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Administrator

DATE: February 27, 2020

PROGRAM: A013(905)

KEY NO: 13905

TO: Muhammad Zubery, P.E.
Materials Engineer

PROGRAM ID, COUNTY, ETC.:
N 10th Avenue ITS & Overlay, Caldwell
Canyon County

FROM: Wayne A. Herbel, P.E.
Federal-aid Engineer

RE: Phase I(R) – Pavement Rehabilitation Report

I have completed my review of the attached Phase I(R) – Pavement Rehabilitation Report, dated February 26, 2020. The materials consultant, Terracon, has submitted the report for approval. The final report is submitted for your review with a recommendation for approval.

Reviewed & Recommended by:

Federal-aid Engineer

02-27-2020

Date

Approved by:

Muhammad Zubery, P.E., Materials Engineer

2/27/2020

Date

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Phase I(R) Pavement Rehabilitation Report

N 10th Avenue ITS & Overlay, Caldwell
Project No. A013(905), Key No. 13905
Caldwell, Idaho

February 26, 2020
Terracon Project No. 62195037

Prepared for:

Six Mile Engineering, PA
Meridian, Idaho

Prepared by:

Terracon Consultants, Inc.
Boise, Idaho

terracon.com

Terracon

Environmental



Facilities



Geotechnical



Materials

February 26, 2020

Six Mile Engineering, PA
704 E. United Heritage Court, Suite 204
Meridian, Idaho 83642

Terracon

Attn: Mr. Jeff Jones, P.E.
P: (208) 378-0654
E: jeff.jones@sixmile.com

RE: Phase I(R) Pavement Rehabilitation Report
N 10th Avenue ITS & Overlay, Caldwell
Project No. A013(905), Key No. 13905
Caldwell, Idaho
Terracon Project No. 62195037

Dear Mr. Jones:

In accordance with our agreement dated December 6, 2019, we have prepared the Phase I(R) Pavement Rehabilitation Report for the referenced project. The accompanying report presents findings of the subsurface exploration and recommendations concerning pavement rehabilitation for this project. This report was prepared in general accordance with the ITD *Materials Manual* guidelines for a Phase I(R) Report. Based on email correspondence dated February 24, 2020, we understand the Local Highway Technical Assistance Council (LHTAC) did not have any comments on the draft report dated January 24, 2020.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further assistance to you in any way, we are available at your convenience.

Sincerely,
Terracon Consultants, Inc.



Kevin C. Hoagland, P.E.
Senior Engineer

A handwritten signature in blue ink that reads "Ryan J. Olsen".

Ryan J. Olsen, P.E.
Geotechnical Department Manager

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TERRACON
PHASE I(R) PAVEMENT REHABILITATION REPORT
N 10TH AVENUE ITS & OVERLAY, CALDWELL
PROJECT NO. A013(905), KEY NO. 13905
CALDWELL, IDAHO

Terracon Project No. 62195037
February 26, 2020

225.0 PHASE I(R) REPORT

225.01 INTRODUCTION

The project consists of resurfacing and rehabilitation of the existing pavement on 10th Avenue, in downtown Caldwell. Additionally, the project includes infrastructure for future signalization, roadway lighting, pedestrian safety and drainage improvements. The project begins on the northeast side of the railroad overpass (Albany Street) and ends on the north side of the westbound I-84 ramps (Kimball Avenue). The existing roadway consist of an asphaltic concrete paved, 4-lane urban arterial roadway with partial middle turn lanes. The project is approximately ½ mile in length. A Site Location Map depicting the project area is included in Appendix A. The roadway is located in an urban environment with adjacent sidewalks, curb-and-gutter, driveways for commercial businesses, and stormwater drainage system with drop inlets within the curb line.

225.02 EVALUATION

225.02.1 Geologic Constraints

225.02.1.1 Seismic Risk

This project does not include new or rehabilitated structures. There does not appear to be any geologic constraints with respect to seismic risks, faults, or settlement associated with pavement resurfacing and rehabilitation.

225.02.1.2 Water

Groundwater was not encountered in the borings at the time they were drilled for this project. Fluctuations of the groundwater level may occur due to variations in rainfall, runoff, irrigation, and other factors not evident at the time of exploration. The evaluation of these factors is beyond the scope of this report.

225.02.1.3 Settlement and Embankment Foundation

The project will follow the existing alignment and grade with some potential minor grade changes to correct drainage flows. Settlement associated with pavement resurfacing and rehabilitation is not anticipated.

225.02.1.4 Highway Construction Materials

Aggregates for hot mix asphalt pavement (HMA), aggregate base and subbase will be supplied from approved contractor furnished sources.

225.02.2 Vicinity Sketch

The Site Location Map is included in Appendix A.

225.02.3 Soil Profile / Pavement Condition Survey

A Soils Profile was not prepared for this project because the existing alignment and grade will generally be maintained. Terracon performed a visual pavement condition survey of the roadway. Project photographs and a table summarizing our observations are included in Appendix A as Exhibits A-10 through A-26. In general, pavement in the project area exhibited moderate to severe distresses. The observed distresses consisted of transverse and longitudinal cracks, edge cracking, block, alligator cracking, minor rutting, and some distress from poor drainage. Pavement distress appeared to be the most severe near the ITD I-84 ramp locations, where pavement sensors have been installed, and adjacent to storm water inlets.

225.02.3.1 Conventional Subsurface Exploration Methods

Information regarding subsurface soil conditions was obtained from soil borings drilled within the roadway. The Exploration Plan, boring logs, and the Field Explorations Description are included in Appendix A. We conducted five borings for the roadway. Borings were drilled to a depth of about 6½ feet below ground surface. An asphalt core was obtained at each boring location. HMA core thickness was measured to the nearest ⅛ inch. Photographs of the cores are included in Appendix A.

In general, the existing asphalt concrete pavement in the cores varied in thickness between about 3½ to 6⅞ inches. Underlying the asphaltic concrete pavement was fill material generally composed of poorly graded gravel with silt and sand that extended to about 2 to 2½ feet. Deeper fill was encountered in boring B-4 with poorly graded gravel underlain by interbedded sandy silt, gravel and sand layers to a depth of about 5 feet. Native subgrade in the borings completed on the southern end of the project (borings B-1 through B-3) consisted of silty sand to silt with variable sand content. The borings completed in the northern portion (B-4 and B-5) of the project encountered variable native material underlying the fill consisting of sandy lean clay with gravel, silty clayey sand and lean clay with sand. Native soils varied from loose to dense for granular soils and soft to medium stiff for fine grained soils.

225.02.3.2 Ground Penetrating Radar (GPR)

Terracon performed a ground penetrating radar (GPR) survey within each travel lane. Information from the surveys was used to supplement the layer thickness information obtained from project cores and borings. GPR procedures, limitation, and results are provided in Appendix C.

225.02.4 Laboratory Testing

Results of the laboratory tests performed on samples obtained from borings are provided on the boring logs in Appendix A and exhibits in Appendix B.

225.02.5 Borrow and Aggregate Source Plats

Borrow and aggregate source plats were not prepared because off-site material will be supplied from approved contractor furnished sources.

225.02.6 Soil Report Summary

A Soil Report Summary was not prepared for this pavement reconstruction/rehabilitation project.

225.02.7 Total Design Pavement Thickness

Analyses of flexible pavement sections (reconstruction and rehabilitation) are presented in Section 225.03.

225.02.8 Sub-Subgrading

Sub-subgrading is not anticipated for this pavement rehabilitation project.

225.02.9 Other Products or Procedures

If the mill and inlay option is selected, the owner may elect to utilize a high strength pavement reinforcement geosynthetic (HSPRG) on the rehabilitation segments in paved areas experiencing significant cracking. The extent of wide cracks observed in the existing HMA varied across the project and some cracks may be observed to be worse once milling operations have been completed. Estimating the extent this product would be required may not be fully evident until during construction. The use of this type of geosynthetic will require an HMA leveling course on the milled surface prior to installing the geosynthetic. Modifications to existing specifications or new specifications will need to be included in the Phase V Special Provision Report for use of this product, and the geosynthetic should be installed in accordance with the manufacturer's recommendation. Other additional products or procedures are not anticipated for rehabilitation of the roadway.

225.02.10 Compaction

HMA materials should be compacted in accordance with ITD specifications. Compaction associated with soft spot repair, new utility trenches (if required) and all other compaction should be Class A unless otherwise specified.

225.02.11 Surface and Subsurface Water

Paved areas should be sloped to provide rapid drainage of surface water away from the pavement surface and edges. Where water is allowed to pond on the pavement, subgrade soils can become saturated and soften, and subsequently accelerate pavement deterioration.

225.02.12 Drainage

Drainage improvements may be included as part of this project. These improvements will be identified by others. Surface runoff should be channeled to existing storm drainage features or collected and diverted to reduce the potential of subgrade saturation. It should be noted that pavement distress was noted near existing drainage features (storm inlets). Project plans should include mitigating poor drainage areas and performing repair of distressed pavement in these areas.

225.02.13 Structures

The project does not include new or rehabilitated structures.

225.02.14 Existing Roadway Material

If the existing asphalt pavement will be reused as RAP in the new HMA, it should meet the requirements of the current ITD Standard Specifications for Highway Construction.

225.02.15 Dust Abatement

Dust abatement will not be a separate bid item for mill and inlay rehabilitation option, as this is considered incidental to that task. Dust abatement will be required for removal and replacement of the existing asphaltic concrete pavement rehabilitation and/or full depth pavement reconstruction. It is estimated that for the removal and replacement of the existing asphalt that 235 MG of water would be required for dust abatement and for full depth pavement reconstruction 470 MG would be required for dust abatement. Calculations are included in Appendix C.

225.03 ANALYSIS

225.03.1 General

Information used to evaluate the roadway segments addressed in this report was based on our visual pavement condition survey, subsurface exploration, GPR survey, laboratory testing, traffic information from ITD, and our understanding of the project. Traffic and pavement design analysis are provided in the following sections. Materials-based Life Cycle Cost Analyses (LCCA) were performed to compare construction alternatives and are discussed below in Section 225.04.2.

Traffic Information

ITD provided projected traffic counts for the segment including flexible ESAL projections. Based on values provided by ITD, the estimated growth was approximately 3.7% for commercial traffic. A directional split and lane factor for the roadway were assumed to be 0.6 and 1.0, respectively. Using the ITD projected ESALs and the directional and lane distribution discussed above resulted in 10-year flexible design ESALs of about 434,000 and a 20-year flexible design ESALs of about 1,000,000. The Traffic Index for the 20-year flexible ESALs converts to a TI of 9.0. The 10-year flexible ESALs was utilized for mill and inlay rehabilitation alternatives and the 20-year flexible ESALs was used for evaluation of the remove and replacement of the existing asphaltic concrete alternative. The TI of 9.0 was utilized for development of full depth reconstruction alternative and development of a soft spot repair section. The provided traffic information and our determination of design lane ESALs are in Appendix C.

Rehabilitation Alternatives

Milling to remove the surface irregularities and distresses followed by an inlay or inlay/overlay is considered a viable option for pavement restoration. Due to the amount of distress noted, a 2-inch mill depth was used in our analyses. Repair of distressed and failed areas will be required prior to placing the inlay. We estimate by visual inspection that approximately 15% to 20% of the project area may require failed area repair prior to completing the mill and overlay work.

Removal and replacement of the existing asphalt concrete section is also considered a viable option for pavement restoration. Any loose or saturated existing granular materials would need to be removed and replaced with Untreated Aggregate Base prior to placing new asphaltic concrete section

Cement Recycled Asphalt Base Section (CRABS) or Recycled Asphalt Base Section (RABS) were not considered viable alternatives due to the following:

- Difficulties with matching existing grades and slopes with the existing concrete curbs and gutters within the area because of the grade raise associated with CRABS and RABS.
- Anticipated limited work areas and lane restrictions due to urban intersection areas and maintaining business access would make construction phasing difficult.

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February 26, 2020 ■ Terracon Project No. 62195037



The project was divided into two roadway segments for evaluation of the two rehabilitation alternatives discussed above based on the variable thickness of the existing pavement. The design values used for the two segments are as follows.

Road Segment	Design Existing Asphaltic Concrete Pavement Thickness	Design Existing Granular Base/Subbase Thickness	Design R-value (resilient modulus)
10th Avenue, Albany St to Freeport St ¹	5 inches	18 inches	20 (4.1 ksi)
10th Avenue, Freeport St to Kimball Ave ¹	3½ inches	20 inches	20 (4.1 ksi)

¹ Values provided consist of anticipated lower average bounds for thickness of existing HMA and granular material as well as anticipated lower subgrade design support value.

225.03.2 Pavement Reconstruction and Rehabilitation Analyses

Conventional Flexible Pavement

A conventional flexible pavement section was evaluated for the roadway for cost comparison to the rehabilitation alternatives using ITD procedures and a TI of 9.0. The flexible pavement section is presented in the following table. A worksheet for the flexible pavement design is presented in Appendix C.

Conventional Flexible Pavement Sections for Reconstruction						
Road Segment	Subgrade R-Value ¹	Design Thickness (feet)				Design Gravel Equivalency
		HMA ½ inch SP-3	¾ inch Untreated Aggregate Base (Type-B)	Granular Subbase	Total	
10 th Avenue	20	0.32 (3.8 in)	0.60 (7.2 in)	1.35 (16.2 in)	2.27 (27.2 in)	2.32

¹ Value based on reduction of R-value test value based on potential variability in soil types and moisture sensitivity of soil.

A Type III subgrade separation geotextile should be installed on top of the properly prepared subgrade prior to placement of the pavement section.

Flexible Pavement Mill & Inlay/Overlay

WINFLEX 2006 software was used to calculate the HMA thickness requirements for the mill and inlay/overlay analyses. This program is a mechanistic-empirical overlay design program for flexible pavement. It was developed by the Center of Transportation Infrastructure and National Institute for Advanced Transportation Technology at the University of Idaho. Standard inputs used in the analysis include typical ITD Poisson's ratio values for the existing materials and a modulus of 400 ksi for new asphalt pavement, as shown in Table 530.08-3 in Section 530 of the ITD Materials Manual. The table below summarizes the results of the mill and inlay analyses. The roadway was divided into two segments based on the thickness of the existing asphalt concrete surfacing present based on core thickness and GPR measurements. The 10-year design lane ESALs of 434,000 was used in the analyses. The WINFLEX 2006 analysis worksheets are included in Appendix C.

Summary of WINFLEX 2006: Mill & Inlay/Overlay Analysis			
Road Segment	Thickness (feet)		
	Mill Depth	HMA Inlay/Overlay Thickness	Vertical Grade Raise
10th Avenue, Albany St to Freeport St	0.17 (2.0 in)	0.17 (2.0 in)	0
10th Avenue, Freeport St to Kimball Ave	0.17 (2.0 in)	0.21 (2.5 in)	0.04 (0.5 in)

Replacement of Existing Asphalt Pavement

WINFLEX 2006 software was also used to calculate the HMA thickness requirements for removal and replacement of the existing asphaltic concrete pavement as described above. The table below summarizes the results of the analyses. The roadway was divided into two segments based on the thickness of the existing asphalt concrete surfacing present based on core thickness and GPR measurements. The 20-year design lane ESALs of 1,000,000 was used in the analyses. The WINFLEX 2006 analysis worksheets are included in Appendix C.

Summary of WINFLEX 2006: Remove and Replace Asphaltic Concrete		
Road Segment	Thickness (feet)	
	Existing Asphalt Thickness Average	New HMA Thickness
10th Avenue, Albany St to Freeport St ¹	0.42 (5.0 in)	0.42 (5.0 in)
10th Avenue, Freeport St to Kimball Ave ²	0.33 (4.0 in)	0.42 (5.0 in)

¹ The existing asphalt thickness varies between about 4 to 6½ inches based on the GPR data. Following removal of the existing asphalt and underlying material, additional new aggregate base may be required to adjust the grade prior to placement of the new HMA thickness.

² The existing asphalt thickness varies between about 2½ and 6 inches based on the GPR data. Removal of approximately 1½ inches or more of the existing base will be required at some locations. Following removal of the existing asphalt and underlying material, additional new aggregate base or reuse of existing base may be required to adjust the grade prior to placement of the new HMA thickness.

225.04 ALTERNATIVES

225.04.1 General

Flexible pavement reconstruction and rehabilitation alternatives are presented above in Section 225.03.2.

225.04.2 Life Cycle Cost Analyses

Life Cycle Cost Analyses (LCCA) were completed for the selected reconstruction and rehabilitation alternatives. The LCCA results are summarized for each alternative and segment in the tables below. The LCCA timeline and summary worksheets are provided in Appendix C.

Phase I(R) Pavement Rehabilitation Report

N 10th Avenue ITS & Overlay, Caldwell ■ Caldwell, Idaho

February 26, 2020 ■ Terracon Project No. 62195037

**LCCA Summary Tables**

LCCA: N 10th Avenue, Albany St to Freeport St			
Type of Cost Comparison	Flexible Pavement Reconstruction 4-Layer [TI=9.0]	Remove and Replace Existing Asphaltic Concrete [1,000,000 ESALs]	Mill 0.17 ft & Inlay 0.17 ft [434,000 ESALs]
Design Life	20 years	20 years	10 years
Initial Cost	\$395,300	\$226,300	\$121,000
Total 36 Year Life Cycle Cost	\$719,900	\$555,900	\$491,813
Equivalent Uniform Annual Cost (EUAC)	\$29,100	\$20,200	\$20,200
Total Net Present Worth at 4% Interest	\$550,100	\$381,900	\$307,900

The LCCA indicates that the reconstruction alternative for the Albany Street to Freeport Street segment of N 10th Avenue has higher initial, total 36-year life cycle, and equivalent uniform annual costs than those associated with rehabilitation. The mill and inlay rehabilitation alternative has slightly lower initial and total 36-year life cycle costs than the remove and replace alternative; however, the EUAC for both rehabilitation alternatives are equivalent.

LCCA: N 10th Avenue, Freeport St to Kimball Avenue			
Type of Cost Comparison	Flexible Pavement Reconstruction 4-Layer [TI=9.0]	Remove and Replace Existing Asphaltic Concrete [1,000, 000 ESALs]	Mill 0.17 ft & Inlay/Overlay 0.21 ft [434,000 ESALs]
Design Life	20 years	20 years	10 years
Initial Cost	\$325,600	\$184,200	\$115,400
Total 36 Year Life Cycle Cost	\$602,100	\$460,700	\$429,276
Equivalent Uniform Annual Cost (EUAC)	\$24,400	\$16,900	\$17,700
Total Net Present Worth at 4% Interest	\$461,200	\$319,500	\$269,800

The LCCA indicates that the reconstruction alternative for the Freeport Street to Kimball Avenue segment of N 10th Avenue has higher initial, total 36-year life cycle and equivalent uniform annual costs than those associated with rehabilitation. The mill and inlay rehabilitation alternative has slightly lower initial and total 36-year life cycle costs than the remove and replace alternative; however, the EUAC for the remove and replace alternative is lower than the mill and inlay alternative.

225.05 CONCLUSIONS AND RECOMMENDATIONS

225.05.1 Pavement Rehabilitation Recommendations

The LCCA indicates lower costs associated with rehabilitation for the two segments of N 10th Avenue evaluated for this project. Although the mill and inlay rehabilitation alternative has slightly lower initial costs, the EUAC for the remove and replace alternative is the same for the Albany Street to Freeport Street segment and lower for the Freeport Street to Kimball Avenue segment. Advantages associated with the remove and replace alternative compared to the mill and inlay for this project include:

- A 20-year design life vs a 10-year design life.
- Eliminates the need to repair the failed asphalt areas prior to mill and overlay.
- Completely removing the existing distressed asphalt removes the potential for crack propagation in the inlay.
- Reduced maintenance costs.
- Ability to correct pavement drainage issues or cross-slope issues.
- Smoother ride quality and ability to match existing grades.

Based on these advantages, complete removal of the existing asphalt and replacement with 0.42 feet (5.0 inches) of new HMA is recommended for these segments of N 10th Street.

The existing asphalt surfacing should be removed, and the grade of the underlying materials adjusted to accommodate placement of the new asphalt surfacing. In areas where the thickness of the existing asphalt surfacing exceeds the thickness of the new asphalt surfacing, additional aggregate base course should be added to the roadway to achieve the required base course elevation prior to paving. In areas where the thickness of the existing asphalt surfacing is less than the thickness of the new asphalt surfacing, some of the existing granular base will need to be removed to achieve the required base course elevation. These granular materials may be used in areas requiring additional base. Some new aggregate base may be required. Pavement sensors and ITS devices within the pavement should be reset and/or replaced prior to placing new asphalt pavement. The HMA should be placed in two approximately equal thickness lifts.

The use of track mounted construction equipment is recommended for removal of the existing asphalt surfacing to help reduce the potential for disturbance of the underlying granular fill and subgrade soils. Construction activities should be closely monitored for the potential development of rutting and pumping of the existing base. When identified, construction activities should be stopped, and the area investigated and repaired.

Care should be taken to avoid repetitive loading and traffic on the exposed granular fill and aggregate base prior to placement of the new pavement. Dump and spread placement techniques

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February 26, 2020 ■ Terracon Project No. 62195037



and the use of track mounted equipment should be used when placing granular pavement section materials. Construction during dry weather would also be beneficial.

Soils that rut, pump, or are otherwise disturbed are not suitable for support of pavements. If unstable soils are encountered, the contractor should remove a minimum of 18 inches of existing material and replace them with compacted $\frac{3}{4}$ -inch crushed aggregate base. The actual depth of over-excavation should be determined by the contractor based on the specific depth of unstable soils.

225.05.2 Repair of Failed Areas

If the mill and inlay alternatives are ultimately selected for rehabilitation, areas of localized failure such as alligator cracking, closely spaced block cracking, fatigue failure in the wheel paths, and any potholes should be repaired prior to placement of the inlay. Repairs should consist of removal of the distressed pavement section (HMA, base, subbase) and underlying soils to the depth needed to accommodate the thicknesses of new Untreated Aggregate Base and HMA shown in the table below.

Failed Area Repair		
Design Thickness (feet)		
Minimum HMA $\frac{1}{2}$ inch, SP-3	Minimum $\frac{3}{4}$ inch Untreated Aggregate Base (Type-B)	Total
0.42 (5.0 in)	1.50 (18.0 in)	1.92 (23.0 in)

The HMA should be placed in two equal lifts. Based on our field exploration, the subgrade soils encountered in the areas requiring repair may be moist and susceptible to rutting and pumping when subjected to heavy construction equipment. Rubber tired construction equipment should not be allowed to operate on these soils when exposed. Dump and spread placement techniques and the use of track mounted equipment should be used when placing granular pavement section materials. A Type III subgrade separation geotextile should be installed at the bottom of the excavation prior to placement of aggregate base material.

225.06 REFERENCES

Idaho Transportation Department, *Materials Manual*, February 2019.

Idaho Transportation Department, *Standard Specifications for Highway Construction*, April 2018.

Phase I(R) Pavement Rehabilitation Report

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Idaho Transportation Department, *2019 Supplemental Specifications for the Standard Specifications for Highway Construction*, June 2019.

ASTM D6432 Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation, 2011

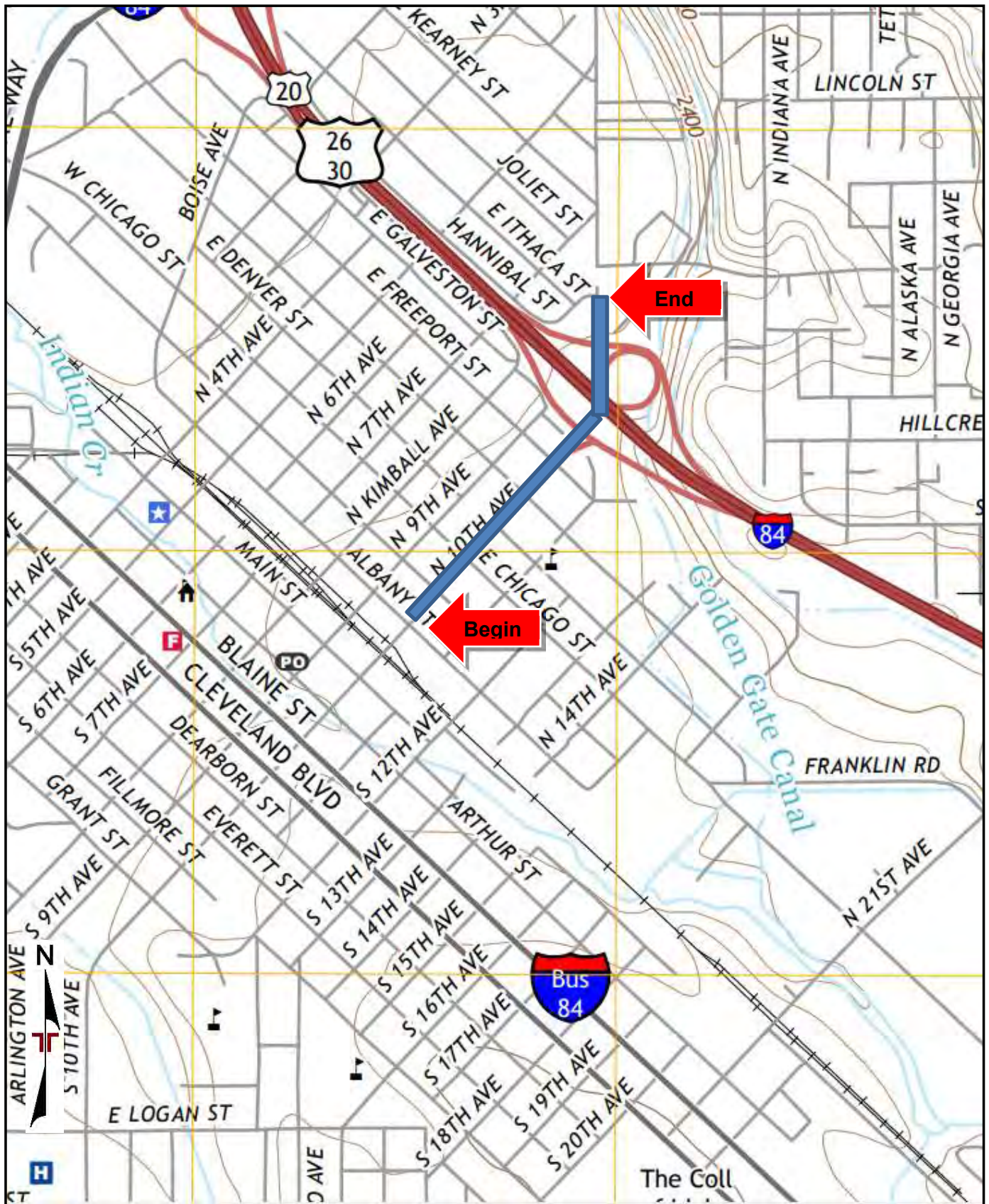
GENERAL COMMENTS

The analysis and recommendations presented in this report are based upon the data obtained from the explorations performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between explorations, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of Six Mile Engineering, PA and the City of Caldwell, and LHTAC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
 QUADRANGLES INCLUDE: CALDWELL, ID (2017).

Project Manager: GAB	Project No. 62195037	 11849 W Executive Dr, Ste G Boise, ID 83713-1944	SITE LOCATION N 10TH AVENUE ITS & OVERLAY Albany Street to Kimball Street Caldwell, ID	Exhibit A-1
Drawn by: AMS	Scale: 1"=2,000'			
Checked by: GAB	File Name: Figures			
Approved by: KCH	Date: 1/8/2020			



Project Manager: GAB Drawn by: AMS Checked by: GAB Approved by: KCH		Project No. 62195037 Scale: AS SHOWN File Name: Figures Date: 1/8/2020		Terracon 11849 W Executive Dr, Ste G Boise, ID 83713-1944		EXPLORATION PLAN N 10TH AVENUE ITS & OVERLAY Albany Street to Kimball Avenue Caldwell, ID		Exhibit A-2
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BORING LOG NO. B-1

Page 1 of 1

PROJECT: N 10th Avenue ITS & Overlay

CLIENT: Six Mile Engineering
Meridian, ID

SITE: N 10th Avenue
Caldwell, ID

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 43.6669° Longitude: -116.6824°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (Ft.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
								LL-PL-PI	
DEPTH									
0.4	ASPHALT , asphalt about 5 1/2" thick				0.4				
	FILL - POORLY GRADED GRAVEL WITH SILT AND SAND , light brown				1.3	25-21-11 N=32			
2.0	SANDY SILT (ML) , brown, medium stiff								
					1.3	2-3-3 N=6	19		50
		5							
					1.5	4-3-4 N=7			
6.5	Boring Terminated at 6.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow stem auger

See Exhibit A-8 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:

Abandonment Method:
Borings backfilled with auger cuttings and asphalt patch.

See Appendix D for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
11849 W Executive Dr, Ste G
Boise, ID

Boring Started: 12-17-2019

Boring Completed: 12-17-2019

Drill Rig: CME 75

Driller: Haz-Tech Drilling, Inc.

Project No.: 62195037

Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 62195037 N 10TH AVENUE ITS GPJ TERRACON DATATEMPLATE GDT 1/10/20

BORING LOG NO. B-2

Page 1 of 1

PROJECT: N 10th Avenue ITS & Overlay

CLIENT: Six Mile Engineering
Meridian, ID

SITE: N 10th Avenue
Caldwell, ID

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 43.6679° Longitude: -116.6813°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (Ft.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
								LL-PL-PI	
	DEPTH								
	ASPHALT , asphalt about 6" thick				0.5				
	0.5								
	FILL - POORLY GRADED GRAVEL WITH SILT AND SAND , light brown				1.3	26-31-17 N=48			
	2.5								
	SILTY SAND (SM) , brown, medium dense				1.4	4-6-4 N=10	14		38
	5.0								
	SILT WITH SAND (ML) , brown, medium stiff				1.4	5-4-3 N=7			
	6.5								
	Boring Terminated at 6.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
12/17/2019

Abandonment Method:
Borings backfilled with auger cuttings and asphalt patch.

See Exhibit A-8 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
11849 W Executive Dr, Ste G
Boise, ID

Boring Started: 12-17-2019

Drill Rig: CME 75

Project No.: 62195037

Boring Completed: 12-17-2019

Driller: Haz-Tech Drilling, Inc.

Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 62195037 N 10TH AVENUE ITS GPJ TERRACON DATATEMPLATE.GDT 1/10/20

BORING LOG NO. B-3

Page 1 of 1

PROJECT: N 10th Avenue ITS & Overlay

CLIENT: Six Mile Engineering
Meridian, ID

SITE: N 10th Avenue
Caldwell, ID

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 43.6691° Longitude: -116.6796°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (Ft.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
								LL-PL-PI	
	DEPTH								
	ASPHALT , asphalt about 6" thick				0.5				
	0.5								
	FILL - POORLY GRADED GRAVEL WITH SILT AND SAND , light brown				1.4	20-26-10 N=36			
	2.0								
	SILTY SAND (SM) , brown, loose				1.2	6-4-3 N=7	18	27-23-4	38
	5.0								
	SILT (ML) , trace sand, light brown, medium stiff	5			1.5	4-3-3 N=6			
	6.5								
	Boring Terminated at 6.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
12/17/2019

Abandonment Method:
Borings backfilled with auger cuttings and asphalt patch.

See Exhibit A-8 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
11849 W Executive Dr, Ste G
Boise, ID

Boring Started: 12-17-2019

Drill Rig: CME 75

Project No.: 62195037

Boring Completed: 12-17-2019

Driller: Haz-Tech Drilling, Inc.

Exhibit: A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 62195037 N 10TH AVENUE ITS GPJ TERRACON DATATEMPLATE.GDT 1/10/20

BORING LOG NO. B-4

Page 1 of 1

PROJECT: N 10th Avenue ITS & Overlay

CLIENT: Six Mile Engineering
Meridian, ID

SITE: N 10th Avenue
Caldwell, ID

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 43.6703° Longitude: -116.6784°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (Ft.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
								LL-PL-PI	
DEPTH									
0.3	ASPHALT , asphalt about 3 3/4" thick				0.3				
	FILL - POORLY GRADED GRAVEL WITH SILT AND SAND , light brown				1.5	26-26-19 N=45			
2.0	FILL - SANDY SILT WITH GRAVEL , brown, light brown and white, multiple layers of gravel, sand, and silt				1.4	15-15-9 N=24	9		
5.0	SANDY LEAN CLAY WITH GRAVEL (CL) , light brown and gray, soft	5			0.3	0-1-2 N=3			
6.5	Boring Terminated at 6.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
12/17/2019

Abandonment Method:
Borings backfilled with auger cuttings and asphalt patch.

See Exhibit A-8 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
11849 W Executive Dr, Ste G
Boise, ID

Boring Started: 12-17-2019

Drill Rig: CME 75

Project No.: 62195037

Boring Completed: 12-17-2019

Driller: Haz-Tech Drilling, Inc.

Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 62195037 N 10TH AVENUE ITS GPJ TERRACON DATATEMPLATE GDT 1/10/20

BORING LOG NO. B-5

Page 1 of 1

PROJECT: N 10th Avenue ITS & Overlay

CLIENT: Six Mile Engineering
Meridian, ID

SITE: N 10th Avenue
Caldwell, ID

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 43.6723° Longitude: -116.6781°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (Ft.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
								LL-PL-PI	
	DEPTH								
	0.3				0.3				
	ASPHALT , asphalt about 3 3/4" thick								
	FILL - POORLY GRADED GRAVEL WITH SILT AND SAND , light brown				1.3	22-27-26 N=53			
	2.5								
	SILTY CLAYEY SAND (SC-SM) , trace gravel, brown, dense				1.5	13-17-15 N=32			
	4.0								
	LEAN CLAY WITH SAND (CL) , black, soft								
		5							
					1.5	2-2-2 N=4	32	32-21-11	74
	6.5								
	Boring Terminated at 6.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
12/17/2019

Abandonment Method:
Borings backfilled with auger cuttings and asphalt patch.

See Exhibit A-8 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
11849 W Executive Dr, Ste G
Boise, ID

Boring Started: 12-17-2019

Drill Rig: CME 75

Project No.: 62195037

Boring Completed: 12-17-2019

Driller: Haz-Tech Drilling, Inc.

Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 62195037 N 10TH AVENUE ITS GPJ TERRACON DATATEMPLATE.GDT 1/10/20

Field Exploration Description

A Terracon field engineer or geologist recorded logs of the borings during the exploration operations. Boring logs are presented in this appendix. General Notes for interpretation of the boring logs, a summary of the Unified Soil Classification System (USCS) are presented in Appendix D.

Borings were drilled to a depth of about 6½ feet below the existing ground surface with a truck-mounted drill rig equipped with continuous-flight hollow-stem augers to advance the borings. The boring locations were chosen by Terracon based on the roadway segments as well as existing utility considerations. Terracon located the borings in the field by visually sighting from existing site features and using a handheld GPS device having an accuracy typically within 20 feet. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them. If elevation or more exact location information is needed, the boring locations should be surveyed.

Disturbed soil samples were obtained at various depths in the borings using a 2-inch-outside-diameter split-spoon sampler driven in general accordance with the Standard Penetration Test (SPT). The result of the SPT is an N-value. The N-value is the number of blows from a 140-pound hammer falling from a height of 30 inches that are required to drive the split-spoon sampler the last 12 inches of an 18-inch interval (or the distance indicated). N-values are shown on the boring logs. Also, bulk soil samples were obtained from auger cuttings.

The N-value provides a reasonable estimate of the relative in-place density of non-cemented sandy type materials. However, the N-value only provides an indication of the relative stiffness of cohesive materials, since the penetration resistance of these soils may be affected by the moisture content. Considerable care must be exercised in interpreting the N-value in gravelly soils, particularly where the size of the gravel particles exceeds the inside diameter of the sampling spoon.

An automatic SPT hammer was used to advance the split-spoon sampler in the borings performed on this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT values and soil properties are based on the cathead and rope method. The higher efficiency of the automatic hammer affects the standard penetration resistance blow count (N-value) by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Asphalt Core Photos

N 10th Ave ITS & Overlay, Caldwell ■ Caldwell, Idaho

ITD Project No. A013(905)

Photos taken on January 3, 2020 ■ Terracon Project No. 62195030



Core ID:	B-1	B-2	B-3
Approximate Location:	8 ft W of curb in outside NB lane, 6 ft S of AutoZone Entrance	19 ft. E of curb in inside SB lane, 33 ft S of BiMart sign	22 ft. W of curb in inside NB Lane, 8 ft N of Fastrack Wash Exit
Total Thickness (inches) ¹ :	4 $\frac{7}{8}$	6 $\frac{1}{8}$	5 $\frac{1}{2}$

¹ Measurements are to the nearest $\frac{1}{8}$ of an inch.



Core ID:	B-4	B-5
Approximate Location:	5 $\frac{1}{2}$ ft E of curb, in outside SB Lane, 60 feet north of stop line at I-84 EB ramps intersection	33 ft. E of curb, in median, 62 $\frac{1}{2}$ ft north of stop line at I-84 WB ramps intersection
Total Thickness (inches) ¹ :	3 $\frac{3}{8}$	3 $\frac{1}{2}$

¹ Measurements are to the nearest $\frac{1}{8}$ of an inch.

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave, north bound lanes from Main St to E Belmont St, transverse and longitudinal cracking



N 10th Ave, north bound lanes from Main St to E Belmont St, transverse and longitudinal cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave, SW corner of intersection with E Belmont St, transverse, longitudinal, and block cracking



N 10th Ave, SE corner of intersection with E Belmont St, transverse, block, and alligator cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037



N 10th Ave, south bound lanes in intersection with E Belmont St, longitudinal and transverse cracking



N 10th Ave, NE corner of intersection with E Belmont St, transverse and alligator cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave, north bound lanes from E Belmont St to E Chicago St, transverse, longitudinal, and alligator cracking, with edge failure



N 10th Ave, northbound lanes from E Belmont St to E Chicago St, transverse and alligator cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037



N 10th Ave, southbound lanes from E Belmont St to E Chicago St, transverse, longitudinal, and block cracking



N 10th Ave, SW corner of intersection with E Chicago St, longitudinal, block, and alligator cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave, SE corner of intersection with E Chicago St, ponding on surface



N 10th Ave, from E Chicago St to E Denver St, transverse, longitudinal, block, and alligator cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave, south bound lanes of intersection with E Denver St, ponding on surface



N 10th Ave, from E Denver St to E Elgin St, extensive edge failure

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037



N 10th Ave, from E Denver St to E Elgin St, extensive edge failure



N 10th Ave, south bound lanes from E Denver St to E Elgin St, transverse and longitudinal cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave, south bound lanes from E Denver St to E Elgin St, transverse and longitudinal cracking



N 10th Ave, south bound lanes from Freeport to east bound I-84 exit ramp, transverse and longitudinal cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037



N 10th Ave, SW corner of intersection with east bound I-84 exit ramp, transverse and longitudinal cracking



N 10th Ave, from east bound I-84 entrance/exit ramps to I-84 overpass, transverse crack extending across all 5 lanes

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave, north bound lanes from east bound I-84 entrance/exit ramps to I-84 overpass, transverse cracking



N 10th Ave, south bound lanes from east bound I-84 entrance/exit ramps to I-84 overpass, transverse and longitudinal cracking with utility patches

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave, south bound lanes from I-84 overpass to west bound I-84 entrance/exit ramps, longitudinal cracking and soft spots surrounding storm drain



N 10th Ave, north bound lane from I-84 overpass to west bound I-84 entrance ramp, transverse, longitudinal, and alligator cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



**N 10th Ave, south bound lanes from I-84 overpass to west bound I-84 entrance ramp,
transverse and longitudinal cracking**



**N 10th Ave, north bound lanes from I-84 overpass to west bound I-84 entrance/exit ramps,
transverse and longitudinal cracking**

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037



N 10th Ave, north bound lanes from I-84 overpass to west bound I-84 entrance/exit ramps, transverse and longitudinal cracking with utility patching



N 10th Ave, intersection with west bound I-84 entrance/exit ramps, transverse and longitudinal cracking from utility

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave (N Illinois Ave), SE corner/crosswalk of intersection with west bound I-84 exit ramp, longitudinal, transverse, and alligator cracking



N 10th Ave (N Illinois Ave), NE corner of intersection with west bound I-84 entrance/exit ramps, transverse and longitudinal cracking

10th Avenue ITS and Overlay

Core Photo Log ■ Caldwell, Idaho

Photos Taken on: 12/09/2019 ■ Terracon Project No. 62195037

Terracon



N 10th Ave (N Illinois Ave), south bound lanes from west bound I-84 entrance/exit ramps to W Kimball Ave, longitudinal and transverse cracking



N 10th Ave (N Illinois Ave), north bound lanes from west bound I-84 entrance/exit ramps to W Kimball Ave, transverse and alligator cracking

Phase I(R) Pavement Rehabilitation Report

N 10th Avenue ITS & Overlay, Caldwell ■ Caldwell, Idaho
Terracon Project No. 62195037



Roadway Features and Pavement Condition Survey Summary

Road Segment	Approximate Elevation (ft) ¹	Number of Lanes and Other Features
Albany Street to Belmont Street	2,376 ft to 2,360 ft	The existing roadway is four lanes with no center turn lane. Roadway is on existing embankment for bridge crossing over Albany Street, UPRR, and Main Street. Curb, gutter, and sidewalks are on each side of the roadway and drainage flow is to the northeast. Moderate distress noted in alligator and some transverse cracking. Greater distress was observed in southbound lanes than northbound. More severe cracking was noted near storm drainage inlets indicating probable ponding issues.
Belmont Street to Chicago Street	2,360 ft to 2,359 ft	The existing roadway is four lanes with dedicated left turn/center lane at the intersection of Chicago Street. Curb, gutter, and sidewalks are on both sides of the roadway with driveway entrances to various business on either side. The roadway has moderate distress mainly consisting of alligator, transverse, edge, and longitudinal cracking. Generally, the most severe cracking is in the northbound inside lane and near storm drainage inlets.
Chicago Street to Elgin Street	2,359 ft to 2,358 ft	The existing roadway is four lanes with a dedicated left turn/center lane and left turn lane at Elgin Street and Chicago Street. Curb, gutter, and sidewalks are on both sides of the roadway with driveway entrances to various business on either side. The roadway has moderate to severe distress mainly consisting of alligator, transverse, edge and longitudinal cracking. Generally, the most severe cracking in northbound lanes.
Elgin Street to Freeport Street	2,358 ft	The existing roadway is four lanes with a dedicated left turn/center lane and left turn lane at Elgin. Curb, gutter, and sidewalks are on both sides of the roadway with driveway entrances to various business on either side. Roadway has moderate distress mainly consisting of alligator, transverse, and longitudinal cracking.
Freeport Street to I-84 EB Ramps	2,358 ft	The existing roadway is four lanes with wide center lane not for use except as left turn lane at Freeport. Curb, gutter, and sidewalks are on both sides of the roadway. The roadway has moderate distress mainly consisting of alligator, transverse, block, and longitudinal cracking. Most severe distress was noted at roadway pavement traffic sensors and at ramp transition areas.
I-84 EB Ramps to I-84 WB Ramps	2,358 ft to 2,356 ft	The existing roadway is four lanes with dedicated left turn lanes at the entrance ramp locations. Curb, gutter, and sidewalks are on both sides of the roadway. The roadway has moderate to severe distress mainly consisting of alligator, transverse, block, and longitudinal cracking. Most severe distress was noted at roadway pavement traffic sensors and at ramp transition areas.
I-84 WB Ramps to Kimball Avenue	2,356 ft to 2,355 ft	The existing roadway is four lanes with a wide center lane not for use except as left turn lane at Kimball. Curb, gutter, and sidewalks are on both sides of the roadway. The roadway has moderate distress mainly consisting of transverse, block, and longitudinal cracking.

¹ Approximate elevations were obtained from Google Earth Pro.

APPENDIX B

Laboratory Test Description

Soil samples obtained during the field exploration were transferred to the laboratory and were visually classified in general accordance with the Unified Soil Classification System described in Appendix D. Soil and rock samples were selected for testing to determine physical and engineering properties of the subsurface materials. Following are the laboratory tests conducted and a brief description of the purpose of each test:

Test Conducted	To Determine:
Moisture Content	Moisture content of a sample.
Atterberg Limits	Determine the Liquid Limit, Plastic Limit, and Plasticity Index of a sample.
Percent Passing the No. 200 Sieve	Amount of clay/silt sized particles in a sample.
Gradation	Percentage of gravel, sand, and clay/silt sized particles in a sample.
Moisture-Density Relationship	Maximum density and optimum moisture content of the soil for a given compaction effort.
Resistance “R”-Value	Determine the R-Value and expansion pressure of a sample (used in the Design of Pavement Sections).

The tests were performed in general accordance with the respective ASTM standards. These standards are references to general methodology. In some cases, variations to methods are applied as a result of local practice or professional judgment. Results of the laboratory tests are generally summarized on the boring logs in Appendix A. The graphical result of the gradation, moisture-density relationship, and R-value tests are presented in this appendix.

ASTM D422 / ASTM C136



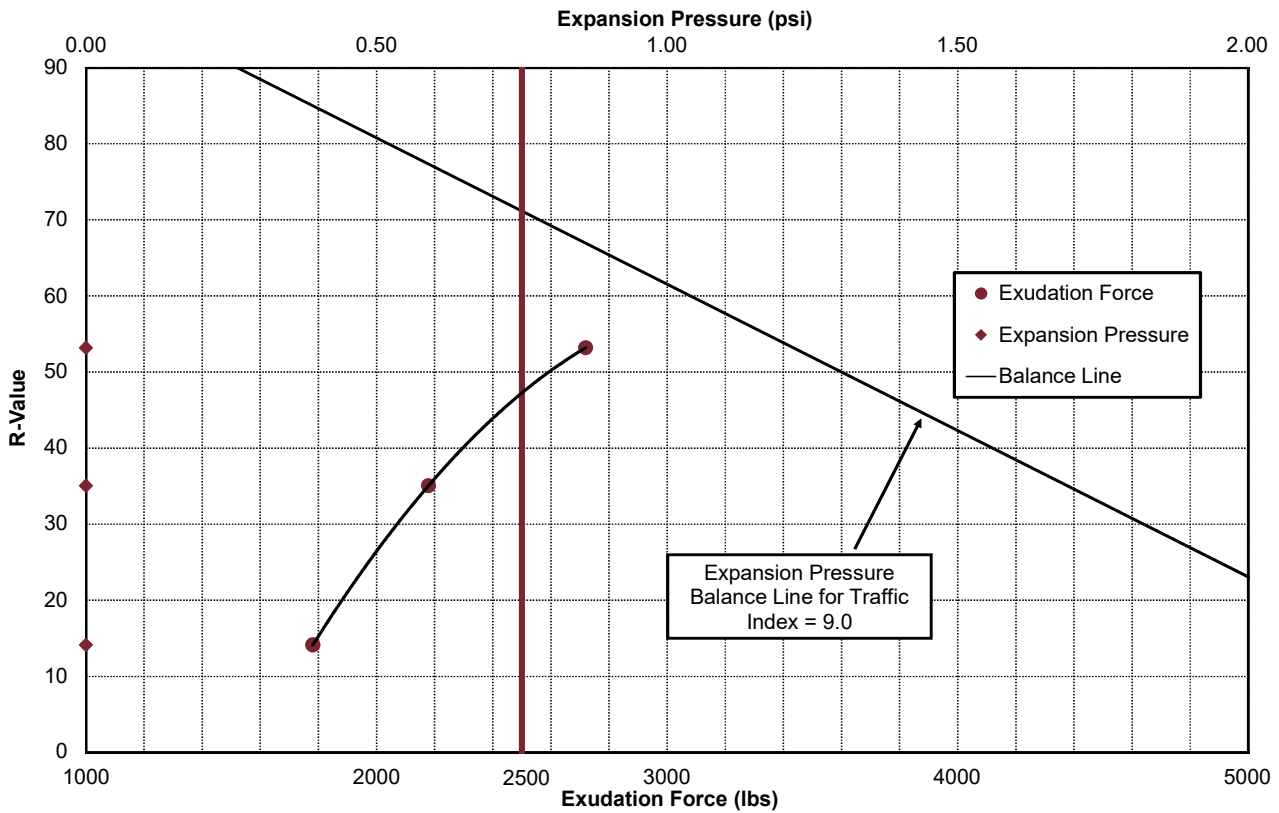
LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 62195037 N 10TH AVENUE ITS.GPJ TERRACON DATATEMPLATE.GDT 1/10/20

R-VALUE & EXPANSION PRESSURE TEST RESULTS

IDAHO T-8

Boring ID: B-2	3.0-4.0	Date of Test: 1/6/2020
Description: Silty Sand		

Specimen No.:	1	2	3
Molding Pressure (psi):	75	75	75
Kneading Pressure (psi):	100	100	100
Dry Density (pcf):	116.9	120.4	119.8
Moisture Content (%):	14.0%	12.6%	12.3%
Expansion Pressure (psi):	0.00	0.00	0.00
Horizontal Pressure at 160 psi Vertical Pressure (psi):	125	84	52
Sample Height (in.):	2.52	2.51	2.53
Exudation Force (lbs):	1781	2179	2720
Uncorrected R-Value:	14	35	53
Corrected R-Value:	14	35	53



R-Value at 2500 lbs Exudation Force: **47**

Expansion Pressure: **0.43** psi = **2.96** kPa

Traffic Index: **9**

PROJECT: 10th Ave ITS & Overlay

SITE: 10th Avenue, Caldwell, ID

Terracon

11849 W. Executive Dr., Suite G
Boise Idaho

PROJECT NUMBER: 62191037

CLIENT: Six Mile Engineering

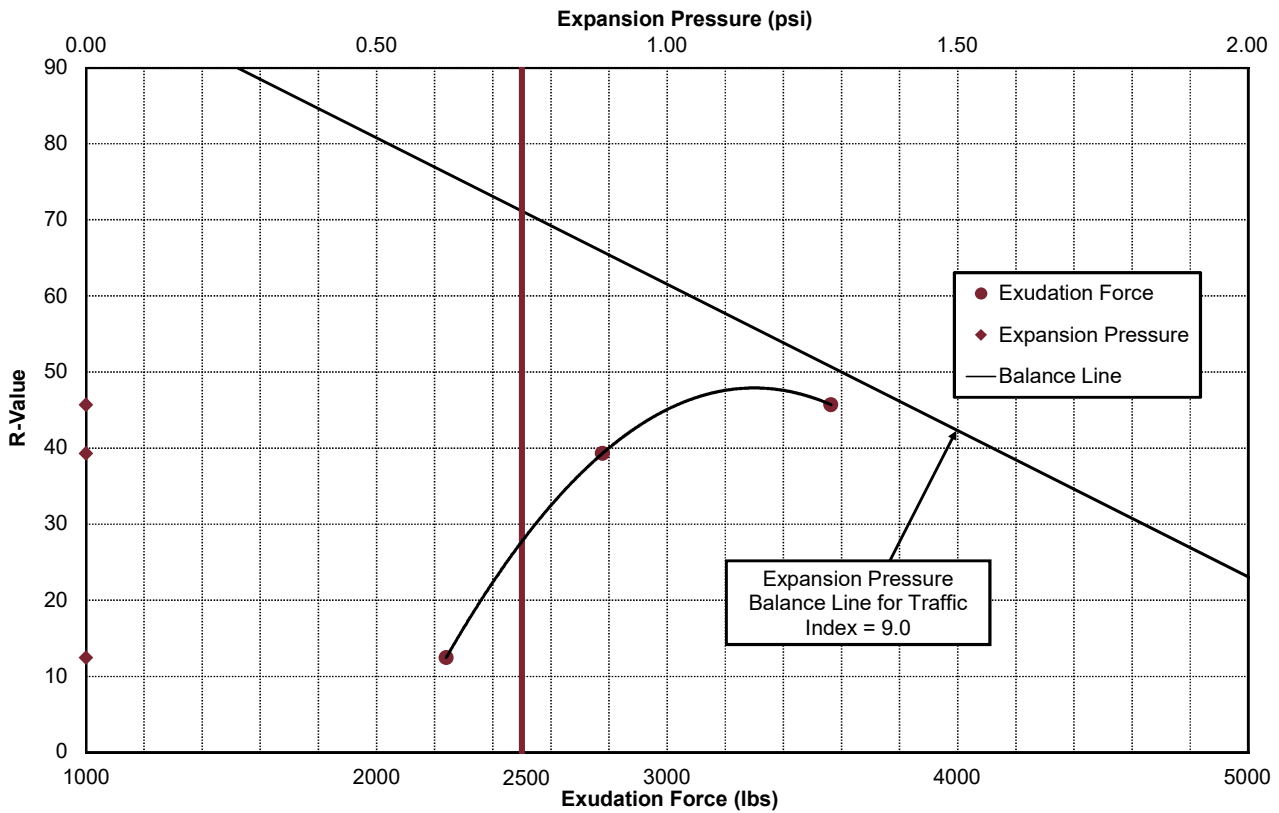
EXHIBIT: B-3

R-VALUE & EXPANSION PRESSURE TEST RESULTS

IDAHO T-8

Boring ID: B-3	2.5-4.0	Date of Test: 1/6/2020
Description: Silty Sand		

Specimen No.:	1	2	3
Molding Pressure (psi):	75	75	75
Kneading Pressure (psi):	80	100	100
Dry Density (pcf):	116.8	119.2	119.5
Moisture Content (%):	14.4%	13.0%	12.9%
Expansion Pressure (psi):	0.00	0.00	0.00
Horizontal Pressure at 160 psi Vertical Pressure (psi):	130	77	65
Sample Height (in.):	2.52	2.51	2.50
Exudation Force (lbs):	2240	2778	3564
Uncorrected R-Value:	12	39	46
Corrected R-Value:	12	39	46



R-Value at 2500 lbs Exudation Force: **28**

Expansion Pressure: **0.43** psi = **2.96** kPa

Traffic Index: **9**

PROJECT: 10th Ave ITS & Overlay

SITE: 10th Avenue, Caldwell, ID

Terracon

11849 W. Executive Dr., Suite G
Boise Idaho

PROJECT NUMBER: 62195037

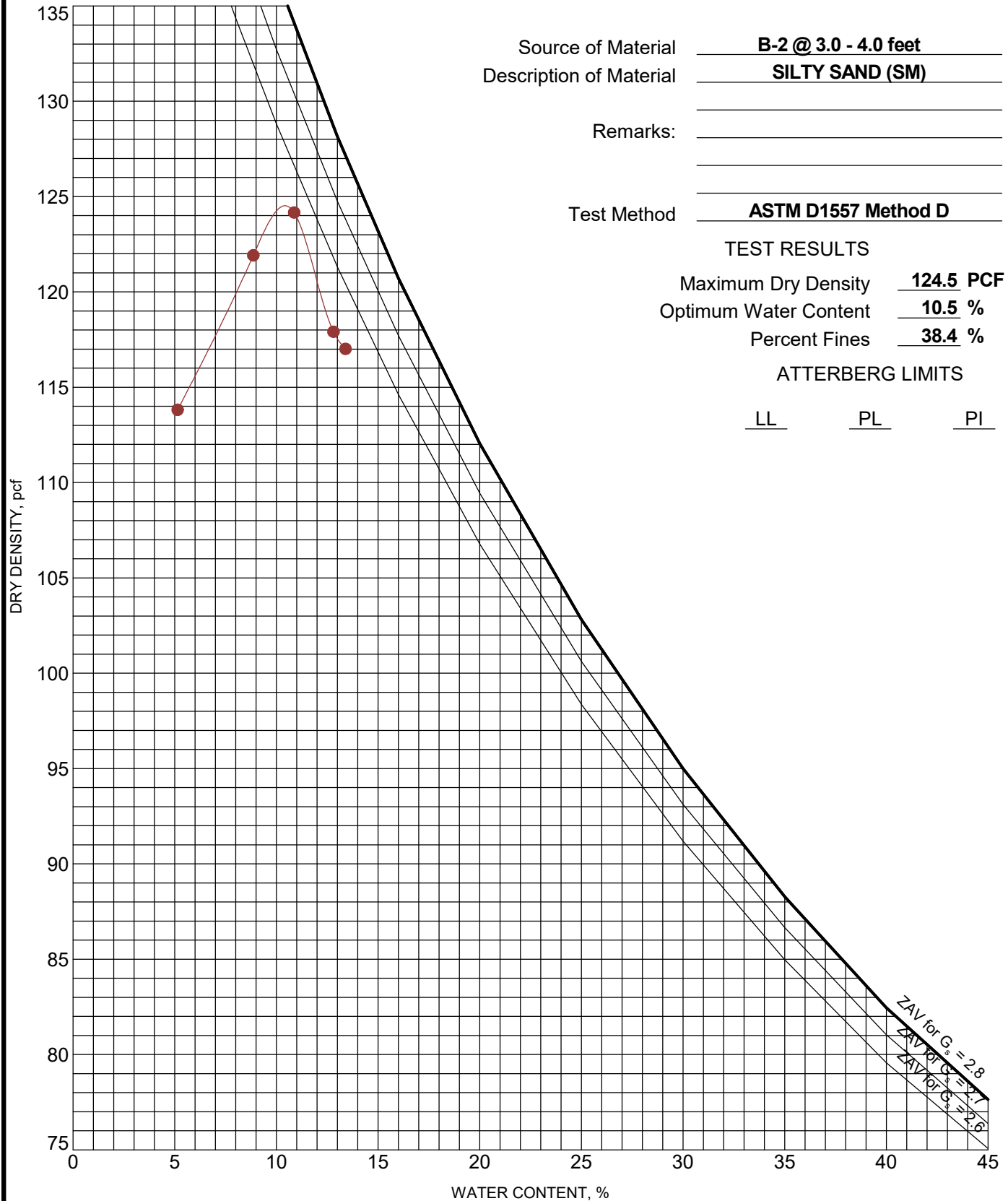
CLIENT: Six Mile Engineering

EXHIBIT: B-4

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 62195037 N 10TH AVENUE ITS.GPJ TERRACON_DATATEMPLATE.GDT 19/20



PROJECT: N 10th Avenue ITS & Overlay

SITE: N 10th Avenue
Caldwell, ID

Terracon
11849 W Executive Dr, Ste G
Boise, ID

PROJECT NUMBER: 62195037

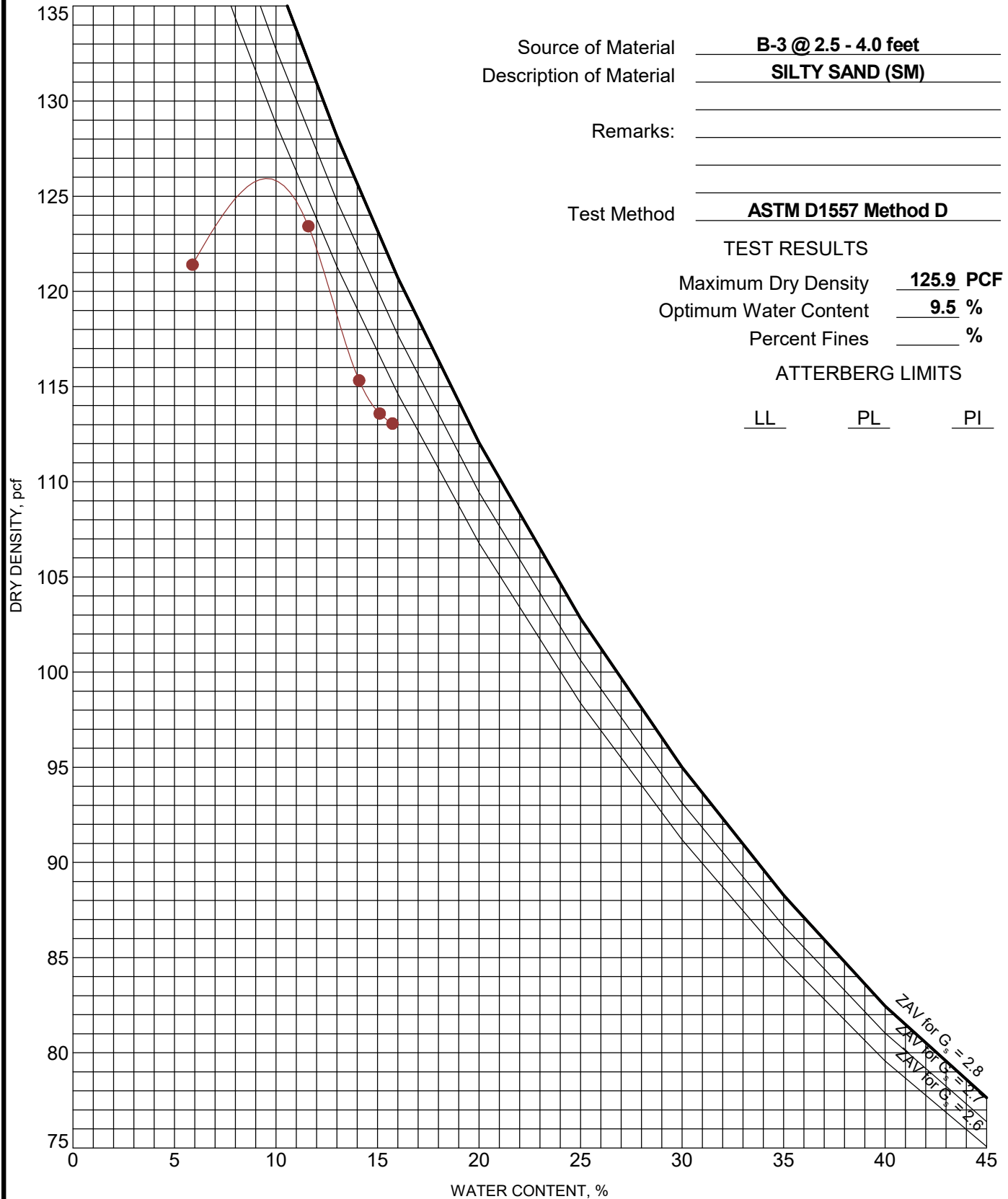
CLIENT: Six Mile Engineering
Meridian, ID

EXHIBIT: B-5

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 62195037 N 10TH AVENUE ITS.GPJ TERRACON_DATATEMPLATE.GDT 19/20



PROJECT: N 10th Avenue ITS & Overlay

SITE: N 10th Avenue
Caldwell, ID

Terracon
11849 W Executive Dr, Ste G
Boise, ID

PROJECT NUMBER: 62195037

CLIENT: Six Mile Engineering
Meridian, ID

EXHIBIT: B-6

APPENDIX C

GPR Scan Description

In general, our GPR field collection follows the procedures detailed in ASTM D6432 *Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation*. More information on both the general method and collection procedures can be found in the standard. GPR utilizes radio waves to detect changes in the subsurface of the area being scanned. Changes or reflections in the signal generally indicate material property changes, such as, but not limited, to electromagnetic conductivity and dielectric constant, which are used to estimate changes in pavement section layer thicknesses.

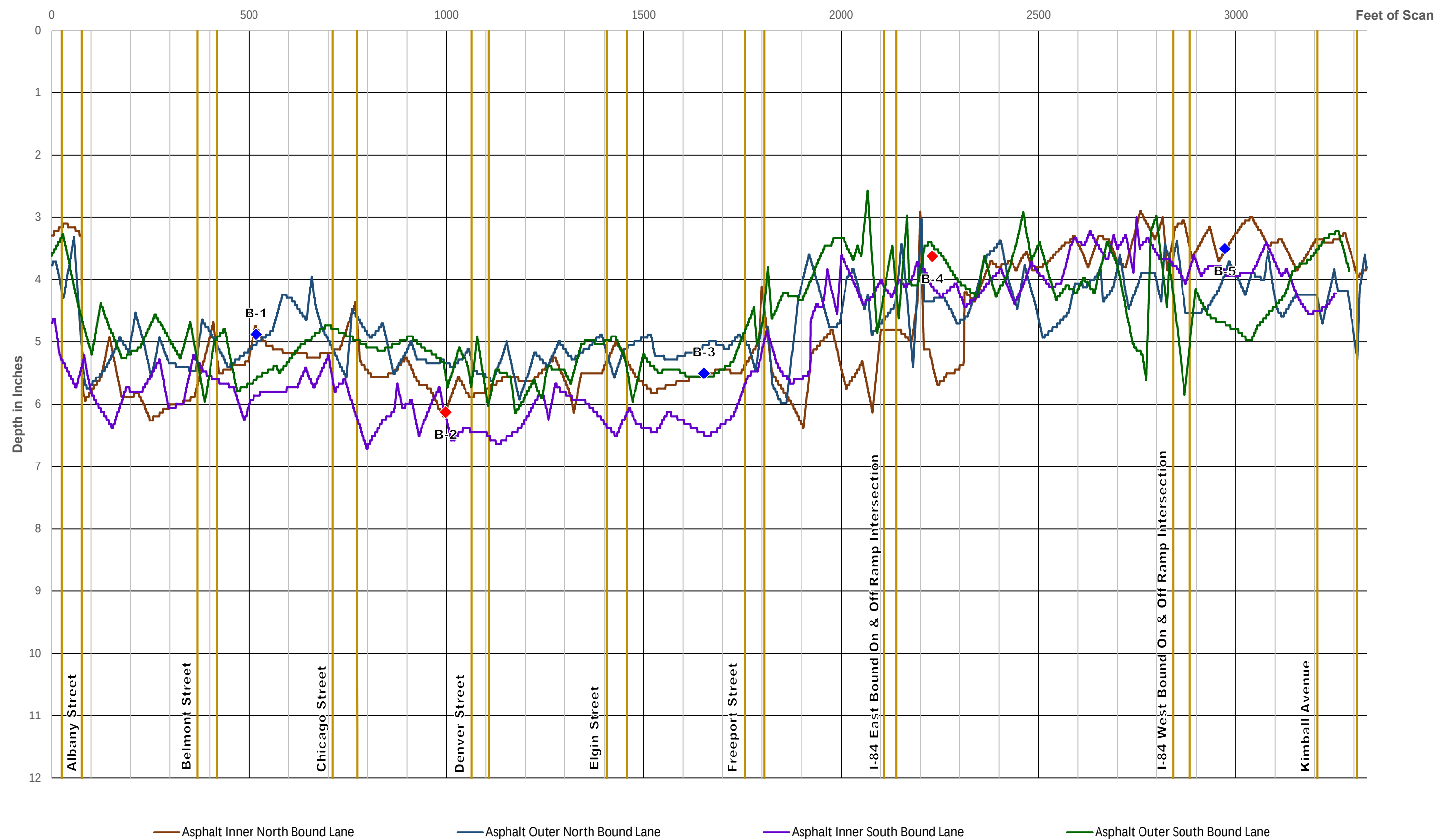
Terracon used a truck-mounted air-coupled GPR system consisting of 2,000 MHz antenna made by Geophysical Survey Systems, Inc. (GSSI) to perform the GPR survey. GPR data collection was performed at the approximate center of each travel lane at typical roadway speed. Data was collected using normal antenna orientation at a rate of 1 pulse per foot.

The collected GPR data was correlated to the pavement layer thicknesses obtained from cores at the borings, and post-processed using RADAN software developed by GSSI. The results were exported into EXCEL to produce a line diagram of pavement section thickness and summary statistics. Note that the method is intended to model the areas between points of 'hard' data (such as cores). The depicted depths are an estimation of thickness based on the method.

GPR Limitations

It should be noted that, as with any geophysical testing method, the GPR process relies on instrument signals to indicate physical conditions in the field. Signal information can be affected by on-site conditions beyond the control of the operator, such as, but not limited to, cultural features, aggregate/soil types and moisture, groundwater table depth, or other conditions. Interpretation of the return signals is based on a combination of known factors, the experience of the operator and the geophysical scientist evaluating the results.

GPR Scan Summary; 10th Avenue, Albany Street to Kimball Avenue



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

Project number: Not Provided Key number: 13905 Location: E Freeport St to Chicago St
 Route: Off Highway - N 10th Ave RouteID: 04570AOH000 FromMeasure: 4.580 ToMeasure: 4.771
 Truck Density = 1 Light Last year with data: 2018 Cumulating ESALS up to: 2061 Starting to Cumulate in: 2021

Year	ADTS			Rigid Pavement ESALS (In 1000s)				Flexible Pavement ESALS (In 1000s)			
	Total	Pass	Comm	Both Directions		50% Dir of Travel		Both Directions		50% Dir of Travel	
				Year Value	Cumulative	50% Year	50% Cum	Year Value	Cumulative	50% Year	50% Cum
2018	21500	21050	450								
2021	22820	22310	500	79	79	39	39	60	60	30	30
2022	23260	22730	520	82	161	41	80	63	123	31	62
2023	23700	23160	540	84	245	42	123	65	188	32	94
2024	24130	23580	560	87	332	44	166	67	255	33	127
2025	24570	24000	580	90	422	45	211	69	324	35	162
2026	25010	24420	590	93	515	46	258	71	395	36	197
2027	25450	24840	610	96	611	48	305	73	468	37	234
2028	25890	25260	630	98	709	49	355	75	544	38	272
2029	26330	25680	650	101	810	51	405	78	621	39	311
2030	26770	26100	670	104	914	52	457	80	701	40	350
2031	27210	26520	680	107	1021	53	511	82	783	41	391
2032	27650	26940	700	110	1131	55	565	84	867	42	433
2033	28090	27370	720	112	1243	56	622	86	953	43	476
2034	28520	27790	740	115	1358	58	679	88	1041	44	521
2035	28960	28210	760	118	1476	59	738	90	1131	45	566
2036	29400	28630	770	121	1597	60	799	92	1224	46	612
2037	29840	29050	790	124	1721	62	860	95	1319	47	659
2038	30280	29470	810	126	1847	63	923	97	1415	48	708
2039	30720	29890	830	129	1976	65	988	99	1514	49	757
2040	31160	30310	850	132	2108	66	1054	101	1615	51	808
2041	31600	30730	860	135	2243	67	1121	103	1718	52	859
2042	32040	31150	880	137	2380	69	1190	105	1824	53	912
2043	32480	31580	900	140	2520	70	1260	107	1931	54	966
2044	32910	32000	920	143	2663	72	1332	110	2041	55	1020
2045	33350	32420	940	146	2809	73	1405	112	2152	56	1076
2046	33790	32840	950	149	2958	74	1479	114	2266	57	1133
2047	34230	33260	970	151	3109	76	1555	116	2382	58	1191
2048	34670	33680	990	154	3264	77	1632	118	2500	59	1250
2049	35110	34100	1010	157	3421	79	1710	120	2620	60	1310
2050	35550	34520	1030	160	3580	80	1790	122	2743	61	1371
2051	35990	34940	1040	163	3743	81	1872	124	2867	62	1434
2052	36430	35360	1060	165	3908	83	1954	127	2994	63	1497
2053	36870	35790	1080	168	4077	84	2038	129	3123	64	1561
2054	37300	36210	1100	171	4248	85	2124	131	3254	65	1627
2055	37740	36630	1120	174	4421	87	2211	133	3387	67	1693
2056	38180	37050	1130	177	4598	88	2299	135	3522	68	1761
2057	38620	37470	1150	179	4777	90	2389	137	3659	69	1830
2058	39060	37890	1170	182	4959	91	2480	139	3798	70	1899
2059	39500	38310	1190	185	5144	92	2572	142	3940	71	1970
2060	39940	38730	1210	188	5332	94	2666	144	4084	72	2042
2061	40380	39150	1220	190	5522	95	2761	146	4230	73	2115

10th Avenue ITS Overlay

Design Traffic Information

Year	CADT	Annual Growth	Construction Year	Directional Split	Lane Split	CADT for 2021	CADT for 2031	CADT for 2041	10 Year Ave CADT	20 year Ave CADT
2018	450	3.7%	2021	60%	100%	500	680	860	590	680

Flex ESALS for Year 2021	60000
Flex ESALS for 10 Years	783000
Flex ESALS for 20 Years	1718000

Design ESALS for 10 years	433800
Design ESALS for 20 years	994800
TI 20 Years	9.0

Phase I(R) Pavement Rehabilitation Report

N 10th Avenue ITS & Overlay, Caldwell ■ Caldwell, Idaho

Terracon Project No. 62195037

**LCCA Summary Tables**

LCCA: N 10th Avenue, Albany St to Freeport St			
Type of Cost Comparison	Flexible Pavement Reconstruction 4-Layer [TI=9.0]	Remove and Replace Existing Asphaltic Concrete [1,000,000 ESALs]	Mill 0.17 ft & Inlay 0.17 ft [434,000 ESALs]
Design Life	20 years	20 years	10 years
Initial Cost	\$395,300	226,300	\$121,000
Total 36 Year Life Cycle Cost	\$719,900	\$555,900	\$491,813
Equivalent Uniform Annual Cost (EUAC)	\$29,100	\$20,200	\$20,200
Total Net Present Worth at 4% Interest	\$550,100	\$381,900	\$307,900

LCCA: N 10th Avenue, Freeport St to Kimball Avenue			
Type of Cost Comparison	Flexible Pavement Reconstruction 4-Layer [TI=9.0]	Remove and Replace Existing Asphaltic Concrete [1,000,000 ESALs]	Mill 0.17 ft & Inlay/Overlay 0.21 ft [434,000 ESALs]
Design Life	20 years	20 years	10 years
Initial Cost	\$325,600	\$184,200	\$115,400
Total 36 Year Life Cycle Cost	\$602,100	\$460,700	\$429,276
Equivalent Uniform Annual Cost (EUAC)	\$24,400	\$16,900	\$17,700
Total Net Present Worth at 4% Interest	\$461,200	\$319,500	\$269,800

Four Layer Pavement System

Pavement, Base, Subbase, and Subgrade

Flexible Full Depth Pavement

Current Year ESAL'S 62
Design year ESAL'S 859

Traffic Index = 9.0
Climate Region = 1
Climate Adjustment = 1.00

Subgrade R-Value = 20

Type of base to be used = Aggregate Base

Type of subbase to be used = Granular Subbase

	R-Value	Substitution Ratio
Plant Mix Pavement		1.8
Aggregate Base	80	1.0
Granular Subbase	60	0.85

Note: Options for base include atb, ATPB, aggregate base, CRABS, and rock cap.

Note: Options for subbase include granular subbase, CRABS, and rock cap.



Layer Thickness		
Pavement	Gravel Eq. 1	0.58 ft
	Thickness 1	0.32 ft
	Use	0.32 ft (Round to nearest 0.01)
Aggregate Base	GE 1 (actual)	0.58 ft
	Gravel Eq. 2	1.15 ft
	Thickness 2	0.57 ft
Granular Subbase	Use	0.60 ft (Round to nearest 0.05)
	GE 2 (actual)	1.18 ft
	Gravel Eq. 3	2.30 ft
Total	Thickness 3	1.32 ft
	Use	1.35 ft (Round to nearest 0.05)
	GE 3 (actual)	2.33 ft
Required Thickness for Expansion Pressure	Min. Gravel Eq.	2.30 ft
	T (actual)	2.27 ft

No Expansion Pressure

GE 3 is Recalculated if Expansion Pressure thickness is greater than T (actual).

Thickness 3	
Use	
GE 3 (actual)	

(Round to nearest 0.05)

If needed, adjust the layer thickness below.
Make sure that the new thickness is greater than the required thickness.

Layer	Thickness
Pavement	0.32 ft
Aggregate Base	0.60 ft
Granular Subbase	1.35 ft

Plant Mix Surface		↑	GE1	↑	GE2	↑	GE3
Aggregate Base	R= 80						
Granular Subbase	R= 60						
Subgrade Soil	R= 20						



Plant Mix Pavement
Aggregate Base
Granular Subbase

Thickness	
0.32 ft	3.84 in
0.60 ft	7.2 in
1.35 ft	16.2 in

Three Layer Pavement System

Pavement, Base, and Subgrade
(Deep Strength Pavement)

Soft Spot
(ON NATIVE)

Project Name:	10th Avenue ITS & Overlay
Project Number:	A13(905)
Key Number:	KN 13905
District:	3
Designer:	GAB



Current Year ESAL'S = 496 Traffic Index = 9.0
Design year ESAL'S = 1,015 Climate Region = 1
Climate Adjustment = 1.00

Subgrade R-Value = 20
Type of base to be used = **Aggregate Base**

Note: Options for base include aggregate base, atb, ATPB, CRABS, and rock cap.

	R-Value	Substitution Ratio
Plant Mix Pavement		1.8
Aggregate Base	80	1.0

Layer Thickness		
Pavement	Gravel Eq. 1	0.58 ft
	Thickness 1	0.32 ft
	Use	0.42 ft
	GE 1 (actual)	0.76 ft
Aggregate Base	Gravel Eq. 2	2.30 ft
	Thickness 2	1.54 ft
	Use	1.50 ft
	GE 2 (actual)	2.26 ft
Total	Min. Gravel Eq.	2.30 ft
	T(actual)	1.92 ft
Required Thickness for Expansion Pressure		0.00 ft

(Round to nearest 0.01)

(Round to nearest 0.05)

No Expansion Pressure

GE 2 is Recalculated if Expansion Pressure thickness is greater than T (actual).

Thickness 2	
Use	
GE 2(actual)	

(Round to nearest 0.05)

If needed, adjust the layer thickness below. Make sure that the new thickness is greater than the required thickness.	
Layer	Thickness
Pavement	0.42 ft
Aggregate Base	1.50 ft

Plant Mix Surface	↑	GE1	↑
Aggregate Base R = 80			GE2
Subgrade Soil R= 20			



Plant Mix Pavement
Aggregate Base

Thickness	
0.42 ft	5.0 in.
1.50 ft	18 in.
1.92 ft	23 in.

Albany to Freeport 2 in mill & overlay
WINFLEX 2006, REPORT FOR SINGLE LOCATION, 1/16/2020 2:37:05 PM
Input File: Albany to Freeport 2 in mill.inp

Description: 10th Avenue, Albany to Freeport, 2 in mill & overlay 10 year design

1. SUMMARY OF INPUT DATA

1.1 TRAFFIC DATA

DESIGN WHEEL LOAD (lb) = 4500
DESIGN DUAL TIRE SPACING (in) = 13.5
TIRE PRESSURE (psi) = 80
DESIGN FUTURE TRAFFIC (ESALs) = 434,000
FATIGUE SHIFT FACTOR FOR NEW ASPHALT = 10
FATIGUE SHIFT FACTOR FOR OLD ASPHALT = 4

1.2 SEASONAL VARIATION DATA

	WINTER	SPRING	SUMMER	FALL
SUBGRADE VARIATION	0.62	0.81	1.00	1.00
BASE/SBASE VARIATION	0.65	0.85	1.00	1.00
TRAFFIC VARIATION	1.00	1.00	1.00	1.00
TEMPERATURE VARIATION(F)	44.00	58.00	66.00	36.00
PERIOD (MONTHS)	3.00	1.00	4.00	4.00

1.3 PAVEMENT DATA

CLIMATIC ZONE: 3 (Idaho Zone)
TEMPERATURE AT FWD TEST (F): 77

	MODULUS (ksi)	POISSON RATIO	THICKNESS (in.)
OLD AC LAYER	650	0.35	3
BASE LAYER	30	0.40	17
SUBGRADE	4.1	0.45	SEMI-INFINITE

SUBGRADE TYPE: LINEAR
BASE TYPE: LINEAR

1.4 OVERLAY DATA

OVERLAY MODULUS(ksi) = 400 AT TEMPERATURE (F) = 77
POISSON'S RATIO = 0.35
MINIMUM THICKNESS(in.) = 2

2. RESULTS

2.1 PAVEMENT SEASONAL DATA

VARIATION OF LAYER MODULUS FOR OVERLAY (ksi)

Albany to Freeport 2 in mill & overlay

	WINTER	SPRING	SUMMER	FALL
Air Temp.(F)	44	58	66	36
E (ksi)	1020	582	382	1390

VARIATION OF LAYER MODULI VALUES FOR EACH SEASON (ksi)

	WINTER	SPRING	SUMMER	FALL
	-----	-----	-----	-----
E1	1510	925	675	1920
E2	19.5	25.5	30	30
E3	2.54	3.32	4.1	4.1

E1 = Modulus for Old Pavement, E2= Modulus for Base
E3 = Modulus for Subgrade

2.2 OVERLAY RESULTS

OVERLAY(in.)	DAMA1	DAMA2	DAMA3	DAMA4
-----	-----	-----	-----	-----
2	0.00004	0.53031	0	0.24686

DAMA1 = FATIGUE DAMAGE ON OVERLAY
DAMA2 = FATIGUE DAMAGE ON OLD AC
DAMA3 = FATIGUE DAMAGE ON BTB
DAMA4 = RUTTING DAMAGE

Fatigue Model: The Asphalt Institute (AI)
Rutting Model: The Asphalt Institute (AI)

Freeport to Kimball, 2 inch mill 2.5 inch overlay
WINFLEX 2006, REPORT FOR SINGLE LOCATION, 1/16/2020 2:39:32 PM
Input File: Freeport to Kimball, 2 inch mill.inp

Description: 10th Avenue, Freeport to Kimball, 2 in mill 2.5 in overlay 10 year design

1. SUMMARY OF INPUT DATA

1.1 TRAFFIC DATA

DESIGN WHEEL LOAD (lb) = 4500
DESIGN DUAL TIRE SPACING (in) = 13.5
TIRE PRESSURE (psi) = 80
DESIGN FUTURE TRAFFIC (ESALs) = 434,000
FATIGUE SHIFT FACTOR FOR NEW ASPHALT = 10
FATIGUE SHIFT FACTOR FOR OLD ASPHALT = 4

1.2 SEASONAL VARIATION DATA

	WINTER	SPRING	SUMMER	FALL
SUBGRADE VARIATION	0.62	0.81	1.00	1.00
BASE/SBASE VARIATION	0.65	0.85	1.00	1.00
TRAFFIC VARIATION	1.00	1.00	1.00	1.00
TEMPERATURE VARIATION(F)	44.00	58.00	66.00	36.00
PERIOD (MONTHS)	3.00	1.00	4.00	4.00

1.3 PAVEMENT DATA

CLIMATIC ZONE: 3 (Idaho Zone)
TEMPERATURE AT FWD TEST (F): 77

	MODULUS (ksi)	POISSON RATIO	THICKNESS (in.)
OLD AC LAYER	650	0.35	1.5
BASE LAYER	30	0.40	20
SUBGRADE	4.1	0.45	SEMI-INFINITE

SUBGRADE TYPE: LINEAR
BASE TYPE: LINEAR

1.4 OVERLAY DATA

OVERLAY MODULUS(ksi) = 400 AT TEMPERATURE (F) = 77
POISSON'S RATIO = 0.35
MINIMUM THICKNESS(in.) = 2

2. RESULTS

2.1 PAVEMENT SEASONAL DATA

VARIATION OF LAYER MODULUS FOR OVERLAY (ksi)

Freeport to Kimball, 2 inch mill 2.5 inch overlay

	WINTER	SPRING	SUMMER	FALL
Air Temp.(F)	44	58	66	36
E (ksi)	1060	582	382	1390

VARIATION OF LAYER MODULI VALUES FOR EACH SEASON (ksi)

	WINTER	SPRING	SUMMER	FALL
	-----	-----	-----	-----
E1	1510	925	675	1920
E2	19.5	25.5	30	30
E3	2.54	3.32	4.1	4.1

E1 = Modulus for Old Pavement, E2= Modulus for Base
E3 = Modulus for Subgrade

2.2 OVERLAY RESULTS

OVERLAY(in.)	DAMA1	DAMA2	DAMA3	DAMA4
-----	-----	-----	-----	-----
2.5	0.00741	0.95816	0	0.2834

DAMA1 = FATIGUE DAMAGE ON OVERLAY
DAMA2 = FATIGUE DAMAGE ON OLD AC
DAMA3 = FATIGUE DAMAGE ON BTB
DAMA4 = RUTTING DAMAGE

Fatigue Model: The Asphalt Institute (AI)
Rutting Model: The Asphalt Institute (AI)

Albany to Freeport remove & replace 5 in
WINFLEX 2006, REPORT FOR SINGLE LOCATION, 1/16/2020 2:38:28 PM
Input File: Albany to Freeport remove and replace.inp

Description: 10th Avenue, Albany to Freeport R&R 5 in, 20 year design

1. SUMMARY OF INPUT DATA

1.1 TRAFFIC DATA

DESIGN WHEEL LOAD (lb) = 4500
DESIGN DUAL TIRE SPACING (in) = 13.5
TIRE PRESSURE (psi) = 80
DESIGN FUTURE TRAFFIC (ESALs) = 1,000,000
FATIGUE SHIFT FACTOR FOR NEW ASPHALT = 10
FATIGUE SHIFT FACTOR FOR OLD ASPHALT = 4

1.2 SEASONAL VARIATION DATA

	WINTER	SPRING	SUMMER	FALL
SUBGRADE VARIATION	0.62	0.81	1.00	1.00
BASE/SBASE VARIATION	0.65	0.85	1.00	1.00
TRAFFIC VARIATION	1.00	1.00	1.00	1.00
TEMPERATURE VARIATION(F)	44.00	58.00	66.00	36.00
PERIOD (MONTHS)	3.00	1.00	4.00	4.00

1.3 PAVEMENT DATA

CLIMATIC ZONE: 3 (Idaho Zone)
TEMPERATURE AT FWD TEST (F): 77

	MODULUS (ksi)	POISSON RATIO	THICKNESS (in.)
OLD AC LAYER	650	0.35	0.1
BASE LAYER	30	0.40	17
SUBGRADE	4.1	0.45	SEMI-INFINITE

SUBGRADE TYPE: LINEAR
BASE TYPE: LINEAR

1.4 OVERLAY DATA

OVERLAY MODULUS(ksi) = 400 AT TEMPERATURE (F) = 77
POISSON'S RATIO = 0.35
MINIMUM THICKNESS(in.) = 1.5

2. RESULTS

2.1 PAVEMENT SEASONAL DATA

VARIATION OF LAYER MODULUS FOR OVERLAY (ksi)

Albany to Freeport remove & replace 5 in

	WINTER	SPRING	SUMMER	FALL
Air Temp.(F)	44	58	66	36
E (ksi)	1060	605	418	1390

VARIATION OF LAYER MODULI VALUES FOR EACH SEASON (ksi)

	WINTER	SPRING	SUMMER	FALL
	-----	-----	-----	-----
E1	19.5	25.5	30	30
E2	19.5	25.5	30	30
E3	2.54	3.32	4.1	4.1

E1 = Modulus for Old Pavement, E2= Modulus for Base
E3 = Modulus for Subgrade

2.2 OVERLAY RESULTS

OVERLAY(in.)	DAMA1	DAMA2	DAMA3	DAMA4
-----	-----	-----	-----	-----
5	0.95249	N/A	0	0.6412

DAMA1 = FATIGUE DAMAGE ON OVERLAY
DAMA2 = FATIGUE DAMAGE ON OLD AC
DAMA3 = FATIGUE DAMAGE ON BTB
DAMA4 = RUTTING DAMAGE

Fatigue Model: The Asphalt Institute (AI)
Rutting Model: The Asphalt Institute (AI)

Freeport to Kimball, remove & replace 5 in
WINFLEX 2006, REPORT FOR SINGLE LOCATION, 1/16/2020 2:41:02 PM
Input File: Freeport to Kimball remove and replace.inp

Description: 10th Avenue, Freeport to Kimball, R&R 5 20 year design

1. SUMMARY OF INPUT DATA

1.1 TRAFFIC DATA

DESIGN WHEEL LOAD (lb) = 4500
DESIGN DUAL TIRE SPACING (in) = 13.5
TIRE PRESSURE (psi) = 80
DESIGN FUTURE TRAFFIC (ESALs) = 1,000,000
FATIGUE SHIFT FACTOR FOR NEW ASPHALT = 10
FATIGUE SHIFT FACTOR FOR OLD ASPHALT = 4

1.2 SEASONAL VARIATION DATA

	WINTER	SPRING	SUMMER	FALL
SUBGRADE VARIATION	0.62	0.81	1.00	1.00
BASE/SBASE VARIATION	0.65	0.85	1.00	1.00
TRAFFIC VARIATION	1.00	1.00	1.00	1.00
TEMPERATURE VARIATION(F)	44.00	58.00	66.00	36.00
PERIOD (MONTHS)	3.00	1.00	4.00	4.00

1.3 PAVEMENT DATA

CLIMATIC ZONE: 3 (Idaho Zone)
TEMPERATURE AT FWD TEST (F): 77

	MODULUS (ksi)	POISSON RATIO	THICKNESS (in.)
OLD AC LAYER	650	0.35	0.1
BASE LAYER	30	0.40	20
SUBGRADE	4.1	0.45	SEMI-INFINITE

SUBGRADE TYPE: LINEAR
BASE TYPE: LINEAR

1.4 OVERLAY DATA

OVERLAY MODULUS(ksi) = 400 AT TEMPERATURE (F) = 77
POISSON'S RATIO = 0.35
MINIMUM THICKNESS(in.) = 2

2. RESULTS

2.1 PAVEMENT SEASONAL DATA

VARIATION OF LAYER MODULUS FOR OVERLAY (ksi)

Freeport to Kimball, remove & replace 5 in

	WINTER	SPRING	SUMMER	FALL
Air Temp.(F)	44	58	66	36
E (ksi)	1060	605	418	1390

VARIATION OF LAYER MODULI VALUES FOR EACH SEASON (ksi)

	WINTER	SPRING	SUMMER	FALL
	-----	-----	-----	-----
E1	19.5	25.5	30	30
E2	19.5	25.5	30	30
E3	2.54	3.32	4.1	4.1

E1 = Modulus for Old Pavement, E2= Modulus for Base
E3 = Modulus for Subgrade

2.2 OVERLAY RESULTS

OVERLAY(in.)	DAMA1	DAMA2	DAMA3	DAMA4
-----	-----	-----	-----	-----
4.9	0.92605	N/A	0	0.35981

DAMA1 = FATIGUE DAMAGE ON OVERLAY
DAMA2 = FATIGUE DAMAGE ON OLD AC
DAMA3 = FATIGUE DAMAGE ON BTB
DAMA4 = RUTTING DAMAGE

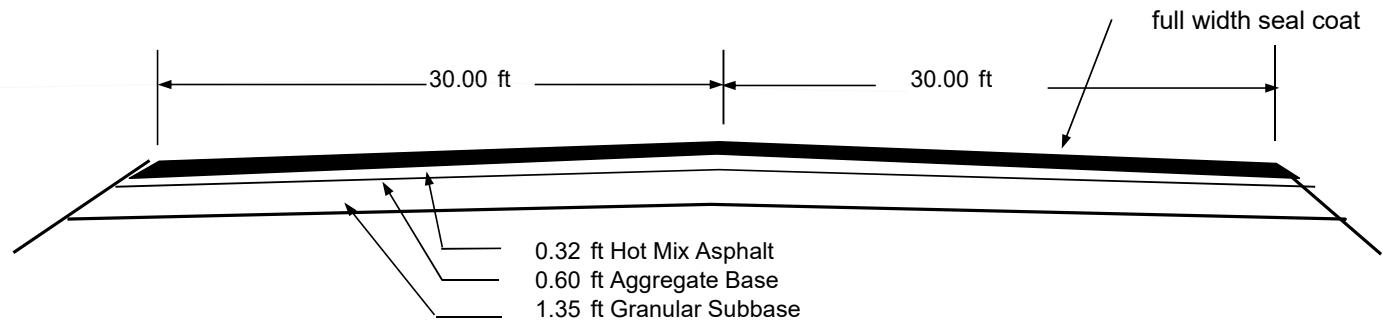
Fatigue Model: The Asphalt Institute (AI)
Rutting Model: The Asphalt Institute (AI)

FLEXIBLE PAVEMENT WORKSHEET

Flexible Pavement Reconstruction Albany to Freeport

PROJECT NAME 10th Avenue ITS & Overlay
PROJECT NUMBER A13(905)
KEY 13905

Material	Depth	Haul	Width	Weight / ft³	Cost
HMA PG with high polymer	0.32 ft	mile	60.00 ft	156.07 lb	60.00 / t
HMA PG with low polymer	ft	mile	ft	lb	/ t
Asplt Treat Permeable Base	ft	mile	ft	lb	/ t
Aggregate Base	0.60 ft	mile	60.00 ft	156.07 lb	15.00 / t
Rock Cap	ft	mile	ft	lb	/ t
Granular Subbase	1.35 ft	mile	60.00 ft	109.87 lb	10.50 / t
Granular Borrow	ft	mile	ft	lb	/ yd³
Future Mill/Inlay	0.15 ft	mile	60.00 ft	142.96 lb	0.57 / t
Project Length	1,700 ft				
Travel Lane Width	60.00 ft				
Surface Width - Left Side	30.00 ft				
Surface Width - Right Side	30.00 ft				
Additional Borrow	cu.yard				
Traffic Cross Overs	no				
Number of Edge Drains	no				
Longitudinal Cracks	1 no				
Transverse Cracks	100 / mile				
Foreslope Angle - Left	0 Vertical				
Foreslope Angle - Right	0 Vertical				
Do Excavation	2.27 ft				
Do Subgrade Sep. Fabric Layer	60.00 ft				
No Future Pavement Geotextile	26.00 ft				
24 Year Standard Remaining Life					



PROJECT NAME 10th Avenue ITS & Overlay

36 YEAR LIFE CYCLE

PROJECT NUMBER A13(905)

UNIFORM PROJECT COSTS PER MILE

KEY 13905

(English units)

Flexible Pavement Reconstruction Albany to Freeport

YEAR	WORK	COST	PRESENT WORTH FACTOR	CAPITAL RECOVERY FACTOR	EQUIVALENT UNIFORM ANNUAL COST
0	----> Initial Cost	\$395,300	1.0000	0.0529	\$20,900
-					
-					
-					
5					
-					
-	----> Seal Coat Driving Lanes	\$20,800	0.7307	0.0529	\$800
10					
-	----> Preservation Mill & Inlay-Year 12	\$104,100	0.6246	0.0529	\$3,400
-					
15	----> Seal Cracks	\$9,000	0.5553	0.0529	\$300
-					
-	----> Seal Cracks	\$9,000	0.4936	0.0529	\$200
-	----> Seal Coat Driving Lanes	\$20,800	0.4746	0.0529	\$500
20					
-	----> Seal Cracks	\$9,000	0.4388	0.0529	\$200
-					
-	----> Preservation Mill & Inlay-Year 24	\$104,100	0.3901	0.0529	\$2,100
25					
-	----> Seal Cracks	\$9,000	0.3468	0.0529	\$200
-					
30	----> Seal Cracks	\$9,000	0.3083	0.0529	\$100
-	----> Seal Coat Driving Lanes	\$20,800	0.2965	0.0529	\$300
-					
-	----> Seal Cracks	\$9,000	0.2741	0.0529	\$100
35					
-	----> End Life - Salvage Value	\$0	0.2444	0.0529	\$0
TOTAL		\$719,900		EUAC ---->	\$29,100
Total Net Present Worth @ 4%					\$550,100

LIFE CYCLE COST ANALYSIS
10th Avenue ITS & Overlay
A13(905)

Flexible Pavement Reconstruction Albany to Freeport

Construct roadway using 0.32 ft of Hot Mix Asphalt PG with high polymer on top of 0.60 ft of Aggregate Base and 1.35 ft of Granular Subbase. Roadway shoulders at Vertical (L) and Vertical (R) slopes.

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:

Traffic Cross Overs	\$0
Borrow	\$0
Excavation	\$72,900
Hot Mix Asphalt PG with low polymer	\$0
Hot Mix Asphalt PG with high polymer	\$152,800
Permeable Base	\$0
Aggregate Base	\$71,600
Rock Cap	\$0
Granular Subbase	\$79,400
Granular Borrow	\$0
Edge Drains	\$0
Seal Coat at Year 1	\$0
Subgrade Fabric Layer	\$18,600
TOTAL INITIAL	\$395,300
Seal Coat Full Width	\$20,800
Seal Driving Lanes	\$20,800
Seal Cracks	\$9,000

PRESERVATION AT 12 YEARS:

Coldmill travel lanes	\$8,700
Hot Mix Asphalt inlay (recycled)	\$65,600
Seal coat full width	\$20,800
Seal cracks	\$9,000
TOTAL 12 YEAR PRESERVATION	\$104,100

PRESERVATION AT 24 YEARS:

Coldmill travel lanes	\$8,700
Hot Mix Asphalt inlay (recycled)	\$0
Pavement Geotextile	\$0
Plant mix overlay	\$65,600
Seal coat full width	\$20,800
Seal cracks	\$9,000
TOTAL 24 YEAR PRESERVATION	\$104,100

TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)	\$719,900
EQUIVALENT UNIFORM ANNUAL COST (euac)	\$29,100
TOTAL NET PRESENT WORTH AT 4% INTEREST	\$550,100

FLEXIBLE PAVEMENT WORKSHEET

Remove & Replace Pavement Reconstruction Albany to

PROJECT NAME

10th Avenue ITS & Overlay

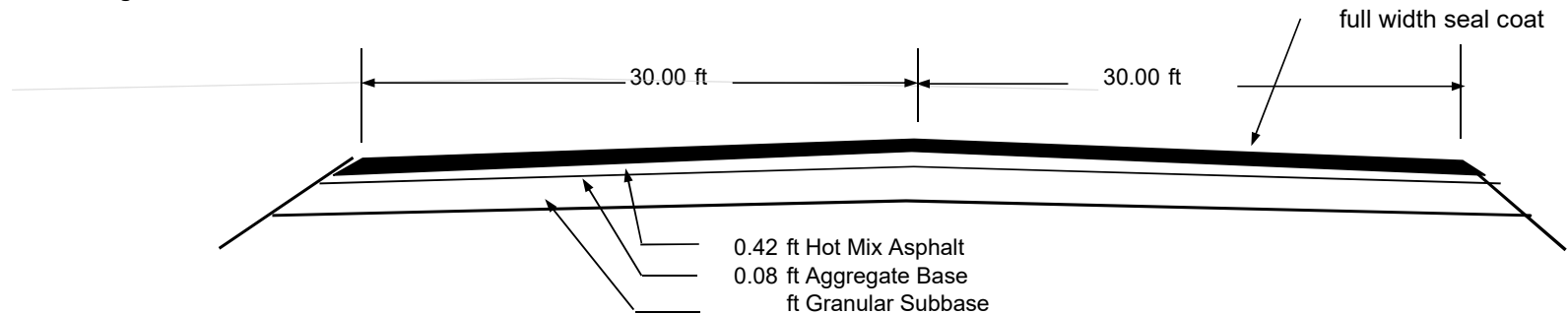
PROJECT NUMBER

A13(905)

KEY

13905

Material	Depth	Haul	Width	Weight / ft³	Cost
HMA PG with high polymer	0.42 ft	mile	60.00 ft	156.07 lb	60.00 / t
HMA PG with low polymer	ft	mile	ft	lb	/ t
Asplt Treat Permeable Base	ft	mile	ft	lb	/ t
Aggregate Base	0.08 ft	mile	60.00 ft	156.07 lb	15.00 / t
Rock Cap	ft	mile	ft	lb	/ t
Granular Subbase	ft	mile	ft	lb	/ t
Granular Borrow	ft	mile	ft	lb	/ yd³
Future Mill/Inlay	0.15 ft	mile	60.00 ft	142.96 lb	0.57 / t
Project Length	1,700 ft				
Travel Lane Width	60.00 ft				
Surface Width - Left Side	30.00 ft				
Surface Width - Right Side	30.00 ft				
Additional Borrow	cu.yard				
Traffic Cross Overs	no				
Number of Edge Drains	no				
Longitudinal Cracks	1 no				
Transverse Cracks	100 / mile				
Foreslope Angle - Left	0 Vertical				
Foreslope Angle - Right	0 Vertical				
Do Excavation	0.50 ft				
No Subgrade Sep. Fabric Layer	60.00 ft				
No Future Pavement Geotextile	26.00 ft				
24 Year Standard Remaining Life					



PROJECT NAME 10th Avenue ITS & Overlay

36 YEAR LIFE CYCLE

PROJECT NUMBER A13(905)

UNIFORM PROJECT COSTS PER MILE

KEY 13905

(English units)

Remove & Replace Pavement Reconstruction Albany to Freeport

			PRESENT WORTH FACTOR	CAPITAL RECOVERY FACTOR	EQUIVALENT UNIFORM ANNUAL COST
YEAR	WORK	COST			
0	----> Initial Cost	\$226,300	1.0000	0.0529	\$12,000
-					
-					
-					
5					
-					
-	----> Seal Coat Driving Lanes	\$20,800	0.7307	0.0529	\$800
-					
10					
-	----> Preservation Mill & Inlay-Year 12	\$104,100	0.6246	0.0529	\$3,400
-					
15	----> Seal Cracks	\$9,000	0.5553	0.0529	\$300
-					
-	----> Seal Cracks	\$9,000	0.4936	0.0529	\$200
-	----> Seal Coat Driving Lanes	\$20,800	0.4746	0.0529	\$500
20					
-	----> Seal Cracks	\$9,000	0.4388	0.0529	\$200
-					
-	----> Preservation Mill & Inlay-Year 24	\$104,100	0.3901	0.0529	\$2,100
25					
-	----> Seal Cracks	\$9,000	0.3468	0.0529	\$200
-					
30	----> Seal Cracks	\$9,000	0.3083	0.0529	\$100
-	----> Seal Coat Driving Lanes	\$20,800	0.2965	0.0529	\$300
-					
-	----> Seal Cracks	\$9,000	0.2741	0.0529	\$100
-					
35					
-	----> End Life - Salvage Value	\$0	0.2444	0.0529	\$0
TOTAL		\$550,900	EUAC ---->		\$20,200
Total Net Present Worth @ 4%					\$381,900

LIFE CYCLE COST ANALYSIS
10th Avenue ITS & Overlay
A13(905)

Remove & Replace Pavement Reconstruction Albany to Freeport

Construct roadway using 0.42 ft of Hot Mix Asphalt PG with high polymer on top of
0.08 ft of Aggregate Base. Roadway shoulders at Vertical (L) and Vertical (R)
slopes.

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:

Traffic Cross Overs	\$0
Borrow	\$0
Remove Existing Pavement	\$16,100
Hot Mix Asphalt PG with low polymer	\$0
Hot Mix Asphalt PG with high polymer	\$200,600
Permeable Base	\$0
Aggregate Base	\$9,600
Rock Cap	\$0
Granular Subbase	\$0
Granular Borrow	\$0
Edge Drains	\$0
Seal Coat at Year 1	\$0
Subgrade Fabric Layer	\$0
TOTAL INITIAL	\$226,300

Seal Coat Full Width	\$20,800
Seal Driving Lanes	\$20,800
Seal Cracks	\$9,000

PRESERVATION AT 12 YEARS:

Coldmill travel lanes	\$8,700
Hot Mix Asphalt inlay (recycled)	\$65,600
Seal coat full width	\$20,800
Seal cracks	\$9,000

TOTAL 12 YEAR PRESERVATION	\$104,100
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PRESERVATION AT 24 YEARS:

Coldmill travel lanes	\$8,700
Hot Mix Asphalt inlay (recycled)	\$0
Pavement Geotextile	\$0
Plant mix overlay	\$65,600
Seal coat full width	\$20,800
Seal cracks	\$9,000

TOTAL 24 YEAR PRESERVATION	\$104,100
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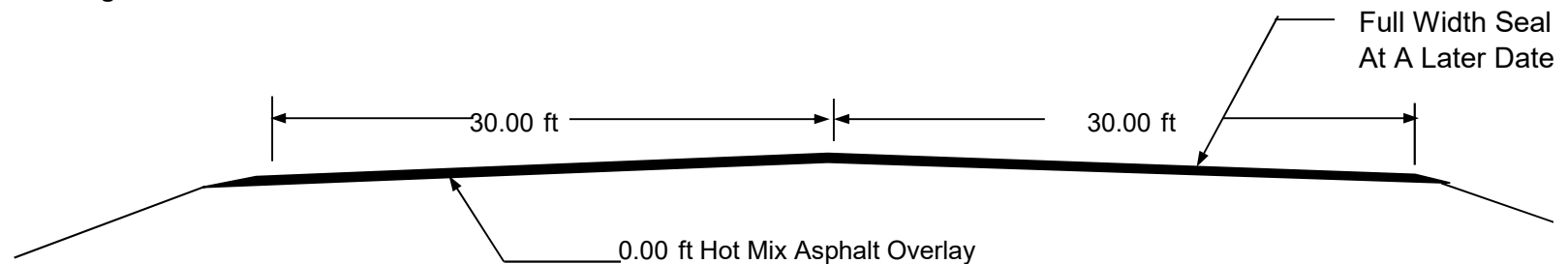
TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)	\$550,900
EQUIVALENT UNIFORM ANNUAL COST (euac)	\$20,200
TOTAL NET PRESENT WORTH AT 4% INTEREST	\$381,900

INLAY / OVERLAY WORKSHEET

Inlay / Overlay Existing Pavement Albany to Freepo

PROJECT NAME 10th Avenue ITS & Overlay
PROJECT NUMBER A13(905)
KEY 13905

Material	Depth	Haul	Width	Weight / ft³	Cost
Existing Road	0.42 ft	mile	60.00 ft	156.07 lb	60.00 / t
HMA PG with high polymer	ft	mile	ft	lb	/ t
HMA PG with low polymer	ft	mile	ft	lb	/ t
Inlay	0.17 ft	mile	60.00 ft	156.07 lb	82.16 / t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ yd³
Future Mill & Inlay	0.15 ft	mile	60.00 ft	156.07 lb	0.57 / t
Project Length	1,700 ft				
Travel Lane Width	60.00 ft				
Surface Width - Left Side	30.00 ft				
Surface Width - Right Side	30.00 ft				
Estimated Salvage Value		\$ / t			
Additional Borrow		cu.yard			
Traffic Cross Overs		no			
Number of Edge Drains		no			
Longitudinal Cracks	2	no			
Transverse Cracks	100	/ mile			
Foreslope Angle - Left	0	Vertical			
Foreslope Angle - Right	0	Vertical			
No Excavation: None	0.00				
Recycle	No				
No Pavement Geotextile	60.00 ft				
24 Year Standard Remaining Life					



LIFE CYCLE COST ANALYSIS
10th Avenue ITS & Overlay
A13(905)

Inlay / Overlay Existing Pavement Albany to Freeport

Coldmill and inlay the existing pavement to a depth of 0.17 ft at a width of 60.00 ft.
Roadway shoulders at Vertical (L) and Vertical (R) slopes.

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:

Traffic Cross Overs	\$0
Borrow	\$0
Excavation: None	
Plant Mix Overlay	\$0
Plant Mix Inlay	\$111,200
Rotomill for Inlay	\$9,800
Salvage Value of Coldmill Material	\$0
Geotextile	\$0
TOTAL INITIAL	\$121,000

Seal Coat at Year 1	\$20,800
Seal Driving Lanes	\$20,800
Seal Cracks	\$11,000

PRESERVATION AT 12 YEARS:

Coldmill travel lanes	\$8,700
Plant mix inlay (recycled)	\$98,100
Seal coat full width	\$20,800
Seal cracks	\$11,000

TOTAL 12 YEAR PRESERVATION	\$138,600
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RECONSTRUCTION AT 24 YEARS:	\$395,300
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SALVAGE VALUE (79%)	(\$312,287)
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TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)	\$491,813
EQUIVALENT UNIFORM ANNUAL COST (euac)	\$20,200
TOTAL NET PRESENT WORTH AT 4% INTREST	\$307,900

LIFE CYCLE COST ANALYSIS

STANDARD TIME LINES

21-Jan-20

PROJECT NAME 10th Avenue ITS & Overlay

36 YEAR LIFE CYCLE

PROJECT NUMBER A13(905)

UNIFORM PROJECT COSTS PER MILE

KEY 13905

(English units)

Inlay / Overlay Existing Pavement Albany to Freeport

			PRESENT	CAPITAL	EQUIVALENT	
YEAR	WORK	COST	WORTH	RECOVERY	UNIFORM	
			FACTOR	FACTOR	ANNUAL	
					COST	
0	---->	Rehab Initial Cost	\$121,000	1.0000	0.0529	\$6,400
	----	Seal Coat Full Width	\$20,800	0.9615	0.0529	\$1,100

	---->	Seal Cracks	\$11,000	0.8890	0.0529	\$500
5	----					
	---->	Seal Cracks	\$11,000	0.7903	0.0529	\$500
	----	Seal Coat Driving Lanes	\$20,800	0.7599	0.0529	\$800

	---->	Seal Cracks	\$11,000	0.7026	0.0529	\$400

10	----	Mill & Inlay Travel Lanes	\$138,600	0.6246	0.0529	\$4,600

15	---->	Seal Cracks	\$11,000	0.5553	0.0529	\$300

	---->	Seal Cracks	\$11,000	0.4936	0.0529	\$300
	----	Seal Coat Driving Lanes	\$20,800	0.4746	0.0529	\$500
20	----					
	---->	Seal Cracks	\$11,000	0.4388	0.0529	\$300

	---->	24 Year Reconst Cost	\$395,300	0.3901	0.0529	\$8,200
25	----					

30	----					
	---->	Seal Coat Driving Lanes	\$20,800	0.2851	0.0529	\$300

35	----					
	---->	End Life - Salvage Value	(\$312,287)	0.2444	0.0529	(\$4,000)
TOTAL		\$491,813	EUAC ---->		\$20,200	
Total Net Present Worth @ 4%					\$307,900	

FLEXIBLE PAVEMENT WORKSHEET

Flexible Pavement Reconstruction Freeport to Kimi

PROJECT NAME

10th Avenue ITS & Overlay

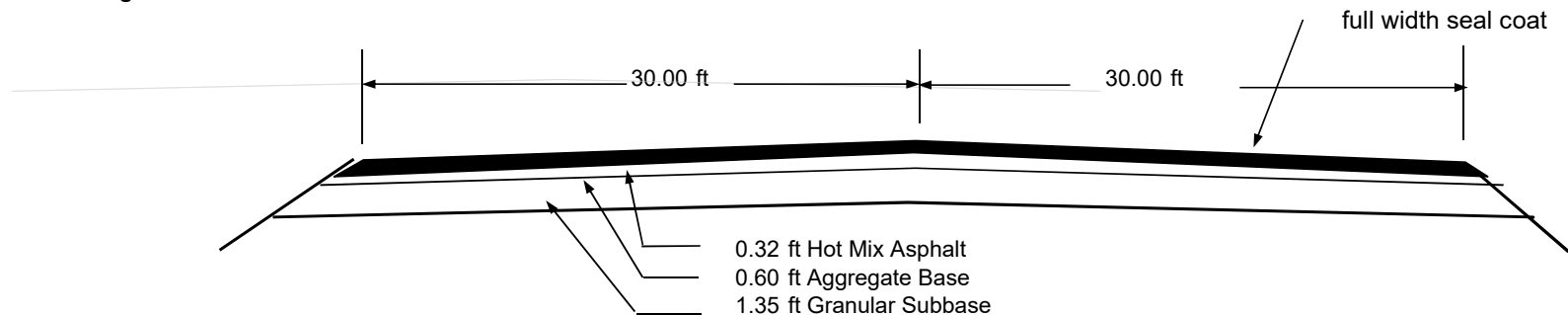
PROJECT NUMBER

A13(905)

KEY

13905

Material	Depth	Haul	Width	Weight / ft³	Cost
HMA PG with high polymer	0.32 ft	mile	60.00 ft	156.07 lb	60.00 / t
HMA PG with low polymer	ft	mile	ft	lb	/ t
Asplt Treat Permeable Base	ft	mile	ft	lb	/ t
Aggregate Base	0.60 ft	mile	60.00 ft	156.07 lb	15.00 / t
Rock Cap	ft	mile	ft	lb	/ t
Granular Subbase	1.35 ft	mile	60.00 ft	109.87 lb	10.50 / t
Granular Borrow	ft	mile	ft	lb	/ yd³
Future Mill/Inlay	0.15 ft	mile	60.00 ft	142.96 lb	0.57 / t
Project Length	1,400 ft				
Travel Lane Width	60.00 ft				
Surface Width - Left Side	30.00 ft				
Surface Width - Right Side	30.00 ft				
Additional Borrow	cu.yard				
Traffic Cross Overs	no				
Number of Edge Drains	no				
Longitudinal Cracks	1 no				
Transverse Cracks	100 / mile				
Foreslope Angle - Left	0 Vertical				
Foreslope Angle - Right	0 Vertical				
Do Excavation	2.27 ft				
Do Subgrade Sep. Fabric Layer	60.00 ft				
No Future Pavement Geotextile	26.00 ft				
24 Year Standard Remaining Life					



PROJECT NAME 10th Avenue ITS & Overlay

36 YEAR LIFE CYCLE

PROJECT NUMBER A13(905)

UNIFORM PROJECT COSTS PER MILE

KEY 13905

(English units)

Flexible Pavement Reconstruction Freeport to Kimball

			PRESENT	CAPITAL	EQUIVALENT
YEAR	WORK	COST	WORTH	RECOVERY	UNIFORM
			FACTOR	FACTOR	ANNUAL
					COST
0	----> Initial Cost	\$325,600	1.0000	0.0529	\$17,200
-					
-					
-					
5					
-					
-	----> Seal Coat Driving Lanes	\$17,100	0.7307	0.0529	\$700
10					
-	----> Preservation Mill & Inlay-Year 12	\$86,800	0.6246	0.0529	\$2,900
-					
15	----> Seal Cracks	\$8,600	0.5553	0.0529	\$300
-					
-	----> Seal Cracks	\$8,600	0.4936	0.0529	\$200
-	----> Seal Coat Driving Lanes	\$17,100	0.4746	0.0529	\$400
20					
-	----> Seal Cracks	\$8,600	0.4388	0.0529	\$200
-					
-	----> Preservation Mill & Inlay-Year 24	\$86,800	0.3901	0.0529	\$1,800
25					
-	----> Seal Cracks	\$8,600	0.3468	0.0529	\$200
-					
30	----> Seal Cracks	\$8,600	0.3083	0.0529	\$100
-	----> Seal Coat Driving Lanes	\$17,100	0.2965	0.0529	\$300
-					
-	----> Seal Cracks	\$8,600	0.2741	0.0529	\$100
35					
-	----> End Life - Salvage Value	\$0	0.2444	0.0529	\$0
TOTAL		\$602,100	EUAC ---->		\$24,400
Total Net Present Worth @ 4%					\$461,200

LIFE CYCLE COST ANALYSIS
10th Avenue ITS & Overlay
A13(905)

Flexible Pavement Reconstruction Freeport to Kimball

Construct roadway using 0.32 ft of Hot Mix Asphalt PG with high polymer on top of 0.60 ft of Aggregate Base and 1.35 ft of Granular Subbase. Roadway shoulders at Vertical (L) and Vertical (R) slopes.

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:

Traffic Cross Overs	\$0
Borrow	\$0
Excavation	\$60,000
Hot Mix Asphalt PG with low polymer	\$0
Hot Mix Asphalt PG with high polymer	\$125,900
Permeable Base	\$0
Aggregate Base	\$59,000
Rock Cap	\$0
Granular Subbase	\$65,400
Granular Borrow	\$0
Edge Drains	\$0
Seal Coat at Year 1	\$0
Subgrade Fabric Layer	\$15,300
TOTAL INITIAL	\$325,600
Seal Coat Full Width	\$17,100
Seal Driving Lanes	\$17,100
Seal Cracks	\$8,600

PRESERVATION AT 12 YEARS:

Coldmill travel lanes	\$7,100
Hot Mix Asphalt inlay (recycled)	\$54,000
Seal coat full width	\$17,100
Seal cracks	\$8,600
TOTAL 12 YEAR PRESERVATION	\$86,800

PRESERVATION AT 24 YEARS:

Coldmill travel lanes	\$7,100
Hot Mix Asphalt inlay (recycled)	\$0
Pavement Geotextile	\$0
Plant mix overlay	\$54,000
Seal coat full width	\$17,100
Seal cracks	\$8,600
TOTAL 24 YEAR PRESERVATION	\$86,800

TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)	\$602,100
EQUIVALENT UNIFORM ANNUAL COST (euac)	\$24,400
TOTAL NET PRESENT WORTH AT 4% INTEREST	\$461,200

FLEXIBLE PAVEMENT WORKSHEET

Remove & Replace Pavement Reconstruction Albany to

PROJECT NAME

10th Avenue ITS & Overlay

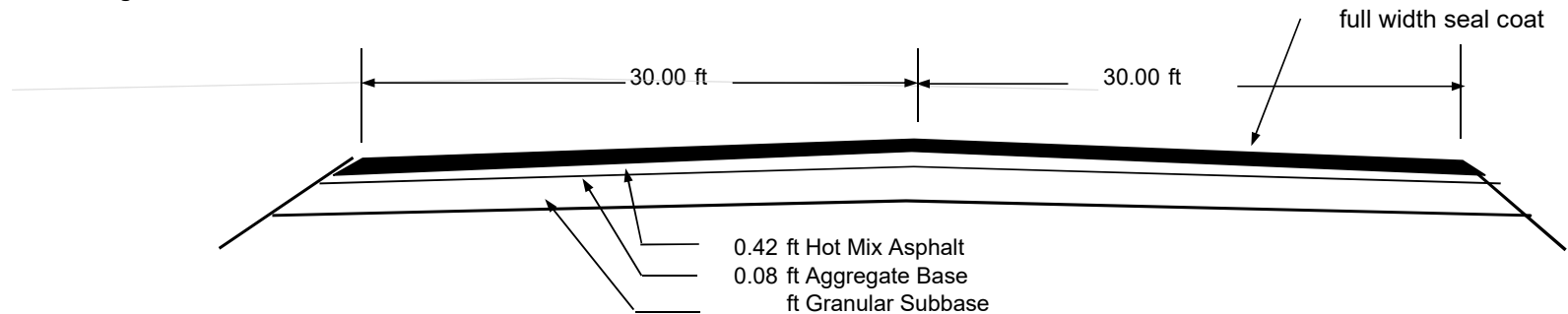
PROJECT NUMBER

A13(905)

KEY

13905

Material	Depth	Haul	Width	Weight / ft³	Cost
HMA PG with high polymer	0.42 ft	mile	60.00 ft	156.07 lb	60.00 / t
HMA PG with low polymer	ft	mile	ft	lb	/ t
Asplt Treat Permeable Base	ft	mile	ft	lb	/ t
Aggregate Base	0.08 ft	mile	60.00 ft	156.07 lb	15.00 / t
Rock Cap	ft	mile	ft	lb	/ t
Granular Subbase	ft	mile	ft	lb	/ t
Granular Borrow	ft	mile	ft	lb	/ yd³
Future Mill/Inlay	0.15 ft	mile	60.00 ft	142.96 lb	0.57 / t
Project Length	1,700 ft				
Travel Lane Width	60.00 ft				
Surface Width - Left Side	30.00 ft				
Surface Width - Right Side	30.00 ft				
Additional Borrow	cu.yard				
Traffic Cross Overs	no				
Number of Edge Drains	no				
Longitudinal Cracks	1 no				
Transverse Cracks	100 / mile				
Foreslope Angle - Left	0 Vertical				
Foreslope Angle - Right	0 Vertical				
Do Excavation	0.50 ft				
No Subgrade Sep. Fabric Layer	60.00 ft				
No Future Pavement Geotextile	26.00 ft				
24 Year Standard Remaining Life					



PROJECT NAME 10th Avenue ITS & Overlay

36 YEAR LIFE CYCLE

PROJECT NUMBER A13(905)

UNIFORM PROJECT COSTS PER MILE

KEY 13905

(English units)

Remove & Replace Pavement Reconstruction Freeport to Kimball

			PRESENT	CAPITAL	EQUIVALENT
YEAR	WORK	COST	WORTH	RECOVERY	UNIFORM
			FACTOR	FACTOR	ANNUAL
					COST
0	----> Initial Cost	\$184,200	1.0000	0.0529	\$9,700
-					
-					
-					
5					
-					
-	----> Seal Coat Driving Lanes	\$17,100	0.7307	0.0529	\$700
-					
10					
-	----> Preservation Mill & Inlay-Year 12	\$86,800	0.6246	0.0529	\$2,900
-					
15	----> Seal Cracks	\$8,600	0.5553	0.0529	\$300
-					
-	----> Seal Cracks	\$8,600	0.4936	0.0529	\$200
-	----> Seal Coat Driving Lanes	\$17,100	0.4746	0.0529	\$400
20					
-	----> Seal Cracks	\$8,600	0.4388	0.0529	\$200
-					
-	----> Preservation Mill & Inlay-Year 24	\$86,800	0.3901	0.0529	\$1,800
25					
-	----> Seal Cracks	\$8,600	0.3468	0.0529	\$200
-					
30	----> Seal Cracks	\$8,600	0.3083	0.0529	\$100
-	----> Seal Coat Driving Lanes	\$17,100	0.2965	0.0529	\$300
-					
-	----> Seal Cracks	\$8,600	0.2741	0.0529	\$100
-					
35					
-	----> End Life - Salvage Value	\$0	0.2444	0.0529	\$0
TOTAL		\$460,700	EUAC ---->		\$16,900
Total Net Present Worth @ 4%					\$319,500

LIFE CYCLE COST ANALYSIS
10th Avenue ITS & Overlay
A13(905)

Remove & Replace Pavement Reconstruction Freeport to Kimball

Construct roadway using 0.42 ft of Hot Mix Asphalt PG with high polymer on top of
0.08 ft of Aggregate Base. Roadway shoulders at Vertical (L) and Vertical (R)
slopes.

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:

Traffic Cross Overs	\$0
Borrow	\$0
Excavation	\$11,100
Hot Mix Asphalt PG with low polymer	\$0
Hot Mix Asphalt PG with high polymer	\$165,200
Permeable Base	\$0
Aggregate Base	\$7,900
Rock Cap	\$0
Granular Subbase	\$0
Granular Borrow	\$0
Edge Drains	\$0
Seal Coat at Year 1	\$0
Subgrade Fabric Layer	\$0
TOTAL INITIAL	\$184,200

Seal Coat Full Width	\$17,100
Seal Driving Lanes	\$17,100
Seal Cracks	\$8,600

PRESERVATION AT 12 YEARS:

Coldmill travel lanes	\$7,100
Hot Mix Asphalt inlay (recycled)	\$54,000
Seal coat full width	\$17,100
Seal cracks	\$8,600

TOTAL 12 YEAR PRESERVATION	\$86,800
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PRESERVATION AT 24 YEARS:

Coldmill travel lanes	\$7,100
Hot Mix Asphalt inlay (recycled)	\$0
Pavement Geotextile	\$0
Plant mix overlay	\$54,000
Seal coat full width	\$17,100
Seal cracks	\$8,600

TOTAL 24 YEAR PRESERVATION	\$86,800
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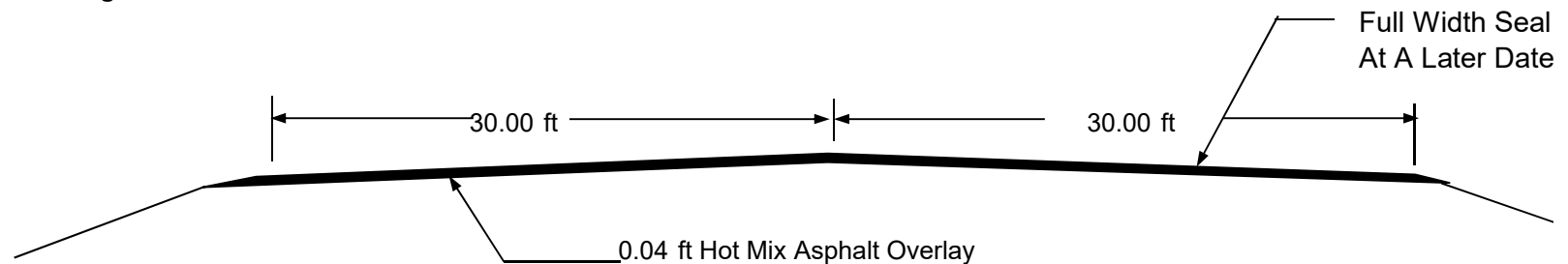
TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)	\$460,700
EQUIVALENT UNIFORM ANNUAL COST (euac)	\$16,900
TOTAL NET PRESENT WORTH AT 4% INTEREST	\$319,500

INLAY / OVERLAY WORKSHEET

Inlay / Overlay Existing Pavement Freeport to Kimball

PROJECT NAME 10th Avenue ITS & Overlay
PROJECT NUMBER A13(905)
KEY 13905

Material	Depth	Haul	Width	Weight / ft³	Cost
Existing Road	0.42 ft	mile	60.00 ft	156.07 lb	60.00 / t
HMA PG with high polymer	0.04 ft	mile	60.00 ft	156.07 lb	60.00 / t
HMA PG with low polymer	ft	mile	ft	lb	/ t
Inlay	0.17 ft	mile	60.00 ft	156.07 lb	82.16 / t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ t
	ft	mile	ft	lb	/ yd³
Future Mill & Inlay	0.15 ft	mile	60.00 ft	156.07 lb	0.57 / t
Project Length	1,400 ft				
Travel Lane Width	60.00 ft				
Surface Width - Left Side	30.00 ft				
Surface Width - Right Side	30.00 ft				
Estimated Salvage Value		\$ / t			
Additional Borrow		cu.yard			
Traffic Cross Overs		no			
Number of Edge Drains		no			
Longitudinal Cracks	2	no			
Transverse Cracks	100	/ mile			
Foreslope Angle - Left	0	Vertical			
Foreslope Angle - Right	0	Vertical			
No Excavation: None	0.00				
Recycle	No				
No Pavement Geotextile	60.00 ft				
24 Year Standard Remaining Life					



LIFE CYCLE COST ANALYSIS

STANDARD TIME LINES

21-Jan-20

PROJECT NAME 10th Avenue ITS & Overlay

36 YEAR LIFE CYCLE

PROJECT NUMBER A13(905)

UNIFORM PROJECT COSTS PER MILE

KEY 13905

(English units)

Inlay / Overlay Existing Pavement Freeport to Kimball

			PRESENT	CAPITAL	EQUIVALENT
YEAR	WORK	COST	WORTH	RECOVERY	UNIFORM
			FACTOR	FACTOR	ANNUAL
					COST
0	----> Rehab Initial Cost	\$115,400	1.0000	0.0529	\$6,100
-	----> Seal Coat Full Width	\$17,100	0.9615	0.0529	\$900
-					
-	----> Seal Cracks	\$10,300	0.8890	0.0529	\$500
-					
5					
-	----> Seal Cracks	\$10,300	0.7903	0.0529	\$400
-	----> Seal Coat Driving Lanes	\$17,100	0.7599	0.0529	\$700
-					
-	----> Seal Cracks	\$10,300	0.7026	0.0529	\$400
10					
-					
-	----> Mill & Inlay Travel Lanes	\$115,300	0.6246	0.0529	\$3,800
-					
15	----> Seal Cracks	\$10,300	0.5553	0.0529	\$300
-					
-					
-	----> Seal Cracks	\$10,300	0.4936	0.0529	\$300
-	----> Seal Coat Driving Lanes	\$17,100	0.4746	0.0529	\$400
20					
-	----> Seal Cracks	\$10,300	0.4388	0.0529	\$200
-					
-					
-	----> 24 Year Reconst Cost	\$325,600	0.3901	0.0529	\$6,700
25					
-					
-					
-					
30					
-					
-	----> Seal Coat Driving Lanes	\$17,100	0.2851	0.0529	\$300
-					
35					
-	----> End Life - Salvage Value	(\$257,224)	0.2444	0.0529	(\$3,300)
TOTAL		\$429,276	EUAC ---->		\$17,700
Total Net Present Worth @ 4%					\$269,800

LIFE CYCLE COST ANALYSIS
10th Avenue ITS & Overlay
A13(905)

Inlay / Overlay Existing Pavement Freeport to Kimball

Coldmill and inlay the existing pavement to a depth of 0.17 ft at a width of 60.00 ft,
then overlay the roadway using 0.04 ft of PG Plant Mix to a width of 60.00 ft.
Roadway shoulders at Vertical (L) and Vertical (R) slopes.

COST PER MILE SUMMARY:

INITIAL CONSTRUCTION:

Traffic Cross Overs	\$0
Borrow	\$0
Excavation: None	
Plant Mix Overlay	\$15,700
Plant Mix Inlay	\$91,600
Rotomill for Inlay	\$8,100
Salvage Value of Coldmill Material	\$0
Geotextile	\$0
TOTAL INITIAL	\$115,400

Seal Coat at Year 1	\$17,100
Seal Driving Lanes	\$17,100
Seal Cracks	\$10,300

PRESERVATION AT 12 YEARS:

Coldmill travel lanes	\$7,100
Plant mix inlay (recycled)	\$80,800
Seal coat full width	\$17,100
Seal cracks	\$10,300

TOTAL 12 YEAR PRESERVATION	\$115,300
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RECONSTRUCTION AT 24 YEARS:	\$325,600
------------------------------------	------------------

SALVAGE VALUE (79%)	(\$257,224)
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TOTAL 36 YEAR LIFE CYCLE COST (from Time Line Chart)	\$429,276
EQUIVALENT UNIFORM ANNUAL COST (euac)	\$17,700
TOTAL NET PRESENT WORTH AT 4% INTREST	\$269,800

DUST ABATEMENT
Project Name: 10th Avenue ITS & Overlay
Remove and Replace Existing Asphalt Pavement
Project No.: 13905

Segment	Length (ft.)	Width (ft.)	Depth of H₂O (in.)	Area (ft.²)	Volume (ft.³)	Volume (gal)
Mainline	2900	65	2	188,500	31,417	235,013
				-	-	-
Total	2,900			188,500	31,417	235,013
						Use 235 MG

Project Name: 10th Avenue ITS & Overlay
Full Depth Reconstruction
Project No.: 13905

Segment	Length (ft.)	Width (ft.)	Depth of H₂O (in.)	Area (ft.²)	Volume (ft.³)	Volume (gal)
Mainline	2900	65	4	188,500	62,833	470,026
				-	-	-
Total	2,900			188,500	62,833	470,026
						Use 470 MG

APPENDIX D

GENERAL NOTES

SAMPLING	WATER LEVEL	FIELD TESTS
 Auger Cuttings  Rock Core  Standard Penetration Test	 Water Initially Encountered  Water Level After a Specified Period of Time  Water Level After a Specified Period of Time  Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength Qu, (tsf)	Standard Penetration or N-Value Blows/Ft.
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification	
					Group Symbol	Group Name ^B
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ≥ 4 and 1 ≤ Cc ≤ 3 ^E		GW	Well-graded gravel ^F
			Cu < 4 and/or 1 > Cc > 3 ^E		GP	Poorly graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH		GM	Silty gravel ^{F,G,H}
			Fines classify as CL or CH		GC	Clayey gravel ^{F,G,H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu ≥ 6 and 1 ≤ Cc ≤ 3 ^E		SW	Well-graded sand ^I
			Cu < 6 and/or 1 > Cc > 3 ^E		SP	Poorly graded sand ^I
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH		SM	Silty sand ^{G,H,I}
			Fines classify as CL or CH		SC	Clayey sand ^{G,H,I}
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots on or above “A” line ^J		CL	Lean clay ^{K,L,M}
			PI < 4 or plots below “A” line ^J		ML	Silt ^{K,L,M}
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}
			Liquid limit - not dried			Organic silt ^{K,L,M,O}
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above “A” line		CH	Fat clay ^{K,L,M}
			PI plots below “A” line		MH	Elastic Silt ^{K,L,M}
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K,L,M,P}
			Liquid limit - not dried			Organic silt ^{K,L,M,Q}
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

^A Based on the material passing the 3-inch (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

