SUBMITTED TO:
Horrocks Engineers
2194 Snake River Parkway
Idaho Falls, ID. 83402

BY:
Shannon & Wilson
5260 Chinden Boulevard
Boise, ID 83714

(208) 658-8700
www.shannonwilson.com

ROADWAY MATERIALS REPORT

US-20, Bonneville CO Line to Idaho Falls

MP 281 TO MP 310.4

ITD KEY NO. 23244

SHANNON & WILSON

September 30, 2025

Shannon & Wilson No: 71-112895

Submitted To: Horrocks Engineers
2194 Snake River Parkway
Idaho Falls, ID. 83402
Attn: Kelly Hoppes, PE

Subject: ROADWAY MATERIALS REPORT
US-20, BONNEVILLE CO LINE TO IDAHO FALLS
MP 281 TO MP 310.4

Shannon & Wilson prepared this report and participated in this project, as a subconsultant to Horrocks Engineers. Our scope of services was specified in Agreement Number ID-8709-24 US-20 with Horrocks Engineers, dated June 28, 2024. This report presents the results of the field investigation, analyses, and design recommendations for the Roadway Materials Report and was prepared by the undersigned in general accordance with the ITD Materials Manual.

Shannon & Wilson has included the document "Important Information About Your Roadway Materials Report" following this report to assist you and others in understanding the use and limitations of our reports.

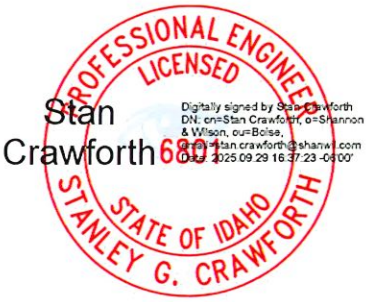
We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON



Michael J. Santi, PE
Materials Engineer



Stanley G. Crawforth, PE
Geotechnical Engineer

CONTENTS

240 Roadway Materials Report 6
240.01 Introduction 6
240.02 Vicinity Map 6
240.03 Soils Profile 6
240.04 Soil Report Summary 9
240.05 Total Design Pavement Thickness 9
240.06 Sub-Subgrading 10
240.07 Grade Pointing 10
240.08 Earthwork 11
240.09 Compaction 12
240.10 Slope Design Summary 12
240.11 Slope Design 12
240.12 Embankment Foundation 13
240.13 Surface and Subsurface Water 13
240.14 Drainage 13
240.15 Geosynthetics 13
240.16 Existing Roadway Material 14
240.17 Rock Subgrade 14
240.18 Topsoil 14
240.19 Pipe 14
240.20 Riprap 15
240.21 Staged Construction 15
240.22 Pavement Data 15
240.23 Base 16
240.24 Tack Coat 16
240.25 Prime Coat 16
240.26 Surface Treatment 17
240.27 Paving 17
240.28 Seal 17
240.29 Dust Abatement 17

CONTENTS

240.30 Aggregate Estimating Data 17
240.31 Disclaimer 18
240.32 Aggregate Sources 18
240.33 Current Specifications and Minimum Testing Requirements 19
240.34 Special Provisions 20
240.35 Notes to Contractor 23
240.36 Notes to Resident Engineer 27
240.37 Notes to Designer 27
540 Pavement Structure Analysis 28
540.01 General 28
540.02 Methodology 28
540.03 Existing Pavement Condition – Surface Distresses 28
540.04 Existing Pavement Structure – Thicknesses 28
540.05 Traffic Loading 28
540.06 Climate 30
540.07 Material Properties 31
540.08 Analyses and Designs 31
540.09 Life Cycle Cost 33
540.10 Recommendation 34
541 References 35

Exhibits

Exhibit 240.03-1: Existing US-20 Pavement Structure 7
Exhibit 240.03-2: Summary of Subgrade Soil Laboratory Test Results 8
Exhibit 240.03-3: Subgrade Soil Resilient Moduli 8
Exhibit 240.03-4: Rock Core Unconfined Compressive Strength 9
Exhibit 240.05-5: Recommended Pavement Structure for US-20 10
Exhibit 240.07-6: Typical Grade Pointing 11
Exhibit 240.19-7: Summary of Soil Corrosion Test Results 14
Exhibit 240.22-8: Flexible New Construction – Typical Section for US-20 Realignment 15
Table 1: Joint Adhesive Specifications 20
Exhibit 540.05-1: Traffic Loading Parameters Summary 29
Exhibit 540.05-2: FHWA Vehicle Class Truck Traffic Distribution 30

CONTENTS

Exhibit 540.07-3: Summary of Design Moduli and Material Properties for AASHTO Pavement M-E Analyses 31
Exhibit 540.08-4: Design Results for the Flexible Reconstruction (20-Year Analysis) Strategy 32
Exhibit 540.08-5:Design Results for the Rigid Reconstruction (40-Year Analysis) Strategy....33
Exhibit 540.09-6: Life-Cycle Cost Analysis Results[1,2] 34
Exhibit 540.09-7: Pavement Design Alternative....34

Appendices

Appendix A: General Information and Site Data
Appendix B: Subsurface Investigation Data
Appendix C: Laboratory Test Results
Appendix D: Materials Properties
Appendix E: Traffic
Appendix F: Pavement Design Calculation Reports
Appendix G: Life Cycle Cost Analysis
Important Information

ACRONYMS

AADTT	annual average daily truck traffic
AC	asphalt concrete
EUAC	equivalent uniform annual cost
HMA	hot-mix asphalt
IRI	international roughness index
ITD	Idaho Transportation Department
JPCP	jointed plain concrete pavement
LCCA	life cycle cost analyses
MG	thousand gallons
MP	mile post
MTR	Minimum Testing Requirements
PME	pavement mechanistic-empirical
RAP	recycled asphalt pavement
SP	special provisions
TI	traffic index

240 ROADWAY MATERIALS REPORT

240.01 Introduction

The Idaho Transportation Department (ITD) is planning a roadway reconstruction project on US-20, from the INL Puzzle (MP 261.8) to Idaho Falls (MP 301.4). The reconstruction will occur over two phases, consisting of

- KN 24149_FY 2028_US-20, INL Puzzle to Bonneville CO Line (MP 263.8 to 281), and
- KN 23244_FY 2027_US-20, Bonneville CO Line to Idaho Falls (MP 281 to MP 301.4).

This Roadway Materials Report (RMR) relates solely to **KN 23244_FY 2027_US-20, Bonneville CO Line to Idaho Falls (MP 281 to MP 301.4)**. A separate RMR will be prepared for the FY 2028 phase.

This segment of US-20 is classified as a Rural Principle Arterial. The posted speed limit is 65 and 70 MPH. The pavement reconstruction is anticipated to begin in 2027.

For this project (FY 2027), the proposed US-20 will be relocated on both sides (north and south) of the existing US-20, such that the existing US-20 alignment will be substantially developed into a median safety area. The existing US-20 will be demolished. Roadway materials from the existing US-20 may be reused, as discussed in Section 240.16. All drain pipes will be new.

Project planning does not include:

- Bridge structures
- Roadside retaining walls

240.02 Vicinity Map

A Vicinity Map is in Appendix A.

240.03 Soils Profile

The project development area for US-20, Bonneville CO Line to Idaho Fall is predominantly rural or undeveloped with gentle rolling hills consisting predominantly of windblown silty clay, silt, and fine sand over meandering fractured basalt flows. A map describing the general geologic conditions is in Appendix A. Site Photographs are also in Appendix A.

Borings within the US-20 Pavement Structure

In 2021, the Idaho Transportation Department (ITD) advanced 21 borings through the US-20 pavement structure (B-49A to B-52A, B-53C to B-55C, B-56AC, B-57C to B-62C, B-64A to B-66A, B-67C to B-69C and B-71C). In 2015, American Geotechnics (AGEO, now Shannon & Wilson) advanced two borings (AGEO-8 and AGEO-9). The ITD and AGEO pavement boring logs are in Appendix B. An Exploration Location Map is also in Appendix B.

A summary of measured layer thicknesses listed on the ITD/AGEO pavement boring logs is presented in the following table.

Exhibit 240.03-1: Existing US-20 Pavement Structure

Layer	Thickness (feet)		
	Maximum	Average	Minimum
Asphalt Concrete (AC)	0.40	0.31	0.17
Cement Recycled Asphalt Base Stabilization (CRABS)	1.25	0.70	0.50
Base	2.00	0.55	0.20

It is noted that the base layer is predominantly described as volcanic cinders. The subgrade soil is generally classified as silty clay (CL-ML).

Borings and Soundings adjacent to the US-20 Pavement Structure

In 2025, Shannon & Wilson (S&W) advanced 37 borings (SW-121 to SW-152 and SW-201 to SW-206) adjacent to the existing US-20 pavement structure and within the ITD right-of-way where the new alignment is planned. The S&W boring logs are in Appendix B, together with the Exploration Location Map.

In general, the surficial soils anticipated to be the roadbed were classified as lean clay, silty clay, and silt. The following table summarizes laboratory results for subgrade soils. The laboratory test results are included in Appendix C.

Exhibit 240.03-2: Summary of Subgrade Soil Laboratory Test Results

Sample		Water Content (%)	Atterberg Limits			Particle Size (Percent Passing)			USCS Class
Location	Depth (feet)		LL (%)	PL (%)	PI	Gravel (%)	Sand (%)	Fine (%)	
SW-125	2.9-3.6	18.1	NV	NP	NP	0	10	90	ML
SW-126	2.0-4.0	12.4	26	21	5	0	4	96	CL-ML
SW-131	3.0-3.7	15.9	29	20	9	0	2	98	CL
SW-140	4.0-6.0	22.3	29	19	10	0	7	93	CL
SW-142	2.0-4.0	13.5	35	20	15	44	9	47	GC
SW-144	2.3-3.0	19.5	37	17	20	0	5	95	CL
SW-150	2.5-4.0	13.0	29	23	6	0	5	95	ML
SW-151	2.2-2.9	20.1	NV	NP	NP	0	2	98	ML
SW-202	2.5-4.0	19.4	27	19	8	1	8	91	CL
SW-204	2.5-4.0	18.4	27	20	7	0	6	94	CL-ML
SW-205	2.5-4.0	12.1	26	19	7	36	15	49	GC-GM

Four AASHTO T 307 resilient modulus tests were performed to calibrate the stiffness of the roadbed for pavement structure design. The following are the AASHTO T 307 test results.

Exhibit 240.03-3: Subgrade Soil Resilient Moduli

Boring	Sample	Sample Depth Interval (feet)	AASHTO Classification	Subgrade Soil Resilient Modulus (psi) [1.]
SW-125	RM-31	2.9 to 3.6	A4	5885
SW-131	RM-36	3.0 to 3.7	A4	4687
SW-144	RM-23	2.3 to 3.0	A6	4010
SW-151	RM-39	2.2 to 2.9	A4	7935

Notes:
1 AASHTO T 307, Sequence 13 per NCHRP 1-28A guidance.

Basalt bedrock is intermittently visible along the corridor and was frequently encountered in the S&W borings (SW-boring series). In 2025, S&W sounded (S-001 to S-255 and S-400 to S-408) for bedrock using a drill rig hydraulic hammer and hardened steel E-size drill rods. The depth-to-bedrock measurements and the soundings were accompanied by latitude and longitude locations. Additionally, exposed basalt bedrock outcrop faces (F-01 through F-80) were located by latitude and longitude.

Depth-to-bedrock data was provided to the project roadway designer to aid in modeling the buried bedrock surface. The data is in Appendix B. In all, 788 depth-to-bedrock data points

were provided for bedrock surface modeling. The data points are shown on the Exploration Location Plan in Appendix A.

The proposed profile design for US-20 will necessitate near surface excavation of basalt bedrock, particularly at topographic rises along the corridor. Five cores were obtained along the corridor at borings SW-121, SW-127, SW-134, SW-143, and SW-150. The cores showed medium- to large-vesicularity and fractures. RQD values ranged from 32 to 96. Core photographs are in Appendix B. Unconfined compressive strengths are summarized below

Exhibit 240.03-4: Rock Core Unconfined Compressive Strength

Boring	Depth (ft)	Unconfined Compressive Strength (psi)
SW-121	3.5-4.0	5,117
SW-127	10.5-11.0	4,766
SW-134	4.5-5.0	4,406
SW-143	8.5-9.0	7,408
SW-150	11.5-12.0	4,642

In 2025, Shannon & Wilson conducted two seismic refraction surveys (SR-1 and SR-4) in accordance with ASTM D5777 to provide information related to rippability. The locations of the survey lines are on the Exploration Location Map in Appendix B. The processed results indicated that near surface (upper 5 feet) velocities ranged from about 5,000 to 7,000 fps.

Two large culverts (MP 296.6 and MP 297.17) having diameters of 8 and 9 feet will be replaced with precast concrete culverts. Borings SW-201 through SW-206 were advanced near the existing pipes. The borings indicate that the original pipe excavations were backfilled with basalt rubble to within about 4 to 8 feet of the pavement surface.

240.04 Soil Report Summary

A summary of the soil report or a materials handling plan detailing the origin and placement of materials will not be provided for design. The Contractor will develop a materials handling plan. Shrink and swell factors are discussed in Section 240.08, which may be considered to estimate the design materials balance.

240.05 Total Design Pavement Thickness

The analyses related to the recommended pavement structure are detailed in Section 540.08, Analyses and Design.

The following pavement structure is recommended for US-20.

Exhibit 240.05-5: Recommended Pavement Structure for US-20

Layer	Thickness (ft)
Superpave Hot Mix Asphalt	0.35
Aggregate for Untreated Base	0.65
Granular Subbase	1.25
Total	2.25

The above recommended pavement structure is dependent on the roadbed density confirmation specified in Section 240-35.

Aggregate for Open Graded Base (Class III) may be substituted for Aggregate for Untreated Base (Type A or B).

The recommended pavement structure is based on the use of materials outlined in the ITD Standard specifications and in the acceptance testing methods and frequency of testing outlined in the ITD Materials Testing Requirements.

240.06 Sub-Subgrading

Sub-subgrading of soil is not required.

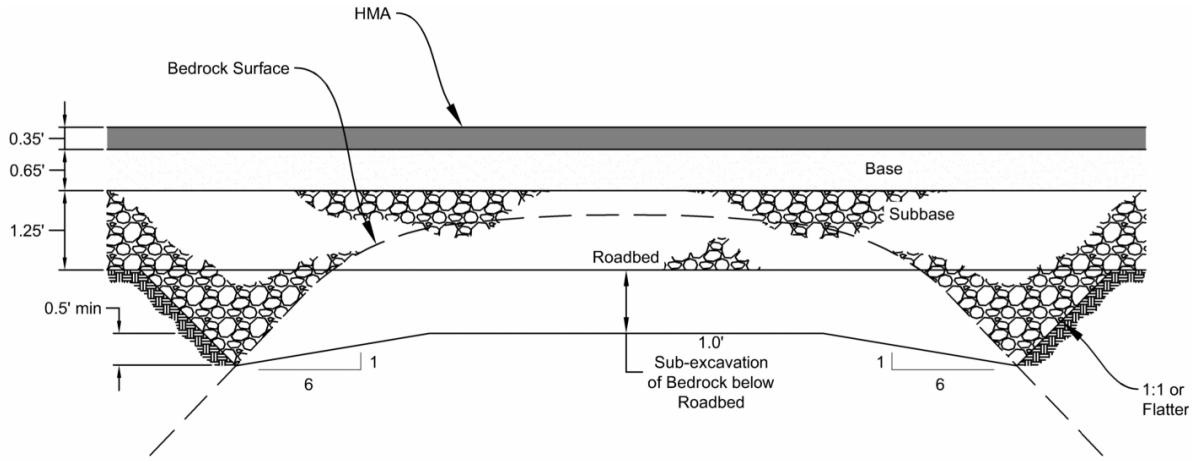
240.07 Grade Pointing

Where the pavement structure is situated immediately on bedrock, grade point excavation is required to inhibit frost heave potential and to inhibit pavement cracking at abrupt changes in roadbed support.

Grade pointing includes the sub-excavation of bedrock to a depth of 12 inches below the pavement structure presented in Section 240.05. After grade point excavation, backfill with Granular Subbase to the roadbed elevation (bottom of subbase layer).

Abrupt changes of bedrock profile should be tapered 1V:6H or flatter to inhibit the development of pavement cracking. See the following figure for inclusion on the Plans.

Exhibit 240.07-6: Typical Grade Pointing



240.08 Earthwork

Clearing and Grubbing

There is sagebrush and dense concentrations of tall weeds along the corridor that are not suitable for placement in fill. Clear and grub per ITD Standard Specifications Section 201.

Stripping Topsoil

Strip 8 inches of topsoil below the existing ground surface. Stripping is incidental and the cost included in excavation.

Process Old Road

Process old road in accordance with Standard Specifications Section 205.03-D to ensure it does not interfere with the new pavement structure.

Excavation and Repair of Soft Spot

Laboratory testing indicates that natural water content at the time of drilling (August 2025) is occasionally higher than the plastic limit of the soil. This is an indication that soft spots in the roadbed may be encountered during construction of the new alignment. The risk of encountering soft spots is highest in the early spring. A contingency for soft spot repair should be planned. A contingency of about 5 to 10 percent of the roadway may be considered for the bid schedule.

For soft spot repair, sub-excavate 2 feet below the roadbed and place a Subgrade Separation Geotextile, Type III (718.07). Backfill with Aggregate for Granular Subbase (703.11) to the roadbed.

Shrink-Swell Factors

It is anticipated there will be a combination of soil and bedrock excavation to develop the planned roadway profile. The Contractor's station-to-station materials handling plan is unknown. Shrink-Swell factors are substantially affected by final borrow operation.

The following shrink-swell factors are published in the ITD Operational Memo No. 26 dated July 1, 1982.

100% Basalt Rock: 43% swell (bank to compacted fill)

75% Basalt Rock/25% Sandy Soil Mixed: 12% swell (bank to compacted fill)

50% Basalt Rock/50% Sandy Soil Mixed: 6% shrink (bank to compacted fill)

Silty Sand/Sandy Silt: 14% shrink (bank to compacted fill)

Given the wide range of shrink-swell possibilities, it is a challenge to assume a shrink-swell value for design of a balanced earthwork. Bedrock surface and roadway profile modeling can aid in the tentative selection of a rock/soil mix and an associated shrink-swell factor for bank cuts to compacted fills.

To reduce the potential for large swell factor, a Contractor Note is provided in Section 240.35 precluding the placement of all-rock fills having large, nested rocks with large void space. Embankment fills should be comprised of soil or a soil/rock mix to avoid nested rock embankments wherein overlying soil could migrate potentially causing surface subsidence.

Design fill slopes could be flattened, if there is an excess of fill material.

240.09 Compaction

Compact roadway materials in accordance with Standard Specifications Section 205.03.G.

240.10 Slope Design Summary

This is a roadway reconstruction project with slope heights of less than 15 feet. Construct cut and fill slopes at 2H:1V or flatter.

240.11 Slope Design

Existing slopes higher than 4 feet and steeper than 3H:1V that are to be widened should be benched.

Finished embankment slopes should not have exposed basalt rubble and should be covered with soil and smoothly compacted.

240.12 Embankment Foundation

Embankment foundations should be stripped at least 8 inches and compacted to Class B requirements (205.03.G). As required, direct Excavation and Repair of Soft Spot (205.03.E).

240.13 Surface and Subsurface Water

Surface run-off and run on from precipitation can be managed by existing roadside ditches and culverts. Roadside ditches should conform to ITD Standard Detail A2. Refer to Appendix A for a copy of Standard Detail A2.

Groundwater is deep and not expected to affect the project development.

240.14 Drainage

Drainage ditches along the roadway should extend at least 1 foot or the diameter of the pipe below the bottom of the pavement structure (roadbed), and maintain positive drainage as shown on ITD Standard Detail A-2. For embankments consisting of erodible soils, Embankment Protectors (607) may be used. Special erosion controls should be considered for ditches.

Roadside in-situ infiltration testing (GI-5 through GI-8) using a Guelph permeameter was performed by Shannon & Wilson in July 2025 at locations specified by David Evans and Associates. The infiltration test locations are shown on the Exploration Location Plan in Appendix B. A summary of the infiltration test rates is in Appendix B. Measured rates generally ranged from about 1.7 to 3.5 inches per hour. Measured infiltration values should not be used for design; rather, the measured values should be reduced for design. Given the clayey-silty nature of the corridor soils, a corridor-wide infiltration rate of 1.0 inches/hour is suggested.

240.15 Geosynthetics

A subgrade separation geotextile is not specified for the roadbed.

A Subgrade Separation Geotextile, Type III (718.07) is required for soft spot repair, as discussed in Section 240.08.

240.16 Existing Roadway Material

The US-20 existing base material is generally classified as volcanic cinders.

Pulverized asphalt concrete and existing base materials from required project excavations, blended and mixed, may be reused as Granular Subbase, provided the blended material meets the material requirements for Granular Subbase (301.03.D).

Existing asphalt concrete should be reused in the project development and not wasted.

240.17 Rock Subgrade

To develop the proposed roadway profile, rock subgrade and rock cuts are anticipated at many locations throughout the project. See 240.07 Grade Pointing.

240.18 Topsoil

Topsoil required should be provided by the Contractor from Contractor Furnished Sources. Stripped topsoil obtained from required project stripping that is free of brush and weeds can be reused as topsoil.

240.19 Pipe

Based on the NRCS Soil Survey of Bingham and Bonneville Counties, the project soils have moderate potential for corrosion of uncoated steel and low potential for concrete degradation. The bed load for pipes should be considered non-abrasive.

Soil samples were tested for corrosion characteristics. The following table summarizes the soil corrosion test results.

Exhibit 240.19-7: Summary of Soil Corrosion Test Results

Sample Location	USCS Classification	pH	Resistivity (ohm-cm)	Chloride (mg/kg)	Sulfate (mg/kg)	Bed Load*
SW-125	CL	8.0	1,350	51	11	N
SW-131	ML	8.4	1,910	33	ND	N
SW-144	CL	8.4	1,050	67	54	N
SW-151	ML	7.8	1,090	4,470	1,530	N

*A = abrasive, N = nonabrasive

The soil corrosion laboratory test results are in Appendix C.

240.20 Riprap

Given the silty nature of the soil, riprap should be considered for pipe outlets.

240.21 Staged Construction

Staged construction for time-rate consolidation of embankment foundations is not required.

240.22 Pavement Data

Flexible pavement is recommended using Superpave HMA, Class SP-3 (405). Specify Surface Smoothness Schedule I (405.03.P). The following exhibit summarizes the typical section for the project.

Exhibit 240.22-8: Flexible New Construction – Typical Section for US-20 Realignment

Traffic Loading – Flexible ESALs: 4,615,000			
	Thickness (feet)	Layer	Materials
	0.35	Superpave Hot Mix Asphalt, Class SP-3 (405); 2 equal lifts	Aggregate for Superpave HMA Pavement, ½-inch (703.05) Asphalt, PG 64-34 (702.01)
	0.65	Aggregate for Untreated Base (303)	Aggregate for Untreated Base, ¾-inch Type A or B (703.04)
	1.25	Aggregate for Granular Subbase (301)	Aggregate for Granular Subbase (703.11)

The above recommended pavement structure is dependent on the roadbed density confirmation specified in Section 240-35.

Aggregate for Open Graded Base (Class III) may be substituted for Aggregate for Untreated Base (Type A or B). See the modification to the Standard Specifications in Section 240.33.

Backfill for grade pointing and for soft spot repair is Aggregate for Granular Subbase (703.11).

LTPPBind Output

The PG Binder grade as determined by LTPPBind is PG 64-34 for all paving. The project-specific details are in 540.08 Analyses and Designs, and the LTPPBind output is in Appendix D.

240.23 Base

Geotextile for Soft Spot Repair

Subgrade Separation Geotextile, Type III (718.07)

Granular Subbase (301)

Aggregate for Granular Subbase (703.11)

Granular Subbase (301) with Recycled Asphalt Pavement (RAP)

Aggregate for Granular Subbase (703.11) mixed with RAP generated from the project, (720.07) per 301.03.D.

Do not use RAP generated from outside the project.

Aggregate Base (303)

Aggregate for Untreated Base, ¾-inch Type A or B (703.04). (Do not mix RAP with Aggregate for Untreated Base)

Open Graded Base (307)

Aggregate for Open Graded Base, Class III (703.08). See the modification to Standard Specifications in Section 240.33.

240.24 Tack Coat

Tack Coat (401) on New Hot Mix Asphalt (HMA) Surfaces

For new HMA surfaces, use Emulsified Asphalt, CSS-1h (702.03) diluted (1:1 ratio) asphalt applied at a rate of 0.12 gal/sy (residual rate of 0.04 gal/sy estimated).

240.25 Prime Coat

A prime coat is not specified.

240.26 Surface Treatment

Fog Coat

Fog Coat (408) to cover bead blasted striping using Emulsified Asphalt, CSS-1h (702.03) diluted (1:1 ratio) asphalt applied at a rate of 0.05 gal/sy (residual rate of 0.02 gal/sy estimated).

As required for early traffic, Aggregate for Blotter (703.07) at 12 lb/sy.

240.27 Paving

Flexible Pavement

Superpave Hot Mix Asphalt, Class SP-3 (405)

Aggregate for Superpave HMA Pavement, ½-inch (703.05)

Asphalt, PG 64-34 (702.01) at 5.6% by weight of mix (estimated)

Anti-Stripping Additive (702.04) at 0.5% by weight of asphalt binder (estimated)

240.28 Seal

A seal coat is not planned.

240.29 Dust Abatement

Dust Abatement (205.02.C)

Water for Dust Abatement is estimated at 5 inches (estimated) of water applied to areas disturbed by required earthwork activities in units of MG (thousand gallons) for the total project.

240.30 Aggregate Estimating Data

Superpave Hot Mix Asphalt (405)

Aggregate for Superpave HMA Pavement at 148 lb/cf, including asphalt (estimated)

Cover Coat (404)

Aggregate for Cover Coat Material at 108 lb/cf, including 4% water (estimated)

Untreated Base (303)

Aggregate for Untreated Base at 146 lb/cf, including 7% water (estimated)

Open Graded Base (307)

Aggregate for Open Graded Base (Class III – Modified by D6) at 114 lb/cf, including 4% water (estimated)

Granular Subbase (301)

Aggregate for Granular Subbase at 138 lb/cf, including 7% water (estimated)

240.31 Disclaimer

The unit weights in this estimating basis are provided to the designer to develop approximate project quantities. The actual quantities will vary depending on the Contractor-provided sources, crushing operations, and mix designs. The Contractor is solely responsible for determining actual unit weights based on the methods of production and providing adequate materials for the project plus any losses due to stockpile operations, out of specification (rejected) materials, or other wastes.

240.32 Aggregate Sources

Source Identification

Approved Contractor-furnished sources are specified for all aggregates.

Designated Sources

Designated sources are not identified for this project.

Contractor Provided Sources

The Contractor shall furnish approved sources(s) for all materials to be embanked or processed for placement. A list of State-owned or State-controlled sources is available at the ITD District office. Written approval of the Contractor's source operation plan will be required prior to accepting materials or using State-owned or State-controlled sources.

Cost

For Department-controlled sources, the source recovery fee will be the applicable rate as established in the Department's Materials Manual Section 300.02.05 Source Control at the time of bidding.

The Contractor shall be responsible for all costs incurred in obtaining approval for the use of source(s).

240.33 Current Specifications and Minimum Testing Requirements

The following documents are applicable:

- Idaho Transportation Department (ITD). 2023 Standard Specifications for Highway Construction and the 2025 Supplementals for 2023 Standard Specifications (June 2025).
- Idaho Transportation Department (ITD). 2019. Quality Assurance Manual.

Modification of Standard Specifications

ON PAGE 513, SUBSECTION 703.08 – AGGREGATE FOR OPEN GRADED BASE

Add the following after the first paragraph.

In addition to all 703.08 requirements, provide Class III – Modified aggregates from a quarry source that meets Table 703.08-2 criteria. The ¾", 3/8" and #200 screen/sieve size will be used for quality acceptance.

ON PAGE 636 OF 715, STANDARD SPECIFICATION, SUBSECTION 703.08, AGGREGATE FOR OPEN GRADED BASE

Replace Class III Aggregate Gradation Requirements in Table 703.08-1 with the following

Screen/Sieve Size	Percent Passing (by Weight) Class III - Modified
3 in	--
2 in	--
1 ½ in	--
1 in	100
3/4 in [(a)]	80 - 98
1/2 in	60 – 85
3/8 in [(a)]	30 – 65
No. 4	--
No. 8	15 – 30
No. 200 [(a)]	0 – 7.0

(a) Denotes the sieves that will be used for quality acceptance.

TESTING REQUIREMENTS FOR OPEN GRADED BASE (307-012A)

Testing requirements for Open Graded Base will follow Section 270.20, "303-Aggregate Base" in the Quality Assurance Manual.

ON PAGE 637 OF 715, STANDARD SPECIFICATION, SUBSECTION 703.08-2

Add the following characteristic requirement to **Table 703.08-2 – Aggregate Criteria.**

Table 703.08-2 – Aggregate Criteria

Characteristic	Test Method	Requirement
Hydraulic Conductivity	ASTM D5856-15	500 feet/day minimum

Modification of Quality Assurance Manual

No modifications to the Quality Assurance Manual are proposed.

240.34 Special Provisions

S911-05E – SP Pavement Joint Adhesive

Description:

Apply a hot-applied modified asphalt joint adhesive to the face of the longitudinal cold construction joints.

Materials:

Provide joint adhesive meeting requirements as specified in Table 1.

Table 1: Joint Adhesive Specifications

Name	Test Temperature	Specification	Value
Brookfield Viscosity	400°F (204°C)	ASTM D3236	4,000-10,000 cp
Cone Penetration	77°F (25°C)	ASTM D5329	60-100 dmm
Flow	140°F (60°C)	ASTM D5329	5 mm maximum
Resilience	77°F (25°C)	ASTM D5329	30% minimum
Ductility	77°F (25°C)	ASTM D113	30 cm minimum
Ductility	39.2°F (4°C)	ASTM D113	30 cm minimum

Name	Test Temperature	Specification	Value
Tensile Adhesion	77 °F (25°C)	ASTM D5329	500% minimum
Softening Point		ASTM D36	170 °F (77 °C) min.
Asphalt Compatibility		ASTM D5329	Pass
Minimum Application Temperature		--	380°F (193°C)
Maximum Heating Temperature		--	400°F (204°C)

Construction Requirements:

Equipment Requirements:

Use a jacketed double boiler type melter with effective agitation that meets appendix X1.1 of ASTM D6690. The melter must be capable of safely heating adhesive to 400°F (204°C).

Material Handling:

Submit a copy of the manufacturer's recommendations for heating, re-heating, and applying the joint adhesive material.

Do not remove the joint adhesive from the package until immediately before it is placed in the melter. Joint adhesive boxes must be clearly marked with the name of the manufacturer, the trade name of the adhesive, the manufacturer's batch and lot number, the application/pour temperature, and the safe heating temperature. Feed additional material into the melter at a rate equal to the rate of material used.

Verify the pouring temperature of the joint adhesive at least once per hour at the point of discharge. Stop production if the adhesive falls below the recommended application/pour temperature. When the temperature of the adhesive exceeds the maximum safe heating temperature, stop production, empty the melter, and dispose of that adhesive in an environmentally safe method. No payment will be made for this material or its disposal.

Do not blend or mix different manufacturer brands or different types of adhesives.

Joint Adhesive Application:

Follow the manufacturer's installation instructions. The face of the longitudinal joint must be clean and dry before the joint adhesive is applied. Apply the joint adhesive material to the entire face of the final lift of HMA pavement where an adjacent HMA pavement will be constructed. The pavement surface shall be 40°F (4°C) and rising. Apply the joint adhesive to the entire face of concrete pavement where an adjacent HMA shoulder pavement will be

constructed. The recommended band thickness is approximately ⅛inch. An application shoe attached to the end of the application wand is recommended. Do not overlap the joint by greater than ½ inch at the top of the joint or 2 inches at the bottom of the joint. Apply the joint adhesive immediately in front of the paving operation. If the adhesive is tracked by construction vehicles, repair the damaged area and restrict traffic from driving on the adhesive. Compaction at the joint shall be as stated in the manufacturer's installation instruction.

Quality Control:
Acceptance of the joint adhesive material is based on the certification by the manufacturer that the sealant meets the requirements listed in Table 1. The Engineer may elect to sample and test the material to verify the certification(s). For verification, take a sample from the application wand within the first 20 minutes of placing sealant from each melter on the project in the presence of the Engineer.

Obtain one gallon of sealant for each sample in four 1-quart metal screw top cans. The 4 sampling containers shall be labeled with the SP number, date, time, location, manufacturer, and lot number of the sealant. Each container shall be numbered one of four, two of four, etc.

Document the locations where the material from each lot number of sealant is placed.

The material will be subject to rejection should sampling and testing indicate the material does not meet the specifications in Table 1. The Engineer may allow non-specification material to be left in place with a price adjustment if the finished product is found to be capable of performing its intended purpose. The price adjustment will be 75 percent of the contract unit bid price multiplied by the total quantity of material represented by the failing test results.

Independent assurance sampling and testing will not be required.

Method of Measurement:

Pavement Joint Adhesive will be measured by foot of longitudinal joint.

Basis of Payment:

The Department will pay for accepted quantities at contract unit prices as follows:

Pay Item	**Pay Unit**
SP Pavement Joint Adhesive	FT

The cost of milling and saw cutting is covered under a separate pay item.

240.35 Notes to Contractor

Estimating Basis

The unit weights in the estimating basis were determined from area history and past project experience. This information is provided to assist the designer in developing reasonable project quantities. The actual quantities will vary depending on Contractor furnished source, crushing operations, and mix designs. The Contractor is responsible for determining actual unit weights based on the material produced and providing adequate materials for the project, plus any losses to stockpile operations or other wastes.

EXCAVATION AND EMBANKMENT

Basalt bedrock is intermittently visible and exposed in roadside cuts. Bedrock is generally covered by varying thicknesses of soil along the project corridor. Information regarding the depth and quality of the basalt bedrock is provided in the Roadway Materials Report, which also outlines the limitations of the available data. Based on this data, most of the basalt rock may not be ripable using conventional excavation equipment, and where excavation of rock is needed, rock blasting will be required to achieve the proposed grade. Subsurface investigation reports and laboratory data are available with the online reference files during bidding and at the Idaho Transportation Department, District Six Materials Office, located at 206 North Yellowstone Highway, Rigby, ID 83442. It is the Contractor's responsibility to interpret the bedrock-related information in the Roadway Materials Report, assess the associated risks, and incorporate them into unit pricing. Excavation pricing should be based on the Contractor's evaluation of the provided soil and rock data, any independent subsurface investigations, and a thorough review of site conditions.

The Contractor is solely responsible for managing all materials handling operations, including accounting for shrinkage and swelling from embankment material to compacted fill. The Contractor acknowledges that shrink/swell percentages can vary significantly depending on the proportions of soil and rock present, as well as how these materials are mixed or left unblended during construction operations.

The project will involve excavation of existing highway materials, native soils, and native rock, including intact basalt bedrock. Because the depth to bedrock is variable and will be largely unknown until excavation reveals the amount of bedrock to be removed, it is necessary to identify payment methods for areas with little to no intact bedrock removal and areas with extensive bedrock removal. Based on the information available to the Engineer, excavation types anticipated are indicated on the plans. Separate excavation schedules for basis of payment are defined as follows:

205-005A Excavation Type A– Excavation within the station ranges shown on the plans as 205-005A Excavation Type A is anticipated to consist primarily of soil that can be excavated, hauled and compacted with conventional earth moving equipment. Some intact rock may occur within these station ranges. The Contractor shall excavate the rock unless otherwise directed by the Engineer. All excavation required in these station ranges will be paid for as 205-005A Excavation Type A.

205-005B Excavation Type B– Excavation within the station ranges shown on the plans as 205-005B Excavation Type B is anticipated to consist at least in part, of rock that is not likely to be reasonably excavated with conventional earth-moving equipment. The Contractor shall excavate the rock unless otherwise directed by the Engineer. All excavation required in these station ranges will be paid for as 205-005B Excavation Type B. If significant amounts of rock material anticipated to be removed is not required or is permitted to remain by the Engineer (such as in ditch bottoms), excavation for the removed material will be paid for as 205-005A Excavation Type A, even if called out otherwise in the plans.

All excavation, regardless of whether it involves soil or rock, will be measured and paid for by the cubic yard, in accordance with Section 205.05. Separate unit prices will apply to the different excavation locations as indicated on the plans. Shrinkage and swelling of excavated materials is anticipated on this project. Existing asphalt pavement harvested from the existing road surface that is scheduled to be excavated has been included in the mass balance as suitable embankment material. Engineer approval is required prior to the Contractor utilizing the harvested existing pavement material for any other purpose. Replace the harvested pavement material used for other purposes with suitable embankment material at no added cost to the project.

Excavated rock shall be harvested by methods that allow the rock material to be the appropriate size to be used in the embankment areas. Ensure proper placement and compaction of all rock and embankment material used below subgrade on this project. Compaction of both the existing and embankment subgrade material is essential on this project. Cobbles or boulders as defined in ASTM D 2488, placed for embankment shall not protrude on the finished surface.

The overall mass balance of the project anticipates an overall excess of excavated material to be stockpiled at an approved location on the west end of the project. Importing borrow material on the project is not anticipated and can only be done when approved. It is anticipated that the progression of work is as presented in the traffic control plan. Variations to the plan may create the need for offsite borrow to supplement a phase and create more waste at the completion of the project than anticipated. If the Contractor elects to deviate from the anticipated construction phasing plan, additional costs will not be borne

by the State. Deviations to the construction phasing must be approved by the Engineer. Keep a minimum of two lanes open at all times. Limit haul across the roadway to non-peak traffic times.

The Contractor is solely responsible for selecting equipment capable of excavating soil, existing roadway, cobbles and boulders, and basalt rock. The Contractor determines the means and methods to excavate the basalt bedrock, including ripping and blasting. The cost for ripping or blasting is included in the Excavation TY B 205.005B unit price. No additional payment will be made for the cost of ripping or blasting.

GRADE POINTING

Do not place the pavement structure, which consists of the Superpave HMA, aggregate for untreated base, and the granular subbase, directly on bedrock to minimize the potential for frost heaves. In areas where the top of subgrade is less than 12 inches above bedrock, excavate rock to a minimum depth of 12 inches below subgrade. The over-excavation of rock is grade pointing. See the Plans for grade pointing details. Ensure that the compaction and construction conform to section 205.03F of the standard specifications. The over-blasting and/or over-excavation of the rock material below subgrade is grade pointing. Excavation for grade pointing is included in the 205.005B Excavation TY B unit price. Replace the over-excavated rock material with Granular Subbase. Placement of the required Granular Subbase in the over-excavated rock areas will be paid for as 301-005A Granular Subbase.

EXCESS MATERIAL

The project does not intend to waste material. Suitable embankment material shall be used in subsequent construction phases.

PROOF ROLLING AND SOFT SPOT REPAIR OF SUBGRADE SOIL

After excavation to design subgrade (roadbed), proof rolling of each lane is required to search for soft spots in the subgrade. Provide poof roll equipment consisting of a heavily loaded water truck with an operator having a minimum weight of 45,000 lbs. traveling at walking speed. Proof roll in the presence of the Department, who will designate areas subgrade requiring soft spot repair based on depth of back tire rutting. Reroll when directed. Perform Excavation and Repair of Soft Spot (205.03.E) when directed.

The cost of proof rolling is incidental to Excavation.

Furnishing and placing all other materials including Subgrade Separation Geotextile will be paid under pay item 205-095A Soft Spot Repair.

ROADBED COMPACTION OF SUBGRADE SOIL

After proof rolling and soft spot repair, perform roadbed compaction of subgrade soil. Scarify and aerate subgrade soil as necessary to adjust water content, as necessary, and compact subgrade soil with a pad foot roller having adjustable vibratory capability and having a minimum 45,000-lb operating weight. Walk-out the pad foot compactor full width of the roadbed.

Where the roadbed or subgrade consists of soil, Class A Compaction (205.03.G) is required with density testing per the ITD Materials Testing Requirements. Provide acceptable density test reports for every 5000 sy of roadbed prior to placing the subbase. The cost of roadbed compaction and density testing is incidental to Excavation.

SOILS PROFILE AND FOUNDATION INVESTIGATION

Soils summary and foundation investigation are available with the online reference bidding files and at the District 6 Office, Materials Section (208) 745-5640 for review.

SOURCE TESTING OF BASE AGGREGATES FOR RESILIENT MODULUS

Ensure that the source(s) for Aggregate for Untreated Base has a resilient modulus of at least 32,000 psi.

Ensure that the source(s) for Aggregate for Granular Subbase has a resilient modulus of at least 21,000 psi.

AASHTO T 307 is the resilient modulus test standard. Acceptance is based on Sequence 6 of the AASHTO T 307 test. Ensure that the samples provided for AASHTO T 307 testing meet the materials requirements of the ITD Standard Specifications. Provide at least one sample per material type per source. Perform AASHTO T 307 testing using an acceptable independent testing laboratory.

Seek other sources, as required, to meet the resilient modulus standard.

TOPSOIL

Harvest topsoil from onsite excavation areas after clearing and grubbing. Store harvested topsoil onsite within the right of way. Utilize harvested topsoil for the construction of the S913-05A – SP DITCH BERM and for 213-010A TOPSOIL. As described in the roadway detail, replace the topsoil harvested onto slopes prior to permanent seeding activities.

240.36 Notes to Resident Engineer

There are no notes to the Resident Engineer.

240.37 Notes to Designer

Standard Drawings and Standard Details

Include the following in the plan set:

- ITD Standard Detail A2
- ITD Standard Detail A9
- Standard Drawings and Standard Details are in Appendix B.

Revision of This Roadway Materials Report

Delay of project advertisement or project changes that occur after the final design package is issued often necessitate revisions to the Roadway Materials Report. The Roadway Materials Report must be reviewed and revised as necessary when any of the following occur after the original Roadway Materials Report is issued and before project advertisement:

- New standard specifications or supplemental specifications are released and are to be used on the project.
- Revised Minimum Testing Requirements (MTRs) are released.
- Additional bid items are added to the project, and design changes are made that have an impact on materials specification.

Geotechnical/Materials Review After Final Design

The ITD "Consultant Agreement Specifications" document states:

"the Consultant must ensure that any Subconsultant performing geotechnical and materials work be involved in the final design review. This does not mean that the geotechnical materials consultant must attend the actual final design review meeting, but does mean that the Subconsultant, will at a minimum, participate in the final design plan and proposal review to assure that all geotechnical and materials recommendations/issues it raised concerning the project have been addressed, or notify the Consultant of any outstanding issues." (2019)

540 PAVEMENT STRUCTURE ANALYSIS

540.01 General

This section details project-specific data and the general requirements of Section 540 of the ITD Materials Manual (2020).

Information relating to project location, limits, and general geometry is summarized in Section 240.01 – Introduction.

540.02 Methodology

AASHTOWare Pavement ME Design Analysis (ITD 1993, 2012, 2014, 2015) is ITD's preferred method (ITD 2020 Materials Manual Section 520). AASHTOWare PMED V3.31 The performance criteria and reliability levels for the PMED approach are listed on the calculation summaries in Appendix D.

540.03 Existing Pavement Condition – Surface Distresses

Reconstruction options are being considered for this project which will remove and replace all pavement structure layers. Therefore, a pavement distress survey was not performed.

540.04 Existing Pavement Structure – Thicknesses

Borings for existing pavement thicknesses are not used in the pavement design because all existing pavement structure will be removed and replaced.

540.05 Traffic Loading

Appendix E contains the traffic data provided by ITD, together with a traffic projection summary.

The following exhibit summarizes the project design parameters for traffic loading.

Exhibit 540.05-1: Traffic Loading Parameters Summary

Traffic Data Summary	Design Parameter
AADT	3197
AADTT	314
Number of Lanes in Design Direction	1
Percent Trucks in the Design Direction	60%
Percent Trucks in the Design Lane	100%
Assumed Growth Rate	5.0%
20-Year Flexible ESALS	4,615,200 [2.]
40-Year Rigid ESALS	24,414,600

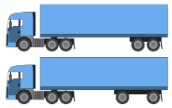
NOTE:

1 ITD traffic projections were calculated based on the ITD projected commercial and 18,000 lb ESAL loadings.

2 Traffic Index of 10.8.

The following is the design lane truck volume distribution based on AASHTO's PME's Truck Traffic Category (TTC) No. 8.

Exhibit 540.05-2: FHWA Vehicle Class Truck Traffic Distribution

FHWA Vehicle Class[1]		AADTT Volume (%)
4. Buses		1.7
5. Two-Axle, Six-Tire, Single-Unit Trucks		19.3
6. Three-Axle Single-Unit Trucks		4.6
7. Four or More Axle Single-Unit Trucks		0.9
8. Four or Fewer Axle Single-Trailer Trucks		6.7
9. Five-Axle Single-Trailer Trucks		44.8
10. Six or More Axle Single-Trailer Trucks		6
11. Five or Fewer Axle Multi-Trailer Trucks		2.6
12. Six-Axle Multi-Trailer Trucks		1.6
13. Seven or More Axle Multi-Trailer Trucks		11.8
Total		100.00

NOTES:

1 FHWA Vehicle classes 1-3 (motorcycles, passenger cars, and pickups) are not used for pavement design using AASHTOWare Pavement ME design software.

540.06 Climate

For PMED analysis, multiple local weather stations within the project climate zone and near the project elevation provided MERRA2 climate data to predict the temperature or moisture content of the various pavement structure layers.

The project is situated at Latitude 43.5 and Longitude -112.5 with an elevation of about 5100 feet.

Climate inputs are summarized on the pavement structure calculations in Appendix F.

540.07 Material Properties

Summary of Design Moduli and Material Properties

The following exhibit shows the design moduli and material properties assumed for AASHTO Pavement M-E Analyses.

Exhibit 540.07-3: Summary of Design Moduli and Material Properties for AASHTO Pavement M-E Analyses

Layer	Moduli	Design Value (ksi)
New HMA (Binder grade PG 64-34) (Air voids 7%) (Effective binder content 11.6%) (Asphalt content by weight of mix 4.5%)	E*	The dynamic modulus of the new HMA layer is dependent on truck speed, tire load and pressure, and the thickness of the HMA layer. Dynamic moduli are computed by AASHTOWare ME software for Level 3 data quality.
New Aggregate Base	M_R	32
New Granular Subbase	M_R	21
Subgrade Soil	M_R	4.8

Binder Grade Selection for New HMA

LTPPBind (ver. 3.1) and guidance from Section 560 of the ITD Materials Manuals was used to select the PG Binder Grade for New HMA. The LTPPBind output report is in Appendix D.

Given the 20-year ESALs and project climate location, a PG 64 -34 is specified for "fast" traffic and 98% reliability. One PG grade is recommended for all new HMA lifts.

540.08 Analyses and Designs

In collaboration with the design team, Shannon & Wilson selected the design strategies for feasibility evaluation and life cycle cost comparison.

Evaluation of Pavement Design Alternatives

For flexible pavement, 20 years of service is specified. For rigid pavement, 40 years of service is required. The traffic opening date is assumed to be 2027.

Analysis strategies included the following:

- Strategy 1 – Flexible Reconstruction (20-year analysis).
- Strategy 2 – Rigid Reconstruction (40-year analysis).

Appendix G contains the PMED calculation results. The following is a summary of results.

Flexible Reconstruction

This strategy includes the following activities:

- Prepare the roadbed.
- Place 1.25 foot of Granular Subbase.
- Place 0.65 foot of Aggregate for Untreated Base.
- Place 0.35 foot of HMA.

The following exhibit shows the proposed pavement layer structure for Flexible Reconstruction design alternative.

Exhibit 540.08-4: Design Results for the Flexible Reconstruction (20-Year Analysis) Strategy

Pavement Layer	Thickness (ft)
HMA	0.35
New Untreated Aggregate Base	0.65
New Granular Subbase	1.25
Total	**2.25**

Based on the AASHTO Pavement ME Method, this strategy appears to meet all performance criteria for 20 years of service.

Rigid JPCP Reconstruction

This strategy includes the following activities:

- Excavate 2.6 feet full width of the roadway.
- Place a subgrade separation geotextile on the prepared subgrade.
- Place 1.00 foot of Granular Subbase.
- Place 0.5 foot of Aggregate for Untreated Base.
- Place 0.25 foot of HMA.
- Place 10.0 inches of JPCP

The following exhibit shows the proposed rigid pavement layer structure.

Exhibit 540.08-5:Design Results for the Rigid Reconstruction (40-Year Analysis) Strategy

Pavement Layer	Thickness (inches)
JPCP	10.0
HMA Leveling Course	3.0
New Aggregate Base	6.0
New Granular Subbase	12.0
Subgrade Separation Geotextile	Recommended
Total	**31.0**

Based on the AASHTO Pavement ME Method, this strategy appears to meet all performance criteria for 40 years of service.

Pavement Interlayer Systems

A pavement interlayer system is not recommended due to the strategy selected.

Subsurface Pavement Drainage

A subsurface pavement drainage system is not planned for this pavement.

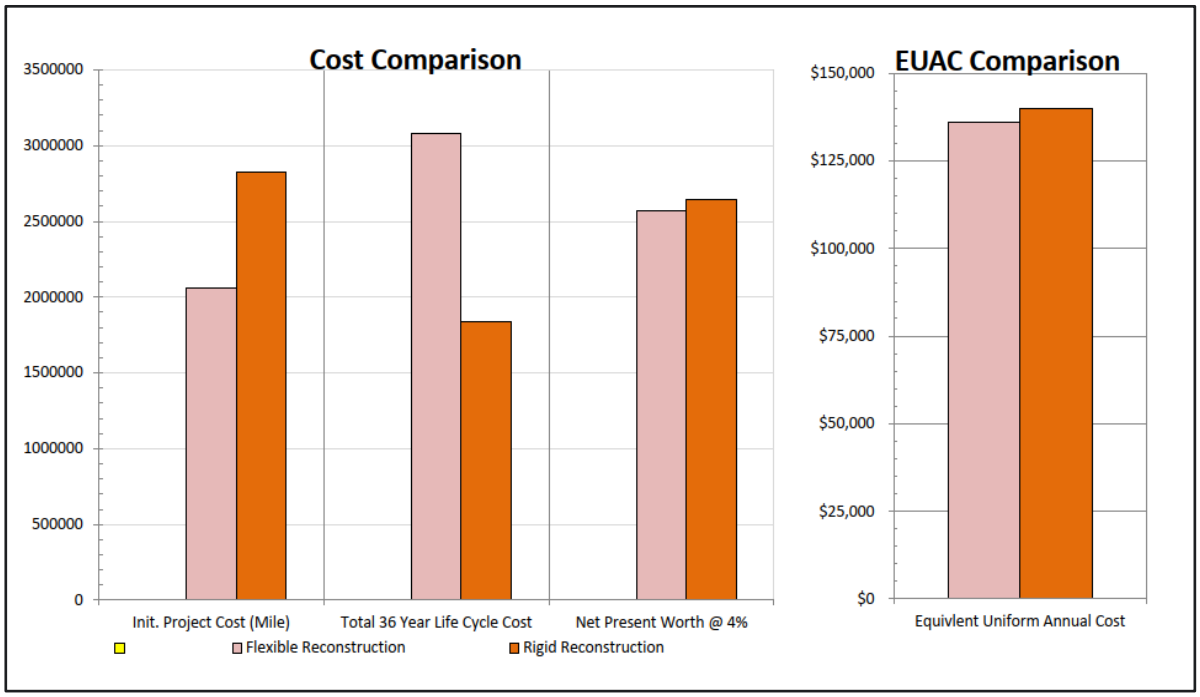
540.09 Life Cycle Cost

Two feasible strategies for US-20 were analyzed using each method described in Appendix G. Flexible reconstruction and rigid reconstruction alternates were analyzed using the ITD LCCA methodology.

LCCAs for all alternates are included in Appendix G.

The following exhibit summarizes the LCCA results.

Exhibit 540.09-6: Life-Cycle Cost Analysis Results[1,2]



Notes:

1 The LCCA uses unit costs provided by ITD.

2 Does not include all costs that are common to each alternative.

Exhibit 540.09-7: Pavement Design Alternative

Pavement Design Alternative	EUAC
Flexible Reconstruction	$136,000
Rigid Reconstruction	$140,000

The LCCA results indicate the Flexible Reconstruction strategy has the most favorable Equivalent Uniform Annual Cost (EUAC), Initial Project Cost, and Net Present Worth.

540.10 Recommendation

Based on the LCCA, Flexible Reconstruction is the preferred strategy.

541 REFERENCES

American Association of State Highway and Transportation Officials (AASHTO). 1993. AASHTO Guide for Design of Pavement Structures. Washington, DC: AASHTO.

American Association of State Highway and Transportation Officials (AASHTO). 1999. AASHTO T 307, Test for Determining the Resilient Modulus of Soils and Aggregate Materials. Washington, DC: AASHTO.

American Association of State Highway and Transportation Officials (AASHTO). 2020. Mechanistic-Empirical Pavement Design Guide; A Manual of Practice. Third Edition. Washington, DC: AASHTO.

ARA - ERES Division. 2001. Guide for Mechanistic-Empirical Design of New and Rehabilitated Pavement Structures – Transportation Research Board. Champaign, IL: ARA.

ASTM International (ASTM). 2006. D4748 Thickness of Bound Pavement Layers Using Short-Pulse Radar. West Conshohocken, PA: ASTM.

Federal Highway Administration (FHWA). 2008. LTPPBind Software Version 3.1. LTPP InfoPave - LTPPBind (dot.gov), McLean, VA: US Department of Transportation Federal Highway Administration.

Federal Highway Administration (FHWA). 2014. Verification, Refinement, and Applicability of Long-Term Pavement Performance Vehicle Classification Rules. Publication No. FHWA-HRT-13-091, McLean, VA: US Department of Transportation Federal Highway Administration.

Idaho Department of Water Resources. Floodplain Management. Accessed August 21, 2025. Wells and Groundwater Management (idaho.gov)

Idaho Department of Water Resources. Groundwater Levels Overview. Accessed August 21, 2025. https://idwr-groundwater-data.idaho.gov/

Idaho Geological Survey. 2012. Idaho Geological Survey Interactive Maps. Accessed August 21, 2025. http://www.idahogeology.org/webmap/.

Idaho Transportation Department (ITD). 1993. RP-112B, Development of Recommendations and Guidelines for Pavement Rehabilitation Design Procedures for the State of Idaho – Phase I: Software Evaluation and Data Analyses.

Idaho Transportation Department (ITD). 2012. RP-193, Implementation of the MEPDG for Flexible Pavements in Idaho.

Idaho Transportation Department (ITD). 2014. RP-211B, Idaho AASHTOWare Pavement ME Design User's Guide Version 1.1.

Idaho Transportation Department (ITD). 2016. Idaho Transportation Department Systems Procedures.

Idaho Transportation Department (ITD). 2015. Idaho Transportation System Pavement Performance Report.(Published 7/29/2016)

Idaho Transportation Department (ITD). 2011. Pavement Rating Manual.

Idaho Transportation Department (ITD). 2023. Standard Specifications for Highway Construction and the 2025 Supplementals for 2023 Standard Specifications (June 2025).

Idaho Transportation Department (ITD). 2020. Materials Manual.

National Highway Institute. 1999. Pavement Subsurface Design FHWA NHI-99-028. Arlington, VA: US Department of Transportation Federal Highway Administration.

Pavement Interactive. http://www.pavementinteractive.org/ . Accessed October 8, 2024.

Salem, Hassan, Fouad Bayomy, and Metwally Al-Taher. 2003. Prediction of Seasonal Variation of Subgrade Resilient Modulus Using LTPP Data. Paper No. 03-03642. Transportation Research Board, University of Idaho.

Transportation Research Board (TRB). 2003. "Harmonized Test Methods for Laboratory Determination of Resilient Modulus for Flexible Pavement Design." NCHRP 1-28A. Univ. of Maryland. May.

US Army Corps of Engineers. 2001. Chapter 20, "Pavement Design for Seasonal Frost Conditions." In UFC Manual 3-260-02 Pavement Design for Airfields. Washington DC: US Department of Defense. June 30, 2001.

US Department of Agriculture. Natural Resources Conservation Service, National Cooperative Soil Survey (NCSS) Web Soil Survey. Accessed August 21, 2025. Web Soil Survey - Home

US Department of Transportation. 2016. Implementation of the Remaining Service Interval Concept. Publication No. FHWA-HRT-16-066, Washington DC: US Department of Transportation.

Von Quintus, H., and B. Killingsworth. 1997. Design Pamphlet for the Determination of Design Subgrade in Support of the 1993 AASHTO Guide for the Design of Pavement Structures. Report No. FHWA-RD-97-083. Federal Highway Administration. McLean, VA. September 30, 1997.

APPENDIX A: GENERAL INFORMATION AND SITE DATA

Appendix A

General Site Information and Site Data

CONTENTS

- Vicinity Map
- Geologic Map
- Site Photographs
- ITD Standard Details (for designer reference)

APPENDIX A: GENERAL INFORMATION AND SITE DATA

VICINITY MAP

Shannon & Wilson

US-20, INL Puzzle to Bonneville County Line
KN 24149
FY 2028
BMP 263.8
EMP 281.0

US-20, INL Puzzle to Bonneville County Line
US-20, Bonneville County Line to Idaho Falls
KN 24149
FY 2028
KN 23244
FY 2027
BMP 263.8
EMP 281.0
BMP 281.0
EMP 301.4

US-20, Bonneville County Line to Idaho Falls
KN 23244
FY 2027
BMP 281.0
EMP 301.4

Arco, ID

US-20, INL Puzzle to Idaho Falls
Bingham and Bonneville Counties, Idaho

VICINITY MAP

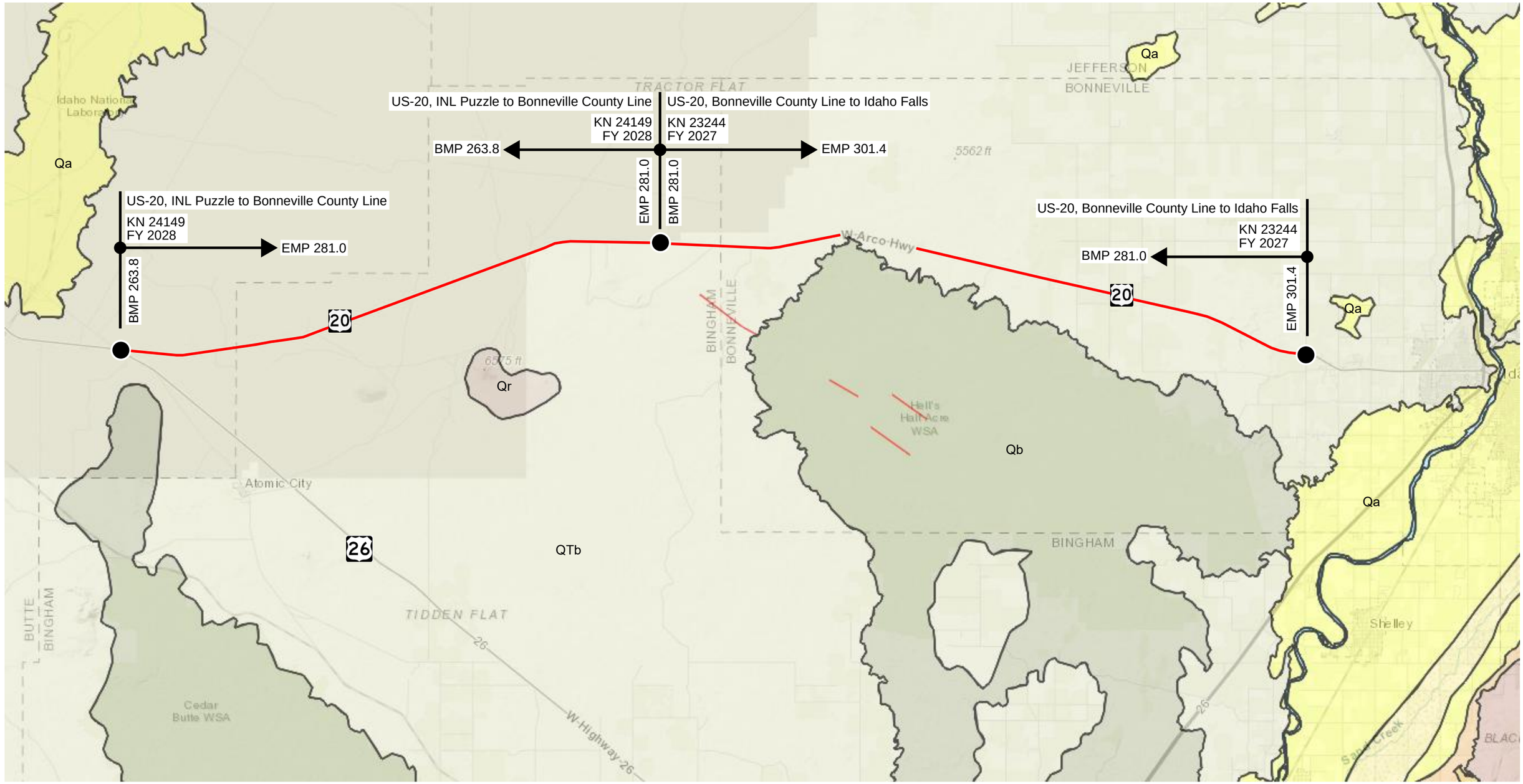
August 2025 71-112895

SHANNON & WILSON FIG. 1

APPENDIX A: GENERAL INFORMATION AND SITE DATA

GEOLOGICAL MAP

Shannon & Wilson



LEGEND

- ITD Milepost
- Project Alignment

- Qa: Alluvial Deposits (Quaternary)
  Lithology: Gravel | Sand | Silt
- Qb: Basalt (Quaternary)
  Lithology: Olivine tholeiite basalt | minor latite | alkaline basalt
- QTb: Basalt (Pleistocene and Pliocene)
  Lithology: Olivine tholeiite basalt
- Qr: Rhyolite (Pleistocene)
  Lithology: Rhyolite tuffs, flows, and domes

US-20, INL Puzzle to Idaho Falls
Bingham and Bonneville Counties, Idaho

GEOLOGICAL MAP

August 2025 71-112895

SHANNON & WILSON **FIG. 2**

APPENDIX A: GENERAL INFORMATION AND SITE DATA

SITE PHOTOGRAPHS

APPENDIX A: GENERAL SITE PHOTOGRAPHS



Site Photograph 1: Looking East for Puzzle Junction (Begin Project)



Site Photograph 2: Looking East near MP 275

APPENDIX A: GENERAL SITE PHOTOGRAPHS



Site Photograph 3: Looking East near MP 280



Site Photograph 4: Looking East near MP 285

APPENDIX A: GENERAL SITE PHOTOGRAPHS



Site Photograph 5: Looking East near MP 290



Site Photograph 6: Looking East near MP 295

APPENDIX A: GENERAL SITE PHOTOGRAPHS



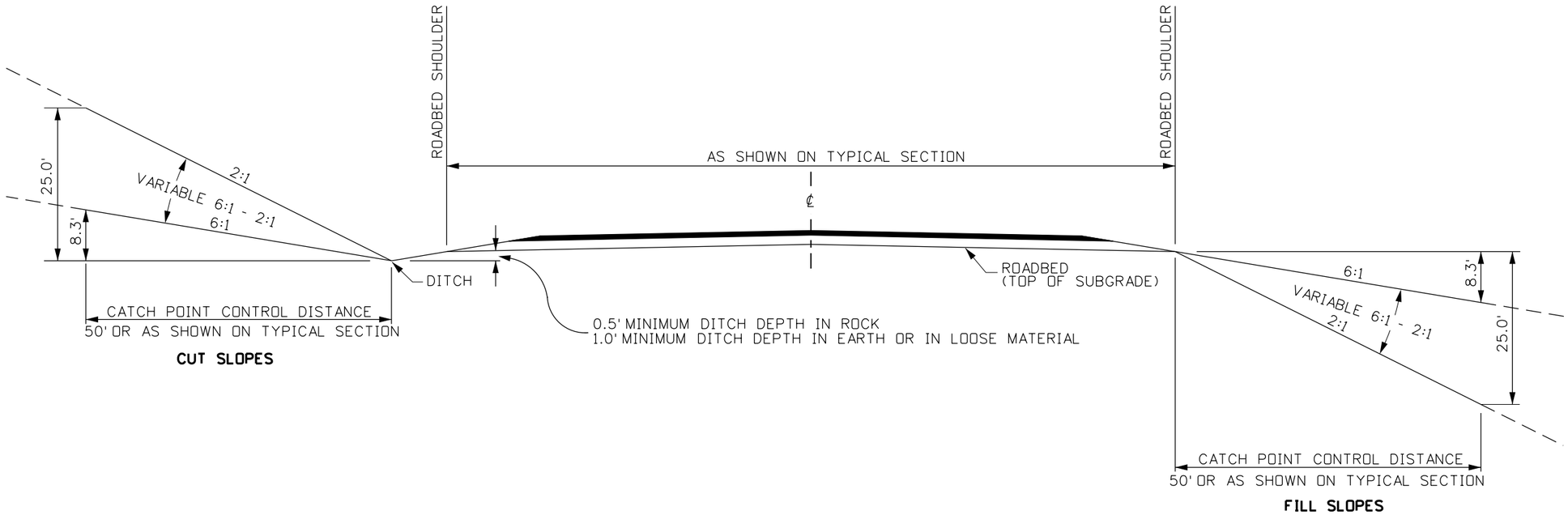
Site Photograph 7: Looking East near MP 300



Site Photograph 8: Looking West Near MP 301.3 (End Project)

APPENDIX A: GENERAL INFORMATION AND SITE DATA

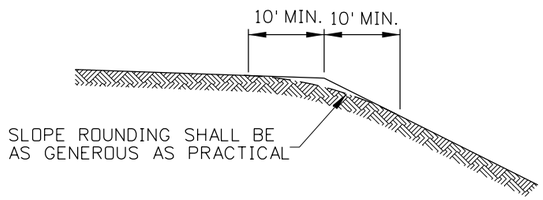
ITD STANDARD DETAILS



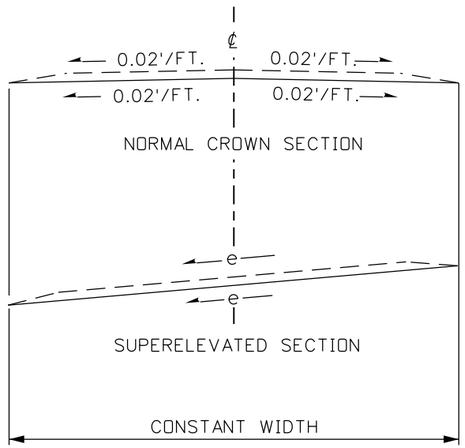
CUT SLOPES

FILL SLOPES

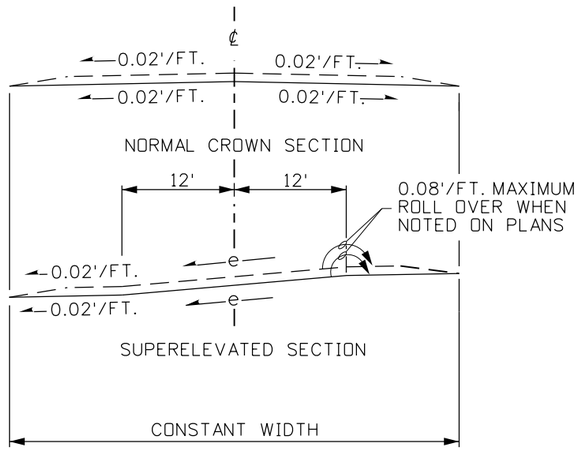
SLOPE GRADING



SLOPE ROUNDING



SUPERELEVATION

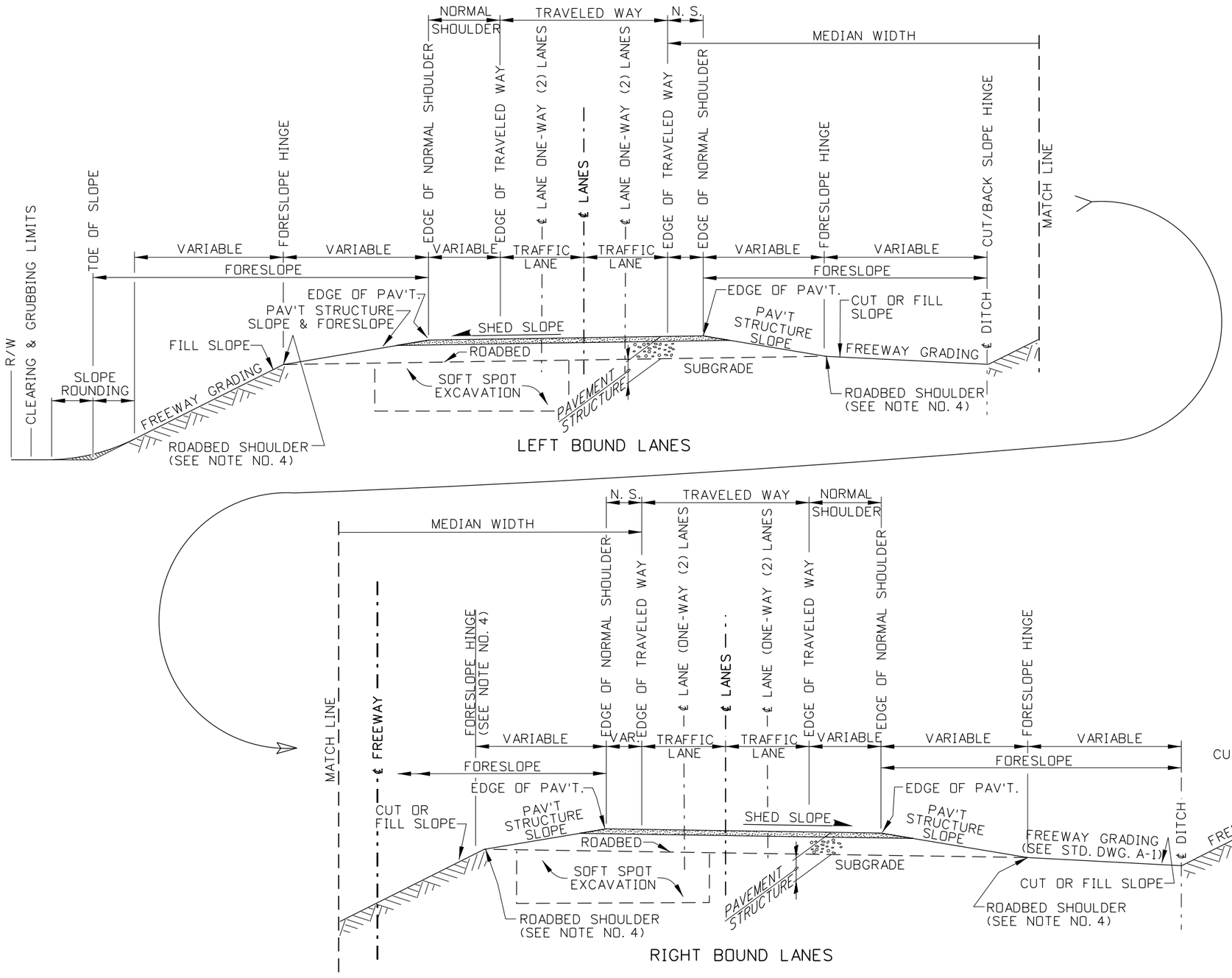


SUPERELEVATION WITH ROLL OVER

NOTES

1. FOR THE 50' CATCH POINT CONTROL DISTANCE:
   USE 6:1 SLOPE FOR CUTS AND FILLS UP TO 8.3' IN HEIGHT.
   USE VARIABLE SLOPES FOR CUTS AND FILLS OVER 8.3' AND UP TO 25' IN HEIGHT MAINTAINING THE CONSTANT 50' CATCH POINT DISTANCE.
   USE 2:1 SLOPE FOR CUTS AND FILLS OVER 25' IN HEIGHT.
   SLOPES SHOWN ARE MAXIMUM, FLATTER SLOPES SHOULD BE USED WHEN FEASIBLE.
2. CUT AND FILL SLOPES IN DIFFICULT TERRAIN MAY REQUIRE SPECIAL CONSIDERATION.
3. SLOPE ROUNDING SHALL CONSIST OF ONE OR MORE CHORDS OR ROUNDED SURFACE. THE DEPTH AND WIDTH OF SLOPE ROUNDING SHALL BE AS DIRECTED.
4. ROLL OVER WILL NOT BE USED UNLESS SHOWN ON THE PLANS.
5. SLOPE TREATMENT SHALL BE AS SHOWN ON THE PLANS OR AS DIRECTED.
6. ALL SLOPES SHALL BE CHECKED TO DETERMINE IF THERE IS A GUARDRAIL WARRANT BASED ON SLOPE HEIGHT AND STEEPNESS.
7. WHEN USING GUARDRAIL, WIDEN SHOULDER AS SHOWN ON THE APPROPRIATE ITD GUARDRAIL STANDARD DRAWING.
8. DRAWING NOT TO SCALE.

REVISIONS				DESIGNED	SCALES SHOWN ARE FOR 11" X 17" PRINTS ONLY	IDAHO TRANSPORTATION DEPARTMENT	PROJECT NO.	STANDARD DETAIL A-2	English	NOT APPROVED FOR CONSTRUCTION
NO.	DATE	BY	DESCRIPTION	DESIGN CHECKED				RURAL PRINCIPAL ARTERIAL GRADING	COUNTY	PRELIMINARY
				DETAILED	CADD FILE NAME				KEY NUMBER	
				DRAWING CHECKED	DRAWING DATE:				SHEET 1 OF 1	



TYPICAL MULTI-LANE HIGHWAY

REVISIONS				DESIGNED	SCALES SHOWN ARE FOR 11" X 17" PRINTS ONLY	IDAHO TRANSPORTATION DEPARTMENT	PROJECT NO.	STANDARD DETAIL A-9	English	NOT APPROVED PRELIMINARY FOR CONSTRUCTION
NO.	DATE	BY	DESCRIPTION	DESIGN CHECKED				ITD ROADWAY NOMENCLATURE LOCATIONS & EXAMPLES	COUNTY	
				DETAILED	CADD FILE NAME				KEY NUMBER	
				DRAWING CHECKED	DRAWING DATE:				SHEET 3 OF 4	

APPENDIX B: SUBSURFACE INVESTIGATION DATA

Appendix B

Subsurface Investigation Data

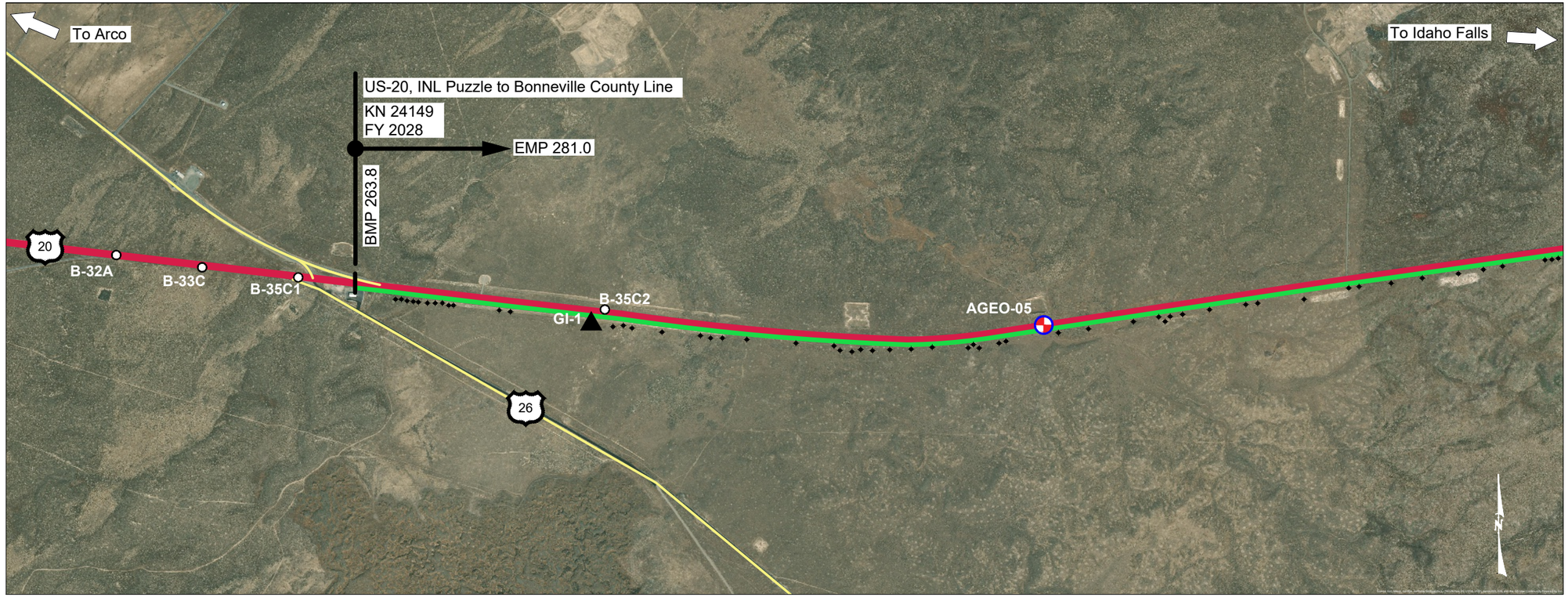
CONTENTS

- Exploration Location Map
- ITD and AGEO Boring Logs
- S&W Boring Logs
- Rock Core Photographs
- Infiltration Tests
- Depth to Bedrock Data

APPENDIX B: SUBSURFACE INVESTIGATION DATA

EXPLORATION LOCATION MAP

Shannon & Wilson





LEGEND

- Existing US-20 Alignment
- Proposed Alignment
- **SR-1** Seismic Refraction Survey Line
- **MP** ITD Milepost
- **B-1** ITD Borings within Existing US-20
- **SW-101** S&W Boring
- **AGEO-01** American Geotechnics Boring
- **GI-1** Guelph Infiltration Test
- Rock Sounding/Exposed Rock Face (See Section 240.07 in the Roadway Materials Report)

500 0 1000 2000 3000

APPROXIMATE SCALE IN FEET

US-20, INL Puzzle to Idaho Falls
Bingham and Bonneville Counties, Idaho

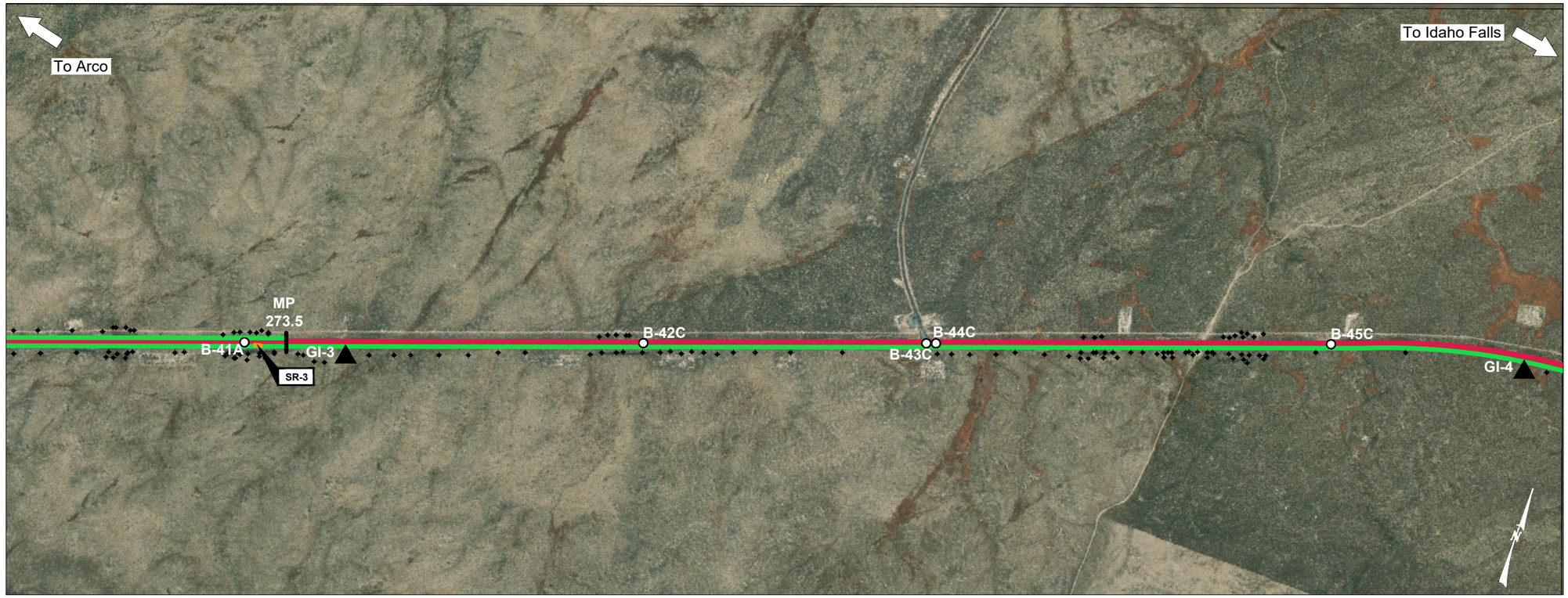
EXPLORATION LOCATION MAP

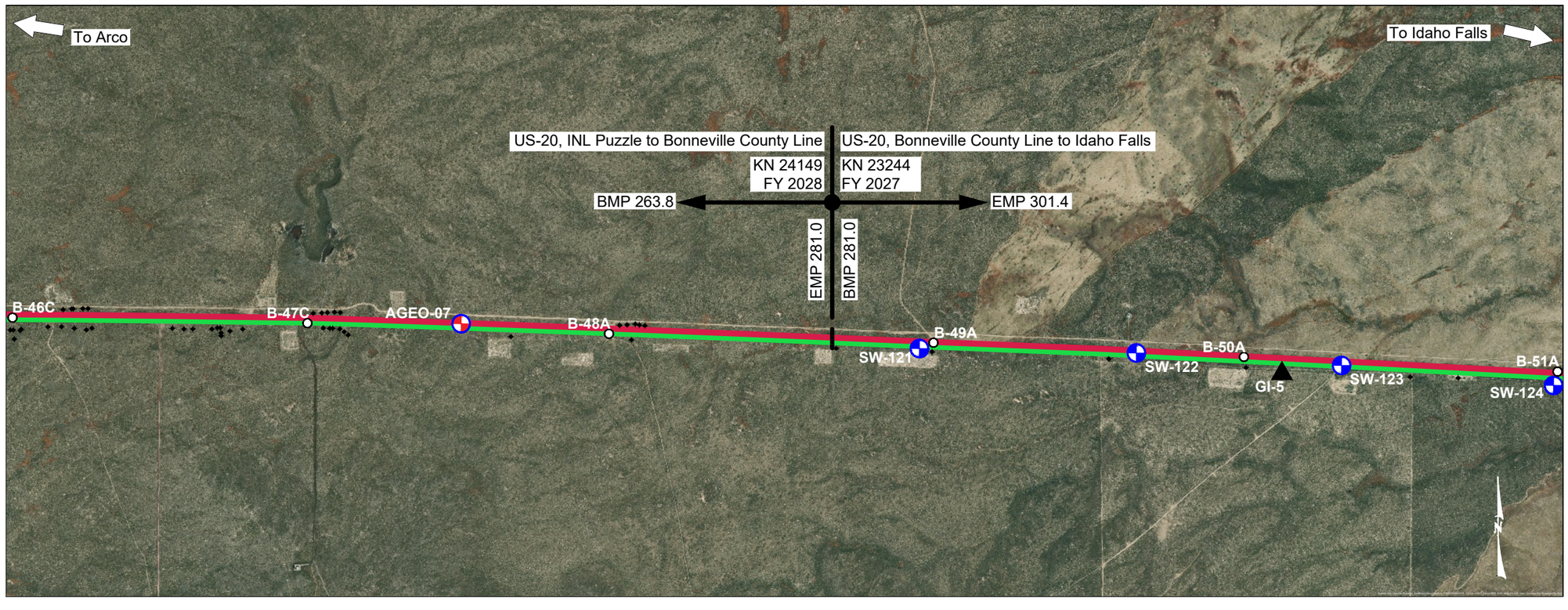
August 2025 71-112895

SHANNON & WILSON **FIG. 3.1**

By: FJC Plot Date: 8/27/2025 4:30:11 PM File Name: 112895 INL Puzzle to ID_Exploration Location Map_11 PRLIMED 8-27-25.dwg

Shannon & Wilson





LEGEND

- Existing US-20 Alignment
- Proposed Alignment
- SR-1 — Seismic Refraction Survey Line
- MP — ITD Milepost
- B-1 — ITD Borings within Existing US-20
- SW-101 — S&W Boring
- AGEO-01 — American Geotechnics Boring
- GI-1 — Guelph Infiltration Test
- Rock Sounding/Exposed Rock Face (See Section 240.07 in the Roadway Materials Report)

500 0 1000 2000 3000

APPROXIMATE SCALE IN FEET

US-20, INL Puzzle to Idaho Falls
Bingham and Bonneville Counties, Idaho

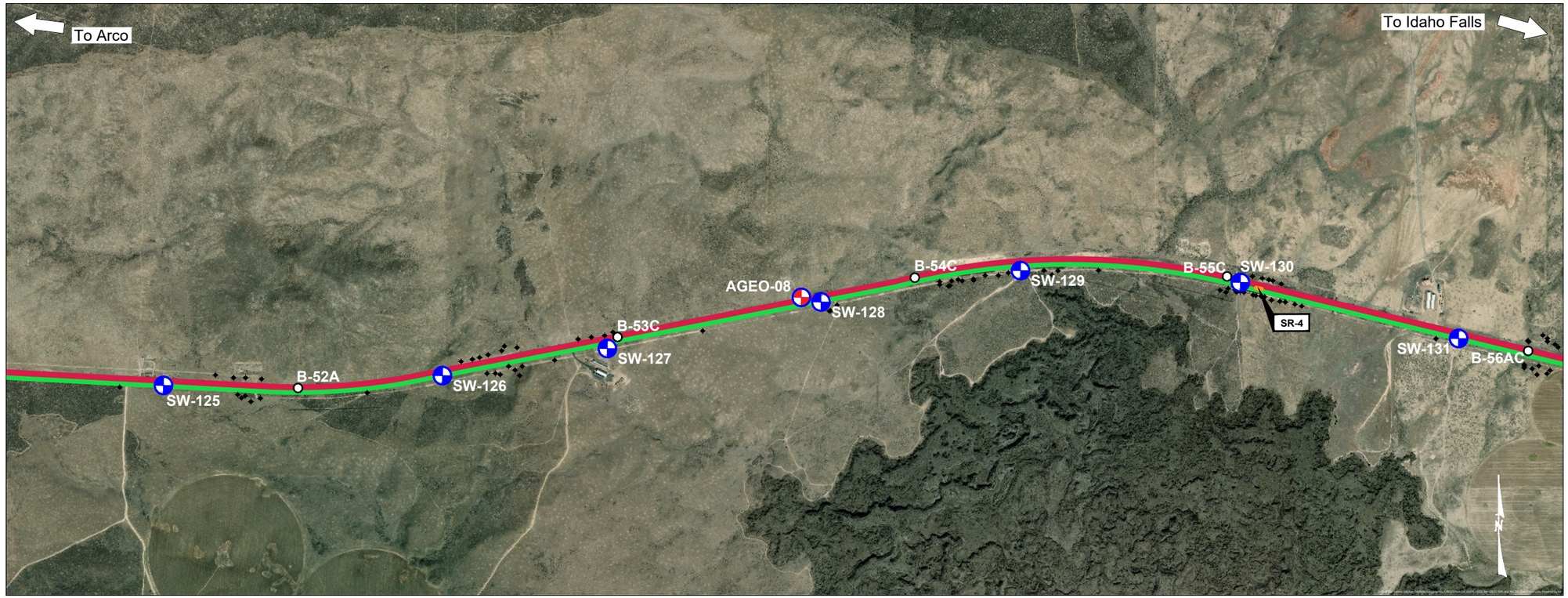
EXPLORATION LOCATION MAP

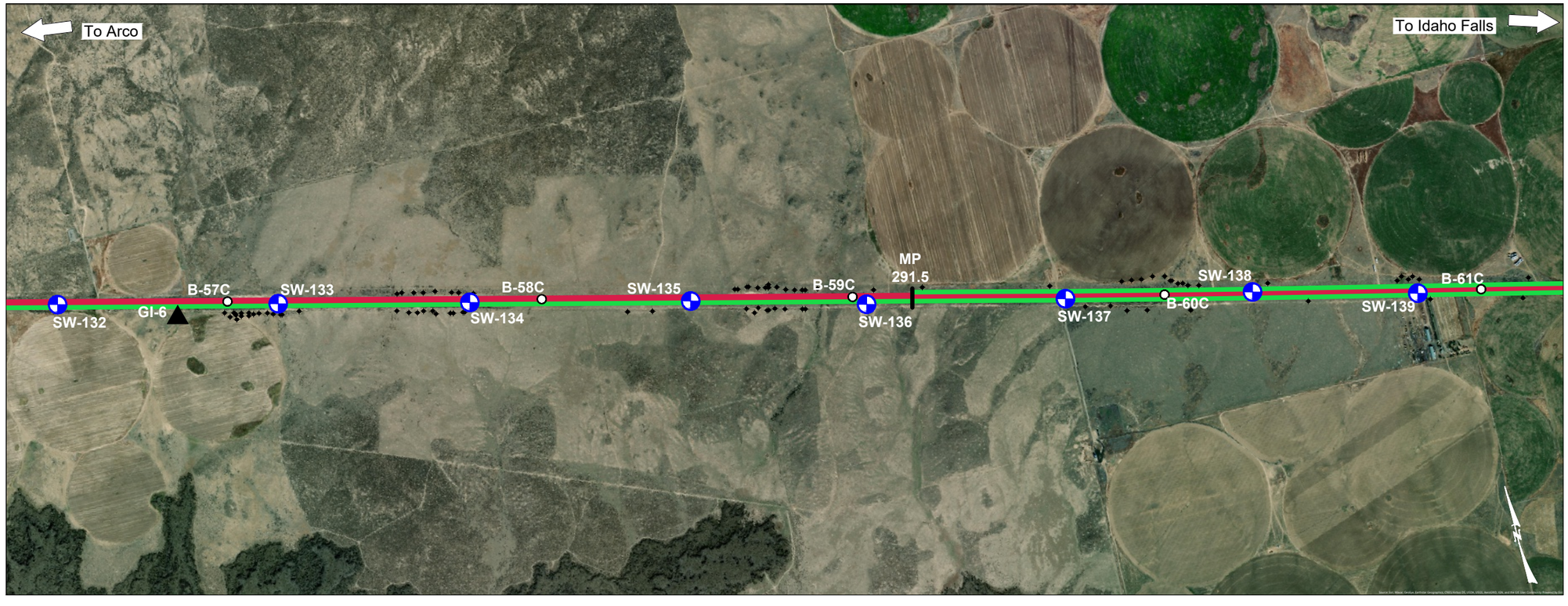
August 2025 71-112895

SHANNON & WILSON **FIG. 3.2**

By: FJC Plot Date: 8/27/2025 4:30:11 PM File Name: 112895 INL Puzzle to ID_Exploration Location Map_11 PREPARED 8-27-25.dwg

Shannon & Wilson





LEGEND

- Existing US-20 Alignment
- Proposed Alignment
- SR-1 — Seismic Refraction Survey Line
- MP — ITD Milepost
- B-1 — ITD Borings within Existing US-20
- SW-101 — S&W Boring
- AGEO-01 — American Geotechnics Boring
- GI-1 — Guelph Infiltration Test
- Rock Sounding/Exposed Rock Face (See Section 240.07 in the Roadway Materials Report)

500 2000
0 1000 3000
APPROXIMATE SCALE IN FEET

US-20, INL Puzzle to Idaho Falls
Bingham and Bonneville Counties, Idaho

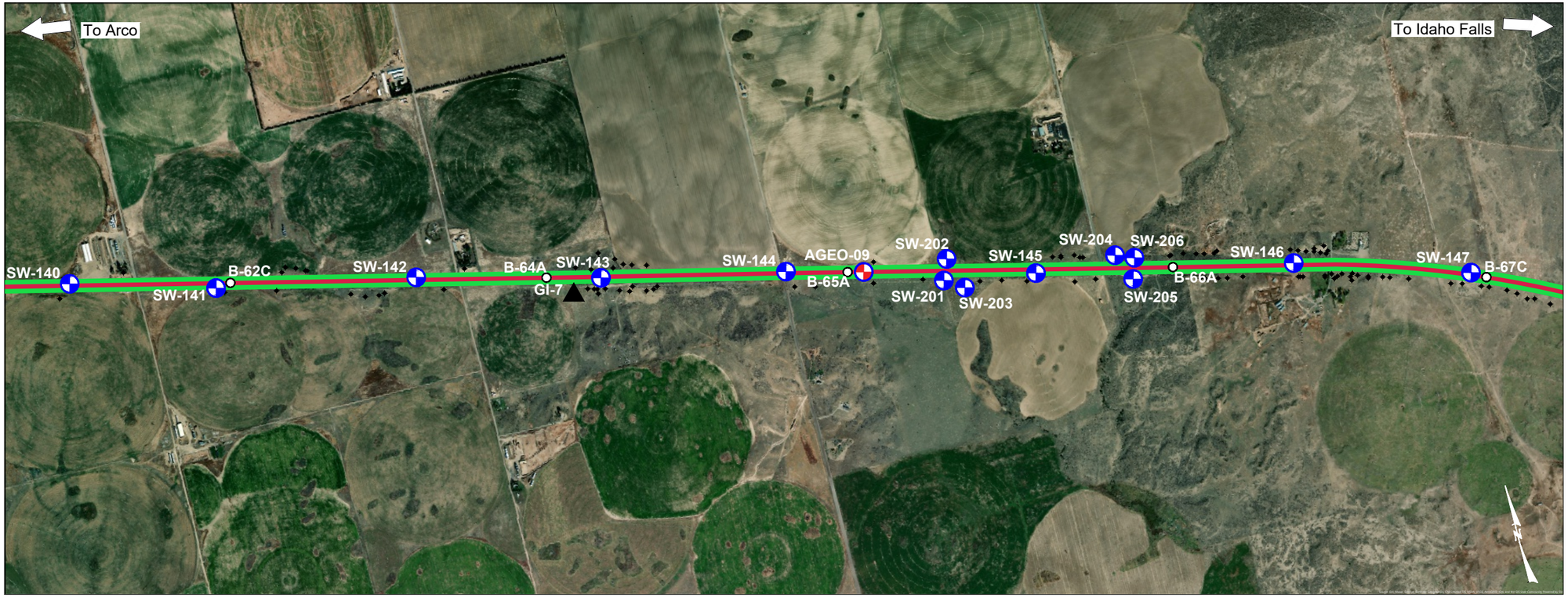
EXPLORATION LOCATION MAP

August 2025 71-112895

SHANNON & WILSON **FIG. 3.3**

By: FJC Plot Date: 8/27/2025 4:30:11 PM File Name: 112895 INL Puzzle to IF_Exploration Location Map_11 PRLIMED 8-27-25.dwg

Shannon & Wilson





LEGEND

- Existing US-20 Alignment
- Proposed Alignment
- SR-1 — Seismic Refraction Survey Line
- MP — ITD Milepost
- B-1 — ITD Borings within Existing US-20
- SW-101 — S&W Boring
- AGEO-01 — American Geotechnics Boring
- GI-1 — Guelph Infiltration Test
- Rock Sounding/Exposed Rock Face (See Section 240.07 in the Roadway Materials Report)

500 2000
0 1000 3000
APPROXIMATE SCALE IN FEET

US-20, INL Puzzle to Idaho Falls
Bingham and Bonneville Counties, Idaho

EXPLORATION LOCATION MAP

August 2025 71-112895

SHANNON & WILSON **FIG. 3.4**

By: FJC Plot Date: 8/27/2025 4:30:11 PM File Name: 112895 INL Puzzle to ID_Exploration Location Map_11 PRLIMED X8-27-25.dwg

APPENDIX B: SUBSURFACE INVESTIGATION DATA

ITD AND AGEO BORING LOGS

CONDITION SURVEY LOGS

DATE DRILLED: 11/3/2021

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Solid Stem Auger - SSA **LOCATION** _____

COLLAR ELEV. _____ **HOLE SIZE** 6" **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 280.28

GPS COORDINATES LAT: 43.55361617° / Long: -112.5710844° **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT				0.23	0.23
				CRABS (CEMENT RECYCLED ASPHALT BASE)				1.12	1.35
	2.5			light Tan, 1/2" Good crushed aggregate base				2.00	3.35
	5.0			Tan, compact, slightly moist, SILT.				2.15	5.50

Bottom of hole at 5.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED: 11/3/2021

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Solid Stem Auger - SSA **LOCATION** _____

COLLAR ELEV. _____ **HOLE SIZE** 6" **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 281.32

GPS COORDINATES LAT: 43.5531914º / Long: -112.5506406º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT				0.20	0.20
				CRABS (CEMENT RECYCLED ASPHALT BASE)				1.20	1.40
				(SAMPLE 005 composite from Test hole's 49A and 50A) Red, moderatly dense, dry, VOLCANIC CINDERS (2" minus)				0.60	2.00
	2.5			Tan, soft, slightly moist to moist, SILTY CLAY. Embankment fill					
	5.0							6.80	8.80

Bottom of hole at 5.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED: 11/3/2021

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Solid Stem Auger - SSA **LOCATION** Bingham Co.

COLLAR ELEV. _____ **HOLE SIZE** 6" **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 282.31

GPS COORDINATES LAT: 43.5525596º / Long: -112.5307335º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)	TESTS
				ASPHALT				0.17	0.17	
				CRABS (CEMENT RECYCLED ASPHALT BASE)				1.23	1.40	
				(SAMPLE 005 composite from Test hole's 49A and 50A) Red, moderatly dense, dry, VOLCANIC CINDERS (2" PLUS.				0.60	2.00	
	2.5			Tan, soft, slightly moist to moist, SILTY CLAY. Embankment fill						Composite sample from Test hole numbers 49A & 50A
	5.0				33	11		6.80		006-P 5.5' - 8.8' (CL) Fines = 94.2% Sample collected to develope correlation between R value in sample 005 and modulus of subgrade reaction.
	7.5								8.80	

Bottom of hole at 8.2 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED: 11/3/2021

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Solid Stem Auger - SSA **LOCATION** Bonneville Go.

COLLAR ELEV. _____ **HOLE SIZE** 6" **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 283.3

GPS COORDINATES LAT: 43.55186678° / Long: -112.510951° **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT				0.17	0.17
				CRABS (CEMENT RECYCLED ASPHALT BASE)				0.78	0.95
				Red, moderatly dense, dry, VOLCANIC CINDERS (2" minus)				0.40	1.35
				Tan to brown, soft to slightly compact, moist to slightly moist, SILTY CLAY with sand				0.65	2.00
				Large boulder or basalt bedrock?				0.20	2.20

Bottom of hole at 2.2 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED: 11/3/2021

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Solid Stem Auger - SSA **LOCATION** _____

COLLAR ELEV. _____ **HOLE SIZE** 6" **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 284.31

GPS COORDINATES LAT: 43.5512523º / Long: -112.4909468º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT				0.22	0.22
				CRABS (CEMENT RECYCLED ASPHALT BASE)				0.28	0.50
				"granular subbase" Dark brown, loose, well rounded GRAVEL with sand. (-1/2" clasts)				0.55	1.05
				Red, moderatly dense, moist, VOLCANIC CINDERS.				0.45	1.50
	2.5			Tan, soft, moist, SILTY CLAY. Composite sample from TH's 49A and 52A				4.00	
	5.0								5.50

Bottom of hole at 5.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 285.325

GPS COORDINATES LAT: 43.55362835º / Long: -112.4710764º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT next to longitudinal crack				0.37	0.37
				CRABS (CEMENT RECYCLED ASPHALT BASE) Note: Upper conact with asphalt stripped from 0.37' to 0.47'. abundant red cinders incorporated into CRABS.				0.43	0.80
				Redish brown, compact, dry, GRAVEL and VOLCANIC CINDERS 1/2"minus				0.20	1.00
				Red, compact, dry, VOLCANIC CINDERS 1"minus				0.50	1.50
				Tan, soft to slightly stiff, moist to slightly moist, SILTY CLAY				0.30	1.80

Bottom of hole at 1.8 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

PROJECT: FY14 Corridor Inventory
LOCATION: East Idaho Loop Corridor, Idaho

BORING NO. B-08

METHOD: Hollow-Stem Auger
DATE LOGGED: 9/21/2015
LOGGED BY: Chuck Burgert, PE

GROUNDWATER:

Groundwater not encountered on 9/21/2015

LATITUDE: 43.5554495°
LONGITUDE: -112.4587126° by Hand Held GPS

DEPTH (ft)	TYPE - No.	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.0		CR-8		Asphalt Concrete- Core recovery 4.75", Measured insitu 4.75". Seal Coat; dense AC to 0.40'; overlay interfaces at 0.16' and 0.35'; delaminated at 0.16' and 0.35'.	0.40	0.40	Located on US-20, westbound travel lane near MP 285.96.
0.5				Concrete Recycled Asphalt Base Stabilization- (CRABS) Core recovery 2.0", Measured insitu 2.0"; broken.	0.16	0.56	
		GB-5		Well-Graded Sand with Gravel (SW)- (BASE) 56% Hard, fine to coarse sand; 42% hard, subrounded to subangular gravel to 1"; 2% non-plastic fines; moist; brown.	0.39	0.95	
1.0		GB-6			0.75		
1.5				Well-Graded Sand with Silt and Gravel (SW-SM)- (BORROW) 50% Hard, fine to coarse sand; 40% hard, subrounded to subangular gravel to 3/4"; 10% non-plastic fines; moist; reddish gray (cinders).		1.70	
2.0		BK-3		Lean Clay with Sand (CL)- 82% Low plasticity fines; LL= 31; PL= 19; PI= 12; 16% hard, subrounded, fine to coarse sand; 2% hard, subrounded gravel to 3/8"; ω= 15%, tan gray.	1.80		R-Value= 35. Pocket Penetrometer= 1.0 tsf.
2.5							
3.0						3.50	
3.5				Silt (ML)- moist, tan.			Pocket Penetrometer= 1.5 tsf.
4.0	SS-3				1.50		
4.5							
5.0						5.00	

Bottom of Boring at 5.0 ft on 9/21/2015.

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 286.31

GPS COORDINATES LAT: 43.55646123º / Long: -112.4517981º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	PI (%)	MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT widly spaced transverse cracks, intermittent. 3 layers, top chip seal, overlay and origonal				0.37	0.37
				CRABS (CEMENT RECYCLED ASPHALT BASE) /RABS? Note: large pieces of asphalt mixed with crabs				0.73	1.10
				Redish brown, compact, dry, GRAVEL and VOLCANIC CINDERS 1/2"minus				0.40	1.50

Bottom of hole at 1.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 287.32

GPS COORDINATES LAT: 43.5565419º / Long: -112.431815º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	PI (%)	MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT major distress at centerline and EBL right wheel path				0.50	0.50
				CRABS (CEMENT RECYCLED ASPHALT BASE) Note: stripped of cement.				0.60	1.10
				Redish brown, compact, dry, GRAVEL and VOLCANIC CINDERS 1"minus				0.40	1.50

Bottom of hole at 1.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

56AC

DATE DRILLED: 11/3/2021

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Solid Stem Auger - SSA **LOCATION** _____

COLLAR ELEV. _____ **HOLE SIZE** 6" **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 288.299

GPS COORDINATES LAT: 43.5532019º / Long: -112.4129133º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT				0.36	0.36
				CRABS (CEMENT RECYCLED ASPHALT BASE)				0.49	0.85
				Red, moderatly dense, dry, VOLCANIC CINDERS (1" minus)				0.55	1.40
	2.5			Tan, slightly compact, slightly moist to moist, SILTY CLAY.				4.10	5.50
	5.0								

Bottom of hole at 5.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 289.299

GPS COORDINATES LAT: 43.5499194º / Long: -112.3935167º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT 3' from longitudinal crack. numerous vugs in core.				0.34	0.34
				CRABS (CEMENT RECYCLED ASPHALT BASE) Note: weak crabs with abundant large asphalt pieces mixed with red cinders incorporated into CRABS.				0.66	1.00
				Redish brown, compact, dry, GRAVEL and VOLCANIC CINDERS 1" plus				0.50	1.50
				Tan, soft, slightly moist to moist, SILTY CLAY.				0.50	2.00

Bottom of hole at 2.0 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 290.295

GPS COORDINATES LAT: 43.54654458º / Long: -112.3742022º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT VERY MINOR LONGITUDINAL CRACKING				0.25	0.25
				CRABS (CEMENT RECYCLED ASPHALT BASE) Note: Upper contact with asphalt strongly bonded in upper 0.1 of CRABS. abundant red cinders incorporated into CRABS.				0.75	1.00
				Redish brown, compact, dry, VOLCANIC CINDERS				0.30	1.30

Bottom of hole at 1.3 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 291.295

GPS COORDINATES LAT: 43.5432428º / Long: -112.3548113º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT in rutted, aligator cracked and sealed in wheel path rut. Note: Core shows possible asphalt shoving with cur.ved surface				0.30	0.30
				CRABS (CEMENT RECYCLED ASPHALT BASE) Note; not cemented CRABS totally stripped of cement binder due to water/				0.70	1.00

Bottom of hole at 1.3 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 292.95

GPS COORDINATES LAT: 43.5398247º / Long: -112.3355539º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	PI (%)	MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT core is 1" from longitudinal crack. side closes to crack shows stripping of asphalt binder.				0.30	0.30
				CRABS (CEMENT RECYCLED ASPHALT BASE) Weak to stripped of cement in layers.				0.80	1.10
				Red, moderatly dense, dry, VOLCANIC CINDERS (1" minus)				0.40	1.50
				Tan, slightly stiff to stiff, moist, SILTY CLAY.				0.50	2.00

Bottom of hole at 1.3 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 293.3

GPS COORDINATES LAT: 43.53664342º / Long: -112.3159974º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT core is 6" from longitudinal and transverse crack. Crack side closest to cracks shows stripping of asphalt binder along lift contacts.				0.30	0.30
				CRABS (CEMENT RECYCLED ASPHALT BASE) Weak to stripped of cement in layers.				0.70	1.00
				Red, moderatly dense, dry, VOLCANIC CINDERS,				0.50	1.50
				Tan, slightly stiff to stiff, slightly moist, SILTY CLAY.				0.50	2.00

Bottom of hole at 2.0 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 294.3

GPS COORDINATES LAT: 43.53345468º / Long: -112.2966958º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	PI (%)	MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT Little distress in this section of roadway mainly Tansverse cracks. CRABS still bonded to asphalt.				0.30	0.30
				CRABS (CEMENT RECYCLED ASPHALT BASE) Good strong cement treated base in upper core still bonded to asphalt. Weak to stripped of cement below 0.65'				0.70	1.00
				Red, moderatly dense, dry, VOLCANIC CINDERS (1" plus)				0.50	1.50
				Tan, slightly stiff to stiff, slightly moist, SILTY CLAY.				0.50	2.00

Bottom of hole at 2.0 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED: 11/3/2021

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Solid Stem Auger - SSA **LOCATION** _____

COLLAR ELEV. _____ **HOLE SIZE** 6" **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 295.32

GPS COORDINATES LAT: 43.53019658º / Long: -112.2770652º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT				0.30	0.30
				CRABS (CEMENT RECYCLED ASPHALT BASE)				0.70	1.00
				Red, moderatly dense, dry, VOLCANIC CINDERS (2" minus)				0.50	1.50
				(Embankment fill) Tan, soft to compact, slightly moist to moist, SILT.				9.00	10.50

2.5

5.0

7.5

10.0

Bottom of hole at 10.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED: 11/3/2021

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Solid Stem Auger - SSA **LOCATION** _____

COLLAR ELEV. _____ **HOLE SIZE** 6" **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 296.3

GPS COORDINATES LAT: 43.5269656º / Long: -112.2578895º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)	TESTS
				ASPHALT				0.30	0.30	
				CRABS (CEMENT RECYCLED ASPHALT BASE)				0.70	1.00	
				Red, moderatly dense, dry, VOLCANIC CINDERS (2" minus)				0.50	1.50	
				(Embankment fill) Tan, compact, slightly moist to dry, SILT.						
	2.5									
	5.0				27	3		6.70		008-P 5.5' - 8.2' (ML) Fines = 98.3%
	7.5								8.20	

Bottom of hole at 8.2 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

PROJECT: FY14 Corridor Inventory
LOCATION: East Idaho Loop Corridor, Idaho

BORING NO. B-09

METHOD: Hollow-Stem Auger
DATE LOGGED: 9/21/2015
LOGGED BY: Chuck Burgert, PE

GROUNDWATER:

Groundwater not encountered on 9/21/2015

LATITUDE: 43.5269178°
LONGITUDE: -112.2574599° by Hand Held GPS

AMERICAN GEO TECHNICS

DEPTH (ft)	TYPE - No.	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
		CR-9		Asphalt Concrete- Core recovery 4.00", Measured insitu 4.00". Seal Coat; dense AC to 0.33'; overlay interface at 0.17'.	0.33	0.33	Located on US-20, westbound travel lane near MP 296.32.
0.5				Concrete Recycled Asphalt Base Stabilization- (CRABS) Core recovery 6.25", Measured insitu 6.25"; broken.	0.52	0.85	
1.0		GB-3		Well-Graded Sand with Silt and Gravel (SW-SM)- (BASE) 62% Hard, fine to coarse sand; 32% hard, subangular gravel to 1"; 6% non-plastic fines; moist; gray brown.	0.45	1.30	
1.5		GB-4			0.30	1.60	
2.0				Poorly Graded Sand with Silt and Gravel (SP-SM)- (BORROW) 48% Hard, fine to coarse sand; 41% hard, subrounded to subangular gravel to 1-1/2"; 11% non-plastic fines; moist, brown.			
2.5				Silty Clay (CL-ML)- 86% Low plasticity fines; LL= 25; PL= 21; PI= 4; 13% hard, subrounded, fine to coarse sand; 1% hard, subrounded gravel to 3/8"; ω= 21%, tan.			
3.0		BK-2					R-Value= 54.
3.5					3.40		
4.0	SS-2						
4.5							
5.0						5.00	

Bottom of Boring at 5.0 ft on 9/21/2015.

CONDITION SURVEY LOGS

DATE DRILLED: 11/3/2021

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Solid Stem Auger - SSA **LOCATION** _____

COLLAR ELEV. _____ **HOLE SIZE** 6" **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 297.31

GPS COORDINATES LAT: 43.52367632º / Long: -112.2382587º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT				0.30	0.30
				CRABS (CEMENT RECYCLED ASPHALT BASE)				0.50	0.80
				Brown, compact, dry, SANDY GRAVEL with minor volcanic cinders 1" minus.				0.70	1.50
	2.5			Tan, compact, slightly moist to dry, SILT.				4.00	
	5.0								5.50

Bottom of hole at 5.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 298.31

GPS COORDINATES LAT: 43.51982433º / Long: -112.2191622º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT cminor distress in roadway near core, mostly near centerline paving joint. Two lifts: upper 0.2 is 1/2"mix and lower lift is a large stone mix. Vugs in lower large stone mix.				0.35	0.35
				CRABS (CEMENT RECYCLED ASPHALT BASE) Weak to stripped of cement in layers.				0.55	0.90
				Brown, compact, dry, GRAVEL				0.20	1.10
				Red, moderatly dense, dry, VOLCANIC CINDERS (1" plus).				0.40	1.50
				Tan, soft to stiff, slightly moist, SILT.				0.50	2.00

Bottom of hole at 2.0 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 299.3

GPS COORDINATES LAT: 43.51337585° / Long: -112.2016001° **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	PI (%)	MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT cminor distress in roadway near core, mostly near centerline paving joint. Two lifts: upper 0.18 is 1/2"mix and lower lift is a large stone mix. some stripping between 0.18' and 0.22'.				0.40	0.40
				CRABS (CEMENT RECYCLED ASPHALT BASE)				0.60	1.00
				Brown, compact, dry, GRAVEL well rounded clasts with some Volcanic Cinders.				0.50	1.50

Bottom of hole at 1.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 300.301

GPS COORDINATES LAT: 43.50694792º / Long: -112.1837323º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT cminor distress in roadway near core, mostly near centerline paving joint. chip seal plus Two lifts: upper 0.17 is 1/2"mix and lower lift is a large stone mix. diagonal crack appears Top Down.				0.30	0.30
				CRABS (CEMENT RECYCLED ASPHALT BASE) diagonal faulted crack in crabs corrisponds to crack in asphalt. competent CRABS to 0.7'.				0.70	1.00
				Brown, compact, dry, GRAVE (1/2' minus) and Volcanic Cinders (1" minus).				0.50	1.50

Bottom of hole at 1.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

CONDITION SURVEY LOGS

DATE DRILLED:

SHEET 1 of 1

DISTRICT 6

KEY NUMBER _____ **PROJECT NUMBER** Multiple **PROJECT NAME** Arco to Idaho Falls

COUNTY Multiple **GROUNDWATER MEASUREMENT(S)** No Water Encountered

DRILLER/CONTRACTOR D6 Michael Martin **LOGGED BY** Shawn Enright **GEOLOGIST** Shawn Enright

DRILLING METHOD Pavement Core **LOCATION** _____

COLLAR ELEV. _____ **ROUTE/SEGMENT/MILEPOST** US-20 / 002070 / 301.3

GPS COORDINATES LAT: 43.5045042º / Long: -112.1643208º **STATION** _____

ELEV. (ft)	DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials.)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	LAYER THICKNESS (ft)	DEPTH (ft)
				ASPHALT two lifts of 0.25 each. upper lift shows segregation of aggregate. Pavement Distress: Minor surface cracks begining both longitudinal and transverse with minor rutting.				0.50	0.50

Bottom of hole at 0.5 feet.

AUGER HOLES - 022415.GDT - 12/22/21 11:03 - C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINTCL\PROJECTS\PROGRAM ARCO TO IDAHO FALLS.GPJ

APPENDIX B: SUBSURFACE INVESTIGATION DATA

S&W BORING LOGS

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger/HQ-3 Diamond Core
DATE LOGGED: 8/12/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-121

GROUNDWATER:

Groundwater not encountered on 8/12/2025

LATITUDE: 43.55304445°
LONGITUDE: -112.5509232° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY % (RQD)	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
2					Sandy Silt (ML) - About 70% nonplastic fines; about 30% fine to medium sand; dry; light brown; vegetation present.	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
	SS-42	42	25/2.5"		Similar to above, except with fractured basalt.	Sampler refusal at 2.7', switch to HQ3 coring.
4	CR-43	100 (92)			Basalt - (BEDROCK) Medium strong rock (R3), gray, fine grained, highly to moderately vesicular, stepped, closely-spaced, slightly to moderately weathered; 45 degree angle at joint from horizontal surface.	CR-43: Compressive Strength of Intact Rock Cores = 5,117 psi at 3.5'-4.0'.
6	CR-44	99 (32)			Similar to above, except slightly vesicular and slightly weathered.	
8					Bottom of Boring at 8.3 ft on 8/12/2025.	

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/12/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-122

GROUNDWATER:

Groundwater not encountered on 8/12/2025

LATITUDE: 43.55272972°
LONGITUDE: -112.5376198° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Sandy Silt (ML) - About 70% nonplastic fines; about 30% fine to medium sand; dry; light brown; traces of red scoracious basalt and organics resent.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0				Similar to above, except about 60% nonplastic fines; 40% sand; strong HCl reaction.			
2.5							
3.0	OSS-45	88			6.00		
3.5							
4.0				Similar to above, except strong cementation.			
4.5							
5.0	SS-46	33					
5.5							
6.0						6.00	
				Bottom of Boring at 6.0 ft on 8/12/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/12/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-123

GROUNDWATER:

Groundwater not encountered on 8/12/2025

LATITUDE: 43.55220926°
LONGITUDE: -112.5246077° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Gravel Road (GP-GM) - About 60% hard, fine to coarse, rounded gravel to 2"; about 30% hard, fine to coarse, subangular sand; about 10% nonplastic fines; dry; light brown.	1.00	1.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0				Silty Sand (ML) - About 70% nonplastic fines; about 25% fine to medium sand; about 5% fine, subrounded gravel to 3/8"; moist; brown; strong HCl reaction.			
1.5							
2.0							
2.5					3.00		
3.0	OSS-47	54					
3.5							
4.0						4.00	
	SS-48	60		Sandy Lean Clay with Gravel (CL) - About 50% low plasticity fines; about 30% medium hard, fine to coarse, subangular to angular sand; about 20% medium hard, fine to coarse, subangular basalt gravel; moist; brown.	0.70		Sampler refusal at 4.7' on bedrock.
4.5						4.70	

Bottom of Boring at 4.7 ft on 8/12/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

BORING NO. SW-124

METHOD: Hollow Stem Auger
DATE LOGGED: 8/6/2025
LOGGED BY: Franklin Caceres, WAQTC

GROUNDWATER:

Groundwater not encountered on 8/6/2025

LATITUDE: 43.55175261°
LONGITUDE: -112.5106945° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
			Sandy Silt (ML) - About 70% nonplastic fines; about 30% fine to medium sand; dry; light brown; organics present.	0.50	0.50	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings Auger refusal at 0.5' on bedrock. Basalt present on surface.
0.5			Bottom of Boring at 0.5 ft on 8/6/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/6/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-125

GROUNDWATER:

Groundwater not encountered on 8/6/2025

LATITUDE: 43.55133363°
LONGITUDE: -112.499618° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5		GB-30		Silt (ML) - About 95% nonplastic to low plasticity fines; about 5% fine to coarse, subangular sand; moist; brown; organics present.	2.00	2.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0				Silt (ML) -			ST-31: 650-800 psi
2.5	BK-32	ST-31			1.60		
3.0				90% fines; LL=NV, PL=NV, PI=NP; 10% fine sand; moist, ϖ=18.1%; brown.			
3.5				Bottom of Boring at 3.6 ft on 8/6/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/7/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-126

GROUNDWATER:

Groundwater not encountered on 8/7/2025

LATITUDE: 43.55183269°
LONGITUDE: -112.4818863° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Silt (ML) - About 95% nonplastic to low plasticity fines; slow dilatancy; about 5% fine to medium sand; dry; brown; organics present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0					2.00		
1.5							
2.0						2.00	
2.5				Silty Clay (CL-ML) 96% fines, LL=26, PL=21, PI=5; 4% fine sand; moist; ω=12.4%; brown.			
3.0	OSS-33	96					
3.5							
4.0					4.00		
4.5							
5.0	SS-34	38					
5.5							
6.0						6.00	

Bottom of Boring at 6.0 ft on 8/7/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger/HQ-3 Diamond Core
DATE LOGGED: 8/14/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-127

GROUNDWATER:

Groundwater not encountered on 8/14/2025

LATITUDE: 43.55341008°
LONGITUDE: -112.4712979° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY % (RQD)	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
0					Silty Sand (SM) - About 55% fine to coarse, subrounded to subangular sand; about 40% nonplastic fines; about 5% hard, fine, rounded gravel to 3/8"; dry; tan; loose.	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
2					Sandy Lean Clay (CL) - About 55% nonplastic to low plasticity fines; about 45% hard, fine to coarse, subrounded sand; trace fragmented basalt; dry to moist; brown; strong HCl reaction.	
	SS-74	39	7-7-5			
4						
	SS-75	77	3-2-3/0"			
6						
8	SS-76	100	15-15-27		Silty Sand with Gravel (SM) - About 45% hard, fine to medium with few coarse, subrounded sand; about 40% nonplastic to low plasticity fines; about 15% fractured basalt gravel; moist; light brown; strong HCl reaction/	Auger refusal at 8.4', switched to HQ3 coring. Gray water return.
	CR-77	89 (48)			Basalt - (BEDROCK) Medium strong rock (R3), gray, fine grained, slightly vesicular, stepped, closely-spaced, slightly to moderately weathered; 45 degree angle at joint from horizontal surface.	
10					Similar to above, except highly vesicular, highly weathered at joints; horizontal fractures.	Gray water return.
	CR-78	85 (80)				CR-78: Compressive Strength of Intact Rock Cores = 4,766 psi at 10.5'-11.0'.
12						
14						

Bottom of Boring at 14.8 ft on 8/14/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/12/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-128

GROUNDWATER:

Groundwater not encountered on 8/12/2025

LATITUDE: 43.55534811°
LONGITUDE: -112.4583605° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.0				Silt (ML) - About 95% nonplastic to low plasticity fines; slow dilatancy; about 5% fine to medium sand; dry; brown; organics present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
2.0				Similar to above, except strong HCl reaction.			
3.0	OSS-51	58			6.00		
4.0				Similar to above, except moist.			
5.0	SS-52	50					
6.0				Bottom of Boring at 6.0 ft on 8/12/2025.		6.00	

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/12/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-129

GROUNDWATER:

Groundwater not encountered on 8/12/2025

LATITUDE: 43.55705819°
LONGITUDE: -112.445328° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.0				Silt (ML) - About 95% nonplastic to low plasticity fines; slow dilatancy; about 5% fine to medium sand; dry; brown; organics present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
2.0				Similar to above, except strong HCl reaction.			
3.0	OSS-53	46			6.00		
4.0				Similar to above, except moist; weak cementation; strong HCl reaction.			
5.0	SS-54	38					
6.0				Bottom of Boring at 6.0 ft on 8/12/2025.		6.00	

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/12/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-130

GROUNDWATER:

Groundwater not encountered on 8/12/2025

LATITUDE: 43.55636091°
LONGITUDE: -112.4317144° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Silt (ML) - About 95% nonplastic to low plasticity fines; slow dilatancy; about 5% fine to medium sand; dry; brown; organics present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0				Similar to above, except weak cementation.			
2.5							
3.0	OSS-55	42			6.00		
3.5							
4.0				Similar to above, except moist; no cementation.			
4.5							
5.0	SS-56	46					
5.5							
6.0						6.00	
				Bottom of Boring at 6.0 ft on 8/12/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/7/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-131

GROUNDWATER:

Groundwater not encountered on 8/7/2025

LATITUDE: 43.55380307°
LONGITUDE: -112.4172998° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5		GB-35		Silt (ML) - About 95% nonplastic to low plasticity fines; low dry strength, no dilatancy; about 5% fine sand; moist; brown.	2.00	2.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0				Lean Clay (CL) -			ST-37: 600 psi
2.5	BK-37	ST-36			1.70		
3.0				98% fines; LL=29, PL=20, PI=9; 2% fine sand; moist, ω=15.9%; brown.			
3.5							

Bottom of Boring at 3.7 ft on 8/7/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/12/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-132

GROUNDWATER:

Groundwater not encountered on 8/12/2025

LATITUDE: 43.55161865°
LONGITUDE: -112.4040933° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Sandy Silt (ML) - About 70% nonplastic fines; about 30% fine to medium sand; dry; light brown; organics present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0					4.10		
2.5							
3.0	OSS-57	79					
3.5				Fractured basalt present at 3.35'.			
4.0	SS-58	83				4.10	SS-58: Basalt in shoe of sampler.
				Bottom of Boring at 4.1 ft on 8/12/2025.			Sampler refusal at 4.1' on bedrock.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/13/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-133

GROUNDWATER:

Groundwater not encountered on 8/13/2025

LATITUDE: 43.5492332°
LONGITUDE: -112.3904565° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Sandy Silt (ML) - About 70% nonplastic fines; about 30% fine to medium sand; dry; light brown; organics present.	2.00	2.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0							
2.5	OSS-59	58		Silty Sand (SM) - About 60% fine to medium, with few coarse, sand; about 35% nonplastic fines; about 5% fragmented basalt present; moist; brown; strong HCl reaction.	2.80	4.80	SS-59: Large basalt gravel in shoe of sampler.
3.0							
3.5							
4.0	SS-60	94					
4.5							

Bottom of Boring at 4.8 ft on 8/13/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger/HQ-3 Diamond Core
DATE LOGGED: 8/14/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-134

GROUNDWATER:

Groundwater not encountered on 8/14/2025

LATITUDE: 43.54718414°
LONGITUDE: -112.3783606° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY % (RQD)	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
2					Poorly Graded Gravel with Silt, Sand, and Cobbles (GP-GM) - (FILL) About 60% hard, fine to coarse, rounded gravel to 3"; about 30% hard, fine to coarse, subangular sand; about 10% nonplastic fines; dry; gray-brown. Basalt boulders and cobbles present on surface.	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
	SS-79	69	2-4-25/4"		Clayey Sand (CL) - About 50% hard, fine to coarse, subangular sand; about 45% low plasticity fines; about 5% medium hard, fine, round to angular basalt gravel to 1/2"; moist; brown to light brown; strong HCl reaction.	SS-79: Auto hammer ringing and rebounding on bedrock.
4					Basalt - (BEDROCK) Medium strong rock (R3), gray, fine grained, moderately vesicular, stepped, closely-spaced, fresh to slightly weathered; 45 degree angle at joint from horizontal surface.	Gray water return.
6	CR-80	95 (79)				CR-80: Compressive Strength of Intact Rock Cores = 4,406 psi at 4.5'-5.0'.
8					Bottom of Boring at 8.8 ft on 8/14/2025.	

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/13/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-135

GROUNDWATER:

Groundwater not encountered on 8/13/2025

LATITUDE: 43.54481484°
LONGITUDE: -112.3649517° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Sandy Silt (ML) - About 70% nonplastic fines; about 30% fine to medium sand; dry; light brown; organics present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0					2.00		
1.5							
2.0						2.00	
2.5				Sandy Lean Clay with Gravel (CL) - About 50% nonplastic to low plasticity fines; about 45% fine to medium sand; about 5% medium strong rock, weathered basalt to 1/2"; moist; brown; strong HCl reaction.			
3.0	OSS-61	63					
3.5							
4.0				Similar to above, except basalt gravel content increases with depth.	4.00		
4.5							
5.0	SS-62	8					
5.5							
6.0				Bottom of Boring at 6.0 ft on 8/13/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/13/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-136

GROUNDWATER:

Groundwater not encountered on 8/13/2025

LATITUDE: 43.54290082°
LONGITUDE: -112.3542671° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Sandy Silt with Gravel (ML) - About 50% nonplastic fines; about 30% fine to medium sand; about 20% hard, fine to coarse, rounded to subangular gravel to 3/4"; dry; light brown; organics present.	1.00	1.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0				Sandy Lean Clay (CL) - About 55% low plasticity fines; about 35% medium hard, fine to coarse, angular sand; about 10% medium hard, fine to coarse, angular basalt gravel to 1-1/2"; dry to moist; light brown; strong HCl reaction.			
1.5							
2.0							OSS-63: Slow drive; Pocket Penetrometer = 2.25 tsf
2.5					3.30		
3.0	OSS-63	63					
3.5							
4.0	SS-64	56				4.30	SS-64: Basalt in shoe of sampler.
				Bottom of Boring at 4.3 ft on 8/13/2025.			Sampler refusal at 4.3' on bedrock.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/13/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-137

GROUNDWATER:

Groundwater not encountered on 8/13/2025

LATITUDE: 43.54081511°
LONGITUDE: -112.3417951° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Silty Sand with Gravel (SM) - About 40% hard, fine to coarse, subangular sand; about 30% hard, fine to coarse, subrounded to subangular gravel to 3/4"; 30% nonplastic fines; dry; brown; organics present.	1.00		Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0						1.00	
1.5				Sandy Silt (ML) - About 60% nonplastic fines; about 40% fine to medium sand; moist; light brown; strong HCl reaction.			
2.0							
2.5							
3.0	OSS-65	71					
3.5					5.00		
4.0							SS-66: Loose material, easy sampler advance.
4.5							
5.0	SS-66	38					
5.5							
6.0						6.00	

Bottom of Boring at 6.0 ft on 8/13/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

BORING NO. SW-138

METHOD: Hollow Stem Auger
DATE LOGGED: 8/6/2025
LOGGED BY: Franklin Caceres, WAQTC

GROUNDWATER:

Groundwater not encountered on 8/6/2025

LATITUDE: 43.53905751°
LONGITUDE: -112.3301455° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Silt (ML) - About 95% nonplastic to low plastic fines; low dry strength, no dilatancy; about 5% fine sand; moist; brown, organics present.	0.90		Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings Auger refusal at 0.8'.
1.0				Similar to above, except fragments of basalt encountered in split spoon.			
1.5	SS-29	22			1.50		
2.0							

Bottom of Boring at 2.4 ft on 8/6/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/13/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-139

GROUNDWATER:

Groundwater not encountered on 8/13/2025

LATITUDE: 43.53706154°
LONGITUDE: -112.3195199° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Sandy Silt (ML) - About 70% nonplastic fines; about 30% fine to medium sand; dry; light brown; organics present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0				Similar to above, except about 60% fines; about 40% medium sand; moist; strong HCl reaction.	4.00		
2.5							
3.0	OSS-67	42					
3.5							
4.0						4.00	
4.5				Silty Sand (SM) - About 60% hard, fine to coarse, subangular sand; about 40% nonplastic fines; moist; red-brown; strong HCl reaction.			
5.0	SS-68	38			2.00		
5.5							
6.0						6.00	
				Bottom of Boring at 6.0 ft on 8/13/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/6/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-140

GROUNDWATER:

Groundwater not encountered on 8/6/2025

LATITUDE: 43.53517929°
LONGITUDE: -112.3066026° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.0				Silt (ML) - About 95% nonplastic to low plasticity fines; low dry strength, no dilatancy; about 5% fine sand; moist; brown, organics present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
2.0					4.00		
3.0	OSS-27	71					
4.0						4.00	
4.0				Lean Clay (CL) - 93% fines; LL=29, PL=19; PI=10 7% fine sand; moist; ω=22.3%; brown.			
5.0	SS-28	67			2.00		
6.0						6.00	

Bottom of Boring at 6.0 ft on 8/6/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/13/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-141

GROUNDWATER:

Groundwater not encountered on 8/13/2025

LATITUDE: 43.53335817°
LONGITUDE: -112.2971953° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.0				Poorly Graded Gravel with Silt, Sand, and Cobbles (GP-GM) - About 60% hard, fine to coarse, rounded gravel to 3"; about 30% hard, fine to coarse, subangular sand; about 10% nonplastic fines; dry; gray-brown. Cobbles present on surface.	1.50	1.50	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.5				Silty Sand (SM) - About 60% fine to medium, with few coarse, sand; about 40% nonplastic fines; trace fine, rounded gravel to 1/2"; moist; gray-brown; strong HCl reaction.	2.50	4.00	
3.0	OSS-69	25					
4.0				Sandy Silt (ML) - About 60% nonplastic fines; about 40% fine to medium sand; moist; brown; strong HCl reaction.	2.00	6.00	SS-70: Loose material, easier sampler advancement.
5.0	SS-70	46					
6.0				Bottom of Boring at 6.0 ft on 8/13/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/6/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-142

GROUNDWATER:

Groundwater not encountered on 8/6/2025

LATITUDE: 43.53164501°
LONGITUDE: -112.285143° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Silt (ML) - About 95% nonplastic to low plasticity fines; low dry strength, no dilatancy; about 5% fine sand; moist; brown, organics present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0					2.00		
1.5							
2.0						2.00	
2.5				Clayey Gravel (GC) - 47% fines, LL=35, PL=20, PI=15; 44% hard, subrounded to subangular, fine to coarse gravel to 1 1/2"; 9% fine to coarse, subrounded to subangular sand; moist, ω=13.5%; brown.			
3.0	OSS-25	100					
3.5							
4.0				Similar to above, except trace fragments of basalt rock in split spoon.	4.00		
4.5							
5.0	SS-26	75			2.00		
5.5							
6.0						6.00	

Bottom of Boring at 6.0 ft on 8/6/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger/HQ-3 Diamond Core
DATE LOGGED: 8/14/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-143

GROUNDWATER:

Groundwater not encountered on 8/14/2025

LATITUDE: 43.52959593°
LONGITUDE: -112.274177° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY % (RQD)	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
					Poorly Graded Gravel with Silt, Sand, and Cobbles (GP-GM) - (FILL) About 60% hard, fine to coarse, rounded gravel to 3"; about 30% hard, fine to coarse, subangular sand; about 10% nonplastic fines; dry; gray-brown. Basalt boulders and cobbles present	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
2					Sandy Lean Clay (CL) - About 70% low plasticity fines; about 30% fine to medium sand; dry; light brown; vegetation present.	
	SS-81	29	2-4-50/5"		Similar to above, except fragmented basalt to 1" present in sampler.	SS-81: Sampler refusal at 3.9'.
4					Basalt - (BEDROCK) Medium strong rock (R3), gray, fine grained, moderately vesicular, stepped, closely-spaced, fresh weathered; 45 degree angle at joint from horizontal surface.	Auger refusal at 4', switched to HQ3 coring.
6	CR-82	94 (67)				
8					Similar to above, except moderately vesicular, mechanical fractures.	
	CR-83	96 (96)				CR-83: Compressive Strength of Intact Rock Cores = 7,408 psi at 8.5'-9.0'.

Bottom of Boring at 9.9 ft on 8/14/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/6/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-144

GROUNDWATER:

Groundwater not encountered on 8/6/2025

LATITUDE: 43.52781805°
LONGITUDE: -112.2622618° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5	GB-22			Silt (ML) - About 95% nonplastic to low plasticity fines; low dry strength, no dilatancy; about 5% fine sand; moist; brown.	2.00	2.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
2.0	ST-23	98		Lean Clay (CL) - 95% fines, LL=37, PL=17, PI=20; 5% fine sand; moist, ω=19.5%; brown.			
3.5				Simial to above.	3.70		ST-23: 600 psi
4.5	SS-24	58			2.00		
5.5				Bottom of Boring at 5.7 ft on 8/6/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/13/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-145

GROUNDWATER:

Groundwater not encountered on 8/13/2025

LATITUDE: 43.52497195°
LONGITUDE: -112.2468356° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
	GB-71		Sandy Silt with Gravel and Cobbles (ML) - About 50% nonplastic fines; about 35% fine to medium sand; about 15% basalt gravel; dry; brown; organics present; strong HCl reaction. Basalt and cobbles to 7" present on surface.	0.50	0.50	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings Auger refusal at 0.5'.
0.5			Bottom of Boring at 0.5 ft on 8/13/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/4/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-146

GROUNDWATER:

Groundwater not encountered on 8/4/2025

LATITUDE: 43.52258647°
LONGITUDE: -112.2308416° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5	GB-09			Sandy Silt with Gravel (ML) - (NATIVE) About 85% nonplastic fines; low dry strength, no dilatancy; about 15% hard, fine to coarse, subrounded to subangular sand; trace gravel to 3/4" (mostly fragments of basalt); dry; brown and gray.	2.00	2.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0	SS-10	100		Fragments of basalt encountered in split spoon.	0.10	2.10	Auger and sampler refusal at 2.1'.
				Bottom of Boring at 2.1 ft on 8/4/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow-Stem Auger
DATE LOGGED: 8/13/2025
LOGGED BY: Kelli Browning, WAQTC

BORING NO. SW-147

GROUNDWATER:

Groundwater not encountered on 8/13/2025

LATITUDE: 43.51986763°
LONGITUDE: -112.2197505° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Poorly Graded Gravel with Silt, Sand, and Cobbles (GP-GM) - About 60% fine to coarse, hard, rounded gravel to 3"; about 20% hard, fine to coarse, subangular sand; about 20% nonplastic fines; dry; brown; organics present; Cobbles present.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0							
2.5							
3.0	OSS-72	54			6.00		
3.5							
4.0				Similar to above, except 20% basalt rubble; 40% nonplastic fines; 40% fine to medium sand; moist; brown.			
4.5							
5.0	SS-73	46			2.00		
5.5							
6.0						6.00	

Bottom of Boring at 6.0 ft on 8/13/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/4/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-148

GROUNDWATER:

Groundwater not encountered on 8/4/2025

LATITUDE: 43.5163249°
LONGITUDE: -112.2091984° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5	GB-07			Silt (ML) - About 95% nonplastic to low plasticity fines; low dry strength, no dilatancy; about 5% fine sand; moist; brown.	2.00	2.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0	SS-08	117		Fragments of basalt encountered in split spoon.	0.50		Auger and sampler refusal at 2.5'.
2.5				Bottom of Boring at 2.5 ft on 8/4/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

BORING NO. SW-149

METHOD: Hollow Stem Auger
DATE LOGGED: 8/7/2025
LOGGED BY: Franklin Caceres, WAQTC

GROUNDWATER:

Groundwater not encountered on 8/7/2025

LATITUDE: 43.51161171°
LONGITUDE: -112.1971481° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5			Sandy Silt with Cobbles (ML) - About 85% nonplastic fines; no dilatancy, low dry strength; about 15% fine to medium sand; organics present; strong HCl reaction. Basalt and cobbles to 7" present on surface.	1.00	1.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0			Bottom of Boring at 1.0 ft on 8/7/2025.			Auger refusal at 1.0'.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger/HQ-3 Diamond Core
DATE LOGGED: 8/4/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-150

GROUNDWATER:

Groundwater not encountered on 8/4/2025

LATITUDE: 43.50851164°
LONGITUDE: -112.1879715° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY % (RQD)	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	REMARKS
					Sandy Silt (ML) - About 85% nonplastic fines; low dry strength, no dilatancy; about 15% hard, fine to coarse, subrounded to subangular sand; trace gravel; moist; brown.				Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
2									
	SS-02	61	2-1-2		Silt (ML) - 95% fines; 5% fine sand; moist, brown.	29	6	13	
4					Similar to above; except low plasticity to nonplastic fines.				Auger refusal at 8.0', switched to HQ3 coring.
	SS-03	72	1-1-1						
6									
	SS-04	0							
8	CR-05	83 (50)			Basalt Bedrock - (BEDROCK) Medium strong rock (R3), gray, fine grained, highly to moderately vesicular, stepped, closely-spaced, slightly to moderately weathered; 45 degree angle at joint from horizontal surface.				
10					Similar to above, except moderately vesicular.				
12	CR-06	92 (67)							CR-06: Compressive Strength of Intact Rock Cores = 4,642 psi at 11.5'-12.0'.
14									

Bottom of Boring at 15.0 ft on 8/4/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/7/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-151

GROUNDWATER:

Groundwater not encountered on 8/7/2025

LATITUDE: 43.50521827°
LONGITUDE: -112.1767032° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Silt (ML) - About 95% nonplastic to low plasticity fines; low dry strength, no dilatancy; about 5% fine sand; moist; brown.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
		GB-38					
1.0					2.00		
1.5							
2.0				Silt (ML) - 98% fines; LL=NV, PL=NV, PI=NP; 2% fine sand; moist, ϖ=20.1%; brown.			ST-40: 600 psi
2.5							
3.0	BK-40	ST-39			1.70		
3.5						3.70	

Bottom of Boring at 3.7 ft on 8/7/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/4/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-152

GROUNDWATER:

Groundwater not encountered on 8/4/2025

LATITUDE: 43.5047277°
LONGITUDE: -112.164468° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Sandy Silt with Gravel (ML) - About 70% nonplastic fines; low dry strength, no dilatancy; about 15% hard, fine to coarse, subrounded to subangular sand; about 15% hard, fine to coarse, subrounded to subangular gravel to 3/4"; dry; brown.	2.00	2.00	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0							
1.5							
2.0	SS-01	100		Fragments of basalt encountered in split spoon.	0.10		Auger and sampler refusal at 2.1'.
				Bottom of Boring at 2.1 ft on 8/4/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/7/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-153

GROUNDWATER:

Groundwater not encountered on 8/7/2025

LATITUDE: 43.50294831°
LONGITUDE: -112.1564555° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)	REMARKS
0.5				Silt (ML) - About 95% nonplastic fines to low plasticity; low dry strength, no dilatancy; about 5% fine sand; moist; brown.			Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
1.0					2.00		
1.5							
2.0	OSS-41	100				2.00	
				Fragments of basalt encountered in split spoon.	0.10		Auger and sampler refusal at 2.0'.
				Bottom of Boring at 2.1 ft on 8/7/2025.			

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/5/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-201

GROUNDWATER:

Groundwater not encountered on 8/5/2025

LATITUDE: 43.52600016°
LONGITUDE: -112.2522697° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
0					Asphalt Concrete - Seal coat; dense; AC interface at 0.15'; AC core recovery = 0.32'.	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings Hard auger at 2.5'. Auger and sampler refusal at 3.5'.
					CRABS - Dense, CRABS core recovery = 0.06'.	
2					Poorly Graded Gravel with Silt, Sand, and Cobbles (GP-GM) - (FILL) About 60% hard, fine to coarse, rounded gravel to 3"; about 30% hard, fine to coarse, subangular sand; about 10% nonplastic fines; dry; gray-brown.	
	SS-20	50	15-20-10		Fragments of rubble basalt in split spoon.	
4					Bottom of Boring at 4.0 ft on 8/5/2025.	

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/5/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-202

GROUNDWATER:

Groundwater not encountered on 8/5/2025

LATITUDE: 43.5260794°
LONGITUDE: -112.2523122° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	REMARKS
					Asphalt Concrete - Seal coat; dense; AC interface at 0.17'; AC core recovery = 0.35'.				Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
					CRABS - Dense, CRABS core recovery = 0.05'.				
2					Poorly Graded Gravel with Silt, Sand, and Cobbles (GP-GM) - (FILL)				
	SS-18	56	1-3-4		About 65% hard, fine to coarse, rounded gravel to 3"; about 25% hard, fine to coarse, subangular sand; about 10% nonplastic fines; dry; gray-brown.	27	8	19	Hard auger at 2.5'.
4					Lean Clay (CL) - 90% fines; 8% fine corse sand; 1% fine gravel to 3/8"; moist, brown.				Auger and sampler refusal at 5.0'.
	SS-19	6	11-2-11		Fragments of rubble basalt in split spoon.				
6					Bottom of Boring at 6.5 ft on 8/5/2025.				

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

BORING NO. SW-203

METHOD: Hollow Stem Auger
DATE LOGGED: 8/5/2025
LOGGED BY: Franklin Caceres, WAQTC

GROUNDWATER:

Groundwater not encountered on 8/5/2025

LATITUDE: 43.52585017°
LONGITUDE: -112.2521702° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
2					Sandy Silt with Gravel (ML) - About 70% nonplastic fines; low dry strength, no dilatancy; about 15% hard, fine to coarse, subrounded to subangular sand; about 15% hard, fine to coarse, subrounded to subangular gravel to 3/4"; organics present; dry; brown.	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
	SS-21	231	25/2.5"		Fragments of basalt encountered in split spoon.	Auger and sampler refusal at 2.0'.
					Bottom of Boring at 2.6 ft on 8/5/2025.	

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

BORING NO. SW-204

METHOD: Hollow Stem Auger
DATE LOGGED: 8/5/2025
LOGGED BY: Franklin Caceres, WAQTC

GROUNDWATER:

Groundwater not encountered on 8/5/2025

LATITUDE: 43.524361°
LONGITUDE: -112.2411584° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	REMARKS
2					Sandy Silt with Gravel (ML) - About 70% nonplastic fines; low dry strength, no dilatancy; about 15% hard, fine to coarse, subrounded to subangular sand; about 15% hard, fine to coarse, subrounded to subangular gravel to 3/4"; organics present; dry; brown.				Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
4	SS-16	42	2-3-5		Lean Clay (CL) - 94% fines; 6% fine sand; moist; brown.	27	7	18	
	SS-17	100	25/1"		Fragments of basalt encountered in split spoon. Bottom of Boring at 5.1 ft on 8/5/2025.				Auger and sampler refusal at 5.1'.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/5/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-205

GROUNDWATER:

Groundwater not encountered on 8/5/2025

LATITUDE: 43.52412479°
LONGITUDE: -112.2409618° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAB DATA LL (%)	LAB DATA PI (%)	LAB DATA MC (%)	REMARKS
					Asphalt Concrete - Seal coat; dense; AC interface at 0.16'; AC core recovery = 0.36'.				Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
					CRABS - Dense, CRABS core recovery = 0.1'.				
2					Poorly Graded Gravel with Silt, Sand, and Cobbles (GP-GM) - (FILL) About 60% hard, fine to coarse, rounded gravel to 3"; about 30% hard, fine to coarse, subangular sand; about 10% nonplastic fines; dry; gray-brown.				
	SS-14	72	1-11-11			26	7	12	SS-14; TSF = 0.5.
4					Silty Clayey Gravel (GC-GM) - 49% fines; 36% hard, subrounded to subangular; fine to coarse gravel to 1 1/2"; 15% fine to coarse, subrounded to subangular sand; moist, brown.				
	SS-15	6	3-4-5		Fragments of rubble basalt in split spoon.				Auger and sampler refusal at 5.5'.
6									

Bottom of Boring at 6.5 ft on 8/5/2025.

PROJECT: US-20, INL Puzzle to Idaho Falls
LOCATION: Bonneville County, Idaho

SHANNON & WILSON

METHOD: Hollow Stem Auger
DATE LOGGED: 8/5/2025
LOGGED BY: Franklin Caceres, WAQTC

BORING NO. SW-206

GROUNDWATER:

Groundwater not encountered on 8/5/2025

LATITUDE: 43.52419269°
LONGITUDE: -112.2409524° by Juniper Geode GNS3S

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
					Asphalt Concrete - Seal coat; dense; AC interface at 0.15'; AC core recovery = 0.36'.	Driller: S&W Drill: Simco 2800 Hammer: Auto per ASTM D1586 Auger I.D.: 4.25" Backfill: Bentonite and Cuttings
					CRABS - Dense, CRABS core recovery = 0.1'.	
2					Poorly Graded Gravel with Silt, Sand, and Cobbles (GP-GM) - (FILL) About 60% fine to coarse, hard, rounded gravel to 3"; about 30% fine to coarse, hard, subangular sand; about 10% nonplastic fines; dry; gray-brown.	
	SS-11	72	1-4-8		Sandy Lean Clay (CL) - About 95% low to high plasticity fines, slow dilatancy; about 5% fine sand and rubble basalt; moist; brown.	SS-14; TSF = 0.5. Hard augering at 3.8
4						
	SS-12	39	1-3-15		Similar to above, except rubble basalt fragments present at bottom of split spoon.	
6						
	SS-13	28	20-10-4		Fragments of rubble basalt in split spoon.	Auger and sampler refusal at 7.5'.
8					Bottom of Boring at 9.0 ft on 8/5/2025.	

APPENDIX B: SUBSURFACE INVESTIGATION DATA

ROCK CORE PHOTOGRAPHS

APPENDIX A: ROCK CORE PHOTO LOG



Exhibit A-1: SW-121, CR-43 to CR-44, 5.7’ to 8.3’



Exhibit A-2: SW-127, CR-77 to CR-78, 8.4’ to 14.8’

APPENDIX A: ROCK CORE PHOTO LOG



Exhibit A-3: SW-134, CR-80, 3.8' to 8.8'



Exhibit A-4: SW-143, CR-82 to CR-83, 3.8' to 9.85'

APPENDIX A: ROCK CORE PHOTO LOG



Exhibit A-5: SW-150, CR-05 to CR-06, 8.0’ to 15.0’

APPENDIX B: SUBSURFACE INVESTIGATION DATA

INFILTRATION TESTS

Shannon & Wilson
5260 Chinden Blvd.
Boise, Idaho 83714
Phone:(208) 658-8700
Fax: (208) 658-8703

Report to: Horrocks
Project: US-20, Bonneville Co Line to IF
Report Date: 7/23/2025
Project No.: 112895 KN24394

Material Information

Date Tested: 7/17 & 7/18/2025
Tested By: Shannon & Wilson
Weather Condition: Partly Cloudy

Test Results

In-Situ Permeability, Guelph Permeameter Method (Constant Head)

Location	Soil Description	Well Depth	Hydraulic Conductivity cm/sec
GI-1; Lat. 43.5044444 Long. -112.8708333	Sandy Silt; Dry	12"	$1.82x10^{-3}$
GI-2; Lat. 43.510466 Long. -112.784547	Sandy Silt; Dry	12"	$1.96x10^{-3}$
GI-3; Lat. 43.53500 Long. -112.687777	Silty Sand; Dry	12"	$1.18x10^{-3}$
GI-4; Lat. 43.53507 Long. -111.616752	Silty Sand; Dry	12"	$2.28x10^{-3}$
GI-5; Lat. 43.552290 Long. -112.528025	Silty Sand; Dry	12"	$2.35x10^{-3}$
GI-6; Lat. 43.550187 Long. -112.396504	Silty Sand; Dry	12"	$2.34x10^{-3}$
GI-7; Lat. 43.529803 Long. -112.275804	Silt with Sand; Dry	12"	$7.96x10^{-5}$
GI-8; Lat. 43.512776 Long. -112.200431	Poorly Graded Gravel w/Sand; Dry	12"	$2.49x10^{-3}$

Reviewed By: Stan Crawforth

DEPTH-TO-BEDROCK DATA

APPENDIX B: SUBSURFACE INVESTIGATION DATA

SHANNON & WILSON

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
S-001	43.50569563	-112.8827895	0.9	possible boulders or bedrock
S-001A	43.50564878	-112.8824354	2.4	possible boulders or bedrock
S-001B	43.50562873	-112.8820526	1.8	possible boulders or bedrock
S-001C	43.50563636	-112.8815682	3.2	possible boulders or bedrock
S-002	43.50455665	-112.868594	3.1	possible boulders or bedrock
S-003	43.50379102	-112.8585439	5.4	possible boulders or bedrock
S-004	43.50363906	-112.8559793	1	bedrock
S-005	43.50380433	-112.8466761	1.5	bedrock
S-006	43.50376826	-112.8467826	1.1	bedrock
S-007	43.50379897	-112.8461457	5	no bedrock encountered
S-008	43.50512697	-112.835044	2.3	bedrock
S-009	43.50506267	-112.8349371	0.5	bedrock
S-010	43.50511811	-112.8348728	1.7	bedrock
S-011	43.5052142	-112.8345225	1.6	bedrock
S-012	43.50657299	-112.822885	7	no bedrock encountered
S-013	43.5079573	-112.8104494	4.1	possible boulders or bedrock
S-014	43.50901387	-112.8003532	4	possible boulders or bedrock
S-015	43.51074933	-112.784347	2.6	possible boulders or bedrock
S-016	43.51076834	-112.7839758	5.2	possible boulders or bedrock
S-017	43.51177107	-112.7755263	2.5	possible boulders or bedrock
S-018	43.51198424	-112.7744511	2	possible boulders or bedrock
S-019	43.514611	-112.7642483	5.3	bedrock
S-020	43.51520108	-112.7621162	3.4	bedrock
S-021	43.51840651	-112.7504068	2	possible boulders or bedrock
S-022	43.51931105	-112.7469524	3.4	possible boulders or bedrock
S-023	43.52251713	-112.7350658	1.6	bedrock
S-024	43.52447184	-112.7277367	2.2	bedrock
S-025	43.52534237	-112.7245954	1.8	possible boulders or bedrock
S-026	43.55549394	-112.4575763	2.3	bedrock
S-026A	43.55549994	-112.4574025	0.3	possible boulders or bedrock
S-026B	43.55551215	-112.4571967	5.7	possible boulders or bedrock
S-027	43.55660457	-112.45003	2	possible boulders or bedrock
S-027A	43.55658392	-112.4498187	1	possible boulders or bedrock
S-027B	43.55673388	-112.4490595	7.3	bedrock
S-028	43.55710725	-112.4381195	3.6	possible boulders or bedrock
S-029	43.55619466	-112.4307561	8.8	possible boulders or bedrock
S-029B	43.55575489	-112.4284558	2.4	possible boulders or bedrock
S-029C	43.55572466	-112.4280543	9.7	possible boulders or bedrock
S-030	43.5541033	-112.4188813	2.3	bedrock
S-031	43.55238305	-112.4085565	9.8	possible boulders or bedrock
S-032	43.55175195	-112.4050631	4.2	possible boulders or bedrock
S-033	43.54974543	-112.3934332	0.7	possible boulders or bedrock
S-033A	43.54960167	-112.3923507	0.9	possible boulders or bedrock
S-033B	43.54921833	-112.3903884	6.2	possible boulders or bedrock
S-034	43.54771253	-112.3818392	8.2	possible boulders or bedrock
S-034A	43.54745287	-112.3803657	7.2	possible boulders or bedrock
S-034B	43.54704889	-112.3779054	5.4	possible boulders or bedrock
S-035	43.5278134	-112.7148876	6.1	possible boulders or bedrock
S-036	43.53007335	-112.7068072	7.2	bedrock
S-037	43.53102555	-112.7033695	2.5	possible boulders or bedrock
S-037 A	43.53110131	-112.7029456	3.5	possible boulders or bedrock
S-037 B	43.53122248	-112.7025783	4.9	possible boulders or bedrock
S-038	43.5323915	-112.6979142	2	possible boulders or bedrock
S-039	43.53327479	-112.6948282	3.5	possible boulders or bedrock
S-039 A	43.53344103	-112.6942542	1.5	possible boulders or bedrock
S-039 B	43.53368921	-112.6932284	3.5	possible boulders or bedrock
S-039 C	43.53387917	-112.6925282	3.5	possible boulders or bedrock
S-040	43.53486814	-112.6888101	6	no bedrock encountered
S-041	43.53731655	-112.6799647	6	no bedrock encountered
S-042	43.53948304	-112.6717974	4	possible boulders or bedrock
S-042 A	43.53966862	-112.6710805	4	bedrock
S-042 B	43.53998715	-112.6698972	3.5	possible boulders or bedrock
S-043	43.54121143	-112.665248	1.5	bedrock

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
S-044	43.54214409	-112.6619841	3.5	possible boulders or bedrock
S-044 A	43.54246671	-112.6608048	0.8	bedrock
S-044 B	43.54264523	-112.6602709	1	possible boulders or bedrock
S-045	43.54454042	-112.6528416	2.9	possible boulders or bedrock
S-046	43.54582842	-112.6486382	3.5	possible boulders or bedrock
S-046 A	43.54591179	-112.6482513	6	no bedrock encountered
S-046 B	43.54605482	-112.6476321	1.6	bedrock
S-046 C	43.54620012	-112.6470761	2.2	bedrock
S-047	43.54686845	-112.6441652	6	no bedrock encountered
S-047A	43.54703423	-112.6432686	6	no bedrock encountered
S-047B	43.54727629	-112.6425764	4	possible boulders or bedrock
S-047C	43.54753447	-112.641955	4.7	possible boulders or bedrock
S-048	43.54802691	-112.6401465	6	no bedrock encountered
S-048A	43.54812395	-112.6393587	3.8	possible boulders or bedrock
S-048B	43.54836064	-112.6390249	6	no bedrock encountered
S-049	43.54856376	-112.6380694	1.5	possible boulders or bedrock
S-049A	43.54879668	-112.6375441	2	possible boulders or bedrock
S-049B	43.54900067	-112.6366319	6	no bedrock encountered
S-050	43.54994398	-112.6333802	5	no bedrock encountered
S-051	43.55249176	-112.6240975	2.1	bedrock
S-052	43.55375177	-112.616334	3.2	possible boulders or bedrock
S-053	43.55395313	-112.6066775	4.8	possible boulders or bedrock
S-054	43.55399492	-112.5966914	6	no bedrock encountered
S-056	43.55364951	-112.5772362	4.3	possible boulders or bedrock
S-057	43.55349249	-112.5696602	5	no bedrock encountered
S-058	43.55316321	-112.556951	4.7	bedrock
S-059	43.55302291	-112.5504233	5.3	possible boulders or bedrock
S-060	43.55274088	-112.5392723	6	possible boulders or bedrock
S-061	43.55246173	-112.5298828	0.9	possible boulders or bedrock
S-062	43.55203549	-112.5202105	5	no bedrock encountered
S-063	43.55197832	-112.5173994	6	no bedrock encountered
S-065	43.55118401	-112.4948356	1.2	possible boulders or bedrock
S-066	43.55134889	-112.485978	6	no bedrock encountered
S-067	43.55271498	-112.4758171	1.8	possible boulders or bedrock
S-068	43.55418914	-112.4653917	5	possible boulders or bedrock
S-069	43.53219424	-112.7006429	6	no bedrock encountered
S-070	43.53203791	-112.7015036	5.6	possible boulders or bedrock
S-071	43.53149691	-112.7031424	6.9	possible boulders or bedrock
S-072	43.53101582	-112.7049686	2	possible boulders or bedrock
S-073	43.53047831	-112.7068705	6.5	possible boulders or bedrock
S-074	43.53005043	-112.7085776	6	no bedrock encountered
S-075	43.52953543	-112.7104872	3.1	bedrock
S-077	43.52860908	-112.7140635	4.1	possible boulders or bedrock
S-078	43.52807279	-112.7159522	3.8	possible boulders or bedrock
S-079	43.52754298	-112.7175832	2.7	bedrock
S-080	43.51947196	-112.7477689	1.7	possible boulders or bedrock
S-081	43.51924506	-112.7487799	1.6	bedrock
S-082	43.51871863	-112.7504361	4.4	possible boulders or bedrock
S-083	43.51826599	-112.7521526	3.9	possible boulders or bedrock
S-084	43.51776805	-112.7541162	0.8	bedrock
S-085	43.51728653	-112.7559133	1.5	possible boulders or bedrock
S-086	43.50498013	-112.8744873	5	no bedrock encountered
S-087	43.50480629	-112.8722969	5	no bedrock encountered
S-088	43.50428663	-112.8653274	4.2	possible boulders or bedrock
S-089	43.50397613	-112.8625055	1.5	possible boulders or bedrock
S-089A	43.50390856	-112.8622729	0.8	possible boulders or bedrock
S-089B	43.50396324	-112.8616508	1.4	possible boulders or bedrock
S-090	43.50392722	-112.8605803	1.1	possible boulders or bedrock
S-091	43.50345214	-112.8532314	0.6	bedrock
S-092	43.50351052	-112.8517043	4.3	possible boulders or bedrock
S-093	43.50349265	-112.8505585	3.8	possible boulders or bedrock
S-094	43.50358726	-112.848355	2.7	possible boulders or bedrock
S-095	43.50384932	-112.8450821	3.2	possible boulders or bedrock
S-095A	43.50389002	-112.8447909	0.7	possible boulders or bedrock
S-097	43.5044777	-112.8403585	5	no bedrock encountered
S-098	43.50478139	-112.8376898	2.9	possible boulders or bedrock

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
S-099	43.50491702	-112.8364375	3.2	possible boulders or bedrock
S-100	43.50529984	-112.8333944	5	no bedrock encountered
S-101	43.50543092	-112.8322572	0.4	possible boulders or bedrock
S-102	43.50559627	-112.8306778	5	no bedrock encountered
S-103	43.50575967	-112.8289471	5	no bedrock encountered
S-104	43.50609258	-112.8261006	4.1	possible boulders or bedrock
S-105	43.50671653	-112.8203715	3.6	possible boulders or bedrock
S-106	43.50702891	-112.8184392	4.2	possible boulders or bedrock
S-107	43.50721036	-112.8159758	5	no bedrock encountered
S-108	43.50742067	-112.8143112	5	no bedrock encountered
S-109	43.50761543	-112.8128554	3.7	possible boulders or bedrock
S-110	43.50845058	-112.8052262	4.6	possible boulders or bedrock
S-111	43.50877001	-112.8023418	5	no bedrock encountered
S-112	43.50915321	-112.7987798	3.8	possible boulders or bedrock
S-113	43.50941741	-112.7960494	4.4	possible boulders or bedrock
S-114	43.50967961	-112.7937084	3.9	possible boulders or bedrock
S-114 A	43.50983155	-112.7924755	4.8	possible boulders or bedrock
S-115	43.51014467	-112.7895927	5	no bedrock encountered
S-116	43.51043355	-112.7872314	1.2	possible boulders or bedrock
S-116 A	43.51048083	-112.7868098	0.9	possible boulders or bedrock
S-117	43.51105965	-112.781313	4.3	possible boulders or bedrock
S-117 A	43.51110741	-112.7808664	1.6	possible boulders or bedrock
S-117 B	43.51115226	-112.78044	2.4	possible boulders or bedrock
S-117 C	43.51117214	-112.7800704	3.6	possible boulders or bedrock
S-118	43.51139392	-112.7784719	3.3	possible boulders or bedrock
S-119	43.5116086	-112.7769024	3.4	possible boulders or bedrock
S-120	43.51232475	-112.7730028	4.5	bedrock
S-120 A	43.51244063	-112.7725636	3.2	possible boulders or bedrock
S-121	43.51280513	-112.7705834	1.3	possible boulders or bedrock
S-122	43.51330735	-112.7690133	3.7	bedrock
S-123	43.51388996	-112.7668605	4.4	possible boulders or bedrock
S-124	43.5156229	-112.760388	5	no bedrock encountered
S-125	43.51624338	-112.7583366	3.4	possible boulders or bedrock
S-126	43.51646629	-112.7573751	4.5	possible boulders or bedrock
S-127	43.51691836	-112.755764	3.4	possible boulders or bedrock
S-128	43.51717013	-112.7546182	3.2	possible boulders or bedrock
S-129	43.51751762	-112.7533619	3.5	possible boulders or bedrock
S-130	43.51787253	-112.7521269	4.3	possible boulders or bedrock
S-131	43.51892526	-112.7483736	4.3	possible boulders or bedrock
S-132	43.51969655	-112.7454524	3.7	possible boulders or bedrock
S-133	43.52020119	-112.7436046	5	no bedrock encountered
S-134	43.5205244	-112.7423182	4.4	possible boulders or bedrock
S-135	43.52091286	-112.7410355	3.4	possible boulders or bedrock
S-136	43.52128062	-112.739492	1.2	possible boulders or bedrock
S-137	43.52177592	-112.7373326	6	possible boulders or bedrock
S-138	43.52290704	-112.7335619	2.9	possible boulders or bedrock
S-139	43.52308556	-112.7329584	4.7	possible boulders or bedrock
S-140	43.52331837	-112.7316793	3.6	possible boulders or bedrock
S-141	43.52388266	-112.7298637	2.8	possible boulders or bedrock
S-142	43.52484577	-112.7261847	4.2	possible boulders or bedrock
S-143	43.52604492	-112.7219364	3.2	possible boulders or bedrock
S-144	43.52632837	-112.7204701	3.4	possible boulders or bedrock
S-145	43.52717463	-112.717657	5	possible boulders or bedrock
S-146	43.52810446	-112.713748	3.4	possible boulders or bedrock
S-147	43.52914995	-112.7102789	4.1	possible boulders or bedrock
S-148	43.52964961	-112.7083788	3.3	possible boulders or bedrock
S-149	43.53035417	-112.7058571	2.6	possible boulders or bedrock
S-150	43.53076507	-112.7043051	2.8	possible boulders or bedrock
S-151	43.53158158	-112.7012417	5	no bedrock encountered
S-151 A	43.53160651	-112.7007368	2	possible boulders or bedrock
S-152	43.53436855	-112.6906741	3.7	possible boulders or bedrock
S-153	43.53538877	-112.686981	1.9	possible boulders or bedrock
S-154	43.53576211	-112.6859067	2.9	possible boulders or bedrock
S-154 A	43.53593014	-112.6854038	4.3	possible boulders or bedrock
S-154 B	43.53603994	-112.6849555	3.6	possible boulders or bedrock
S-154 C	43.53618345	-112.6843435	4.6	possible boulders or bedrock

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
S-155	43.5367091	-112.6823536	3.8	possible boulders or bedrock
S-156	43.53695382	-112.6813187	2.9	possible boulders or bedrock
S-157	43.53760936	-112.6788655	4.7	possible boulders or bedrock
S-158	43.53797189	-112.6774284	5	no bedrock encountered
S-159	43.53915504	-112.6729381	4.4	possible boulders or bedrock
S-160	43.54021518	-112.6690322	4.5	possible boulders or bedrock
S-161	43.54037507	-112.6685412	3.6	possible boulders or bedrock
S-162	43.54076678	-112.6670651	1.6	possible boulders or bedrock
S-163	43.54097247	-112.6662995	2.4	possible boulders or bedrock
S-164	43.54146255	-112.6641629	2.3	possible boulders or bedrock
S-165	43.54296383	-112.6590737	2.4	possible boulders or bedrock
S-166	43.5432793	-112.6578149	2.6	possible boulders or bedrock
S-167	43.54359437	-112.6563672	3.4	possible boulders or bedrock
S-168	43.54387762	-112.6554741	3.9	possible boulders or bedrock
S-169	43.54414753	-112.6544361	3.1	possible boulders or bedrock
S-170	43.54482936	-112.6517514	3.4	possible boulders or bedrock
S-171	43.54512662	-112.6507475	3.8	possible boulders or bedrock
S-172	43.54554039	-112.6497981	2.7	possible boulders or bedrock
S-173	43.54644783	-112.6460874	2.9	possible boulders or bedrock
S-174	43.54775318	-112.641297	4.3	possible boulders or bedrock
S-175	43.54991185	-112.6335584	4.3	possible boulders or bedrock
S-176	43.55052481	-112.6313335	2.8	possible boulders or bedrock
S-177	43.52730293	-112.2612386	5	no bedrock encountered
S-178	43.52720082	-112.260344	5	no bedrock encountered
S-178	43.52720082	-112.260344	5	no bedrock encountered
S-179	43.52698035	-112.2592215	5	no bedrock encountered
S-180	43.52668517	-112.2576316	5	no bedrock encountered
S-181	43.52657044	-112.2569189	3.4	possible boulders or bedrock
S-182	43.52630787	-112.2554863	2.4	possible boulders or bedrock
S-183	43.52603379	-112.2538578	4.7	possible boulders or bedrock
S-184	43.52576375	-112.2521866	5	no bedrock encountered
S-185	43.52561491	-112.2509279	4.4	possible boulders or bedrock
S-186	43.52543569	-112.2498773	3.1	possible boulders or bedrock
S-187	43.5250936	-112.2480189	6.3	possible boulders or bedrock
S-188	43.52495216	-112.2467196	0.5	possible boulders or bedrock
S-189	43.52459688	-112.245343	4.6	possible boulders or bedrock
S-190	43.5243571	-112.2437297	2.8	possible boulders or bedrock
S-191	43.52367242	-112.2389852	3.4	possible boulders or bedrock
S-192	43.52344381	-112.2376271	2.1	possible boulders or bedrock
S-193	43.52294385	-112.2341873	4.1	possible boulders or bedrock
S-194	43.52257425	-112.2319887	0.4	possible boulders or bedrock
S-195	43.52205724	-112.2289703	1.3	possible boulders or bedrock
S-196	43.52171953	-112.2276363	2.7	possible boulders or bedrock
S-197	43.5214977	-112.2267069	3.6	possible boulders or bedrock
S-197 A	43.52144817	-112.2264526	1.5	possible boulders or bedrock
S-197 B	43.52117807	-112.2253856	2.9	possible boulders or bedrock
S-197 C	43.52095592	-112.2243482	2.9	possible boulders or bedrock
S-198	43.52024292	-112.220992	3.2	possible boulders or bedrock
S-198	43.52066186	-112.2230099	3.2	possible boulders or bedrock
S-199	43.52011013	-112.2204894	1.3	possible boulders or bedrock
S-200	43.50472231	-112.1630011	6.5	possible boulders or bedrock
S-201	43.50505495	-112.1740257	4.1	bedrock
S-202	43.50732746	-112.1846637	11.5	bedrock
S-203	43.50992475	-112.1918296	4.6	bedrock
S-204	43.51023955	-112.1926993	15.6	bedrock
S-205	43.5129894	-112.2002323	3.7	bedrock
S-206	43.51467443	-112.2047908	3.7	bedrock
S-207	43.51589327	-112.2080882	5.9	bedrock
S-208	43.51930499	-112.2173993	7.2	bedrock
S-209	43.52223057	-112.228977	1.8	bedrock
S-210	43.52390878	-112.2389857	5.9	possible boulders or bedrock
S-211	43.52565227	-112.249429	6.1	bedrock
S-212	43.52745219	-112.2602519	1.8	bedrock
S-213	43.52929512	-112.2711702	2.1	possible boulders or bedrock
S-214	43.53110285	-112.2821067	5.7	possible boulders or bedrock
S-215	43.53279433	-112.2923688	1.9	bedrock

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
S-216	43.53458227	-112.3030629	4.2	bedrock
S-217	43.53549577	-112.3085336	4.5	bedrock
S-218	43.53720827	-112.318934	5.6	bedrock
S-219	43.53894949	-112.3293431	8.7	bedrock
S-220	43.5398551	-112.334836	2.5	bedrock
S-220A	43.53991725	-112.3349018	3.2	possible boulders or bedrock
S-220B	43.53998152	-112.3349865	7.5	bedrock
S-220C	43.53989573	-112.3351144	3.5	bedrock
S-220D	43.53992829	-112.3352602	2.7	bedrock
S-221	43.54122802	-112.3426397	6.8	possible boulders or bedrock
S-222	43.5431696	-112.3535792	2.6	bedrock
S-223	43.54425238	-112.3602932	11	possible boulders or bedrock
S-223A	43.5443177	-112.3604221	12	bedrock
S-223B	43.54438904	-112.3606693	8.9	bedrock
S-223C	43.54441978	-112.3609165	13	possible boulders or bedrock
S-223D	43.54448064	-112.3611561	6.8	possible boulders or bedrock
S-223E	43.54443491	-112.3614146	2.9	bedrock
S-224	43.54597017	-112.3701643	20	no bedrock encountered
S-225	43.54499182	-112.3660273	13.5	possible boulders or bedrock
S-226	43.54441856	-112.362538	5	possible boulders or bedrock
S-226A	43.54433291	-112.3620319	8.6	possible boulders or bedrock
S-226B	43.54431319	-112.3618777	1.9	possible boulders or bedrock
S-226C	43.54425842	-112.3616414	6.3	possible boulders or bedrock
S-226D	43.54422556	-112.3611461	1.3	possible boulders or bedrock
S-227	43.54218898	-112.3497258	1.9	possible boulders or bedrock
S-228 A	43.54045877	-112.3395567	3	possible boulders or bedrock
S-228 B	43.5402945	-112.3385084	1.9	possible boulders or bedrock
S-228 C	43.54003963	-112.3369585	2	possible boulders or bedrock
S-229	43.53837235	-112.3272798	0.6	possible boulders or bedrock
S-230	43.53686629	-112.3177621	16.7	possible boulders or bedrock
S-231	43.53575683	-112.3115721	8.6	possible boulders or bedrock
S-232	43.53482446	-112.3055537	4.5	possible boulders or bedrock
S-233	43.53340317	-112.2973147	16.1	possible boulders or bedrock
S-234	43.53273766	-112.2930202	0.9	possible boulders or bedrock
S-235	43.53121321	-112.2840364	8.6	possible boulders or bedrock
S-236	43.52960119	-112.2741567	8.8	possible boulders or bedrock
S-236 A	43.52956431	-112.2739616	15.8	possible boulders or bedrock
S-236 B	43.52941699	-112.2729541	1.3	possible boulders or bedrock
S-238 C	43.5291632	-112.2716512	5.7	possible boulders or bedrock
S-239	43.52754113	-112.2618878	5.8	possible boulders or bedrock
S-240	43.5263487	-112.2546281	10.2	possible boulders or bedrock
S-241	43.52534924	-112.2486836	2.2	possible boulders or bedrock
S-242	43.52437848	-112.2426715	11.8	possible boulders or bedrock
S-243	43.52322584	-112.2359811	3.4	possible boulders or bedrock
S-243 A	43.52306263	-112.2355399	4.8	possible boulders or bedrock
S-244	43.52252437	-112.2320053	1.8	possible boulders or bedrock
S-244 A	43.52240325	-112.2313587	8	possible boulders or bedrock
S-244 B	43.5222687	-112.23028	6.9	possible boulders or bedrock
S-245	43.52153311	-112.2262534	11	possible boulders or bedrock
S-245 A	43.52120185	-112.224704	2.1	possible boulders or bedrock
S-245 B	43.52146076	-112.226039	3.8	possible boulders or bedrock
S-245 C	43.52140141	-112.225831	3.5	possible boulders or bedrock
S-245 D	43.52137911	-112.2255222	1.4	possible boulders or bedrock
S-245 E	43.52134733	-112.2253422	1.5	possible boulders or bedrock
S-246	43.51848953	-112.2157998	1.9	possible boulders or bedrock
S-247	43.51778354	-112.2138791	3.3	possible boulders or bedrock
S-247 A	43.51769844	-112.2136199	20	no bedrock encountered
S-247 B	43.5173559	-112.2128295	5.3	possible boulders or bedrock
S-247 C	43.51751839	-112.213298	5.8	possible boulders or bedrock
S-247 D	43.51750088	-112.2130675	1.5	possible boulders or bedrock
S-248	43.51418542	-112.2040545	6	possible boulders or bedrock
S-248 A	43.51409203	-112.2038503	4.4	possible boulders or bedrock
S-248 B	43.51404193	-112.2035323	3.8	possible boulders or bedrock
S-248 C	43.51387932	-112.2030929	2.1	possible boulders or bedrock
S-248 D	43.51379195	-112.2028886	4.8	possible boulders or bedrock
S-249	43.5128469	-112.2004089	7.3	possible boulders or bedrock

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
S-249 A	43.51269202	-112.2001008	5.5	possible boulders or bedrock
S-249 B	43.51250359	-112.1997417	10.1	possible boulders or bedrock
S-249 C	43.51236992	-112.1993747	3.8	possible boulders or bedrock
S-249 D	43.51222808	-112.1989794	7.7	possible boulders or bedrock
S-249 E	43.51213727	-112.198755	8.1	possible boulders or bedrock
S-250	43.51154069	-112.1968864	5	no bedrock encountered
S-251	43.51005011	-112.1929076	5.4	possible boulders or bedrock
S-251 A	43.50970896	-112.1920034	4.3	possible boulders or bedrock
S-252	43.50930933	-112.1908232	1	bedrock
S-252 A	43.50819262	-112.1878403	5.6	possible boulders or bedrock
S-253	43.50560678	-112.1787704	4.5	possible boulders or bedrock
S-254	43.50442185	-112.1687276	5	no bedrock encountered
S-255	43.50438757	-112.1638547	5.3	possible boulders or bedrock
S-400	43.51995369	-112.220044	2.6	possible boulders or bedrock
S-401	43.51965018	-112.2188879	2.8	possible boulders or bedrock
S-402	43.51940377	-112.2181169	2.1	possible boulders or bedrock
S-403	43.51916052	-112.2174135	1.7	possible boulders or bedrock
S-404	43.51892369	-112.2167395	2.3	possible boulders or bedrock
S-405	43.51843767	-112.2154232	1.6	possible boulders or bedrock
S-406	43.5181853	-112.2147295	2.1	possible boulders or bedrock
S-407	43.51723224	-112.2121389	1.7	possible boulders or bedrock
S-408	43.51663936	-112.2105253	2.3	possible boulders or bedrock
F-01	43.50897841	-112.1892553	0	Face
F-01A	43.50908719	-112.1895278	0	Face
F-01B	43.5092048	-112.1898555	0	Face
F-02	43.50983266	-112.1913856	0	Face
F-02A	43.50984563	-112.1914237	0	Face
F-02B	43.50985625	-112.1914596	0	Face
F-02C	43.50986457	-112.1915612	0	Face
F-03	43.51005239	-112.1921283	0	Face
F-03B	43.51009027	-112.1924134	0	Face
F-03C	43.51012821	-112.1923705	0	Face
F-04	43.51272834	-112.1994118	0	Face
F-04B	43.5126907	-112.1992749	0	Face
F-04C	43.5120574	-112.1975757	0	Face
F-04D	43.51193065	-112.1972646	0	Face
F-04E	43.51217114	-112.1978454	0	Face
F-04F	43.51254754	-112.1989114	0	Face
F-04G	43.51247086	-112.1987367	0	Face
F-04H	43.5126418	-112.1991228	0	Face
F-04I	43.51243407	-112.1986026	0	Face
F-04J	43.51238137	-112.1984567	0	Face
F-04K	43.51227452	-112.1981327	0	Face
F-05	43.5142055	-112.2033429	0	Face
F-05A	43.51422742	-112.2034242	0	Face
F-05B	43.51425858	-112.2035359	0	Face
F-05C	43.51424847	-112.2034807	0	Face
F-06	43.51449938	-112.2042032	0	Face
F-06A	43.51466951	-112.2046662	0	Face
F-06B	43.51461784	-112.2045047	0	Face
F-06C	43.51457217	-112.2043264	0	Face
F-06D	43.51470455	-112.204773	0	Face
F-07	43.51680428	-112.2104896	0	Face
F-07A	43.51684701	-112.2105974	0	Face
F-07B	43.51686923	-112.2106364	0	Face
F-07C	43.51698186	-112.2109906	0	Face
F-07D	43.51690868	-112.2107491	0	Face
F-08	43.51778792	-112.2131128	0	Face
F-08A	43.51773339	-112.2129797	0	Face
F-08B	43.51769075	-112.2128394	0	Face
F-08C	43.51761394	-112.2126365	0	Face
F-08D	43.51752315	-112.2123717	0	Face
F-08E	43.51742372	-112.2121243	0	Face
F-09	43.51832473	-112.2146071	0	Face
F-09A	43.51828873	-112.2144898	0	Face
F-09B	43.51822794	-112.2143177	0	Face

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
F-09C	43.51817026	-112.2141488	0	Face
F-09D	43.51812379	-112.2140307	0	Face
F-09E	43.51809792	-112.2139354	0	Face
F-09F	43.51805323	-112.2138123	0	Face
F-09G	43.51801121	-112.2136823	0	Face
F-09H	43.51797861	-112.2135924	0	Face
F-09I	43.51792761	-112.2134571	0	Face
F-09J	43.5178631	-112.2133089	0	Face
F-09K	43.51796394	-112.2135408	0	Face
F-09L	43.51850129	-112.2151335	0	Face
F-09M	43.5184171	-112.2148946	0	Face
F-10	43.51865395	-112.2155001	0	Face
F-10A	43.51870232	-112.2156447	0	Face
F-11	43.5227824	-112.2321712	0	Face
F-11A	43.52277282	-112.2320589	0	Face
F-11B	43.52270804	-112.2316372	0	Face
F-11C	43.52266066	-112.2313706	0	Face
F-11D	43.52265119	-112.231295	0	Face
F-11E	43.52259137	-112.2310429	0	Face
F-11F	43.52257882	-112.2309804	0	Face
F-12	43.52330689	-112.2353156	0	Face
F-12A	43.52328977	-112.2352238	0	Face
F-12B	43.52326483	-112.2351272	0	Face
F-13	43.52334034	-112.2354957	0	Face
F-13A	43.52333224	-112.235448	0	Face
F-13B	43.5233148	-112.2353939	0	Face
F-14	43.5234151	-112.2358836	0	Face
F-14A	43.52340319	-112.2357791	0	Face
F-14B	43.52337968	-112.2356595	0	Face
F-15	43.5234845	-112.2363217	0	Face
F-15A	43.52346517	-112.2362095	0	Face
F-16	43.52385534	-112.2384833	0	Face
F-16A	43.52386628	-112.2384175	0	Face
F-16B	43.52385719	-112.2383558	0	Face
F-16C	43.52380199	-112.2381886	0	Face
F-16D	43.52377765	-112.2379288	0	Face
F-16E	43.52373392	-112.2377785	0	Face
F-16F	43.52370844	-112.2376658	0	Face
F-16G	43.52367815	-112.2374273	0	Face
F-16H	43.52366294	-112.2372245	0	Face
F-16I	43.52364265	-112.2370778	0	Face
F-16J	43.52363749	-112.2369707	0	Face
F-16K	43.52357793	-112.236799	0	Face
F-16L	43.52354967	-112.236632	0	Face
F-16M	43.52386672	-112.2385239	0	Face
F-17	43.52978146	-112.2740898	0	Face
F-17A	43.52977147	-112.2739221	0	Face
F-17B	43.5297454	-112.2736919	0	Face
F-18	43.52984482	-112.2744837	0	Face
F-19	43.53282835	-112.2923716	0	Face
F-19A	43.53282972	-112.2922695	0	Face
F-19B	43.53281253	-112.2921926	0	Face
SF-20	43.54797028	-112.3818399	0	Exposed cut showing fractured boulders
SF-20A	43.54793595	-112.3815644	0	Exposed cut showing fractured boulders
SF-20B	43.54786565	-112.3811101	0	Exposed cut showing fractured boulders
SF-20C	43.54781027	-112.3806819	0	Exposed cut showing fractured boulders
SF-20D	43.54773285	-112.3802127	0	Exposed cut showing fractured boulders
SF-20E	43.54764424	-112.379758	0	Exposed cut showing fractured boulders
SF-20F	43.5475456	-112.3791825	0	Exposed cut showing fractured boulders
SF-20G	43.54749818	-112.3788567	0	Exposed cut showing fractured boulders
F-21	43.55643701	-112.430842	0	Face
F-21A	43.55635098	-112.4302773	0	Face
F-21B	43.55628757	-112.4299194	0	Face
F-21C	43.55622276	-112.4296575	0	Face
F-22	43.55256582	-112.4790581	0	Face
F-22A	43.55259224	-112.4788305	0	Face

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
F-22B	43.55259758	-112.4787255	0	Face
F-22C	43.55258872	-112.4785635	0	Face
F-22D	43.55261715	-112.4785244	0	Face
F-22E	43.55267326	-112.4783735	0	Face
F-22F	43.55273402	-112.4781609	0	Face
F-22G	43.55275741	-112.4779662	0	Face
F-23	43.55142325	-112.4952195	0	Face
F-23A	43.55141979	-112.4950089	0	Face
F-23B	43.55139991	-112.4946643	0	Face
F-23C	43.55139788	-112.4945189	0	Face
F-24	43.55371208	-112.570505	0	Face
F-24A	43.55371702	-112.5703361	0	Face
F-24B	43.55372081	-112.5700853	0	Face
F-24C	43.55374802	-112.5699736	0	Face
F-24D	43.55368941	-112.5697733	0	Face
F-25	43.55415287	-112.5891731	0	Face
F-25A	43.55415816	-112.5890573	0	Face
F-25B	43.55417072	-112.5889777	0	Face
F-25C	43.55418218	-112.5887565	0	Face
F-26	43.5542262	-112.6056858	0	Face
F-26A	43.55424194	-112.6054305	0	Face
F-26B	43.55423463	-112.6052658	0	Face
F-26C	43.55422908	-112.6051256	0	Face
F-27	43.54969848	-112.6353388	0	Face
F-27A	43.54975762	-112.6351519	0	Face
F-27B	43.54985772	-112.6348043	0	Face
F-27C	43.54990508	-112.6345673	0	Face
F-27D	43.5499426	-112.6344036	0	Face
F-28	43.54946336	-112.6361648	0	Face
F-28A	43.54951604	-112.6359957	0	Face
F-28B	43.54956548	-112.63583	0	Face
F-29	43.54755962	-112.6432755	0	Face
F-29A	43.54759725	-112.6431433	0	Face
F-29B	43.54761596	-112.6430427	0	Face
F-30	43.54008103	-112.6710321	0	Face
F-30A	43.54011801	-112.6708586	0	Face
F-30B	43.54017572	-112.6706445	0	Face
F-31	43.53991968	-112.6715572	0	Face
F-31A	43.53996993	-112.6714044	0	Face
F-31B	43.53994911	-112.6714577	0	Face
F-32C	43.53380718	-112.6943354	0	Face
F-32D	43.53385289	-112.6942406	0	Face
F-32E	43.53387919	-112.6941293	0	Face
F-32F	43.53393705	-112.6939459	0	Face
F-32G	43.53407435	-112.6934225	0	Face
F-32H	43.53410861	-112.6933169	0	Face
F-32I	43.53415361	-112.6932455	0	Face
F-32J	43.53419163	-112.6930759	0	Face
F-33K	43.53155779	-112.7026022	0	Face
F-33L	43.53152546	-112.7027135	0	Face
F-33M	43.53157548	-112.7025427	0	Face
F-34N	43.51514217	-112.7637497	0	Face
F-34O	43.51499042	-112.7639403	0	Face
F-34P	43.5150074	-112.7639146	0	Face
F-34Q	43.51502673	-112.7638691	0	Face
F-34R	43.51507728	-112.7638233	0	Face
F-34S	43.51512492	-112.7636622	0	Face
F-35	43.51477861	-112.7639592	0	Face
F-35A	43.51476243	-112.7640181	0	Face
F-35B	43.51475049	-112.7640531	0	Face
F-35C	43.51217039	-112.7751853	0	Face
F-35D	43.51219812	-112.7750347	0	Face
F-35E	43.51222623	-112.7749594	0	Face
F-35F	43.5122824	-112.7746768	0	Face
F-35G	43.51228454	-112.7746051	0	Face
F-35H	43.51230023	-112.7745021	0	Face

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
SF-35	43.51210729	-112.775427	0	Exposed cut showing fractured boulders
SF-35	43.51214302	-112.7752882	0	Exposed cut showing fractured boulders
SF-35A	43.51224185	-112.7748454	0	Exposed cut showing fractured boulders
SF-35B	43.51233443	-112.7743281	0	Exposed cut showing fractured boulders
SF-36C	43.50576312	-112.8826874	0	Exposed cut showing fractured boulders
SF-36D	43.50578261	-112.8829117	0	Exposed cut showing fractured boulders
SF-36	43.50579971	-112.8831353	0	Exposed cut showing fractured boulders
SF-36A	43.50582934	-112.8836079	0	Exposed cut showing fractured boulders
F-36	43.50585067	-112.8837771	0	Face
F-37	43.53139724	-112.7024173	0	Face
F-37A	43.5313758	-112.7024818	0	Face
F-37B	43.53135547	-112.70256	0	Face
F-37C	43.53132576	-112.7026207	0	Face
F-37D	43.53120679	-112.7030408	0	Face
F-37E	43.53114757	-112.7029644	0	Face
F-37F	43.53113609	-112.7030553	0	Face
F-37G	43.53111516	-112.7031398	0	Face
F-37H	43.53116416	-112.703188	0	Face
F-37I	43.51208585	-112.7745013	0	Face
F-37J	43.51201413	-112.7747731	0	Face
F-37K	43.51206801	-112.7745359	0	Face
F-37L	43.51201638	-112.7746857	0	Face
F-38	43.53388989	-112.693013	0	Face
F-38A	43.53385137	-112.693179	0	Face
F-38B	43.53382082	-112.6933184	0	Face
F-38C	43.53371747	-112.6936769	0	Face
F-38D	43.53368915	-112.6938216	0	Face
F-38E	43.53363502	-112.6939766	0	Face
F-38F	43.53360488	-112.6940482	0	Face
F-38G	43.53359297	-112.6941617	0	Face
F-39	43.5359078	-112.6857621	0	Face
F-39A	43.53587954	-112.6857996	0	Face
F-39B	43.53587835	-112.6858942	0	Face
F-40	43.54758551	-112.6422488	0	Face
F-40A	43.54755209	-112.6423692	0	Face
F-40B	43.54751115	-112.6425321	0	Face
F-40C	43.54741004	-112.6429108	0	Face
F-40D	43.54736489	-112.6430475	0	Face
F-40E	43.54735686	-112.6430978	0	Face
F-41	43.54839877	-112.639341	0	Face
F-41A	43.54836837	-112.6393972	0	Face
F-41B	43.54832014	-112.6395574	0	Face
F-41C	43.54829713	-112.6396532	0	Face
F-41D	43.54828469	-112.6397474	0	Face
F-42	43.54874198	-112.6376756	0	Face
F-42A	43.54873592	-112.6377489	0	Face
F-43	43.54910455	-112.6367644	0	Face
F-43A	43.54909837	-112.6367975	0	Face
F-44	43.54934545	-112.6357891	0	Face
F-44A	43.54931843	-112.6358921	0	Face
F-44B	43.5492899	-112.6360115	0	Face
F-44C	43.54927339	-112.636103	0	Face
F-45	43.54974368	-112.6343563	0	Face
F-45A	43.54971053	-112.6344602	0	Face
F-45B	43.54965719	-112.6346653	0	Face
F-45C	43.54962928	-112.6347433	0	Face
F-45D	43.54962511	-112.6348266	0	Face
F-45E	43.54969065	-112.6345695	0	Face
F-46	43.55404167	-112.6096732	0	Face
F-46A	43.55403898	-112.6098124	0	Face
F-46B	43.55406308	-112.6099085	0	Face
F-47	43.55400676	-112.5988691	0	Face
F-47A	43.55400015	-112.5991747	0	Face
F-47B	43.55401628	-112.5993589	0	Face
F-47C	43.5540062	-112.5990248	0	Face
F-48	43.55400408	-112.597671	0	Face

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
F-48A	43.55395043	-112.5977962	0	Face
F-48B	43.55399927	-112.5979052	0	Face
F-48C	43.55401277	-112.5980231	0	Face
F-49	43.55397693	-112.5887125	0	Face
F-49A	43.55395868	-112.5888453	0	Face
F-49B	43.55396952	-112.5889562	0	Face
F-50	43.55386001	-112.5880596	0	Face
F-50A	43.5539317	-112.5881358	0	Face
F-50B	43.55396694	-112.5882475	0	Face
F-51	43.55114377	-112.4945009	0	Face
F-51A	43.55110028	-112.4946302	0	Face
F-51B	43.55115107	-112.494759	0	Face
F-51C	43.55113322	-112.4948688	0	Face
F-51D	43.55119597	-112.4948425	0	Face
F-52E	43.55214344	-112.4787886	0	Face
F-52F	43.55217457	-112.4790713	0	Face
F-52G	43.55218478	-112.47894	0	Face
F-53	43.55229322	-112.4778867	0	Face
F-53A	43.55229349	-112.4779671	0	Face
F-53B	43.55235941	-112.478082	0	Face
F-53C	43.55235777	-112.478145	0	Face
F-54	43.5555411	-112.4573914	0	Face
F-55	43.55638155	-112.4503819	0	Face
F-55A	43.55635271	-112.4504395	0	Face
F-55B	43.55635008	-112.450498	0	Face
F-55C	43.55634603	-112.4505498	0	Face
F-56	43.55655954	-112.449413	0	Face
F-56A	43.55660497	-112.4494577	0	Face
F-56B	43.55660791	-112.4495152	0	Face
F-57	43.55708947	-112.4424868	0	Face
F-57A	43.55705581	-112.4425956	0	Face
F-57B	43.55712589	-112.4426886	0	Face
F-58	43.55628716	-112.4319536	0	Face
F-58A	43.556314	-112.4320328	0	Face
F-58B	43.5563393	-112.4319586	0	Face
F-58C	43.55635609	-112.4319996	0	Face
F-58D	43.55639623	-112.4320908	0	Face
F-58E	43.5563917	-112.4321309	0	Face
F-59	43.55618725	-112.4315359	0	Face
F-59A	43.55619053	-112.4315781	0	Face
F-60	43.55587446	-112.429896	0	Face
F-60A	43.5559517	-112.4300408	0	Face
F-60B	43.55602878	-112.430055	0	Face
F-61	43.55177299	-112.4051862	0	Face
F-61A	43.55176763	-112.4053348	0	Face
F-61B	43.55184086	-112.4054218	0	Face
F-61C	43.55186955	-112.4056274	0	Face
F-61D	43.55185462	-112.4057598	0	Face
F-62	43.54945078	-112.3916102	0	Face
F-62A	43.54940887	-112.3913748	0	Face
F-62B	43.54927374	-112.3912003	0	Face
F-62C	43.54932945	-112.3914109	0	Face
F-62D	43.54940713	-112.3915835	0	Face
F-62E	43.54943387	-112.3918859	0	Face
F-62F	43.54946672	-112.3921026	0	Face
F-62G	43.54952955	-112.3922347	0	Face
F-62H	43.54946947	-112.3923063	0	Face
F-62I	43.54946335	-112.3924848	0	Face
F-62J	43.54954218	-112.3925185	0	Face
F-62K	43.54964485	-112.3926936	0	Face
F-62L	43.54966348	-112.392855	0	Face
F-62M	43.549698	-112.3930031	0	Face
F-62N	43.54968641	-112.3932058	0	Face
F-63	43.5319381	-112.2891475	0	Face
F-63A	43.53195369	-112.289154	0	Face
F-64	43.52922963	-112.272001	0	Face

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
F-64A	43.52923927	-112.2721379	0	Face
F-64B	43.52937771	-112.2731298	0	Face
F-64C	43.52940202	-112.2732853	0	Face
F-64D	43.52942643	-112.2733291	0	Face
F-65	43.52891464	-112.2712461	0	Face
F-65A	43.5289839	-112.2712361	0	Face
F-65B	43.52907965	-112.2711742	0	Face
F-65C	43.52900241	-112.2712692	0	Face
F-65D	43.52909468	-112.2713128	0	Face
F-65E	43.52909989	-112.2714057	0	Face
F-66	43.52563285	-112.2505181	0	Face
F-66A	43.52563899	-112.2506205	0	Face
F-66B	43.52565815	-112.2507663	0	Face
F-66C	43.52570925	-112.2509095	0	Face
F-67	43.52497127	-112.2465088	0	Face
F-67A	43.52496804	-112.2465779	0	Face
F-67B	43.52498846	-112.2467394	0	Face
F-67C	43.52503028	-112.2468761	0	Face
SF-68	43.52311176	-112.2362712	0	Exposed cut showing fractured boulders
SF-68A	43.52304974	-112.2361282	0	Exposed cut showing fractured boulders
SF-68B	43.5230926	-112.2357026	0	Exposed cut showing fractured boulders
SF-68C	43.52303569	-112.235849	0	Exposed cut showing fractured boulders
SF-68D	43.52307949	-112.2355154	0	Exposed cut showing fractured boulders
F-69	43.5225265	-112.2318493	0	Face
F-69A	43.52255833	-112.2319971	0	Face
F-69B	43.52255836	-112.2320632	0	Face
F-69C	43.52257946	-112.2321422	0	Face
F-70	43.5220067	-112.2286979	0	Face
F-70A	43.52201734	-112.2287904	0	Face
F-70B	43.52204562	-112.2288745	0	Face
F-70C	43.52205523	-112.2289912	0	Face
F-70D	43.52204934	-112.2290538	0	Face
F-70E	43.52208537	-112.2291862	0	Face
F-71	43.52142942	-112.2257956	0	Face
F-71A	43.52144812	-112.225894	0	Face
F-71B	43.52146275	-112.2259868	0	Face
F-72	43.51727003	-112.2126247	0	Face
F-72A	43.51739766	-112.2127111	0	Face
F-72B	43.51726234	-112.2128543	0	Face
F-72C	43.51749443	-112.2130178	0	Face
F-72D	43.51746294	-112.2132437	0	Face
F-72E	43.51758525	-112.2133524	0	Face
F-72F	43.51754074	-112.2134035	0	Face
F-72G	43.5174707	-112.213378	0	Face
F-72H	43.51756809	-112.2135295	0	Face
F-72I	43.51772513	-112.2136107	0	Face
F-72J	43.51769563	-112.2138562	0	Face
F-72K	43.51782735	-112.2138591	0	Face
F-72L	43.51782823	-112.2139154	0	Face
F-72M	43.51778217	-112.2139613	0	Face
F-72N	43.51783315	-112.2140627	0	Face
F-72O	43.51796512	-112.2142698	0	Face
F-72P	43.51799859	-112.2144687	0	Face
F-73	43.51679772	-112.2110568	0	Face
F-73A	43.51682092	-112.2111796	0	Face
F-73B	43.51675181	-112.2111212	0	Face
F-73C	43.51669741	-112.2111254	0	Face
F-73D	43.5167212	-112.211242	0	Face
F-73E	43.5168188	-112.2111891	0	Face
F-73F	43.51688076	-112.2112857	0	Face
F-73G	43.51803851	-112.2146599	0	Face
F-74	43.51572341	-112.2082082	0	Face
F-74A	43.51570969	-112.2083184	0	Face
F-74B	43.51576902	-112.2083323	0	Face
F-74C	43.51579945	-112.2083995	0	Face
F-75D	43.51400332	-112.2035165	0	Face

Deoth-to-Bedrock Data

Name	Latitude (WGS 84)	Longitude (WGS 84)	Sounding/Drilling Depth (ft)	Notes
F-75E	43.51397772	-112.2034655	0	Face
F-75F	43.51391025	-112.2033331	0	Face
F-75G	43.51383716	-112.2032634	0	Face
F-75H	43.51381423	-112.2033062	0	Face
F-75I	43.51375614	-112.2033515	0	Face
F-75J	43.5139318	-112.2034218	0	Face
F-75K	43.51386061	-112.203424	0	Face
F-75L	43.51385081	-112.2034757	0	Face
F-75M	43.51383901	-112.2035401	0	Face
F-75N	43.51392054	-112.2034971	0	Face
F-75O	43.5139599	-112.2035041	0	Face
F-75P	43.51401167	-112.2035463	0	Face
F-76	43.51314847	-112.2015779	0	Face
F-76A	43.51310327	-112.2016367	0	Face
F-76B	43.51312092	-112.2016291	0	Face
F-76C	43.5131647	-112.2015703	0	Face
F-77	43.51246874	-112.1993376	0	Face
F-77A	43.51242596	-112.1991993	0	Face
F-77B	43.51194302	-112.1980107	0	Face
F-77C	43.5121459	-112.1985254	0	Face
F-77D	43.51222886	-112.198743	0	Face
F-77E	43.51244	-112.1993245	0	Face
F-77F	43.51249635	-112.1994837	0	Face
F-78	43.51128123	-112.1963402	0	Face
F-78A	43.51130107	-112.1962973	0	Face
F-78B	43.5113241	-112.1962808	0	Face
F-79	43.50981623	-112.1922021	0	Face
F-79A	43.5097628	-112.192252	0	Face
F-79B	43.50969983	-112.1923943	0	Face
F-79C	43.50977467	-112.1923827	0	Face
F-79D	43.50982726	-112.1922665	0	Face
F-79E	43.50982306	-112.1923246	0	Face
F-79F	43.50994121	-112.1925227	0	Face
F-80	43.50893857	-112.1897534	0	Face
F-80A	43.50908622	-112.1901971	0	Face
F-80B	43.50906835	-112.1901116	0	Face
F-80C	43.50832257	-112.1881254	0	Face
F-80D	43.5084397	-112.1884523	0	Face
F-80E	43.50847527	-112.1885529	0	Face
F-80F	43.50855939	-112.1887668	0	Face
F-80G	43.50886647	-112.1896252	0	Face
F-80H	43.50890673	-112.1897348	0	Face
F-80I	43.50892885	-112.1897993	0	Face
F-80J	43.50898068	-112.1899647	0	Face
F-80K	43.50905077	-112.1901224	0	Face
F-80L	43.50907786	-112.1901996	0	Face
SW-153	43.50294831	-112.1564555	2	bedrock
SW-151	43.50521827	-112.1767032	3.7	no bedrock encountered
SW-149	43.51161171	-112.1971481	1	bedrock
SW-131	43.55380307	-112.4172998	3.7	no bedrock encountered
SW-126	43.55183269	-112.4818863	6	no bedrock encountered
SW-125	43.55133363	-112.499618	3.7	no bedrock encountered
SW-124	43.55175261	-112.5106945	0.5	bedrock
SW-138	43.53905751	-112.3301455	2.4	bedrock
SW-140	43.53517929	-112.3066026	6	no bedrock encountered
SW-142	43.53164501	-112.285143	6	bedrock
SW-144	43.52781805	-112.2622618	5.7	no bedrock encountered
SW-201	43.52600016	-112.2522697	3.5	rubble basalt encountered
SW-202	43.5260794	-112.2523122	5	rubble basalt encountered
SW-204	43.524361	-112.2411584	5	rubble basalt encountered
SW-205	43.52412479	-112.2409618	5.5	rubble basalt encountered
SW-206	43.52419269	-112.2409524	7.5	rubble basalt encountered
SW-146	43.52258647	-112.2308416	2.1	bedrock
SW-148	43.5163249	-112.2091984	2.5	bedrock
SW-150	43.50851164	-112.1879715	15	bedrock
SW-152	43.5047277	-112.164468	2.1	bedrock

APPENDIX C: LABORATORY TEST RESULTS

Appendix C

Laboratory Test Results

CONTENTS

- Summary of Laboratory Test Results
- Atterberg Limits Test Results
- Particle-Size Distribution Reports
- Compaction Test Report
- AASHTO Classification
- Resilient Modulus Test Results
- Rock Core Compressive Strength
- Soil Resistivity and pH for Corrosion Test Reports
- Chloride & Sulfate Corrosion Reports

SHANNON & WILSON

Project Information

Report to: Horrocks Engineers
Project: US-20 W, Puzzle to Idaho Falls
Report Date: 8/18/2025
File No.: 71-112895-200

Material Information

Date Sampled: 8/4 to 8/7/2025
Sampled By: Shannon & Wilson
Date Received: 8/11/2025
Date Tested: 8/12 to 8/15/2025

SUMMARY OF LABORATORY RESULTS

Lab Number	Borehole	Sample Type	Depth (ft)	Water Content (%)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index	Soil Type	Remarks
25-0845	SW-125	RM-31	2.9'-3.6'	18.1	89.8	NV	NP	ML	--
25-0846	SW-126	OSS-33	2.0'-4.0'	12.4	95.8	26	5	CL-ML	--
25-0848	SW-131	RM-36	3.0'-3.7'	15.9	97.8	29	9	CL	--
25-0849	SW-140	SS-28	4.0'-6.0'	22.3	93.4	29	10	CL	--
25-0850	SW-142	OSS-25	2.0'-4.0'	13.5	47.0	35	15	GC	--
25-0852	SW-144	RM-23	2.3'-3.0'	19.5	94.5	37	20	CL	--
25-0853	SW-150	SS-02	2.5'-4.0'	13.0	95.2	29	6	ML	--
25-0855	SW-151	RM-39	2.2'-2.9'	20.1	97.6	NV	NP	ML	--
25-0856	SW-202	SS-18	2.5'-4.0'	19.4	90.9	27	8	CL	--
25-0857	SW-204	SS-16	2.5'-4.0'	18.4	93.5	27	7	CL-ML	--
25-0858	SW-205	SS-14	2.5'-4.0'	12.1	49.4	26	7	GC-GM	Contaminated with asphalt

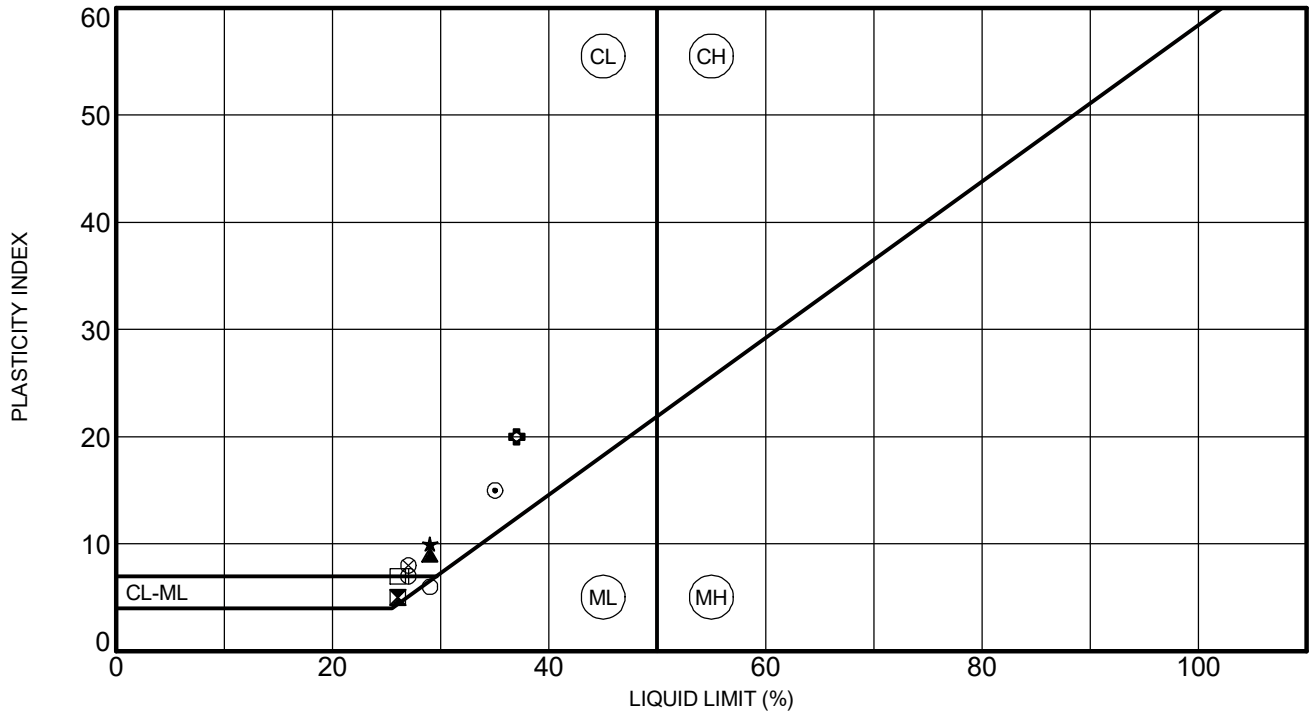
Prepared By: Roxanne Boucher

QC: TT

ATTERBERG LIMITS REPORT

SHANNON & WILSON

CLIENT: Horrocks Engineers
PROJECT NAME: US-20 W, Puzzle to Idaho Falls
FILE NUMBER: 71-112895-200
PROJECT LOCATION: Bonneville County, Idaho



	Specimen Identification		MC	LL	PL	PI	Fines	Classification
	SW-125 RM-31	2.9	18.1	NV	NV	NP	90	SILT (ML)
⊠	SW-126 OSS-33	2.0	12.4	26	21	5	96	SILTY CLAY (CL-ML)
▲	SW-131 RM-36	3.0	15.9	29	20	9	98	LEAN CLAY (CL)
★	SW-140 SS-28	4.0	22.3	29	19	10	93	LEAN CLAY (CL)
⊙	SW-142 OSS-25	2.0	13.5	35	20	15	47	CLAYEY GRAVEL (GC)
✿	SW-144 RM-23	2.3	19.5	37	17	20	95	LEAN CLAY (CL)
○	SW-150 SS-02	2.5	13.0	29	23	6	95	SILT (ML)
	SW-151 RM-39	2.2	20.1	NV	NV	NP	98	SILT (ML)
⊗	SW-202 SS-18	2.5	19.4	27	19	8	91	LEAN CLAY (CL)
⊕	SW-204 SS-16	2.5	18.4	27	20	7	94	SILTY CLAY (CL-ML)
□	SW-205 SS-14	2.5	12.1	26	19	7	49	SILTY, CLAYEY GRAVEL (GC-GM)
			--				--	
			--				--	
			--				--	
			--				--	
			--				--	
			--				--	
			--				--	

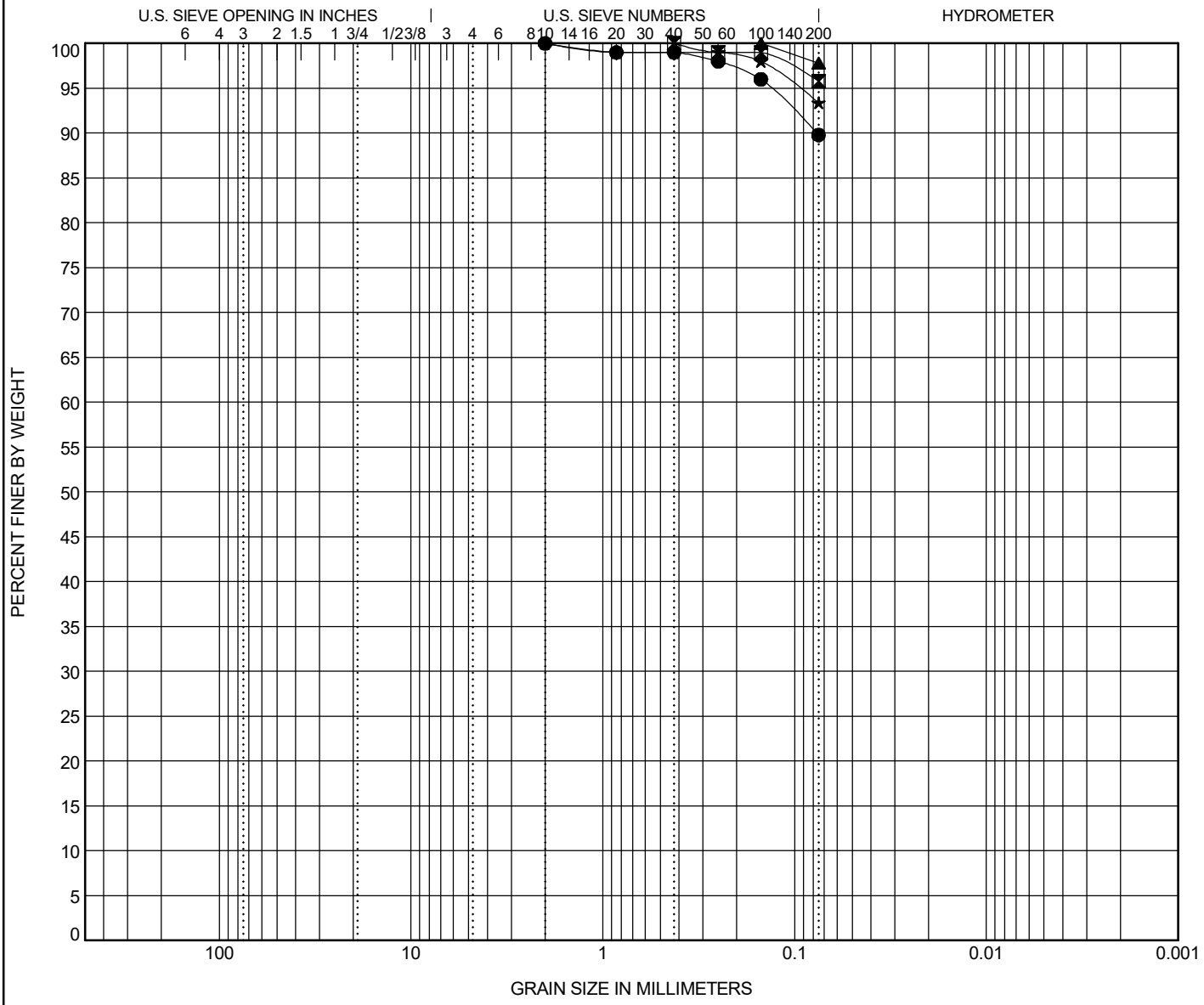
QC: TT

Prepared By: Roxanne Boucher

PARTICLE-SIZE DISTRIBUTION REPORT

SHANNON & WILSON

CLIENT: Horrocks Engineers
PROJECT NAME: US-20 W, Puzzle to Idaho Falls
FILE NUMBER: 71-112895-200
PROJECT LOCATION: Bonneville County, Idaho



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	D10	D30	D60
●	SW-125 RM-31 2.9	SILT (ML)	--	--	--
⊠	SW-126 OSS-33 2.0	SILTY CLAY (CL-ML)	--	--	--
▲	SW-131 RM-36 3.0	LEAN CLAY (CL)	--	--	--
★	SW-140 SS-28 4.0	LEAN CLAY (CL)	--	--	--

	Specimen Identification	%Gravel	%Sand	%Fines	D15	D50	D85	Cc	Cu	MC	LL	PI
●	SW-125 RM-31 2.9	0.0	10.2	89.8	--	--	--	--	--	18.1	NV	NP
⊠	SW-126 OSS-33 2.0	0.0	4.2	95.8	--	--	--	--	--	12.4	26	5
▲	SW-131 RM-36 3.0	0.0	2.2	97.8	--	--	--	--	--	15.9	29	9
★	SW-140 SS-28 4.0	0.0	6.6	93.4	--	--	--	--	--	22.3	29	10

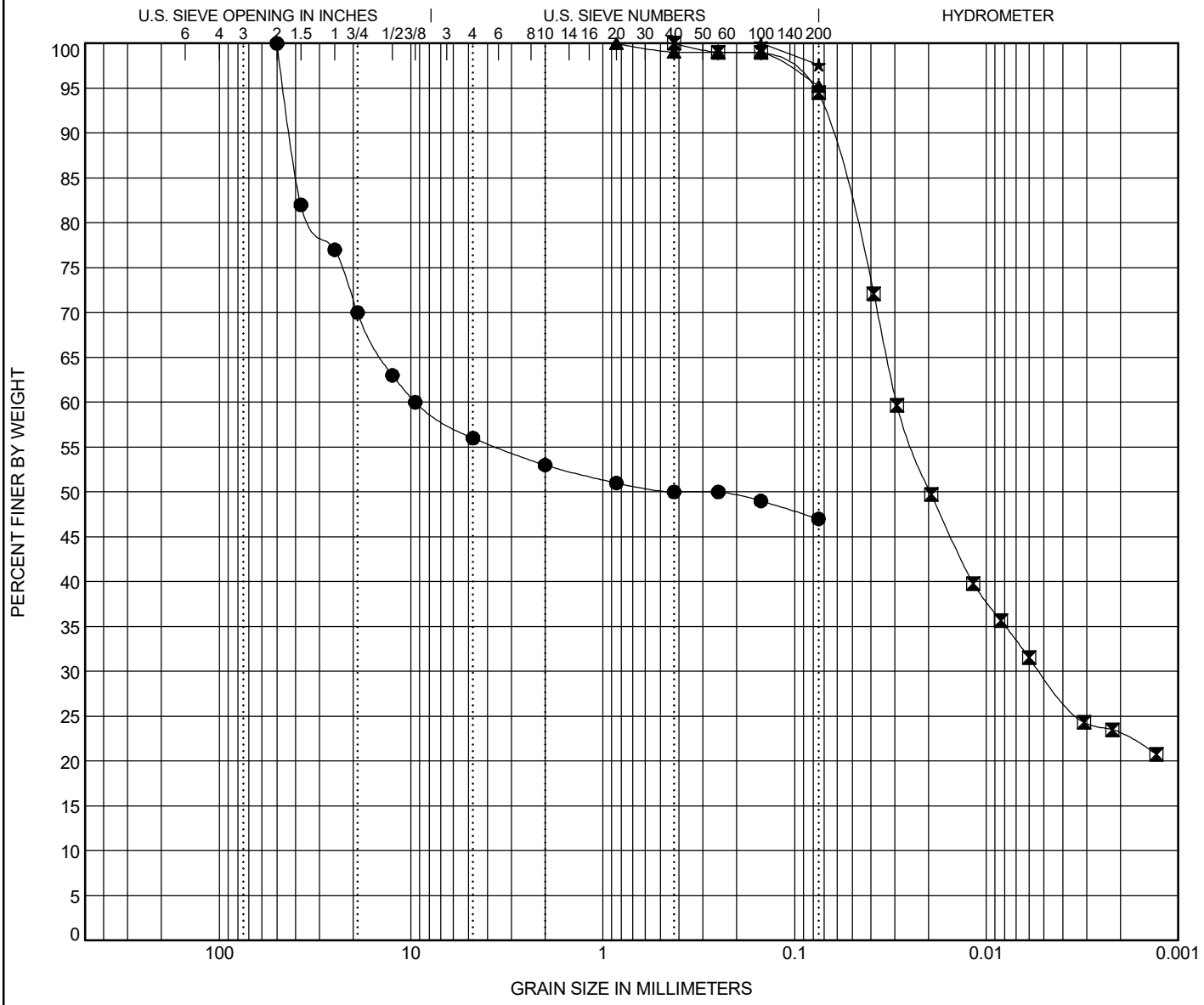
QC: TT

Prepared By: Roxanne Boucher

PARTICLE-SIZE DISTRIBUTION REPORT

SHANNON & WILSON

CLIENT: Horrocks Engineers
PROJECT NAME: US-20 W, Puzzle to Idaho Falls
FILE NUMBER: 71-112895-200
PROJECT LOCATION: Bonneville County, Idaho



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	D10	D30	D60
● SW-142 OSS-25 2.0	CLAYEY GRAVEL (GC)	--	--	9.5
⊠ SW-144 RM-23 2.3	LEAN CLAY (CL)	--	0.005	0.029
▲ SW-150 SS-02 2.5	SILT (ML)	--	--	--
★ SW-151 RM-39 2.2	SILT (ML)	--	--	--

Specimen Identification	%Gravel	%Sand	%Fines	D15	D50	D85	Cc	Cu	MC	LL	PI
● SW-142 OSS-25 2.0	44.0	9.0	47.0	--	0.25	39.342	--	--	13.5	35	15
⊠ SW-144 RM-23 2.3	0.0	5.5	94.5	--	0.02	0.057	--	--	19.5	37	20
▲ SW-150 SS-02 2.5	0.0	4.8	95.2	--	--	--	--	--	13.0	29	6
★ SW-151 RM-39 2.2	0.0	2.4	97.6	--	--	--	--	--	20.1	NV	NP

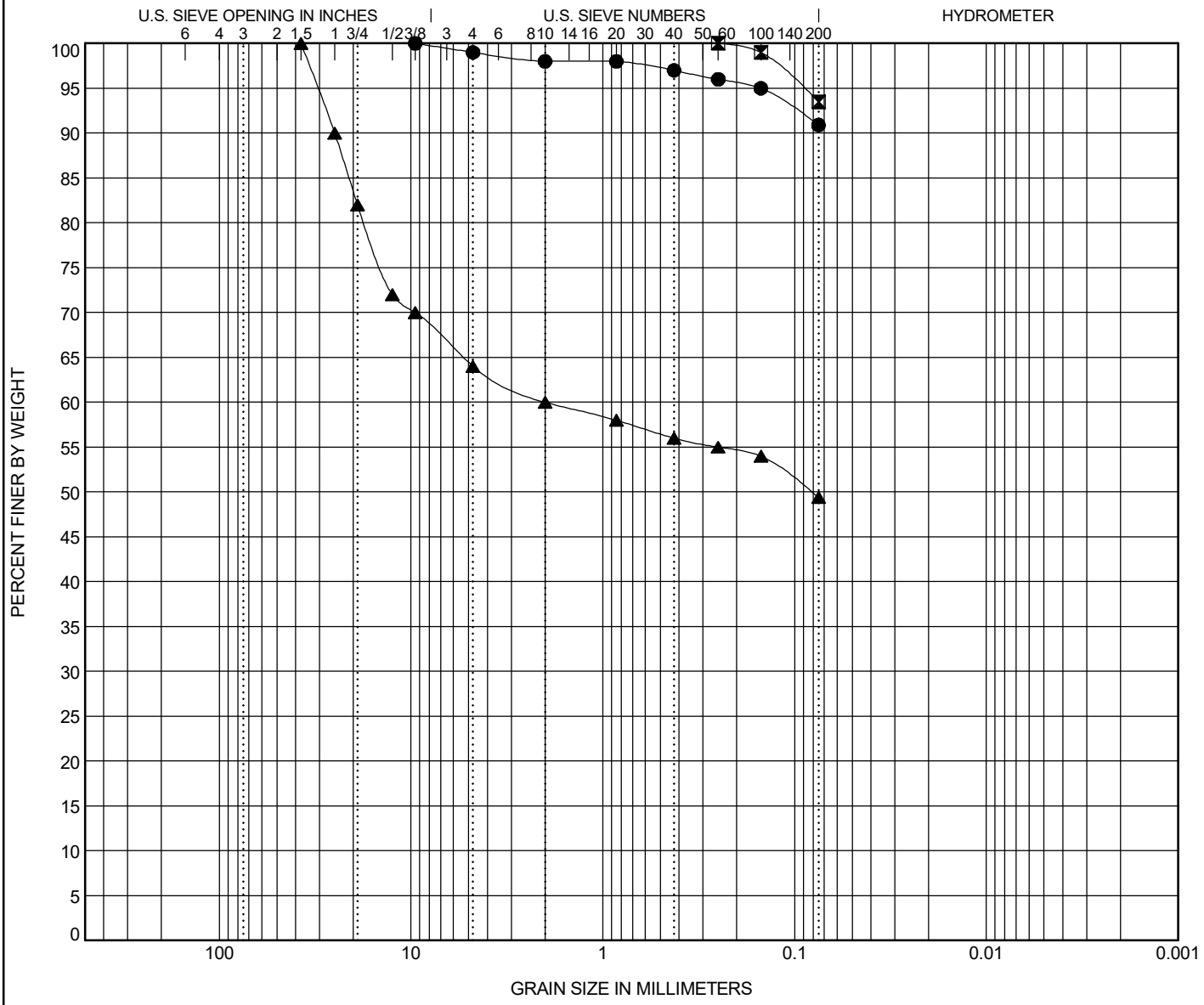
QC: TT

Prepared By: Roxanne Boucher

PARTICLE-SIZE DISTRIBUTION REPORT

SHANNON & WILSON

CLIENT: Horrocks Engineers
PROJECT NAME: US-20 W, Puzzle to Idaho Falls
FILE NUMBER: 71-112895-200
PROJECT LOCATION: Bonneville County, Idaho



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

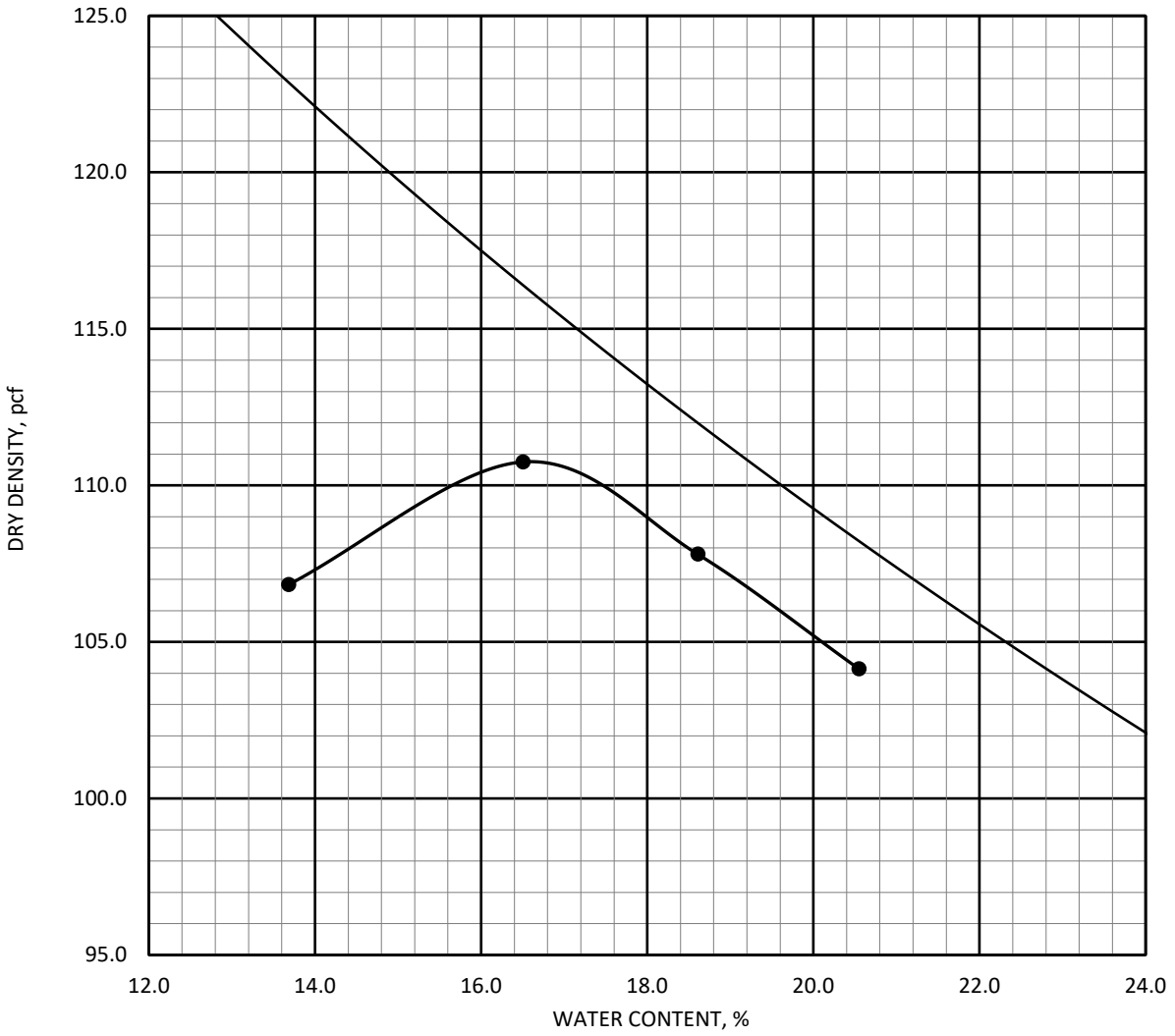
Specimen Identification				Classification	D10	D30	D60
●	SW-202	SS-18	2.5	LEAN CLAY (CL)	--	--	--
⊠	SW-204	SS-16	2.5	SILTY CLAY (CL-ML)	--	--	--
▲	SW-205	SS-14	2.5	SILTY, CLAYEY GRAVEL (GC-GM)	--	--	2

Specimen Identification				%Gravel	%Sand	%Fines	D15	D50	D85	Cc	Cu	MC	LL	PI
●	SW-202	SS-18	2.5	1.0	8.1	90.9	--	--	--	--	--	19.4	27	8
⊠	SW-204	SS-16	2.5	0.0	6.5	93.5	--	--	--	--	--	18.4	27	7
▲	SW-205	SS-14	2.5	36.0	14.6	49.4	--	0.082	21.06	--	--	12.1	26	7

QC: TT

Prepared By: Roxanne Boucher

COMPACTION TEST REPORT



Sp.G. for ZAV = 2.7

Project Number	112895	**AASHTO T-99, Method A**	
Project Name	US-20 West Puzzle to IF	**Maximum Dry Density, pcf**	**110.8**
Client	Horrocks		
Sample Location	SW-131, BK-37; 2.0'-3.7'	**Optimum Moisture, %**	**16.6**
Sample Description	Lean Clay (CL)		
Lab Number	25-0848	Percent of Aggregate > #4	0
Date Sampled	8/4 to 8/7/2025		
Sampled By	Shannon & Wilson		
Date Tested	8/13/2025		
Tested By	EH		
Remarks			

SHANNON & WILSON

Reviewed By: *Roxanne Boucher*

Shannon & Wilson
5260 Chinden Blvd.
Boise, Idaho 83714
Phone:(208) 658-8700

Report to: Horrocks
Report Date: 8/15/2025
Project No.: 112895
Project: US-20 W, Puzzle to Idaho Falls

Material Information

Date Sampled: 8/4 to 8/7/2025
Sampled By: Shannon & Wilson
Date Received: 8/11/2025
Date Tested: 8/12 to 8/14/2025

AASHTO CLASSIFICATION

Lab Number	Boring/Pit	Sample ID	Depth	AASHTO Classification	
25-0845	SW-125	RM-31	2.9'-3.6'	A-4	Silty Soils
25-0848	SW-131	RM-36	3.0'-3.7'	A-4	Silty Soils
25-0852	SW-144	RM-23	2.3'-3.0'	A-6	Clayey Soils
25-0855	SW-151	RM-39	2.2'-2.9'	A-4	Silty Soils

Reviewed By: *Travis Thomsen*

SHANNON & WILSON

Client Name: Horrocks
Project Name: US-20 West Puzzle to IF
Project No: 71-112895
Report Date: 8/15/2025

Material Information

Boring/Sample ID: SW-125, RM-31
Material Type: Type-2 (Subgrade)
Type of Sample: 4" Dia Undisturbed
Dry Density (pcf): 79.0 In-situ
Specimen WC (%) 18.1 In-situ

Lab Number: 25-0845
AASHTO Clasification: A4
Depth of Specimen (ft.): 3.30
Date Sampled: August 2025
Date Tested: 8/12/2025

Test Results

Resilient Modulus Test (AASHTO T-307)

Sequence No	Confining Stress	Total Axial Stress	Bulk Stress	Octahedral Shear Stress	Measured Resilient Modulus	Predicted Resilient Modulus
	σ_3	σ_d	θ	τ_{oct}	M_r	Pred. M_r
	psi	psi	psi	psi	psi	psi
1	6.00	2.02	20.04	0.95	10519	9928
2	6.00	4.08	22.09	1.92	8550	9295
3	6.00	6.08	24.10	2.87	8597	8734
4	6.01	8.10	26.11	3.82	8406	8221
5	6.00	10.05	28.06	4.74	8566	7763
6	4.00	2.03	14.04	0.96	9307	8093
7	4.00	4.17	16.18	1.97	7453	7736
8	4.00	6.11	18.12	2.88	6861	7409
9	4.00	8.06	20.06	3.80	6894	7082
10	4.00	10.04	22.05	4.73	7197	6764
11	2.01	2.04	8.06	0.96	6622	5883
12	2.00	4.07	10.06	1.92	5407	5927
13	2.00	6.05	12.06	2.85	5295	5885
14	2.00	8.06	14.06	3.80	5585	5777
15	2.00	10.03	16.02	4.73	5967	5637

Resilient Modulus Equation

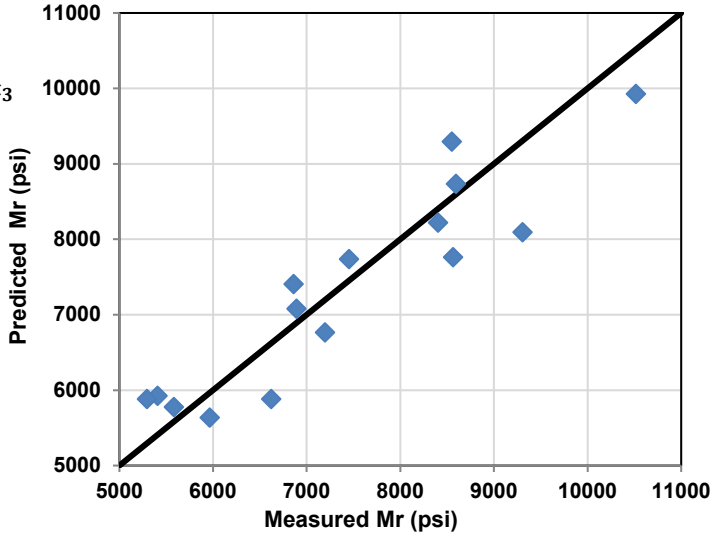
$$Mr = k_1 * Pa * \left(\frac{\theta}{Pa}\right)^{k_2} * \left(\frac{\zeta oct}{Pa} + 1\right)^{k_3}$$

Resilient Modulus Model Parameters

k_1 = **642.634**

k_2 = **0.573**

k_3 = **-2.027**



Note: As per NCHRP 1-28A guidance, consider a design resilient modulus for subgrade materials using the confining stress of 2 psi and total axial stress of 6 psi

Tested By: REB **Reviewed By:** THT

SHANNON & WILSON

Client Name: Horrocks
Project Name: US-20 West Puzzle to IF
Project No: 71-112895
Report Date: 8/15/2025

Material Information

Boring/Sample ID: SW-131, RM-36
Material Type: Type-2 (Subgrade)
Type of Sample: 4" Dia Undisturbed
Dry Density (pcf): 84.3 In-situ
Specimen WC (%) 15.9 In-situ

Lab Number: 25-0848
AASHTO Clasification: A4
Depth of Specimen (ft.): 3.30
Date Sampled: August 2025
Date Tested: 8/12/2025

Test Results

Resilient Modulus Test (AASHTO T-307)

Sequence No	Confining Stress	Total Axial Stress	Bulk Stress	Octahedral Shear Stress	Measured Resilient Modulus	Predicted Resilient Modulus
	σ_3	σ_d	θ	τ_{oct}	M_r	Pred. M_r
	psi	psi	psi	psi	psi	psi
1	6.00	2.06	20.07	0.97	7833	7918
2	6.01	4.21	22.23	1.98	7452	7260
3	6.01	6.07	24.08	2.86	6748	6749
4	6.01	8.04	26.05	3.79	6455	6265
5	6.01	10.02	28.03	4.72	6298	5829
6	4.00	2.04	14.06	0.96	6779	6569
7	4.00	4.17	16.18	1.96	5617	6153
8	4.01	6.05	18.07	2.85	5228	5803
9	4.00	8.04	20.05	3.79	5289	5454
10	4.01	10.02	22.04	4.72	5415	5132
11	2.00	2.03	8.03	0.95	5851	4893
12	2.00	4.07	10.08	1.92	4502	4821
13	2.00	6.04	12.04	2.85	4220	4687
14	2.00	8.03	14.02	3.79	4379	4519
15	2.00	10.02	16.02	4.72	4521	4337

Resilient Modulus Equation

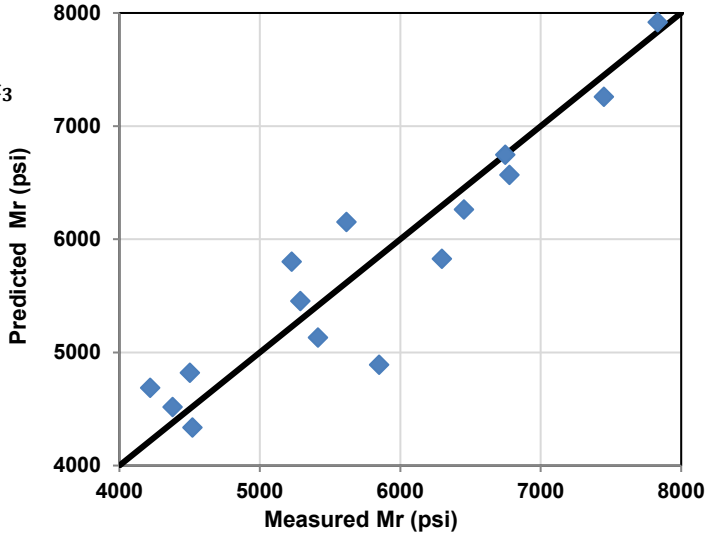
$$Mr = k_1 * Pa * \left(\frac{\theta}{Pa}\right)^{k_2} * \left(\frac{\zeta oct}{Pa} + 1\right)^{k_3}$$

Resilient Modulus Model Parameters

k_1 = **527.927**

k_2 = **0.528**

k_3 = **-2.249**



Note: As per NCHRP 1-28A guidance, consider a design resilient modulus for subgrade materials using the confining stress of 2 psi and total axial stress of 6 psi

Tested By: REB **Reviewed By:** THT

SHANNON & WILSON

Client Name: Horrocks
Project Name: US-20 West Puzzle to IF
Project No: 71-112895
Report Date: 1/0/1900

Material Information

Boring/Sample ID: SW-144, RM-23
Material Type: Type-2 (Subgrade)
Type of Sample: 4" Dia Undisturbed
Dry Density (pcf): 81.0 In-situ
Specimen WC (%) 19.5 In-situ

Lab Number: 25-0852
AASHTO Clasification: A6
Depth of Specimen (ft.): 2.70
Date Sampled: August 2025
Date Tested: 8/12/2025

Test Results

Resilient Modulus Test (AASHTO T-307)

Sequence No	Confining Stress	Total Axial Stress	Bulk Stress	Octahedral Shear Stress	Measured Resilient Modulus	Predicted Resilient Modulus
	σ_3	σ_d	θ	τ_{oct}	M_r	Pred. M_r
	psi	psi	psi	psi	psi	psi
1	6.00	2.03	20.04	0.96	5940	6701
2	6.00	4.05	22.06	1.91	5635	5987
3	6.01	6.06	24.07	2.85	5274	5378
4	6.00	8.05	26.06	3.79	5234	4857
5	6.01	10.04	28.06	4.73	5222	4407
6	4.00	2.03	14.04	0.96	7103	5756
7	4.00	4.04	16.05	1.90	5018	5232
8	4.01	6.04	18.06	2.85	4427	4763
9	4.00	8.04	20.06	3.79	4354	4346
10	4.01	10.05	22.07	4.74	4350	3975
11	2.00	2.02	8.04	0.95	5644	4542
12	2.00	4.04	10.05	1.90	3902	4286
13	2.00	6.03	12.04	2.84	3417	4010
14	2.00	8.05	14.04	3.79	3457	3733
15	2.00	10.04	16.05	4.73	3281	3471

Resilient Modulus Equation

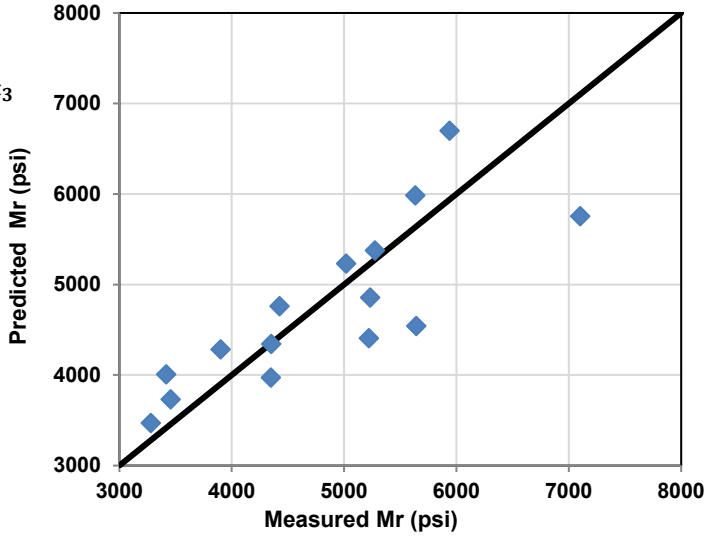
$$Mr = k_1 * Pa * \left(\frac{\theta}{Pa}\right)^{k_2} * \left(\frac{\zeta oct}{Pa} + 1\right)^{k_3}$$

Resilient Modulus Model Parameters

k_1 = **470.919**

k_2 = **0.426**

k_3 = **-2.603**



Note: As per NCHRP 1-28A guidance, consider a design resilient modulus for subgrade materials using the confining stress of 2 psi and total axial stress of 6 psi

Tested By: REB **Reviewed By:** THT

SHANNON & WILSON

Client Name: Horrocks
Project Name: US-20 West Puzzle to IF
Project No: 71-112895
Report Date: 1/0/1900

Material Information

Boring/Sample ID: SW-151, RM-39
Material Type: Type-2 (Subgrade)
Type of Sample: 4" Dia Undisturbed
Dry Density (pcf): 96.8 In-situ
Specimen WC (%) 20.1 In-situ

Lab Number: 25-0855
AASHTO Clasification: A4
Depth of Specimen (ft.): 2.60
Date Sampled: August 2025
Date Tested: 8/12/2025

Test Results

Resilient Modulus Test (AASHTO T-307)

Sequence No	Confining Stress	Total Axial Stress	Bulk Stress	Octahedral Shear Stress	Measured Resilient Modulus	Predicted Resilient Modulus
	σ_3	σ_d	θ	τ_{oct}	M_r	Pred. M_r
	psi	psi	psi	psi	psi	psi
1	6.00	2.02	20.03	0.95	13498	13162
2	6.01	4.16	22.18	1.96	12671	12795
3	6.00	6.21	24.22	2.93	11943	12436
4	6.00	8.25	26.26	3.89	11953	12093
5	6.00	10.19	28.21	4.81	12121	11777
6	4.00	2.03	14.04	0.96	11503	10430
7	4.00	4.20	16.20	1.98	10090	10399
8	4.00	6.15	18.16	2.90	9717	10329
9	4.00	8.13	20.13	3.83	10121	10213
10	4.00	10.16	22.17	4.79	10544	10074
11	2.00	2.03	8.03	0.96	7528	7237
12	2.00	4.17	10.17	1.96	7243	7681
13	2.00	6.08	12.08	2.87	7429	7935
14	2.00	8.10	14.10	3.82	8168	8102
15	2.00	10.06	16.06	4.74	8679	8189

Resilient Modulus Equation

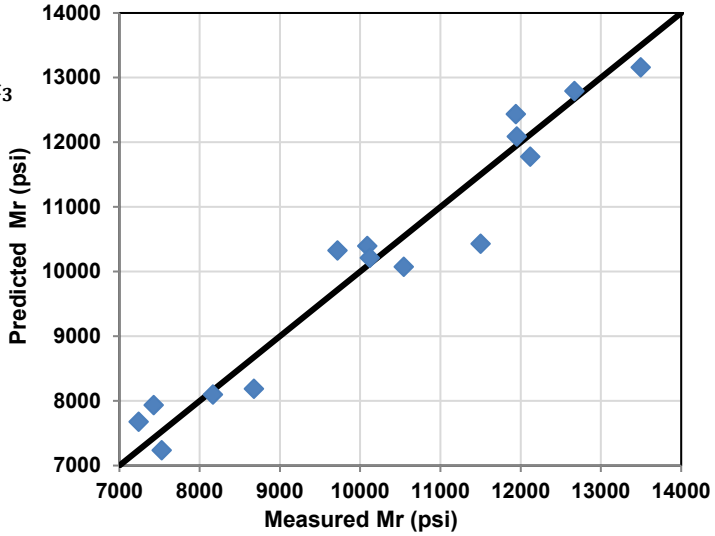
$$Mr = k_1 * Pa * \left(\frac{\theta}{Pa}\right)^{k_2} * \left(\frac{\zeta oct}{Pa} + 1\right)^{k_3}$$

Resilient Modulus Model Parameters

k_1 = **804.990**

k_2 = **0.654**

k_3 = **-1.522**



Note: As per NCHRP 1-28A guidance, consider a design resilient modulus for subgrade materials using the confining stress of 2 psi and total axial stress of 6 psi

Tested By: REB

Reviewed By: THT

Shannon & Wilson
5260 Chinden Blvd.
Boise, Idaho 83714
Phone:(208) 658-8700

Report to: Horrocks
Project: US-20 W, Puzzle to Idaho Falls
Report Date: 8/18/2025
File No.: 112895

Material Information

Date Sampled: 8/4 to 8/7/2025
Sampled By: Shannon & Wilson
Date Received: 8/11/2025
Date Tested: 8/13 to 8/14/2025

Test Results

Soil Resistivity and pH for Corrosion Testing

AASHTO T-288, T-289

Lab Number	Sample ID	Soil Type	Minimum Resistivity Ohm-cm	pH	@ Temp, F°
25-0844	SW-125, GB-30; 0.5'-1.0'	CL	1,350	8.0	75.7
25-0847	SW-131, GB-35; 0.5'-1.0'	ML	1,910	8.4	77.0
25-0851	SW-144, GB-22; 0.5'-1.0'	CL	1,050	8.4	75.8
25-0854	SW-151, GB-38; 0.5'-1.0'	ML	1,090	7.8	76.9

Reviewed By: *Travis Thomsen*

Analytical Laboratories Inc

1804 N. 33rd Street
Boise, Idaho 83703
Phone (208) 342-5515

www.analyticallaboratories.com
Lab Federal ID# ID00020

Laboratory Analysis Report

Report To: ROXY BOUCHER
SHANNON & WILSON
5260 CHINDEN BLVD
BOISE, ID 83714
Phone: (208) 658-8700 Copy:
e-mail: roxy.boucher@shanwil.com
Date Received: 08/13/2025
Collection Date/Time: 08/07/2025 0:00

Lab/Sample Number: 2517785-01
Sample Location: US-20 WEST PUZZLE TO IF - PROJECT NO.: 71-112895 - 25-0844, SW-125, GB-30; 0.5'-1.0'
Date Printed: 08/27/2025 14:38
Collector's Name:
Transported By: ETHAN HOEFER
Temp C Received at Lab:

Field Measurements

pH: Total Chlorine mg/L: DO mg/L:
Temp C: Free Chlorine mg/L: Flow g/min:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Inorganics									
Sulfate, SO4	11	mg/kg	10	2		8/15/25 18:35	NC	EPA 300.0	
Chloride, Cl	51	mg/kg	10	2		8/15/25 18:35	NC	EPA 300.0	

Analytical Laboratories Inc

1804 N. 33rd Street
Boise, Idaho 83703
Phone (208) 342-5515

www.analyticallaboratories.com
Lab Federal ID# ID00020

Laboratory Analysis Report

Report To: ROXY BOUCHER
SHANNON & WILSON
5260 CHINDEN BLVD
BOISE, ID 83714
Phone: (208) 658-8700 Copy:
e-mail: roxy.boucher@shanwil.com
Date Received: 08/13/2025
Collection Date/Time: 08/07/2025 0:00

Lab/Sample Number: 2517785-02
Sample Location: US-20 WEST PUZZLE TO IF - PROJECT NO.: 71-112895 - 25-0847, SW-131, GB-35; 0.5'-1.0'
Date Printed: 08/27/2025 14:38
Collector's Name:
Transported By: ETHAN HOEFER
Temp C Received at Lab:

Field Measurements

pH: Total Chlorine mg/L: DO mg/L:
Temp C: Free Chlorine mg/L: Flow g/min:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Inorganics									
Sulfate, SO4	ND	mg/kg	10	2		8/15/25 18:35	NC	EPA 300.0	
Chloride, Cl	33	mg/kg	10	2		8/15/25 18:35	NC	EPA 300.0	

Analytical Laboratories Inc

1804 N. 33rd Street
Boise, Idaho 83703
Phone (208) 342-5515

www.analyticallaboratories.com
Lab Federal ID# ID00020

Laboratory Analysis Report

Report To: ROXY BOUCHER
SHANNON & WILSON
5260 CHINDEN BLVD
BOISE, ID 83714
Phone: (208) 658-8700 Copy:
e-mail: roxy.boucher@shanwil.com
Date Received: 08/13/2025
Collection Date/Time: 08/07/2025 0:00

Lab/Sample Number: 2517785-03
Sample Location: US-20 WEST PUZZLE TO IF - PROJECT NO.: 71-112895 - 25-0851, SW-144, GB-22; 0.5'-1.0'
Date Printed: 08/27/2025 14:38
Collector's Name:
Transported By: ETHAN HOEFER
Temp C Received at Lab:

Field Measurements

pH: Total Chlorine mg/L: DO mg/L:
Temp C: Free Chlorine mg/L: Flow g/min:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Inorganics									
Sulfate, SO4	54	mg/kg	10	2		8/15/25 18:35	NC	EPA 300.0	
Chloride, Cl	67	mg/kg	10	2		8/15/25 18:35	NC	EPA 300.0	

Analytical Laboratories Inc

1804 N. 33rd Street
Boise, Idaho 83703
Phone (208) 342-5515

www.analyticallaboratories.com
Lab Federal ID# ID00020

Laboratory Analysis Report

Report To: ROXY BOUCHER
SHANNON & WILSON
5260 CHINDEN BLVD
BOISE, ID 83714
Phone: (208) 658-8700 Copy:
e-mail: roxy.boucher@shanwil.com
Date Received: 08/13/2025
Collection Date/Time: 08/07/2025 0:00

Lab/Sample Number: 2517785-04
Sample Location: US-20 WEST PUZZLE TO IF - PROJECT NO.: 71-112895 - 25-0854, SW-151, GB-38; 0.5'-1.0'

Date Printed: 08/27/2025 14:38
Collector's Name:
Transported By: ETHAN HOEFER
Temp C Received at Lab:

Field Measurements

pH: Total Chlorine mg/L: DO mg/L:
Temp C: Free Chlorine mg/L: Flow g/min:

Analyte	Result	Units	MRL	MDL	MCL	Analyzed	Analyst	Method	Notes
Inorganics									
Sulfate, SO4	1,530	mg/kg	10	2		8/23/25 22:41	NC	EPA 300.0	
Chloride, Cl	4,470	mg/kg	10	2		8/23/25 22:41	NC	EPA 300.0	

Authorized Signature,

JAMES HIBBS, Client Manager

This report shall not be reproduced except in full, without the written approval of the laboratory
The results reported relate only to the samples indicated.

ND - Non Detect
MCL - Maximum Contaminant Level
MDL - Method Detection Limit
MRL - Method Reporting Limit

Shannon & Wilson
5260 Chinden Blvd.
Boise, Idaho 83714
Phone:(208) 658-8700

SHANNON & WILSON

Report to: Horrocks
Project: US-20 West Supplemental 1
Report Date: 8/22/2025
Project No.: 112895-002

Material Information

Date Sampled: 8/4 to 8/15/2025
Sampled By: S&W
Date Received: 8/19/2025
Date Tested: 8/21/2025

Compressive Strength of Intact Rock Cores ASTM D7012 Method C

Lab Number	Sample ID	Sample Depth, ft	Average Diameter, in	Average Height, in	Load, lbs	Compressive Strength, psi
25-0907	SW-121,CR-43	3.5'-4.0'	2.387	5.605	22,899	**5,117**
25-0908	SW-127,CR-78	10.5'-11.0'	2.405	5.525	21,650	**4,766**
25-0909	SW-134,CR-80	4.5'-5.0'	2.404	5.261	19,999	**4,406**
25-0910	SW-143,CR-83	8.5'-9.0'	2.403	5.573	33,595	**7,408**
25-0911	SW-150,CR-06	11.5'-12.0'	2.363	5.536	20,358	**4,642**

Reviewed By: *Paul Clawges*

APPENDIX D: MATERIALS PROPERTIES

Appendix D

Materials Properties

CONTENTS

- LTPPBind Report

US-20, Exit 337 Ramps 3 mil

LTPPBind V3.0 PG Binder Selection Report (Date: 5/28/2025)

Parameter	A=3 km	B=21 km	C=38 km	D=40 km	E=41 km
Station ID	ID7644	ID8022	ID9065	ID4457	ID0470
Elevation, m	4570	4598	5732	4393	4886
Degree-Days >10 C	2460	2308	1952	2477	2152
Low Air Temperature, C	-29.6	-30.7	-33.1	-28.5	-29.6
Low Air Temp. Std Dev	4.9	4.7	4.1	4.9	3.8

Input Data

Latitude, Degree	43.8
Yearly Degree-Days>10C	2270
Lowest Yearly Air Temp., Deg. C	-30.3
Low Temp. Std. Dev., Deg. C	4.5
Base HT PG	52

Traffic Adjustments for HT

Desired Reliability, Percent	98
Traffic Loading, Million ESAL	3 to 10 M. ESAL
Traffic Speed	Slow
High Temp. Adjustment	10.3

PG Temperature	HIGH	LOW
PG Temp. at 50% Reliability	50.0	-22.3
PG Temp. at Desired Reliability	53.1	-30.2
Adjustments for Traffic	10.3	
Adjustments for Depth	0.0	0.0
Adjusted PG Temperature	63.4	-30.2
Selected PG Binder Grade	64	-34

QC:mjs

APPENDIX E: TRAFFIC

Appendix E

Traffic

CONTENTS

- Traffic Data
- Traffic Projection Worksheet

APPENDIX E: TRAFFIC

TRAFFIC DATA

Projected Commercial and 18,000 Equivalent Single Axle Loadings (ESALS)				
Project Number:	A024(394)		Key Number:	24394
County:	Butte, Bingham, and Bonneville		District:	District_6
Route:	US-020		From Measure:	261.276
RouteID:	02070AUS020		To Measure:	299.855
Last year with data:	2023			
Starting to Cumulate in:	2026		Requested By:	Mart Earl
Cumulating ESALs up to:	2068		Email:	mee@Shanwil.com

RouteID	From Measure	To Measure	Description From	Description To	Truck Density	Projection Year	Projection ADTs			Rigid Pavement ESALs (In 1000s) Both Directions		Flexible Pavement ESALs (In 1000s) Both Directions	
							Total (AADT)	Passenger (PAADT)	Commercial (CAADT)	Year	Cumulative	Year	Cumulative
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2026	3197	2883	314	483	483	249	249
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2028	3328	2992	336	526	1515	272	782
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2030	3459	3101	358	572	2636	297	1365
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2032	3590	3210	381	619	3850	323	1997
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2034	3722	3318	403	667	5159	348	2679
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2036	3853	3427	426	715	6565	375	3415
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2038	3984	3536	448	766	8071	403	4207
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2040	4115	3645	470	818	9680	431	5054
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2042	4246	3754	493	871	11395	459	5958
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2044	4378	3862	515	925	13216	487	6919
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2046	4509	3971	538	983	15153	518	7941
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2048	4640	4080	560	1039	17202	550	9024
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2050	4771	4189	582	1095	19364	583	10172
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2052	4902	4298	605	1155	21644	614	11384
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2054	5034	4406	627	1216	24045	650	12667
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2056	5165	4515	650	1278	26571	686	14022
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2058	5296	4624	672	1342	29225	721	15448
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2060	5427	4733	694	1410	32011	758	16947
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2062	5558	4842	717	1476	34930	793	18516
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2064	5690	4950	739	1544	37983	829	20155
US-20	261.276	299.855	US-26	W BROADWAY CONN	3 - Heavy	2066	5821	5059	762	1613	41174	865	21867

*Traffic data obtained from ITD Planning on 6/13/2025 by M. Earl. Some rows and columns not used in the design process are hidden

QC:mjs

APPENDIX E: TRAFFIC

TRAFFIC PROJECTION WORKSHEET

SHANNON & WILSON

Traffic Projection Worksheet

Project Name: US-20, Puzzle to IF
Location: MP 271.0 to MP 301.3
Project No: 71-112895
Date: June 30, 2025

Flexible Pavement --> **Beginning Year:** 2026 **Ending Year:** 2046 **Analysis Period:** 20
Rigid Pavement --> **Beginning Year:** 2026 **Ending Year:** 2066 **Analysis Period:** 40

Parameter		Roadway Segment: US-20 Puzzle to IF
Traffic Volume		
2026	AADT	
2030	Passenger AADT	
2026	Commercial AADTT	
	% Truck Traffic	
	ITD Truck Density	
Lane Information		
	No. of Lanes in Design Direction	1
	% Trucks in Design Direction	60%
	% of Trucks in Design Lane	100%
Flexible ESAL Projections - Both Directions		
2026	Flexible Cummulative ESALs	249,000
2046	Flexible Cummulative ESALs	7,941,000
Design Values:		
	Flexible Design ESALs	**4,615,200**
	Traffic Index, TI	**10.8**
Rigid ESAL Projections - Both Directions		
2026	Rigid Cummulative ESALs	483,000
2066	Rigid Cummulative ESALs	41,174,000
Design Value:		
	Rigid Design ESALs	**24,414,600**

Flexible

Rigid

By:mee
QC:mjs

APPENDIX F: PAVEMENT DESIGN CALCULATION REPORTS

Appendix F

Pavement Design Calculation Reports

CONTENTS

AASHTOWare Pavement M-E Designs

- Flexible Reconstruction
- Rigid Reconstruction

APPENDIX F: PAVEMENT DESIGN CALCULATION REPORTS

FLEXIBLE RECONSTRUCTION

US-20 Puzzle to IF Flex V-3_31 Prep 8-27-25

Tenant: Shannon and Wilson Inc - BOISE IDAHO OFFICE

Workspace: System Workspace

Design Inputs

Design Life: 20 years
Design Type: FLEXIBLE

Base Construction: July 2026
Pavement construction: August 2026
Traffic Opening: September 2026

Climate Data Sources (lat., long.): 43.5, -112.5; 43.5, -111.875; 43.5, -113.125

Design Structure

Layer Type	Material Type	Thickness (in)
Flexible	New HMA (PG 64-34)	4.2
NonStabilized	Untreated Aggregate Base (A-1-a)	7.8
NonStabilized	Granular Subbase (A-1-a)	15
Subgrade	Subgrade (A-6)	Semi-infinite

Volumetric at Construction:	
Effective binder content (%)	11.6
Air voids (%)	7.5

Traffic

Age (year)	Heavy Trucks (cumulative)
2026 (initial)	314
2036 (10 years)	865,524
2046 (20 years)	2,275,370

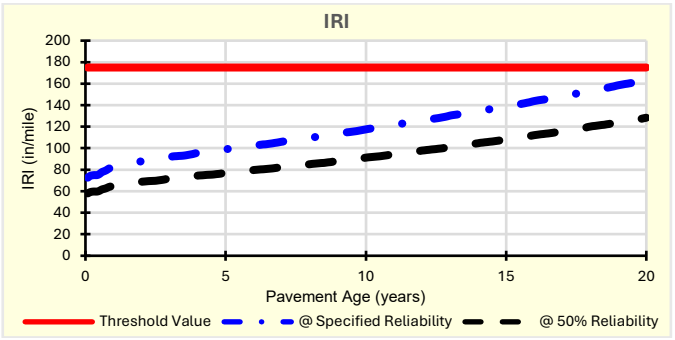
Age in Design Period, years	Cumulative Flexible ESALs - Design Lane
2036 (10 years)	1793064
2046 (20 years)	4661081

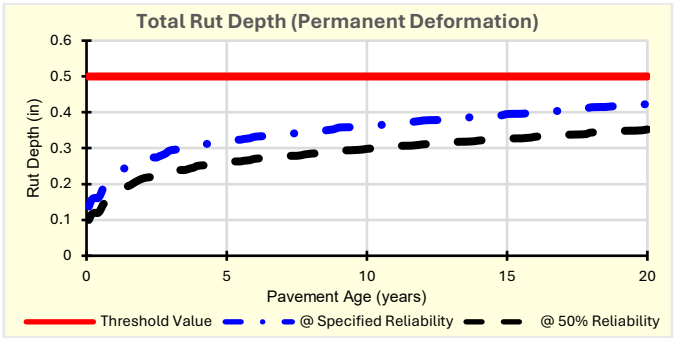
Design Outputs

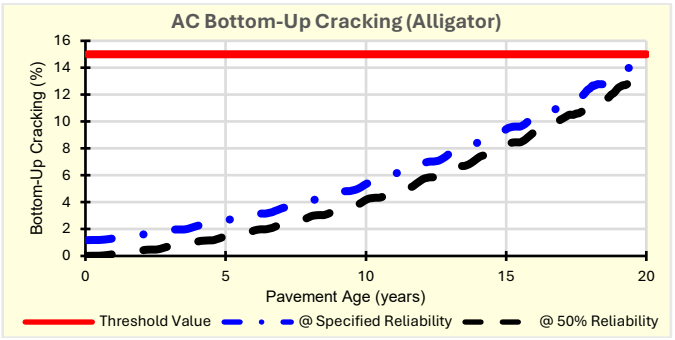
Distress Prediction Summary

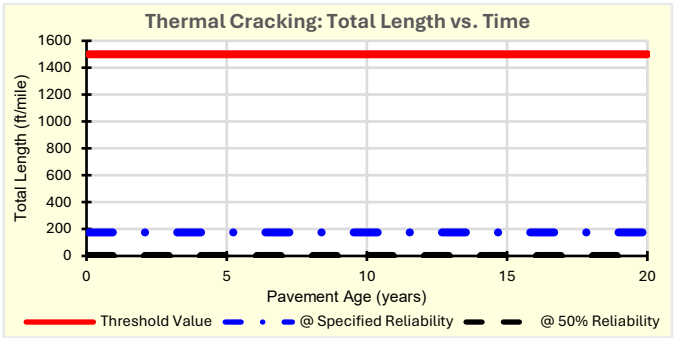
Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in/mile)	175.00	163.50	85.00	91.52	Pass
Permanent deformation - total pavement (in)	0.50	0.42	85.00	98.38	Pass
AC bottom-up fatigue cracking (%)	15.00	14.87	85.00	87.43	Pass
AC thermal cracking (ft/mile)	1500.00	175.12	85.00	100.00	Pass
Permanent deformation - AC only (in)	0.50	0.09	85.00	100.00	Pass

Distress Charts





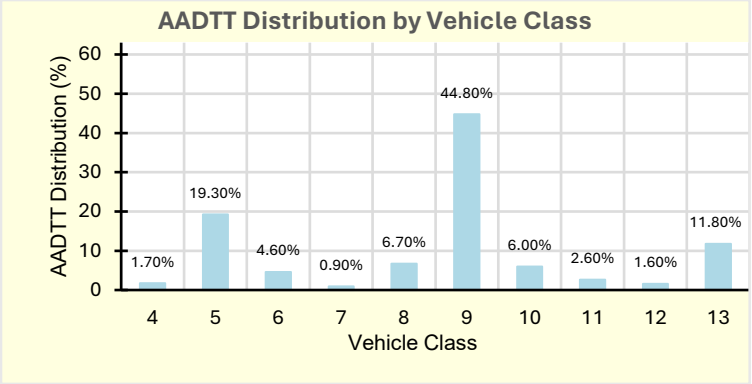




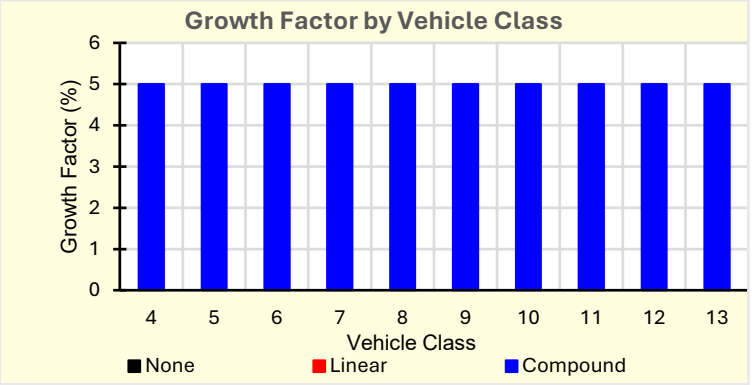
Traffic Inputs

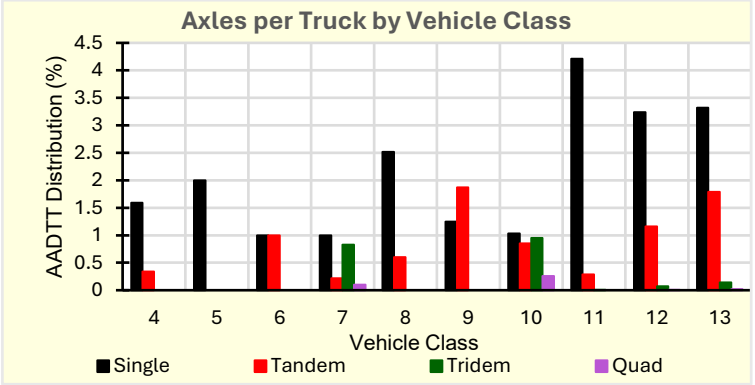
Graphical Representation of Traffic Inputs

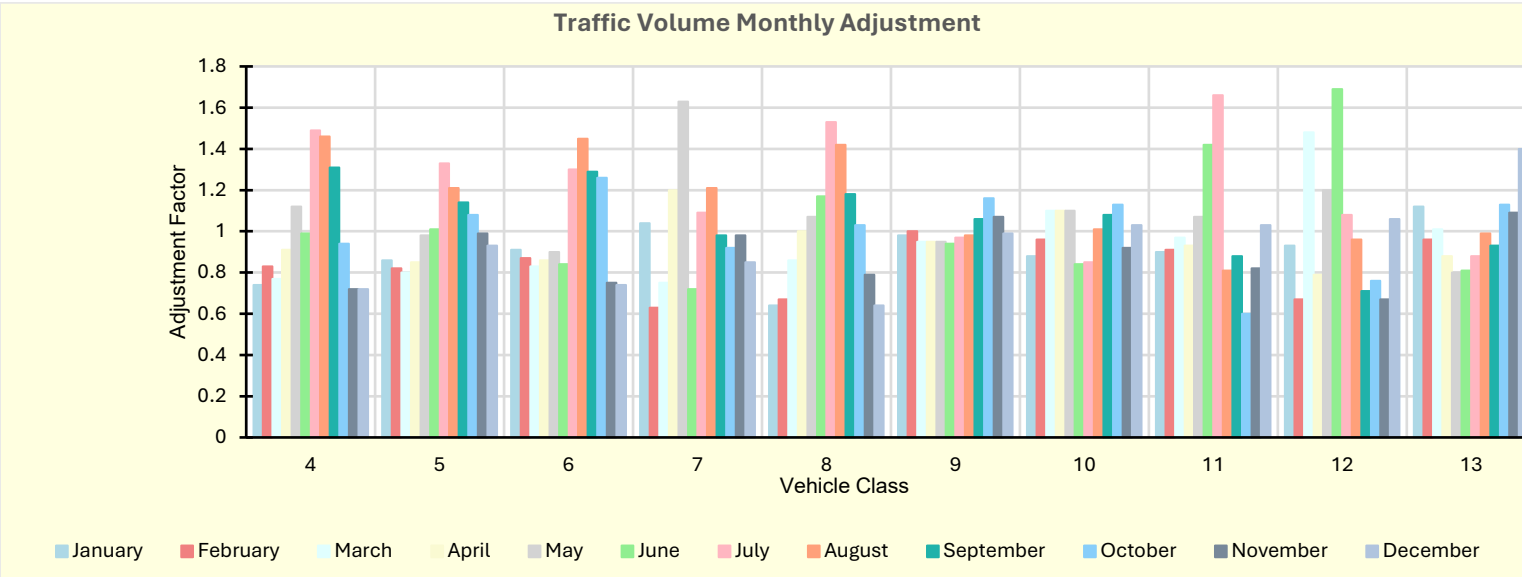
Initial two-way AADTT	314
Number of lanes in design direction	1
Percent of trucks in design direction (%)	60
Percent of trucks in design lane (%)	100
Operation speed (mph)	65
Axle Distribution	Custom



Truck Distribution by Hour does not apply to the design type.







Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors (Level 3: Default MAF)

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.7	0.9	0.9	1.0	0.6	1.0	0.9	0.9	0.9	1.1
February	0.8	0.8	0.9	0.6	0.7	1.0	1.0	0.9	0.7	1.0
March	0.8	0.8	0.8	0.8	0.9	1.0	1.1	1.0	1.5	1.0
April	0.9	0.9	0.9	1.2	1.0	1.0	1.1	0.9	0.8	0.9
May	1.1	1.0	0.9	1.6	1.1	1.0	1.1	1.1	1.2	0.8
June	1.0	1.0	0.8	0.7	1.2	0.9	0.8	1.4	1.7	0.8
July	1.5	1.3	1.3	1.1	1.5	1.0	0.9	1.7	1.1	0.9
August	1.5	1.2	1.5	1.2	1.4	1.0	1.0	0.8	1.0	1.0
September	1.3	1.1	1.3	1.0	1.2	1.1	1.1	0.9	0.7	0.9
October	0.9	1.1	1.3	0.9	1.0	1.2	1.1	0.6	0.8	1.1
November	0.7	1.0	0.8	1.0	0.8	1.1	0.9	0.8	0.7	1.1
December	0.7	0.9	0.7	0.9	0.6	1.0	1.0	1.0	1.1	1.4

Distributions by Vehicle Class

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.7%	5%	Compound
Class 5	19.3%	5%	Compound
Class 6	4.6%	5%	Compound
Class 7	0.9%	5%	Compound
Class 8	6.7%	5%	Compound
Class 9	44.8%	5%	Compound
Class 10	6.0%	5%	Compound
Class 11	2.6%	5%	Compound
Class 12	1.6%	5%	Compound
Class 13	11.8%	5%	Compound

Truck Distribution by Hour does not apply

Axle Configuration

Traffic Wander	
Mean wheel location (in)	18.0
Traffic wander standard deviation (in)	10.0
Design lane width (ft)	12.0

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in)	12.0
Tire pressure (psi)	120.0

Average Axle Spacing	
Tandem axle spacing (in)	51.6
Tridem axle spacing (in)	49.2
Quad axle spacing (in)	49.2

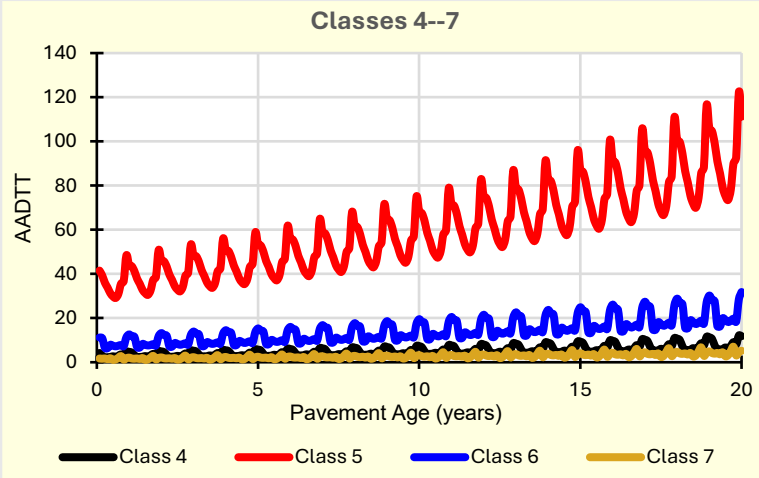
Wheelbase does not apply

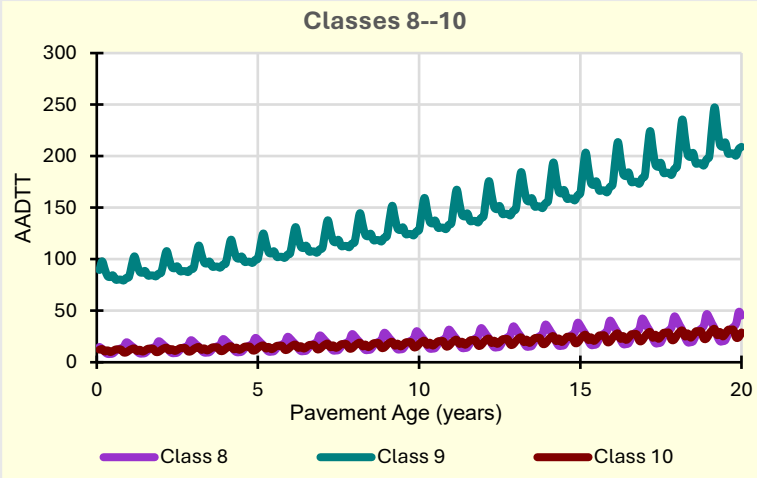
Number of Axles per Truck

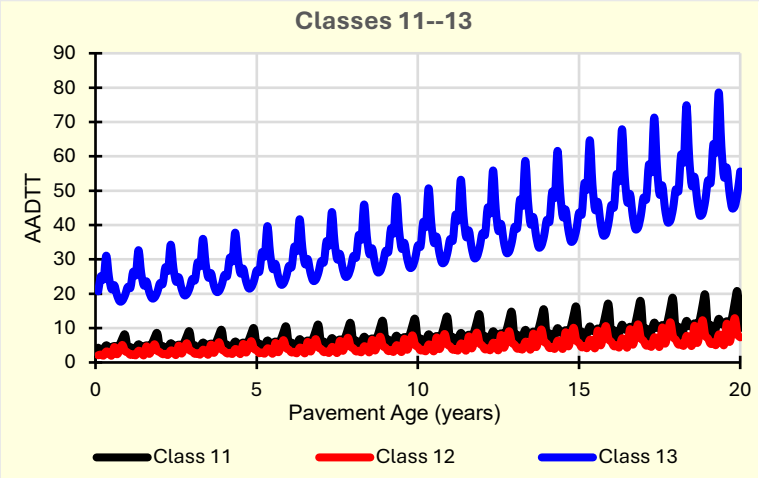
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.59	0.34	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1	0.22	0.83	0.1
Class 8	2.52	0.6	0	0
Class 9	1.25	1.87	0	0
Class 10	1.03	0.85	0.95	0.26
Class 11	4.21	0.29	0.01	0
Class 12	3.24	1.16	0.07	0.01
Class 13	3.32	1.79	0.14	0.02

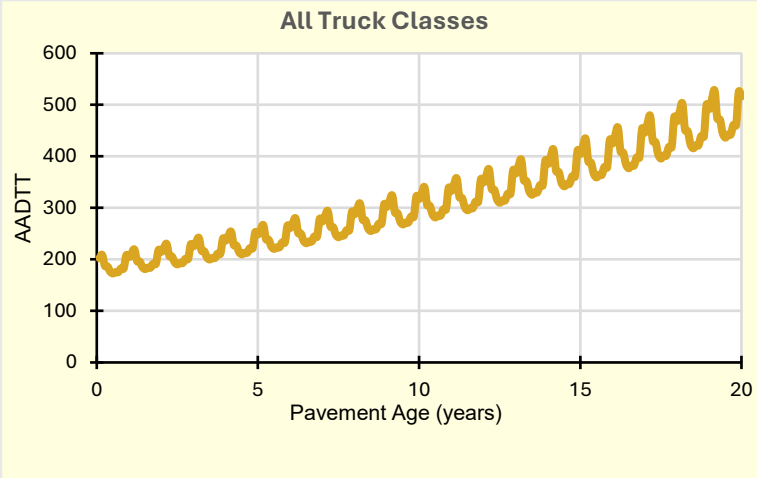
AADTT (Average Annual Daily Truck Traffic) Growth

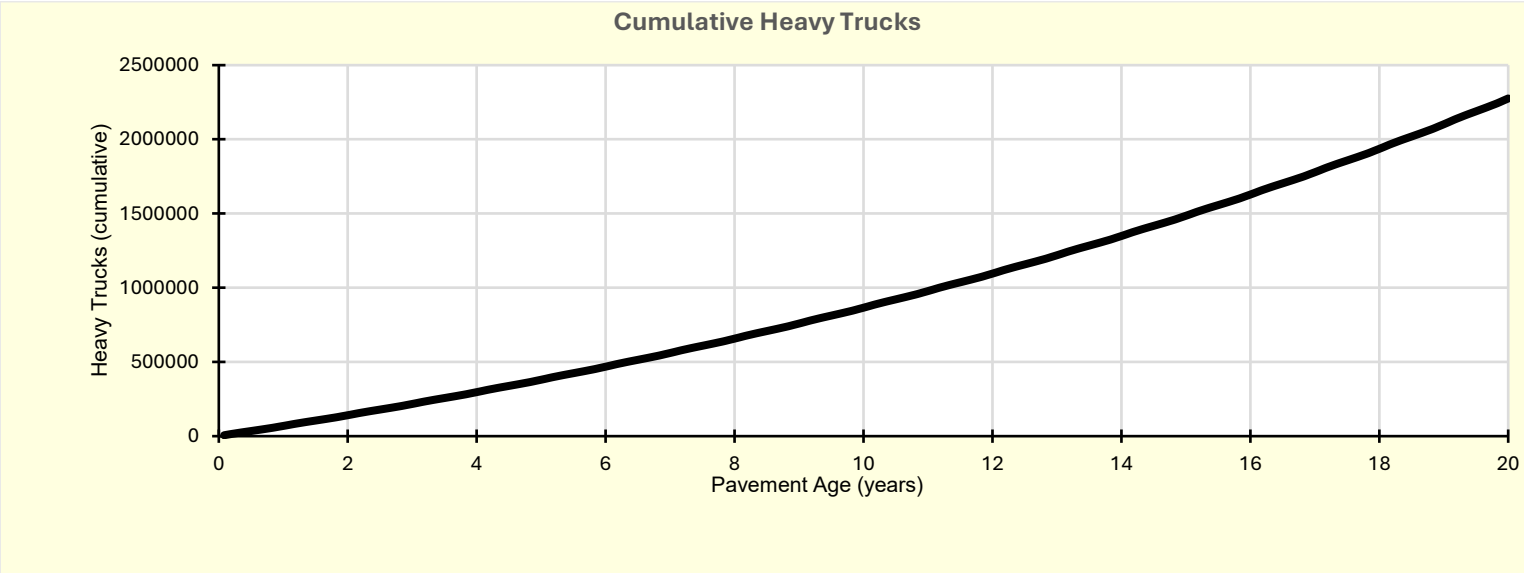
* Traffic cap is not enforced











Cumulative ESALs



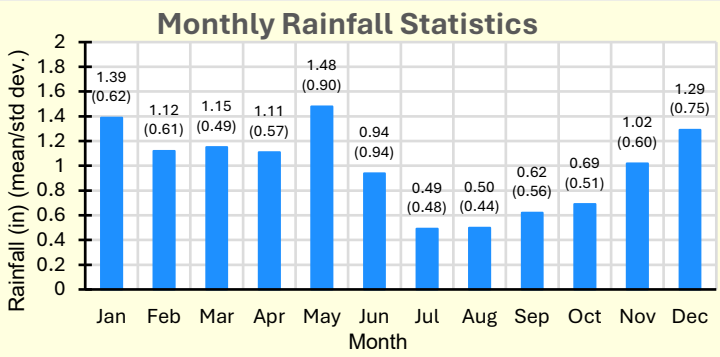
Climate Inputs

Climate Data Sources:

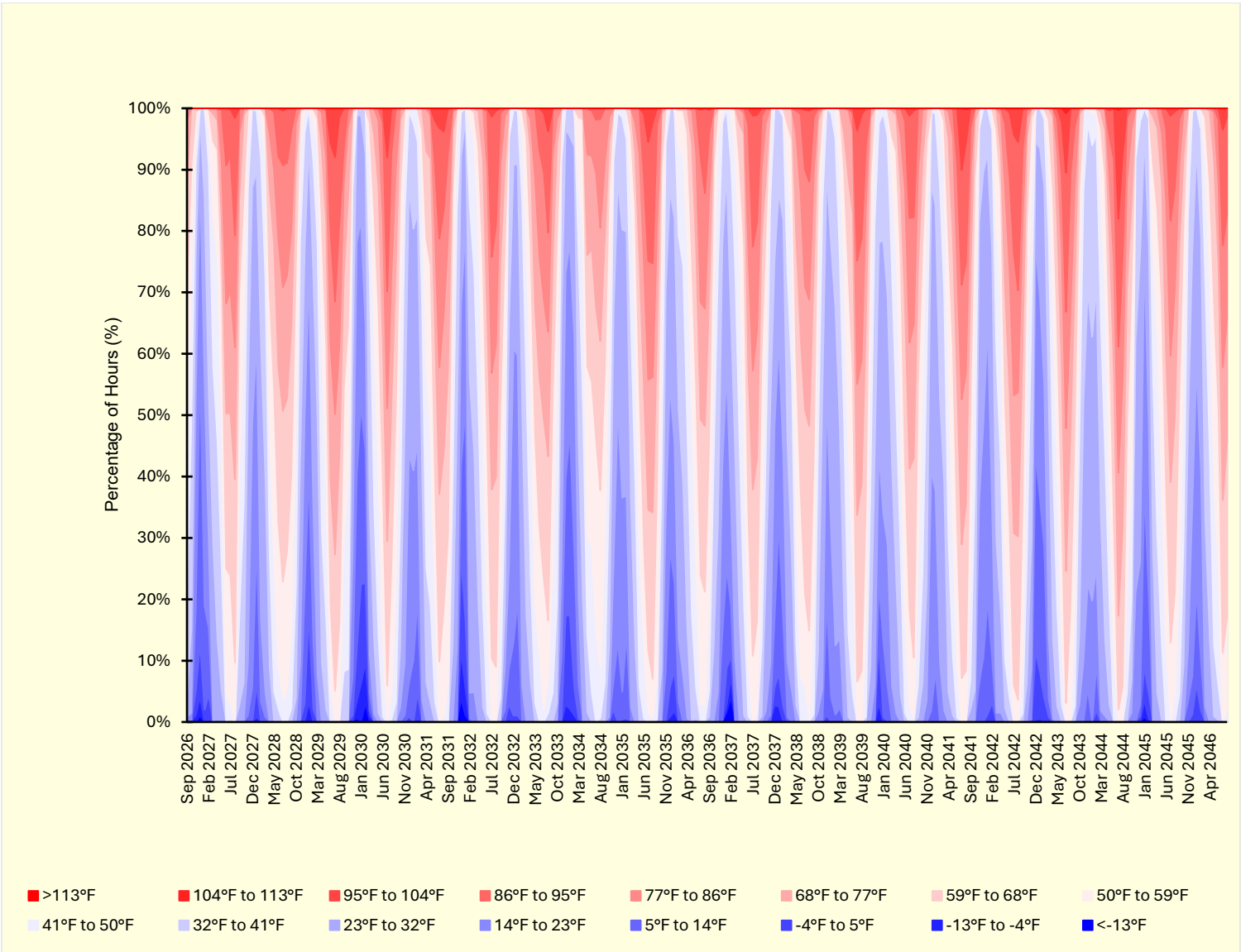
Climate Station Cities:	Location (lat, long, elevation(ft))
US, ID	43.50000, -112.50000, 5192
US, ID	43.50000, -111.87500, 5038
US, ID	43.50000, -113.12500, 5104

Annual Statistics:

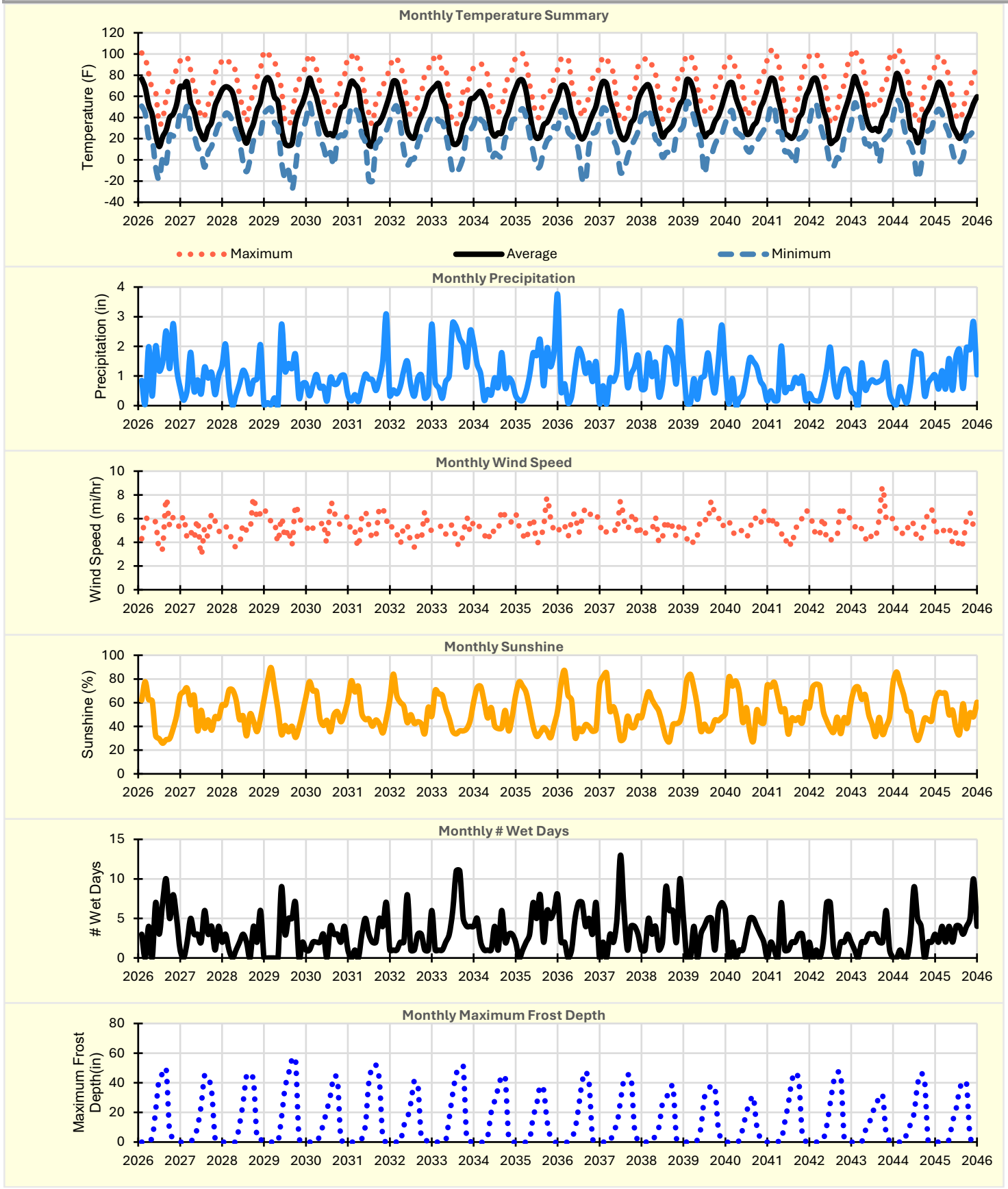
Mean annual air temperature (F):	46.41
Mean annual precipitation (in):	11.72
Freezing index (F - days):	927.31
Average annual number of freeze/thaw cycles:	118.65
Water table depth (ft)	10.00



Hourly Air Temperature Distribution by Month:



Monthly Climate Summary:



Design Properties

HMA Design Properties

Multilayer Rutting Model	False
NCHRP 1-37A HMA Rutting Model Coefficients	True
Endurance Limit	-
Using Reflective Cracking	True

Structure - ICM Properties	
AC surface shortwave absorptivity	0.85

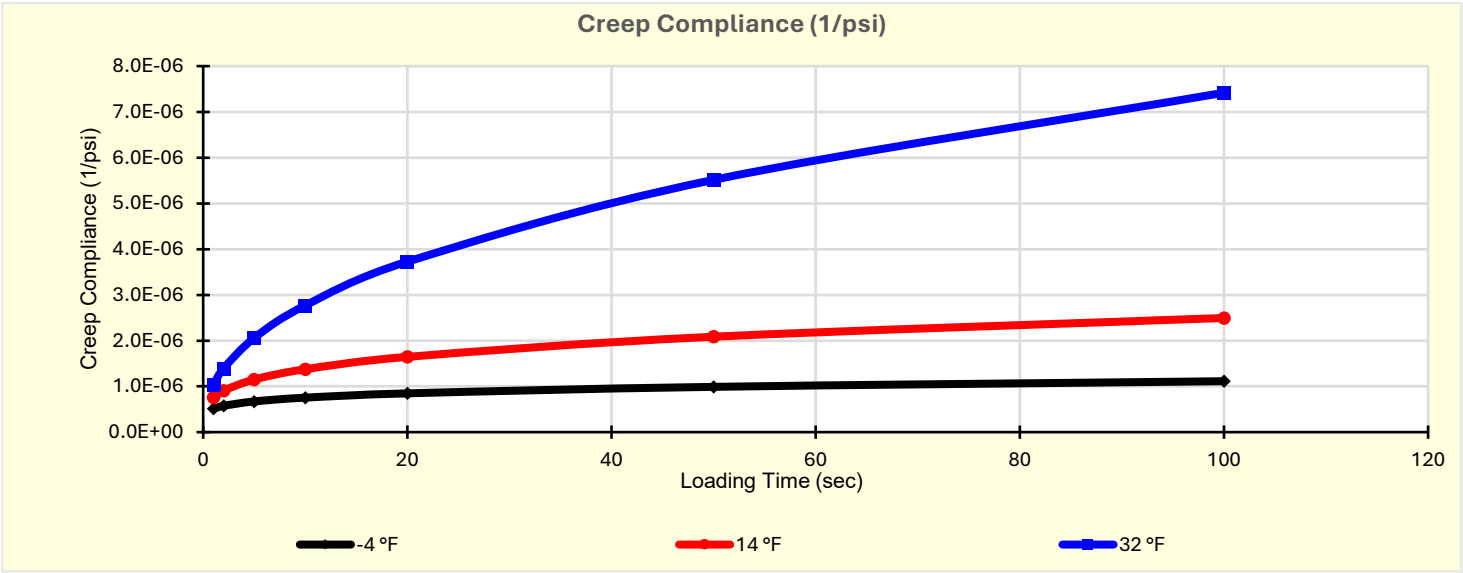
Layer Name	Layer Type	Interface Friction
Layer 1 Flexible : New HMA (PG 64-34)	Flexible (1)	1.00
Layer 2 Non-stabilized Base (original - 1) : Untreated Aggregate Base (A-1-a)	Non-stabilized Base (4)	1.00
Layer 3 Non-stabilized Base (original - 1) : Granular Subbase (A-1-a)	Non-stabilized Base (4)	1.00
Layer 4 Subgrade : Subgrade (A-6)	Subgrade (5)	-

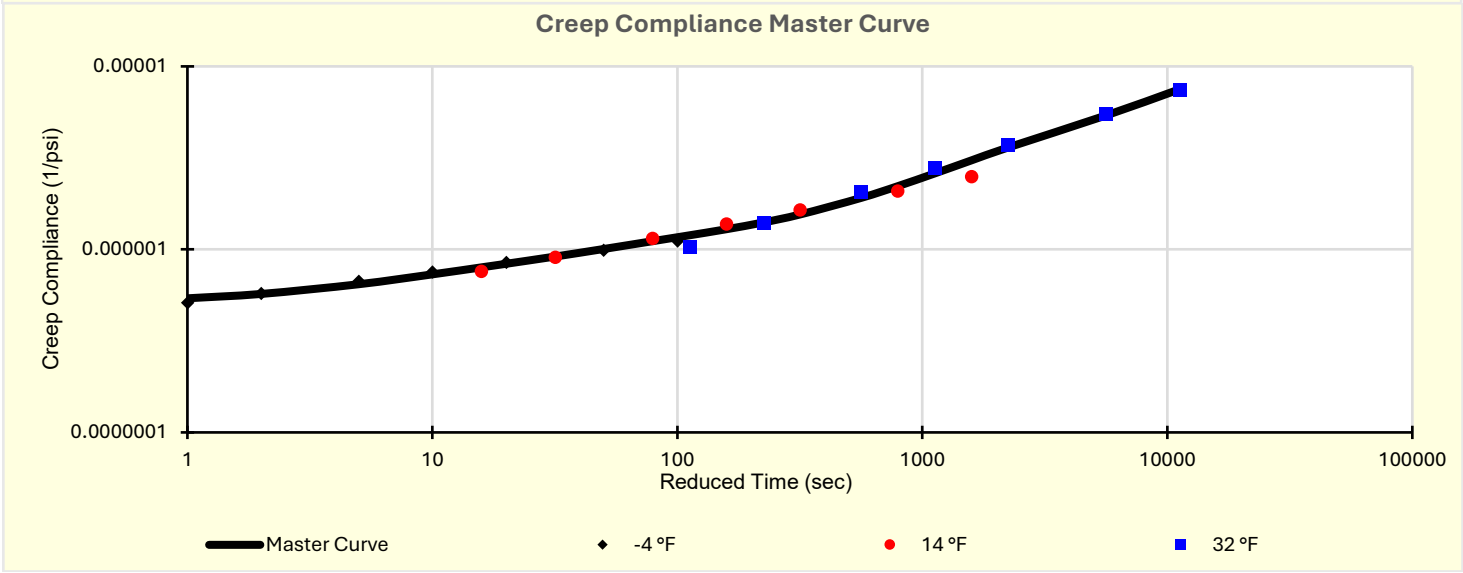
Thermal Cracking

Thermal Contraction	
Is thermal contraction calculated?	True
Mix coefficient of thermal contraction (in/in/°F)	-
Aggregate coefficient of thermal contraction (in/in/°F)	5E-06
Voids in Mineral Aggregate (%)	19.1

Indirect Tensile Strength (Input Level: 3)	
Test Temperature (°F)	**Indirect Tensile Strength (psi)**
14	479.49954287005903

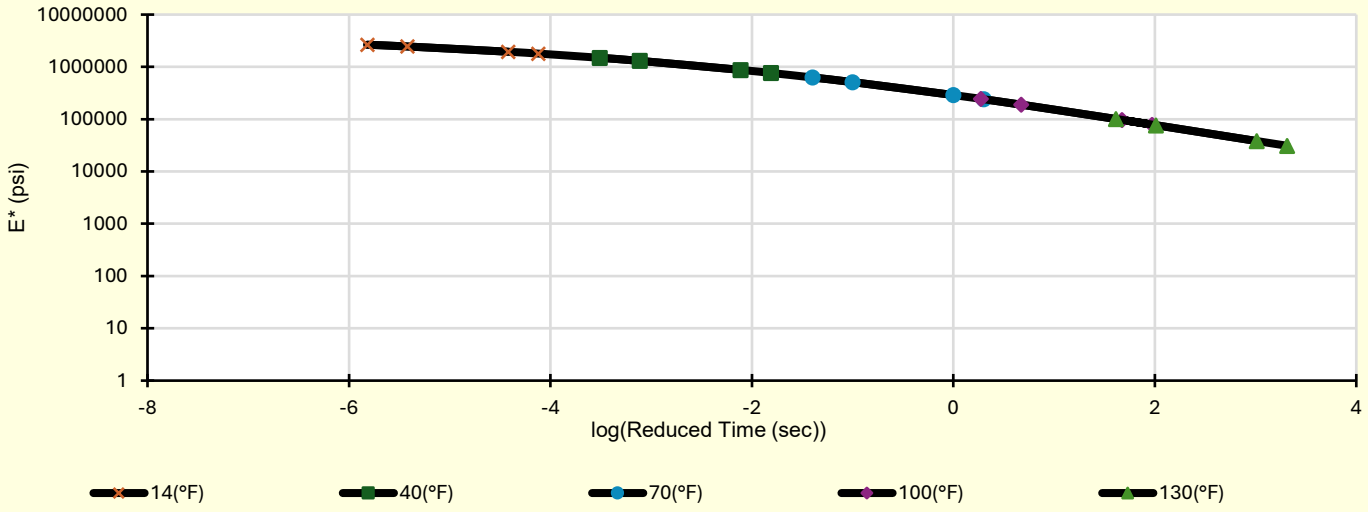
Creep Compliance (1/psi) (Input Level: 3)			
Loading time (sec)	**-4 °F**	**14 °F**	**32 °F**
1	5.11E-07	7.57E-07	1.03E-06
2	5.74E-07	9.06E-07	1.39E-06
5	6.71E-07	1.15E-06	2.06E-06
10	7.54E-07	1.37E-06	2.77E-06
20	8.48E-07	1.65E-06	3.73E-06
50	9.90E-07	2.09E-06	5.51E-06
100	1.11E-06	2.50E-06	7.42E-06



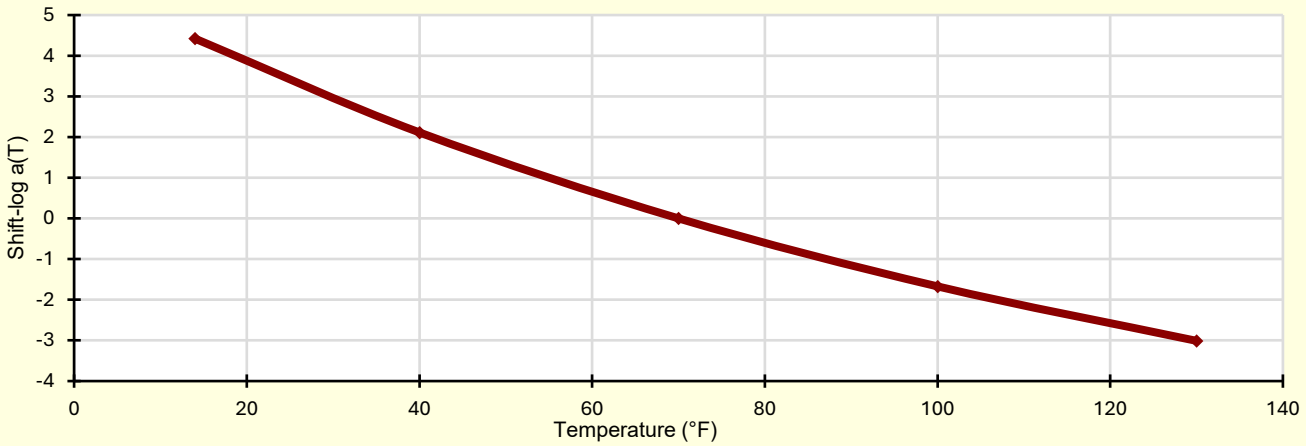


HMA Layer 1 (Proposed Overlay): Layer 1 Flexible : New HMA (PG 64-34)

Master Curve HMA Layer 1

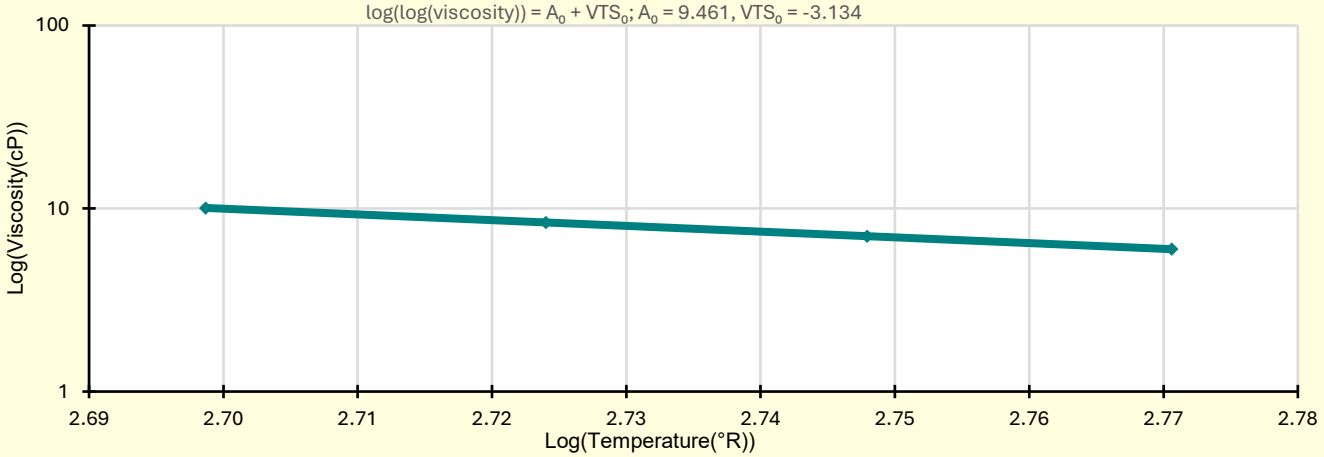


Shift Curve HMA Layer 1

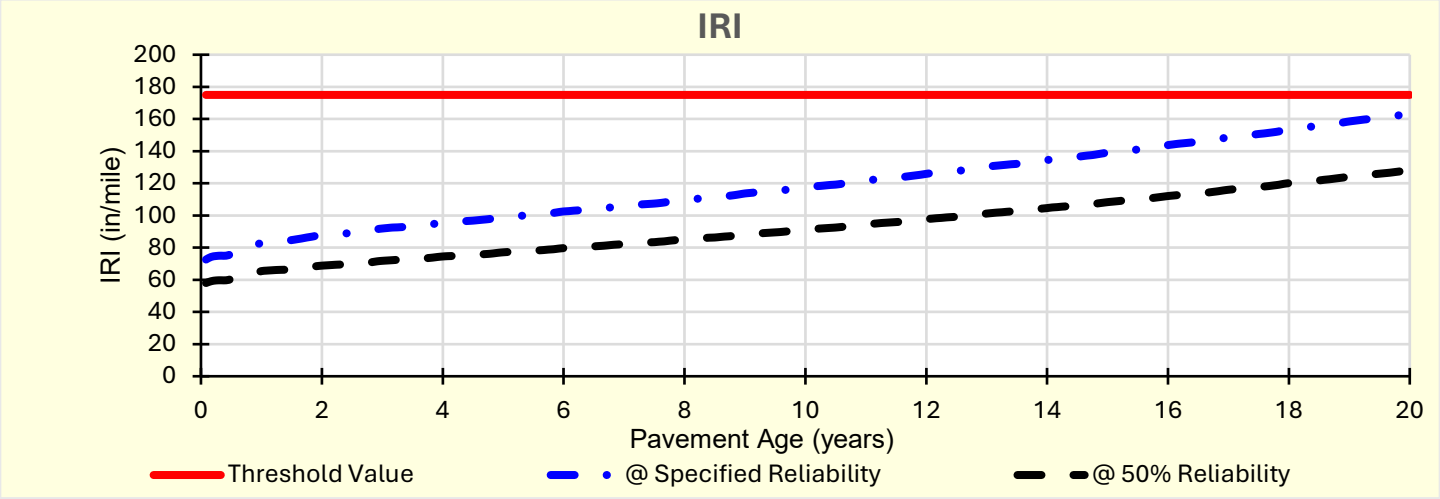


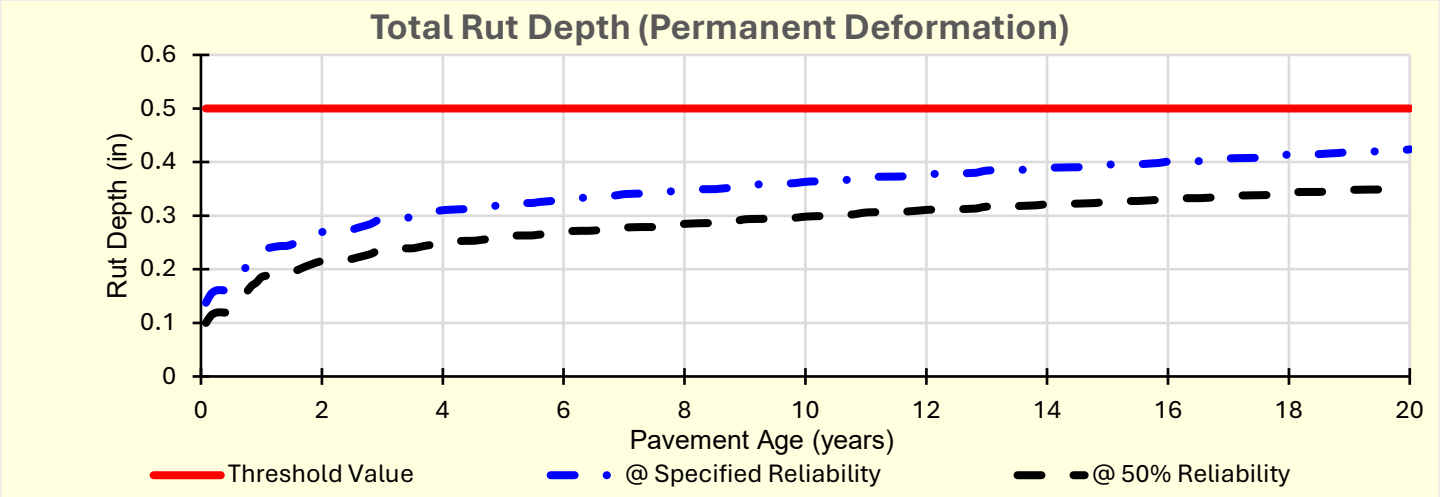
Viscosity Curve HMA Layer 1

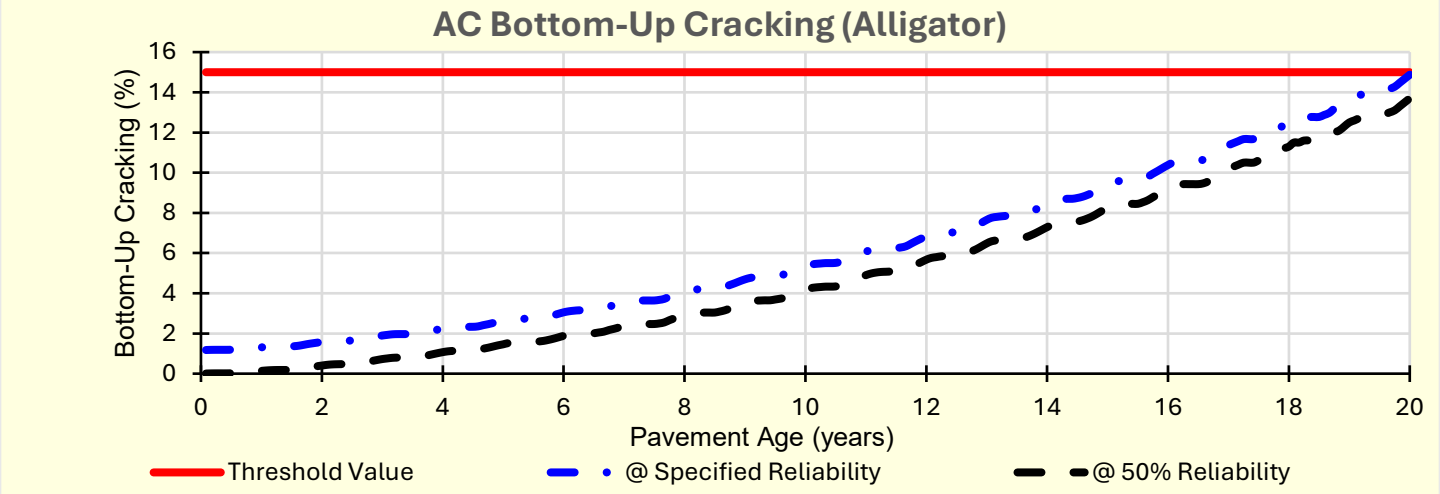
log(log(viscosity)) = A_0 + VTS_0; A_0 = 9.461, VTS_0 = -3.134



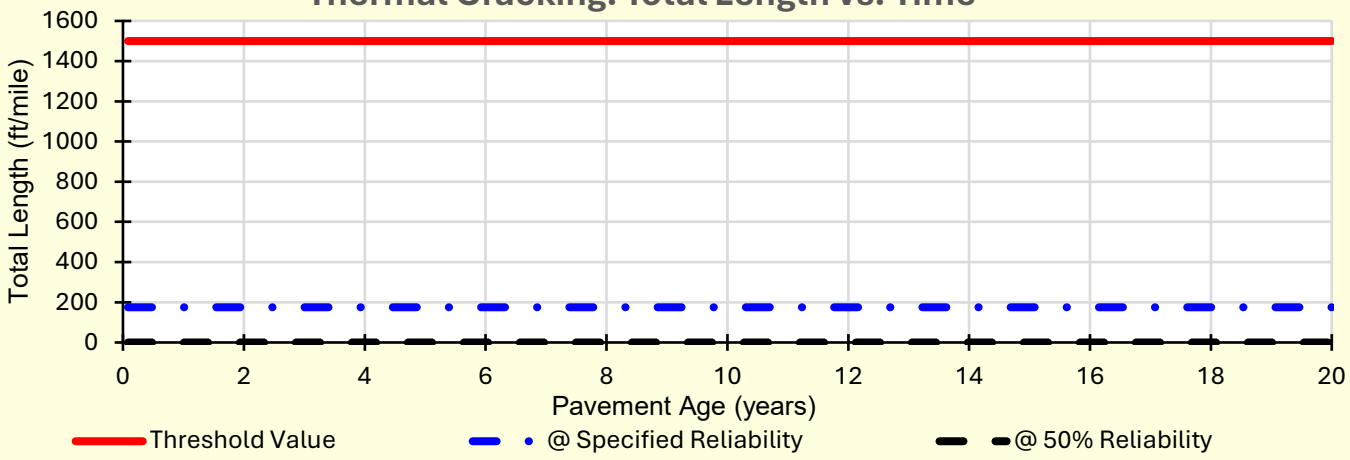
Analysis Output Charts



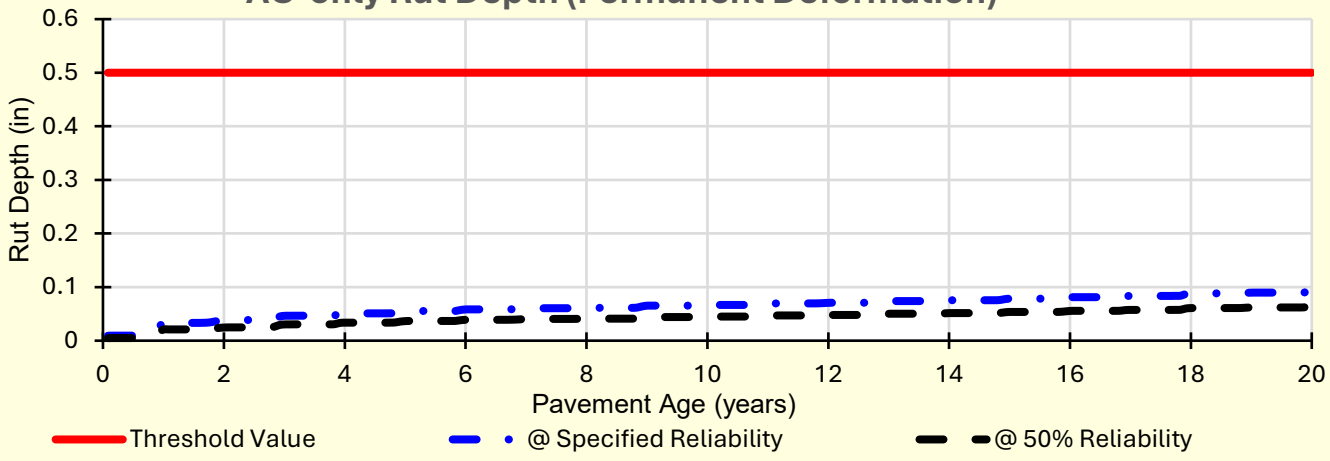




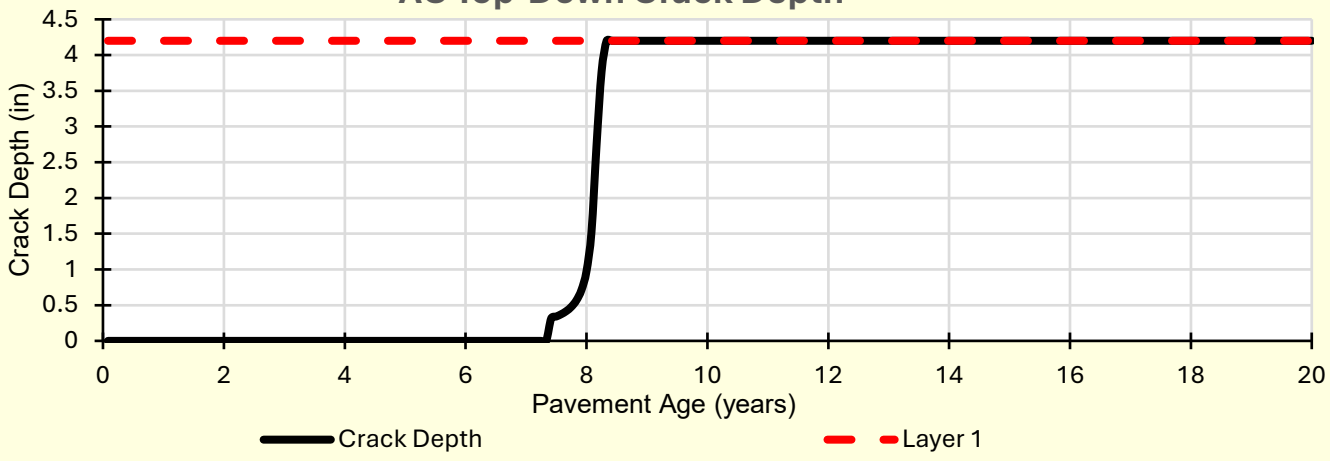
Thermal Cracking: Total Length vs. Time



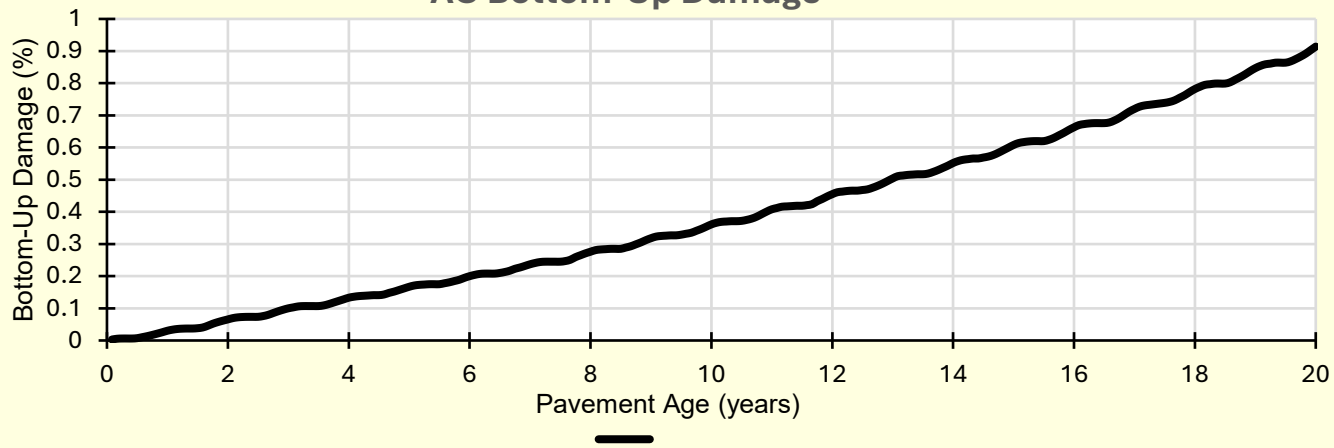
AC-only Rut Depth (Permanent Deformation)



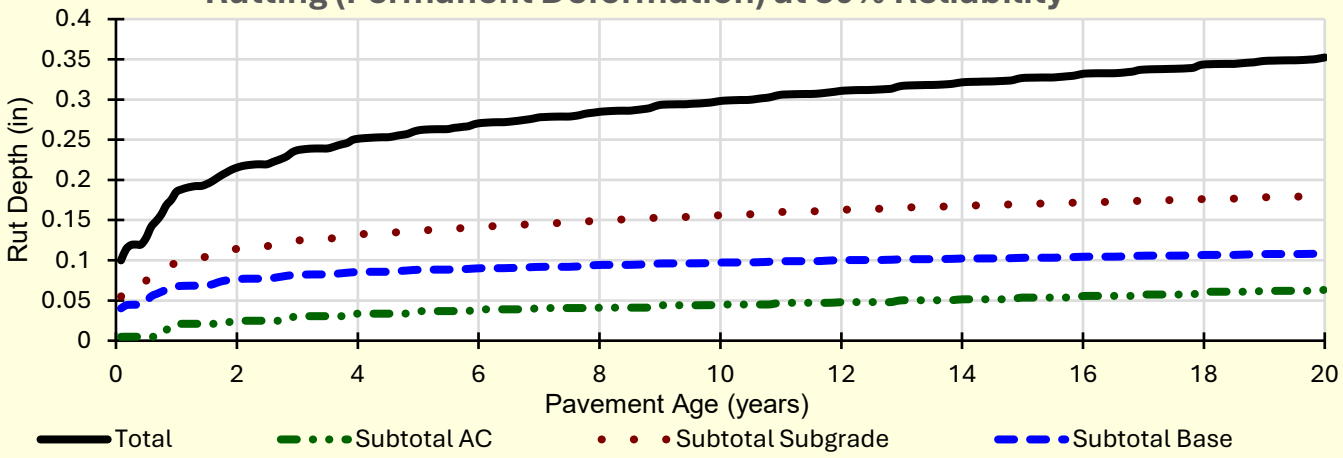
AC Top-Down Crack Depth



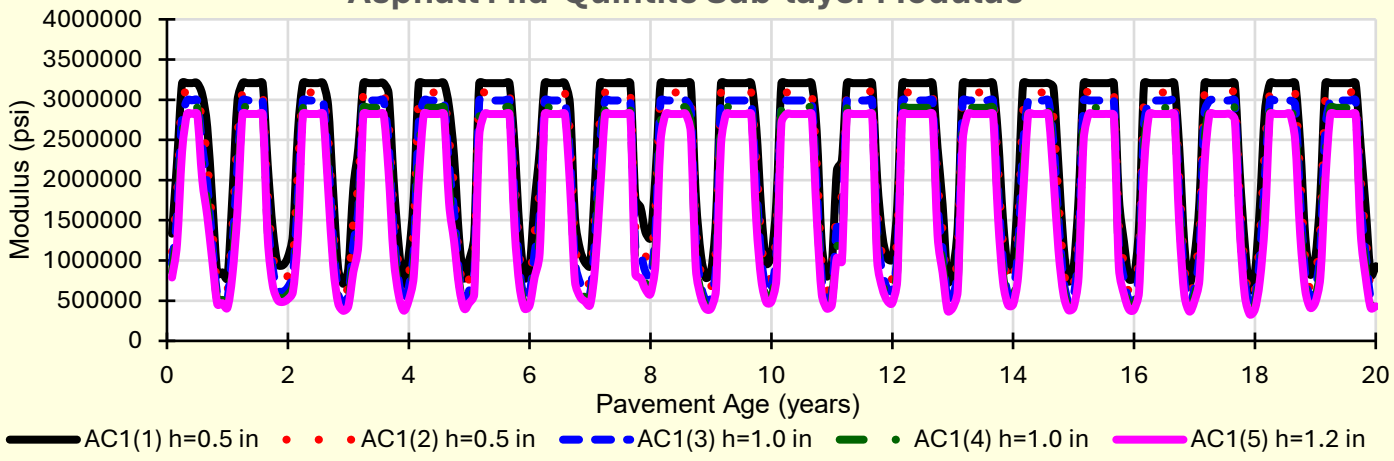
AC Bottom-Up Damage

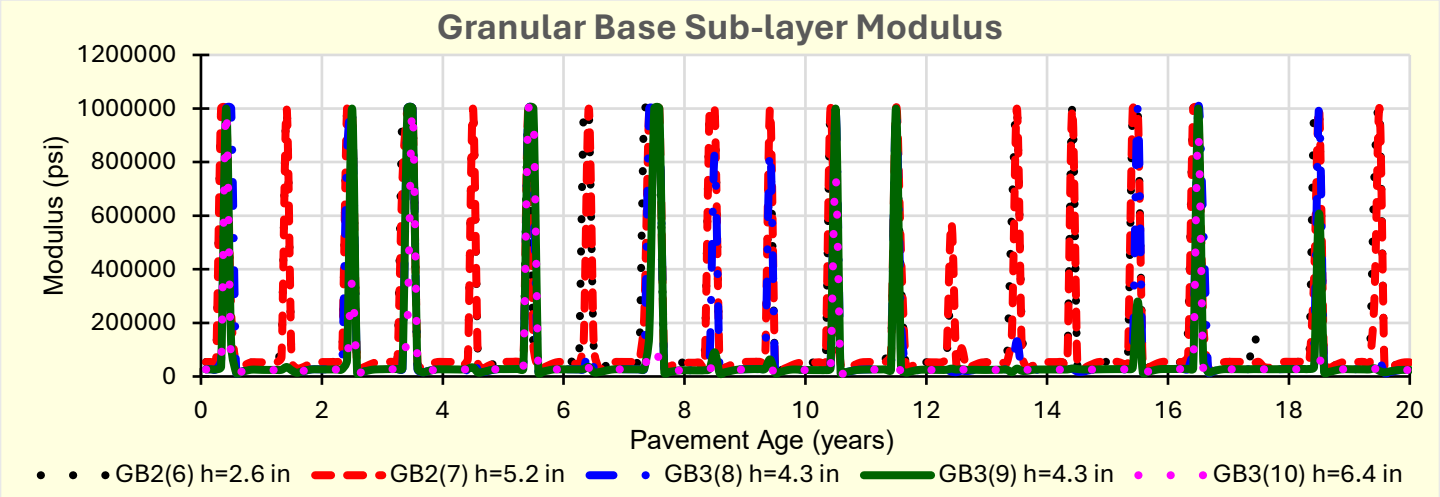


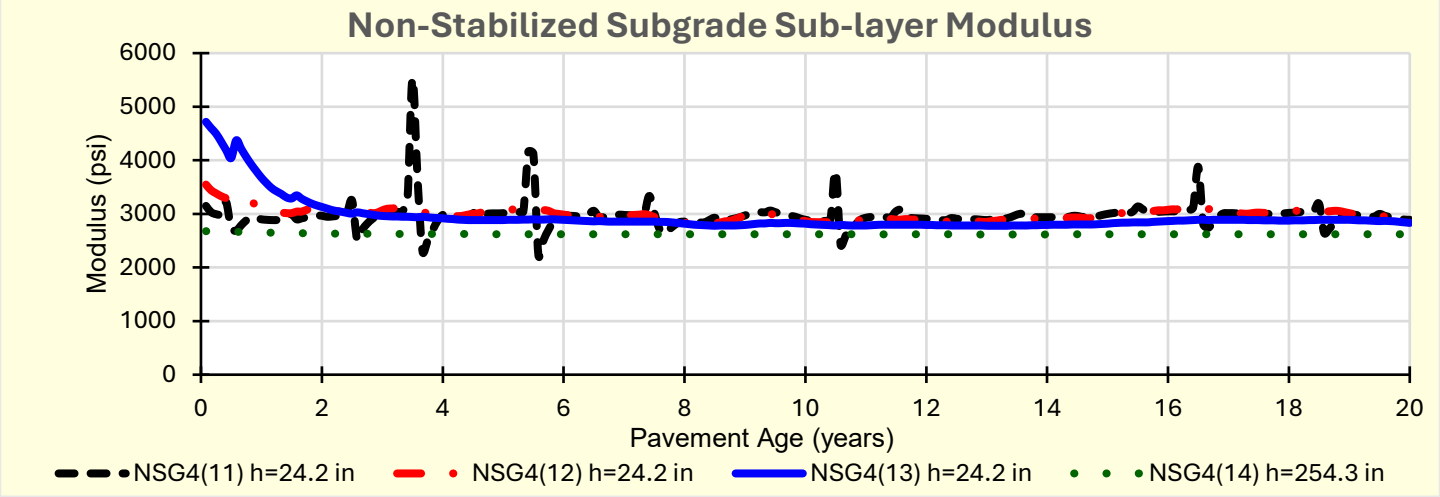
Rutting (Permanent Deformation) at 50% Reliability



Asphalt Mid-Quintile Sub-layer Modulus







Layer Information

US-20 Puzzle to IF Flex V-3_31 Prep 8-27-25

Tenant: Shannon and Wilson Inc - BOISE IDAHO OFFICE

Workspace: System Workspace

Layer 1 Flexible (Proposed Overlay) : New HMA (PG 64-34)

Asphalt		
Thickness (in)		4.2
Unit Weight (pcf)		144.0
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 3)

Gradation	Percent Passing
3/4-in sieve	100
3/8-in sieve	77
No. 4 sieve	60
No. 200 sieve	6

Asphalt Binder

Parameter	Percent Value
Grade	Superpave Performance Grade
Binder Type	64-34
A	9.461
VTS	-3.134

General Info

Name	Value
Reference Temperature (°F)	70
Effective binder content (%)	11.6
Air void (%)	7.5
Thermal conductivity (BTU/hr-ft-°F)	0.67
Heat Capacity (BTU/lb-°F)	0.23
Percent Content by Weight (%)	4.5
Aggregate Parameter	0.402
Dynamic Modulus E* Fitting Method	1-37A

Identifiers

Field	Value
Display name/identifier	New HMA (PG 64-34)
Description of object	New Superpave Hot Mix Asphalt
Author	MEE
Date Created	8/19/2025 12:00:00 AM
Approver	SGC
Date approved	8/19/2025 12:00:00 AM
State/Province	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
User defined field 1	
User defined field 2	
User defined field 3	
Revision Number	0

Layer 2 Non-stabilized base : Untreated Aggregate Base (A-1-a)

Unbound	
Layer thickness (in)	7.8
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
MR Method:	Resilient Modulus (psi)
Resilient Modulus (psi)	32000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor	-

Identifiers

Field	Value
Display name/identifier	Untreated Aggregate Base (A-1-a)
Description of object	New Untreated Aggregate Base
Author	MEE
Date Created	8/19/2025 12:00:00 AM
Approver	SGC
Date approved	8/19/2025 12:00:00 AM
State/Province	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
User defined field 1	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	0.01907
Specific gravity of solids	False	2.7
Water Content (%)	False	7.6

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	5.135856137329385
bf	2.0745928833024134
cf	0.746309667906325
hr	112

Sieve Size	% Passing
0.001 mm	
0.002 mm	
0.02 mm	
#200	6
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	
#8	40
#4	55
3/8 in	
1/2 in	
3/4 in	95
1 in	100
1 1/2 in	
2 in	
2 1/2 in	
3 in	
3 1/2 in	

Layer 3 Non-stabilized base : Granular Subbase (A-1-a)

Unbound	
Layer thickness (in)	15
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
MR Method:	Resilient Modulus (psi)
Resilient Modulus (psi)	21000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor	-

Identifiers

Field	Value
Display name/identifier	Granular Subbase (A-1-a)
Description of object	New Granular Subbase
Author	MEE
Date Created	8/19/2025 12:00:00 AM
Approver	SGC
Date approved	8/19/2025 12:00:00 AM
State/Province	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
User defined field 1	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.5
Saturated hydraulic conductivity (ft/hr)	False	0.02635
Specific gravity of solids	False	2.7
Water Content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	9.948659978083066
bf	1.1708375544165033
cf	0.9577065619969332
hr	115

Sieve Size	% Passing
0.001 mm	
0.002 mm	
0.02 mm	
#200	7.5
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	
#8	
#4	52.5
3/8 in	
1/2 in	
3/4 in	
1 in	
1 1/2 in	
2 in	
2 1/2 in	
3 in	95
3 1/2 in	100

Layer 4 Subgrade : Subgrade (A-6)

Unbound	
Layer thickness (in)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
MR Method:	Resilient Modulus (psi)
Resilient Modulus (psi)	4800.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor	-

Identifiers

Field	Value
Display name/identifier	Subgrade (A-6)
Description of object	Default material
Author	MEE
Date Created	8/19/2025 12:00:00 AM
Approver	SGC
Date approved	8/19/2025 12:00:00 AM
State/Province	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
User defined field 1	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	33.0
Plasticity Index	16.0
Is layer compacted	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	107.9
Saturated hydraulic conductivity (ft/hr)	False	0.00002
Specific gravity of solids	False	2.7
Water Content (%)	False	17.1

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	108.40908936617681
bf	0.6800697758049122
cf	0.21612410082307038
hr	500

Sieve Size	% Passing
0.001 mm	
0.002 mm	
0.02 mm	
#200	63.2
#100	
#80	73.5
#60	
#50	
#40	82.4
#30	
#20	
#16	
#10	90.2
#8	
#4	93.5
3/8 in	96.4
1/2 in	97.4
3/4 in	98.4
1 in	99
1 1/2 in	99.5
2 in	99.8
2 1/2 in	
3 in	
3 1/2 in	100

Calibration Coefficients

AC Cracking

AC Top Down Cracking

$$L(t) = L_{Max} e^{-\left(\frac{C_1 \rho}{t - C_3 t_o}\right)^{C_2 \beta}}$$

$$t_0(\text{Days}) = \frac{k_{L1}}{1 + e^{(k_{L2} \times 100 \times a_0/2A_0) + (k_{L3} \times \text{HT}) + (k_{L4} \times \text{LT}) + (k_{L5} \times \log_{10}\text{AADTT})}}$$

c1: 2.5219	c2: 0.8069	c3: 1		
kL1: 64271618	kL2: 0.2855	kL3: 0.011	kL4: 0.01488	kL5: 3.266

Top Down Cracking Standard Deviation

0.3657 * TOP + 3.6563

AC Bottom Up Cracking

$$FC_{Bottom} = \left(\frac{1}{60}\right)\left(\frac{C_4}{1 + e^{C_1 C_1^* + C_2 C_2^* Log(DI_{Bottom} \times 100)}}\right)$$

$$C_1^* = -2C_2^*$$

$$C_2^* = -2.40874 - 39.748(1 + H_{AC})^{-2.856}$$

c1: 0.31	c2: 1.1585	c4: 6000

Bottom Up Cracking Standard Deviation

1.13 + 13/(1+exp(7.57-15.5*LOG10(BOTTOM+0.0001)))

Bottom = Bottom Up Fatigue Damage %

AC Fatigue

$$N_f = 0.00432 * C * \beta_{f1} k_1 \left(\frac{1}{\varepsilon_1}\right)^{k_2 \beta_{f2}} \left(\frac{1}{E}\right)^{k_3 \beta_{f3}}$$

$$C = 10^M$$

$$M = 4.84\left(\frac{V_b}{V_a + V_b} - 0.69\right)$$

k1: 3.75
k2: 2.87
k3: 1.46
Bf1: 0.02054
Bf2: 1.38
Bf3: 0.88

AC Rutting

$$\frac{\varepsilon_p}{\varepsilon_r} = k_z \beta_{r1} 10^{k_1} T^{k_2 \beta_{r2}} N^{k_3 \beta_{r3}}$$

$$k_z = (C_1 + C_2 * depth) * 0.328196^{depth}$$

$$C_1 = -0.1039 * H_{ac}^2 + 2.4868 * H_{ac} - 17.342$$

$$C_2 = 0.0172 * H_{ac}^2 - 1.7331 * H_{ac} + 27.428$$

Where:

$H_{ac} = total\ AC\ thickness(in)$

$\varepsilon_p = plastic\ strain\left(^{in}/_{in}\right)$

$\varepsilon_r = resilient\ strain\left(^{in}/_{in}\right)$

$T = layer\ temperature(^{\circ}F)$

$N = number\ of\ load\ repetitions$

AC Rutting Standard Deviation

0.24 * Pow(RUT,0.8026) + 0.001

AC Layer 1	K1: -2.45 K2: 3.01 K3: 0.22	Br1: 0.3 Br2: 0.52 Br3: 1.36

CSM Cracking

$$FC_{ctb} = C_1 + \frac{C_2}{1 + e^{C_3 - C_4 * log_{10}(Damage)}}$$

C1: 0	C2: 75	C3: 2	C4: 2

CSM Cracking Standard Deviation

CTB*1

CSM Fatigue

$$N_f = 10^{\left(\frac{k_1 \beta_{c1} \left(\frac{\sigma_s}{M_r}\right)}{k_2 \beta_{c2}}\right)}$$

N_f = number of repetitions to fatigue cracking
σ_s = Tensile stress(psi)
M_r = modulus of rupture(psi)

k1: 0.972	k2: 0.0825	Bc1: 1	Bc2: 1

IRI Flexible Pavements

C1 - Rutting
C2 - Fatigue Crack
C3 - Transverse Crack
C4 - Site Factors

C1: 80	C2: 0.6	C3: 0.008	C4: 0.02

Thermal Fracture

$$C_f = \beta_{t1} N \left[\frac{1}{\sigma_d} log\left(\frac{C}{h_{AC}}\right)\right]$$

$$\Delta C = A(\Delta K)^n$$

$$A = k_t \beta_t 10^{[4.389 - 2.52 \log(E_{HMA} \sigma_m n)]}$$

C_f = Observed amount of thermal cracking, ft. / 500ft.
β_{t1} = Regression coefficient determined through global calibration (400)
N[z] = Standard normal distribution evaluated at [z]
σ_d = Standard deviation of the logarithm of crack depth in the pavement (0.769), in.
C = Crack depth, in.
h_{AC} = Thickness of asphalt layer, in.
ΔC = Change in the crack depth due to a cooling cycle
ΔK = Change in the stress intensity factor due to a cooling cycle
A, n = Fracture parameters for the asphalt mixture
E = Asphalt mixture stiffness, MPa
σ_m = Undamaged mixture tensile strength, MPa
k_t = Regression coefficient determined through field calibration
β_t = Calibration parameter

Level 1 K: ((3 * Pow(10,-7)) * Pow(MAAT,4.0319)) * 1 + 0	
Level 2 K: ((2.591 * Pow(10,-7)) * Pow(MAAT,4.0319)) * 1 + 0	
Level 3 K: ((3 * Pow(10,-7)) * Pow(MAAT,4.0319)) * 1 + 0	

Unbound Layer Rutting

$$\delta_a(N) = \beta_{s_1} k_1 \varepsilon_v h \left(\frac{\varepsilon_0}{\varepsilon_r}\right) \left| e^{-\left(\frac{\rho}{N}\right)^{\beta}} \right|$$

δ_a = permanent deformation for the layer
N = number of repetitions
ε_v = average vertical strain(in/in)
$\varepsilon_0, \beta, \rho$ = material properties
ε_r = resilient strain(in/in)

Base Rutting		Subgrade Rutting	
k1: 0.965	Bs1: 0.86	k1: 0.965	Bs1: 0.736
Standard Deviation: 0.1477 * Pow(BASERUT,0.6711) + 0.001		Standard Deviation: 0.1235 * Pow(SUBRUT,0.5012) + 0.001	

APPENDIX F: PAVEMENT DESIGN CALCULATION REPORTS

RIGID RECONSTRUCTION

US-20 Puzzle to IF Rigid V-3_31 Prep 8-27-25

Tenant: Shannon and Wilson Inc - BOISE IDAHO OFFICE

Workspace: System Workspace

Design Inputs

Design Life: 40 years
Design Type: JPCP

Existing Construction: -
Pavement construction: August 2026
Traffic Opening: September 2026

Climate Data Sources (lat., long.): 43.516, -112.067
43.733, -112.03

Design Structure

Layer Type	Material Type	Thickness (in)
PCC	JPCP Default	10
Flexible	Default asphalt concrete	3
NonStabilized	Untreated Aggregate Base (A-1-a)	6
NonStabilized	Granular Subbase (A-1-a)	12
Subgrade	Subgrade (A-6)	Semi-infinite

Joint Design	
Joint spacing (ft)	15.0
Dowel diameter (in)	1.50
Slab width (ft)	13.5 (w)

Traffic

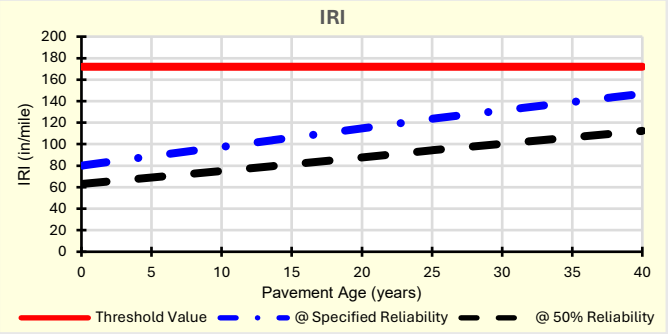
Age (year)	Heavy Trucks (cumulative)
2026 (initial)	314
2046 (20 years)	2,275,370
2066 (40 years)	8,312,610

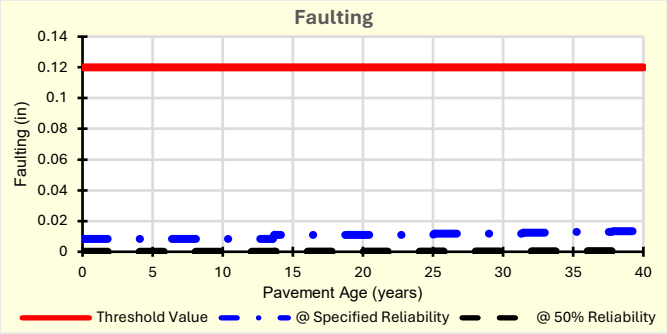
Design Outputs

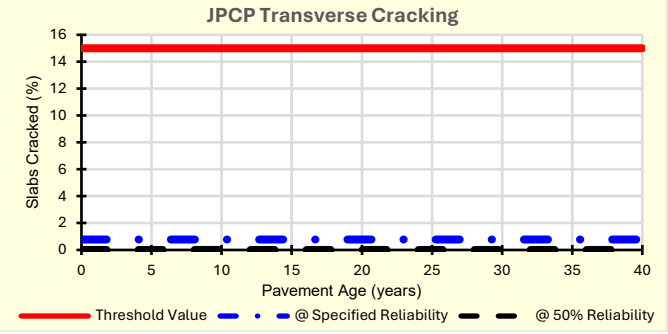
Distress Prediction Summary

Distress Type	Distress @ Specified Reliability		Reliability (%)		Criterion Satisfied?
	Target	Predicted	Target	Achieved	
Terminal IRI (in/mile)	172.00	146.89	85.00	96.34	Pass
Mean joint faulting (in)	0.12	0.01	85.00	100.00	Pass
JPCP transverse cracking (% slabs)	15.00	0.78	85.00	100.00	Pass

Distress Charts



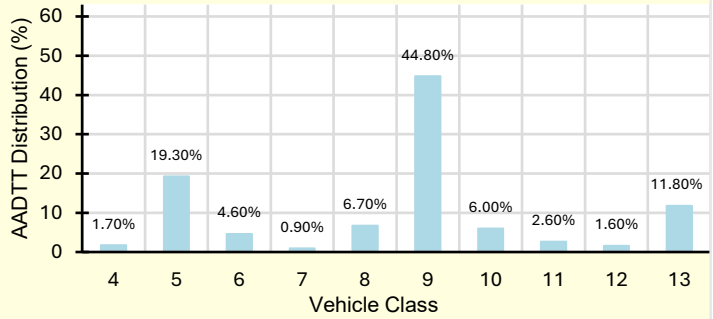


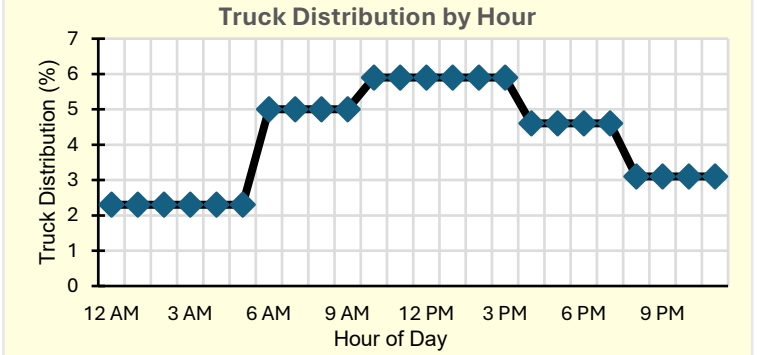


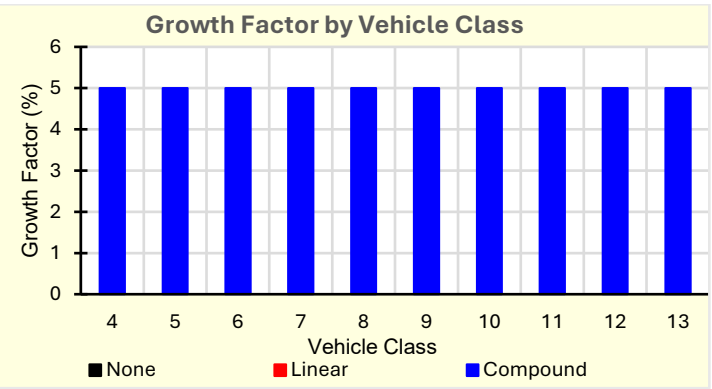
Traffic Inputs

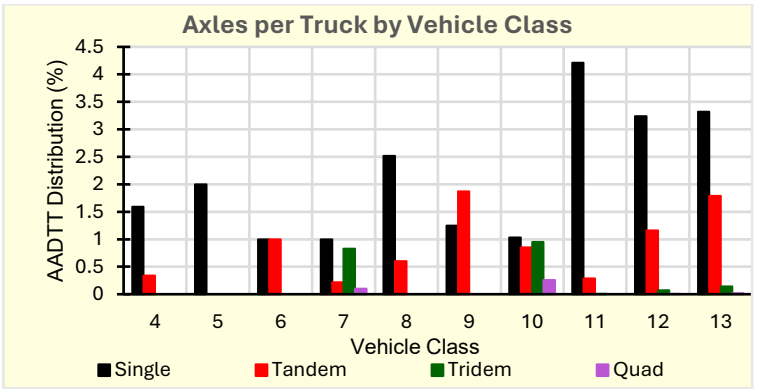
Graphical Representation of Traffic Inputs

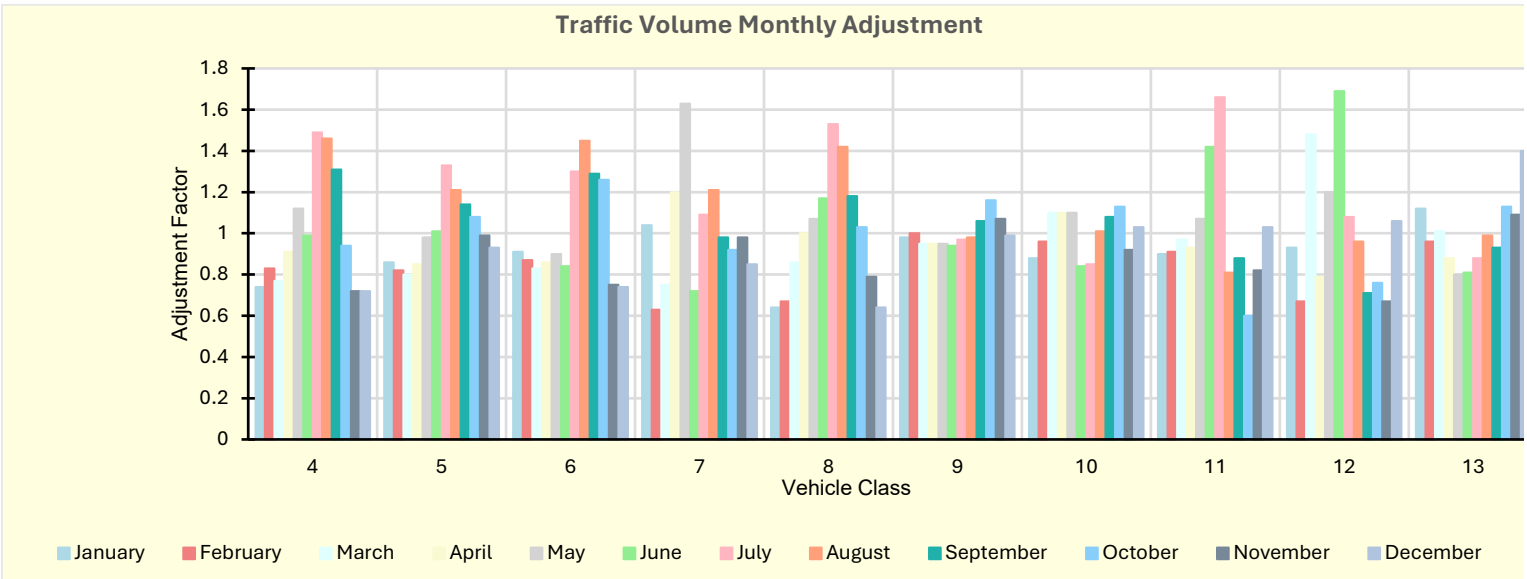
Initial two-way AADTT	314
Number of lanes in design direction	1
Percent of trucks in design direction (%)	60
Percent of trucks in design lane (%)	100
Operation speed (mph)	65
Axle Distribution	Custom











Tabular Representation of Traffic Inputs

Volume Monthly Adjustment Factors (Level 3: Default MAF)

Month	Vehicle Class									
	4	5	6	7	8	9	10	11	12	13
January	0.7	0.9	0.9	1.0	0.6	1.0	0.9	0.9	0.9	1.1
February	0.8	0.8	0.9	0.6	0.7	1.0	1.0	0.9	0.7	1.0
March	0.8	0.8	0.8	0.8	0.9	1.0	1.1	1.0	1.5	1.0
April	0.9	0.9	0.9	1.2	1.0	1.0	1.1	0.9	0.8	0.9
May	1.1	1.0	0.9	1.6	1.1	1.0	1.1	1.1	1.2	0.8
June	1.0	1.0	0.8	0.7	1.2	0.9	0.8	1.4	1.7	0.8
July	1.5	1.3	1.3	1.1	1.5	1.0	0.9	1.7	1.1	0.9
August	1.5	1.2	1.5	1.2	1.4	1.0	1.0	0.8	1.0	1.0
September	1.3	1.1	1.3	1.0	1.2	1.1	1.1	0.9	0.7	0.9
October	0.9	1.1	1.3	0.9	1.0	1.2	1.1	0.6	0.8	1.1
November	0.7	1.0	0.8	1.0	0.8	1.1	0.9	0.8	0.7	1.1
December	0.7	0.9	0.7	0.9	0.6	1.0	1.0	1.0	1.1	1.4

Distributions by Vehicle Class

Vehicle Class	AADTT Distribution (%) (Level 3)	Growth Factor	
		Rate (%)	Function
Class 4	1.7%	5%	Compound
Class 5	19.3%	5%	Compound
Class 6	4.6%	5%	Compound
Class 7	0.9%	5%	Compound
Class 8	6.7%	5%	Compound
Class 9	44.8%	5%	Compound
Class 10	6.0%	5%	Compound
Class 11	2.6%	5%	Compound
Class 12	1.6%	5%	Compound
Class 13	11.8%	5%	Compound

Truck Distribution by Hour

Hour	Distribution (%)	Hour	Distribution (%)
12 AM	2.3%	12 PM	5.9%
1 AM	2.3%	1 PM	5.9%
2 AM	2.3%	2 PM	5.9%
3 AM	2.3%	3 PM	5.9%
4 AM	2.3%	4 PM	4.6%
5 AM	2.3%	5 PM	4.6%
6 AM	5%	6 PM	4.6%
7 AM	5%	7 PM	4.6%
8 AM	5%	8 PM	3.1%
9 AM	5%	9 PM	3.1%
10 AM	5.9%	10 PM	3.1%
11 AM	5.9%	11 PM	3.1%
		Total	100.0%

Axle Configuration

Traffic Wander	
Mean wheel location (in)	18.0
Traffic wander standard deviation (in)	10.0
Design lane width (ft)	12.0

Axle Configuration	
Average axle width (ft)	8.5
Dual tire spacing (in)	12.0
Tire pressure (psi)	120.0

Average Axle Spacing	
Tandem axle spacing (in)	51.6
Tridem axle spacing (in)	49.2
Quad axle spacing (in)	49.2

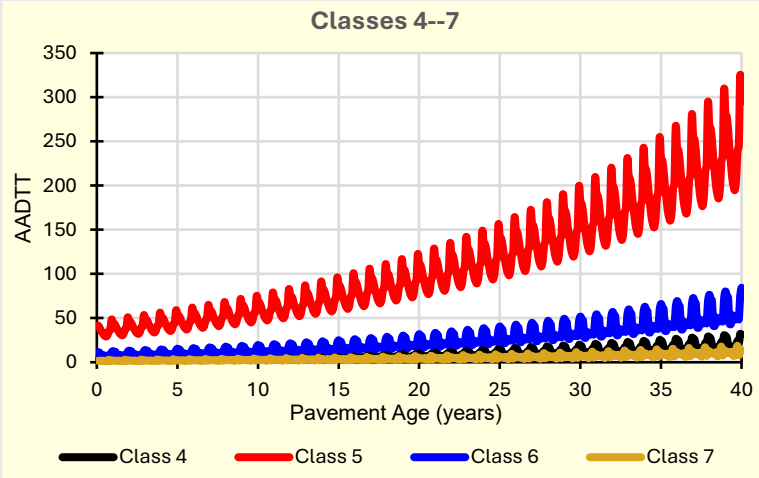
Wheelbase			
Value Type	Axle Type		
	Short	Medium	Long
Average spacing of axles (ft)	12.0	15.0	18.0
Percent of Trucks (%)	17.0	22.0	61.0

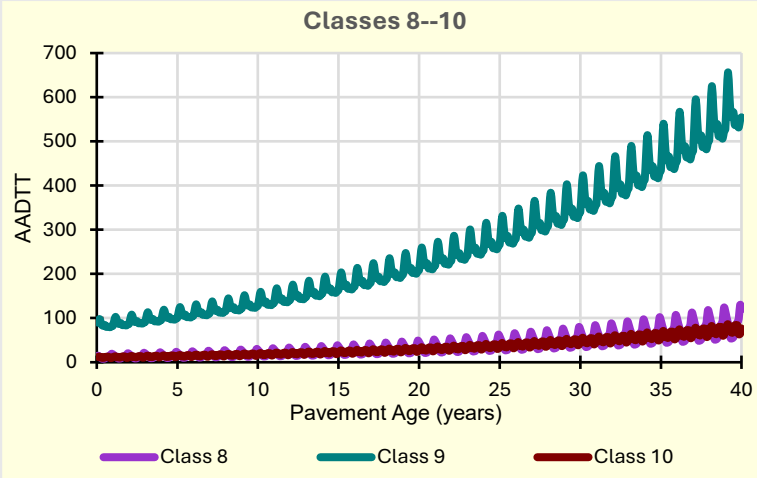
Number of Axles per Truck

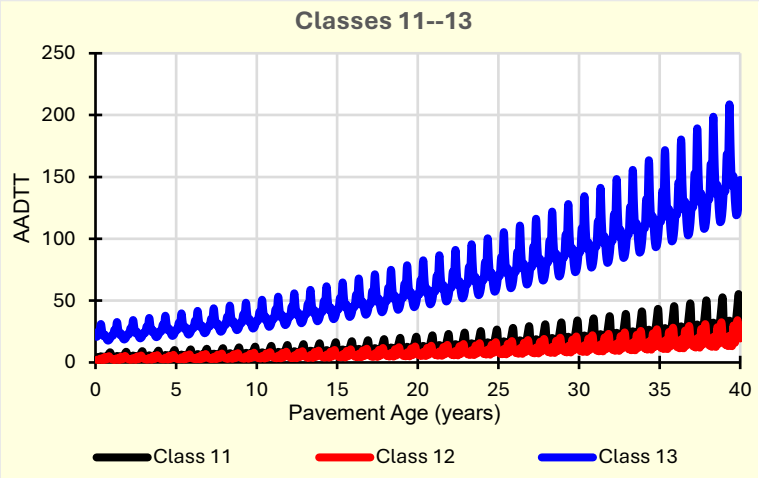
Vehicle Class	Single Axle	Tandem Axle	Tridem Axle	Quad Axle
Class 4	1.59	0.34	0	0
Class 5	2	0	0	0
Class 6	1	1	0	0
Class 7	1	0.22	0.83	0.1
Class 8	2.52	0.6	0	0
Class 9	1.25	1.87	0	0
Class 10	1.03	0.85	0.95	0.26
Class 11	4.21	0.29	0.01	0
Class 12	3.24	1.16	0.07	0.01
Class 13	3.32	1.79	0.14	0.02

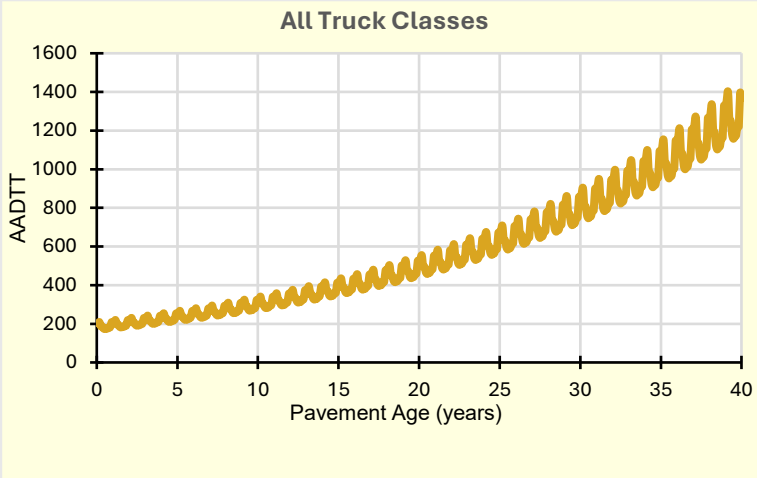
AADTT (Average Annual Daily Truck Traffic) Growth

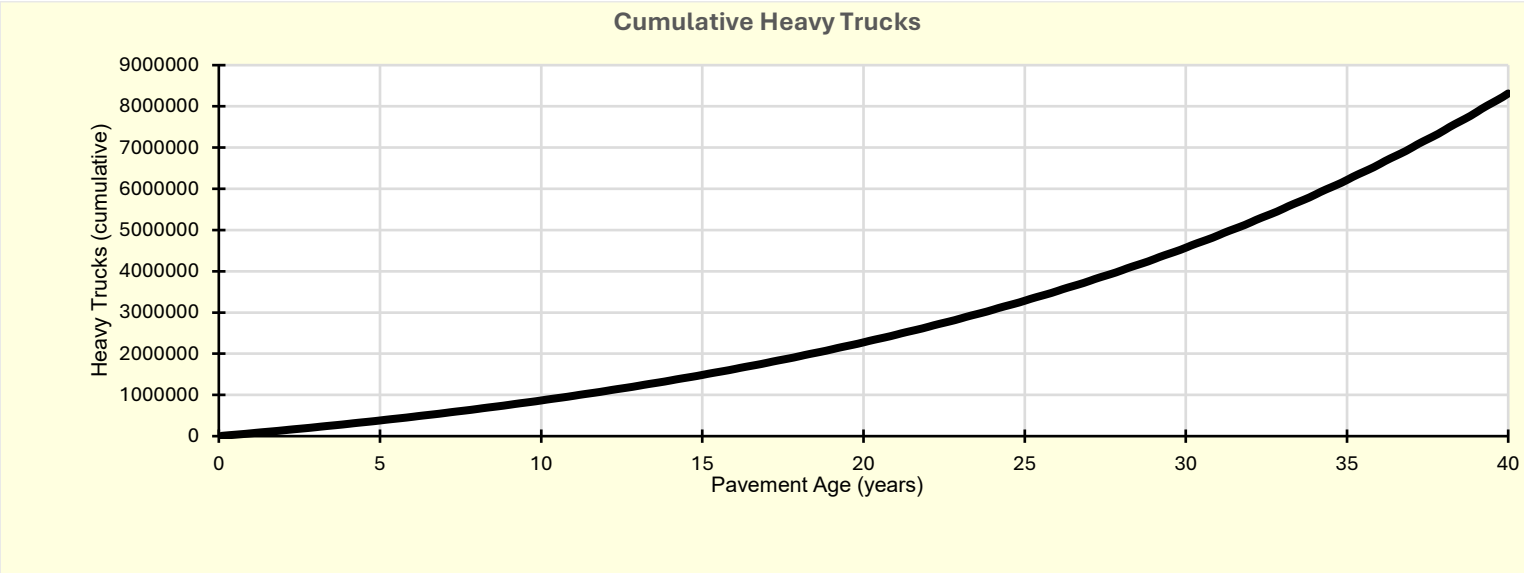
* Traffic cap is not enforced



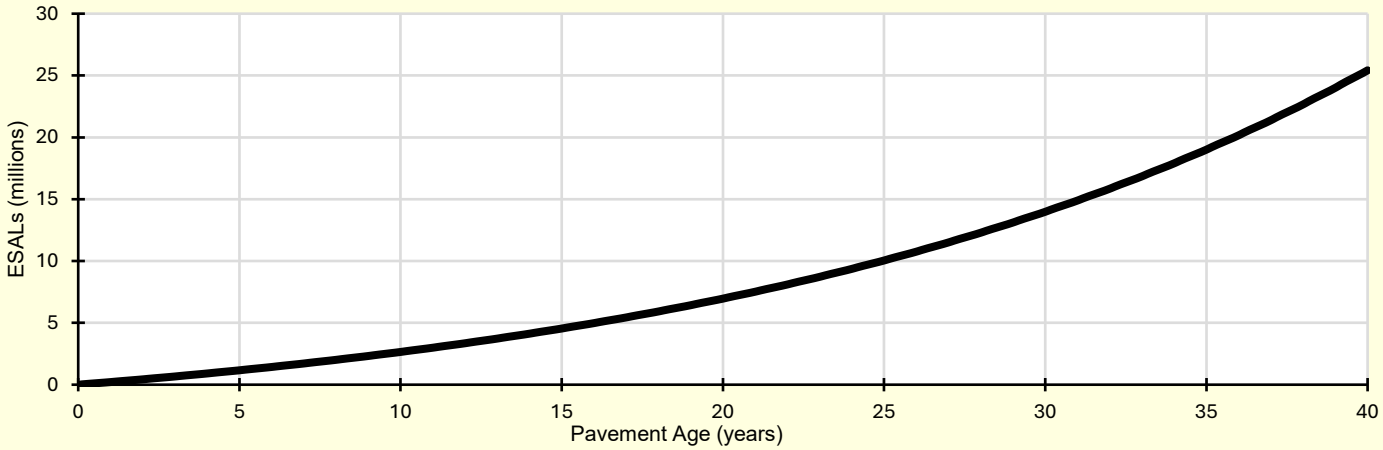








Cumulative ESALs



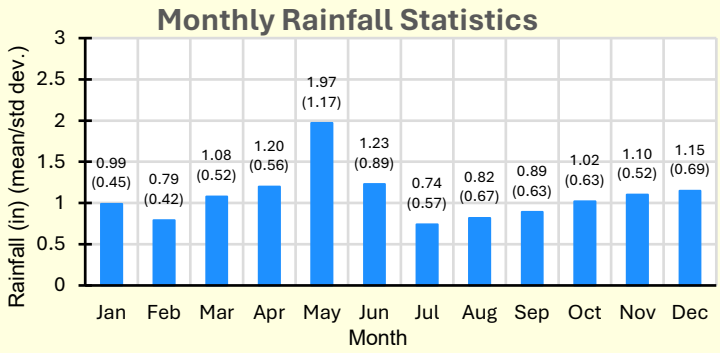
Climate Inputs

Climate Data Sources:

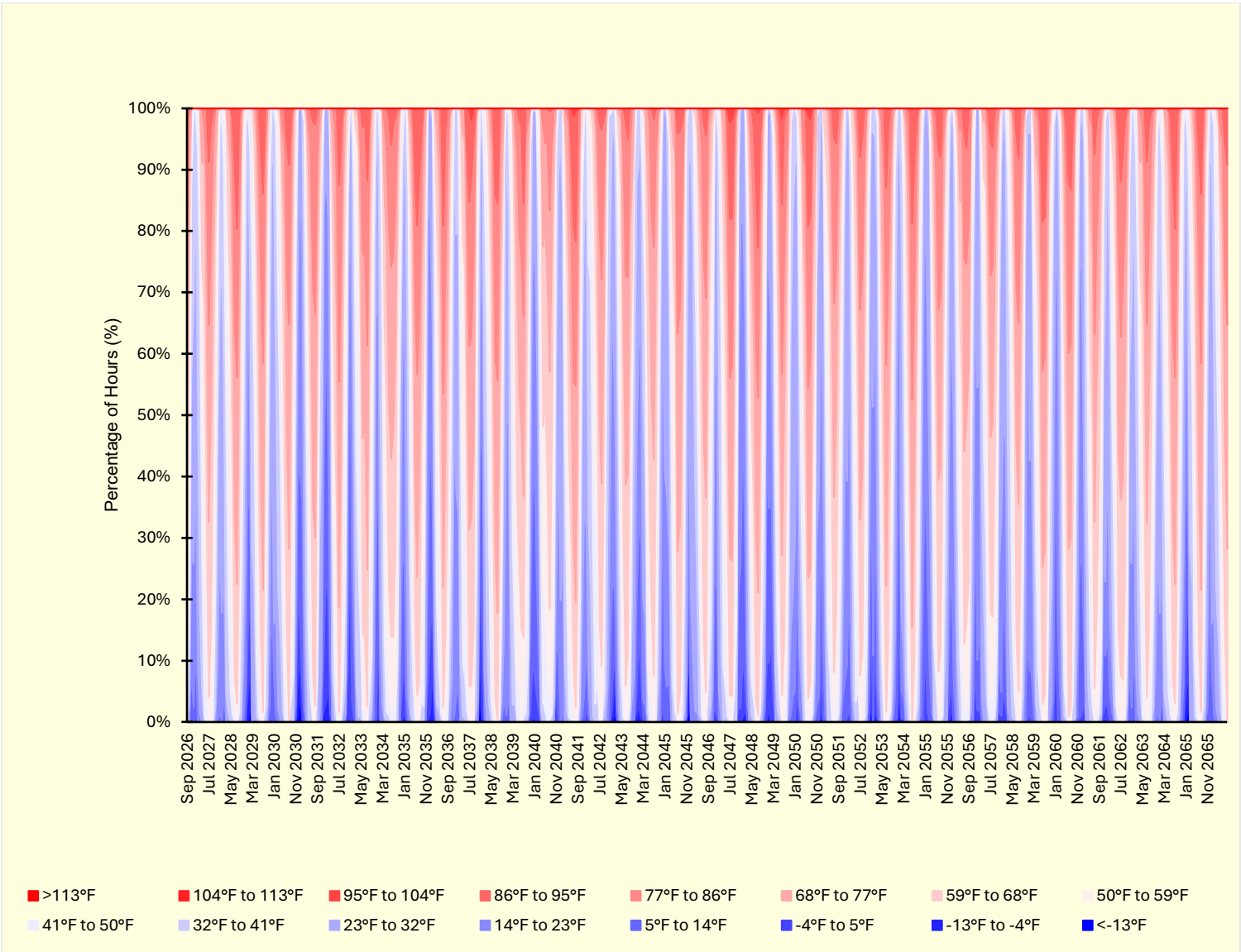
Climate Station Cities:	Location (lat, long, elevation(ft))
IDAHO FALLS_NARR_GRIDPOINT, ID	43.51600, -112.06700, 4730
REXBURG_NARR_GRIDPOINT, ID	43.73288, -112.02997, 4780

Annual Statistics:

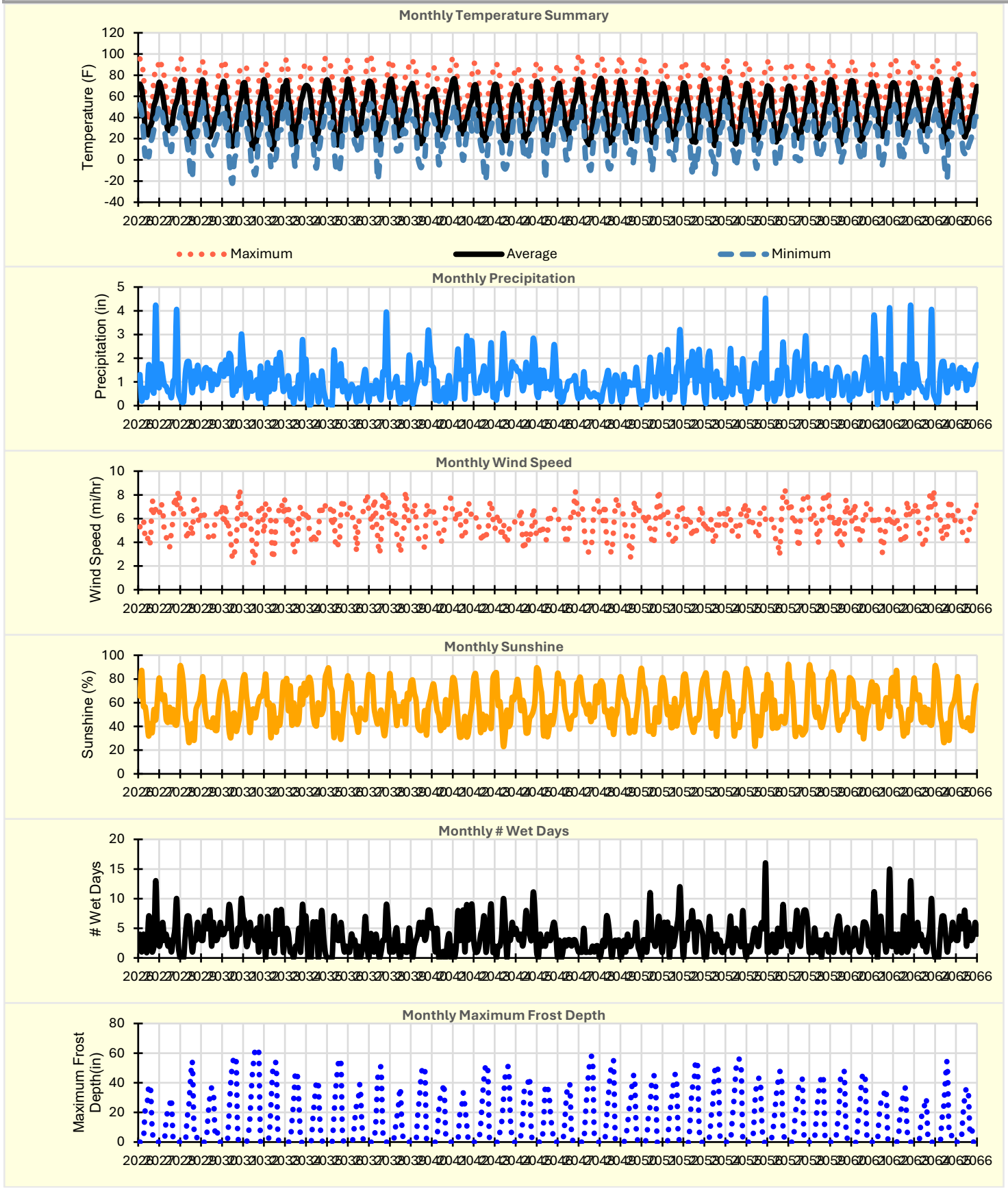
Mean annual air temperature (F):	46.12
Mean annual precipitation (in):	12.98
Freezing index (F - days):	1119.56
Average annual number of freeze/thaw cycles:	53.34
Water table depth (ft)	10.00



Hourly Air Temperature Distribution by Month:



Monthly Climate Summary:



Design Properties

JPCP Design Properties

Structure - ICM Properties	
PCC Surface shortwave absorptivity	0.85

PCC joint spacing (ft)	
Is joint spacing random?	False
Joint spacing (ft)	15.00

Doweled Joints	
Is joint doweled?	True
Dowel diameter (in)	1.50
Dowel spacing (in)	12.00

Widened Slab	
Is slab widened?	True
Slab width (ft)	13.50

Sealant type	Other(Including No Sealant... Liquid... Silicone)

PCC-Base Interface Friction	
Nondimensional Friction Factor	0.1
Friction Degradation Factor	300
Characteristic Length (in)	2.5

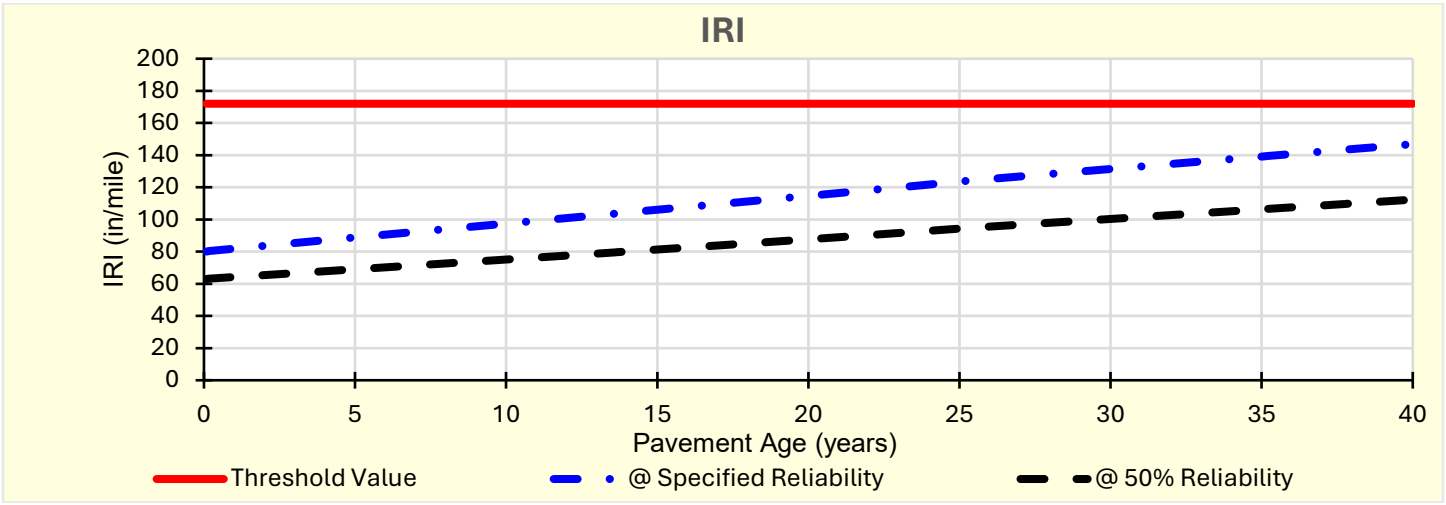
Tied Shoulders	
Tied shoulders	True
Load transfer efficiency (%)	50

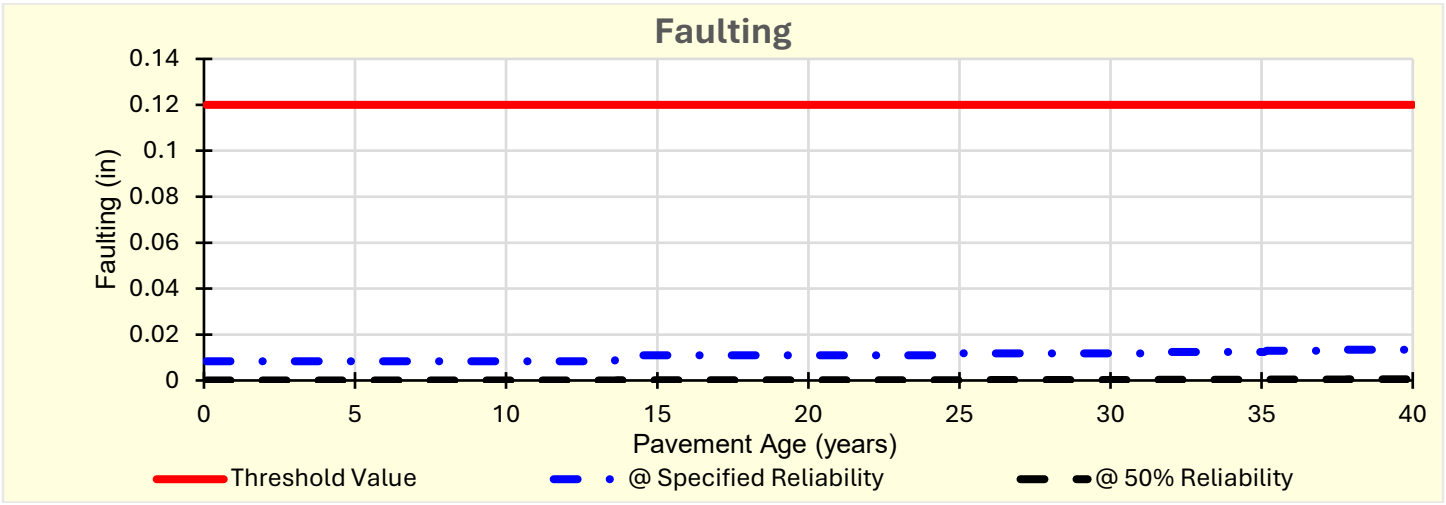
PCC-Base Contact Friction	
PCC-Base full friction contact	True
Months until friction loss	480.00

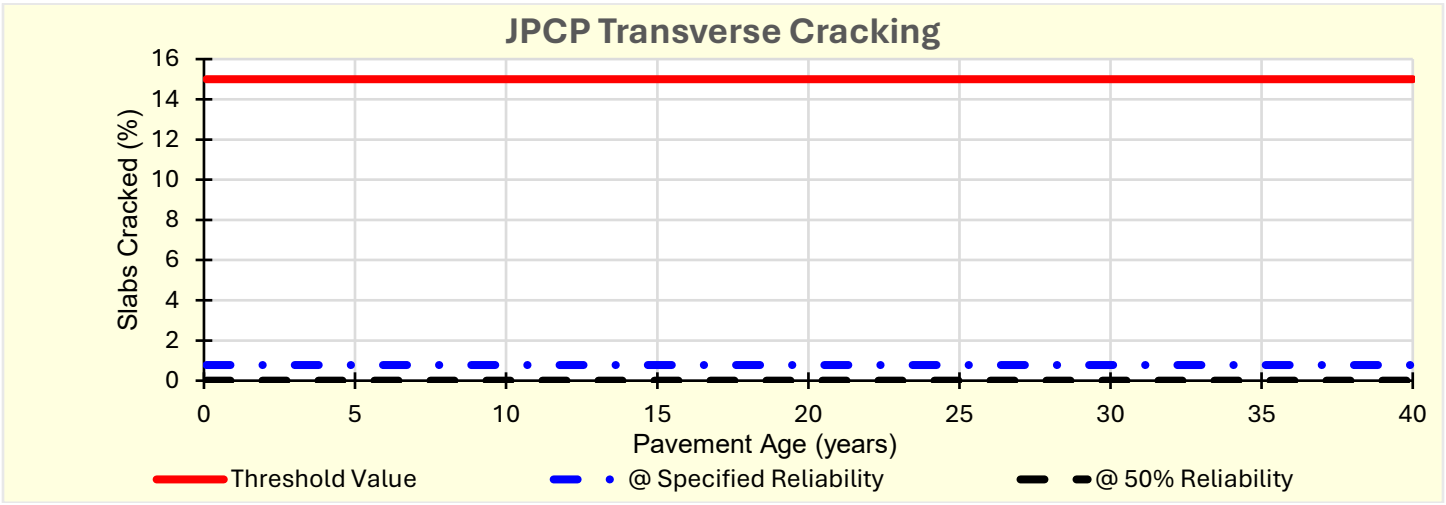
Erodibility index	1

Permanent curl/warp effective temperature difference (°F)	- 10.00

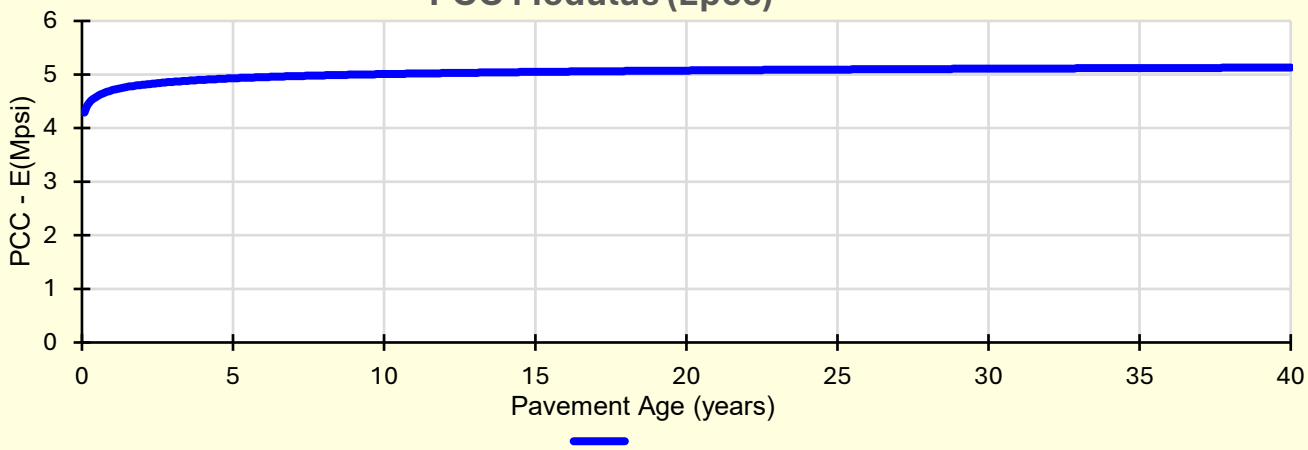
Analysis Output Charts



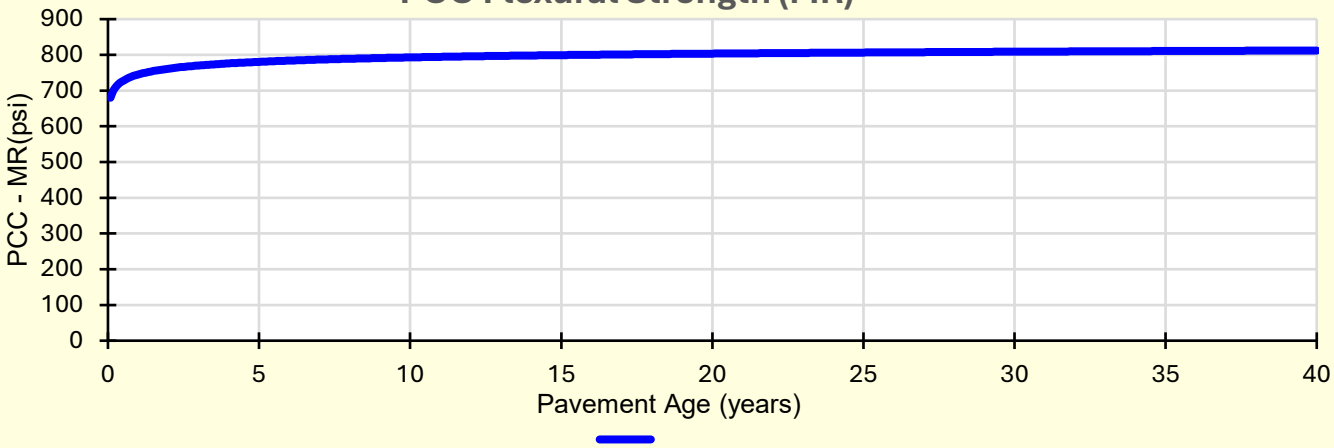




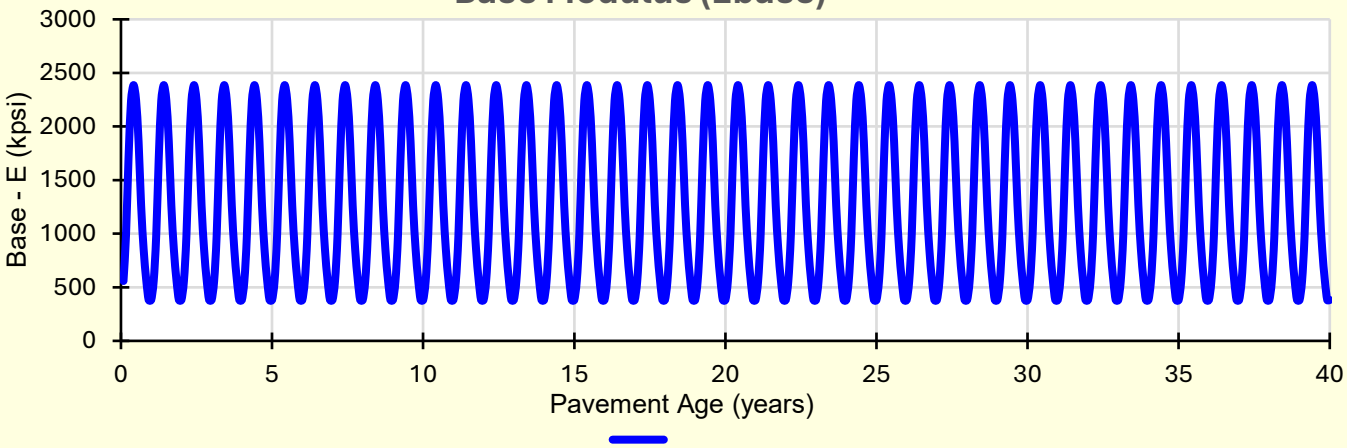
PCC Modulus (Epcc)

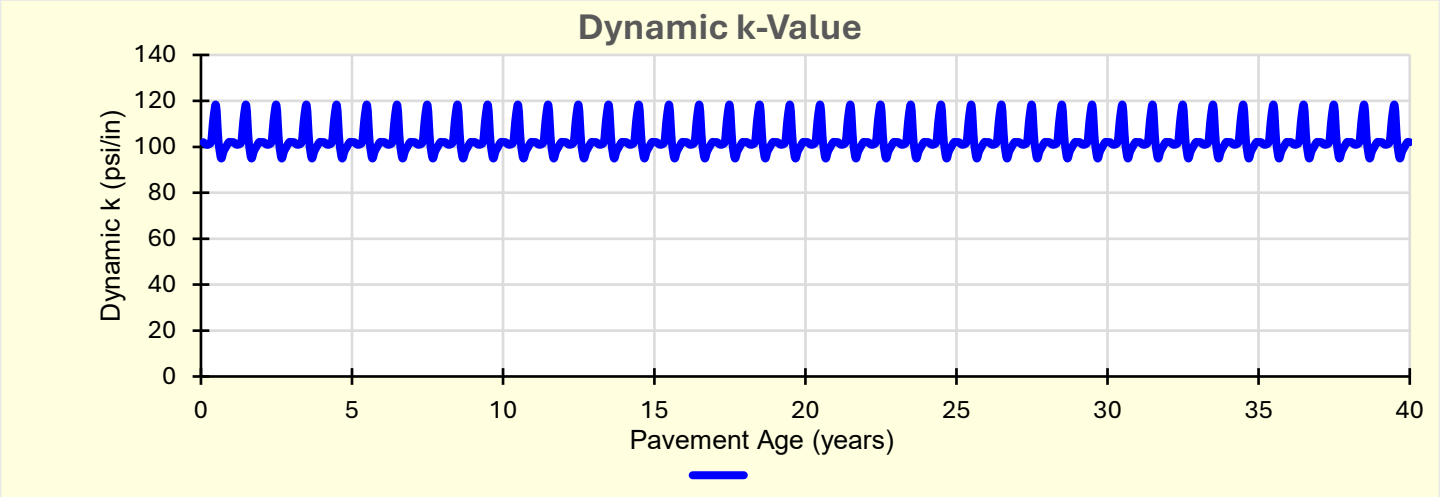


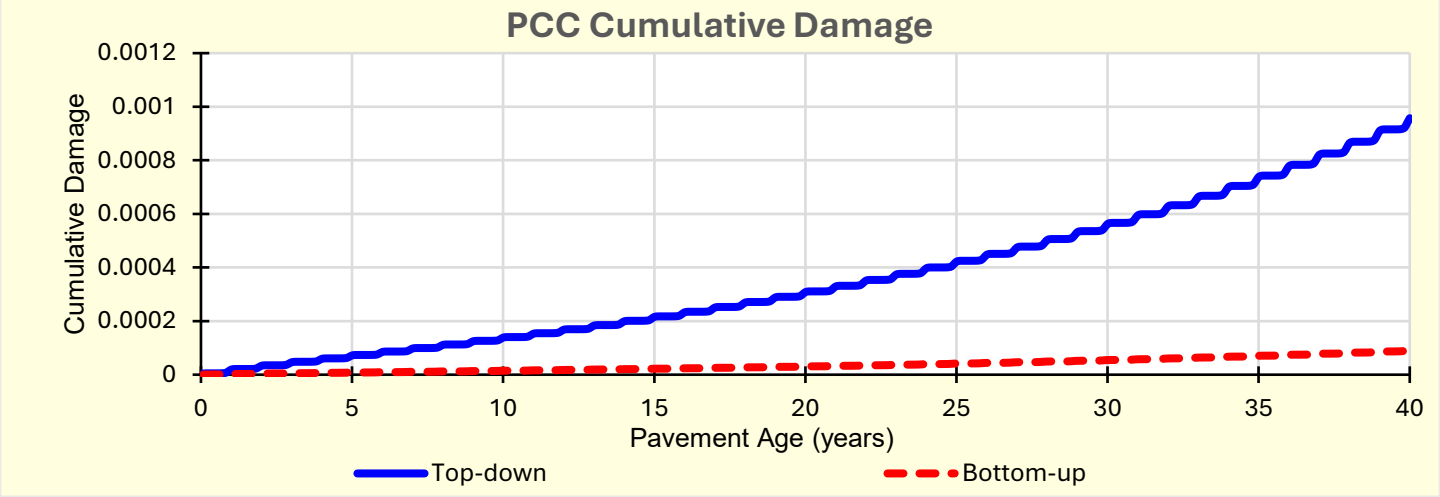
PCC Flexural Strength (MR)

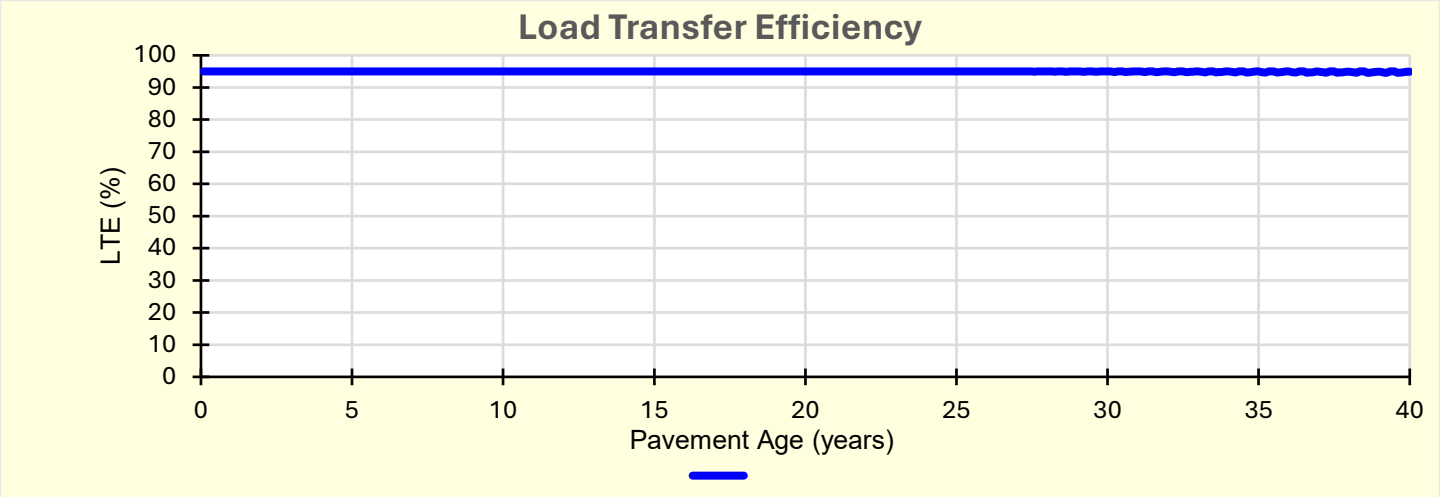


Base Modulus (Ebase)









Layer Information

Layer 1 PCC (Proposed Overlay) : JPCP Default

PCC	
Thickness (in)	10
Unit weight (pcf)	150
Poisson's ratio	0.2

Thermal	
PCC coefficient of thermal expansion (in/in/deg F X 10^-6)	4.9
PCC thermal conductivity (BTU/hr-ft-°F)	1.25
PCC heat capacity (BTU/lb-°F)	0.28

Mix		
Cement type		Type I (1)
Cementitious material content (lb/yd^3)		600
Water to cement ratio		0.42
Aggregate type		Dolomite (2)
PCC zero-stress temperature (°F)	Calculated Internally?	True
	User Value	-
	Calculated Value	104.745
Ultimate Shrinkage (microstrain)	Calculated Internally?	True
	User Value	-
	Calculated Value	629.8
Reversible Shrinkage (%)		50
Time to develop 50% of ultimate shrinkage (days)		35
Curing Compound		

PCC strength and modulus (Input Level: 3)

28-Day PCC modulus of rupture (psi)	700
28-Day PCC elastic modulus (psi)	4200000

Identifiers

Field	Value
Display name/identifier	JPCP Default
Description of object	
Author	MJS
Date Created	8/25/2025 12:00:00 AM
Approver	SGC
Date approved	8/25/2025 12:00:00 AM
State/Province	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
User defined field 1	
User defined field 2	
User defined field 3	
Revision Number	0

Layer 2 Flexible (Proposed Overlay) : Default asphalt concrete

Asphalt		
Thickness (in)		3.0
Unit Weight (pcf)		150.0
Poisson's ratio	Is Calculated?	False
	Ratio	0.35
	Parameter A	-
	Parameter B	-

Asphalt Dynamic Modulus (Input Level: 3)

Gradation	Percent Passing
3/4-in sieve	100
3/8-in sieve	77
No. 4 sieve	60
No. 200 sieve	6

Asphalt Binder

Parameter	Percent Value
Grade	Superpave Performance Grade
Binder Type	64-28
A	10.312
VTS	-3.44

General Info

Name	Value
Reference Temperature (°F)	70
Effective binder content (%)	11.6
Air void (%)	7
Thermal conductivity (BTU/hr-ft-°F)	0.67
Heat Capacity (BTU/lb-°F)	0.23
Percent Content by Weight (%)	-
Aggregate Parameter	-
Dynamic Modulus E* Fitting Method	1-37A

Identifiers

Field	Value
Display name/identifier	Default asphalt concrete
Description of object	
Author	MJS
Date Created	8/25/2025 12:00:00 AM
Approver	SGC
Date approved	8/25/2025 12:00:00 AM
State/Province	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
User defined field 1	
User defined field 2	
User defined field 3	
Revision Number	0

Layer 3 Non-stabilized base : Untreated Aggregate Base (A-1-a)

Unbound	
Layer thickness (in)	6
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
MR Method:	Resilient Modulus (psi)
Resilient Modulus (psi)	32000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor	-

Identifiers

Field	Value
Display name/identifier	Untreated Aggregate Base (A-1-a)
Description of object	New Untreated Aggregate Base
Author	MJS
Date Created	8/25/2025 12:00:00 AM
Approver	SGC
Date approved	8/25/2025 12:00:00 AM
State/Province	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
User defined field 1	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.2
Saturated hydraulic conductivity (ft/hr)	False	0.01907
Specific gravity of solids	False	2.7
Water Content (%)	False	7.6

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	5.135856137329385
bf	2.0745928833024134
cf	0.746309667906325
hr	112

Sieve Size	% Passing
0.001 mm	
0.002 mm	
0.02 mm	
#200	6
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	
#8	40
#4	55
3/8 in	
1/2 in	
3/4 in	95
1 in	100
1 1/2 in	
2 in	
2 1/2 in	
3 in	
3 1/2 in	

Layer 4 Non-stabilized base : Granular Subbase (A-1-a)

Unbound	
Layer thickness (in)	12
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
MR Method:	Resilient Modulus (psi)
Resilient Modulus (psi)	21000.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor	-

Identifiers

Field	Value
Display name/identifier	Granular Subbase (A-1-a)
Description of object	New Granular Subbase
Author	MJS
Date Created	8/25/2025 12:00:00 AM
Approver	SGC
Date approved	8/25/2025 12:00:00 AM
State/Province	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
User defined field 1	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	6.0
Plasticity Index	1.0
Is layer compacted	True

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	127.5
Saturated hydraulic conductivity (ft/hr)	False	0.02635
Specific gravity of solids	False	2.7
Water Content (%)	False	7.4

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	9.948659978083066
bf	1.1708375544165033
cf	0.9577065619969332
hr	115

Sieve Size	% Passing
0.001 mm	
0.002 mm	
0.02 mm	
#200	7.5
#100	
#80	
#60	
#50	
#40	
#30	
#20	
#16	
#10	
#8	
#4	52.5
3/8 in	
1/2 in	
3/4 in	
1 in	
1 1/2 in	
2 in	
2 1/2 in	
3 in	95
3 1/2 in	100

US-20 Puzzle to IF Rigid V-3_31 Prep 8-27-25

Tenant: Shannon and Wilson Inc - BOISE IDAHO OFFICE

Workspace: System Workspace

Layer 5 Subgrade : Subgrade (A-6)

Unbound	
Layer thickness (in)	Semi-infinite
Poisson's ratio	0.35
Coefficient of lateral earth pressure (k0)	0.5

Modulus (Input Level: 3)

Analysis Type:	Modify input values by temperature/moisture
MR Method:	Resilient Modulus (psi)
Resilient Modulus (psi)	4800.0

Use Correction factor for NDT modulus?	-
NDT Correction Factor	-

Identifiers

Field	Value
Display name/identifier	Subgrade (A-6)
Description of object	Default material
Author	MJS
Date Created	8/25/2025 12:00:00 AM
Approver	SGC
Date approved	8/25/2025 12:00:00 AM
State/Province	
District	
County	
Highway	
Direction of Travel	
From station (miles)	
To station (miles)	
User defined field 1	
User defined field 2	
User defined field 3	
Revision Number	0

Sieve

Liquid Limit	33.0
Plasticity Index	16.0
Is layer compacted	False

	Is User Defined?	Value
Maximum dry unit weight (pcf)	False	107.9
Saturated hydraulic conductivity (ft/hr)	False	0.00002
Specific gravity of solids	False	2.7
Water Content (%)	False	17.1

User-defined Soil Water Characteristic Curve (SWCC)	
Is User Defined?	False
af	108.40908936617681
bf	0.6800697758049122
cf	0.21612410082307038
hr	500

Sieve Size	% Passing
0.001 mm	
0.002 mm	
0.02 mm	
#200	63.2
#100	
#80	73.5
#60	
#50	
#40	82.4
#30	
#20	
#16	
#10	90.2
#8	
#4	93.5
3/8 in	96.4
1/2 in	97.4
3/4 in	98.4
1 in	99
1 1/2 in	99.5
2 in	99.8
2 1/2 in	
3 in	
3 1/2 in	100

Calibration Coefficients

IRI-jpcp		
C1 - Cracking C2 - Spalling C3 - Faulting C4 - Site Factor	C1: 0.845	C2: 0.4417
	C3: 1.4929	C4: 28.24
	Reliability Standard Deviation	
	29.03 * Ln(IRI) - 103.8	
	Initial IRI Standard Deviation	
	5.4	

JPCP Transverse Cracking

$$\text{Crk}_{Bottom-up/Top-down} = \frac{100}{1 + C_4 \left(FD_{bottom-up/top-down} \right)^{C_5}}$$

$$\text{Crk}_{Total} = Crk_{Bottom-up} + Crk_{Top-down} - \left(Crk_{Bottom-up} \times Crk_{Top-down} \right)$$

$$FD_{bottom-up/top-down} = \sum \frac{n_{i,j,k,l,m,n,o}}{N_{i,j,k,l,m,n,o}}$$

$$\log\left(N_{i,j,k,l,m,n} \right) = C_1 \left(\frac{MR_i}{\sigma_{i,j,k,l,m,n}} \right)^{C_2} + 0.431 - \log\left(1 - C_c \frac{\sigma^0_{i,j,m} + \sigma_{NL}}{\sigma_{Total}} \right)$$

Fatigue Coefficients		Cracking Coefficients	
C1: 2.366	C2: 1.22	C4: 0.52	C5: -2.17
PCC Reliability Crack Standard Deviation			
3.5522 * Pow(CRACK,0.3415) + 0.75			
Friction Damage Degradation			0
Curling and Other Stresses (CC Factor)			0
Built-in Curling A			0
Built-in Curling B			0

PCC Faulting

$$C_{12} = C_1 + (C_2 * FR^{0.25})$$

$$C_{34} = C_3 + (C_4 * FR^{0.25})$$

$$FaultMax_0 = C_{12} * \delta_{curling} * \left[\log(1 + C_5 * 5.0^{EROD}) * \log\left(P_{200} * \frac{WetDays}{p_S} \right) \right]^{C_6}$$

$$FaultMax_i = FaultMax_0 + C_7 * \sum_{j=1}^{m} DE_j * \log(1 + C_5 * 5.0^{EROD})^{C_6}$$

$$\Delta Fault_i = C_{34} * (FaultMax_{i-1} - Fault_{i-1})^2 * DE_i$$

$$C_8 = DowelDeterioration$$

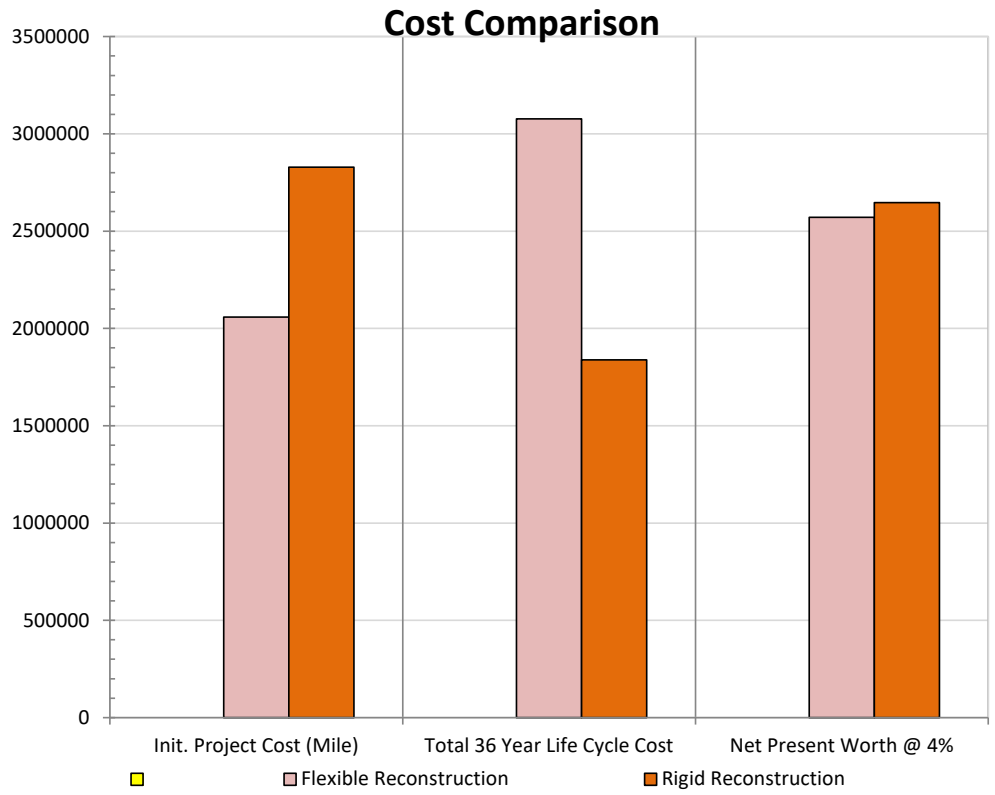
C1: 0.516	C2: 1.636	C3: 0.00217	C4: 0.00444
C5: 250	C6: 0.47	C7: 7.3	C8: 400
PCC Reliability Fault Standard Deviation			
0.07162 * Pow(FAULT,0.368) + 0.00806			

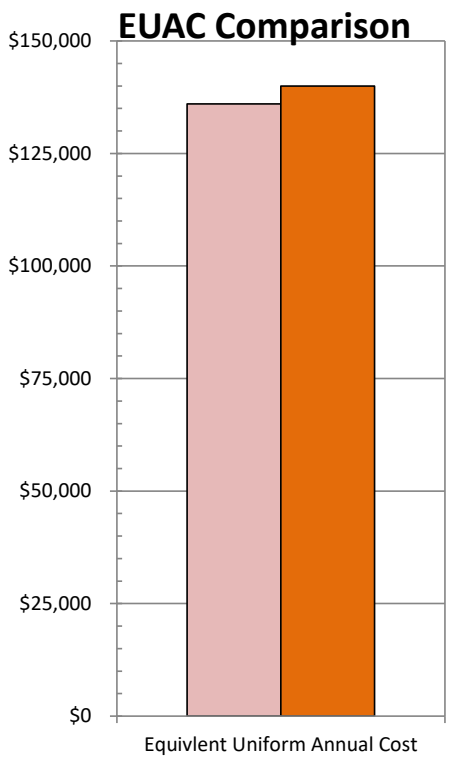
APPENDIX G: LIFE CYCLE COST ANALYSIS

Appendix G

Life Cycle Cost Analysis

Strategy	Init. Project Cost (Mile)	Total 36 Year Life Cycle Cost	Net Present Worth @ 4%	Equivlent Uniform Annual Cost
Rigid Reconstruction	$2,829,000	$1,839,000	$2,647,000	$140,000
Flexible Reconstruction	$2,059,000	$3,077,000	$2,571,000	$136,000





QC:mjs

SHANNON & WILSON

Designed By: MEE

8/26/2025

FLEXIBLE PAVEMENT WORKSHEET

Flexible Reconstruction

PROJECT NAME	**US-20, Puzzle to Arco (MP 248.9 to 272.0)**
PROJECT NUMBER	**A024(394)**
KEY NUMBER	**24394**

Material	Depth		Haul		Width		Weight / ft³		Cost	
Hot Mix Asphalt (HMA)	**0.35**	ft	**10.0**	mile	**39.40**	ft	**156.00**	lb	**60.00**	/ ton
Untreated Aggregate Base	**0.65**	ft	**10.0**	mile	**42.00**	ft	**142.00**	lb	**15.00**	/ ton
Granular Subbase	**1.25**	ft	**10.0**	mile	**47.00**	ft	**134.00**	lb	**20.00**	/ ton
Cold Mill										
Preservation Mill/Inlay	**0.15**	ft	**10.0**	mile	**24.00**	ft	**145.00**	lb	**1.00**	/ sq. yard

Project Length	**5,280**	ft
Travel Lane Width	**24.00**	ft
Surface Width - Left Side	**16.00**	ft
Surface Width - Right Side	**22.00**	ft
Additional Borrow		cu.yard
Traffic Cross Overs		Ea.
Number of Edge Drains		Ea.
Longitudinal Cracks	**3**	Ea.
Transverse Cracks	**176**	/ mile
Foreslope Angle - Left	**4**	(H): 1(V)
Foreslope Angle - Right	**4**	(H): 1(V)
Excavation	**2.00**	ft
Subgrade Sep. Fabric Layer	**41.00**	ft
Pavement Geotextile		ft

QC:mjs

SHANNON & WILSON

Designed By: MEE

LIFE CYCLE COST ANALYSIS		STANDARD TIME LINES	**26-Aug-25**
PROJECT NAME	**US-20, Puzzle to Arco (MP 248.9 to 272.0)**	36 YEAR LIFE CYCLE	
PROJECT NUMBER	**A024(394)**	UNIFORM PROJECT COSTS PER MILE	
KEY NUMBER	**24394**	(English units)	

Flexible Reconstruction

YEAR		WORK	COST	PRESENT WORTH FACTOR	CAPITAL RECOVERY FACTOR	EQUIVALENT UNIFORM ANNUAL COST
0	-->	Initial Cost	$2,059,000	1.000	0.0529	$108,900
-	-->	Seal Coat Full Width	$67,000	0.962	0.0529	$3,400
-						
-						
-						
5						
-						
-						
-	-->	Seal Coat Driving Lanes	$42,000	0.731	0.0529	$1,600
-						
10						
-						
-	-->	Preservation at Year 12	$240,000	0.625	0.0529	$7,900
-						
-						
15	-->	Seal Cracks	$27,000	0.555	0.0529	$800
-						
-						
-	-->	Seal Cracks	$27,000	0.494	0.0529	$700
-	-->	Seal Coat Driving Lanes	$42,000	0.475	0.0529	$1,100
20						
-	-->	Seal Cracks	$27,000	0.439	0.0529	$600
-						
-						
-	-->	Preserv. Mill & Inlay/Overlay-Year 24	$423,000	0.390	0.0529	$8,700
25						
-						
-	-->	Seal Cracks	$27,000	0.347	0.0529	$500
-						
-						
30	-->	Seal Cracks	$27,000	0.308	0.0529	$400
-						
-	-->	Seal Coat Driving Lanes	$42,000	0.285	0.0529	$600
-	-->	Seal Cracks	$27,000	0.274	0.0529	$400
-						
35						
-	-->	End Life - Salvage Value	$0	0.244	0.0529	$0
		TOTAL	$3,077,000		EUAC ----->	$136,000
					Total Net Present Worth @ 4%	$2,571,000

QC:mjs

SHANNON & WILSON

Designed By: MEE

8/26/2025

LIFE CYCLE COST ANALYSIS
US-20, Puzzle to Arco (MP 248.9 to 272.0)
A024(394)
Flexible Reconstruction

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:		
	Hot Mix Asphalt (HMA)	$426,000
	Untreated Aggregate Base	$308,000
	Granular Subbase	$728,000
		$0
		$0
		$0
		$0
	Cold Mill	$0
	Traffic Cross Overs	$0
	Excavation	$549,000
	Additional Borrow	$0
	Edge Drains	$0
	Subgrade Sep. Fabric Layer	$48,000
	Pavement Geotextile	
TOTAL INITIAL COST		**$2,059,000**
PERIODIC MAINTENANCE		
	Seal Coat Full Width @ Yr 1	$67,000
	Seal Driving Lanes @ Yr 8, 19, & 32	$126,000
	Seal Cracks @ Yr 15, 18, 21, 27, 30, & 33	$54,000
TOTAL PERIODIC MAINTENANCE		**$247,000**
PRESERVATION AT 12 YEARS:		
	Preservation Mill Travel Lanes	$35,000
	Hot Mix Asphalt Inlay	$111,000
	Seal Coat Full Width	$67,000
	Seal Cracks	$27,000
TOTAL 12 YEAR PRESERVATION		**$240,000**
PRESERVATION AT 24 YEARS:		
	Preservation Mill Travel Lanes	$35,000
	Hot Mix Asphalt inlay	$111,000
	Pavement Geotextile	$0
	Overlay Full Width	$183,000
	Seal Coat Full Width	$67,000
	Seal Cracks	$27,000
TOTAL 24 YEAR PRESERVATION		**$423,000**
TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)		**$2,969,000**
EQUIVALENT UNIFORM ANNUAL COST (euac)		**$136,000**
TOTAL NET PRESENT WORTH AT 4% INTREST		**$2,571,000**

QC:mjs

SHANNON & WILSON

Designed By: MEE

8/26/2025

RIGID PAVEMENT WORKSHEET

Rigid Reconstruction

PROJECT NAME	**US-20, Puzzle to Arco (MP 248.9 to 272.0)**
PROJECT NUMBER	**A024(394)**
KEY NUMBER	**24394**

Material	Depth		Haul		Width		Weight / ft³		Cost	
Concrete Pavement (PCC) CY & SY	**10.00**	in	**10.00**	mile	**38.00**	ft	**150.00**	lb	**126.00**	/ CY & / SY
Hot Mix Asphalt (HMA)	**3.00**	in	**10.00**	mile	**38.00**	ft	**156.00**	lb	**60.00**	/ ton
Untreated Aggregate Base	**6.00**	in	**10.00**	mile	**38.00**	ft	**142.00**	lb	**15.00**	/ ton
Granular Subbase	**12.00**	in	**10.00**	mile	**38.00**	ft	**134.00**	lb	**20.00**	/ ton

Project Length	**5,280**	ft
Travel Lane Width	**24.00**	ft
Surface Width - Left Side	**16.00**	ft
Surface Width - Right Side	**22.00**	ft
Additional Borrow		CY
Traffic Cross Overs		Ea.
Number of Edge Drains		Ea.
Longitudinal Joints	**1**	Ea.
Transverse Joints	**350**	/ mile
Foreslope Angle - Left	**0**	(H): 1 (V)
Foreslope Angle - Right	**0**	(H): 1 (V)
Excavation	**31.00**	in
Subgrade Sep. Fabric Layer	**32.00**	ft

QC:mjs

SHANNON & WILSON

Designed By: MEE

LIFE CYCLE COST ANALYSIS
PROJECT NAME **US-20, Puzzle to Arco (MP 248.9 to 272.0)**
PROJECT NUMBER **A024(394)**
KEY NUMBER **24394**

STANDARD TIME LINES **26-Aug-25**
36 YEAR LIFE CYCLE
UNIFORM PROJECT COSTS PER MILE
(English Units)

Rigid Reconstruction

YEAR		WORK	COST	PRESENT WORTH FACTOR	CAPITAL RECOVERY FACTOR	EQUIVALENT UNIFORM ANNUAL COST
0	-->	Initial Cost	$2,829,000	1.000	0.0529	$149,700
10	-->	Seal Joints	$48,000	0.703	0.0529	$1,800
20	-->	Rehab & Seal Joints	$121,000	0.494	0.0529	$3,200
30	-->	Seal Joints	$48,000	0.347	0.0529	$900
35	---->	End Life - Salvage Value	($1,207,000)	0.244	0.0529	($16,000)
		TOTAL	$1,839,000		EUAC ----->	$140,000
				Total Net Present Worth @ 4%		$2,647,000

QC:mjs

SHANNON & WILSON

Designed By: MEE

8/26/2025

LIFE CYCLE COST ANALYSIS
US-20, Puzzle to Arco (MP 248.9 to 272.0)
A024(394)
Rigid Reconstruction

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:

	Concrete Pavement (PCC) CY & SY	$1,227,000
	Hot Mix Asphalt (HMA)	$294,000
	Untreated Aggregate Base	$214,000
	Granular Subbase	$471,000
		$0
		$0
		$0
	Traffic Cross Overs	$0
	Excavation	$585,000
	Additional Borrow	$0
	Edge Drains	$0
	Subgrade Sep. Fabric Layer	$38,000
TOTAL INITIAL COST		**$2,829,000**

REHABILITATION AT 9 YEARS:

	Seal Longitudinal Joints	$21,000
	Seal Transverse Joints	$27,000
TOTAL 9 YEAR PRESERVATION		**$48,000**

PRESERVATION AT 18 YEARS:

	Slab Replacement at 2%	$45,000
	Grinding Driving Lanes	$28,000
	Seal Longitudinal Joints	$21,000
	Seal Transverse Joints	$27,000
TOTAL 18 YEAR PRESERVATION		**$121,000**

REHABILITATION AT 27 YEARS:

	Seal Longitudinal Joints	$21,000
	Seal Transverse Joints	$27,000
TOTAL 27 YEAR PRESERVATION		**$48,000**

TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)	**$1,839,000**
EQUIVALENT UNIFORM ANNUAL COST (euac)	**$140,000**
TOTAL NET PRESENT WORTH AT 4% INTREST	**$2,647,000**
SALVAGE VALUE	**($1,207,000)**

QC:mjs

IMPORTANT INFORMATION

Important Information

About Your Report

IMPORTANT INFORMATION

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining

IMPORTANT INFORMATION

your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland.

IMPORTANT INFORMATION