer's recommended size with each pole. When using anchor bolts, fit each bolt with 3 nuts and 2 washers. Include 1 extra anchor bolt per batch for destructive testing.
- e. Submit shop drawings and calculations for approval before fabrication.

713.10 Base Breakaway Device. Provide a base breakaway device with 4 steel necked couplers and female anchors, meeting NCHRP 350 requirements and certified for loads up to 1,000 pounds. Provide the base breakaway device with an aluminum skirt and associated hardware.

713.11 Signal Heads. Provide signal heads meeting the following requirements:

1. Vehicular Signal Heads:

- a. Adjustable, one-way type with the number of sections as specified.
- b. UV stabilized polycarbonate signal housing with top and bottom reinforcement plates.
- c. Vehicular signal head assembly exteriors that are traffic signal green.
- d. Terminal block in the center section of the signal head.
- e. Lamp module wires with terminal connectors fastened to the terminal block.
- f. Optically programmed signal heads allow the visibility zone of the indication to be determined optically and require no hoods or louvers. The projected indication may be selectively visible or veiled anywhere within 15 degrees of the optical axis.
- g. Indication cannot result from external illumination or from one lamp module illuminating another.
- h. LED lamp modules that comply with the current Institute of Transportation Engineers (ITE) vehicle traffic control signal head (VTCSH) requirements, except green indications require a clear, polycarbonate lens.
- i. Tunnel visors for each signal face that are:
 - (1) One-piece polycarbonate.
 - (2) Eight (8) inches for 8-inch lens and 10 to 12 inches for 12-inch lens.
 - (3) Inside of visors that are flat black and exteriors that are traffic signal green.
 - (4) Approved to be mounted on the provided signal head without field modifications.

- j. Signal backplates that are:
 - (1) Five (5) inches, one-piece polycarbonate.
 - (2) Flat black finish on the front and signal green on the back.
 - (3) Conforming to the signal head outline.
 - (4) Approved to be mounted on the provided signal head without field modifications.
2. Pedestrian Signal Heads:
- a. One-way illuminated LED lamps.
 - b. Pedestrian signal housing that is:
 - (1) Nominally 18 inches high by 18 inches wide.
 - (2) One (1) piece.
 - (3) UV stabilized polycarbonate or powder-coated aluminum.
 - (4) Traffic signal green exteriors.
 - c. Flat black tunnel visors.
 - d. Terminal block in the pedestrian signal head housing.
 - e. Lamp module wires with terminal connectors and fastened to the terminal block.
 - f. Countdown pedestrian timer.
 - g. LED lamp modules that comply with the current ITE pedestrian traffic control signal indicator (PTCSI) requirements.
 - h. Filled hand/man symbols.

713.12 Signal Head Covers. Provide signal head covers that meet the following requirements:

- 1. Opaque, light in color (e.g., yellow, tan):
 - a. With a transparent center section or port for partial viewing of individual lens indications for circuit testing.
 - b. Full opaque covers for blanking out or restricting the visibility of an unwanted signal display.
- 2. At least 50 percent contrast to the signal housing and signal back plate.
- 3. Sized to cover the appropriate signal head faces.
- 4. Weather and UV light resistant material.
- 5. Method to securely attach to prevent accidental removal or being dislodged by winds up to 90 mph.

713.13 Electrical Service Pedestals. Provide underground service pedestal that is the type specified and as follows:

- 1. 120/240-volt single phase.
- 2. Underground feed.
- 3. NEMA 3R enclosure.
- 4. Twelve (12) gauge galvanized steel construction.
- 5. White powder-coated interior and exterior.

6. Meet additional underground service pedestal detail criteria as specified.

713.14 Signal Controllers and Cabinet Assemblies. Provide traffic signal controller, cabinet, and auxiliary equipment that is the type specified or as directed.

SECTION 714 – SECONDARY CEMENTITIOUS MATERIALS

714.01 General Requirements. Protect secondary cementitious materials (SCM) from exposure to moisture until used. Tightly seal and adequately separate containers used for transport or storage from other material containers to prevent seepage or mixing of materials. Provide equipment used for discharge with positive shut-off controls at the point of discharge.

SCM used as a partial substitute for portland cement may cause a delay in strength gain and may require more curing time before the concrete is exposed to loadings.

The Engineer may accept SCM for use on the basis of the manufacturer's certification as specified in 106.04 and 106.05. Submit the manufacturer's certification indicating material class and compliance to material specifications.

714.02 Fly Ash. Provide natural pozzlans and fly ash that meets AASHTO M 295 Class F, except loss of ignition (LOI) must not exceed 1.5 percent.

When fly ash is used for mitigation of ASR do not exceed 1.5 percent available alkalis (as Na_2O) and do not exceed 11 percent calcium oxide (CaO) content.

When fly ash is used as a mineral admixture, use fly ash meeting the Class F requirements with a maximum CaO limit of 15 percent. The Engineer will not apply the available alkalis limits.

714.03 Ground Granulated Blast Furnace Slag. Provide ground granulated blast furnace slag that meets AASHTO M 302 Grade 100.

714.04 Silica Fume. Provide silica fume that meets AASHTO M 307 with a maximum available alkali of 1.5 percent and 10 percent or less retained when wet-sieved on the No. 325 screen.

SECTION 715 – GABION AND REVET MATTRESS

715.01 Mesh. Fabricate gabion panels for the base, ends, sides, diaphragms, and lids from welded or twisted wire mesh. Use only 1 type of wire mesh within a structure. Meet the requirements in Table 715.01-1 below for individual wires of welded or twisted mesh:

Table 715.01-1 – Wire Criteria

Characteristic	Test Designation	Requirements
Minimum Tensile Strength	ASTM A370	60,000 psi
Wire Size	US Steel Wire Gauge	11
Wire Diameter		0.120 in
Minimum		0.116 in
Galvanizing	ASTM A641 and ASTM A90	0.80 oz/ft ²
Wire Size	US Steel Wire Gauge	9
Wire Diameter		0.148 in
Minimum		0.144 in
Galvanizing	ASTM A641 and ASTM A90	0.90 oz/ft ²

Provide welded wire mesh that meets ASTM A185, except 600 pounds force for 11-gauge and 800 pounds force for 9-gauge wires on the weld shears. Wire gauges are United States Steel Wire Gauge (USSWG) after galvanizing.

Manufacture gabion panels of the welded wire mesh from 11-gauge or 9-gauge wire. Provide mesh to form a nominal 3 inch by 3 inch square grid pattern made by resistance welding in accordance with ASTM A185. Ensure the maximum diagonal dimension of a grid opening is 4.75 inches.

Manufacture gabion panels of twisted wire mesh from 11-gauge wire with 9-gauge selvedge wires. Form a uniform hexagonal pattern and with a nonraveling twist. Do not exceed 4.75 inches on the major axis (maximum line dimension) of hexagonal openings.

715.02 Fabrication. Fabricate gabions so the sides, ends, lids, and diaphragms can be assembled at the project site into a rectangular or square basket of required sizes. Construct gabions as a single unit. Weave the base, ends, and sides into a single unit or 1 edge of these members connected to the base section of the gabion so strength and flexibility at the point of connection is at least equal to that of the mesh.

Where the length of the gabion exceeds its horizontal width, equally divide the gabion by diaphragms, of the same mesh and gauge as the body of the gabion, into cells whose length does not exceed the horizontal width. Provide the gabion with the necessary diaphragms secured in proper position on the base section so additional tying at this juncture will not be necessary.

Securely selvedge or bound perimeter edges so the joints formed by tying the selvedges have the same strength as the body of the mesh.

715.03 Packing and Marking. Ship gabions folded flat in bundles weighing less than 1,200 pounds. Ensure each bundle contains gabions of 1 size except odd numbers necessary to complete an order may be made into a bundle of less than the uniform number. Clearly mark this bundle to distinguish it from others. Clearly mark each gabion by color code or some other readily identifiable means to show size. Handle bundles without lifting the gabion mesh to avoid damage to wire or galvanizing.

715.04 Dimensions. Provide gabion meshes with the specified dimensions. The dimensions are subject to a tolerance limit of plus or minus 5 percent of manufacturer's stated sizes.

715.05 Joints. Provide wires used to form joints in accordance with ASTM A641 for zinc-coated (galvanized) carbon steel wire and that meet the requirements in Table 715.05-1.

Table 715.05-1 – Wire Criteria

Characteristic	Test Designation	Requirements
Minimum Tensile Strength	ASTM A370	60,000 psi
Wire Size	US Steel Wire Gauge	13.5
Wire Diameter		0.086 in
Minimum		0.083 in
Galvanizing	ASTM A641 and ASTM A90	0.72 oz/ft ²
Wire Size	US Steel Wire Gauge	9
Wire Diameter		0.148 in
Minimum		0.144 in
Galvanizing	ASTM A641 and ASTM A90	0.90 oz/ft ²

Ensure spiral binders have a 3 inch separation between continuous, successive loops.

Provide internal connecting wires or preformed stiffeners with at least 13.5-gauge. Meet the minimum specification requirements with each wire.

Alternate fasteners may be used if approved. Alternative fasteners must form a closed loop with an overlap of at least 1 inch when the ends are brought together and properly closed. Ensure the closed loop has an inside area that is large enough to enclose up to 4 selvedge wires.

Provide fasteners that meet ASTM A764, with the same weight of coating in accordance with ASTM A641. Provide stainless steel that meets ASTM A313 for applications involving PVC-coated gabion baskets. Ensure the fastener resists a direct tension force across any axis of at least 600 pounds force while remaining closed. Submit random samples of fasteners for testing at least 10 business days before construction of gabions. Submit 12 formed and 12 unformed fasteners. Assemble the 12 formed fasteners at the project site and witnessed by the Engineer. Space fasteners at intervals of 4 to 6 inches with at least 1 fastener per gabion mesh opening.

715.06 Gabion Fill Material. The fill material for the gabion baskets is rock ranging in size from at least 4 inches to a maximum of 8 inches, both measured in the greatest dimension. Provide rock that is sound, durable, well graded, and does not disintegrate on exposure to water or weathering during the life of the structure. Obtain rock for gabions from an approved source. Ensure the minimum unit weight of a rock-filled gabion is 110 pounds per cubic foot. Verify the gabion unit weight when directed.

715.07 Geotextile. Meet the requirements of 718.06.

715.08 Testing. When directed, test gabions which have not been previously tested and approved as follows:

1. Cubical-Celled Gabions. Test wire mesh of gabions with a 3 foot by 3 foot square cross-section for sufficient strength and flexibility when assembled and filled with rock as follows:
 - a. Loading and Configuration. Place an approximate 4,000-pound line load over the center of a 12-foot long gabion (perpendicular to the long axis), which is unsupported under the middle 6 feet and anchored at each end. (A piece of concrete pipe 4-foot diameter or less with a weight about 4,000 pounds can be used to impose the required line load on the gabion).

- b. Requirements: Deflection at the unsupported mid span of 0.50 foot or less. Visible reduction of wire size in a panel, loss of internal rock, and unraveling of twisted-mesh or weld breaks in welded-mesh is not allowed.
- 2. Mattress-Style Gabions. Test wire mesh of gabion mattresses, 1 foot or 1.5 foot high, for sufficient strength and flexibility when assembled and filled with rock as following:
 - a. Loading and Configuration. Initially support the base of a 3-foot wide by 12-foot long gabion 2.5 feet above the ground. A load will not be placed on the mattress. Remove about 3 feet of support from the end of the mattress.
 - b. Requirements. The cantilevered, unsupported end may sag and touch the ground. Visible reduction of the wire size in a panel, loss of internal rock, and unraveling of twisted-mesh or weld breaks in welded-mesh is not allowed.

The Engineer may accept gabion systems which have been previously tested and approved.

SECTION 718 – GEOTEXTILES

718.01 General Requirements. Use geotextile consisting of a long chain polymeric filaments or yarns oriented into a stable network that retains its relative structure, including selvages, during handling, placement, and design service life. Ensure that at least 85 percent by weight of the long chain polymers are polyolefins, polyesters, or polyamides. Ensure the geotextile has no defects or tears. The Engineer may reject geotextile if dimensional stability or resistance to ambient temperatures, acid or alkaline conditions, and micro-organisms/insects are unsatisfactory. Provide geotextile in accordance with the properties indicated for each specified use. Provide the geotextile without treatment or coating, which might adversely alter its physical properties after installation.

718.02 Certification. Submit the geotextile manufacturer's certification consisting of certified test results showing the geotextile and factory seams meet the specifications. Ensure the certification includes the named product and representative samples have been delivered and tested as specified.

Include the following information in the certification for each geotextile to be used:

1. Manufacturer's name and current address.
2. Full product name.
3. Geotextile roll number.
4. Proposed geotextile use(s).
5. Certified test results.

Submit the name and address of the testing agency and the test date on the identification certification. Provide a means to identify the geotextile, including a lot number that can be used to ensure the product delivered is the certified product.

Submit a certified copy of the test results including each test result, each mean roll value, the calculated standard deviation for each lot, and the manufacturer's coefficient of variation for test results.

Submit duplicate certification with 1 copy sent with the shipment to the Engineer and 1 copy sent to the Central Materials Laboratory.

718.03 Samples. The Engineer will sample geotextiles for QA testing.

Cut the geotextile samples from the roll with scissors, sharp knife, or by another suitable method that produces a smooth edge and does not cause ripping or tearing. Do not take samples from the outer wrap of the geotextile roll or from the inner wrap of the core. The minimum dimension for each sample is 6 feet by the full roll width. Submit 1 sample for each lot.

Label the samples with the lot and batch number, date of sampling, project number, specifications, manufacturer, and product name. The Department defines a lot as geotextile rolls within the same consignment or shipment that a manufacturer produced with the same product name or designation.

Before installing geotextiles, submit samples of sewn seams to the Central Materials Laboratory. Sew the seam sampling using the same equipment and procedures as will be used to sew the production seams. If production seams are sewn in both the machine and cross-machine directions, provide sewn seams for sampling oriented in both the machine and cross-machine directions and at least 6 feet long in each direction. If the seams are sewn in the factory, the Engineer will obtain samples of the factory seam at random from the rolls to be used.

718.04 Testing. The Department may perform tests as necessary to determine the geotextile properties are in accordance with the values specified for the intended application.

Geotextile property requirements specified are minimum average roll values. Determine the tensile strengths in both machine and cross-machine directions.

718.05 Drainage Geotextile Property Requirements. Provide nonwoven or monofilament woven geotextiles. The Engineer will not accept slit film or slit tape geotextiles for drainage applications. Meet the requirements in Table 718.05-1 below.

Table 718.05-1 – Drainage Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)	
		Type I ^(a)	Type II ^(b)
Grab Tensile Strength, lb	ASTM D4632	80	180
Grab Elongation, %	ASTM D4632	—	
Puncture Strength, lb	ASTM D6241	300	500
Apparent Opening Size (AOS), Standard Sieve	ASTM D4751	#70 or finer	
Permittivity, sec ⁻¹	ASTM D4491	0.7	

Note: Strength properties of drainage geotextiles placed on level or near level surfaces (e.g., under drain blankets, on subgrade) must meet those specified in 718.07.

^(a) Type I refers to protected conditions. Protected conditions include trench depth of 10 feet or less, rounded aggregate or crushed aggregate less than 4 inch size, and relatively smooth trench walls. Other conditions are unprotected.

^(b) Type II refers to unprotected conditions.

718.06 Riprap/Erosion Control Geotextile Property Requirements. Provide nonwoven or monofilament woven geotextiles. The Engineer will not accept slit film or slit tape geotextiles for riprap/erosion control applications, including installation behind gabions. Meet the requirements in Table 718.06-1.

Table 718.06-1 – Riprap/Erosion Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)	
		Type I ^(a)	Type II ^(b)
Grab Tensile Strength, lb	ASTM D4632	130	200
Grab Elongation, %	ASTM D4632	15	15
Puncture Strength, lb	ASTM D6241	400	600
Trapezoidal Tear, lb	ASTM D4533	40	50
Apparent Opening Size (AOS), Standard Sieve	ASTM D4751	#50 or Finer	
Permittivity, sec ⁻¹	ASTM D4491	0.5	
Ultraviolet (UV) Radiation Stability	ASTM D4355	70% Strength Retained @ 150 hours	

^(a) Type I refers to low to moderate survivability geotextiles. The Contractor may use Type I behind gabions less than 10 feet high without an aggregate cushion.

^(b) Type II refers to higher survivability geotextiles. Use a Type II geotextile in severe conditions, where stones will be larger than 250 pounds or drop heights cannot be practically reduced.

718.07 Subgrade Separation Geotextile Property Requirements. Provide nonwoven or woven geotextiles, except only nonwoven geotextile can be used for Type III. Meet the requirements in Table 718.07-1.

Table 718.07-1 – Subgrade Separation Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)		
		Type I ^(a)	Type II ^(b)	Type III ^{(b)(c)}
Grab Tensile Strength, lb ^(d)	ASTM D4632	180/115	270/180	270/180
Grab Elongation, % ^(d)	ASTM D4632	< 50% / ≥ 50%		
Puncture Strength, lb ^(d)	ASTM D6241	500/300	600/450	600/450
Trapezoidal Tear Strength, lb ^(d)	ASTM D4533	70/40	100/75	100/75
Apparent Opening Size (AOS), Standard Sieve	ASTM D4751	#30 or Finer	#30 or Finer	#70 or finer
Permittivity, sec ⁻¹	ASTM D4491	0.02	0.02	0.7

- ^(a) Type I refers to moderate survivability conditions. Moderate survivability is low to moderate ground pressure equipment, 40 psi or less, with 12 to 18 inch initial lift thickness or high ground pressure equipment, greater than 40 psi, with more than 18 inch initial lift thickness.
- ^(b) Type II and Type III refers to high survivability conditions. High survivability is low to moderate ground pressure equipment with 6 to 12 inch initial lift thickness or high ground pressure equipment with 12 to 18 inch initial lift thickness.
- ^(c) Type III is used when subgrade separation geotextile will also function in a drainage application.
- ^(d) The dual values for strengths for each geotextile type are related to the grab elongation. For geotextiles with elongation which is less than 50%, the first strength values are applied. For geotextiles with elongation which is equal or greater than 50%, the second strength values are applied. Higher strength is required for geotextiles with lower elongation.

The subgrade condition is assumed to be cleared of rocks, stumps and large limbs, and graded reasonably smooth. If subgrade preparation or clearing is not as stated, or cover material is angular shot rock, even higher survivability geotextiles may be necessary.

718.08 Pavement Overlay Geotextile Property Requirements. Provide only nonwoven geotextiles. Meet the requirements in Table 718.08-1.

Table 718.08-1 – Overlay Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)
Grab Tensile Strength, lb	ASTM D4632	80
Grab Tensile Elongation, %	ASTM D4632	50
Trapezoidal Tear Strength, lb	ASTM D4533	40
Asphalt Retention, gal/yd ²	ASTM D6140	0.20

718.09 Temporary Silt-Fence Geotextile Property Requirements. Meet the requirements in Table 718.09-1.

Table 718.09-1 – Temporary Silt-Fence Geotextile Criteria

Geotextile Property	Test Method	Minimum Average Roll Values (in weaker principal direction)
Grab Tensile Strength, lb	ASTM D4632	90
Grab Tensile Elongation, % (At 50% of minimum Tensile Strength, 45 lb)	ASTM D4632	50 max ^(a)
Permittivity, sec ⁻¹	ASTM D4491	0.05
Apparent Opening Size (AOS)	ASTM D4751	#20 or finer
Ultraviolet (UV) Radiation Stability Retained	ASTM D4355	70% Strength Retained @ 150 hours

^(a) For wire-supported silt fence geotextile, elongation requirements are not applicable.

SECTION 720 – MISCELLANEOUS

720.01 Water for Concrete, Grout, and Mortar. The Contractor may use water from municipal drinking water supplies for concrete, grout, or mortar. The Contractor may use water from other sources, provided it is reasonably clear without oil, contains less than 1,000 parts per million of chlorides and less than 1,000 parts per million of sulfates in accordance with ASTM C1602. If a water source other than a municipal drinking water supply is proposed, submit independent laboratory test reports verifying compliance with these chemical requirements. Submit reports that are less than 2 years old before using a nonmunicipal drinking water supply.

720.02 Elastomeric Bearings.

1. Description. Elastomeric bearings include unreinforced pads, consisting of elastomer only, and reinforced bearings with steel laminates.

The Engineer will not allow stacking of individually-laminated pads.

Provide bearings with the dimensions, material properties, elastomer grade, and type of laminates specified. Show the design load specified and testing requirements. Provide Grade 3 bearings with a shear modulus of 0.130 ksi, steel reinforced, and subjected to the load-testing requirements.

2. Materials. The raw elastomer consists of virgin neoprene (polychloroprene) or virgin natural rubber (polyisoprene). Provide the elastomer compound classified as being of low-temperature Grade 0, 2, 3, 4, or 5. The grades and other material properties are defined in the AASHTO LRFD Bridge Design Specifications Section 14 and AASHTO M 251. A higher grade of elastomer may be substituted for a lower one.
3. Fabrication. Fabricate bearings in accordance with AASHTO M 251.
4. Testing. Subject materials for elastomeric bearings and the finished bearings to the tests described in AASHTO M 251 Section 8.9.2.
5. Installation. The Contractor may place elastomeric bearings without external load plates directly on a concrete or steel surface, provided that it is flat within a tolerance of 0.005 of the nominal dimension for steel reinforced bearings and 0.01 of the nominal dimension for others. Place bearings on surfaces that are horizontal to within 0.01 radian. Correct the lack of parallelism between the top of the bearing and the underside of the girder that exceeds 0.01 radian by grouting or as directed.

Do not weld exterior plates of the bearing, unless at least 1.5 inches of the steel exists between the weld and the elastomer. Do not allow the elastomer or the bond to be subjected to temperature higher than 400 °F.

720.03 Polytetrafluoroethylene (TFE/PTFE) Bridge Bearing Pads. Provide TFE/PTFE pads and stainless steel mating surface where specified that meet AASHTO Specifications for Highway Bridges. If filled TFE/PTFE sheet is used, only glass-fiber filler will be approved.

720.04 Epoxy-Resin-Base Bonding Systems for Concrete. Meet ASTM C881 with the classification (type and grade) of the system selected as specified. The Contractor and the Contractor's supplier, with approval, will determine the class after work conditions have been established. Provide materials and applications that meet applicable ACI Standards 503.1, 503.2, 503.3, or 503.4. Submit the manufacturer's certification verifying compliance to material specifications.

720.05 Recycled Glass. Provide recycled glass, whole bottles or crushed glass, for use in roadway fills, and crushed glass for use in granular borrow, granular subbase, or aggregate base meeting the requirements of AASHTO M 318. Certify in writing the glass is from a waste stream generated in Idaho.

720.06 Hydrated Lime. Provide hydrated lime as follows:

1. QuickLime for Cold In-Place Recycled Pavement. Meet ASTM C977.
2. Hydrated Lime for Plant Mix Additive. Meet AASHTO M 303 Type I.

720.07 Recycled Asphalt Pavement (RAP). Prepare and maintain a RAP processing and stockpiling quality control plan and make these records available to the Department.

1. RAP Categories. Provide RAP that complies with one of the following categories:

- a. Category 1. The Department defines this material as being from a Department project or is traceable to another public agency sponsored project. The Engineer will accept Category 1 RAP for use provided the Contractor submits a letter stating the RAP is from a specific pavement, including the route and mile post. Do not add material from other sources during stockpiling and submit certification of this from the producer on a stockpile-by-stockpile basis.

Category 1 RAP may consist of asphalt material removed from interstates, United States Highways, primary routes, secondary routes, airfields, or local projects.

- b. Category 2. The Department defines this material as not being from Department projects or is not traceable to a Department project. Produce uniform RAP stockpiles when Category 2 material originates from different sources. The Engineer will accept Category 2 RAP for use as Category 1 RAP if the Contractor performs tests as specified in 720.07.3 and submits test results and materials that show the RAP meets the specifications and is verifiable by the Department. Submit test results within 10 calendar days before mix design submittal.

Do not use Category 2 RAP that does not meet these requirements as Category 1 RAP.

Category 2 RAP is:

- (1) Production Returns. Asphalt material generated from plant waste (e.g., start-up/shut down material).
- (2) Random RAP. Crushed and screened asphalt material removed from private paving projects, plant overruns, rejected loads, or combination.

2. RAP Processing. The Contractor may use processed RAP as follows:

- a. Processed RAP. RAP that is processed by crushing and screening to produce a uniform gradation from coarse to a fine and a uniform binder content in the RAP before use in a recycled mix. Provide processed RAP with 100 percent passing the $\frac{5}{8}$ inch sieve on entry into the mixing plant.

The Contractor may recycle processed RAP in Superpave HMA at the percentages shown below:

- (1) Category 1 RAP is limited to 30 percent.
- (2) Category 2 RAP is allowed up to 10 percent when used in the top lift and is limited to 30 percent maximum when used in a lower lift.

Processed RAP stockpiles may contain RAP from sources as indicated by the category and may be replenished with RAP from sources of that same category.

3. RAP Testing and Test Frequency. Perform the following tests at the specified testing frequencies for each category and provide the data to the Department as soon as test results are available:

- a. Category 1. Establish an extraction correlation. Determine the asphalt binder content and aggregate gradation in accordance with the FOP for AASHTO T 308 and AASHTO T 30 at the

minimum frequency of 1 test per 500 tons for the first 2,000 tons and 1 test per 1,000 tons thereafter. Then perform at least 6 tests for stockpiles less than 4,000 tons.

Perform chemical binder extractions in accordance with AASHTO T 319 to reclaim the binder from the RAP when blending charts are used. Determine the PG binder grading of the recycled binder as specified in 702 at the frequency of 1 test per 5,000 tons with at least 1 test per stockpile.

- b. Category 2. Asphalt binder content, aggregate gradation, and binder grade testing requirements are the same as Category 1. In addition, test the aggregate recovered from the RAP by the extraction process AASHTO T 308 or AASHTO T 164 or AASHTO T 319 to determine the aggregate quality. Test RAP aggregate quality as follows:
 - (1) AASHTO T 96 and Idaho IT 15 tested on extracted aggregate as specified at a frequency of 1 test per stockpile.
 - (2) AASHTO T 335, AASHTO T 304, and ASTM D4791 at the minimum frequency of 1 test per 500 tons for the first 2,000 tons and 1 test per 1,000 tons thereafter. Perform at least 6 tests for stockpiles less than 4,000 tons.

Meet the applicable aggregate quality requirements in Table 703.05-1 and 703 for the combination of virgin and RAP aggregate.

Use the RAP as Category 2 RAP, unprocessed, if it was not tested.

Asphalt Binder/Aggregate Correlation Factor. Perform at least 6 AASHTO T 164 or AASHTO T 319 chemical extraction tests and AASHTO T 30 gradation tests and 6 AASHTO T 308 burn tests and AASHTO T 30 gradation tests to establish a correlation factor for asphalt binder and aggregate gradation. Prepare 6 identical pairs of samples and test 1 sample of each pair in accordance with AASHTO T 164 or AASHTO T 319 and test the other sample in accordance with AASHTO T 308. The standard deviation of the correlation test results must be less than 0.07. If the standard deviation for the correlation test results exceeds 0.07, the Engineer will require additional AASHTO T 164 or AASHTO T 319 and AASHTO T 308 testing until the standard deviation for the correlation testing falls below 0.07.

Bulk Specific Gravity of the RAP Aggregate. Test RAP material for G_{sb} according to Idaho IT 146 at the rate of 1 test per 500 tons for the first 2,000 tons and 1 test per 1,000 tons thereafter. Perform a minimum of 10 tests per stockpile. Provide the test results on a spreadsheet with the mix design submittal and update the spreadsheet, if additional RAP is produced before producing HMA.

For testing after stockpiling, submit a sample plan and test the RAP pile, either in-situ or by re-stockpiling, for approval. Meet the minimum frequency required and detail the procedure used to obtain representative samples throughout the stockpile for testing.

4. RAP Stockpiles and Record Keeping. Place RAP stockpiles on a base with adequate drainage and construct in layers to minimize RAP segregation and ensure a workable face. Construct separate stockpiles for each source of RAP based on the category of RAP, the quality of aggregate, type and quantity of asphalt binder, and size of processed material. Identify RAP stockpiles on a map of the stockpile areas and place signs in or near each stockpile.

Maintain a record system at the plant site for RAP stockpiles that includes, at a minimum, the following:

- a. Stockpile identification and a sketch of stockpile areas at the plant site.
- b. RAP category (project, state route, plant waste, rejected loads).
- c. Origin or dates milled and approximate number of tons in the stockpile.
- d. Chemical extraction and AASHTO T 308 burn test results.

Make the RAP stockpile records available at the plant site. The Engineer will reject, by visual inspection, stockpiles that are not kept clean and free of foreign materials. The Engineer will reject RAP containing contaminants (e.g., earth, brick, sand, concrete, pavement fabric, joint sealants). The Contractor may reprocess the rejected RAP stockpile to meet requirements or remove the stockpile from use.