SHANNON & WILSON

Roadway Materials Report

US-26, Jct. Hitt Road (25th E)

Bonneville County, Idaho

ITD Project No. A021(923), Key No. 21923

Prepared for:

Horrocks Engineers

June 13, 2022

<108841>

File No. 108841

SHANNON & WILSON

June 13, 2022

Horrocks Engineers
901 Pier View Drive, Suite 205
Idaho Falls, Id 83402

Attention: Mr. Kelly Hoopes, PE

Roadway Materials Report

US-26, Jct. Hitt Road (25th E)

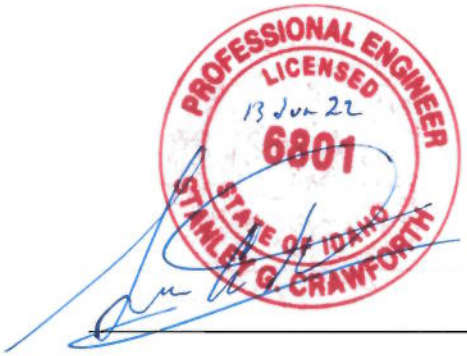
Bonneville County, Idaho

ITD Project No. A021(923)

Key No. 21923

Prepared by:

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240.00 ROADWAY MATERIALS REPORT

240.01 Introduction

This roadway project is located in Bonneville County near Idaho Falls, Idaho, on Hitt Road and US 26.

The purpose of the project is primarily intersection reconstruction with some minor realignment.

Since the proposed work is primarily a reconstruction project, this Roadway Materials Report will not require geological reconnaissance and mapping; soil profile drawings; or slope investigations. Roadside embankments and/or retaining walls are not anticipated.

The existing roadway is classified as a principal arterial and is situated in an urban area. In the immediate area, development in all quadrants of the intersection appears to be industrial, turning into agricultural north of the project limit. Notably a gas station/ convenience store is located in the northwest quadrant. Current loading primarily includes residential traffic, including some associated bus and truck loads.

The near surface soils are predominantly fine-grained silty alluvial and eolian sediments. Near surface bedrock is not anticipated. Near surface groundwater is not anticipated to affect the construction.

The proposed construction year is 2026.

As provided for in the Materials Manual, this Roadway Material Report includes an abbreviated Geotechnical Engineering Report that addresses the requirements for signal poles at the intersection of US 26 and Hitt Road.

Note: This project was initiated and most of the field investigation was completed by American Geotechnics prior to 2022. However, following the company acquisition, effective January 1, 2022, the project has been reassigned to Shannon & Wilson. Any references to American Geotechnics in this report are with respect to the work performed prior to the acquisition.

240.02 Vicinity Map

A Vicinity Map is in Appendix A.

240.03 Soils Profile

This project involves reconstruction along an existing alignment, such that soils profile drawings are not needed. The following table summarizes the subgrade soil characteristics.

Subgrade Soils Laboratory Test Results										
Sample		Moisture (%)	Atterberg Limits			Particle Size			R-Value	USCS
Location	Depth (ft)		LL (%)	PL (%)	PI	Gravel (%)	Sand (%)	Fine (%)		
AG-01	2.0-4.0	14.1	--	--	--	29	21	50	44	GM
AG-02	4.0-6.0	--	--	--	--	3	40	57	--	ML
AG-04	2.0-4.0	17.9	--	--	--	2	16	82	23	ML
AG-05	2.0-4.0	14.9	36	15	21	17	23	60	7	CL
AG-06	4.0-6.0	--	--	--	--	0	14	86	--	ML
AG-08	2.0-4.0	9.6	27	15	12	36	24	40	13	GC
AG-08	4.0-6.0	--	--	--	--	0	25	75	--	ML

The moisture content is typically near the plastic limit, which indicates that Excavation and Repair of Soft Spot (205.03.D) of fine-grained subgrade soils may be a necessary contingency.

Contaminated soils were not identified.

240.04 Soil Report Summary

This project involves reconstruction along an existing alignment; therefore, a Soil Report Summary Form ITD-944 was not prepared.

240.05 Total Design Pavement Thickness

The recommended pavement structure design is detailed in Section 540.14 *Recommendations*. The following summarizes the design recommendation for the roadway based on a combination of feasibility, constructability, and assumed cost benefits.

US-26 Flexible Reconstruction:

The following process is recommended:

- Excavate 3.86 ft full width of the roadway.
- Place a subgrade separation geotextile on the prepared subgrade.
- Spread 2.55 ft of granular subbase across the width of the roadway.
- Place 0.80 ft of ¾" Untreated Aggregate Base on top of the subbase.
- Tight grade and compact to design roadway crown and cross-slopes to the required base layer lines and grades.
- Place a uniform 0.50 ft (in two equal lifts) of Superpave HMA (405).

Hitt Rd and Iona Rd Flexible Reconstruction:

The following process is recommended:

- Excavate 3.56 ft full width of the roadway.
- Place a subgrade separation geotextile on the prepared subgrade.
- Spread 2.35 ft of granular subbase across the width of the roadway.
- Place 0.75 ft of ¾" Untreated Aggregate Base on top of the subbase.
- Tight grade and compact to design roadway crown and cross-slopes to the required base layer lines and grades.
- Place a uniform 0.45 ft (in two equal lifts) of Superpave HMA (405).

240.06 Sub-subgrading

Sub-subgrading is not required.

240.07 Grade Pointing

Grade pointing is not anticipated.

240.08 Special Placement

Special placement of materials is not specified.

240.09 Compaction

Compact roadway materials in accordance with *ITD Standard Specifications* – Section 205.03.G (2018).

240.10 Slope Design Summary

This project does not include slope design.

240.11 Slope Design

All embankment slopes will conform to standards.

240.12 Embankment Foundation

Embankment foundations are not planned.

240.13 Surface and Subsurface Water

Run-off and run-on from precipitation may be managed by existing drainage features.

Groundwater was not encountered during the roadway borings and such the project development should not be affected.

240.14 Drainage

Any drainage ditches along the roadway should extend a minimum of 1 foot or the diameter of any pipe size below the bottom of the pavement structure, per ITD Standard Detail A-2 for a principal arterial.

240.15 Geosynthetics

The subgrade soils typically have more than 50% passing the No. 200 sieve and a plasticity index greater than 10. For subgrade separation, show a Subgrade Separation Geotextile, Type III (718.07) immediately below the pavement structure.

240.16 Existing Roadway Material

Pulverized asphalt obtained from required milling activities may be reused as RAP in accordance with 405 limitations.

Pulverized asphalt, existing base materials from required project excavations may be reused as Granular Subbase, so long as the pulverized asphalt, existing base meets the material requirements for Granular Subbase (301.03.D).

240.17 Rock Subgrade

Rock was not observed during the field investigations. Rock subgrade or rock cuts are not anticipated.

240.18 Topsoil

Topsoil is not generally present in the project development areas. Topsoil, if required, will have to be imported.

240.19 Pipe

Pipe replacement is not within the scope or intent of this project.

240.20 Riprap

Riprap is not planned.

240.21 Staged Construction

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

240.22 Pavement Data

Flexible pavement is the recommended pavement type for this project

Shannon & Wilson recommends the Surface Smoothness to be checked with a 10-foot straightedge at locations determined by the Engineer.

Typical Section

The following tables summarize the typical sections for the project.

US-26 Flexible Reconstruction (TI-11.5)			
	Thickness (ft)	Layer	Materials
	0.50	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)
	0.80	Aggregate Base (303)	Aggregate for Untreated Base, ¾-inch Type B (703.04)
	2.55	Granular Subbase (301)	Aggregate for Granular Subbase (703.11)
Subgrade Separation Geotextile, Type III (718.07)			

Hitt Rd & Iona Rd Flexible Reconstruction (TI-10.5)			
	Thickness (ft)	Layer	Materials
	0.45	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)
	0.75	Aggregate Base (303)	Aggregate for Untreated Base, ¾-inch Type B (703.04)
	2.35	Granular Subbase (301)	Aggregate for Granular Subbase (703.11)
Subgrade Separation Geotextile, Type III (718.07)			

The LTPPBind output is in Appendix D.

240.23 Earthwork and Soft Spot Repair

Excavation and Repair of Soft Spot (205.03.D)

Combined areas of soft spot repair may total about .5% of the project or about 250 sy (contingency) with up to 2 feet of sub-excavation.

Granular Borrow (205.02.B)

Subgrade Separation Geotextile, Type III (718.07)

240.24 Base

Granular Subbase (301) with RAP

Aggregate for Granular Subbase (703.11) mixed with less than 50% Recycled Asphalt Pavement (RAP), Category 1 or 2 (720.07) per 301.03.D.

Aggregate Base (303)

Aggregate for Untreated Base, ¾-inch Type B (703.04)

Geotextile on Subgrade

Subgrade Separation Geotextile, Type III (718.07)

Granular Subbase (301)

Aggregate for Granular Subbase (703.11)

240.25 Surface Treatment

A surface treatment (404) is not anticipated.

240.26 Paving

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)

Tack Coat (401)

Emulsified Asphalt, CSS-1 (702.03) diluted (1:1 ratio) asphalt applied at a rate of 0.12 gal/sy (residual rate of 0.04 gal/sy estimated)

240.27 Seal

A seal coat is not planned.

240.28 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.

240.29 Ancillary Construction

Ancillary construction is not planned.

240.30 Aggregate Estimating Data

Superpave Hot Mix Asphalt (405)

Aggregate for Superpave HMA Pavement at 146 lb/cf, including asphalt (estimated)

Aggregate Base (303)

Aggregate for Untreated Base at 145 lb/cf, including 7% water (estimated)

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.

240.31 Aggregate Sources

240.31.01 Source Identification

Approved Contractor-furnished sources are specified for all aggregates.

240.31.02 Designated Sources

Designated sources are not identified for this project.

240.31.03 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.

240.31.04 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).

240.32 Current Specifications and Minimum Testing Requirements

The following documents are applicable:

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

Idaho Transportation Department (ITD). 2019. *Quality Assurance Manual.*

Idaho Transportation Department (ITD). 2018. *Standard Specifications for Highway Construction.*

Idaho Transportation Department (ITD). 2021. *Supplemental to 2018 Standard Specifications for Highway Construction.*

240.33 Modification of Standard Specifications

There are no materials-related modifications to the Standard Specifications.

240.34 Special Provisions

There are no Special Provisions materials-related modifications.

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 dependent 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.

Soft Subgrade Soils

The Contractor should anticipate soft and moisture-sensitive subgrade soils, which could occur throughout this project. These soils will be prone to rutting or pumping under construction equipment, especially if they become wetter than optimum moisture content at the time of construction.

The Contractor is to protect these soils during construction activities, and the Contractor is to determine how best to achieve this requirement. No separate measurement of payment will be made for any excavation or replacement of excavated material below subgrade elevation made necessary from construction activities.

Excess Material Sites

Excess material sites will conform to the requirements of *ITD Standard Specifications* Subsection 205.03.A. General. All excess or unsuitable material removed from the project becomes the property of the Contractor.

Existing Pavement Thicknesses

The existing AC pavement is expected to range in thickness from about 0.26 to 0.75 feet.

240.36 Notes to Resident Engineer

There are no notes to the Resident Engineer.

240.37 Notes to Designer

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:

1. New standard specifications or supplemental specifications are released and are to be used on the project.
2. Revised Minimum Testing Requirements (MTRs) are released.
3. 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

In the ITD "Consultant Agreement Specifications" document, the policy states that:

"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)

540.00 PAVEMENT STRUCTURE ANALYSIS

540.01 Introduction

See Section 240.01 Introduction.

540.02 Methodology

The Idaho R-value method was used for the flexible pavement design and AASHTO 93 for the rigid pavement design.

540.03 Existing Pavement Conditions

This project involves reconstruction along an existing alignment, such that existing pavement conditions are not needed.

540.04 Existing Pavement Structure – Materials and Thicknesses

Borings were advanced to a depth of about 6 feet as shown on the Exploration Location Map in Appendix B. Subgrade soil and aggregate descriptions are on the boring logs in Appendix B.

The borings serve several purposes:

- Determine the thickness of the AC pavement course
- Providing an opportunity to examine the condition and quality of the buried materials and the nature of the native subgrade and to obtain samples for laboratory testing
- Identifying the near-surface bedrock or groundwater, if encountered

Groundwater or bedrock was not encountered at the time of drilling.

The boring logs were updated to include laboratory ASTM D2487 (USCS) soils classification information. Laboratory test reports are in Appendix C. Subgrade soils classified as Silty Gravel with Sand (GM), Sandy Silt (ML), Silt with Sand (ML), Sandy Lean Clay with Gravel (CL), and Silt (ML). The soils have F4 frost susceptibility characteristics, as classified by the US Army Corps of Engineers (USACE 2001).

540.05 Traffic Load

ITD Roadway Data Section provided traffic data for these segments. The following table summarizes the 20-year and 40-year design traffic loads, and traffic input parameters.

Traffic Data			
Roadway	Traffic Data Summary	ESALs	TI*
US-26	20-Year Flexible	7,650,180	11.5
	40-Year Rigid	36,710,820	--
Hitt Rd	20-Year Flexible	3,099,060	10.5
	40-Year Rigid	12,270,960	--
Iona Rd	20-Year Flexible	3,395,400	10.5
	40-Year Rigid	16,378,200	---
*TI is rounded to the nearest 0.5 per ITD Materials Manual			

Traffic for the R-Value design was determined in accordance with Section 510.02 Traffic Evaluation. The Traffic Index was determined using the equation in Section 510.02.03 Traffic Index.

Traffic for the rigid pavement design was determined from the ITD Roadway Data Section ESAL projections.

Traffic data, together with the traffic projection worksheet are included in Appendix D.

540.06 Climate

The climate factor for the Idaho R-Value design was determined from Section 510.04 Climate Factor, Figure 510.04.01.1. CF= 1.05 for Region 2. Climate is not a direct input into the AASHTO 93 design.

540.07 Deflections and E_{FWD} Layer Moduli

This section does not apply.

540.08 Dynamic Modulus of New HMA

This section does not apply.

540.09 C-Value and Resilient Moduli

This section does not apply.

540.10 R-Values

Determination of the R-Value selected for this project was based on Section 510.03 Idaho R-Value. For the Idaho R-value method of design, 4 bulk samples were obtained of subgrade soil from the boring locations. The following is a summary of the Idaho IT-8 R-value measurements.

Summary of Subgrade R-Values		
Boring	USCS Classification	R-Value
AG-01	GM	44
AG-04	ML	23
AG-05	CL	7
AG-08	GC	13

The R-value test reports are in Appendix E.

A design subgrade R-value of 7 is selected. The moisture-sensitive nature of the subgrade was considered in the selection of the design value.

540.11 Modulus of Subgrade Reaction

Dynamic Cone Penetrometer (DCP) tests from 4 boring location were used to calculate the effective subgrade (k-value). K-value is used in the rigid pavement design only. DCP test results are shown in the following table and are included in Appendix C.

Summary of DCP results for Effective k-value					
Test #	DCP (k-value)	Depth of Rigid Layer	Thickness of Base	Density of Base	Effective Subgrade (k-value)
DCP-1	225	> 10 ft	8.0 in.	140.0 lb/ft^3	310
DCP-2	150	> 10 ft	8.0 in.	140.0 lb/ft^3	280
DCP-3	275	> 10 ft	8.0 in.	140.0 lb/ft^3	320
DCP-4	150	> 10 ft	8.0 in.	140.0 lb/ft^3	280
Ave	200	> 10 ft	8.0 in.	140.0 lb/ft^3	300

540.12 Layer Material Properties for ME Analysis

This section does not apply.

540.13 Analyses and Designs

Evaluation of Pavement Design Alternatives

20 years of service is specified for the flexible pavement designs and 40 years of service for the rigid pavement design.

US-26 Flexible Reconstruction (20-year) by Idaho R-Value Design

This strategy includes the following activities:

- Excavate 3.86 ft full width of the roadway.
- Place a subgrade separation geotextile on the prepared subgrade.
- Place 2.55 ft of Granular subbase.
- Place 0.80 ft of ¾" Untreated Aggregate Base.
- Place 0.50-ft (in two equal lifts) Hot Mix Asphalt (HMA).

The following table shows the proposed pavement layer structure.

US-26 Flexible Reconstruction (TI=11.5)	
Pavement Design Element	Thickness (ft)
HMA	0.50
¾" Untreated Aggregate Base	0.80
Granular Subbase	2.55

Hitt Rd & Iona Rd Flexible Reconstruction (20-year) by Idaho R-Value Design

This strategy includes the following activities:

- Excavate 3.56 ft full width of the roadway.
- Place a subgrade separation geotextile on the prepared subgrade.
- Place 2.35 ft of Granular subbase.
- Place 0.75 ft of ¾" Untreated Aggregate Base.
- Place 0.45-ft (in two equal lifts) HMA.

The following table shows the proposed pavement layer structure.

Hitt Rd & Iona Rd Flexible Reconstruction (TI-10.5)	
Pavement Design Element	Thickness (ft)
HMA	0.45
¾" Untreated Aggregate Base	0.75
Granular Subbase	2.35

US-26 Rigid Reconstruction (40-year) by AASHTO 93

This strategy includes the following activities:

- Excavate 22.75 inches full width of the roadway.
- Place a subgrade separation geotextile on the prepared subgrade.
- Place 8.0 inches of ¾" Untreated Aggregate Base.

- Place 3.0 in HMA
- Place 10.75* inches of Jointed Plain Concrete Pavement (JPCP)

*Includes 1.00 inch for future surface milling

The following table shows the proposed pavement layer structure.

US-26 Rigid Reconstruction (ESALs=36,710,820)	
Pavement Design Element	Thickness (inches)
JPCP	10.75
HMA	3.0
¾" Untreated Aggregate Base	8.0

Hitt Rd & Iona Rd Rigid Reconstruction (40-year) by AASHTO 93

This strategy includes the following activities:

- Excavate 21.51 inches full width of the roadway.
- Place a subgrade separation geotextile on the prepared subgrade.
- Place 8.0 inches of ¾" Untreated Aggregate Base.
- Place 3.0 in HMA
- Place 9.51* inches of Jointed Plain Concrete Pavement (JPCP)

*Includes 1.00 inch for future surface milling

The following table shows the proposed pavement layer structure.

Hitt Rd & Iona Rd Rigid Reconstruction (ESALs=16,378,200)	
Pavement Design Element	Thickness (inches)
JPCP	10.51
HMA	3.0
¾" Untreated Aggregate Base	8.0

540.14 Economic Comparison of Alternatives

Life-Cycle Cost Analysis (LCCA) determination for this project was based on Section 541 Life Cycle Cost Analysis.

For the mainline, a LCCA was performed for the following strategies:

- Flexible Reconstruction
- Rigid Reconstruction

The following table summarizes the LCCA results. The LCCA output is in Appendix F.

Summary of Life-Cycle Cost Analysis[1, 2]				
Pavement Design Alternative	Initial Cost	Total 36-Year Life-Cycle Cost	EUAC	Total Net Present Worth at 4%
Flexible Reconstruction	$3,271,700	$4,402,900	$202,900	$3,835,500
Rigid Reconstruction	$4,306,500	$2,675,905	$209,800	$3,966,000
[1]The LCCA uses unit costs provided by ITD. The LCCA costs are for comparison purposes only. [2]Does not include all costs that are common to each alternative.				

The LCCA results indicate the Flexible Reconstruction strategy has the most favorable Equivalent Uniform Annual Cost (EUAC).

540.15 Recommendations

Based on the EUAC of the LCCA, **Flexible Reconstruction**, as detailed in 540.09, is the preferred strategy. Other reasons for this preferred strategy include the use of recycled materials and anticipated lower impact to traffic and surrounding businesses.

540.16 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). 1998. *Supplement to the AASHTO Guide for Design of Pavement Structures.* Washington, DC: AASHTO.

Federal Highway Administration (FHWA). 2014. V*erification, Refinement, and Applicability of Long-Term Pavement Performance Vehicle Classification Rules*. *LTPPBind Software Version 3.1*. McLean, VA: US Department of Transportation Federal Highway Administration.

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

Idaho Transportation Department (ITD). 2018. *Standard Specifications for Highway Construction*.

Idaho Transportation Department (ITD). 2021. *Supplemental to 2018 Standard Specifications for Highway Construction.*

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

541.00 LIFE CYCLE COST ANALYSIS

541.017 Introduction

Life cycle cost analyses were prepared for each of the feasible strategies analyzed. Worksheets for each strategy are included in Appendix F.

541.018 Methodology

Shannon & Wilson used the Life Cycle Cost Analysis method presented in the ITD Material Manual (ITD 2020) and the ITD LCCA Spreadsheet and standard cost date last published in 2018.

Two strategies for this project were analyzed and a Summary of Life Cycle Cost Analyses is found in Section 540.14.

541.03 Recommendations

Based on the EUAC of the LCCA, **Flexible Reconstruction** is the preferred strategy, as discussed in Section 540.15.

543.00 PAVEMENT INTERLAYER SYSTEMS

543.019 Introduction

A pavement interlayer system, ITD Materials Manual (ITD 2020) Section 543, was not selected for this project.

550.00 SUBSURFACE PAVEMENT DRAINAGE

550.020 General

This section provides discussion for internal drainage of the recommended strategies for the project.

550.021 General Design Considerations

Excess moisture in pavements is a leading cause of pavement distress. By managing this moisture, it may be possible to extend pavement life by reducing the rate of distress.

The following four approaches are commonly used to reduce moisture problems in pavements. Design objectives should include (FHWA 1999):

- Preventing moisture from entering the pavement system
- Using materials that are insensitive to moisture
- Incorporating features to inhibit moisture damage
- Incorporating features that quickly remove moisture from the pavement system

Idaho is located in the Dry-Freeze climate zone as identified in the Long–Term Pavement Performance (LTPP) program. The average annual precipitation in the project area is around 9.95 inches per year which is less than the ≤20 inch criteria used in the LTPP definition of "Dry Climate".

550.02.01 Drainage Requirements by Roadway Type

ITD Materials Manual (ITD 2020) states the following in Section 550.02.01 Drainage Requirements by Roadway Type:

For non-Interstate highways, a Positive Drainage System is not required when subgrade soils consist predominantly of sand and gravel and the above conditions do not exist.

On highways with less than 1,000 truck-ADT, subsurface drainage should be addressed on a project by project basis utilizing the process outlined in Section 3.1.5.1 of Chapter 1.

550.03 Recommendations

This project has less than 1000 ADT trucks for Hitt and Iona Roads and approaches 1000 ADT trucks on US-26. It is not cost effective to incorporate subsurface drainage for this short project and therefore not recommended.

550.04 References

Refer to the references provided in Section 550.11 References in the ITD Materials Manual (ITD 2020).

560.00 BINDER SELECTION USING LTPPBIND SOFTWARE

560.022 Introduction

Superpave asphalt binders were selected using the Performance Grade (PG) methodology described in Section 560 of the ITD Materials Manual (ITD 2020) for strategies that require Superpave HMA.

560.023 Methodology

Shannon & Wilson used LTPPBind Version 3.1 and guidance from Section 560 to determine PG Binder Grade of the asphalt binder.

PG Binder grades were determined for flexible pavement strategies.

PG binder grades were determined at the pavement surface. Depth of Layer of 0 mm was used.

Temperature adjustment for 98% desired reliability was selected.

High temperature adjustments for fast traffic speed and 3 to 10 million ESAL was selected.

Weather Stations selected in this analysis were:

- ID4457, Idaho Falls Fanning Field;
- ID4455, Idaho Falls 6 n;
- ID4456, Idaho Falls 16
- ID0915, Blackfoot 4 nne
- ID7644, Rexburg BYU Idaho

560.03 Recommendation

Shannon & Wilson recommends the following PG Binder Grades:

- Use PG 64-34 for HMA paving.

Note: PG 64-28 may be considered based on adjustments allowed in Section 240.05.01 Performance Graded Binder Selection.

230.00 GEOTECHNICAL ENGINEERING REPORT FOR TRAFFIC SIGNALS

230.01 Introduction

This Geotechnical Engineering Report presents the results of a subsurface site investigation performed by American Geotechnics (AGEO) for the proposed construction of two traffic signals at the intersection of US-26 and Hitt Road (25th E) in Idaho Falls, Bonneville County, Idaho.

Proposed Construction of Traffic Signals

The locations of the proposed traffic signals are summarized below:

- NW Signal: NW Corner of US-26/Hitt Rd. Intersection
- SE Signal: SE Corner of US-26/Hitt Rd. Intersection

The proposed traffic signals will be supported by drilled shaft foundations.

Since all the traffic signals will have mast arm at or less than 55 feet long, it is anticipated the ITD standard sizes for traffic signals will be used for this project.

230.02 Field Exploration and Laboratory Testing

230.02.01 Borings/Test Pits

American Geotechnics conducted subsurface investigations in December 2021 utilizing a Mobil B-59 geotechnical auger drill. The borings were completed with 4.25” ID hollow-stem augers. The subsurface soils in the borings were sampled using a split-spoon sampler.

AGEO completed two borings (H-1 and H-2) to obtain information for the proposed traffic signal foundations, as summarized below.

Summary of Subsurface Exploration		
Feature	Boring No.	Boring Depth (Feet)
NW Signal	H-1	26.5
SE Signal	H-2	26.5

An American Geotechnics geotechnical technician classified the materials encountered in the borings in general accordance with ASTM D2488 classification procedures. Samples of soil were packaged and transported to the American Geotechnics laboratory in Boise, Idaho, for testing.

230.02.02 Field Tests

Field testing included Standard Penetration Tests (SPT) performed with an automatic hammer in accordance with ASTM D1586 to determine the relative density of cohesionless soils or stiffness of cohesive soils. The SPT N-values are included on the boring logs in Appendix B.

230.03 Surface Conditions

The ground surface in the proposed traffic signals area is relatively flat. Commercial businesses and structures occupy the south and east quarters of the present US-26/Hitt Road intersection. Farm land exists at the NW corner of the intersection.

230.04 Subsurface Conditions

Subsurface conditions encountered at the boring locations are indicated on the exploration boring logs in Appendix B.

Stratification boundaries shown on the logs represent the approximate location of changes in the subsurface strata. In situ, the transition between strata may be gradual or abrupt. Variations in the subsurface conditions may occur between the borings.

Based on the results of the site investigation, a generalized subsurface profile has been developed to provide a basis for discussion of the subsurface conditions for the proposed traffic signals. The generalized subsurface profile can be represented in the following sections.

230.04.01 Soil Profiles

Soils Profile at NW Signal - Boring H-1

Silt with Sand

Medium dense silt with sand (ML) existed from ground surface to a depth of about 4 feet below the ground surface (BGS).

Sand with Gravel and Cobbles

Very dense poorly graded sand with gravel and cobbles (SP) existed from depth of 4 feet to 24.5 feet BGS.

Standard Penetration Test N-values ranged from 23 blows per foot of penetration (bpf) to refusal (more than 50 blows per 0.5" of penetration), with an average N-value of 56 bpf.

Silty Sand with Gravel

Dense silty sand with gravel (SM) existed from depth of 24.5 feet to 26.5 feet (bottom of Boring H-1).

Standard Penetration Test (SPT) N-value was 35 blows per foot of penetration.

Soils Profile at SE Signal - Boring H-2

Silt

Medium dense silt or organic silt (ML) existed from ground surface to a depth of about 4 feet below the ground surface (BGS).

Poorly Graded Sand with Gravel and Cobbles

Very dense poorly graded sand with gravel and cobbles existed below the silt stratum to depth of 26.5 feet BGS (bottom of Boring H-2).

Standard Penetration Test (SPT) N-values ranged from 48 blows per foot of penetration to refusal (more than 50 blows per 0.5" of penetration), with an average N-value of 68 bpf.

230.04.02 Groundwater

Groundwater was not encountered in the borings at the time of the site investigation on December 12, 2021.

Fluctuations of the groundwater level at this site could occur due to rainfall runoff or other factors. Monitoring the actual changes in the seasonal groundwater level fluctuations is beyond the scope of this report.

230.04.03 Frost

Recommended frost depth in the project area is 3 feet.

230.05 Conclusions and Recommendations

230.05.01 General

Based on the subsurface conditions encountered at the boring locations, the proposed traffic signals can be supported by drilled shaft foundations.

The following sections provide recommended design parameters and construction considerations for the drilled shaft foundations. If any revisions in the nature, design, location, or construction of the proposed traffic signals occur at a later date, the recommendations within the following sections are subject to review by Shannon & Wilson and may be modified as deemed necessary.

230.05.02 Foundations

230.05.02.01 Spread Footings

ITD typically use drilled shafts to support traffic signals and therefore spread footing foundations are not recommended for this project.

230.05.02.02 Deep Foundations

Drilled Shafts

Drilled shafts should be used to support the traffic signals of this project. Since all four of the signals in this project have mast arm length of 55 feet or less, their foundation types should be selected from the table of Pole Foundation Schedule in the ITD Standard Drawing No. 656-3 "Mast Arm Signal Pole and Pedestrian Pole Foundation Details".

230.05.03 Drainage

The ground surface should be graded to direct surface runoff away from the traffic signals and drilled shaft foundations. If necessary, interceptor drain

trenches should be installed to collect surface drainage and direct the water away from the traffic signals locations.

230.05.04 Construction

230.05.04.01 Drilled Shaft Installation

The recommendations provided in this report are for properly constructed drilled shafts with full-time observation of the drilling and concrete placement procedures by the Engineer.

The granular nature of the soils will likely create caving conditions. Temporary steel casing is likely needed to prevent excessive amounts of raveling or caving soil from entering the shaft.

230.05.04.02 Temporary Cuts

Construction site safety and determining appropriate temporary excavation and construction slopes is the sole responsibility of the Contractor, who selects and directs the means, methods, and sequencing of the construction operations. The Contractor must be familiar with, and comply with, all applicable local, state, and federal safety regulations (including the current OSHA Excavation and Trench Safety Standards) for temporary excavations and construction slopes.

230.05.04.03 Utilities

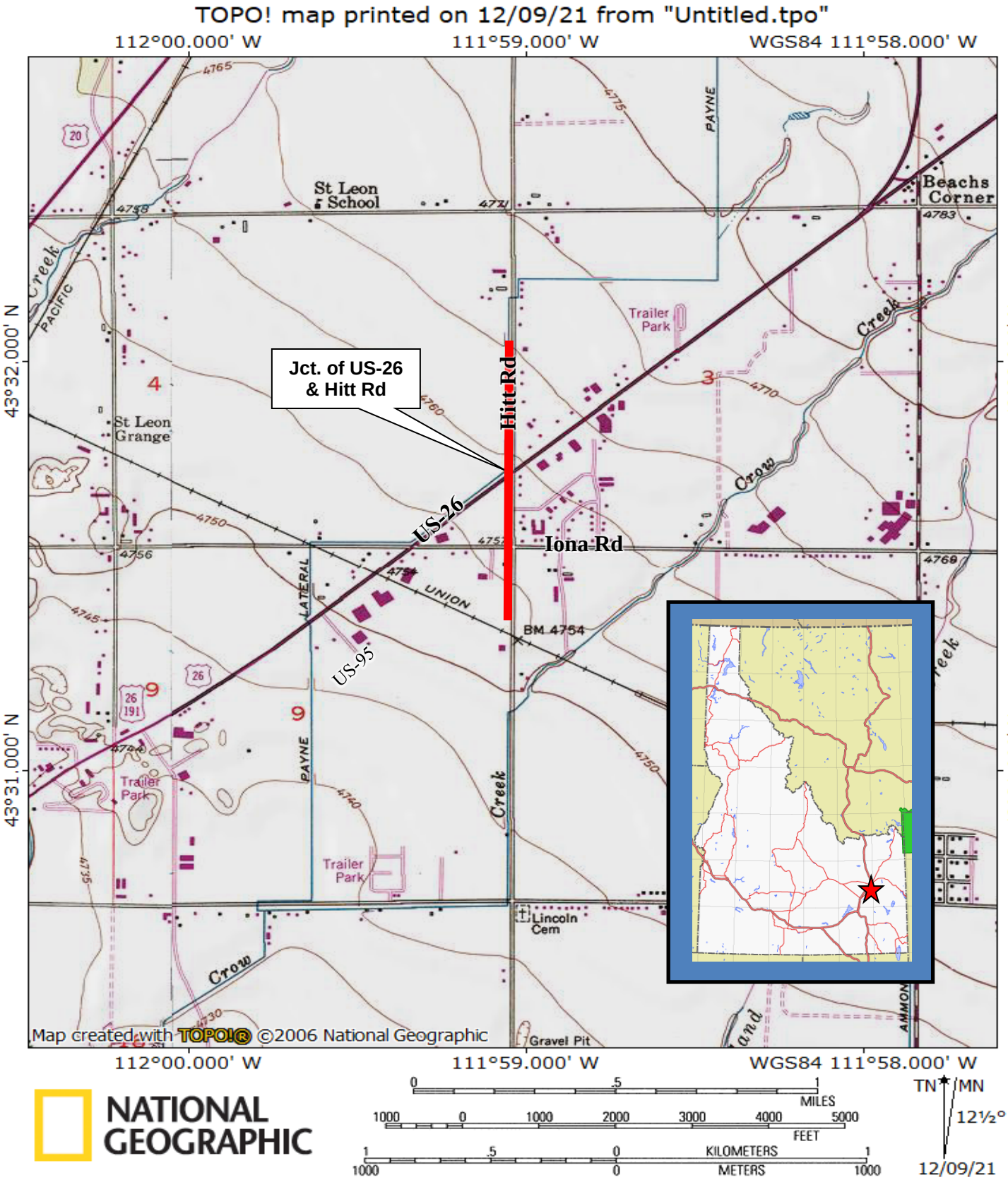
Existing utility lines may need to be protected, relocated, replaced, or otherwise monitored by the Contractor so that excavation and construction of the drilled shafts, or other project-related activities, do not cause damage to the existing utility lines.

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Appendix A

Vicinity Map

Site Photographs



Vicinity Map

US-26, Hitt Road (SH-25 E)
Bonneville County, Idaho

Figure 1

File No.	December 13, 2018
03370	

AMERICAN GEO TECHNICS



Photo 1: Looking north at boring location AG-01



Photo 2: Looking south at boring location AG-02



Photo 3: Looking south at boring location AG-03



Photo 4 Looking south at boring location AG-04



Photo 5: Looking northwest at boring location AG-05



Photo 6: Looking southeast at boring location AG-06



Photo 7: Looking east at boring location AG-07



Photo 8: Looking west at boring location AG-08

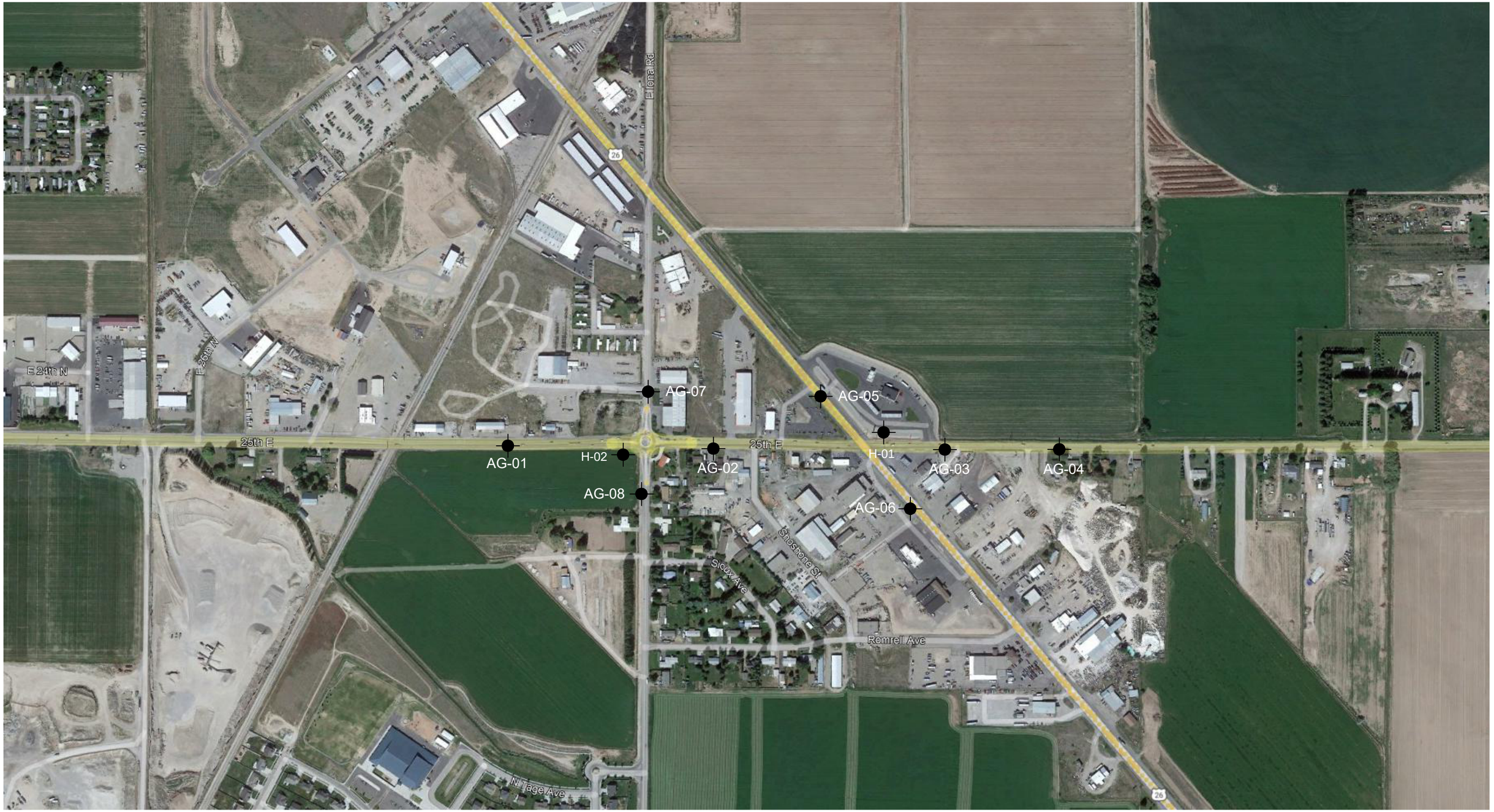
SHANNON & WILSON

Appendix B

Exploration Location Map

Bore Logs

American Geotechnics



LEGEND

BORING LOCATION

AG-01

150 450

0 300 600

SCALE IN FEET

Exploration Location Map

US-26, Jct. Hitt Road (25th E)
Bonneville County, Idaho

File No. 03370

November 2, 2021

Sheet 1 of 1

AMERICAN GEOTECHNICS

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

BORING NO. AG-01

METHOD: Hollow-Stem Auger
DATE LOGGED: 10/26/2021
LOGGED BY: Ryan VanLeuven, EI

GROUNDWATER:

Groundwater not encountered on 10/26/2021

AMERICAN GEO TECHNICS

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)
			Dense AC	0.28	0.28
0.5			Poorly Graded Gravel with Silt and Sand (GP-GM) 58.0% subround to subangular gravel to 3/4" 35.4% fine to coarse sand 6.6% non-plastic fines, moist, Dk Brown.	0.50	0.78
1.0			Poorly Graded Gravel with Silt (GP) About 60% round to subround gravel to 1 1/2" About 30% fine to coarse sand About 10% non-plastic fines, moist, Dk Brown.	1.72	2.50
2.5			Silty Gravel with Sand (GM) 29.0% round to subround gravel to 3/4" 21.4% fine to coarse sand 49.6% non-plastic fines, moist, Dk Brown. Moist = 14.1%	3.50	6.00
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0			Bottom of Boring at 6.0 ft on 10/26/2021.		

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

METHOD: Hollow-Stem Auger
DATE LOGGED: 10/26/2021
LOGGED BY: Ryan VanLeuven, EI

BORING NO. AG-02

AMERICAN GEO TECHNICS

GROUNDWATER:

Groundwater not encountered on 10/26/2021

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)
			Dense AC	0.26	0.26
0.5			Poorly Graded Gravel with Silt and Sand (GP-GM) About 60% subround to subangular gravel to 3/4" About 35% fine to coarse sand About 5% non-plastic fines, moist, Dk Brown.	0.42	0.68
1.0			Poorly Graded Gravel with Silt (GP) About 60% round to subround gravel to 3" About 30% fine to coarse sand About 10% non-plastic fines, moist, Dk Brown.	1.12	1.80
2.0			Sandy Silt (ML) 3.0% round gravel to 1/2" 40.3% fine to coarse sand 56.7% non-plastic fines, moist, Dk Brown.	4.20	6.00
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0			Bottom of Boring at 6.0 ft on 10/26/2021.		

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

METHOD: Hollow-Stem Auger
DATE LOGGED: 10/26/2021
LOGGED BY: Ryan VanLeuven, EI

BORING NO. AG-03

AMERICAN GEO TECHNICS

GROUNDWATER:

Groundwater not encountered on 10/26/2021

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)
			Dense AC	0.50	0.50
0.5			Poorly Graded Gravel with Silt and Sand (GP-GM) About 60% subround to subangular gravel to 3/4" About 35% fine to coarse sand About 5% non-plastic fines, moist, Dk Brown.	0.30	0.80
1.0			Poorly Graded Gravel with Silt and Sand (GP-GM) 73.0% round to subround gravel to 1 1/2" 21.7% fine to coarse sand 5.3% non-plastic fines, moist, Dk Brown.	1.00	1.80
1.5					
2.0			Sandy Silt (ML) About 20% fine to coarse sand About 80% low-plastic fines, moist, Dk Brown.	4.20	6.00
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0			Bottom of Boring at 6.0 ft on 10/26/2021.		

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

METHOD: Hollow-Stem Auger
DATE LOGGED: 10/26/2021
LOGGED BY: Ryan VanLeuven, EI

BORING NO. AG-04

AMERICAN GEO TECHNICS

GROUNDWATER:

Groundwater not encountered on 10/26/2021

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)
0.0			Dense AC	0.59	0.59
0.5			Poorly Graded Gravel with Silt and Sand (GP-GM) About 60% subround to subangular gravel to 3/4" About 35% fine to coarse sand About 5% non-plastic fines, moist, Dk Brown.	0.33	0.92
1.0			Poorly Graded Gravel with Silt (GP) About 60% round to subround gravel to 1 1/2" About 30% fine to coarse sand About 10% non-plastic fines, moist, Dk Brown.	0.48	1.40
1.5			Silt with Sand (ML) 2.0% round gravel to 1/2" 16.0% fine to coarse sand 82.0% non-plastic fines, moist, Dk Brown. Moist = 17.9%	4.60	6.00
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0			Bottom of Boring at 6.0 ft on 10/26/2021.		

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

METHOD: Hollow-Stem Auger
DATE LOGGED: 10/26/2021
LOGGED BY: Ryan VanLeuven, EI

BORING NO. AG-05

AMERICAN GEO TECHNICS

GROUNDWATER:

Groundwater not encountered on 10/26/2021

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)
0.5			Dense AC	0.72	0.72
1.0			Poorly Graded Gravel with Sand (GP) 67.0% subround to subangular gravel to 3/4" 30.9% fine to coarse sand 2.1% non-plastic fines, moist, Dk Brown.	0.53	1.25
1.5			Poorly Graded Gravel with Silt and Sand (GP-GM) 51.0% round to subround gravel to 2 1/2" 41.7% fine to coarse sand 7.3 non-plastic fines, moist, Dk Brown.	1.25	2.50
2.5			Sandy Lean Clay with Gravel (CL) 17.0% round to subround gravel to 1/2" 22.8% fine to coarse sand 60.2% low-plastic fines, moist, Dk Brown. Moist = 14.9%, LL=36, PL=21	3.50	6.00
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0			Bottom of Boring at 6.0 ft on 10/26/2021.		

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

METHOD: Hollow-Stem Auger
DATE LOGGED: 10/26/2021
LOGGED BY: Ryan VanLeuven, EI

BORING NO. AG-06

AMERICAN GEO TECHNICS

GROUNDWATER:

Groundwater not encountered on 10/26/2021

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)
0.5			Dense AC	0.75	0.75
1.0			Poorly Graded Gravel with Sand (GP) About 60% subround to subangular gravel to 3/4" About 35% fine to coarse sand About 5% non-plastic fines, moist, Dk Brown.	0.40	1.15
1.5			Poorly Graded Gravel with Silt and Sand (GP-GM) About 50% round to subround gravel to 2 1/2" About 40% fine to coarse sand About 10% non-plastic fines, moist, Dk Brown.	0.75	1.90
2.0			Silt (ML) 14.4% fine to coarse sand 85.6% non-plastic fines, moist, Dk Brown.	4.10	6.00
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0			Bottom of Boring at 6.0 ft on 10/26/2021.		

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

METHOD: Hollow-Stem Auger
DATE LOGGED: 10/26/2021
LOGGED BY: Ryan VanLeuven, EI

BORING NO. AG-07

AMERICAN GEO TECHNICS

GROUNDWATER:

Groundwater not encountered on 10/26/2021

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)
			Dense AC	0.31	0.31
0.5			Well Graded Sand with Silt and Gravel (SW-SM) 41.0% subround to subangular gravel to 3/4" 52.0% fine to coarse sand 7.0% non-plastic fines, moist, Dk Brown.	0.45	0.76
1.0			Poorly Graded Gravel with Silt and Sand (GP-GM) 68.0% round to subround gravel to 1 1/2" 23.9% fine to coarse sand 8.1% non-plastic fines, moist, Dk Brown.	0.84	1.60
1.5					
2.0			Silty Gravel with Sand (GM) About 30% round to subround gravel to 1/2" About 25% fine to coarse sand About 45% non-plastic fines, moist, Dk Brown.	0.90	2.50
2.5			Silt (ML) About 40% fine to coarse sand About 60% non-plastic fines, moist, Dk Brown.		
3.0					
3.5					
4.0				3.50	
4.5					
5.0					
5.5					
6.0					6.00
			Bottom of Boring at 6.0 ft on 10/26/2021.		

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

BORING NO. AG-08

METHOD: Hollow-Stem Auger
DATE LOGGED: 10/26/2021
LOGGED BY: Ryan VanLeuven, EI

GROUNDWATER:

Groundwater not encountered on 10/26/2021

AMERICAN GEO TECHNICS

DEPTH (ft)	TYPE - No.	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	LAYER THICKNESS (ft.)	DEPTH (ft)
			Dense AC	0.29	0.29
0.5			Poorly Graded Gravel with Sand (GP) About 65% subround to subangular gravel to 3/4" About 30% fine to coarse sand About 5% non-plastic fines, moist, Dk Brown.	0.26	0.55
1.0			Clayey Gravel with Sand (GC) 36.0% round to subround gravel to 1" 24.4% fine to coarse sand 39.6 low-plastic fines, moist, Dk Brown. Moist = 9.6, LL = 27, PL = 12	1.05	1.60
1.5			Silt with Sand (ML) 25.4% fine to coarse sand 74.6% non-plastic fines, moist, Dk Brown.		
2.0					
2.5					
3.0					
3.5					
4.0				4.40	
4.5					
5.0					
5.5					
6.0					6.00

Bottom of Boring at 6.0 ft on 10/26/2021.

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

METHOD: Hollow-Stem Auger
DATE LOGGED: 12/10/2021
LOGGED BY: Joan Gosar-Burgert, PE

BORING NO. H-1

AMERICAN GEO TECHNICS

GROUNDWATER:

Groundwater not encountered on 12/10/2021

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
1					Silty with Sand (ML) - About 85% low plasticity fines; about 15% fine to coarse sand; dry; dark brown.	Driller: American Geotechnics; Drill Rig: Mobile B-59; Hammer Type: Automatic Hammer SPT per ASTM D1586.
2						Located at the NW corner of US-26 and Hitt Rd in front of Sinclair station.
3	SS-46	72	3-4-14			
4					Poorly Graded Sand with Gravel and Cobbles (SP) - About 65% fine to coarse sand; about 35% fine to coarse, subrounded to rounded gravel to 2"; dry; light brown.	
5	SS-47	91	35-50/5"			
6						
7						
8	SS-48	89	25-47-50			Cobbles encountered based on drill auger advancement.
9						
10	SS-49	133	39-50/6"			
11						
12					Less cobbles below 12' to 19.5'.	
13	SS-50	56	20-27-21			
14						

(Continued Next Page)

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

BORING NO. H-1

GROUNDWATER:

Groundwater not encountered on 12/10/2021

AMERICAN GEO TECHNICS

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
16	SS-51	83	8-26-30		Increase in sand to about 80%; about 20% gravel to 1.5".	
17						
18	SS-52	83	19-12-11			
19					Increase in cobbles at 19'.	
20	SS-53	83	43-50/6"		About 75% fine to coarse sand; about 25% fine to coarse gravel to 1.5"; dry; brown.	
21						
22						
23						
24						
25	SS-54	83	10-9-26		Silty Sand with Gravel (SM) - About 60% fine to coarse sand; about 20% fine to coarse gravel; about 20% low plasticity fines; moist; dark brown.	
26						

Bottom of Boring at 26.5 ft on 12/10/2021.

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

METHOD: Hollow-Stem Auger
DATE LOGGED: 12/10/2021
LOGGED BY: Joan Gosar-Burgert, PE

BORING NO. H-2

AMERICAN GEOTECHNICS

GROUNDWATER:

Groundwater not encountered on 12/10/2021

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
1					Silt with Organics	Driller: American Geotechnics; Drill Rig: Mobile B-59; Hammer Type: Automatic Hammer SPT per ASTM D1586.
2					Silty (ML) - About 90% low plasticity fines; about 10% fine to coarse sand; dry; brown.	Located at the SE corner of Hitt Rd and Iona Rd in grassed shoulder.
3	SS-37	78	4-5-7			
4					Poorly Graded Sand with Gravel (SP) - About 70% fine to coarse sand; about 30% fine to coarse, subrounded to rounded gravel to 3"; dry; brown.	
5						
6	SS-38	89	28-36-46			
7						
8	SS-39	72	7-18-30			
9					Poorly Graded Sand with Gravel and Cobbles (SP) - About 60% fine to coarse sand; about 40% fine to coarse to 2"; dry; medium brown.	
10						
11	SS-40	94	19-37-41			
12						Cobbles encountered based on drill auger advancement.
13	SS-41	83	10-37-50/6"			
14						

(Continued Next Page)

PROJECT: US-26, Hitt Rd
LOCATION: Bonneville County, Idaho

BORING NO. H-2

GROUNDWATER:

Groundwater not encountered on 12/10/2021

AMERICAN GEO TECHNICS

DEPTH (ft)	TYPE - No.	RECOVERY %	BLOW COUNTS	LITHOLOGY	MATERIAL DESCRIPTION (Stratification lines represent approximate boundaries between materials)	REMARKS
16	SS-42	59	20-50			
17					Cobbles from 16.5' to 22'.	
18	SS-43	59	36-50			
19						
20						
21	SS-44	78	12-35-29			
22					Less cobbles below 22'.	
23						
24						
25						
26	SS-45	83	14-27-23			

Bottom of Boring at 26.5 ft on 12/10/2021.

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Appendix C

Laboratory Test Reports

DCP Test Reports

Project Information

Report to: Horrocks
Project: US-26, Hitt Rd
Report Date: 11/23/2021
File No.: 03370

Material Information

Date Sampled: 10/26/2021
Sampled By: American Geotechnics
Date Received: 11/1/2021
Date Tested: 11/1 - 11/23/2021

SUMMARY OF LABORATORY RESULTS

Lab Number	Borehole	Sample Type	Depth (ft)	Water Content (%)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index	Soil Type	Remarks
21-0641	AG-01	GB-1	0.5'-1.0'	--	6.6	--	--	GP-GM	--
21-0642	AG-01	BK-3	2.0'-4.0'	14.1	49.6	--	--	GM	--
21-0643	AG-02	SS-6	4.0'-6.0'	--	56.7	--	--	ML	--
21-0644	AG-03	GB-8	1.0'-2.0'	--	5.3	--	--	GP-GM	--
21-0645	AG-04	BK-11	2.0'-4.0'	17.9	82.0	--	--	ML	--
21-0646	AG-05	GB-13	0.5'-1.0'	--	2.1	--	--	GP	--
21-0647	AG-05	GB-14	1.0'-2.0'	--	7.3	--	--	GP-GM	--
21-0648	AG-05	BK-15	2.0'-4.0'	14.9	60.2	36	21	CL	--
21-0649	AG-06	SS-18	4.0'-6.0'	--	85.6	--	--	ML	--
21-0650	AG-07	GB-19	0.5'-1.0'	--	7.0	--	--	SW-SM	--
21-0651	AG-07	GB-20	1.0'-2.0'	--	8.1	--	--	GP-GM	--
21-0652	AG-08	BK-23	2.0'-4.0'	9.6	39.6	27	12	GC	--
21-0653	AG-08	SS-24	4.0'-6.0'	--	74.6	--	--	ML	--

Prepared By: Kelli Browning

Project Information

Report to: Horrocks
Project: US-26, Hitt Rd
Report Date: 11/18/2021
File No.: 03370

Material Information

Date Sampled: 10/26/2021
Sampled By: American Geotechnics
Date Received: 11/1/2021
Date Tested: 11/1 - 11/17/2021

Sand Equivalent Test
AASHTO T-176

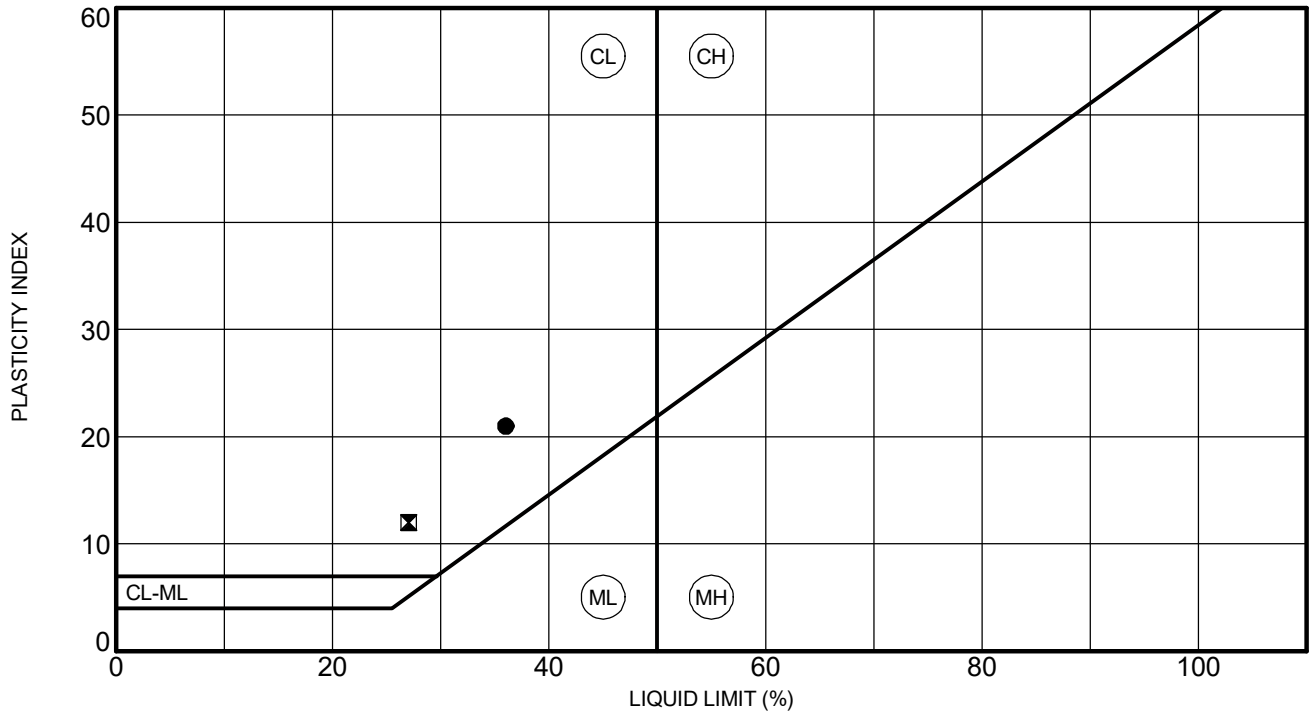
Lab Number	Location	Sample Type	Depth (ft)	Sand Equivalent	Remarks
21-0641	AG-01	GB-1	0.5'-1.0'	42	--
21-0644	AG-03	GB-8	1.0'-2.0'	27	--
21-0646	AG-05	GB-13	0.5'-1.0'	70	--
21-0647	AG-05	GB-14	1.0'-2.0'	39	--
21-0650	AG-07	GB-19	0.5'-1.0'	53	--
21-0651	AG-07	GB-20	1.0'-2.0'	21	--

Prepared By: Kelli Browning

ATTERBERG LIMITS REPORT

CLIENT: Horrocks
FILE NUMBER: 03370

PROJECT NAME: US-26, Hitt Rd
PROJECT LOCATION: Bonneville County, Idaho



	Specimen Identification			MC	LL	PL	PI	Fines	Classification
●	AG-05	BK-15	2.0	14.9	36	15	21	60	SANDY LEAN CLAY with GRAVEL (CL)
⊠	AG-08	BK-23	2.0	9.6	27	15	12	40	CLAYEY GRAVEL with SAND (GC)
				--				--	
				--				--	
				--				--	
				--				--	
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Prepared By: Kelli Browning

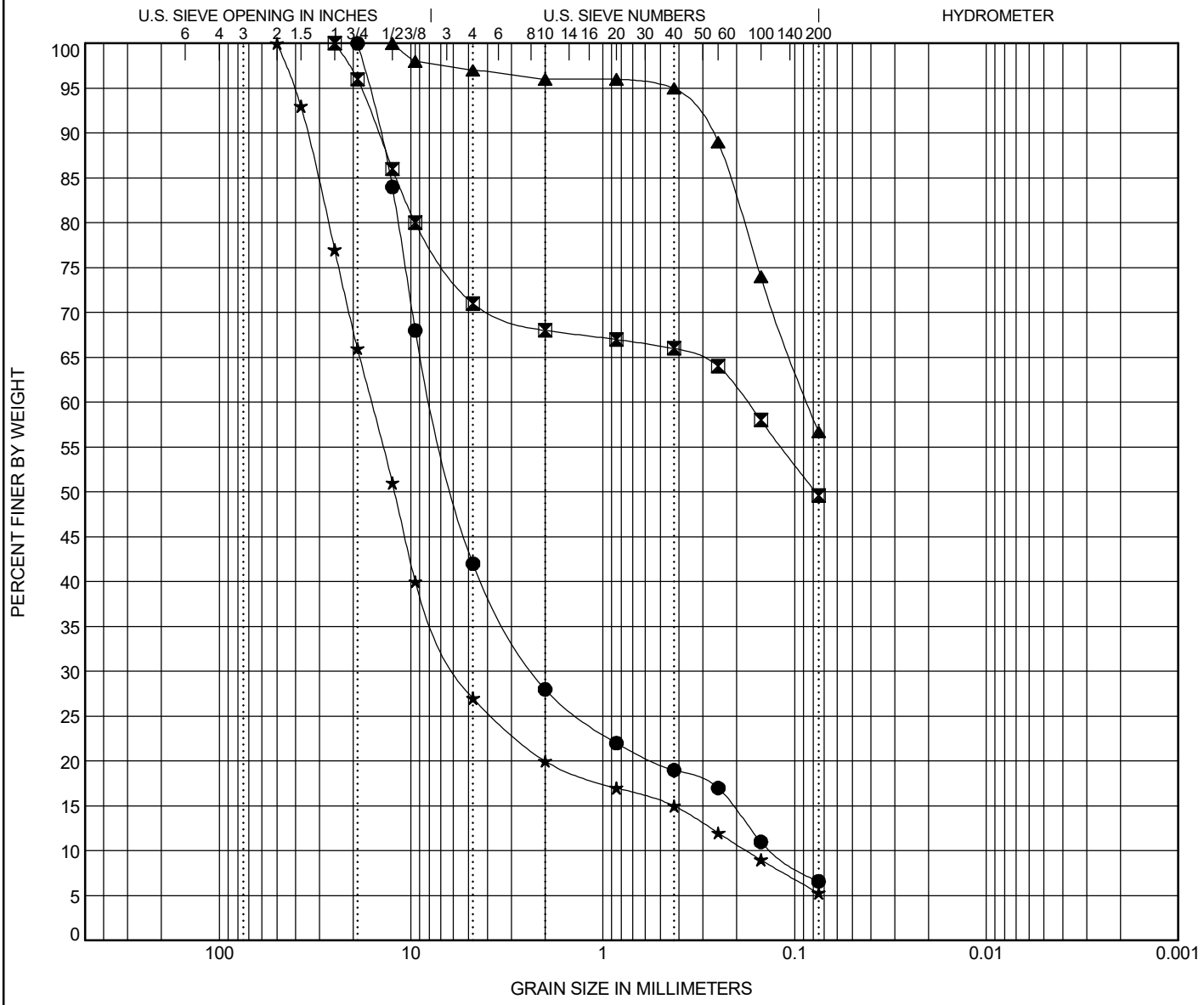
PARTICLE-SIZE DISTRIBUTION REPORT

CLIENT: Horrocks

FILE NUMBER: 03370

PROJECT NAME: US-26, Hitt Rd

PROJECT LOCATION: Bonneville County, Idaho



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

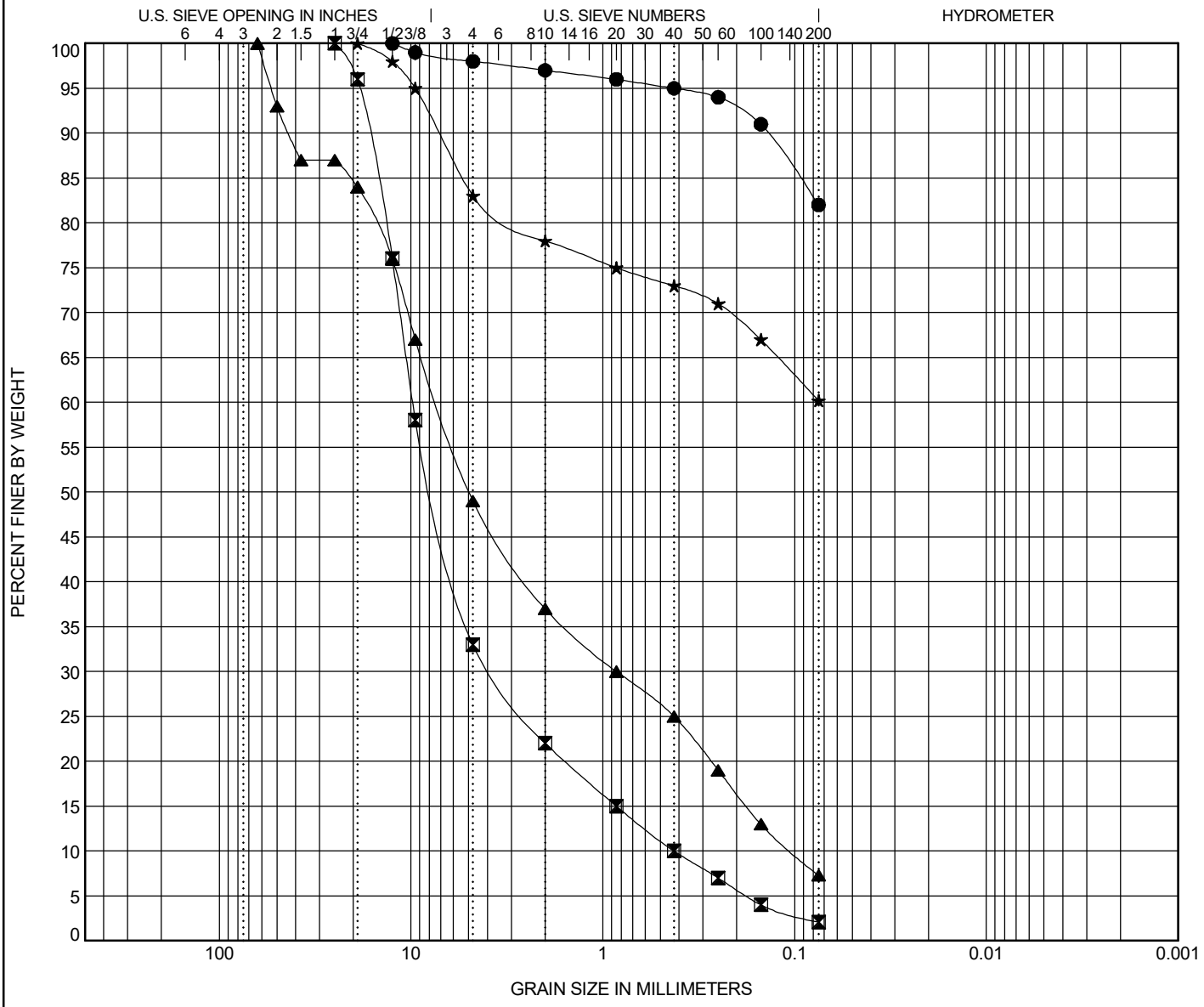
Specimen Identification				Classification	D10	D30	D60
●	AG-01	GB-1	0.5	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	0.128	2.263	7.675
⊠	AG-01	BK-3	2.0	SILTY GRAVEL with SAND (GM)	--	--	0.178
▲	AG-02	SS-6	4.0	SANDY SILT (ML)	--	--	0.086
★	AG-03	GB-8	1.0	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	0.178	5.574	16.07

Specimen Identification				%Gravel	%Sand	%Fines	D15	D50	D85	Cc	Cu	MC	LL	PI
●	AG-01	GB-1	0.5	58.0	35.4	6.6	0.211	5.879	12.831	5.21	59.90	--	--	--
⊠	AG-01	BK-3	2.0	29.0	21.4	49.6	--	0.078	11.941	--	--	14.1	--	--
▲	AG-02	SS-6	4.0	3.0	40.3	56.7	--	--	0.218	--	--	--	--	--
★	AG-03	GB-8	1.0	73.0	21.7	5.3	0.425	12.192	30.619	10.87	90.36	--	--	--

Prepared By: Kelli Browning

PARTICLE-SIZE DISTRIBUTION REPORT

CLIENT: Horrocks
FILE NUMBER: 03370
PROJECT NAME: US-26, Hitt Rd
PROJECT LOCATION: Bonneville County, Idaho



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	D10	D30	D60
● AG-04	BK-11	2.0	SILT with SAND (ML)	--	--	--
⊠ AG-05	GB-13	0.5	POORLY GRADED GRAVEL with SAND (GP)	0.425	3.752	9.794
▲ AG-05	GB-14	1.0	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	0.104	0.85	7.255
★ AG-05	BK-15	2.0	SANDY LEAN CLAY with GRAVEL (CL)	--	--	--

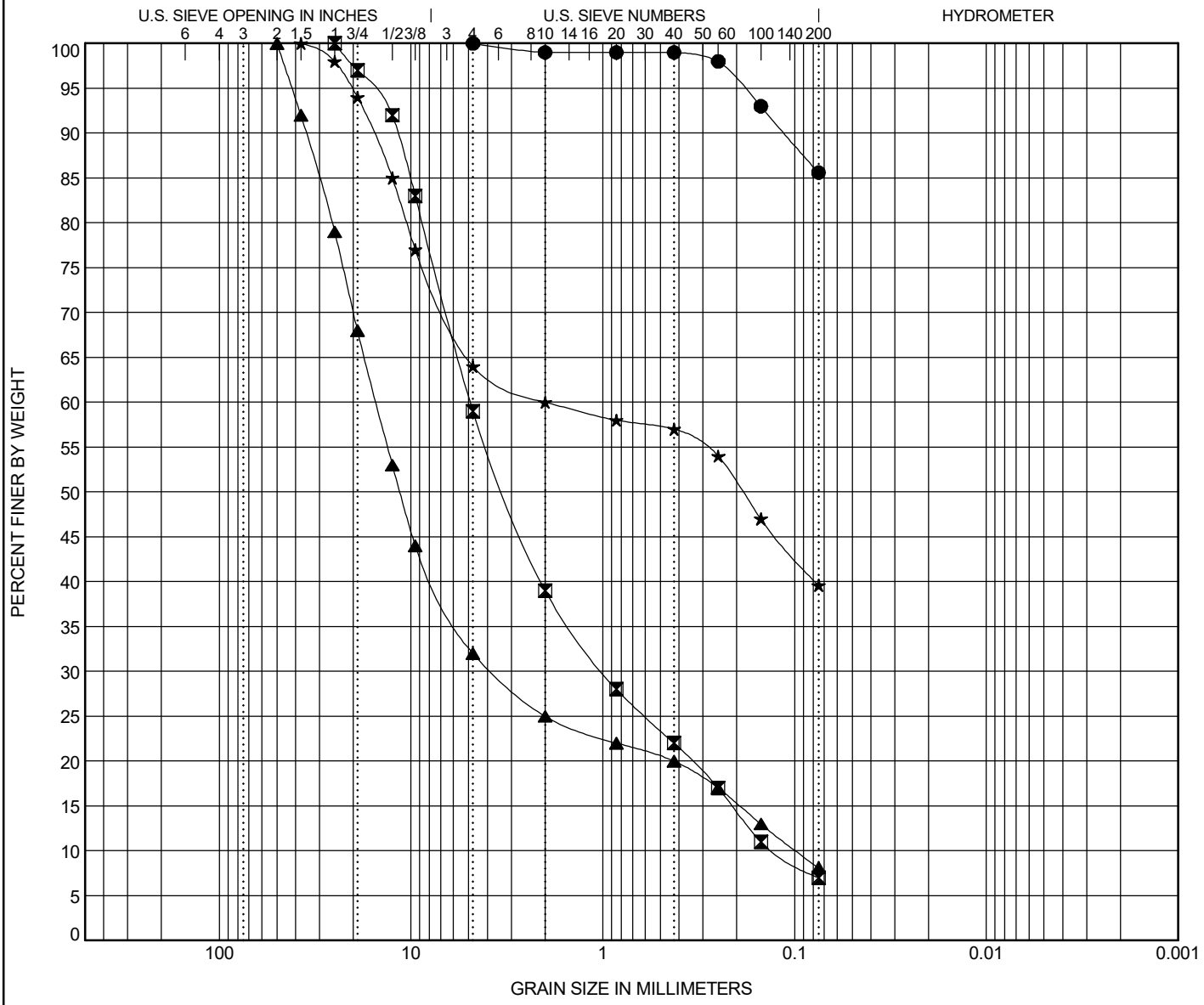
Specimen Identification			%Gravel	%Sand	%Fines	D15	D50	D85	Cc	Cu	MC	LL	PI
● AG-04	BK-11	2.0	2.0	16.0	82.0	--	--	0.094	--	--	17.9	--	--
⊠ AG-05	GB-13	0.5	67.0	30.9	2.1	0.85	7.61	15.092	3.38	23.05	--	--	--
▲ AG-05	GB-14	1.0	51.0	41.7	7.3	0.178	4.936	20.82	0.96	69.66	--	--	--
★ AG-05	BK-15	2.0	17.0	22.8	60.2	--	--	5.332	--	--	14.9	36	21

Prepared By: Kelli Browning

American Geotechnics

PARTICLE-SIZE DISTRIBUTION REPORT

CLIENT: Horrocks
FILE NUMBER: 03370
PROJECT NAME: US-26, Hitt Rd
PROJECT LOCATION: Bonneville County, Idaho



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification				Classification	D10	D30	D60
●	AG-06	SS-18	4.0	SILT (ML)	--	--	--
⊠	AG-07	GB-19	0.5	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	0.126	0.993	4.889
▲	AG-07	GB-20	1.0	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	0.098	3.71	15.197
★	AG-08	BK-23	2.0	CLAYEY GRAVEL with SAND (GC)	--	--	2

Specimen Identification				%Gravel	%Sand	%Fines	D15	D50	D85	Cc	Cu	MC	LL	PI
●	AG-06	SS-18	4.0	0.0	14.4	85.6	--	--	--	--	--	--	--	--
⊠	AG-07	GB-19	0.5	41.0	52.0	7.0	0.211	3.218	10.097	1.60	38.76	--	--	--
▲	AG-07	GB-20	1.0	68.0	23.9	8.1	0.194	11.407	30.145	9.23	154.88	--	--	--
★	AG-08	BK-23	2.0	36.0	24.4	39.6	--	0.187	12.5	--	--	9.6	27	12

Prepared By: Kelli Browning

American Geotechnics

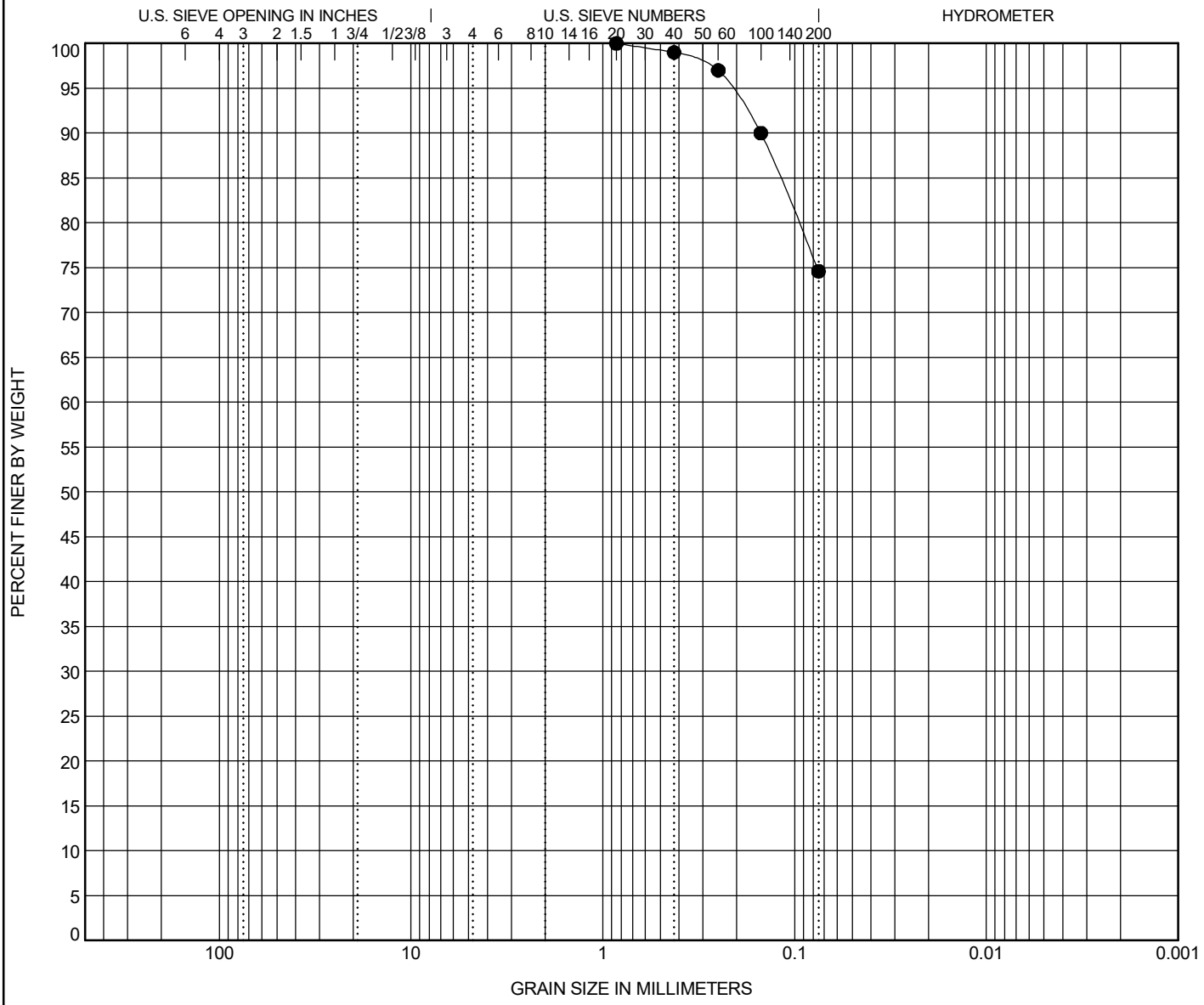
PARTICLE-SIZE DISTRIBUTION REPORT

CLIENT: Horrocks

FILE NUMBER: 03370

PROJECT NAME: US-26, Hitt Rd

PROJECT LOCATION: Bonneville County, Idaho



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	D10	D30	D60
●	AG-08 SS-24	4.0	SILT with SAND (ML)	--	--	--

Specimen Identification			%Gravel	%Sand	%Fines	D15	D50	D85	Cc	Cu	MC	LL	PI
●	AG-08 SS-24	4.0	0.0	25.4	74.6	--	--	0.12	--	--	--	--	--

Prepared By: Kelli Browning

American Geotechnics

American Geotechnics
5260 Chinden Blvd.
Boise, Idaho 83714
Phone:(208) 658-8700
Fax: (208) 658-8703

Report To:	Horrocks	Report Date:	11/17/2021
Project:	US-26, Hitt Road	Date Sampled:	10/26/2021
Project No.:	03370	Date Received:	11/1/2021
Sample ID:	AG-01, BK-3; 2.0'-4.0'	Tested By:	PC
Soil Description:	Silty Gravel with Sand (GM)	Lab Number:	21-0642

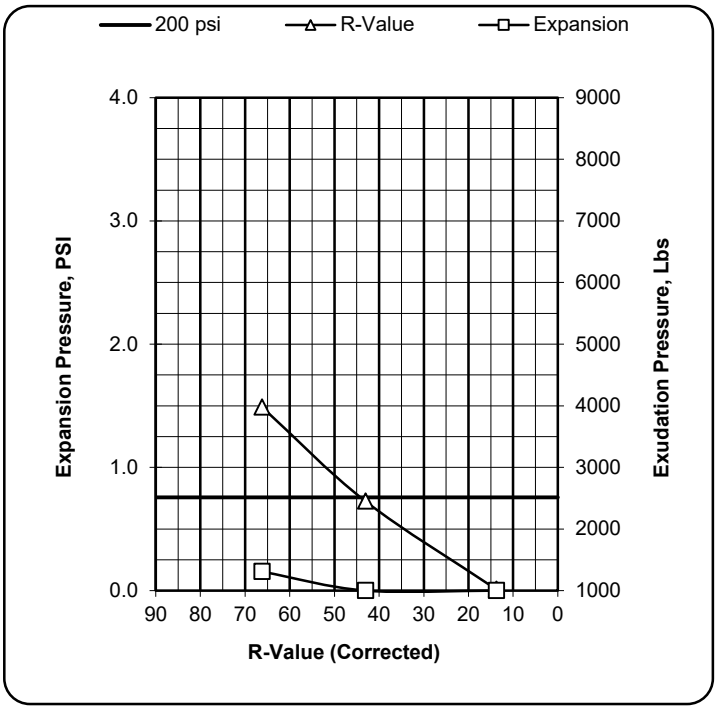
R-VALUE

IDAHO T-8

	Point 1	Point 2	Point 3
Drainage Description	Zero	Zero	Zero
Dry Density, PCF	124.7	125.9	125.9
Moisture Content, %	10.9	10.3	9.7
Exudation, PSI	81	195	317
R-Value (Corrected)	14	43	66
Expansion, PSI	0.00	0.00	0.15

R-Value @ 200 PSI Exudation Pressure

44



Gradation: AASHTO T-11, T-27

Screen Sizes	% Passing As Received	% Passing As Tested
4"		
3"		
2"		
1"	100	
3/4"	96	100
1/2"	86	90
3/8"	80	83
No. 4	71	74
No. 8		
No. 16		
No. 30		
No. 50		
No. 100		
No. 200		

* This report covers only material as represented by this sample and does not necessarily cover all soils from this layer or source.

Reviewed By: *Travis Thomsen*

American Geotechnics
5260 Chinden Blvd.
Boise, Idaho 83714
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Fax: (208) 658-8703

Report To:	Horrocks	Report Date:	11/17/2021
Project:	US-26, Hitt Road	Date Sampled:	10/26/2021
Project No.:	03370	Date Received:	11/1/2021
Sample ID:	AG-04, BK-11; 2.0'-4.0'	Tested By:	PC
Soil Description:	Silt with Sand (ML)	Lab Number:	21-0645

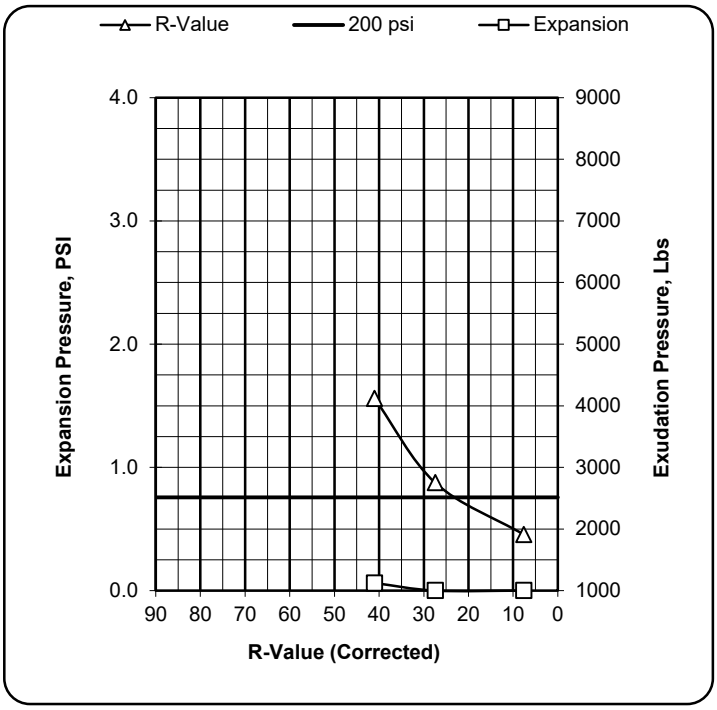
R-VALUE

IDAHO T-8

	Point 1	Point 2	Point 3
Drainage Description	Zero	Zero	Zero
Dry Density, PCF	112.6	114.0	114.5
Moisture Content, %	16.4	15.5	14.9
Exudation, PSI	152	219	328
R-Value (Corrected)	8	27	41
Expansion, PSI	0.00	0.00	0.06

R-Value @ 200 PSI
Exudation Pressure

23



Gradation: AASHTO T-11, T-27		
Screen Sizes	% Passing As Received	% Passing As Tested
4"		
3"		
2"		
1"		
3/4"		
1/2"	100	
3/8"	99	
No. 4	98	100
No. 8		
No. 16		
No. 30		
No. 50		
No. 100		
No. 200		

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Reviewed By: *Travis Thomsen*

American Geotechnics
5260 Chinden Blvd.
Boise, Idaho 83714
Phone:(208) 658-8700
Fax: (208) 658-8703

Report To:	Horrocks	Report Date:	11/12/2021
Project:	US-26, Hitt Road	Date Sampled:	10/26/2021
Project No.:	03370	Date Received:	11/1/2021
Sample ID:	AG-05, BK-15; 2.0'-4.0'	Tested By:	PC
Soil Description:	Sandy Lean Clay with Gravel (CL)	Lab Number:	21-0648

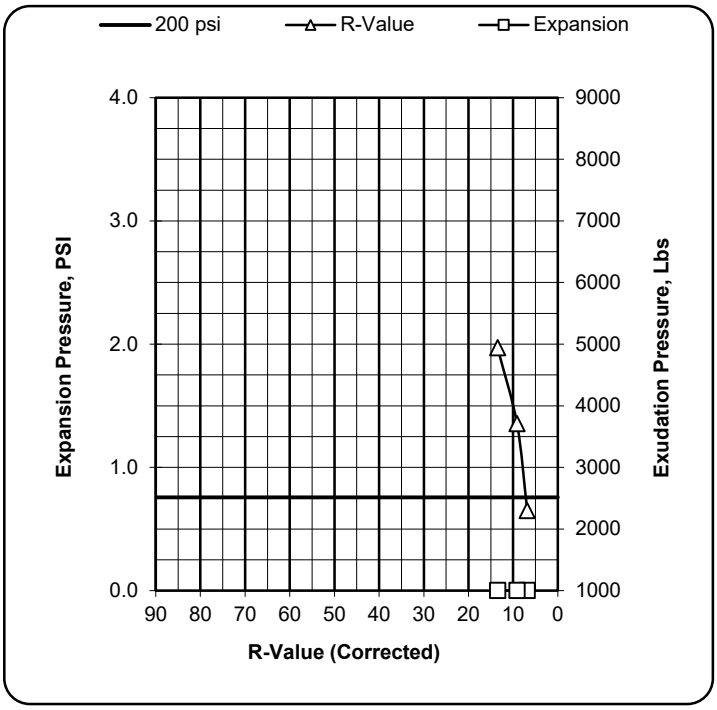
R-VALUE

IDAHO T-8

	Point 1	Point 2	Point 3
Drainage Description	Zero	Zero	Zero
Dry Density, PCF	116.9	119.0	120.5
Moisture Content, %	14.0	13.4	12.7
Exudation, PSI	183	295	393
R-Value (Corrected)	7	9	13
Expansion, PSI	0.00	0.00	0.00

R-Value @ 200 PSI Exudation Pressure

7



Gradation: AASHTO T-11, T-27		
Screen Sizes	% Passing As Received	% Passing As Tested
4"		
3"		
2"		
1"		
3/4"	100	100
1/2"	98	98
3/8"	95	95
No. 4	83	83
No. 8		
No. 16		
No. 30		
No. 50		
No. 100		
No. 200		

* This report covers only material as represented by this sample and does not necessarily cover all soils from this layer or source.

Reviewed By: *Travis Thomsen*

American Geotechnics
5260 Chinden Blvd.
Boise, Idaho 83714
Phone:(208) 658-8700
Fax: (208) 658-8703

Report To:	Horrocks	Report Date:	11/12/2021
Project:	US-26, Hitt Road	Date Sampled:	10/26/2021
Project No.:	03370	Date Received:	11/1/2021
Sample ID:	AG-08, BK-23; 2.0'-4.0'	Tested By:	PC
Soil Description:	Clayey Gravel with Sand (GC)	Lab Number:	21-0652

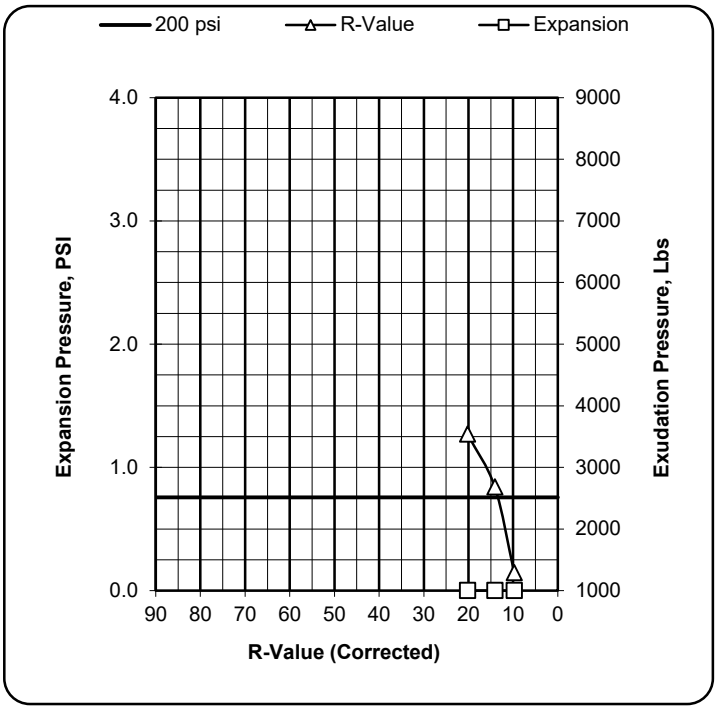
R-VALUE

IDAHO T-8

	Point 1	Point 2	Point 3
Drainage Description	Zero	Zero	Zero
Dry Density, PCF	123.4	125.6	126.1
Moisture Content, %	11.2	10.4	10.0
Exudation, PSI	103	213	282
R-Value (Corrected)	10	14	20
Expansion, PSI	0.00	0.00	0.00

R-Value @ 200 PSI
Exudation Pressure

13



Gradation: AASHTO T-11, T-27		
Screen Sizes	% Passing As Received	% Passing As Tested
4"		
3"		
2"	100	
1"	98	
3/4"	94	100
1/2"	85	90
3/8"	77	82
No. 4	64	68
No. 8		
No. 16		
No. 30		
No. 50		
No. 100		
No. 200		

* This report covers only material as represented by this sample and does not necessarily cover all soils from this layer or source.

Reviewed By: *Travis Thomsen*

Dynamic Cone Penetrometer for Pavement Applications

DCP Test per ASTM D6951

Project Name: US-26, Jct. Hitt Rd (25th E)

Project No: KN 21923 Begin Test at 0.0 feet BGS.

Location of Test: Hitt Rd Log ID: AG-01

Test ID: DCP-1

Test Date: 10/26/21

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.

Soil Type
- ○ CH
- ○ CL
- ◉ All Other Soils

Field Measurement Penetration (mm)	No. of Blows	Hmmer Factor	Cummulative Penetration (mm)	Penetration Between Readings (mm)	Penetration per Blow (mm)	DCP Index (mm/blow)
445	0	1	0	0	0.0	0.0
500	4	1	55	55	13.8	13.8
570	3	1	125	70	23.3	23.3
635	3	1	190	65	21.7	21.7
700	4	1	255	65	16.3	16.3
765	4	1	320	65	16.3	16.3
845	4	1	400	80	20.0	20.0

Dynamic Cone Penetrometer for Pavement Applications

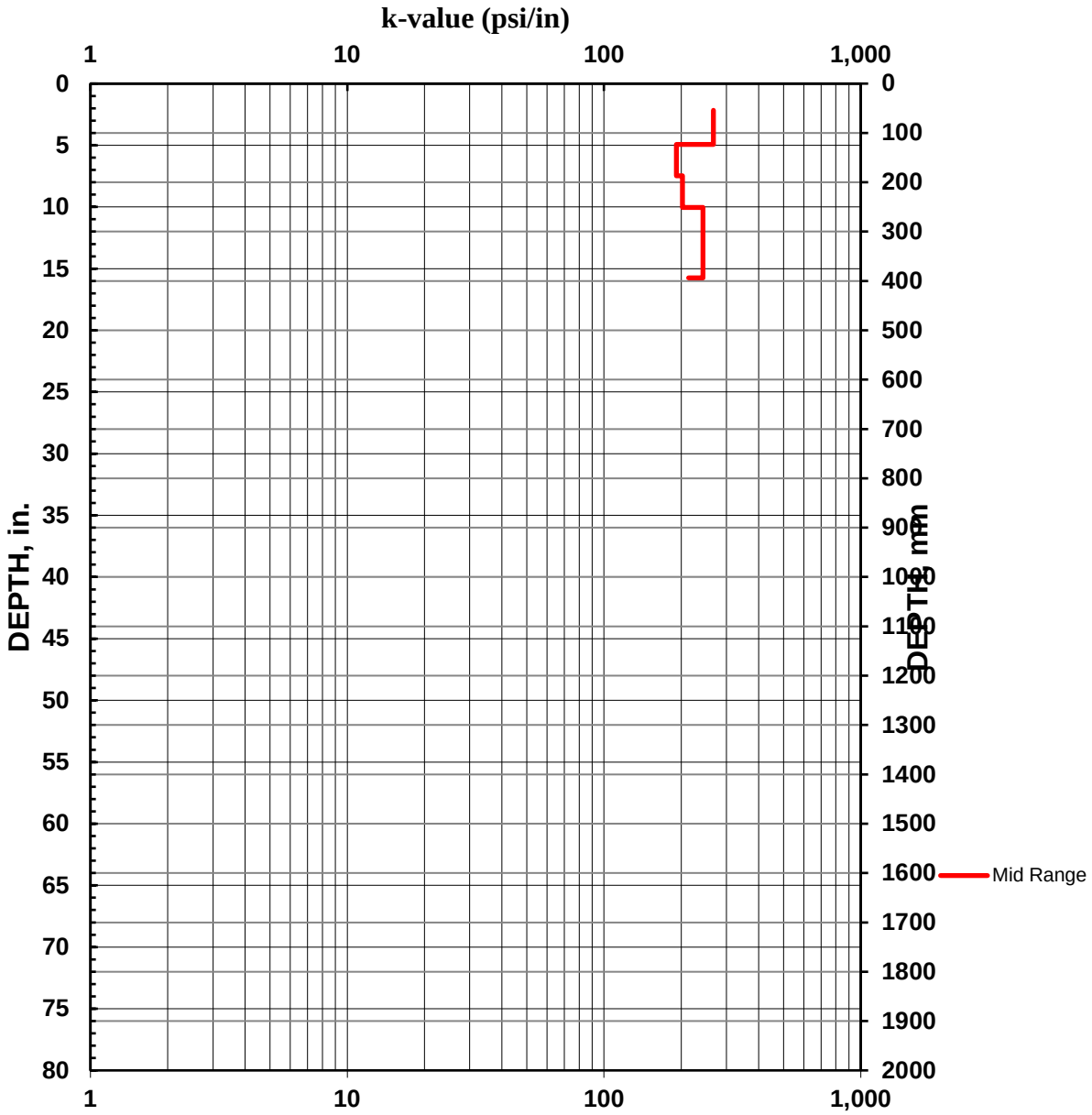
DCP Test per ASTM D6951

Project Name: US-26, Jct. Hitt Rd (25th E)

Project No: KN 21923 Begin Test at 0.0 feet BGS.

Location of Test: Hitt Rd Log ID: AG-01

Test ID: DCP-1 Test Date: 10/26/21



Dynamic Cone Penetrometer for Pavement Applications

DCP Test per ASTM D6951

Project Name: US-26, Jct. Hitt Rd (25th E)

Project No: KN 21923 Begin Test at 0.0 feet BGS.

Location of Test: Hitt Rd Log ID: AG-04

Test ID: DCP-2

Test Date: 10/26/21

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.

Soil Type
- ○ CH
- ○ CL
- ◉ All Other Soils

Field Measurement Penetration (mm)	No. of Blows	Hmmer Factor	Cummulative Penetration (mm)	Penetration Between Readings (mm)	Penetration per Blow (mm)	DCP Index (mm/blow)
450	0	1	0	0	0.0	0.0
535	2	1	85	85	42.5	42.5
585	2	1	135	50	25.0	25.0
635	2	1	185	50	25.0	25.0
690	2	1	240	55	27.5	27.5
850	5	1	400	160	32.0	32.0

Dynamic Cone Penetrometer for Pavement Applications

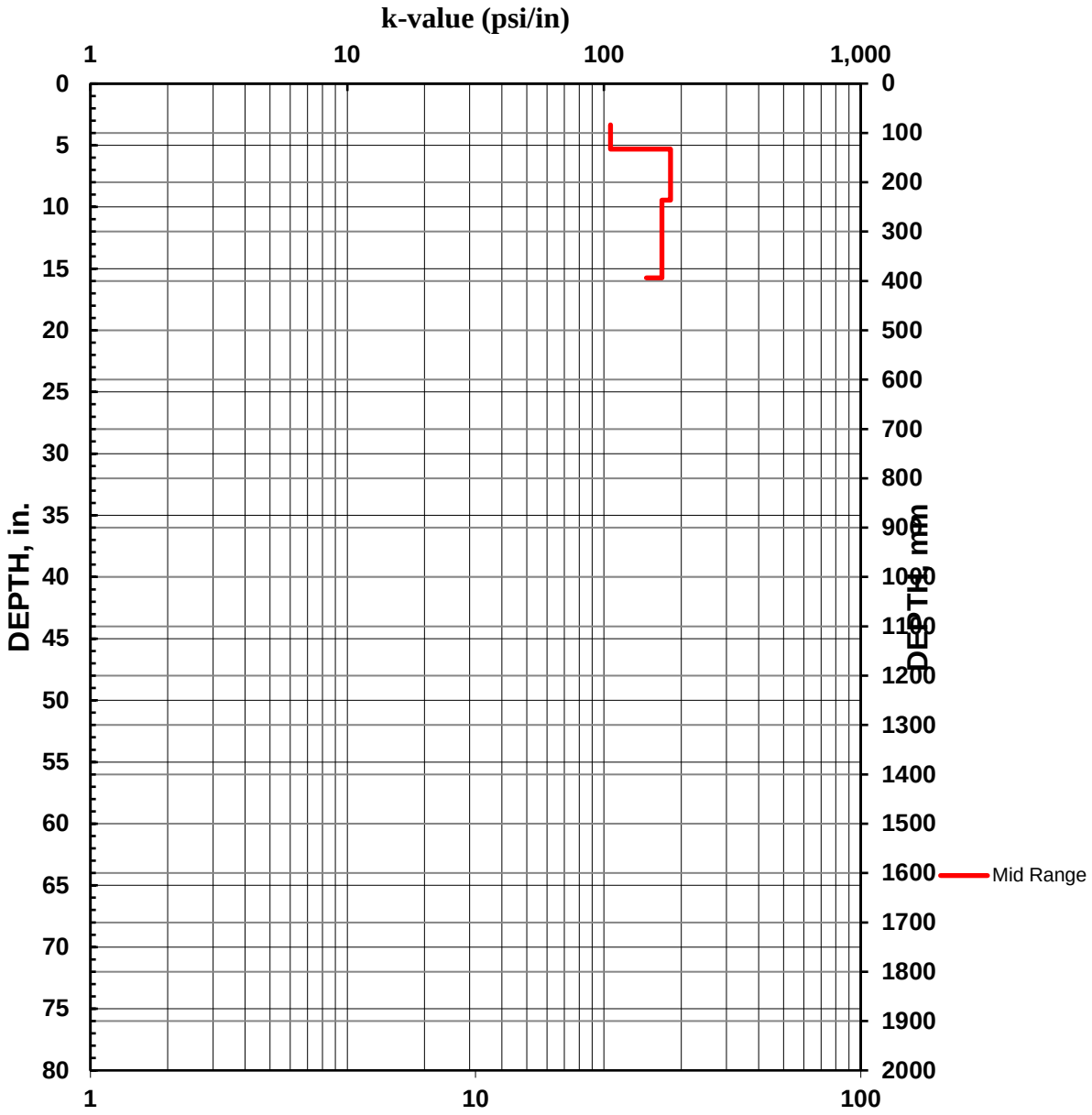
DCP Test per ASTM D6951

Project Name: US-26, Jct. Hitt Rd (25th E)

Project No: KN 21923 | Begin Test at 0.0 feet BGS.

Location of Test: Hitt Rd | Log ID: AG-04

Test ID: DCP-2 | Test Date: 10/26/21



Dynamic Cone Penetrometer for Pavement Applications

DCP Test per ASTM D6951

Project Name: US-26, Jct. Hitt Rd (25th E)

Project No: KN 21923 Begin Test at 0.0 feet BGS.

Location of Test: Hitt Rd Log ID: AG-05

Test ID: DCP-3

Test Date: 10/26/21

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.

Soil Type
- ○ CH
- ○ CL
- ◉ All Other Soils

Field Measurement Penetration (mm)	No. of Blows	Hmmer Factor	Cummulative Penetration (mm)	Penetration Between Readings (mm)	Penetration per Blow (mm)	DCP Index (mm/blow)
455	0	1	0	0	0.0	0.0
535	4	1	80	80	20.0	20.0
580	5	1	125	45	9.0	9.0
625	5	1	170	45	9.0	9.0
680	6	1	225	55	9.2	9.2
745	5	1	290	65	13.0	13.0
875	6	1	420	130	21.7	21.7

Dynamic Cone Penetrometer for Pavement Applications

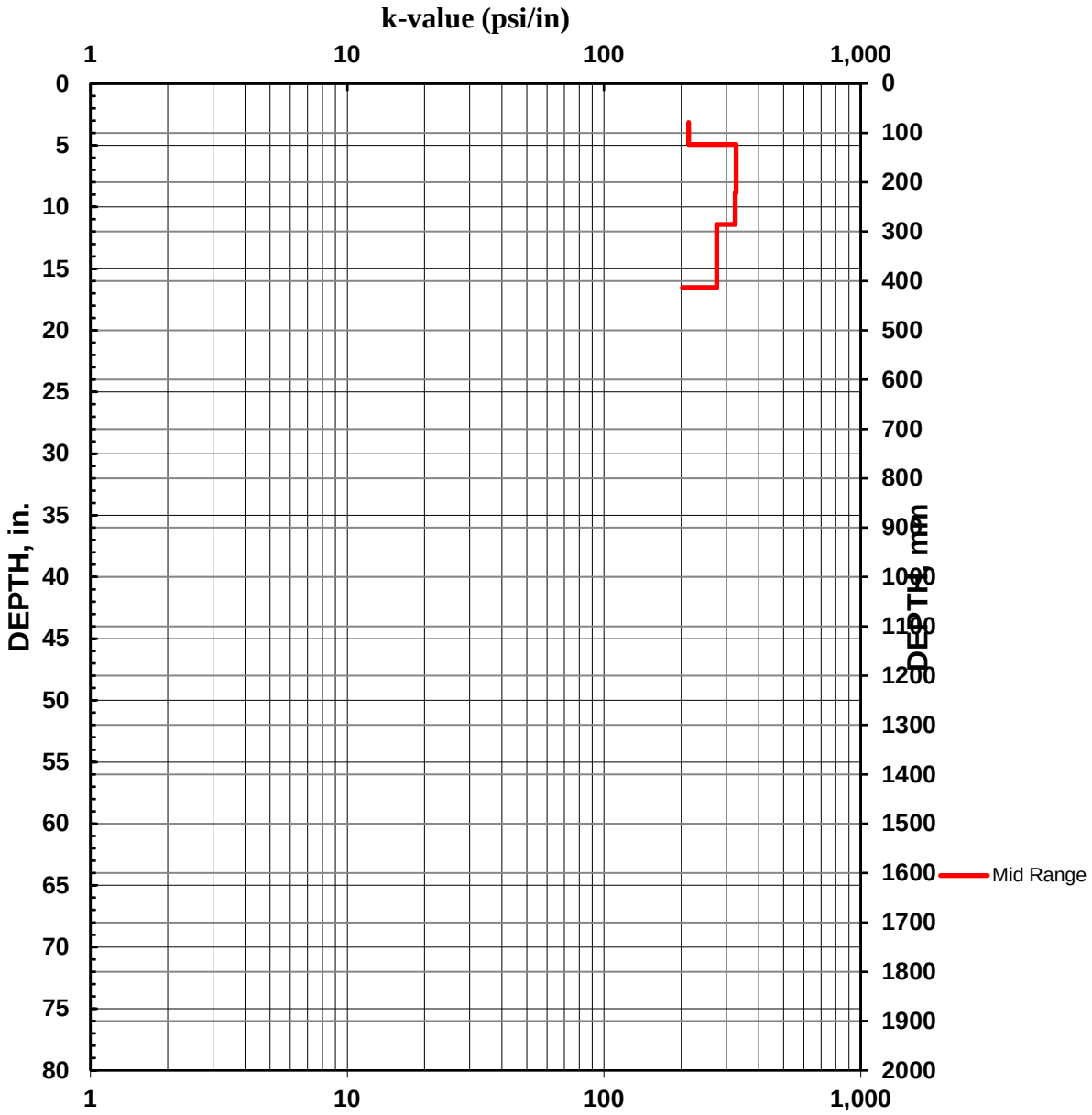
DCP Test per ASTM D6951

Project Name: US-26, Jct. Hitt Rd (25th E)

Project No: KN 21923 | Begin Test at 0.0 feet BGS.

Location of Test: Hitt Rd | Log ID: AG-05

Test ID: DCP-3 | Test Date: 10/26/21



Dynamic Cone Penetrometer for Pavement Applications

DCP Test per ASTM D6951

Project Name: US-26, Jct. Hitt Rd (25th E)

Project No: KN 21923 Begin Test at 0.0 feet BGS.

Location of Test: Hitt Rd Log ID: AG-08

Test ID: DCP-4

Test Date: 10/26/21

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.

Soil Type
- ○ CH
- ○ CL
- ◉ All Other Soils

Field Measurement Penetration (mm)	No. of Blows	Hmmer Factor	Cummulative Penetration (mm)	Penetration Between Readings (mm)	Penetration per Blow (mm)	DCP Index (mm/blow)
460	0	1	0	0	0.0	0.0
545	4	1	85	85	21.3	21.3
630	3	1	170	85	28.3	28.3
745	3	1	285	115	38.3	38.3
870	3	1	410	125	41.7	41.7

Dynamic Cone Penetrometer for Pavement Applications

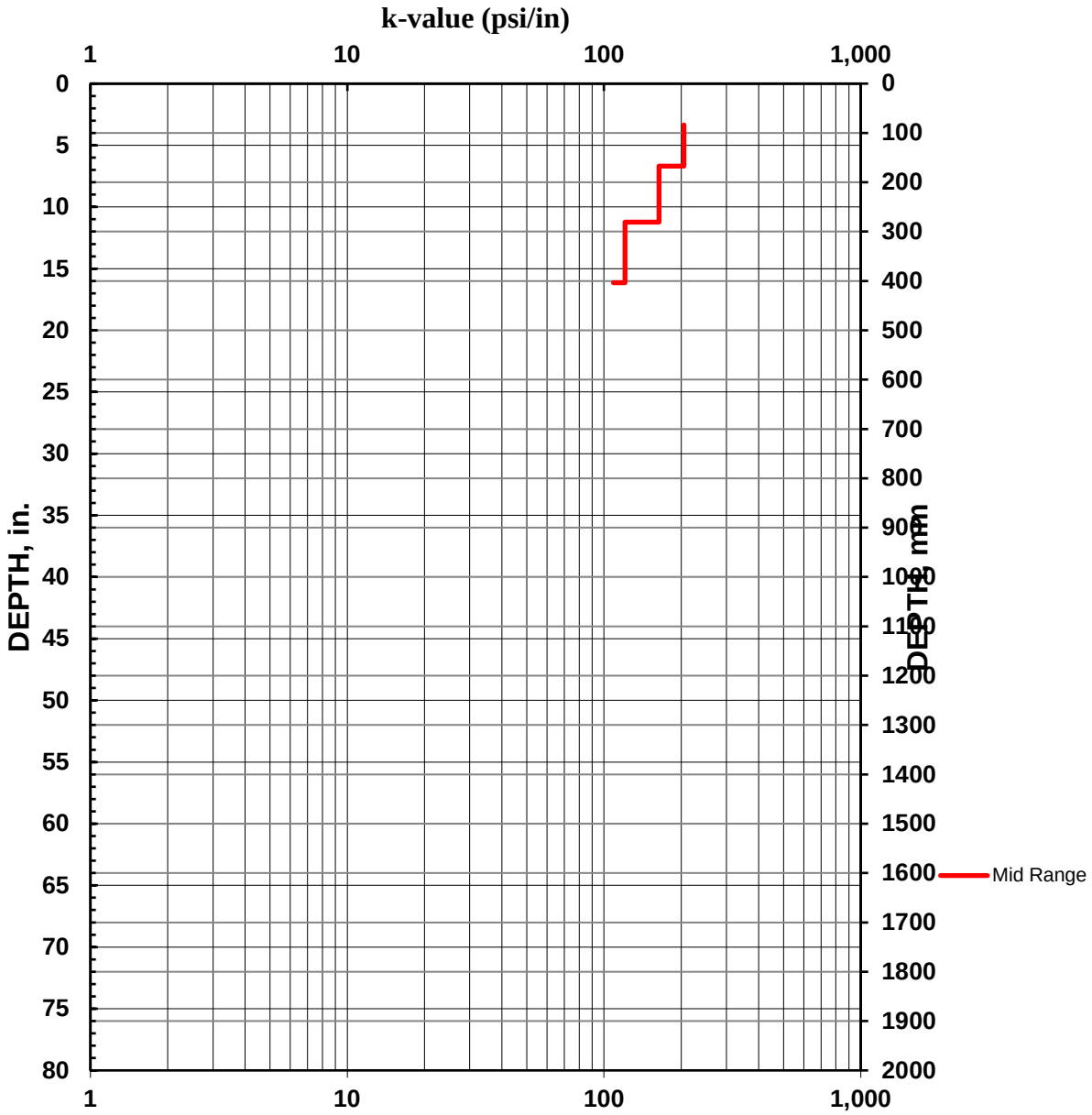
DCP Test per ASTM D6951

Project Name: US-26, Jct. Hitt Rd (25th E)

Project No: KN 21923 Begin Test at 0.0 feet BGS.

Location of Test: Hitt Rd Log ID: AG-08

Test ID: DCP-4 Test Date: 10/26/21



SHANNON & WILSON

Appendix D

Traffic Data Summary

Traffic Projection Worksheet

LTTPBind Output

Projected commercial and 18,000 Equivalent Single Axle Loadings (ESALS)

Project number: A021(923) Key number: 21923 Location: US-26, Jct. Hitt Rd (25th E)
Route: US-26 Segment code: 02240AUS026 From Measure: 335.840 To Measure: 336.950
Truck Density = 3 Heavy Last year with data: 2019 Cumulating ESALs up to: 2066 Starting to Cumulate in: 2026

Year	ADTS			Rigid Pavement ESALs (In 1000s)				Flexible Pavement ESALs (In 1000s)			
				Both Directions		50% Dir of Travel		Both Directions		50% Dir of Travel	
	Total	Pass	Comm	Year Value	Cumulative	50% Year	50% Cum	Year Value	Cumulative	50% Year	50% Cum
2019	10000	9410	590								
2026	11400	10730	670	1037	1037	518	518	534	534	267	267
2027	11600	10920	680	1065	2102	532	1051	550	1084	275	542
2028	11800	11100	700	1091	3193	545	1596	565	1649	282	824
2029	12000	11290	710	1120	4312	560	2156	582	2231	291	1116
2030	12200	11480	720	1149	5461	574	2731	597	2828	299	1414
2031	12400	11670	730	1178	6640	589	3320	612	3441	306	1720
2032	12600	11860	740	1208	7848	604	3924	630	4071	315	2036
2033	12800	12040	760	1239	9087	619	4543	646	4717	323	2358
2034	13000	12230	770	1269	10356	635	5178	662	5379	331	2689
2035	13200	12420	780	1300	11656	650	5828	680	6059	340	3029
2036	13400	12610	790	1328	12984	664	6492	696	6755	348	3378
2037	13600	12800	800	1360	14344	680	7172	716	7471	358	3735
2038	13800	12990	810	1392	15736	696	7868	732	8203	366	4101
2039	14000	13170	830	1424	17160	712	8580	749	8951	374	4476
2040	14200	13360	840	1457	18616	728	9308	769	9720	384	4860
2041	14400	13550	850	1489	20106	745	10053	786	10506	393	5253
2042	14600	13740	860	1523	21629	761	10814	803	11308	401	5654
2043	14800	13930	870	1553	23182	777	11591	820	12128	410	6064
2044	15000	14120	890	1590	24772	795	12386	838	12966	419	6483
2045	15200	14300	900	1625	26397	812	13198	859	13825	429	6912
2046	15400	14490	910	1663	28059	831	14030	877	14701	438	7351
2047	15600	14680	920	1694	29754	847	14877	895	15596	447	7798
2048	15800	14870	930	1730	31483	865	15742	916	16512	458	8256
2049	16000	15060	940	1765	33248	883	16624	935	17447	467	8724
2050	16200	15240	960	1798	35046	899	17523	957	18404	479	9202
2051	16400	15430	970	1834	36880	917	18440	976	19380	488	9690
2052	16600	15620	980	1871	38751	935	19376	995	20375	497	10188
2053	16800	15810	990	1908	40659	954	20329	1018	21393	509	10696
2054	17000	16000	1000	1945	42604	973	21302	1041	22434	520	11217
2055	17200	16190	1010	1983	44587	991	22293	1064	23498	532	11749
2056	17400	16370	1030	2021	46608	1010	23304	1084	24582	542	12291
2057	17600	16560	1040	2063	48671	1032	24335	1108	25690	554	12845
2058	17800	16750	1050	2098	50769	1049	25384	1128	26818	564	13409
2059	18000	16940	1060	2141	52910	1070	26455	1152	27971	576	13985
2060	18200	17130	1070	2180	55090	1090	27545	1173	29144	587	14572
2061	18400	17310	1090	2220	57310	1110	28655	1194	30338	597	15169
2062	18600	17500	1100	2260	59571	1130	29785	1215	31553	607	15776
2063	18800	17690	1110	2301	61871	1150	30936	1236	32789	618	16394
2064	19000	17880	1120	2342	64213	1171	32106	1257	34046	629	17023
2065	19200	18070	1130	2383	66596	1191	33298	1279	35325	639	17663
2066	19400	18260	1140	2424	69020	1212	34510	1301	36626	650	18313

Projected commercial and 18,000 Equivalent Single Axle Loadings (ESALS)

Project number: A021(923) Key number: 21923 Location: US-26, Jct. Hitt Rd (25th E)
Route: Hitt Rd Segment code: 04315A0H000 From Measure: 11.944 To Measure: 14.894
Truck Density = 4 Light/Heavy Last year with data: 2019 Cumulating ESALs up to: 2066 Starting to Cumulate in: 2026

Year	ADTS			Rigid Pavement ESALs (In 1000s)				Flexible Pavement ESALs (In 1000s)			
				Both Directions		50% Dir of Travel		Both Directions		50% Dir of Travel	
	Total	Pass	Comm	Year Value	Cumulative	50% Year	50% Cum	Year Value	Cumulative	50% Year	50% Cum
2019	7400	7140	260								
2026	8440	8140	300	332	332	166	166	215	215	107	107
2027	8580	8280	300	342	674	171	337	222	437	111	218
2028	8730	8430	310	352	1026	176	513	228	665	114	332
2029	8880	8570	310	363	1389	181	694	234	899	117	449
2030	9030	8710	320	372	1761	186	880	241	1140	121	570
2031	9180	8850	320	383	2144	192	1072	248	1388	124	694
2032	9320	9000	330	394	2538	197	1269	254	1642	127	821
2033	9470	9140	330	405	2943	203	1472	261	1903	130	951
2034	9620	9280	340	415	3358	208	1679	267	2170	134	1085
2035	9770	9420	340	427	3785	213	1892	275	2445	138	1222
2036	9920	9570	350	438	4223	219	2112	282	2727	141	1363
2037	10060	9710	350	450	4673	225	2336	289	3015	144	1508
2038	10210	9850	360	460	5133	230	2567	297	3312	148	1656
2039	10360	10000	360	472	5606	236	2803	304	3615	152	1808
2040	10510	10140	370	485	6090	242	3045	311	3926	155	1963
2041	10660	10280	370	497	6587	248	3294	319	4245	160	2123
2042	10800	10420	380	508	7095	254	3547	326	4572	163	2286
2043	10950	10570	380	522	7617	261	3808	334	4905	167	2453
2044	11100	10710	390	533	8150	267	4075	341	5246	170	2623
2045	11250	10850	400	546	8696	273	4348	350	5596	175	2798
2046	11400	11000	400	558	9254	279	4627	357	5954	179	2977
2047	11540	11140	410	571	9824	285	4912	366	6320	183	3160
2048	11690	11280	410	584	10408	292	5204	374	6694	187	3347
2049	11840	11420	420	598	11006	299	5503	382	7076	191	3538
2050	11990	11570	420	610	11616	305	5808	391	7468	196	3734
2051	12140	11710	430	625	12241	312	6120	399	7867	200	3933
2052	12280	11850	430	636	12876	318	6438	407	8274	204	4137
2053	12430	12000	440	648	13525	324	6762	417	8691	208	4346
2054	12580	12140	440	661	14185	330	7093	425	9116	213	4558
2055	12730	12280	450	673	14859	337	7429	435	9551	218	4776
2056	12880	12420	450	688	15546	344	7773	445	9996	223	4998
2057	13020	12570	460	701	16247	350	8124	454	10450	227	5225
2058	13170	12710	460	715	16963	358	8481	462	10912	231	5456
2059	13320	12850	470	729	17691	364	8846	472	11385	236	5692
2060	13470	12990	470	742	18433	371	9217	481	11866	241	5933
2061	13620	13140	480	750	19183	375	9592	486	12352	243	6176
2062	13760	13280	480	758	19942	379	9971	492	12844	246	6422
2063	13910	13420	490	766	20708	383	10354	497	13341	248	6670
2064	14060	13570	490	775	21482	387	10741	502	13843	251	6921
2065	14210	13710	500	783	22265	391	11133	508	14350	254	7175
2066	14360	13850	500	791	23056	395	11528	513	14863	256	7432

Projected commercial and 18,000 Equivalent Single Axle Loadings (ESALS)

Project number: A021(923) Key number: 21923 Location: US-26, Jct. Hitt Rd (25th E)
Route: Iona Rd Segment code: 01559A0H000 From Measure: 1.747 To Measure: 1.979
Truck Density = 2 Medium Last year with data: 2019 Cumulating ESALs up to: 2066 Starting to Cumulate in: 2026

Year	ADTS			Rigid Pavement ESALs (In 1000s)				Flexible Pavement ESALs (In 1000s)			
				Both Directions		50% Dir of Travel		Both Directions		50% Dir of Travel	
	Total	Pass	Comm	Year Value	Cumulative	50% Year	50% Cum	Year Value	Cumulative	50% Year	50% Cum
2019	4000	3560	440								
2026	4560	4060	500	396	396	198	198	215	215	107	107
2027	4640	4130	510	408	804	204	402	220	435	110	217
2028	4720	4200	520	419	1223	210	612	226	660	113	330
2029	4800	4270	530	432	1655	216	828	232	892	116	446
2030	4880	4340	540	445	2100	223	1050	239	1131	120	566
2031	4960	4410	550	456	2557	228	1278	245	1377	123	688
2032	5040	4490	550	470	3026	235	1513	251	1628	126	814
2033	5120	4560	560	481	3508	241	1754	257	1885	129	943
2034	5200	4630	570	495	4003	248	2001	265	2151	133	1075
2035	5280	4700	580	509	4512	255	2256	272	2422	136	1211
2036	5360	4770	590	521	5033	261	2517	278	2700	139	1350
2037	5440	4840	600	535	5569	268	2784	284	2985	142	1492
2038	5520	4910	610	550	6119	275	3059	293	3278	146	1639
2039	5600	4980	620	562	6681	281	3341	299	3577	150	1788
2040	5680	5060	620	577	7258	289	3629	306	3883	153	1941
2041	5760	5130	630	590	7849	295	3924	313	4195	156	2098
2042	5840	5200	640	605	8454	303	4227	322	4517	161	2259
2043	5920	5270	650	621	9075	310	4537	328	4845	164	2423
2044	6000	5340	660	634	9709	317	4854	335	5181	168	2590
2045	6080	5410	670	650	10358	325	5179	342	5523	171	2761
2046	6160	5480	680	666	11024	333	5512	352	5874	176	2937
2047	6240	5550	690	679	11703	340	5852	359	6233	179	3117
2048	6320	5620	700	696	12399	348	6200	366	6599	183	3299
2049	6400	5700	700	712	13111	356	6556	373	6972	187	3486
2050	6480	5770	710	726	13838	363	6919	383	7355	191	3677
2051	6560	5840	720	743	14581	372	7290	390	7745	195	3873
2052	6640	5910	730	760	15341	380	7670	398	8143	199	4071
2053	6720	5980	740	777	16118	389	8059	408	8551	204	4275
2054	6800	6050	750	795	16913	397	8457	415	8966	208	4483
2055	6880	6120	760	813	17726	406	8863	423	9389	212	4695
2056	6960	6190	770	830	18556	415	9278	431	9820	215	4910
2057	7040	6270	770	851	19408	426	9704	439	10258	219	5129
2058	7120	6340	780	867	20274	433	10137	449	10708	225	5354
2059	7200	6410	790	885	21159	443	10580	457	11165	229	5582
2060	7280	6480	800	904	22063	452	11031	465	11630	233	5815
2061	7360	6550	810	914	22977	457	11488	470	12101	235	6050
2062	7440	6620	820	924	23900	462	11950	475	12576	238	6288
2063	7520	6690	830	933	24833	467	12417	481	13056	240	6528
2064	7600	6760	840	943	25777	472	12888	486	13542	243	6771
2065	7680	6840	840	953	26730	477	13365	491	14033	245	7016
2066	7760	6910	850	963	27693	482	13847	496	14529	248	7264

Traffic Projection Worksheet

Project: **US-26, Jct. Hitt Road (25th E)** File No: 3370 Date: **December 9, 2021**

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

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		Roadway Segment						
		US-26	**Hitt Rd**	**Iona Rd**				
	Lane Information							
	No. of Lanes in Design Direction	**2**	**2**	**2**				
	% Split of Trucks in Design Direction	**60%**	**60%**	**60%**				
	% of Trucks in Design Lane	**90%**	**90%**	**100%**				
From ITD's AADT Projection Report	Total Traffic - Both Directions							Flexible
	2026 AADT							
	2046 AADT							
	AADT for the Analysis Period							
	Truck Traffic - Both Directions							
	% Truck Traffic							
	AADTT							
	Truck Density (H, M, L)							
	Design Lane							
	AADTT							
	Traffic Index, TI							
	Flexible Design ESALs							
	Compound Annual Growth Rate							
From ITD's ESAL Projection Report	Flexible ESAL Projections - Both Directions							
	2026 Yearly and Cummulative ESALs	**534,000**	**215,000**	**215,000**				
	2046 Cummulative ESALs	**14,701,000**	**5,954,000**	**5,874,000**				
	Design Lane							
	Flexible Design ESALs	**7,650,180**	**3,099,060**	**3,395,400**				
	Traffic Index, TI	**11.5**	**10.3**	**10.4**				
	Rigid ESAL Projections - Both Directions							Rigid
	2026 Yearly and Cummulative ESALs	**1,037,000**	**332,000**	**396,000**				
	2066 Cummulative ESALs	**69,020,000**	**23,056,000**	**27,693,000**				
	Design Lane							
	Rigid Design ESALs	**36,710,820**	**12,270,960**	**16,378,200**				

US-26, Jct Hitt Rd (25th E)

LTPPBind V3.0 PG Binder Selection Report (Date: 12/10/2021)

Parameter	A=3 km	B=9 km	C=21 km	D=37 km	E=44 km
Station ID	ID4455	ID4457	ID4456	ID0915	ID7644
Elevation, m	4426	4393	5434	4189	4570
Degree-Days >10 C	2633	2477	2012	2633	2460
Low Air Temperature, C	-26.8	-28.5	-33.1	-26.1	-29.6
Low Air Temp. Std Dev	5	4.9	5	4.8	4.9

Input Data

Latitude, Degree	43.47
Yearly Degree-Days>10C	2443
Lowest Yearly Air Temp., Deg. C	-28.8
Low Temp. Std. Dev., Deg. C	4.9
Base HT PG	52

Traffic Adjustments for HT

Desired Reliability, Percent	98
Traffic Loading, Million ESAL	3 to 10 M. ESAL
Traffic Speed	Fast
High Temp. Adjustment	7.8

PG Temperature	HIGH	LOW
PG Temp. at 50% Reliability	51.7	-21.1
PG Temp. at Desired Reliability	54.8	-29.5
Adjustments for Traffic	7.8	
Adjustments for Depth	0.0	0.0
Adjusted PG Temperature	62.6	-29.5
Selected PG Binder Grade	64	-34

SHANNON & WILSON

Appendix E

Design R-Value Worksheet

Modulus of Subgrade Reaction Test Reports

FLEXIBLE PAVEMENT DESIGN - Idaho R-Value Method

Project Name:	**US-26, Jct. Hitt Road (25th E)**
File No:	**03370**
Date:	**December 9, 2021**
Roadway Segment:	**US-26**
Strategy:	**Reconstruction**

	Layer Names
Layer 1:	HMA
Layer 2:	Untreated Base
Layer 3:	Granular Subbase
	Subgrade

		R-Values	
Layer 2:	Untreated Base	80	
Layer 3:	Granular Subbase	60	Expansion Pressure (psi)
	Subgrade	7	

Traffic Index (T.I.): 11.5 → ESALs ≈ 7,845,000

Regional Climate Factor: 1.10 (Reference Figure 16-510.5.1 ITD Materials Manual)

		Material Substitution Ratios
Layer 1:	HMA	1.60
Layer 2:	Untreated Base	1.00
Layer 3:	Granular Subbase	0.85

		Layer Thickness				Gravel Equivalency	
Layer 1:	**HMA**					GE1 Required:	0.81
	Required Thickness:	0.51	feet				
	Recommended Thickness:	0.51	feet	6.1	Inches	GE1 Actual:	0.82
Layer 2:	**Untreated Base**					GE2 Required	1.62
	Required Thickness:	0.80	feet				
	Recommended Thickness:	0.80	feet	9.6	Inches	GE2 Actual	1.62
Layer 3:	**Granular Subbase**					GE3 Required	3.76
	Required Thickness:	2.53	feet				
	Recommended Thickness:	2.53	feet	30.4	Inches	GE3 Actual	3.77

Typical Subgrade Frost Group:	F4		Granular Subbase on Subgrade	D_{15}:	1.1 mm
Design Frost Depth:	36	Inches		D_{85}:	.053 mm
Required Ballast for Frost-Susceptible Subgrade:	70	% of Frost Depth		D_{15}/D_{85}=	20.75 >5

Subgrade Type: Clayey

Subgrade Separation Geotextile (Type III) Required

RECOMMMENDED BALLAST SECTION

HMA :	**0.51**		**6.0**	
Untreated Base :	**0.80**		**9.5**	
Granular Subbase :	**2.55**		**30.5**	
	3.86	**feet**	**46.0**	**inches**

GE Required:	**3.76**	**feet**	
GE Provided:	**3.78**	**feet**	**OK**
Ballast Required to Counter Expansion Pressure:	**0**	**Inches**	
Ballast Provided:	**46**	**Inches**	**OK**
Ballast Required for Frost Protection:	**25**	**Inches**	
Ballast Provided:	**46**	**Inches**	**OK**

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FLEXIBLE PAVEMENT DESIGN - Idaho R-Value Method

Project Name:	**US-26, Jct. Hitt Road (25th E)**
File No:	**03370**
Date:	**December 9, 2021**
Roadway Segment:	**Hitt Rd & Iona Rd**
Strategy:	**Reconstruction**

	Layer Names
Layer 1:	HMA
Layer 2:	Untreated Base
Layer 3:	Granular Subbase
	Subgrade

		R-Values	
Layer 2:	Untreated Base	80	
Layer 3:	Granular Subbase	60	Expansion Pressure (psi)
	Subgrade	7	

Traffic Index (T.I.): 10.5 → ESALs ≈ 3,652,000

Regional Climate Factor: 1.10 (Reference Figure 16-510.5.1 ITD Materials Manual)

		Material Substitution Ratios
Layer 1:	HMA	1.60
Layer 2:	Untreated Base	1.00
Layer 3:	Granular Subbase	0.85

	Layer Thickness				Gravel Equivalency	
Layer 1:	**HMA**					
					GE1 Required:	0.74
	Required Thickness:	0.46	feet			
	Recommended Thickness:	0.46	feet	5.5 Inches		
					GE1 Actual:	0.74
Layer 2:	**Untreated Base**					
					GE2 Required	1.48
	Required Thickness:	0.74	feet			
	Recommended Thickness:	0.74	feet	8.9 Inches		
					GE2 Actual	1.48
Layer 3:	**Granular Subbase**					
					GE3 Required	3.44
	Required Thickness:	2.31	feet			
	Recommended Thickness:	2.31	feet	27.7 Inches		
					GE3 Actual	3.44

Typical Subgrade Frost Group:	F4		Granular Subbase	D_{15}: 1.1	mm
Design Frost Depth:	36	Inches	on Subgrade	D_{85}: .053	mm
Required Ballast for Frost-Susceptible Subgrade:	70	% of Frost Depth		D_{15}/D_{85}= 20.75	>5

Subgrade Type: Clayey

Subgrade Separation Geotextile (Type III) Required

RECOMMMENDED BALLAST SECTION

HMA :	**0.46**		**5.5**	
Untreated Base :	**0.75**		**9.0**	
Granular Subbase :	**2.35**		**27.5**	
	3.56	**feet**	**42.0**	**inches**

GE Required:	**3.44**	**feet**	
GE Provided:	**3.48**	**feet**	**OK**
Ballast Required to Counter Expansion Pressure:	**0**	**Inches**	
Ballast Provided:	**43**	**Inches**	**OK**
Ballast Required for Frost Protection:	**25**	**Inches**	
Ballast Provided:	**43**	**Inches**	**OK**

American Geotechnics MEE

Supplement to the

AASHTO Guide For

Design of Pavement Structures

Part II, - Rigid Pavement Design & Rigid Pavement Joint Design

Published by the
American Association of State Highway
and Transportation Officials

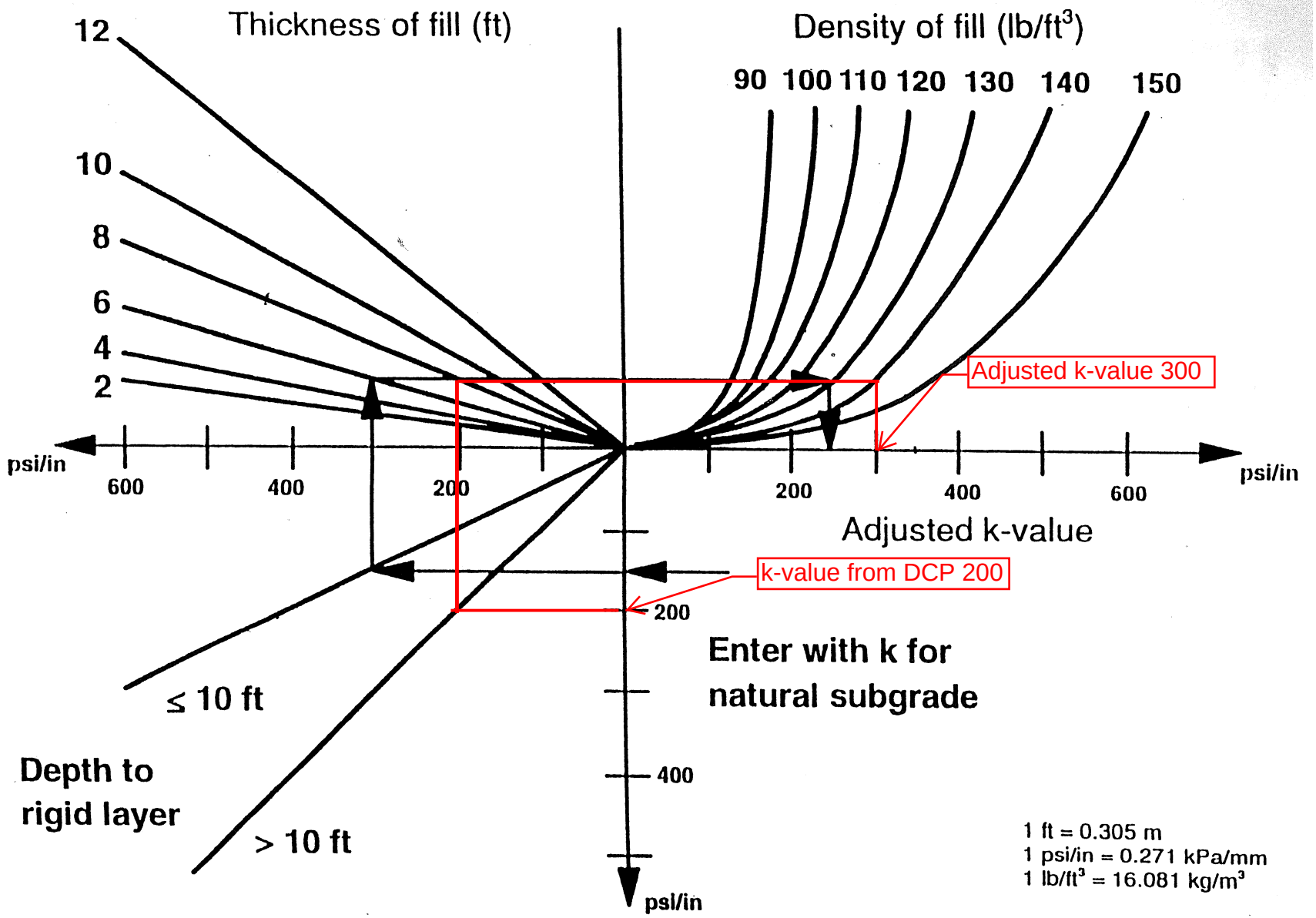


Figure 43. Adjustment to k for fill and/or rigid layer.

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Project Name: US-26, Jct. Hitt Rd (25th E)
Route: US-26
Location:
Owner/Agency: ITD
Design Engineer: MEE

Rigid Pavement Design/Evaluation

Concrete Thickness	9.75	**inches**	**Load Transfer Coefficient**	2.90	
Total Rigid ESALs	36,710,820		**Modulus of Subgrade Reaction**	300	**psi/in.**
Reliability	50.00	**percent**	**Drainage Coefficient**	0.90	
Overall Standard Deviation	0.39		**Initial Serviceability**	4.50	
Flexural Strength	700	**psi**	**Terminal Serviceability**	2.50	
Modulus of Elasticity	4,200,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Unadjusted k-value of the subgrade	200.0
Thickness of Aggregate Base	8.0
Depth to Rigid Foundation	> 10 ft
Density of Aggregate Base (lb/ft^3)	140.0
Loss of Support Value (0,1,2,3)	0

Modulus of Subgrade Reaction	300	**psi/in.**

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Project Name: US-26, Jct. Hitt Rd (25th E)
Route: Hitt Rd & Iona Rd
Location:
Owner/Agency: ITD
Design Engineer: MEE

Rigid Pavement Design/Evaluation

Concrete Thickness	8.51	**inches**	**Load Transfer Coefficient**	2.90	
Total Rigid ESALs	16,378,200		**Modulus of Subgrade Reaction**	300	**psi/in.**
Reliability	50.00	**percent**	**Drainage Coefficient**	0.90	
Overall Standard Deviation	0.39		**Initial Serviceability**	4.50	
Flexural Strength	700	**psi**	**Terminal Serviceability**	2.50	
Modulus of Elasticity	4,200,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Unadjusted k-value of the subgrade	200.0
Thickness of Aggregate Base	8.0
Depth to Rigid Foundation	> 10 ft
Density of Aggregate Base (lb/ft^3)	140.0
Loss of Support Value (0,1,2,3)	0

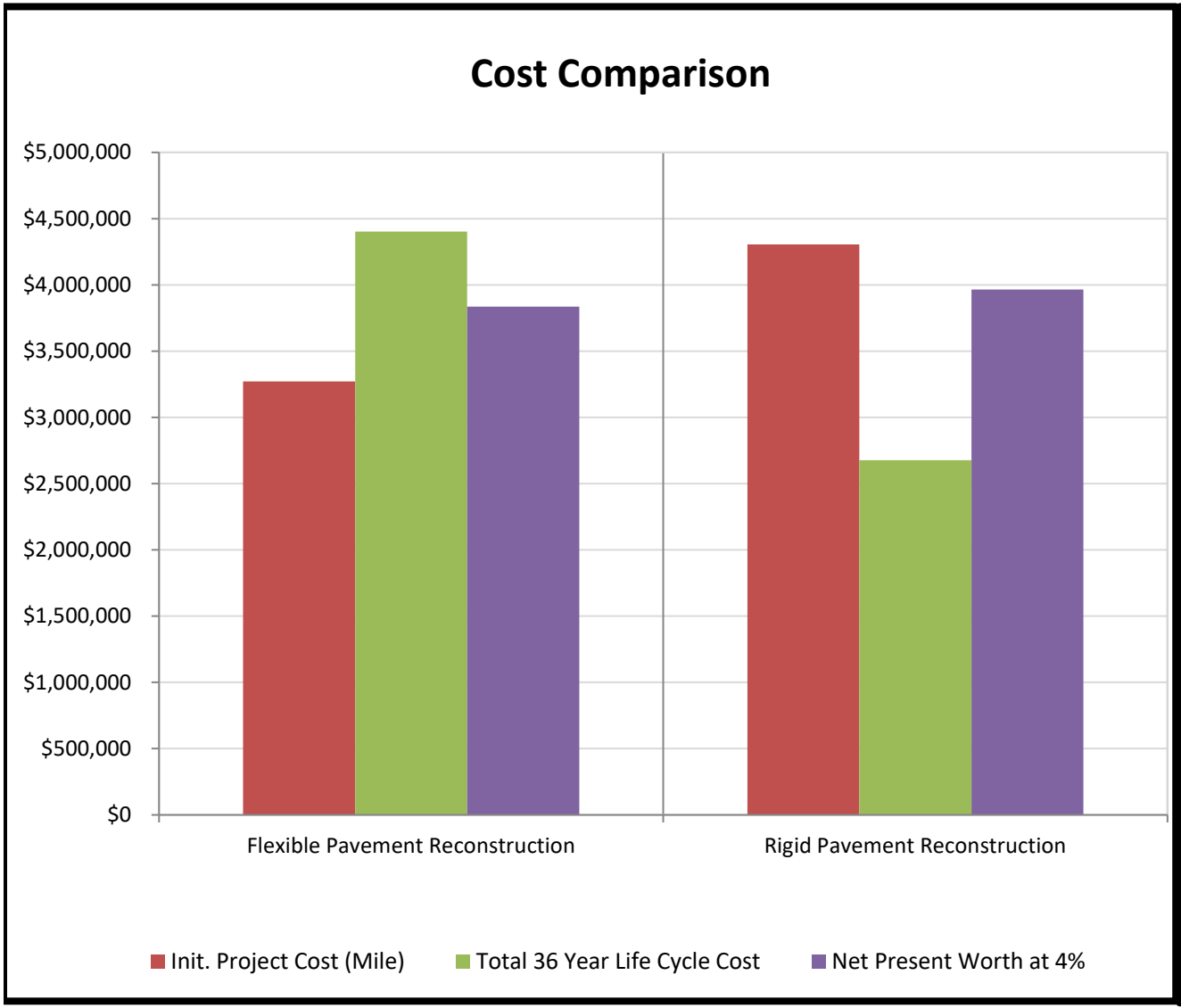
Modulus of Subgrade Reaction	300	**psi/in.**

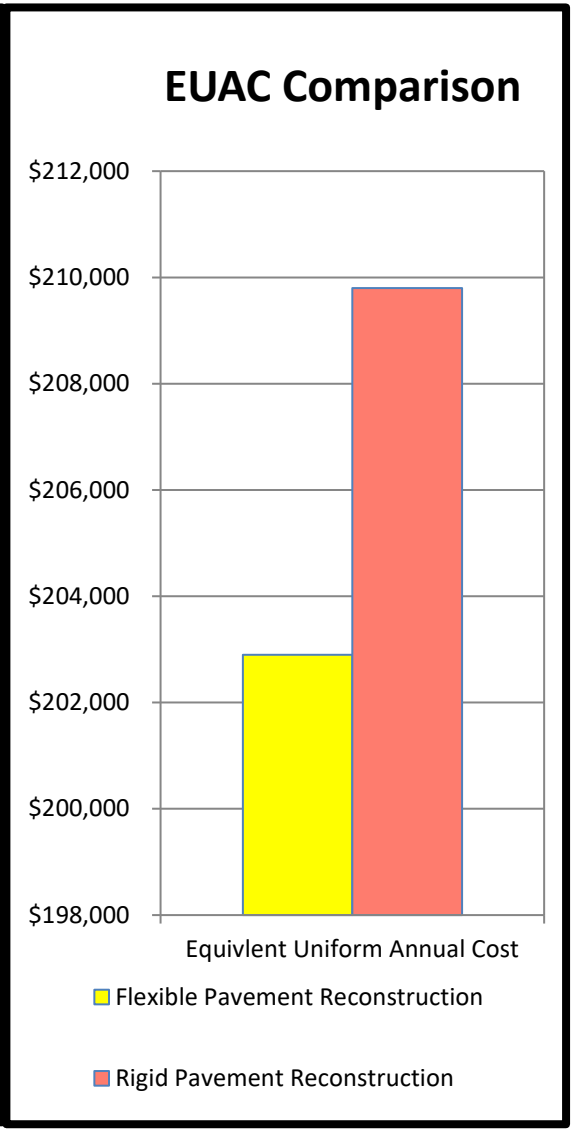
SHANNON & WILSON

Appendix F

Life-Cycle Cost Analysis

Strategy	Init. Project Cost (Mile)	Total 36 Year Life Cycle Cost	Equivlent Uniform Annual Cost	Net Present Worth at 4%
Flexible Pavement Reconstruction	$3,271,700	$4,402,900	$202,900	$3,835,500
Rigid Pavement Reconstruction	$4,306,500	$2,675,905	$209,800	$3,966,000





FLEXIBLE PAVEMENT WORKSHEET

Flexible Pavement Reconstruction

PROJECT NAME	**US-26, Jct. Hitt Rd (25th E)**
PROJECT NUMBER	**A021(923)**
KEY	**21923**

Material	Depth		Haul		Width		Weight / ft³		Cost	
Hot Mix Asphalt (HMA)	0.51	ft	10.00	mile	48.00	ft	156.07	lb	102.97	/ ton
Untreated Aggregate Base	0.80	ft	10.00	mile	53.46	ft	145.00	lb	15.00	/ ton
Granular Subbase	2.55	ft	10.00	mile	63.51	ft	134.00	lb	6.89	/ ton
Preservation Mill/Inlay	0.15	ft	1.00	mile	48.00	ft				

Project Length	5,280	ft
Travel Lane Width	48.00	ft
Surface Width - Left Side	24.00	ft
Surface Width - Right Side	24.00	ft
Widen Width - Left Side		ft
Widen Width - Right Side		ft
Additional Borrow		cu.yard
Traffic Cross Overs	0	Ea.
Number of Edge Drains	0	Ea.
Longitudinal Cracks	1	Ea.
Transverse Cracks	165	/ mile
Foreslope Angle - Left	3	(H): 1(V)
Foreslope Angle - Right	3	(H): 1(V)
Excavation	3.86	ft
Subgrade Sep. Fabric Layer	48.00	ft
Future Pavement Geotextile		ft

LIFE CYCLE COST ANALYSIS		STANDARD TIME LINES	10-Dec-21
PROJECT NAME	**US-26, Jct. Hitt Rd (25th E)**	36 YEAR LIFE CYCLE	
PROJECT NUMBER	**A021(923)**	UNIFORM PROJECT COSTS PER MILE	
KEY	**21923**	(English units)	

Flexible Pavement Reconstruction

YEAR		WORK	COST	PRESENT WORTH FACTOR	CAPITAL RECOVERY FACTOR	EQUIVALENT UNIFORM ANNUAL COST
0	-->	Initial Cost	$3,271,700	1.000	0.0529	$173,100
-						
-						
-						
-						
5						
-						
-						
-	-->	Seal Coat Driving Lanes	$73,200	0.731	0.0529	$2,800
-						
10						
-						
-	-->	Preservation Mill/InLay Year 12	$409,600	0.625	0.0529	$13,500
-						
-						
15	-->	Seal Cracks	$15,400	0.555	0.0529	$500
-						
-						
-	-->	Transverse Cracks	$15,400	0.494	0.0529	$400
-	-->	Seal Coat Driving Lanes	$73,200	0.475	0.0529	$1,800
20						
-	-->	Seal Cracks	$15,400	0.439	0.0529	$400
-						
-						
-	-->	Preservation Mill & Inlay-Year 24	$409,600	0.390	0.0529	$8,500
25						
-						
-	-->	Seal Cracks	$15,400	0.347	0.0529	$300
-						
-						
30	-->	Seal Cracks	$15,400	0.308	0.0529	$300
-	-->	Seal Coat Driving Lanes	$73,200	0.297	0.0529	$1,100
-						
-	-->	Seal Cracks	$15,400	0.274	0.0529	$200
-						
35						
-	-->	End Life - Salvage Value	$0	0.244	0.0529	$0
		TOTAL	$4,402,900		EUAC ----->	$202,900
				Total Net Present Worth @ 4%		$3,835,500

12/10/2021

LIFE CYCLE COST ANALYSIS
US-26, Jct. Hitt Rd (25th E)
A021(923)
Flexible Pavement Reconstruction

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:		
	Hot Mix Asphalt (HMA)	$1,189,900
	Untreated Aggregate Base	$491,100
	Granular Subbase	$1,254,100
	Traffic Cross Overs	$0
	Excavation	$217,300
	Additional Borrow	$0
	Edge Drains	$0
	Seal Coat at Year 1	$73,200
	Subgrade Sep. Fabric Layer	$46,100
TOTAL INITIAL		$3,271,700
	Seal Coat Full Width	$73,200
	Seal Driving Lanes	$73,200
	Seal Cracks	$15,400
PRESERVATION AT 12 YEARS:		
	Coldmill travel lanes	$15,500
	Hot Mix Asphalt Inlay	$305,500
	Seal coat full width	$73,200
	Seal cracks	$15,400
TOTAL 12 YEAR PRESERVATION		$409,600
PRESERVATION AT 24 YEARS:		
	Coldmill travel lanes	$15,500
	Hot Mix Asphalt inlay	$305,500
	Pavement Geotextile	$0
	Seal coat full width	$73,200
	Seal cracks	$15,400
TOTAL 24 YEAR PRESERVATION		$409,600
TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)		$4,402,900
EQUIVALENT UNIFORM ANNUAL COST (euac)		$202,900
TOTAL NET PRESENT WORTH AT 4% INTREST		$3,835,500

RIGID PAVEMENT WORKSHEET

Rigid Pavement Reconstruction

PROJECT NAME	**US-26, Jct. Hitt Rd (25th E)**
PROJECT NUMBER	**A021(923)**
KEY	**21923**

Material	Depth		Haul		Width		Weight / ft³		Cost	
Portland Concrete Cement (PCC)	10.75	in	1.00	mile	48.00	ft	150.00	lb	196.00	/ cu.yard
Hot Mix Asphalt (HMA)	3.00	in	1.00	mile	54.13	ft	156.07	lb	102.97	/ ton
Untreated Aggregate Base	8.00	in	1.00	mile	56.88	ft	145.00	lb	15.00	/ ton

Project Length	5,280	ft
Travel Lane Width	48.00	ft
Surface Width - Left Side	24.00	ft
Surface Width - Right Side	24.00	ft
Widen Width - Left Side		ft
Widen Width - Right Side		ft
Additional Borrow	5	cu.yard
Traffic Cross Overs	0	Ea.
Number of Edge Drains	0	Ea.
Longitudinal Cracks	2	Ea.
Transverse Cracks	100	/ mile
Foreslope Angle - Left	3	(H): 1 (V)
Foreslope Angle - Right	3	(H): 1 (V)
Excavation	22.75	in
Subgrade Sep. Fabric Layer	48.00	ft
Future Pavement Geotextile		ft

LIFE CYCLE COST ANALYSIS		STANDARD TIME LINES	10-Dec-21	
PROJECT NAME	**US-26, Jct. Hitt Rd (25th E)**	36 YEAR LIFE CYCLE		
PROJECT NUMBER	**A021(923)**	UNIFORM PROJECT COSTS PER MILE		
KEY	**21923**	(English units)		

Rigid Pavement Reconstruction

YEAR		WORK	COST	PRESENT WORTH FACTOR	CAPITAL RECOVERY FACTOR	EQUIVALENT UNIFORM ANNUAL COST
0	-->	Initial Cost	$4,306,500	1.000	0.0529	$227,800
5						
10	-->	Seal Joints	$45,400	0.703	0.0529	$1,700
15						
20	-->	Rehab & Seal Joints	$130,400	0.494	0.0529	$3,400
25						
30	-->	Seal Joints	$45,400	0.347	0.0529	$800
35						
	---->	End Life - Salvage Value	($1,851,795)	0.244	0.0529	($23,900)
		TOTAL	$2,675,905		EUAC ----->	$209,800
				Total Net Present Worth @ 4%		$3,966,000

12/10/2021

LIFE CYCLE COST ANALYSIS
US-26, Jct. Hitt Rd (25th E)
A021(923)
Rigid Pavement Reconstruction

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:		
	Portland Concrete Cement (PCC)	$3,321,494
	Hot Mix Asphalt (HMA)	$582,400
	Untreated Aggregate Base	$239,500
	Traffic Cross Overs	$0
	Excavation	$117,000
	Additional Borrow	$54
	Edge Drains	$0
	Subgrade Sep. Fabric Layer	$46,100
TOTAL INITIAL		$4,306,500
REHABILITATION AT 9 YEARS:		
	Seal Longitudinal Joints	$39,800
	Seal Transverse Joints	$5,600
TOTAL 9 YEAR PRESERVATION		$45,400
PRESERVATION AT 18 YEARS:		
	Slab Replacement at 2%	$28,700
	Grinding Driving Lanes	$56,300
	Seal Longitudinal Joints	$39,800
	Seal Transverse Joints	$5,600
TOTAL 18 YEAR PRESERVATION		$130,400
REHABILITATION AT 9 YEARS:		
	Seal Longitudinal Joints	$39,800
	Seal Transverse Joints	$5,600
TOTAL 9 YEAR PRESERVATION		$45,400
TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)		$2,675,905
EQUIVALENT UNIFORM ANNUAL COST (euac)		$209,800
TOTAL NET PRESENT WORTH AT 4% INTREST		$3,966,000
SALVAGE VALUE		($1,851,795)