Geotechnical Evaluation
GB 1 Subgrade Analysis

I-70 South Trench
W-07-109

Prepared For:

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January 2010

GEOTECHNICAL EVALUATION
GB 1 SUBGRADE ANALYSIS

I-70 SOUTH TRENCH
W-07-109

PREPARED FOR:

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JANUARY 2010

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TABLE OF CONTENTS

APPENDICES

Appendix	Description
A	Figures: 1. Site Location Map 2. Soil Boring Locations I-70 South Trench 3. GB 1 Subgrade Analysis I-70 South Trench (West Portion) 4. GB 1 Subgrade Analysis I-70 South Trench (West Central Portion) 5. GB 1 Subgrade Analysis I-70 South Trench (East Central Portion) 6. GB 1 Subgrade Analysis I-70 South Trench (East Portion)
B	Tables: 1. Soil Boring Locations 2. Summary of Topsoil/Existing Pavement Thickness and Observed Water Levels at Boring Locations 3. GB 1 Subgrade Analysis Results
C	GB 1 Model Analysis Output – Entire I-70 South Trench Project Area
D	GB 1 Model Analysis Output – Individual Roadway Segments for I-70 South Trench
E	Boring Logs: I-70 South Trench

1.0 INTRODUCTION

The Ohio Department of Transportation (ODOT) proposes to reconstruct the east and south portions of the Interstate (I) I-70/I-71/I-670 Innerbelt located in downtown Columbus, Ohio. This system of highways, bridges, and interchanges extends in a south to north direction along I-71 and its convergence with State Route (SR) 315 from Greenlawn Avenue to West Broad Street and also in a south to north direction from the I-70/I-71 split north along I-71 to the I-670 interchange. The limits of the project extend along I-70 in a west to east direction from a point near Sullivant Avenue to Fairwood Avenue. Reconstruction of the entire system includes the replacement or reconstruction of I-70 East and I-70 West as well as I-71 North and I-71 South within the project area. Replacement or construction of bridges, abutments, and roadways will be included.

The project area for this GB 1 subgrade analysis report is defined as the I-70 South Trench located between the I-70/SR 315 split (West Interchange) and I-70/I-71 East Interchange. The project site location is shown on **Figure 1**, contained in **Appendix A** of this report (all figures are contained in **Appendix A**). The area generally extends in a west to east direction from the railroad overpass east of Whittier Street to Grant Avenue. Subgrade improvements for other segments of the project area will be submitted in separate GB 1 subgrade analysis reports. The proposed mainline I-70 and associated ramps are included. The locations of the proposed South Trench mainline roadways and ramps are shown on **Figure 2**. Soil borings used to analyze subgrade soils and conditions for the area were drilled by DLZ Ohio, Inc. (DLZ). Subsurface investigations were performed in accordance with ODOT's "Specifications for Geotechnical Explorations," dated January 16, 2009, applicable Geotechnical Bulletins distributed by ODOT Office of Geotechnical Engineering, and applicable American Society for Testing and Materials (ASTM) guidelines. Information from borings drilled for retaining walls was also used to analyze subgrade soils for pavement design if the borings were located adjacent to the proposed roadway alignments.

ODOT Geotechnical Bulletin GB 1, titled "Plan Subgrades," dated January 18, 2007, was used to analyze the soils information gathered during the subsurface investigation. Information from the soil boring logs and laboratory analysis results of the soil samples collected from the borings was entered into the GB 1 data analysis spreadsheet provided by ODOT. Results of the GB 1 analysis were used to prepare the recommended subgrade stabilization methods and extent of subgrade repairs that are summarized in the last

section of this document. The following sections provide a general description of the subsurface conditions in the vicinity of the South Trench, GB 1 analysis input parameters, GB 1 analysis results, and subgrade improvement recommendations.

2.0 SUBSURFACE INVESTIGATION

2.1 Subsurface Investigation Methods

Soil borings were drilled by DLZ with either a truck-mounted or all terrain vehicle (ATV)-mounted drill rig. The soil borings that provide relevant subsurface information for the South Trench are located on **Figure 2** through **Figure 6**. **Table 1**, located in **Appendix B**, is a listing of the soil borings used for this section of the project area. Borings are listed in order of the associated segment of mainline roadway or ramp. In addition to the borings drilled within the proposed pavement area, borings drilled for retaining wall design at various locations within the South Trench were used for analysis. If these borings provided pertinent subsurface information and they were near the proposed edge of pavement, they were included in the analysis.

During drilling, field personnel made measurements and observations of subsurface conditions and recorded them on boring logs. Boring logs for the segment of the project discussed in this report are contained in **Appendix E**. After drilling, each boring location was surveyed in the field for location and elevation. The boring locations (northing and easting) were provided by DLZ in Ohio State Plane coordinates. Elevations were provided by DLZ in North American Datum of 1983.

The borings were drilled using rotary-type drilling methods. At regular intervals, disturbed, but representative soil samples, were obtained using a 2-inch outside diameter (OD) split-barrel sampler driven into the soil by blows from a 140-pound hammer free falling 30 inches (Standard Penetration Test [SPT] - ASTM D1586). Driving resistance was recorded in the field and listed on the boring logs in terms of the number of hammer blows for each 6-inch driving interval. The second and third intervals (N_2 and N_3) are entered into the GB 1 analysis spreadsheets and are added together to calculate the number of blows per foot (N). GB 1 analysis also requires the entry of drill rod energy ratio (ER) for each boring. The drill rod energy is expressed as a percent and is associated with N in the following equation:

$N_{60} = N_m \times (ER/60)$ where: N_m = the measured N value ($N_2 + N_3$)
ER = drill rod energy ratio as a percent for the specific rig used
N_{60} = 60% energy ratio

Three different drill rigs were used to obtain soil samples for the project area. DLZ provided the various ERs for each boring installed. The ERs for the equipment used in this project are listed below:

Notation on GB 1 Analysis	Drill Rod Energy Ratio
A	61
B	62
C	63

2.2 General Geologic Material

The State of Ohio Department of Natural Resources (ODNR), Division of Geological Survey Bulletin 44 indicates that the general area of the site was glaciated by both the Illinoisan- and Wisconsin-age ice sheets, and that the unconsolidated deposits are relatively thick. According to bedrock topography maps of the area, the top of bedrock varies from Elevation 600 to Elevation 650 within the South Trench. This would suggest the depth to bedrock is greater than 75 feet below the existing site grades and would not affect pavement subgrade design.

There are no significant drainage features located within the South Trench area. The topography of the site varies significantly north to south throughout this area as a result of the existing I-70 roadway. The original surface grades in this area were generally between Elevations 750 and 770 prior to construction of the existing I-70 roadway and South Trench. The construction of this depressed roadway created a trench-type condition for portions of the South Trench that are approximately 20 to 30 feet below the surrounding grades.

2.3 General Subsurface Conditions Encountered in the Borings

The following paragraphs provide a general description of the subsurface conditions encountered in the soil borings. Locations of the borings used for the subgrade analysis are shown on the **Figure 2**. For a detailed description of the conditions encountered at each boring location, refer to each individual boring log, contained in **Appendix E**.

Soil borings located within the South Trench area encountered competent glacial till soils or dense granular outwash material. In general, the test borings penetrated approximately 10 to 136 feet below existing grades. Surface materials in the area included topsoil, concrete pavement, or gravel. **Table 2** is a summary of the topsoil, pavement, and pavement base material thicknesses encountered at each boring location in the project area as reported on the boring logs (boring logs are included in **Appendix E**). Surface material thicknesses were noted in order to establish the sampling interval depths of subgrade soils to be input into the GB 1 spreadsheet analysis since topsoil, pavement, and aggregate base materials are not applicable to the analysis.

Soils information used for the pavement subgrade analysis was limited to the first 6 feet of soil below proposed subgrade elevations by the GB 1 analysis spreadsheet. Primarily fine grained (generally cohesive) soils were encountered near surface. The SPT blow counts were generally high and correspond to relative densities of dense or better for granular soils, and for fine grained soils the consistency would typically be correlated as stiff to very stiff. Bedrock was not encountered within the first 6 feet of finished subgrade in any of the borings. The moisture content of the soil samples exhibiting cohesive properties was typically -6 to +6 points from optimum; with optimum moisture content based on the soil classification rather than site-specific laboratory analysis.

2.4 Groundwater Observations

The elevation of groundwater observed in boreholes during drilling was noted on each boring log. Water level information is included in **Table 2**. Observed water elevations in the borings ranged from 9.2 to 43.3 feet below ground surface (bgs). Several borings were reported as "dry" to depths up to 20 feet.

The true groundwater levels cannot be discerned from the information provided. Short-term water level readings in boreholes, especially in cohesive soils, are an indication, but not an accurate measurement of the groundwater elevation in an area. The long-term groundwater elevations would need to be confirmed by installing monitoring wells or piezometers and performing long-term (seasonal) groundwater measurements.

2.5 Laboratory Testing

Laboratory testing on recovered soil samples consisted of ODOT soil classification, moisture content, Atterberg limits, and grain size analysis. Tests results are reported on the boring logs contained in **Appendix E** and within the GB 1 analysis data discussed in Section 3.0.

3.0 PRELIMINARY PAVEMENT SUBGRADE EVALUATION AND RECOMMENDATIONS

3.1 GB 1 Analysis Data Input

The project area for this report is defined as the immediate area of the proposed South Trench for I-70. The proposed mainline I-70 and ramps were included. **Table 1** included in **Appendix B** shows the soil borings used for the subgrade analysis for each segment evaluated. The complete project area was analyzed on one GB 1 analysis spreadsheet in addition to each segment of the project being analyzed on separate GB 1 analysis spreadsheets.

A GB 1 analysis required data input into ODOT provided spreadsheets that will generate recommended subgrade stabilization measures, where necessary. Input data required from each soil boring are as follows:

- Boring number
- Boring location
- Sample depths (from proposed subgrade elevation)
- N_2 and N_3 (blow counts for second and third 6-inch intervals)
- drill rig ER
- liquid limit and plastic limit
- percent silt and percent clay
- moisture content
- soil classification.

The GB 1 analysis spreadsheet calculates the following information for each boring location:

- N_m – number of blows per foot required to drive the sample tube through the soil. $N_M = N_2 + N_3$, sum of blow counts for the second and third 6-inch increments for each split spoon sample drive

- N_L – the lowest N_{60} value recorded in the top 6 feet of material

- N_{60} – N_M corrected to an equivalent drill rod energy of 60 percent
- PI – Plasticity Index
- P_{200} – percent of material passing No. 200 sieve
- M_{opt} – optimum moisture content (based on soil type)
- Problems with subgrade soil relative to the soil classification
- Problems with subgrade soil relative to the soil moisture or soil strength estimated from blow counts
- Possible subgrade treatments (undercutting, cement stabilization [CS], or lime stabilization [LS]).

Sample depths presented on the boring logs were changed to depth below design subgrade prior to input into the GB 1 analysis spreadsheet. This will establish the depth of undercutting or depth of stabilization needed from design subgrade rather than from a reference elevation of the top of each boring (existing grade at the time of drilling). Soil sample results for soils that will be cut out prior to establishing the design subgrade elevations were not entered into the GB 1 analysis.

3.2 GB 1 Analysis Results – Entire I-70 South Trench Area

As required by GB-1, the following is a tabulation of the average results for the entire I-70 South Trench project area:

Average NL for entire South Trench area	22.0
Average PI to the nearest whole number	10
Average design California Bearing Ratio (CBR) to the nearest whole number (as an average not a percent)	9
Average moisture content to the nearest whole number	10

The GB 1 analysis spreadsheet output for the entire South Trench project area is contained in **Appendix C**. The project area was also broken up into segments to complete individual analyses for each roadway segment and ramp. The GB 1 analysis output for each individual segment is contained in **Appendix D**. **Table 3** presents the GB 1 analysis results of the individual segments. The calculated design CBRs ranged from 8 to 11 as indicated in **Table 3**.

The designer, based on the results of subsurface exploration, is responsible for identifying the method, location, and dimensions (including depth) of subgrade stabilization in the plans. GB 1 is to be used as general guidance. Limits for subgrade stabilization estimated in this GB 1 analysis should be verified and adjusted in the field based on proof rolling and visual observation. Undercutting estimates and treatment options were based on the following parameters:

- Soils at a depth of 6 feet or greater below finished subgrade were not considered in the subgrade improvements to be implemented since the soils were too deep.

- Maximum undercut depth was set at 6 feet from design subgrade since the undercut will be filled with competent material.

- Where the GB 1 analysis indicated an undercut depth, the undercut depth was applied only to the sample interval if the underlying soils were indicated to not need undercutting by the GB 1 analysis.

- Where the GB 1 analysis indicated the top sample in the boring required undercutting, the undercut was started at the top of the sample interval needing cut.

The soils classifications data for the project area identified in the boring program were identified as type A-1a, A-1b, A-2-4, A-3, A-3a, A-4a, A-4b, A-6a, A-6b, and A-7-6. Out of the identified materials, only soil type A-4b will be removed or stabilized based on soil type alone.

The moisture content of cohesive soils has a significant effect on the physical properties of the soil. Moisture content reported on the boring logs only represents the moisture content during drilling and sampling. Actual moisture content during construction may vary

greatly from the measured soil moisture content reported. Undercut areas required by GB 1 analysis presented in this report are based on soil type and excessive moisture in the samples collected. The extent and need for subgrade improvement is dependent on the actual subgrade conditions during site preparation and construction. Each area of subgrade for proposed pavements must be confirmed in the field by proof rolling to identify the need for subgrade stabilization.

The following sections summarize the results of the GB 1 analyses performed for individual roadway segments or ramps. As described below, no subgrade stabilization methods are evidenced based on the results of the GB 1 output for the South Trench.

3.3 GB 1 Analysis I-70 Eastbound

Eleven soil borings were used to determine subgrade stabilization needs for I-70 eastbound reconstruction. The calculated design CBR for this portion of the project area is 9.

No areas for undercutting or subgrade stabilization were identified. Boring B-031 on **Figure** 5 shows the presence of A-4b soils located at depths greater than 3 feet below proposed subgrade and therefore these soils need not be removed.

3.4 GB 1 Analysis I-70 Westbound

Eleven soil borings were used to determine subgrade stabilization needs for the proposed I-70 westbound reconstruction in the project area. The calculated design CBR for this portion of the project area is 9. No areas for undercutting or subgrade stabilization were identified.

3.5 GB 1 Analysis Ramp F1

Ramp F1 is located south of the I-70 mainline on the west end of the South Trench. The majority of Ramp F1 is bridge section. One section of Ramp F1, approximately from Station 264+50 to Station 267+50, is not a bridge section. Boring B-018 was used to determine subgrade stabilization needs for the proposed Ramp F1. Ramp F1 is shown on **Figures 3 and 4**. The final design alignment and grade for Ramp F1 shows approximately 9.7 feet of fill material will be added to the ramp subgrade at boring B-018. Since the

amount of fill is greater than 8 feet, the GB 1 analysis spread sheet did not calculate an average group index or a design CBR for the ramp segment. According to the GB 1 analysis, undercutting or other stabilization methods are not required for the 300-foot section of Ramp F1 in the project area.

3.6 GB 1 Analysis Ramp M1

One soil boring (B-022) was used to determine subgrade stabilization needs for the proposed Ramp M1 in the project area. Ramp M1 is shown on **Figures 3 and 4**. The calculated design CBR for this portion of the project area is 11. According to the GB 1 analysis, undercutting or other subgrade stabilization methods are not required for Ramp M1. Only the eastern portion of Ramp M1 is pavement construction from approximately Station 625+50 to 631+00. The western portion of Ramp M1 is a bridge section.

3.7 GB 1 Analysis Ramp N1

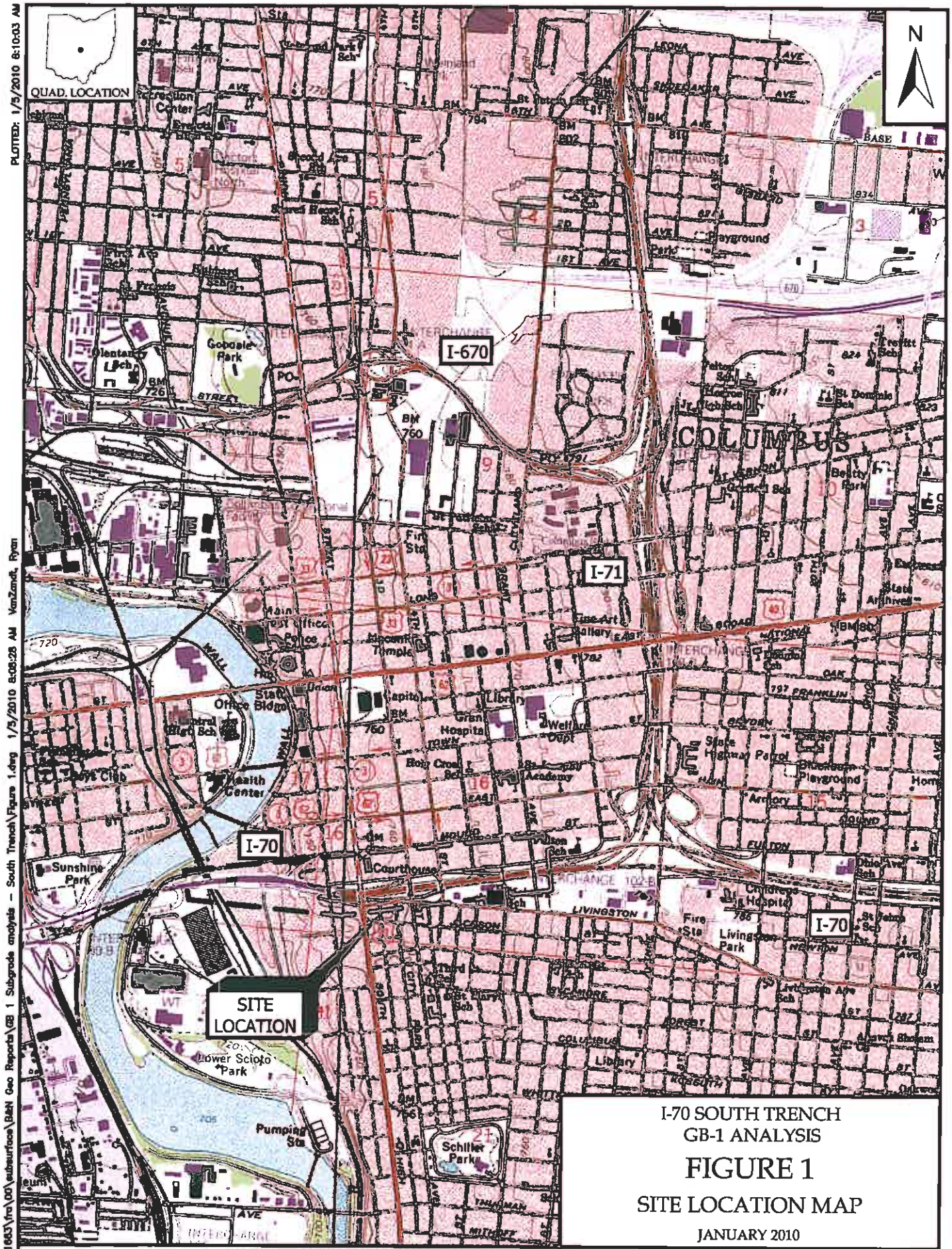
One soil boring (B-043) was used to determine subgrade stabilization needs for the proposed Ramp N1 in the project area. Ramp N1 is shown on **Figure 6**. The calculated design CBR for this portion of the project area is 8. According to the GB 1 analysis, undercutting or other subgrade stabilization methods are not required for the portion of Ramp N1 located west of Grant Avenue. The GB 1 analysis for the portion of Ramp N1 located east of Grant Avenue is contained in a separate GB 1 analysis document for the Southeast Interchange.

3.8 Pavement Subgrade Recommendations

All recommendations for subgrade stabilization improvement/treatments for the South Trench area are based on the Subgrade Version 9.09 as provided by ODOT and described in GB 1. Undercutting is not required in the South Trench project area (22 boring locations). Cement stabilization is an option in one area of westbound I-70 (boring B – 034) but is not considered practical due to the limited area needing cement stabilization. Lime stabilization was not listed as an option in any areas of the South Trench project site.

APPENDIX A

FIGURES



SOURCE:
7.5 MINUTE COLUMBUS U.S.G.S. QUADRANGLE MAP

I-70 SOUTH TRENCH
GB-1 ANALYSIS

FIGURE 1

SITE LOCATION MAP

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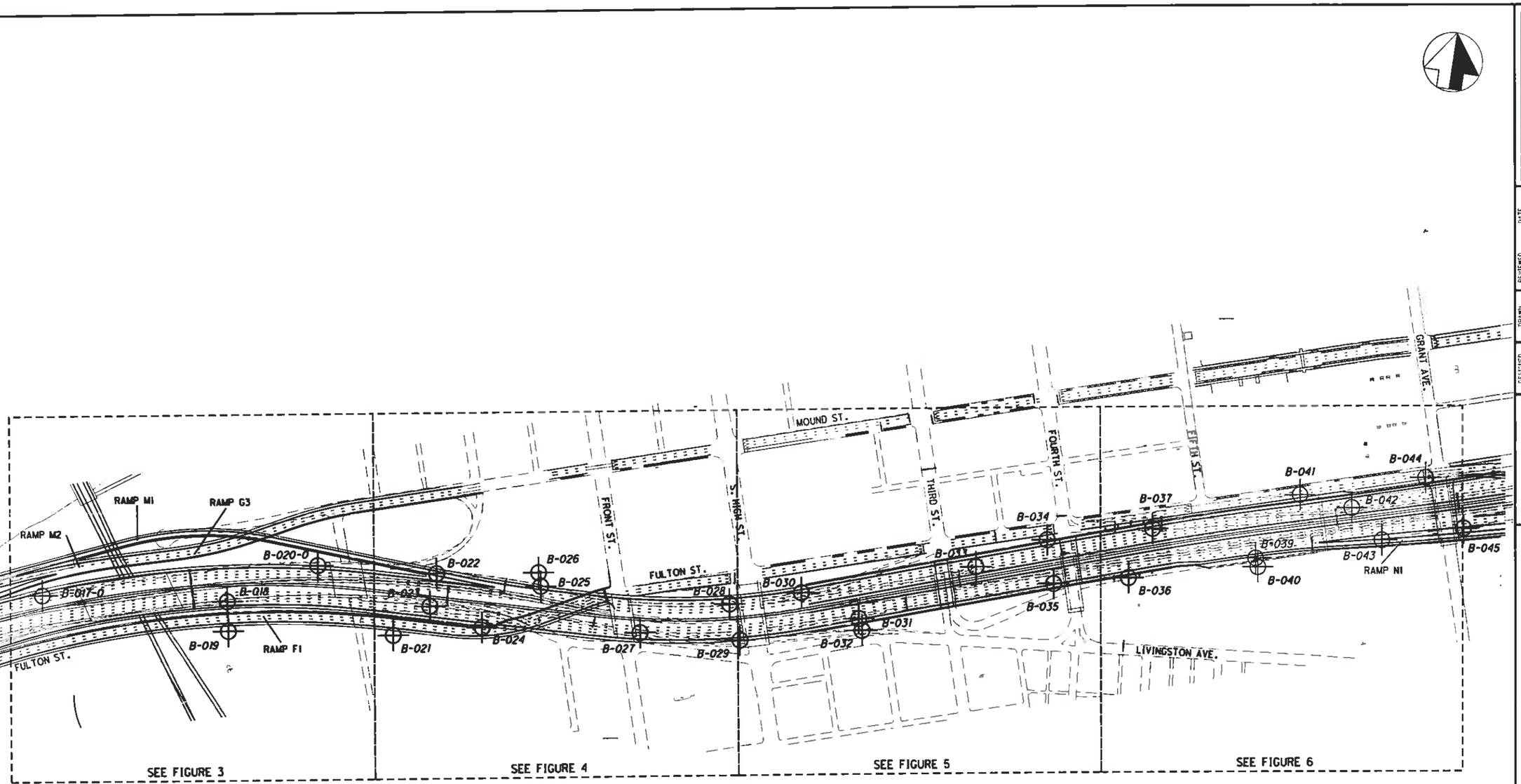
Engineers ▪ Environmental Scientists ▪ Geologists



PLAN

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BURGESS & NIPLE
5085 Reed Road
Columbus, Ohio 43220

DESIGNED	DRAWN	REVIEWED	DATE
VEA	RVZ		
CHECKED	REVISED	STRUCTURE FILE NUMBER	
VEA			

FRANKLIN COUNTY

SOIL BORING LOCATIONS
GB-1 SUBGRADE ANALYSIS
I-70 SOUTH TRENCH

W-07-10.2
FIGURE 2

1 / 5

EXISTING RAILROAD

RAMP M1

RAMP G3

RAMP M2

RAMP F1

MOUND ST.

I-70 (WB)

I-70 (EB)

B-017-0

B-018

B-020-0

610

615

620

715

720

725

810

815

820

825

830

835

255

260

265

WEST INTERCHANGE

SOUTH TRENCH

NOTE:
EACH ROADWAY IS A BRIDGE SEGMENT OVER EXISTING RAILROAD. RAMP M1 IS A BRIDGE SEGMENT OVER RAMP G3

UNDERCUT AREAS

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SOIL BORING LOCATIONS
GB-1 SUBGRADE ANALYSIS
WEST PORTION

W-07-109
FIGURE 3

2 / 5

N 79° 58' 53" E

N 01° 52' 57" E

625

RAMP M1

B-022

630

725

I-70 (WB)

B-026

B-025

730

280

B-028

B-023

I-70 (EB)

735

B-024

275

B-027

B-0

270

B-021

RAMP F1

UNDERCUT AREAS

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DATE
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STRUCTURE FILE NUMBER

FRANKLIN COUNTY

SOIL BORING LOCATIONS
GB-1 SUBGRADE ANALYSIS
WEST CENTRAL PORTION

W-07-10P
FIGURE 4

3 / 5

UNDERCUT AREAS

B-030

745

I-70 (WB)

B-031

B-032

29

I-70 (EB)

B-033

750

B-035

B-034

755

B-0

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VEA			

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SOIL BORING LOCATIONS
CB-1 SUBGRADE ANALYSIS
EAST CENTRAL PORTION

W-07-102
FIGURE 5

4/5

GRANT AVE.

B-044

RAMP N3

870

I-70 (WB)

865

B-041

B-042

I-70 (EB)

775

B-045

RAMP N4

870

B-037

B-043

865

B-039

RAMP N1

B-040

36

UNDERCUT AREAS*

*NOTE: SEE GEOTECHNICAL EVALUATION GB-1 SUBGRADE ANALYSIS, I-70/I-71 EAST INTERCHANGE FOR UNDERCUT AREA EAST OF GRANT AVE.

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VEA			

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SOIL BORING LOCATIONS
GB-1 SUBGRADE ANALYSIS
EAST PORTION

W-07-10.00
FIGURE 6

5 / 5

APPENDIX B

TABLES

Table 1
Soil Boring Locations

Project Segment	Station Range	Total Number of Borings	Boring I.D.s
Entire South Trench area	N/A	22	
I-70 (Eastbound)	716+00 – 768+00	11	B-018, B-023, B-024, B-027, B-029, B-031, B-035, B-036, B-039, B-043, B-045
I-70 (Westbound)	716+00 – 768+00	11	B-020, B-022, B-025, B-028, B-030, B-033, B-034, B-037, B-041, B-042, B-044
Ramp F1	263+50 – 267+50	1	B-018
Ramp M1	612+00 – 631+00	1	B-022
Ramp N1	763+00 – 768+20	1	B-043

Soils information from three borings (B-018, B-022, and B-043) was used for subgrade analysis on more than one road segment or ramp.

Table 2
Summary of Topsoil/Existing Pavement Thickness and Observed Water Levels at Boring Locations

Boring I.D.	Topsoil Thickness (inches)	Concrete Thickness (inches)	Asphalt Thickness (inches	Base Material Thickness (inches)	Depth to Water (feet)	Total Depth (feet)
I-70 Mainline (Eastbound)						
B-018	--	10	--	4	15.0	17.5
B-023	--	12	--	6	19.1	35
B-024	--	--	--	--	16.7	111.5
B-027	--	18	--	11	>14	14
B-029	--	16	--	11	21.0	136.5
B-031	8	--	--	--	9.5	60
B-035	--	18	--	3	9.2	15
B-036	--	20	--	4	14	115.6
B-039	--	16	--	5	>17.5	17.5
B-043	--	18	--	5	14.4	115
B-045	--	8	--	5	>15	15
I-70 Mainline (Westbound)						
B-020	--	16	--	4	>20	20
B-022	--	16	--	4	>20	20
B-025	--	7	--	7	39	59.3
B-028	--	12	--	6	>10	10
B-030	--	11	--	6	13.6	111
B-033	--	--	--	2	9.2	15
B-034	3	--	--	--	43.3	135.5
B-037	--	17	--	5	25.6	130
B-041	--	8	--	5	37.1	135
B-042	2	--	--	--	>15	15
B-044	--	6	--	10	20.8	131.5
Ramp F1						
B-018	--	10	--	4	15.0	17.5
Ramp M1						
B-022	--	16	--	4	>20	20
Ramp N1						
B-043	--	18	--	5	37	115

Soils information from three borings (B-018, B-022, and B-043) was used for subgrade analysis on more than one road segment or ramp.

Table 3
GB 1 Subgrade Analysis Results

Project Segment	Number of Soil Borings	Average N_{60}	Average N_L	Average PI	Average Moisture	Average Opt. Moist.	Average Group Index (GI)	Design CBR
Entire South Trench Area	22	40.9	22.0	9.9	10.0	10.1	3	9
I-70 Mainline Eastbound	11	40.6	22.6	9.7	10.2	10.2	3	9
I-70 Mainline Westbound	11	41.2	21.3	10.1	10.0	10.0	3	9
Ramp F1**	1							
Ramp M1	1	28.2	13.0	4.7	12.2	10.8	1.5	11
Ramp N1	1	72.3	30.0	8.5	10.0	11.5	4	8

** - The GB1 analysis spreadsheets did not calculate an average Group Index or a Design CBR for Ramp F1 since all the soil samples for that ramp are under approximately 10 feet of fill.

APPENDIX C

GB 1 MODEL ANALYSIS OUTPUT - ENTIRE I-70 SOUTH TRENCH PROJECT AREA

Subgrade Analysis

V. 9.09 08/10/07

Design	9
CBR	
Item 320	Option
Global CS	Option
Global LS	No

22	Total Borings

Classification Counts by Sample

R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	9	14	1	2	2	0	0	0	36	1	0	11	7	0	1	0	0
	11%	17%	1%	2%	2%				43%	1%		13%	8%		1%		
0.0%	33.3%								66.7%								

Class @ Surface	
2-5	0
4b	0
5	0
7-5	0
7-6	0
8a	0
8b	0
R	0

% Borings	
N_L <= 5	9%
N_L <=10	14%
N_L >=20	59%
M+	27%
R	0%

% Surface			
9%			
0%	9%		
% Borings			
27%			
0%	5%	5%	27%

Rig	ER
A	61
B	62
C	63
D	75
E	86
F	79
G	
H	

	N_{60}	N_L			PI	Clay		M	M_{OPT}	GI
Average	40.9	22.0			9.9	20.8		10.0	10.1	3.05
Maximum	103	30	44	18	28	43	83	21	18	16
Minimum	3	3	14	5	1	3	3	1	6	0

I-70 South Trench Complete Project Site W-07-109

#	B #	Boring Location		Depth	To	Cut Fill	Standard Penetration n_2	n_3	N_m	Rig	N_{60}	N_L	Physical Characteristics LL	PL	PI	% Silt	% Clay	P 200	Moisture M	M_{OPT}	Classification Class	GI	Comments	Problem w/ Class	Problem w/ MN	Treatments LS	CS	UC Class	UC MN	Analysis
1	B-018	70 Eastbound	1	11.2	12.7	9.7	17	12	29	B	30								10	16	6b		fill 9.7 feet							No undercut upper 18 feet soils will bridge
		Ramp F1	2	13.2	14.7		6	13	19		20		33	16	17	30	29	59	19	16	6b		first sample 1.5							
		720+55, 63' R	3	15.7	17.2		8	10	18		19								10	16	6b		14" conc. and base							
			4	18.2	19.7		8	5	13		13	13							15	10	4a			MN				1		
2	B-020	70 Westbound	1	10.7	12.2	9.2	10	12	22	A	22								13	14	6a		fill 9.2 feet							No undercut upper soil and fill soils will bridge
		724+03, 77' L	2	12.7	14.2		17	21	38		39									14	6a		first sample 1.5							
			3	15.2	16.7		6	6	12		12		23	15	8	37	23	60	11	10	4a		20" conc. and base							
			4	17.7	19.2		2	3	5		5	5							12	10	4a			N				5		
3	B-022	Ramp M1	1	0.0	1.2	-1.8	9	7	16	A	16		15	14	1	29	22	52	13	14	6a	3	cut 1.8 feet							
		70 Westbound	2	1.2	2.7		7	6	13		13		21	18	3	18	9	27	11	10	2-4	0	20" conc. and base							
		Sta. 728+60	3	2.7	4.2		18	27	45		46		28	18	10	30	18	48	13	13	4a	3	Sample 4 dense							
			4	4.2	5.7		21	16	37		38	13								6	1a	0	gravel, no tests							
4	B-023	70 Eastbound	1	15.3	16.8	14.3	2	3	5	C	5									14	6a		fill 14.3 feet		N			5		No undercut under 14.3 feet of new fill
		728+49, 36'R	2	17.8	19.3		1	2	3		3		29	18	11	33	18	51	19	14	6a		first sample 1.5		MN		--	5		
			3	20.3	21.8		1	2	3		3		28	18	10	32	24	56	19	13	4a		18" conc. and base		MN		--	5		
			4	22.8	24.3		2	4	6		6	3							21	10	4a		use sample P1, P2		MN			3		
5	B-024	70 Eastbound	6	0.4	1.9	####	21	22	43	A	44								19	16	6b	10	cut 10.6 feet							
		Sta. 730+50	7	2.9	4.4		14	15	29		29									16	6b	10	no lab analysis							
			8	5.4	6.9		7	7	14		14								9	10	4a		sample #6, 7, 8							
			9	7.9	9.4		4	7	11		11	11	21	13	8	35	22	57	11	10	4a									
6	B-025	70 Westbound	6	0.0	1.4	####	16	17	33	A	34		27	16	11	34	20	54	11	14	6a	4	cut 11.6 feet							
		732+70	7	1.9	3.4		8	12	20		20								11	10	4a	5	first sample at 8.5'							
			8	4.4	5.9		7	12	19		19		14	7	7	32	21	52	9	10	4a	3	no lab tests 7 and 9							
			9	6.9	8.4		6	9	15		15	15								10	4a									
7	B-027	70 Eastbound	6	0.0	0.6	####	26	29	55	A	56		NP	NP	NP	39		39	9	11	4a	1	cut 10.9 feet							
		736+64, 51' R	7	1.6	3.1		27	22	49		50		18	15	3				9	10	4a	5	bottom of boring at 14 feet							
												30																		
8	B-028	70 Westbound	3	1.2	2.7	-4.8	20	22	42	A	43		NP	NP	NP	17		17	8	6	1b	0	cut 4.8 feet							
		740+11, 55' L	4	3.7	5.2		49	46	95		97		NP	NP	NP	9		9	3	6	1a	0								
												30											bottom of boring at 10.0 feet							
9	B-029	70 Eastbound	8	0.0	1.2	####	48	45	93	A	95		NP	NP	NP	11		11	3	6	1a	0	cut 15.3 feet							
		740+42, 86'R	9	1.2	2.2		29	50	79		80		NP	NP	NP	11		11	2	6	1a	0								
			10	3.2	3.7		50		50		51									6	1a	0								
			11	5.7	7.2		28	33	61		62	30								10	2-4									
10	B-030	70 Westbound	5	0.0	1.2	-8.3	19	21	40	A	41		23	14	9	41	25	66	10	10	4a	6	cut 8.3 feet							
		743+00, 64' L	6	1.2	2.7		15	27	42		43		21	15	6				10	10	4a	5	no lab tests #6							
			7	2.7	3.7		50		50		51		NP	NP	NP	12		12	1	6	1a	0								
			8	5.2	6.7		33	38	71		72	30	NP	NP	NP	12		12	3	6	1a									
11	B-031	70 Eastbound	5	0.5	2.0	-6.5	21	25	46	C	48		NP	NP	NP				18	6	1b	0	cut 6.5 feet		M				1	No undercut 4.5' of A-1b soil w/46 b/ft. A-4b > 3', o.k.
		745+02, 73' R	6A	2.0	3.5		15	17	32		34		15	5	10	33	16	48	8	10	4a	3								
			7	4.5	6.0		12	14	26		27									10	4b			4b				3		
			8	7.0	8.5		22	25	47		49	27								10	4a									
12	B-033	70 Westbound	2	0.0	0.9	-4.1	16	19	35	C	37									6	1b	0	cut 4.1 feet							No undercut top 4' of dense
		749+82, 43' L	3	0.9	2.4		21	28	49		51		NP	NP	NP	11		11	4	6	1b	0	no lab sample 2							

I-70 South Trench Complete Project Site W-07-109						Standard Penetration						Physical Characteristics						Moisture		Classification		Comments	Problem		Treatments				Analysis
#	B #	Boring Location		Depth	To	Cut Fill	n_2	n_3	N_m	Rig	N_{60}	N_L	LL	PL	PI	% Silt	% Clay	P 200	M	M_{OPT}	Class	GI		w/ Class	w/ MN	LS	CS	UC Class	UC MN	
			4	2.4	3.9		20	15	35		37		NP	NP	NP	13		13	10	6	1b	0								gravel & sand will bridge
			5	3.9	5.4		13	15	28		29	29	NP	NP	NP	11		11	12	6	1b	0			M				1	
13	B-034	70 Westbound	11	0.0	1.3	####	11	14	25	C	26		NP	NP	NP	5		5	11	6	1a	0	cut 26.2 feet							No undercut upper 4.8' of sand & gravel will bridge
		752+71, 96' L	12	2.3	3.3		19	50	69		72		NP	NP	NP	15		15	8	6	1b	0								
			13	4.8	6.3		4	4	8		8		NP	NP	NP	3		3	7	6	1a	0			N		14		2	
			14	7.3	8.8		30	26	56		59	8	NP	NP	NP	16		16	9	6	1b									
14	B-035	70 Eastbound	4	0.0	0.5	-7.0	14	18	32	A	33		NP	NP	NP	8		8	5	8	3	0	cut 7 feet							
		752+67, 73' R	5	0.5	2.0		24	27	51		52		NP	NP	NP	9		9	4	6	1b	0								
			6	2.0	3.5		22	25	47		48		NP	NP	NP	10		10	9	6	1b	0								
			7	4.0	5.5		23	27	50		51	30	NP	NP	NP		9	9	5	6	1b	0								
15	B-036	70 Eastbound	4	0.0	0.5	-7.5	24	38	62	A	63		NP	NP	NP	13		13	5	6	1b	0	cut 7.5 feet							
		755+56, 101' R	5	0.5	2.0		23	25	48		49		NP	NP	NP	12		12	5	6	1b	0	no lab sample 1, 2							
			6	2.0	3.5		32	34	66		67		NP	NP	NP	13		13	5	6	1b	0								
			7	3.5	5.0		25	26	51		52	30	NP	NP	NP	14		14	10	8	3a	0								
16	B-037	70 Westbound	9	0.0	0.9	####	21	22	43	C	45		26	14	12	32	16	49	13	14	6a	3	cut 20.6 feet							
		756+81, 69' L	10	0.9	2.4		24	29	53		56		27	15	12	36	18	54	10	14	6a	5								
			11	2.4	3.9		48	50	98		103		20	12	8	32	15	47	10	10	4a	2	no lab sample 12							
			12	4.4	5.9		24	24	48		50	30								10	4a	5								
17	B-039	70 Eastbound	4	0.3	1.8	-7.2	16	19	35	A	36		20	13	7	28	15	43	8	10	4a	2	cut 7.2 feet							
		760+57, 102' R	5	1.8	3.3		14	22	36		37		22	13	9	31	15	45	8	10	4a	2								
			6	3.3	4.8		18	21	39		40		20	13	7	29	16	44	8	10	4a	2								
			7	4.8	5.3		12	15	27		27	27	NP	NP	NP				9	8	3a	0								
18	B-041	70 Westbound	12	0.8	2.3	####	23	34	57	C	60		NP	NP	NP				10	11	4a	5	cut 25.2 feet							
		762+59, 116' L	13	3.3	4.8		24	42	66		69		NP	NP	NP				11	11	4a	5								
			14	8.3	9.8		22	30	52		55		22	13	9	36	19	55	10	10	4a									
			15	13.3	14.8		30	42	72		76	30	NP	NP	NP				10	11	4a									
19	B-042	70 Westbound	3	0.6	2.1	-5.4	14	21	35	C	37		22	13	9	36	22	58	9	10	4a	5	cut 5.4 feet							
		764+57, 41' L	4	2.1	3.1		50		50		53		23	14	9	36	21	57	8	10	4a	4								
			5	3.6	5.1		28	27	55		58								8	10	4a	5								
			6	5.1	5.6		50		50		53	30							9	10	4a									
20	B-043	70 Eastbound	3	0.4	1.9	-5.6	25	30	55	C	58		NP	NP	NP	38	10	48	12	11	4a	3	first sample 1.9'							
		and Ramp N1	4	1.9	3.4		12	45	57		60									10	4a	5	no lab sample 4							
		765+57, 96' R	5	3.4	4.9		31	46	77		81		22	16	6	36	22	59	9	11	4a	5								
			6	4.9	6.4		40	46	86		90	30	24	13	11	34	20	54	9	14	6a	4								
21	B-044	70 Westbound	1	0.0	0.8	-1.7	9	7	16	C	17									16	6b	10	cut 1.7'							
		767+55, 121' L	2	0.8	2.3		8	5	13		14		35	16	19	33	42	75	19	16	6b	12	no lab sample 1							
			3	2.3	3.8		5	11	16		17		44	16	28	43	40	83	19	18	7-6	16	Sample 1 and 2							
			4	3.8	5.3		8	12	20		21	14	25	15	10	40	31	71	14	10	4a	7	possible fill							
22	B-045	70 Eastbound	3	0.0	1.0	-5.5	7	11	18	A	18		22	14	8	32	20	53	11	10	4a	4	cut 5.5'							
			4	1.0	2.5		15	19	34		35		23	14	9	30	16	46	9	10	4a	2								
			5	2.5	4.0		16	17	33		34		25	14	11	37	21	58	8	14	6a	5								
			6	4.0	5.5		11	16	27		27	18	37	18	19	36	31	66	16	14	6a	10								
23																														
24																														
25																														
26																														

APPENDIX D

GB 1 MODEL ANALYSIS OUTPUT - INDIVIDUAL ROADWAY SEGMENTS FOR THE I-70 SOUTH TRENCH

Subgrade Analysis

V. 9.09 08/10/07

Design	9
CBR	
Item 320	Option
Global CS	Option
Global LS	No

11	Total Borings

Classification Counts by Sample

R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	3	7	1	2	1	0	0	0	17	1	0	5	5	0	0	0	0
	7%	17%	2%	5%	2%				40%	2%		12%	12%				
0.0%	33.3%								66.7%								

Class @ Surface

2-5	0
4b	0
5	0
7-5	0
7-6	0
8a	0
8b	0
R	0

	N60	NL			PI		Clay		M	MOPT	GI
Average	40.6	22.6			9.7		19.0		10.2	10.2	2.48
Maximum	95	30	37	18	19	39	31	67	21	16	10
Minimum	3	3	15	5	3	8	9	8	2	6	0

% Borings	
NL <= 5	9%
NL <=10	9%
NL >=20	64%
M+	27%
R	0%

% Surface		
18%		
0%	18%	
% Borings		
27%		
0%	0%	9% 27%

Rig	ER
A	61
B	62
C	63
D	75
E	86
F	79
G	
H	

I-70 South Trench (70 Eastbound) W-07-109

#	B #	Boring Location		Depth To		Cut Fill	Standard Penetration: n2	n3	Nm	Rig	N60	NL	Physical Characteristics: LL	PL	PI	% Silt	% Clay	P 200	Moisture: M	MOPT	Classification	GI	Comments	Problem w/ Class	Problem w/ MN	Treatments: LS	CS	UC Class	UC MN	Analysis
1	B-018	Ramp F1	1	11.2 12.7		9.7	17	12	29	B	30								10	16	6b		fill 9.7 feet							No undercut upper 18 feet of soil will bridge
		70 Eastbound	2	13.2 14.7			6	13	19		20		33	16	17	30	29	59	19	16	6b		first sample 1.5							
		720+55, 63' R	3	15.7 17.2			8	10	18		19								10	16	6b		14" concrete							
			4	18.2 19.7			8	5	13		13	13							15	10	4a		and base		MN				1	bridge
2	B-023	70 Eastbound	1	15.3 17.8		14.3	2	3	5	C	5									14	6a		fill 14.3 feet		N				5	No undercut
		728+49, 36'R	2	17.8 19.3			1	2	3		3		29	18	11	33	18	51	19	14	6a		first sample 1.5 feet		MN		--		5	under 14.3
			3	20.3 21.8			1	2	3		3		28	18	10	32	24	56	19	13	4a		18" conc and base		MN		--		5	feet of new
			4	22.8 24.3			2	4	6		6	3							21	10	4a				MN				3	fill
3	B-024	70 Eastbound	6	0.4 1.9		####	21	22	43	A	44								19	16	6b	10	cut 10.6 feet							
		Sta. 730+50	7	2.9 4.4			14	15	29		29									16	6b	10	no lab analysis							
			8	5.4 6.9			7	7	14		14								9	10	4a		sample #6, 7, 8							
			9	7.9 9.4			4	7	11		11	11	21	13	8	35	22	57	11	10	4a									
4	B-027	70 Eastbound	6	0.0 0.6		####	26	29	55	A	56		NP	NP	NP	39		39	9	11	4a	1	cut 10.9 feet							
		736+64, 51'R	7	1.6 3.1			27	22	49		50		18	15	3				9	10	4a	5	bottom of boring at							
												30											14 feet							
5	B-029	70 Eastbound	8	0.0 1.2		####	48	45	93	A	95		NP	NP	NP	11		11	3	6	1a	0	cut 15.3 feet							
		740+42, 86' R	9	1.2 2.2			29	50	79		80		NP	NP	NP	11		11	2	6	1a	0								
			10	3.2 3.7			50		50		51									6	1a	0								
			11	5.7 7.2			28	33	61		62	30								10	2-4									
6	B-031	70 Eastbound	5	0.5 2.0		-6.5	21	25	46	C	48		NP	NP	NP				18	6	1b	0	cut 6.5 feet		M				1	No undercut
		745+02, 73' R	6A	2.0 3.5			15	17	32		34		15	5	10	33	16	48	8	10	4a	3		4b				3		4.5' of A-1b
			7	4.5 6.0			12	14	26		27									10	4b									soil w/46 b/ft.
			8	7.0 8.5			22	25	47		49	27								10	4a									A-4b > 3', o.k.
7	B-035	70 Eastbound	4	0.0 0.5		-7.0	14	18	32	A	33		NP	NP	NP	8		8	5	8	3	0	cut 7 feet							
		752+67, 73'R	5	0.5 2.0			24	27	51		52		NP	NP	NP	9		9	4	6	1b	0								
			6	2.0 3.5			22	25	47		48		NP	NP	NP	10		10	9	6	1b	0								
			7	4.0 5.5			23	27	50		51	30	NP	NP	NP		9	9	5	6	1b	0								
8	B-036	70 Eastbound	4	0.0 0.5		-7.5	24	38	62	A	63		NP	NP	NP	13		13	5	6	1b	0	cut 7.5 feet							
		755+56, 101'R	5	0.5 2.0			23	25	48		49		NP	NP	NP	12		12	5	6	1b	0	no lab sample 1,2							
			6	2.0 3.5			32	34	66		67		NP	NP	NP	13		13	5	6	1b	0								
			7	3.5 5.0			25	26	51		52	30	NP	NP	NP	14		14	10	8	3a	0								
9	B-039	70 Eastbound	4	0.3 1.8		-7.2	16	19	35	A	36		20	13	7	28	15	43	8	10	4a	2	cut 7.2 feet							
		760+57, 102' R	5	1.8 3.3			14	22	36		37		22	13	9	31	15	46	8	10	4a	2								
			6	3.3 4.8			18	21	39		40		20	13	7	29	16	45	8	10	4a	2								
			7	4.8 5.3			12	15	27		27	27	NP	NP	NP				9	8	3a	0								
10	B-043	70 Eastbound	3	0.4 1.9		-5.6	25	30	55	C	58		NP	NP	NP	38	10	48	12	11	4a	3	first sample 1.9'							
		and Ramp N1	4	1.9 3.4			12	45	57		60									10	4a	5	no lab sample 4							
		765+57, 96'R	5	3.4 4.9			31	46	77		81		22	16	6	36	22	58	9	11	4a	5								
			6	4.9 6.4			40	46	86		90	30	24	13	11	34	20	54	9	14	6a	4								
11	B-045	70 Eastbound	3	0.0 1.0		-5.5	7	11	18	A	18		22	14	8	32	20	52	11	10	4a	3	cut 5.5'							
			4	1.0 2.5			15	19	34		35		23	14	9	30	16	46	9	10	4a	2								
			5	2.5 4.0			16	17	33		34		25	14	11	37	21	58	8	14	6a	5								
			6	4.0 5.5			11	16	27		27	18	37	18	19	36	31	67	16	14	6a	10								
12																														

Subgrade Analysis

V. 9.09 08/10/07

Design	9
CBR	
Item 320	Option
Global CS	Option
Global LS	No

11	Total Borings

Classification Counts by Sample

R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	6	7	0	0	1	0	0	0	19	0	0	6	2	0	1	0	0
	14%	17%			2%				45%			14%	5%		2%		
0.0%	33.3%								66.7%								

Class @ Surface	
2-5	0
4b	0
5	0
7-5	0
7-6	0
8a	0
8b	0
R	0

% Borings	
N_L <= 5	9%
N_L <=10	18%
N_L >=20	55%
M+	27%
R	0%

% Surface			
0%			
0%	0%		
% Borings			
27%			
0%	9%	0%	27%

Rig	ER
A	61
B	62
C	63
D	75
E	86
F	79
G	
H	

	N_{60}	N_L			PI		Clay		M	M_{OPT}		GI
Average	41.2	21.3			10.1		18.5		10.0	10.0		3.16
Maximum	103	30	44	18	28	43	25	66	19	18		12
Minimum	5	5	14	7	1	3	9	3	1	6		0

I-70 South Trench 70 Westbound W-07-109

#	B #	Boring Location		Depth	To	Cut Fill	Standard Penetration n_2	n_3	N_m	Rig	N_{60}	N_L	Physical Characteristics LL	PL	PI	% Silt	% Clay	P 200	Moisture M	M_{OPT}	Classification Class	GI	Comments
1	B-020	70 Westbound	1	10.7	12.2	9.2	10	12	22	A	22								13	14	6a		fill 9.2 feet
		724+03, 77'L	2	12.7	14.2		17	21	38		39									14	6a		first sample 1.5
			3	15.2	16.7		6	6	12		12		23	15	8	37	23	60	11	10	4a		20" concrete
			4	17.2	19.2		2	3	5		5	5							12	10	4a		and base
2	B-022	70 Westbound	1	0.0	1.2	-1.8	9	7	16	A	16		15	14	1	29	22	51	13	14	6a	3	cut 1.8 feet
		Ramp M1	2	1.2	2.7		7	6	13		13		21	18	3	18	9	27	11	10	2-4	0	20" conc. And base
		Sta. 728+60	3	2.7	4.2		18	27	45		46		28	18	10	30	18	48	13	13	4a	3	Sample 4 dense
			4	4.2	5.7		21	16	37		38	13								6	1a	0	gravel, no tests
3	B-025	70 Westbound	6	0.0	1.4	####	16	17	33	A	34		27	16	11	34	20	54	11	14	6a	4	cut 11.6 feet
		732+70	7	1.9	3.4		8	12	20		20								11	10	4a	5	first sample at 8.5'
			8	4.4	5.9		7	12	19		19		14	7	7	32	21	53	9	10	4a	4	no lab tests 7 nd 9
			9	6.9	8.4		6	9	15		15	15								10	4a		
4	B-028	70 Westbound	3	1.2	2.7	-4.8	20	22	42	A	43		NP	NP	NP	17		17	8	6	1b	0	cut 4.8 feet
		740+11, 55'L	4	3.7	5.2		49	46	95		97		NP	NP	NP	9		9	3	6	1a	0	
												30											bottom of boring at 10.0 feet
5	B-030	70 Westbound	5	0.0	1.2	-8.3	19	21	40	A	41		23	14	9	41	25	66	10	10	4a	6	cut 8.3 feet
		743+00, 64' L	6	1.2	2.7		15	27	42		43		21	15	6				10	10	4a	5	no lab tests #6
			7	2.7	3.7		50		50		51		NP	NP	NP	12		12	1	6	1a	0	
			8	5.2	6.7		33	38	71		72	30	NP	NP	NP	12		12	3	6	1a		
6	B-033	70 Westbound	2	0.0	0.9	-4.1	16	19	35	C	37									6	1b	0	cut 4.1 feet
		749+82, 43'L	3	0.9	2.4		21	28	49		51		NP	NP	NP	11		11	4	6	1b	0	no lab sample #2
			4	2.4	3.9		20	15	35		37		NP	NP	NP	13		13	10	6	1b	0	
			5	3.9	5.4		13	15	28		29	29	NP	NP	NP	11		11	12	6	1b	0	
7	B-034	70 Westbound	11	0.0	1.3	####	11	14	25	C	26		NP	NP	NP	5		5	11	6	1a	0	cut 26.2 feet
		752+71, 96' L	12	2.3	3.3		19	50	69		72		NP	NP	NP	15		15	8	6	1b	0	
			13	4.8	6.3		4	4	8		8		NP	NP	NP	3		3	7	6	1a	0	
			14	7.3	8.8		30	26	56		59	8	NP	NP	NP	16		16	9	6	1b		
8	B-037	70 Westbound	9	0.0	0.9	####	21	22	43	C	45		26	14	12	32	16	48	13	14	6a	3	cut 20.6 feet
		756+81, 69' L	10	0.9	2.4		24	29	53		56		27	15	12	36	18	54	10	14	6a	5	
			11	2.4	3.9		48	50	98		103		20	12	8	32	15	47	10	10	4a	2	
			12	4.4	5.9		24	24	48		50	30	NP	NP	NP				9	11	4a	5	
9	B-041	70 Westbound	12	0.8	2.3	####	23	34	57	C	60		NP	NP	NP				10	11	4a	5	cut 25.2 feet
		762+59, 116' L	13	3.3	4.8		24	42	66		69		NP	NP	NP				11	11	4a	5	
			14	8.3	9.8		22	30	52		55		22	13	9	36	19	55	10	10	4a		
			15	13.3	14.8		30	42	72		76	30	NP	NP	NP				10	11	4a		
10	B-042	70 Westbound	3	0.6	2.1	-5.4	14	21	35	C	37		22	13	9	36	22	58	9	10	4a	5	cut 5.4 feet
		764+57, 41' L	4	2.1	3.1		50		50		53		23	14	9	36	21	57	8	10	4a	4	
			5	3.6	5.1		28	27	55		58								8	10	4a	5	
			6	5.1	5.6		50		50		53	30							9	10	4a		
11	B-044	70 Westbound	1	0.0	0.8	-1.7	9	7	16	C	17									16	6b	10	cut 1.7'
		767+55, 121' L	2	0.8	2.3		8	5	13		14		35	16	19	33	16	49	19	16	6b	6	no lab sample 1
			3	2.3	3.8		5	11	16		17		44	16	28	43	16	59	19	18	7-6	12	Sample 1 and 2
			4	3.8	5.3		8	12	20		21	14	25	15	10	40	15	55	14	10	4a	4	possible fill
12																							

Problem w/ Class	Problem w/ MN	Treatments LS	CS	UC Class	UC MN	Analysis
						No undercut upper soil and fill soils will bridge
	N				5	
	M				1	No undercut top 4' of dense gravel & sand will bridge
	N		14		2	No undercut upper 4.8' of sand & gravel will bridge

Subgrade Analysis

V. 9.09 08/10/07

Design	
CBR	
Item 320	No
Global CS	Option
Global LS	No

1	Total Borings

Classification Counts by Sample

R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0
									25%				75%				
0.0%	0.0%								100.0%								

Class @ Surface	
2-5	0
4b	0
5	0
7-5	0
7-6	0
8a	0
8b	0
R	0

% Borings	
N_L <= 5	0%
N_L <=10	0%
N_L >=20	0%
M+	100%
R	0%

% Surface			
0%			
0%	0%		
% Borings			
100%			
0%	0%	0%	100%

Rig	ER
A	61
B	62
C	63
D	75
E	86
F	79
G	
H	

	N_{60}	N_L			PI		Clay		M	M_{OPT}		GI
Average	20.5	13.0			17.0		29.0		13.5	14.5		
Maximum	30	13	33	16	17	30	29	59	19	16		
Minimum	13	13	33	16	17	30	29	59	10	10		

I-70 South Trench Ramp F1 W-07-109

#	B #	Boring Location		Depth	To	Cut Fill	Standard Penetration n_2	n_3	N_m	Rig	N_{60}	N_L	Physical Characteristics LL	PL	PI	% Silt	% Clay	P 200	Moisture M	M_{OPT}	Classification Class	GI	Comments
1	B-018	Ramp F1	1	11.2	12.7	9.7	17	12	29	B	30		33	16	17	30	29	59	10	16	6b		fill 9.7 feet
		70 Eastbound	2	13.2	14.7		6	13	19		20								19	16	6b		first sample 1.5
		720+55, 63' R	3	15.7	17.2		8	10	18		19								10	16	6b		14" concrete
			4	18.2	19.7		8	5	13		13	13							15	10	4a		and base
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Problem w/ Class	Problem w/ MN	Treatments LS	CS	UC Class	UC MN	Analysis
	MN				1	No undercut upper 18 feet of soil will bridge

Subgrade Analysis

V. 9.09 08/10/07

Design	11
CBR	
Item 320	No
Global CS	Option
Global LS	No

1	Total Borings

Classification Counts by Sample

R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0
	25%				25%				25%			25%					
0.0%	50.0%								50.0%								

Class @ Surface	
2-5	0
4b	0
5	0
7-5	0
7-6	0
8a	0
8b	0
R	0

% Borings	
N_L <= 5	0%
N_L <=10	0%
N_L >=20	0%
M+	0%
R	0%

% Surface			
0%			
0%	0%		
% Borings			
0%			
0%	0%	0%	0%

Rig	ER
A	61
B	62
C	63
D	75
E	86
F	79
G	
H	

	N_{60}	N_L	PI	Clay	M	M_{OPT}	GI
Average	28.3	13.0	4.7	16.5	12.2	10.8	1.50
Maximum	46	13	28	18	10	29.5	22.2	51.6	12.9	14	3
Minimum	13	13	15	14	1	17.9	9	26.9	11	6	0

I-70 South Trench Ramp M1 W-07-109

#	B #	Boring Location		Depth To		Cut Fill	Standard Penetration n_2	n_3	N_m	Rig	N_{60}	N_L	Physical Characteristics LL	PL	PI	% Silt	% Clay	P 200	Moisture M	M_{OPT}	Classification Class	GI	Comments
1	B-022	Ramp M1	1	0.0	1.2	-1.8	9	7	16	A	16		15	14	1	29	22	52	13	14	6a	3	cut 1.8 feet
		70 Westbound	2	1.2	2.7		7	6	13		13		21	18	3	18	9	27	11	10	2-4	0	20" conc. and base
		Sta. 728+60	3	2.7	4.2		18	27	45		46		28	18	10	30	18	48	13	13	4a	3	Sample 4 dense
			4	4.2	5.7		21	16	37		38	13								6	1a	0	gravel, no tests
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Problem w/ Class	Problem w/ MN	Treatments LS	CS	UC Class	UC MN	Analysis

Subgrade Analysis

V. 9.09 08/10/07

Design	8
CBR	
Item 320	Option
Global CS	Option
Global LS	No

1	Total Borings

Classification Counts by Sample

R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0
									75%			25%					
0.0%	0.0%								100.0%								

Class @ Surface	
2-5	0
4b	0
5	0
7-5	0
7-6	0
8a	0
8b	0
R	0

% Borings	
N_L <= 5	0%
N_L <=10	0%
N_L >=20	100%
M+	0%
R	0%

% Surface			
0%			
0%	0%		
% Borings			
0%			
0%	0%	0%	0%

Rig	ER
A	61
B	62
C	63
D	75
E	86
F	79
G	
H	

	N_{60}	N_L	PI	Clay	M	M_{OPT}	GI
Average	72.3	30.0	8.5	17.3	10.0	11.5	4.25
Maximum	90	30	11	22	12	14	5
Minimum	58	30	6	10	9	10	3

I-70 South Trench Ramp N1 W-07-109

#	B #	Boring Location		Depth	To	Cut Fill	Standard Penetration n_2	n_3	N_m	Rig	N_{60}	N_L	Physical Characteristics LL	PL	PI	% Silt	% Clay	P 200	Moisture M	M_{OPT}	Classification Class	GI	Comments
1	B-043	Ramp N1	3	0.4	1.9	-5.6	25	30	55	C	58		NP	NP	NP	38	10	48	12	11	4a	3	first sample 1.9'
		70 Eastbound	4	1.9	3.4		12	45	57		60									10	4a	5	no lab sample 4
		765+57, 96' R	5	3.4	4.9		31	46	77		81		22	16	6	36	22	58	9	11	4a	5	
			6	4.9	6.4		40	46	86		90	30	24	13	11	34	20	54	9	14	6a	4	
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Problem w/ Class	Problem w/ MN	Treatments LS	CS	UC Class	UC MN	Analysis

APPENDIX E

BORING LOGS
I-70 SOUTH TRENCH

DLZ Ohio, Inc. * 6121 Huntley Road, Columbus, Ohio 43229 * (614) 888-0040

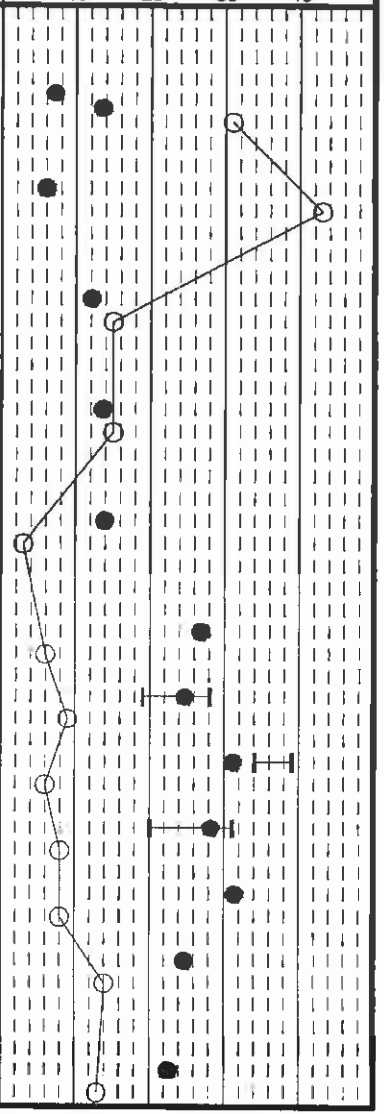
Client: ms consultants	Project: FRA-70-8.93	Job No. 0221-1004.01
LOG OF: Boring B-016-0	Location: Sta. 709+49.49, 63.03 ft Rt. of I-70 CL	Date Drilled: 7/8/2008

WATER OBSERVATIONS: Water seepage at: None; Water level at completion: None

FIELD NOTES: Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	723.8													
1.0	722.8						Asphalt Concrete Pavement - 8" Aggregate Base - ??							
2.2	721.6	9 10 20	15	1A 1B		4.5+	FILL: Medium dense brown COARSE AND FINE SAND (A-3a), some silt, little gravel; moist.							
3.5	720.3						FILL: Hard brown SANDY SILT (A-4a), some fine to coarse sand, trace gravel; contains trace brick fragments; moist.							
5		14 21 21	13	2			FILL: Dense brown GRAVEL WITH SAND AND SILT (A-2-4), some silt; damp.							
6.0	717.8													
		5 6 9	12	3		3.0	FILL: Stiff to very stiff brown and gray SILT AND CLAY (A-6a), some fine to coarse sand, trace to little gravel; contains brick fragments; moist.							
							@ 6.0'-7.5', contains coal fragments.							
10		12 11 4	0	4		1.5								
		1 1 2	9	5		1.5								
13.5	710.3													
15		5 4 2	8	6			FILL: Loose brown COARSE AND FINE SAND (A-3a), some silty clay, little gravel; contains brick fragments, cinders, and rock fragments; damp to moist.							
		4 3 6	8	7										
		5 3 3	2	8					18	33	--	21	5	23
18.0	705.8													
		2 3 5	13	9		1.25	Stiff to very stiff gray SILT AND CLAY (A-6a), little to some fine to coarse sand; moist.							
20		3 3 5	14	10		2.5								
		3 6 8	11	11		3.5	@ 21.0'-25.0', brown and gray.							
		4 6 7	17	12		2.0			0	5	--	20	46	29
25.0	698.8						Bottom of Boring - 25.0'							

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Columbus, Ohio 43229 * (614) 888-0040

Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

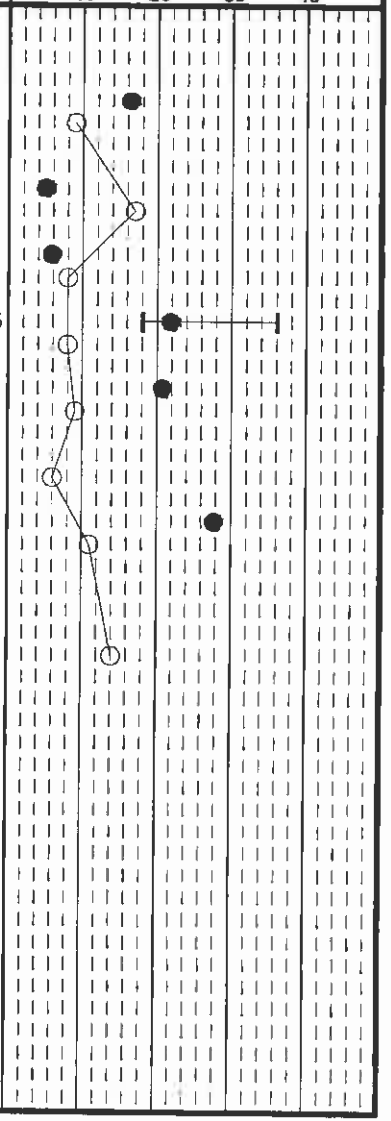
LOG OF: Boring B-017-0 | Location: Sta. 713+49.89, 51.13 ft Lt. of I-70 CL | Date Drilled: 7/25/2008

WATER OBSERVATIONS:
Water seepage at: None
Water level at completion: None

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	737.7													
1.8	735.9	5 5 4	9	1		2.5	Asphalt Concrete - 6" Portland Cement Concrete - 11" Aggregate Base - 4"							
3.5	734.2						Very stiff brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; moist.							
5		2 8 8	14	2			Loose to medium dense brown GRAVEL WITH SAND (A-1-b), trace silt; damp.		40	47	—	6	--7--	
6.5	731.2	3 3 5	12	3					44	43	—	5	--8--	
		5 3 5	15	4		1.5	Medium stiff to stiff brown SILTY CLAY (A-6b), trace to little fine to coarse sand, trace gravel; damp to moist.		3	9	—	10	33	45
9.5	728.2	4 5 4	14	5		0.5								
10		2 2 4	14	6		3.0	Stiff to very stiff gray CLAY (A-7-6), trace fine to coarse sand, trace gravel; moist.							
		5 5 6	16	7		1.5								
13.5	724.2													
15.0	722.7	5 5 9	16	8		1.5	Stiff brown and gray SILTY CLAY (A-6b), little fine to coarse sand, little gravel; moist.							
15							Bottom of Boring - 15.0'							
20														
25														

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Columbus, Ohio 43229 * (614) 888-0040

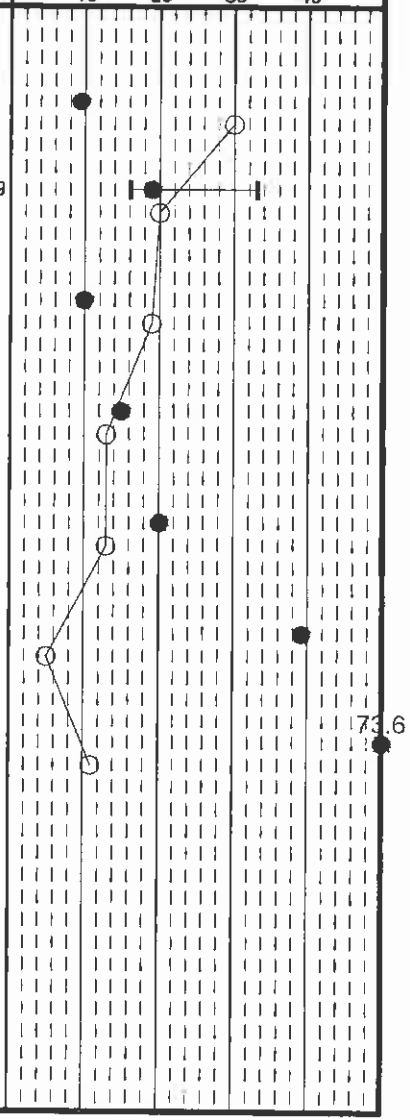
Client: ms consultants	Project: FRA-70-8.93	Job No. 0221-1004.01
LOG OF: Boring B-018	Location: Sta. 720+55.54, 63.68 ft Rt. of I-70 CL	Date Drilled: 7/8/2008

WATER OBSERVATIONS:
Water seepage at: None
Water level at completion: 15.0'

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	740.4													
1.2	739.2						Asphalt Concrete Pavement - 10" Aggregate Base - 4"							
		9 17 12	9	1		2.5	FILL: Very stiff brown SILTY CLAY (A-6b), little to some fine to coarse sand, little gravel; contains rock fragments; moist.							
5		8 6 13	11	2		2.75			14	16	—	11	30	29
7.0	733.4	7 8 10	16	3		4.0								
8.5	731.9						FILL: Medium dense brown SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.							
10		5 8 5	1	4		—	FILL: Stiff gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; contains brick fragments; moist.							
11.0	729.4													
		4 7 6	8	5		3.0	Stiff to very stiff gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; moist.							
15		5 2 3	12	6		1.5								
17.5	722.9	2 4 7	12	7		2.75	@ 16.0'-17.5', contains wood fragments.							
							Bottom of Boring - 17.5'							
20														
25														

STANDARD PENETRATION (N60)
Natural Moisture Content, % -
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Columbus, Ohio 43229 * (614) 888-0040

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

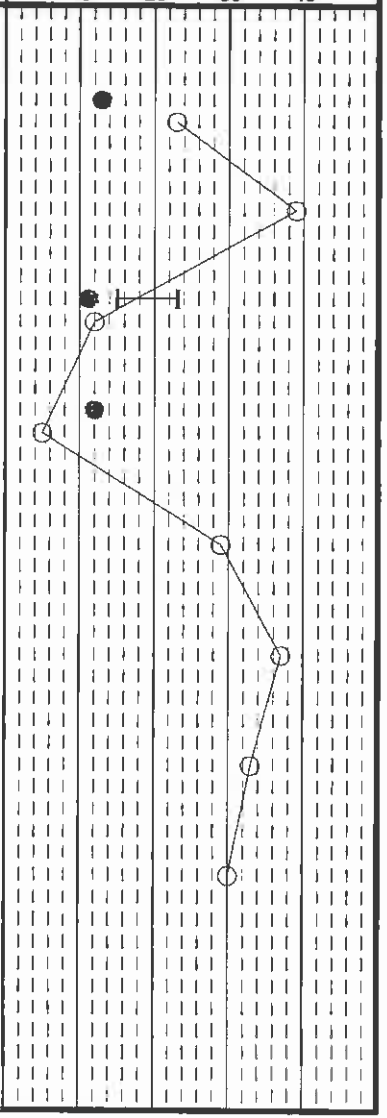
LOG OF: Boring B-020 | *Location:* Sta. 724+03.63, 77.13 ft Lt. of I-70 CL | *Date Drilled:* 7/25/2008

WATER OBSERVATIONS:
Water seepage at: None
Water level at completion: None

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	734.8													
1.7	733.1						Asphalt Concrete - 6" Portland Cement Concrete - 10" Aggregate Base - 4"							
		5 10 12	12	1		3.0	Very stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; moist.							
		6 17 21	9	2		2.25								
5														
6.0	728.8													
		4 6 6	18	3		2.0	Very stiff gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.		6	12	—	22	37	23
		4 2 3	13	4		2.25	@ 8.5'-10.0', contains trace brick fragments; probably carried by spoon from higher elevation.							
10														
		5 14 14	9	5		2.0								
		15 18 18	1	6		—	@ 13.5'-15.0', little gravel							
15														
16.0	718.8													
		10 15 17	11	7		2.25	Very stiff grayish brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; very slightly organic, trace organic odor; damp.							
		14 15 14	18	8		3.75								
20.0	714.8													
20							Bottom of Boring - 20.0'							
25														

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢—⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Columbus, Ohio 43229 * (614) 888-0040

Client: ms consultants	Project: FRA-70-8.93	Job No. 0221-1004.01
LOG OF: Boring B-022	Location: Sta. 728+59.94, 91.57 ft Lt. of I-70 CL	Date Drilled: 7/24/2008

WATER OBSERVATIONS: Water seepage at None; Water level at completion: None

FIELD NOTES: Advanced boring using 3.25" diameter hollowstem augers.

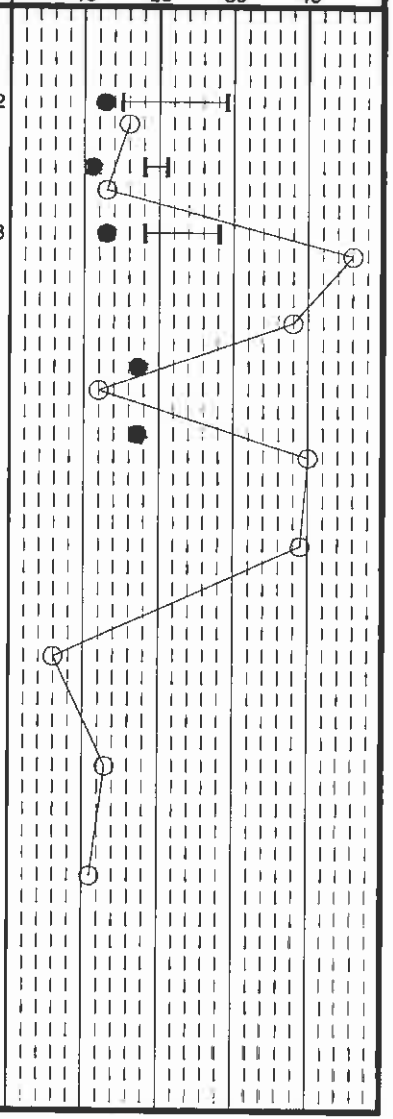
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	738.0						Asphalt Concrete - 6" Portland Cement Concrete - 10" Aggregate Base - 4"							
1.7	736.3													
		6 9 7	12	1		1.5	FILL: Stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; damp.		15	17	—	17	29	22
3.0	735.0													
		8 7 6	7	2		–	FILL: Stiff brown GRAVEL WITH SAND AND SILT (A-2-4), some silt, trace clay; moist.		34	23	—	16	18	9
4.5	733.5													
5		5 18 27	15	3		2.0	FILL: Stiff brown SANDY SILT (A-4a), little gravel, trace clay; contains brick and asphalt fragments; damp.		11	23	—	18	30	18
6.0	732.0													
		9 21 16	16	4			FILL: Dense gray GRAVEL (A-1-a); damp.							
7.5	730.5													
		5 5 7	11	5		3.0	FILL: Very stiff dark brown SILTY CLAY (A-6b), some fine to coarse sand, trace gravel; moist.							
10		5 8 31	14	6		3.0	@ 9.0'-10.5', contains small brick fragments.							
11.0	727.0													
		8 27 11	11	7			FILL: Dense dark gray SANDY SILT (A-4a), some gravel; damp.							
		6 3 3	1	8			@ 13.5'-15.0', loose, brown.							
15														
16.0	722.0													
		5 8 5	13	9			Medium dense brown COARSE AND FINE SAND (A-3a), little silt, trace gravel; damp.							
18.5	719.5													
20.0 20	718.0	4 5 6	14	10		2.25	Very stiff gray SILTY CLAY (A-6b), trace fine to coarse sand; moist.							
							Bottom of Boring - 20.0'							
25														

STANDARD PENETRATION (N60) Natural Moisture Content, % - ●

PL ⊢——⊣ LL

Blows per foot - ○ / Non-Plastic - NP

10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Columbus, Ohio 43229 * (614) 888-0040

Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

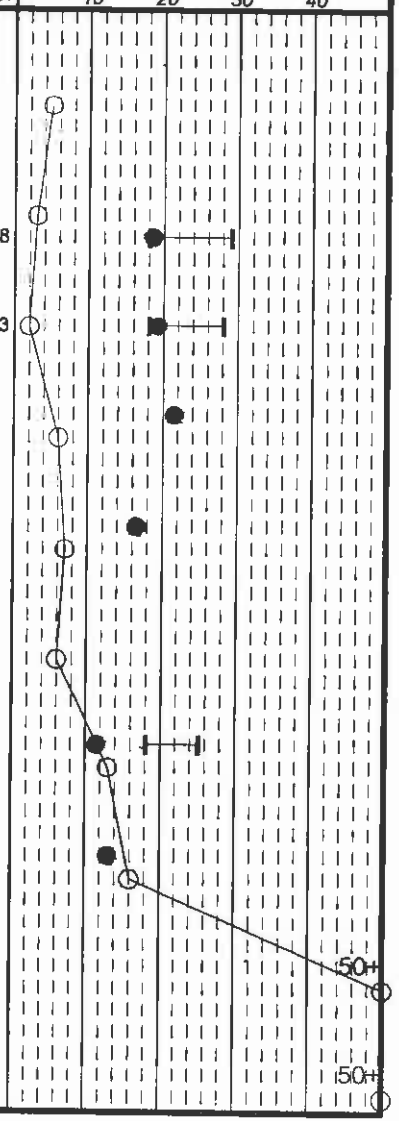
LOG OF: Boring B-023 | Location: Sta. 728+48.63, 36.10 ft Rt. of I-70 CL | Date Drilled: 8/20/2008 to 9/2/2008

WATER OBSERVATIONS
Water seepage at: 25.0'
Water level at completion: 19.1'

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	722.0						Asphalt Concrete - 4" Portland Cement Concrete - 8" Aggregate Base - 6"							
1.5	720.5	7 2 3	4	1		3.0	FILL: Very soft to soft brown SILT AND CLAY (A-6a), some fine to coarse sand, trace to little gravel; contains few brick fragments; moist. @ 1.5'-2.5', stiff.							
5		1 1 2	12	2	P1	0.25								
6.0	716.0	WOH WOH 2	2	3	P2	1.5 0.25			14	14	—	21	33	18
10		1 2 4	18	4		<0.25	FILL: Very soft to soft brown SANDY SILT (A-4a), some to "and" fine to coarse sand, trace to little gravel; contains few brick fragments; moist. @ 6.0'-7.5', slight organic odor.							
		WOH 3 4	18	5		--			9	16	—	20	32	23
13.5	708.5													
15		2 3 3	18	6			POSSIBLE FILL: Loose to medium dense brown GRAVEL WITH SAND AND SILT (A-2-4), trace clay; damp.							
		7 6 6	10	7					40	15	—	14	24	7
20		7 7 8	8	8			@ 21.0'-21.5', contains turpentine odor.							
21.5	700.5	18 50/6	10	9A 9B			Very dense medium orangish-brown SANDY SILT (A-4a), some fine to coarse sand, some gravel; contains turpentine odor; moist.							
25	697.0	11 43 50/5	14	10										

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc * 6121 Huntley Road, Columbus, Ohio 43229 * (614) 888-0040

Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-023 | Location: Sta. 728+48.63, 36.10 ft Rt. of I-70 CL | Date Drilled: 8/20/2008 to 9/2/2008

WATER OBSERVATIONS:
Water seepage at: 25.0'
Water level at completion: 19.1'

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	697.0														
		18 32 33	18	11			Very dense brown COARSE AND FINE SAND (A-3a), some silt, some gravel; wet.								68
							@ 26.0'-27.5', contains turpentine odor.								
30		7 31 36	15	12											70
		18 23 29	17	13			@ 31.0'-35.0', gray, little silt, little gravel.								55
35.0 35	687.0	18 28 35	15	14											66
							Bottom of Boring - 35.0'								
40															
45															
50															

DLZ Ohio, Inc. * 6121 Huntley Road, Columbus, Ohio 43229 * (614) 888-0040

Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

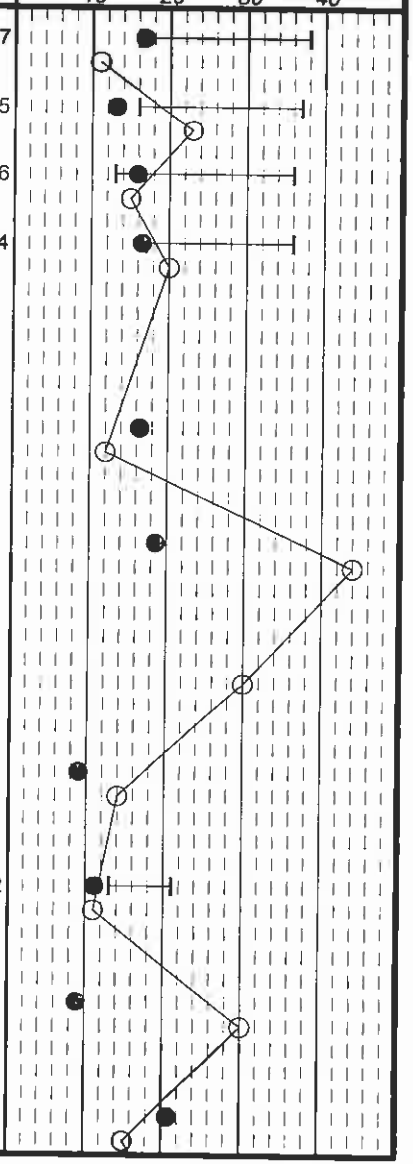
LOG OF: Boring B-024 | Location: Sta. 730+58.01, 93.53 ft Rt. of I-70 CL | Date Drilled: 7/1/2008 to 7/2/2008

WATER OBSERVATIONS:
Water seepage at: 28.5'-80.0'
Water level at completion: 16.5' (prior to coring)
10.7' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	743.4	3 4 7	11	1		--	Stiff to very stiff brown SILTY CLAY (A-6b), trace to little fine to coarse sand, little gravel; damp to moist. @ 0.0 - 3.0', contains roots.		11	9	---	11	32	37
		7 12 11	12	2		4.5+	@ 1.5', hard.		15	8	---	10	32	35
		5 7 8	16	3		4.0	@ 3.0', very stiff to hard.		11	8	---	12	33	36
5		4 6 14	13	4		3.75			12	10	---	13	31	34
		4 4 8	15	5		4.5								
10		14 21 22	9	6		--	@ 11.0', encountered rock fragments.							
		17 14 15	1	7		--								
15.5	727.9													
		4 7 7	18	8		3.5	Very stiff brownish gray SANDY SILT (A-4a), little to some fine to coarse sand, trace gravel; damp to moist.							
		2 4 7	18	9		3.0			9	15	---	19	35	22
20		7 13 16	12	10		--	@ 21.5', encountered possible large rock fragments, cobbles.							
		3 7 8	18	11		3.25								
25	718.4													

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Co ...us, Ohio 43229 * (614) 888-0040

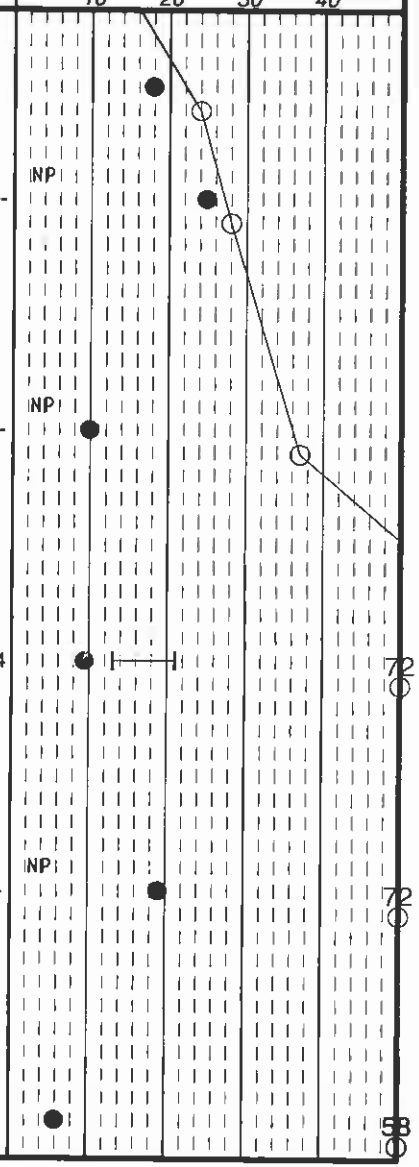
Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-024 | Location: Sta. 730+58.01, 93.53 ft Rt. of I-70 CL | Date Drilled: 7/1/2008 to 7/2/2008

WATER OBSERVATIONS:
Water seepage at: 28.5'-80.0'
Water level at completion: 16.5' (prior to coring)
10.7' (includes drilling water)
FIELD NOTES: Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	718.4	8 10 14	18	12		--	Very stiff brownish gray SANDY SILT (A-4a), little to some fine to coarse sand, trace gravel; damp to moist.							
28.0	715.4													
30		3 12 15	16	13			Medium dense brownish gray SILT (A-4b), little fine sand; wet.	+ +	0	0	---	17	--83--	
32.0	711.4													
35		7 18 18	11	14			Dense brown GRAVEL (A-1-a), some fine to coarse sand, trace to little silty clay; wet.		60	22	---	8	--10--	
37.0	706.4													
40		13 26 45	15	15		--	Hard brownish gray SANDY SILT (A-4a), little gravel, trace clay; damp.		12	14	---	27	33	14
42.0	701.4													
45		17 26 45	18	16			Very dense brownish gray FINE SAND (A-3), trace silty clay; wet. @ 43.5', 2.0 feet sand heave.		16	25	---	47	--12--	
47.0	696.4													
50	693.4	26 30 27	13	17			Very dense brownish gray SANDY SILT (A-4a), little gravel; wet.							

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢—⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Co ous, Ohio 43229 * (614) 888-0040

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-024 | *Location:* Sta. 730+58.01, 93.53 ft Rt. of I-70 CL | *Date Drilled:* 7/1/2008 to 7/2/2008

WATER OBSERVATIONS:
Water seepage at: 28.5'-80.0'
Water level at completion: 16.5' (prior to coring)
10.7' (includes drilling water)

FIELD NOTES: *Advanced boring using 3.25" diameter hollowstem augers.*

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	693.4						Very dense brownish gray SANDY SILT (A-4a), little gravel; wet.								
55		15 40 50/4	13	18			@ 50.0'-60.0', difficulty advancing boring due to obstruction inside augers blocking rods; possible boulder zone.		30	31	---	16	15	8	50+
57.0	686.4						Very dense brownish gray SANDY SILT (A-4a), some gravel, some fine to coarse sand; damp.								
60		37 21 50	13	19					30	19	---	10	28	13	72
62.0	681.4						Very dense brown and gray GRAVEL (A-1-a), some fine to coarse sand, trace silt; wet.								
65		11 50/4	10	20			@ 63.5', one foot sand heave; encountered black shale fragments.		73	17	---	5	--5--		NP 50+
70		50/3	0	21			@ 68.5', possible cobbles or boulders.								50+
75	668.4	50 50/3	6	22			@ 73.5', 6.0 feet sand heave; washed out with tricone.								50+

DLZ Ohio, Inc. * 6121 Huntley Road, Co ...us, Ohio 43229 * (614) 888-0040

Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-024 | Location: Sta. 730+58.01, 93.53 ft Rt. of I-70 CL | Date Drilled: 7/1/2008 to 7/2/2008

WATER OBSERVATIONS:
Water seepage at: 28.5'-80.0'
Water level at completion: 16.5' (prior to coring)
10.7' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	668.4						Very dense brown and gray GRAVEL (A-1-a), some fine to coarse sand, trace silt; wet.								
		39 50/3	9	23			@ 78.5', 3.0 feet sand heave.		55	36	---	5	--4--		NP ● 50+ ○
80							@ 80.0'-90.0', difficult drilling; possible cobbles.								
		50/0	0	24											50+ ○
85															
		50/0	0	25			@ 88.5', 1.0 foot sand heave. @ 90.0' - 91.5', core loss.								50+ ○
90		Core 18"	Rec 0"	RQD 0%	R1		@ 91.5' - 91.8', encountered igneous-plutonic cobble/boulder; likely peridotite or gabbro.								
91.8	651.6						Interbedded Shale (90%) and Limestone (10%) RQD 60%, LOSS 26%; Shale, blue-gray, highly weathered, weak, laminated, slightly calcareous, contains abundant pyritic inclusions, moderately to highly fractured; Limestone, light gray, moderately weathered, moderately strong to strong, fractured.								
95		Core 120"	Rec 116"	RQD 81%	R2		@ 97.7' - 98.1', qu = 1650 psi								
100	643.4														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-024 | *Location:* Sta. 730+58.01, 93.53 ft Rt. of I-70 CL | *Date Drilled:* 7/1/2008 to 7/2/2008

WATER OBSERVATIONS:
Water seepage at: 28.5'-80.0'
Water level at completion: 16.5' (prior to coring)
10.7' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	643.4														
105		Core 120"	Rec 76"	RQD 48%	R3		Interbedded Shale (90%) and Limestone (10%) RQD 60%, LOSS 26%; Shale, blue-gray, highly weathered, weak, laminated, slightly calcareous, contains abundant pyritic inclusions, moderately to highly fractured; Limestone, light gray, moderately weathered, moderately strong to strong, fractured. @ 101.2', dark gray (shale). @ 107.8' - 111.5', core loss due to pyritic inclusion lodged in core barrel.								
110															
111.5	631.9						Bottom of Boring - 111.5'								
115															
120															
125															

DLZ Ohio, Inc. * 6121 Huntley Road, Co ..us, Ohio 43229 * (614) 888-0040

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

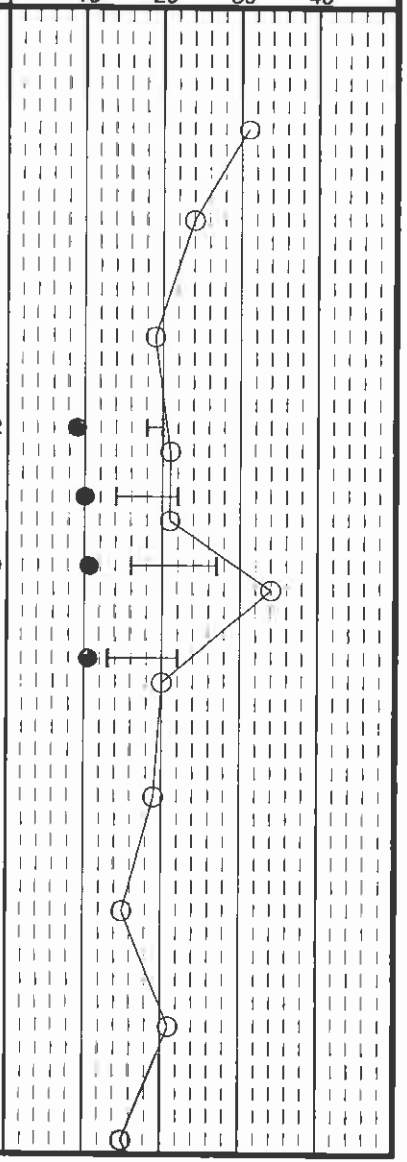
LOG OF: Boring B-025 | *Location:* Sta. 732+65.07, 88.70 ft Lt. of I-70 CL | *Date Drilled:* 7/24/2008

WATER OBSERVATIONS:
Water seepage at: 26.0'
Water level at completion: 39.0'

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	740.4													
1.2	739.2						Asphalt Concrete - 7" Aggregate Base - 7"							
		14 13 17	15	1		4.5+	FILL: Hard brown SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; contains few brick fragments; damp.							
3.5	736.9													
5		11 10 14	14	2		4.5+	Hard gray SANDY SILT (A-4a), some to "and" fine to coarse sand, trace to little gravel; damp.							
		6 8 11	14	3		4.5+								
10		7 10 11	18	4		4.5+			18	12	---	16	32	22
		6 10 11	18	5		4.5+			8	15	---	20	36	21
11.5	728.9													
		14 16 17	4	6		4.5+	Hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; damp to moist.		12	16	---	18	34	20
13.5	726.9													
15		5 8 12	18	7		4.5+	Very stiff to hard gray SANDY SILT (A-4a), some to "and" fine to coarse sand, trace to little gravel; damp.							
		5 7 12	18	8		4.5+								
20		4 6 9	18	9		2.75								
		5 9 12	18	10		4.5								
		5 6 9	18	11		2.5								
25	715.4													

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Co us, Ohio 43229 * (614) 888-0040

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-025 | *Location:* Sta. 732+65.07, 88.70 ft Lt. of I-70 CL | *Date Drilled:* 7/24/2008

WATER OBSERVATIONS:
Water seepage at: 26.0'
Water level at completion: 39.0'

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) / Natural Moisture Content, % - ● / PL ⊢ LL / Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	715.4														
		3 6 17	13	12		3.5	Very stiff gray SILTY CLAY (A-6b), little fine sand; moist.								
28.5	711.9														
30		17 29 37	10	13			Very dense brown GRAVEL WITH SAND (A-1-b), some fine to coarse sand, little silty clay; wet. @ 30.0'-38.5', encountered cobbles while augering.								67 ○
35		29 50/5	6	14					50	21	---	10	14	5	NP ● 50+ ○
38.5	701.9														
		23 50/6	10	15		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.								50+ ○
40															
43.5	696.9														
45		9 30 37	12	16			Very dense gray GRAVEL WITH SAND (A-1-b), "and" fine to coarse sand, little silt; wet.								68 ○
		22 39 30	15	17					39	26	---	22	--13--		NP ● 70 ○
50	690.4														

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Client: ms consultants	*Project:* FRA-70-8.93	*Job No.* 0221-1004.01
LOG OF: Boring B-025	*Location:* Sta. 732+65.07, 88.70 ft Lt. of I-70 CL	*Date Drilled:* 7/24/2008

WATER OBSERVATIONS:
Water seepage at: 26.0'
Water level at completion: 39.0'
FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	690.4														
55		22 33 26	13	18		2.5	Very stiff gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; moist.								60 ○
57.0	683.4														
59.3	681.1	48 50/3	9	19			Very dense brown COARSE AND FINE SAND (A-3a), some silt, little gravel; wet.								
60							Bottom of Boring - 59.3'								50+ ○
65															
70															
75															

DLZ Ohio, Inc. * 6121 Huntley Road, Co ...us, Ohio 43229 * (614) 888-0040

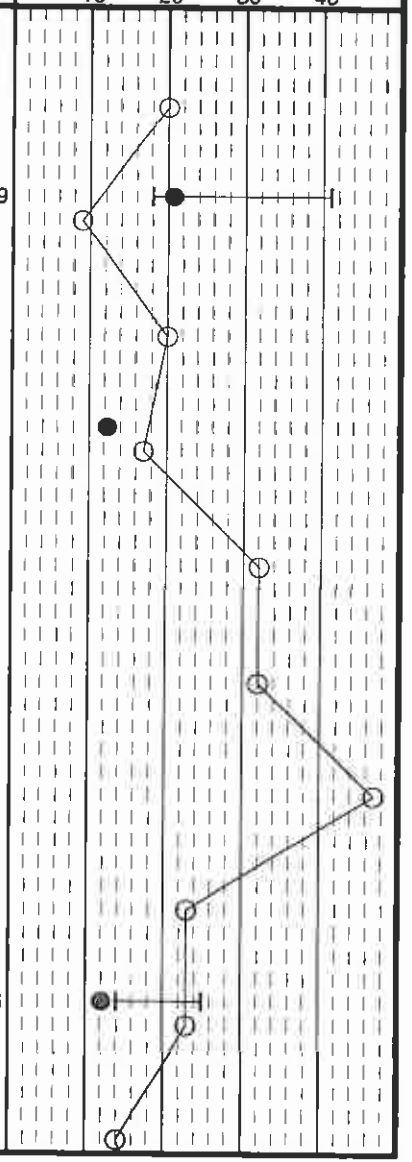
Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-026 | *Location:* Sta. 732+50.74, 140.07 ft Lt. of I-70 CL | *Date Drilled:* 8/1/2008 to 8/6/2008

WATER OBSERVATIONS:
Water seepage at: 41.0', 58.0', 77.0'
Water level at completion: 29.1' (beginning of shift, 8/5/08)
30.7' (includes drilling water)
FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	754.0													
0.3	753.7						Topsoil - 4"							
2.0	752.0	8 11 8	18	1A 1B		1.5 0.5	Stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; moist.							
3.5	750.5						Soft brown SANDY SILT (A-4a), some fine to coarse sand, little gravel; wet.							
5		5 4 5	18	2		2.75	Very stiff to hard brown CLAY (A-7-6), little to some fine to coarse sand, trace to little gravel; moist.		5	6	---	13	37	39
		5 8 11	18	3		4.25								
10		11 8 8	18	4		0.5	@ 8.5'-10.0', soft, wet.							
		8 10 20	4	5		2.5								
15		5 10 20	2	6		1.5	@ 13.5', becomes gray. @ 13.5'-15.0', stiff.							
		19 23 22	0	7		--								
18.5	735.5													
20		11 8 14	18	8		3.0	Very stiff to hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; damp to moist.							
		11 12 10	18	9		2.5			9	14	---	16	35	26
25	729.0	7 5 8	18	10		4.5+								

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Co ...us, Ohio 43229 * (614) 888-0040

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

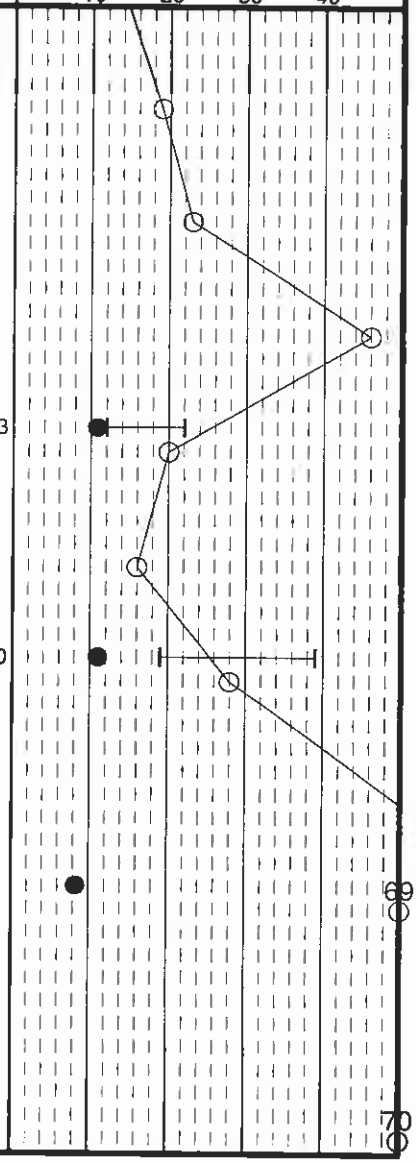
LOG OF: Boring B-026 | *Location:* Sta. 732+50.74, 140.07 ft Lt. of I-70 CL | *Date Drilled:* 8/1/2008 to 8/6/2008

WATER OBSERVATIONS:
Water seepage at: 41.0', 58.0', 77.0'
Water level at completion: 29.1' (beginning of shift, 8/5/08)
30.7' (includes drilling water)
FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	729.0													
		9 10 8	18	11		3.5	Very stiff gray SILT AND CLAY (A-6a), little to some fine to coarse sand, trace gravel; moist.							
		8 12 10	10	12		2.25								
30														
31.0	723.0													
		21 21 23	18	13		1.5	Stiff to very stiff gray SANDY SILT (A-4a), little to some fine to coarse sand, trace to little gravel; damp to moist.							
		4 8 11	18	14		3.0			10	13	---	18	36	23
35														
		12 8 7	18	15		3.25								
38.5	715.5													
		6 9 18	16	16		1.75	Stiff gray SILTY CLAY (A-6b), trace fine sand; damp.		0	0	---	1	39	60
40														
42.0	712.0													
		29 34 32	18	17			Very dense gray GRAVEL WITH SAND AND SILT (A-2-4), some fine to coarse sand, some silty clay; wet.							
45														
		19 35 32	18	18										
50	704.0													

GRADATION

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢—⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-026 | Location: Sta. 732+50.74, 140.07 ft Lt. of I-70 CL | Date Drilled: 8/1/2008 to 8/6/2008

WATER OBSERVATIONS:
Water seepage at: 41.0', 58.0', 77.0'
Water level at completion: 29.1' (beginning of shift, 8/5/08)
30.7' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP
	704.0														10 20 30 40
55		21 23 50/5	17	19		4.5+	Hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace to little gravel; contains sand seams; damp.		10	13	---	22	35	20	50+
57.0	697.0														
60		19 30 44	18	20			Very dense gray GRAVEL WITH SAND (A-1-b), trace to little silt; wet.		30	41	---	21	--8--		NP 78
65		29 50/4	2	21											50+
67.0	687.0														
70		8 20 23	2	22		4.5	Hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace to little gravel; damp to moist.								
75	679.0	13 50/5	10	23		4.5+			9	10	---	19	40	22	50+

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-026 | Location: Sta. 732+50.74, 140.07 ft Lt. of I-70 CL | Date Drilled: 8/1/2008 to 8/6/2008

WATER OBSERVATIONS:
Water seepage at: 41.0', 58.0', 77.0'
Water level at completion: 29.1' (beginning of shift, 8/5/08)
30.7' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	679.0														
		50/5	2	24			Very dense gray GRAVEL (A-1-a); possible cobbles and boulders; wet.								50+
82.0	672.0														
		35 50/5	7	25		1.75	Stiff gray SANDY SILT (A-4a), "and" fine to coarse sand, trace gravel; damp.		9	13	---	27	33	18	50+
87.0	667.0														
		13 19 33	7	26		1.5	Stiff gray CLAY (A-7-6), trace fine to coarse sand, trace gravel; moist.		6	3	---	2	30	59	58
90.0	664.0	Core 60"	Rec 5"	RQD 0%	R1		Claystone, brown, severely weathered, very weak, fractured, RQD 14%, Loss 67%. @ 90.0'-97.8' lost recovery.								
97.8	656.2	Core 60"	Rec 60"	RQD 80%	R2		Shale, blue-gray, highly weathered, weak, laminated, friable, fissile, jointed, fractured to moderately fractured, tight, slightly rough, RQD 87%, Loss 0%.								
	654.0														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-026 | *Location:* Sta. 732+50.74, 140.07 ft Lt. of I-70 CL | *Date Drilled:* 8/1/2008 to 8/6/2008

WATER OBSERVATIONS:
Water seepage at: 41.0', 58.0', 77.0'
Water level at completion: 29.1' (beginning of shift, 8/5/08)
30.7' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP
	654.0														10 20 30 40
105		Core 60"	Rec 60"	RQD 85%	R3		Shale, blue-gray, highly weathered, weak, laminated, friable, fissile, jointed, fractured to moderately fractured, tight, slightly rough, RQD 87%, Loss 0%. Contains dark gray, well cemented shale zones [thin, dark bands]. Dark shale zones are typically 1-2 inches thick, spaced at intervals of 12 to 18 inches.								
		Core 60"	Rec 60"	RQD 90%	R4		@ 100.5' - 101.0', qu = 2391 psi								
108.9	645.1														
110		Core 60"	Rec 60"	RQD 83%	R5		Interbedded Shale (90%) and Limestone (10%), RQD 88%, Loss 0%; Shale, dark gray, moderately weathered, weak, thinly laminated, calcareous, fissile, pyritic, jointed, moderately fractured, tight, slightly rough; Limestone, light gray, slightly weathered, strong, thinly bedded, pyritic. @ 110.2'-110.5', 113.9'-114.2', high angle fractures.								
115.0 115	639.0						Bottom of Boring - 115.0'								
120															
125															

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-027 | Location: Sta. 736+63.93, 51.22 ft Rt. of I-70 CL | Date Drilled: 7/8/2008

WATER OBSERVATIONS
Water seepage at 5.0'
Water level at completion. None

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	735.9														
2.4	733.5	16 23 17	18	1			Asphalt Concrete Pavement - 7" Portland Cement Concrete - 11" Aggregate Base - 11"								
3.0	732.9						FILL: Brick fragments, little fine to coarse sand; damp.								
5		3 8 12	18	2			Medium dense to dense brown GRAVEL WITH SAND (A-1-b), little to some silt; damp.		19	34	—	25	17	5	NP
		13 12 9	18	3					39	32	—	10	19		
		8 6 16	14	4											
		9 14 28	15	5			@ 7.5'-9.0', contains rust stains.		28	34	—	15	23		NP
10.0	725.9														
		13 26 29	13	6			Dense to very dense brown SANDY SILT (A-4a), trace to little gravel; moist.		17	20	—	25	38		NP
															57
		9 27 22	12	7											51
14.0	721.9														
15							Bottom of Boring - 14.0'								
20															
25															

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-028 | Location: Sta. 740+11.22, 55.30 ft Lt. of I-70 CL | Date Drilled: 7/24/2008

WATER OBSERVATIONS:
Water seepage at: None
Water level at completion: None

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft) 731.7	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
1.5	730.2						Asphalt Concrete - 12" Aggregate Base - 6"								
		8 6 7	8	1			FILL: Loose to medium dense brown GRAVEL (A-1-a), little to some fine to coarse sand, little silty clay; moist.		65	16	—	6	13		
5		4 5 2	7	2					70	14	—	5	11		
6.0	725.7														
		10 20 22	16	3			FILL: Dense brown GRAVEL WITH SAND (A-1-b), little silt; contains brick fragments and silty clay seams; damp.		34	35	—	14	17		NP
8.5	723.2														
10.0	721.7	47 49 46	12	4			FILL: Very dense gray GRAVEL (A-1-a), trace fine to coarse sand; contains few silty clay seams; damp.		84	5	—	3	8		NP
							Bottom of Boring - 10.0'								

10 15 20 25

97

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-029 | *Location:* Sta. 740+41.62, 85.96 ft Rt. of I-70 CL | *Date Drilled:* 7/9/2008 to 7/14/2008

WATER OBSERVATIONS:
Water seepage at: 21.0'-25.0',30.0'-32.0',40.0'-110.0'
Water level at completion: 29.4' (beginning of shift, 7/10/08)
20.5' (includes drilling water)
FIELD NOTES: Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	742.3						Asphalt Concrete Pavement - 7" Portland Cement Concrete - 9" Aggregate Base - 11"								
2.3	740.0	5 15 17	7	1			POSSIBLE FILL: Medium dense to dense brown GRAVEL WITH SAND (A-1-b), little to some silt; damp.								
		13 15 12	10	2											
5		11 13 10	6	3					55	17	---	9	--19--		NP
6.0	736.3	4 10 15	14	4		4.5	Hard gray SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.		12	11	---	16	35	26	
7.5	734.8	12 15 15	12	5		4.5	Hard gray SILTY CLAY (A-6b), some fine to coarse sand, trace gravel; damp to moist.		9	9	---	15	41	26	
10.0	732.3	10 14 17	18	6		4.5	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp. @ 11.5'-21.0', difficult drilling.		8	8	---	15	40	29	
15.0	727.3	8 15 19	18	7		4.5									
		15 48 45	12	8			Very dense gray GRAVEL (A-1-a), some fine to coarse sand, trace to little silt; damp.		55	24	---	10	--11--		NP
		29 50/3	8	9					61	16	---	12	--11--		NP
		50/5	1	10			@ 18.5'-18.9', rock fragments; possible cobble blocking shoe.								
20 21.0	721.3	21 28 33	6	11			Very dense gray GRAVEL WITH SAND AND SILT (A-2-4), some silt; wet.								
23.5	718.8	11 18 21	16	12			Dense gray SILT (A-4b), little fine sand; contains interbedded sand seams; wet.								
25	717.3														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-029 | *Location:* Sta. 740+41.62, 85.96 ft Rt. of I-70 CL | *Date Drilled:* 7/9/2008 to 7/14/2008

WATER OBSERVATIONS:
Water seepage at: 21.0'-25.0',30.0'-32.0',40.0'-110.0'
Water level at completion: 29.4' (beginning of shift, 7/10/08)
20.5' (includes drilling water)
FIELD NOTES: Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP
	717.3														
		10 19 25	15	13		4.5+	Hard gray SANDY SILT (A-4a), "and" fine to coarse sand, trace gravel; contains interbedded sand seams; damp.		9	8	---	33	34	16	NP ●
28.5	713.8														
30		13 23 31	13	14			Dense to very dense gray COARSE AND FINE SAND (A-3a), some silt; moist.								55 ○
31.8	710.5	3 6 29	14	15A 15B		4.5+	Hard gray SANDY SILT (A-4a), some gravel, little to some fine to coarse sand; damp.								
35		13 26 31	9	16		--	@ 31.0'-43.5', difficult drilling. @ 33.5', 5 inches sand heave.								58 ○
40		14 23 33	14	17		4.5+			28	15	---	19	25	13	● ⊢ 57 ○
42.0	700.3														
44.2	698.1	10 20 29	18	18A 18B			Dense gray COARSE AND FINE SAND (A-3a), little silt; contains silty clay seams; wet. Dense gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; moist.								
45															○
47.0	695.3														
50	692.3	19 37 50/3	15	19			Very dense gray GRAVEL WITH SAND (A-1-b), trace silt; wet. @ 48.5', 6 inches sand heave.		21	48	---	27	--4--		NP ● 50+ ○

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WATER OBSERVATIONS:
Water seepage at: 21.0'-25.0',30.0'-32.0',40.0'-110.0'
Water level at completion: 29.4' (beginning of shift, 7/10/08) 20.5' (includes drilling water)
FIELD NOTES: Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	692.3						Very dense gray GRAVEL WITH SAND (A-1-b), trace silt; wet.								
		10 16 50/5	13	20			@ 53.5', 1.7 feet sand heave; washed out.								50+
55															
57.0	685.3														
							Very dense gray COARSE AND FINE SAND (A-3a), little to some silt, trace to little gravel; wet.								
		31 50/5	11	21			@ 58.5'-68.5', three to six inches sand heave.								50+
60															
		21 50/5	11	22					18	13	---	52	--17--		NP ● 50+
65															
		13 29 41	14	23											71
70															
73.8	668.5	25 38 50/6	18	24A 24B		3.75	Very stiff gray SILT (A-4b), little fine sand; moist.								50+
75	667.3														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-029 | *Location:* Sta. 740+41.62, 85.96 ft Rt. of I-70 CL | *Date Drilled:* 7/9/2008 to 7/14/2008

WATER OBSERVATIONS:
Water seepage at: 21.0'-25.0',30.0'-32.0',40.0'-110.0'
Water level at completion: 29.4' (beginning of shift, 7/10/08) 20.5' (includes drilling water)
FIELD NOTES: Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	667.3						Stiff gray SILT AND CLAY (A-6a), some to "and" fine to coarse sand, trace to little gravel; damp to moist.								
		50/4	4	25		1.5			25	20	---	18	26	11	50+
80															
84.0	658.3	31		26A		4.5+									
		31 50/3	15	26B			Very dense gray GRAVEL WITH SAND (A-1-b), trace silt; wet.								50+
85															
		15 50/4	10	27											50+
90															
		13 26 30	18	28					NP						
95									31	48	---	18	--2--		57
		41 50/2	8	29			@ 98.5', 1.2 feet sand heave.								
100	642.3														50+

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-029 | *Location:* Sta. 740+41.62, 85.96 ft Rt. of I-70 CL | *Date Drilled:* 7/9/2008 to 7/14/2008

WATER OBSERVATIONS:
Water seepage at: 21.0'-25.0',30.0'-32.0',40.0'-110.0'
Water level at completion: 29.4' (beginning of shift, 7/10/08) 20.5' (includes drilling water)
FIELD NOTES: Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ ○ / Non-Plastic - NP ⊣ LL Blows per foot - ○ 10 20 30 40
	642.3						Very dense gray FINE SAND (A-3), little coarse sand, trace gravel; wet.								
105		2 12 49	18	30			@ 103.5', 2.3 feet sand heave.		3	13	---	76	--8--		NP ● 62
110		41 50/0	6	31											50+
113.5	628.8						@ 113.5', 22 feet sand heave; washed out.								
		50/2	2	32			Severely weathered gray SHALE.								
115															50+
116.5	625.8														
		Core 42"	Rec 38"	RQD 0%	R-1		Shale, dark gray, moderately to highly weathered, weak, thinly laminated, calcareous, pyritic, fissile, friable, jointed, fractured, tight, slightly rough; RQD 0%, Loss 10%.								
120															
120.6	621.7														
		Core 60"	Rec 60"	RQD 88%	R-2		Limestone, brownish-gray, moderately weathered, moderately strong to strong, very thinly bedded, pyritic, cherty, moderately fractured, tight, slightly rough, RQD 86%, Loss 0%. [Delaware Limestone] @ 121.2' - 121.5', qu = 14,137 psi								
125	617.3														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-029 | *Location:* Sta. 740+41.62, 85.96 ft Rt. of I-70 CL | *Date Drilled:* 7/9/2008 to 7/14/2008

WATER OBSERVATIONS:
Water seepage at: 21.0'-25.0',30.0'-32.0',40.0'-110.0'
Water level at completion: 29.4' (beginning of shift, 7/10/08) 20.5' (includes drilling water)
FIELD NOTES: Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) / Natural Moisture Content, % - ● / PL — LL / Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	617.3														
		Core 60"	Rec 60"	RQD 85%	R-3		Limestone, brownish-gray, moderately weathered, moderately strong to strong, very thinly bedded, pyritic, cherty, moderately fractured, tight, slightly rough, RQD 86%, Loss 0%. [Delaware Limestone]								
130.2 130	612.1														
		Core 60"	Rec 54"	RQD 76%	R-4		Limestone, light gray, slightly weathered, strong, thinly bedded, slightly fossiliferous, stylolitic, slightly fractured, tight to narrow, slightly rough, RQD 82%, Loss 8%. [Columbus Limestone]								
135															
		Core 18"	Rec 18"	RQD 100%	R-5										
136.5	605.8														
							Bottom of Boring - 136.5'								
140															
145															
150															

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-030 | *Location:* Sta. 743+00.05, 64.213 ft Lt. of I-70 CL | *Date Drilled:* 7/20/2008 to 7/23/2008

WATER OBSERVATIONS:
Water seepage at: 16.0'
Water level at completion: 13.6' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP
	736.7														10 20 30 40
1.4	735.3						Asphalt Concrete - 11" Aggregate Base - 6"								
		4 6 8	11	1		--	Loose to medium dense brown GRAVEL WITH SAND (A-1-b), some fine to coarse sand, little silt; damp.								
5.0	731.7	3 3 1	8	2		--									
6.5	730.2	4 14 21	18	3		4.5+	Hard gray SILTY CLAY (A-6b), some fine to coarse sand, trace to little gravel; contains few rock fragments; damp to moist.		9	9	---	14	40	28	
8.0	728.7	10 16 19	18	4		4.5+	Hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; damp.		6	10	---	14	40	29	
		13 19 21	18	5		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.		5	11	---	18	41	25	
11.0	725.7	11 15 27	18	6		4.5+									
		16 50/5	8	7			Dense to very dense gray GRAVEL (A-1-a), little to some fine to coarse sand, trace to little silty clay; damp.		71	12	---	5	--12--		NP
		11 33 38	13	8					59	21	---	8	--12--		NP
		18 23 23	13	9			@ 16.0', becomes wet.		61	20	---	8	--11--		
		12 13 21	12	10											
		13 28 36	12	11											
23.5	713.2														
	711.7	17 34 40	14	12			Very dense gray FINE SAND (A-3), some silty clay, trace coarse sand; wet.								

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-030 | *Location:* Sta. 743+00.05, 64.213 ft Lt. of I-70 CL | *Date Drilled:* 7/20/2008 to 7/23/2008

WATER OBSERVATIONS:
Water seepage at: 16.0'
Water level at completion: 13.6' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	711.7						Very dense gray FINE SAND (A-3), some silty clay, trace coarse sand; wet.								
		23 45 50/4	15	13			@ 26.0', 0.4 feet sand heave.								50+
30		9 21 31	16	14											53
		14 30 45	16	15					0	8	---	69	--23--		77
		50/4	4	16			@ 38.5'-38.8', contains sandy silt seams.								
40							@ 38.5'-43.5', difficult drilling.								50+
		11 32 50/5	17	17			@ 43.5', 1.9 feet sand heave.								
45															50+
47.0	689.7														
							Very dense gray COARSE AND FINE SAND (A-3a), little gravel, trace silty clay; wet.								
		12 50/5	10	18					15	54	---	23	--8--		50+
50	686.7														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-030 | *Location:* Sta. 743+00.05, 64.213 ft Lt. of I-70 CL | *Date Drilled:* 7/20/2008 to 7/23/2008

WATER OBSERVATIONS:
Water seepage at: 16.0'
Water level at completion: 13.6' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	686.7						Very dense gray COARSE AND FINE SAND (A-3a), little gravel, little to some silty clay; wet.								
55		41 50/6	10	19			@ 53.5', 0.7 feet sand heave.								50+
60		24 39 45	13	20											86
62.0	674.7														
							Very dense gray FINE SAND (A-3), trace silt, trace gravel; wet.								
65		16 31 41	15	21											73
67.0	669.7														
							Very dense gray GRAVEL WITH SAND (A-1-b), trace to little silty clay; wet.		49	29	---	13	--9--		
70		33 50/5	9	22											50+
		43 50/3	9	23											50+
75	661.7														

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Client: ms consultants	Project: FRA-70-8.93	Job No. 0221-1004.01
LOG OF: Boring B-030	Location: Sta. 743+00.05, 64.213 ft Lt. of I-70 CL	Date Drilled: 7/20/2008 to 7/23/2008

WATER OBSERVATIONS:
Water seepage at: 16.0'
Water level at completion: 13.6' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP
	661.7						Very dense gray GRAVEL WITH SAND (A-1-b), trace to little silty clay; wet.								
80		35 50/5	10	24			@ 78.5', 1.0 foot sand heave.								50+
85		21 47 47	13	25			@ 83.5', 4.6 feet sand heave.		15	39	---	33	--13--		96
90		15 23 46	9	26											70
95		37 50/3	9	27											50+
100	636.7	38 50/5	7	28											50+

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-030 | Location: Sta. 743+00.05, 64.213 ft Lt. of I-70 CL | Date Drilled: 7/20/2008 to 7/23/2008

WATER OBSERVATIONS:
Water seepage at: 16.0'
Water level at completion: 13.6' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	636.7														
103.5	633.2	50/3	3	29			Very dense gray GRAVEL WITH SAND (A-1-b), trace to little silty clay; wet. @ 100.0'-103.5', 25.0 to 27.3 feet sand heave; washed out twice.								
105.0 105	631.7						Severely weathered gray SHALE.								50+
110		Core 60"	Rec 57"	RQD 37%	R1		Shale, dark gray, highly weathered, weak, laminated, slightly calcareous, contains abundant pyritic inclusions, fissile, laminated, fractured to highly fractured, RQD 38%, Loss 4%. @ 107.7'-107.8', encounterd large pyritic inclusion. @ 108.1'-109.1', moderately weathered, moderately strong.								
111.0	625.7	Core 12"	Rec 12"	RQD 42%	R2		@ 111.0', core steel damaged. Abandoned boring at 111.0'.								
							Bottom of Boring - 111.0'								
115															
120															
125															

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

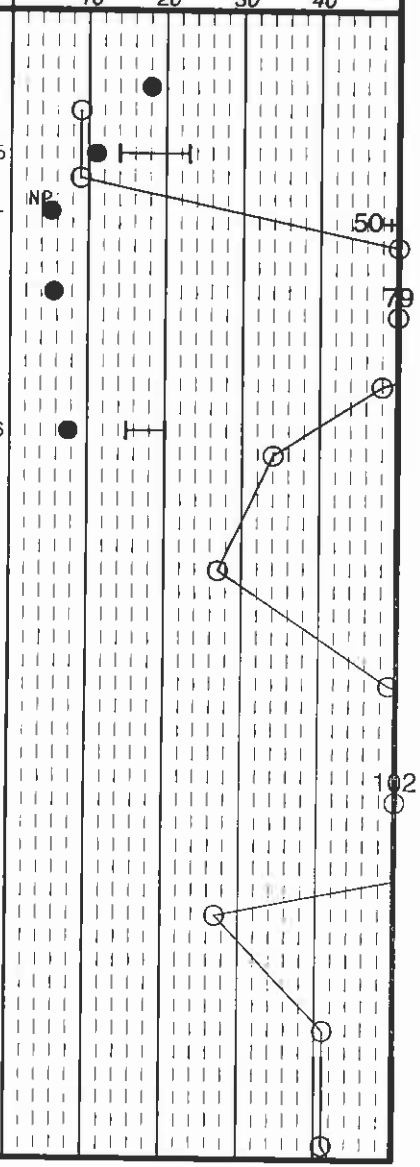
LOG OF: Boring B-031 | *Location:* Sta. 745+02.00, 72.77 ft Rt. of I-70 CL | *Date Drilled:* 7/7/2008 to 7/8/2008

WATER OBSERVATIONS:
Water seepage at: 9.5'
Water level at completion: 8.3' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	735.6													
0.7	734.9						Topsoil - 8"							
		2 4 5	18	1		3.75	FILL: Very stiff to hard brown SANDY SILT (A-4a), little fine to coarse sand, trace to little gravel; contains few brick and coal fragments; damp.							
4.0	731.6	3 4 5	18	2		4.5+			12	5	---	6	52	25
5		16 50/5	5	3			Dense to very dense brownish gray GRAVEL WITH SAND (A-1-b), little silt; damp.		50	20	---	13	--17--	
		42 44 31	1	4			@ 5.0', encountered refusal; offset boring approx. three feet west.							
8.5	727.1	18 21 25	1	5			@ 5.5'-8.5', rock fragments; possible cobble blocking shoe.							
9.5	726.1	9 15 17	18	6A		4.5	Hard gray SANDY SILT (A-4a), trace to little gravel; damp.		15	12	---	25	32	16
10				6B			Medium dense to dense gray SILT (A-4b), some fine sand; wet.							
		4 12 14	18	7										
13.5	722.1													
15		18 22 25	12	8		4.5+	Very stiff to hard gray SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.							
		14 48 49	18	9		3.5								
18.5	717.1													
20		11 13 13	18	10			Medium dense gray SILT (A-4b), trace fine sand; moist.							
21.0	714.6													
		7 18 21	18	11			Dense gray COARSE AND FINE SAND (A-3a), some silt; wet.							
23.5	712.1													
25	710.6	12 18 21	18	12		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.							

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Co ...us, Ohio 43229 * (614) 888-0040

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-031 | *Location:* Sta. 745+02.00, 72.77 ft Rt. of I-70 CL | *Date Drilled:* 7/7/2008 to 7/8/2008

WATER OBSERVATIONS:
Water seepage at: 9.5'
Water level at completion: 8.3' (includes drilling water)
FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	710.6													
		20 50/5	10	13		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace to little gravel; damp.							
28.0	707.6													
		50/5	5	14			Very dense gray SANDY SILT (A-4a), some fine to coarse sand, trace to little gravel; wet.							
30							@ 28.5'-38.9', possible cobbles.							
		24 49 48	18	15										
35														
		50/5	5	16										
40														
42.0	693.6													
		11 13 18	18	17			Dense gray FINE SAND (A-3), trace silt; wet.							
45														
47.0	688.6													
		16 33 41	18	18			Very dense gray COARSE AND FINE SAND (A-3a), little silt, little gravel; wet. @ 48.5', ten feet sand heave; triconed and washed out.							
50	685.6													

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40
50+
50+
102
50+
78

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-031 | Location: Sta. 745+02.00, 72.77 ft Rt. of I-70 CL | Date Drilled: 7/7/2008 to 7/8/2008

WATER OBSERVATIONS:
Water seepage at: 9.5'
Water level at completion: 8.3' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	685.6						Very dense gray COARSE AND FINE SAND (A-3a), trace to little gravel, trace silt; wet.								
55		25 33 40	18	19											17 ○
60.0 60	675.6	38 42 49	18	20											96 ○
							Bottom of Boring - 60.0'								
65															
70															
75															

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

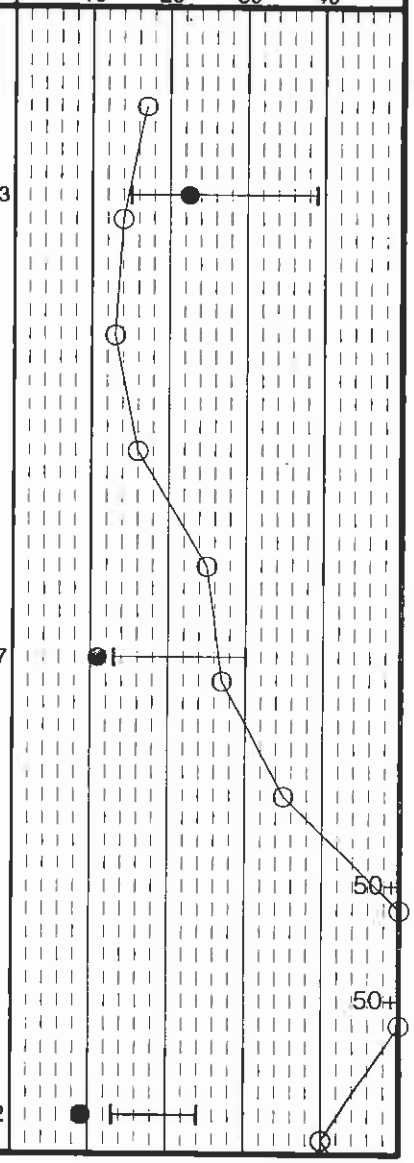
LOG OF: Boring B-032 | *Location:* Sta. 745+06.78, 119.69 ft Rt. of I-70 CL | *Date Drilled:* 7/8/2008 to 7/15/2008

WATER OBSERVATIONS:
Water seepage at: 47.0'
Water level at completion: 25.7' (includes drilling water)

FIELD NOTES:
3.25" diameter hollowstem augers to 120.5';
4.0" diameter flush joint casing from 120.5' to 128.5'.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
1.1	750.3						Asphalt Concrete - 5" Portland Cement Concrete - 3" Aggregate Base - 5"							
2.0	749.4	5 10 6	9	1		4.5+	FILL: Medium dense brown COARSE AND FINE SAND (A-3a), little silt, little gravel; moist.							
5		5 7 6	18	2		2.0	FILL: Very stiff to hard brown SILTY CLAY (A-6b), little to some fine to coarse sand, trace gravel; contains few brick fragments; damp to moist.		8	7	---	13	29	43
6.0	745.4													
		3 4 8	3	3		2.5	Very stiff brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; moist.							
8.5	742.9													
10		4 7 8	3	4			Medium dense gray COARSE AND FINE SAND (A-3a), little silt, little gravel; damp. (POSSIBLE FOUNDRY SAND)							
11.0	740.4													
		5 8 16	18	5		4.5+	Hard gray SILTY CLAY (A-6b), little to some fine to coarse sand, trace to little gravel; damp. @ 11.0'-12.5', brown and gray.							
		12 12 14	18	6		4.5+			12	8	---	15	38	27
15							@ 13.0'-35.0', difficult drilling; possible cobbles and boulders.							
		5 16 17	1	7		--								
		50/1	0	8		--	@ 18.5'-20.0', only gravel recovered in auger cuttings sample.							
20														
		50/3	0	9		--								
23.5	727.9													
25	726.4	34 17 21	18	10		4.5+	Hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; damp.		7	14	---	20	37	22

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



DLZ Ohio, Inc. * 6121 Huntley Road, Co ,us, Ohio 43229 * (614) 888-0040

Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-032 | Location: Sta. 745+06.78, 119.69 ft Rt. of I-70 CL | Date Drilled: 7/8/2008 to 7/15/2008

WATER OBSERVATIONS:
Water seepage at: 47.0'
Water level at completion: 25.7' (includes drilling water)

FIELD NOTES:
3.25" diameter hollowstem augers to 120.5';
4.0" diameter flush joint casing from 120.5' to 128.5'.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	726.4														
		50/1	1	11		--	Hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; damp.								50+
		50/4	0	12		--									50+
30															
		50/1	0	13		--									50+
		50/3	1	14		--									50+
35															
36.0	715.4														
		10 24 45	18	15		4.5+	Hard gray SANDY SILT (A-4a), some to "and" fine to coarse sand, little gravel; damp.		16	20	---	23	26	15	73
		11 17 28	18	16		4.5+									
40															
		11 50/4	10	17		4.5+									50+
45															
		32 50/3	9	18		4.5+	@ 48.5'-49.3', contains occasional thin sand seams.								50+
50	701.4														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-032 | *Location:* Sta. 745+06.78, 119.69 ft Rt. of I-70 CL | *Date Drilled:* 7/8/2008 to 7/15/2008

WATER OBSERVATIONS:
Water seepage at: 47.0'
Water level at completion: 25.7' (includes drilling water)

FIELD NOTES:
3.25" diameter hollowstem augers to 120.5';
4.0" diameter flush joint casing from 120.5' to 128.5'.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	701.4														
							Very dense gray FINE SAND (A-3); contains silty clay seams; wet.								
		26 50/3	9	19			@ 53.5', 1.5 feet sand heave; used tricone bit to wash out.								50+ ○
55															
57.0	694.4														
							Very dense gray GRAVEL WITH SAND (A-1-b), trace silt; contains silty clay seams; wet.								
		18 50/4	10	20					42	30	---	20	--9--		INP ● 50+ ○
60															
		28 50/3	9	21											50+ ○
65															
		16 42 50/3	15	22											50+ ○
70															
		33 50/5	11	23											50+ ○
75	676.4														

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-032 | Location: Sta. 745+06.78, 119.69 ft Rt. of I-70 CL | Date Drilled: 7/8/2008 to 7/15/2008

WATER OBSERVATIONS:
Water seepage at: 47.0'
Water level at completion: 25.7' (includes drilling water)

FIELD NOTES:
3.25" diameter hollowstem augers to 120.5';
4.0" diameter flush joint casing from 120.5' to 128.5'.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	676.4						Very dense gray COARSE AND FINE SAND (A-3a), trace to little silt, trace to little gravel; wet.								
		17 50/4	10	24											50+
80															
		17 41 49	18	25					10	15	---	62	--13--		NP ● 95
85															
		17 49 50/3	15	26			@ 88.5'-90.0', few limestone fragments.								50+
90															
		20 50/4	8	27											50+
95															
		17 50/4	10	28											50+
100	651.4														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-032 | *Location:* Sta. 745+06.78, 119.69 ft Rt. of I-70 CL | *Date Drilled:* 7/8/2008 to 7/15/2008

WATER OBSERVATIONS:
Water seepage at: 47.0'
Water level at completion: 25.7' (includes drilling water)

FIELD NOTES:
3.25" diameter hollowstem augers to 120.5';
4.0" diameter flush joint casing from 120.5' to 128.5'.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) / Natural Moisture Content, % - ● / PL — LL / Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	651.4						Very dense gray GRAVEL WITH SAND (A-1-b), trace silt; wet.								
105		5 37 50/3	15	29											50+ ○
		27 50/4	10	30					38	43	---	13	--6--		NP ● 50+ ○
110															
		50/5	5	31			@ 113.5'-113.9', possible cobbles.								50+ ○
115															
117.0	634.4														
							Very dense gray GRAVEL (A-1-a), "and" fine to coarse sand, trace silt; wet.								
		22 50/4	10	32					55	24	---	14	--7--		NP ● 50+ ○
120.0 120	631.4														
120.5	630.9	50/3	3	33			Severely weathered gray SHALE.								
		Core 60"	Rec 22"	RQD 8%	R1		Shale, dark gray, highly to severely weathered, very weak to weak, laminated, calcareous, friable, fissile, pyritic, jointed, fractured to highly fractured, tight, slightly rough; RQD 5% Loss 53%.								50+ ○
125	626.4														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-032 | *Location:* Sta. 745+06.78, 119.69 ft Rt. of I-70 CL | *Date Drilled:* 7/8/2008 to 7/15/2008

WATER OBSERVATIONS:
Water seepage at: 47.0'
Water level at completion: 25.7' (includes drilling water)

FIELD NOTES:
3.25" diameter hollowstem augers to 120.5';
4.0" diameter flush joint casing from 120.5' to 128.5'.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	626.4														
		Core 36"	Rec 23"	RQD 0%	R2		Shale, dark gray, highly to severely weathered, very weak to weak, laminated, calcareous, friable, fissile, pyritic, jointed, fractured to highly fractured, tight, slightly rough; RQD 5% Loss 53%.								
128.5	622.9						@ 125.2' - 125.5', encountered thin limestone layer. @ 128.5', boring terminated due to difficult coring conditions (core steel broke off during both core runs).								
130							Bottom of Boring - 128.5'								
135															
140															
145															
150															

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Client: ms consultants	Project: FRA-70-8.93	Job No. 0221-1004.01
LOG OF: Boring B-033	Location: Sta. 749+82.21, 43.40 ft Lt. of I-70 CL	Date Drilled: 7/24/2008

WATER OBSERVATIONS:
Water seepage at 6.5'
Water level at completion. 9.2'

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
0.2	730.3						Gravel berm material - 2"								
		8 9 7	5	1			Medium dense brown SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.								
3.0	727.5														
		7 16 19	12	2			Dense to very dense brown GRAVEL WITH SAND (A-1-b), trace to little silty clay; damp.								
5		6 21 28	14	3					36	36	--	17	11		52
		12 20 15	12	4			@ 6.5', becomes wet.		29	35	--	23	13		
		9 13 15	16	5			@ 8.0'-9.5', medium dense.		36	33	--	20	11		
10		15 20 24	18	6					29	37	--	22	12		
		18 25 28	18	7											56
		7 14 27	18	8											
15.0	715.5						Bottom of Boring - 15.0'								
20															
25															

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

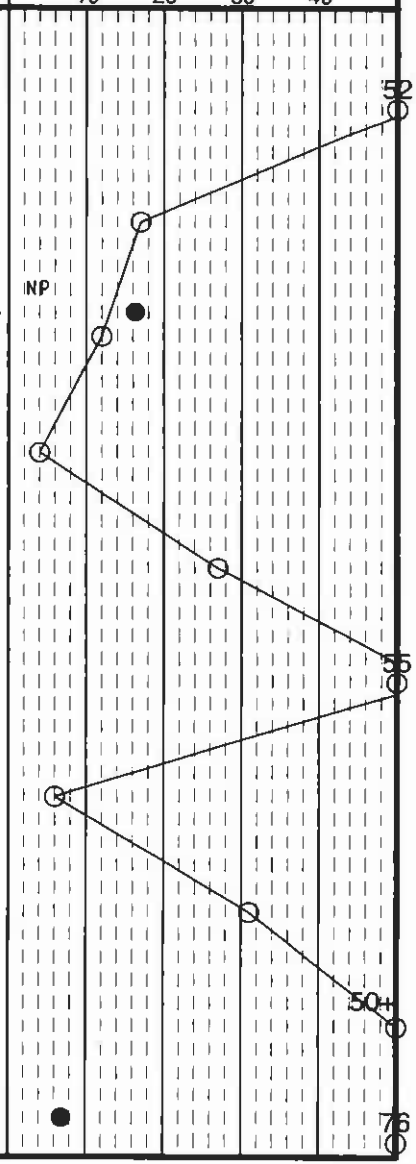
LOG OF: Boring B-034 | *Location:* Sta. 752+71.04, 96.62 ft Lt. of I-70 CL | *Date Drilled:* 8/7/2008 to 8/14/2008

WATER OBSERVATIONS:
Water seepage at: 5.5', 10.5', 20.5', 25.5', 62.0'
Water level at completion: 43.3' (measured inside casing)
At beginning of shift: 8/8 28.5, BOH 45.0'

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0.3	751.2						Topsoil - 3"							
		19 35 14	8	1			Brick Fragments							
3.5	748.0													
5		5 7 9	3	2		1.5	FILL: Stiff brown SANDY SILT (A-4a), little fine to coarse sand, little gravel; contains numerous 1/8"-1/4" size brick fragments; moist.							
6.0	745.5													
		2 5 6	16	3			FILL: Medium dense brown GRAVEL WITH SAND (A-1-b), little silt; contains numerous 1/8"-1/4" size brick fragments; wet.		41	32	---	12	--15--	
8.5	743.0													
10		2 4 WOH	8	4			Brick Fragments							
11.0	740.5													
		4 6 20	10	5		1.75	FILL: Stiff brown and gray SANDY SILT (A-4a), some fine to coarse sand, some gravel; contains brick and rock fragments; moist.							
		15 25 27	18	6		--								
15														
16.0	735.5													
		6 2 4	6	7			FILL: Loose brown GRAVEL WITH SAND (A-1-b), little silt; contains few 1/8'-1/2' size brick fragments; wet.							
18.5	733.0													
20		11 13 16	13	8		4.5+	Hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; contains few 1/8'-1/2' size brick fragments; damp.							
21.0	730.5													
		28 45 50/5	2	9			Very dense gray GRAVEL WITH SAND (A-1-b), trace silt; possible cobbles; wet.							
23.5	728.0													
25	726.5	13 23 49	2	10		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.							

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-034 | *Location:* Sta. 752+71.04, 96.62 ft Lt. of I-70 CL | *Date Drilled:* 8/7/2008 to 8/14/2008

WATER OBSERVATIONS:
Water seepage at: 5.5', 10.5', 20.5', 25.5', 62.0'
Water level at completion: 43.3' (measured inside casing)
At beginning of shift: 8/8 28.5, BOH 45.0'

FIELD NOTES: *Advanced boring using 4.0" diameter flush joint casing.*

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP
	726.5														
		6 11 14	12	11			Medium dense gray GRAVEL (A-1-a), little to some fine to coarse sand, trace silt; contains few brick fragments (likely picked up at higher elevation); wet.		74	15	---	6	--5--		NP
28.5	723.0														
30		19 50/5	6	12			Very dense gray GRAVEL WITH SAND (A-1-b), little silt; wet.		36	34	---	15	--15--		NP 50+
31.0	720.5														
		6 4 4	18	13			Very loose to loose gray GRAVEL (A-1-a), little fine to coarse sand, trace silt; contains few brick fragments (likely picked up at higher elevation); wet.		81	12	---	4	--3--		NP
33.5	718.0														
35		19 30 26	18	14			Very dense gray GRAVEL WITH SAND (A-1-b), trace to little silt; wet.		33	30	---	21	--16--		NP 59
		8 11 26	14	15			@ 36.0'-37.5', contains 3/4"x1-1/2" steel fragment - possible conduit fragment (likely picked up at higher elevation); wet.								
38.5	713.0														
40		16 35 41	18	16			Very dense gray SILT (A-4b), trace silt, trace clay; contains occasional sand seams; wet.								80
41.0	710.5														
		8 8 9	18	17			Medium dense gray GRAVEL (A-1-a), little fine to coarse sand; wet.		87	9	---	3	--1--		NP
							@ 43.5'-44.0', fine sand seam.								
44.0	707.5	18 25 30	18	18		<0.25	Very soft gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; wet.								58
45															
47.0	704.5														
							Very dense gray GRAVEL (A-1-a), some fine to coarse sand; wet.								
50	701.5	8 28 50/5	8	19											50+

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-034 | *Location:* Sta. 752+71.04, 96.62 ft Lt. of I-70 CL | *Date Drilled:* 8/7/2008 to 8/14/2008

WATER OBSERVATIONS:
Water seepage at: 5.5', 10.5', 20.5', 25.5', 62.0'
Water level at completion: 43.3' (measured inside casing)
At beginning of shift: 8/8 28.5', BOH 45.0'
FIELD NOTES: Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	701.5						Very stiff to hard gray SANDY SILT (A-4a), some to "and" fine to coarse sand, trace gravel; damp.							
55		20 18 18	8	20		3.75			5	14	---	21	46	14
		50/2	2	21		4.5+	@ 58.5'-62.0', possible cobbles.							
60														
62.0	689.5													
							Boulder/cobble fragments.							
		50/5	3	22										
65														
67.0	684.5													
							Very dense gray GRAVEL WITH SAND (A-1-b), some fine to coarse sand, little silt; possible cobbles; wet.							
		50/2	2	23										
70														
72.0	679.5													
							Very dense gray COARSE AND FINE SAND (A-3a), little gravel, trace silt; possible cobbles; wet.							
		37 50/5	9	24										
75	676.5													

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40
50+
50+
50+
50+

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-034 | *Location:* Sta. 752+71.04, 96.62 ft Lt. of I-70 CL | *Date Drilled:* 8/7/2008 to 8/14/2008

WATER OBSERVATIONS:
Water seepage at: 5.5', 10.5', 20.5', 25.5', 62.0'
Water level at completion: 43.3' (measured inside casing)
At beginning of shift: 8/8 28.5, BOH 45.0'
FIELD NOTES: Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	676.5														
80		25 38 50/5	15	25			Very dense gray GRAVEL WITH SAND (A-1-b), some silt; moist.		28	31	---	9	--32--		NP ● 50+ ○
85		21 32 47	18	26											83 ○
87.0	664.5														
		22 35 50/5	17	27			Very dense gray SANDY SILT (A-4a), some gravel; moist.								50+ ○
90															
92.0	659.5														
		35 50/5	9	28			Very dense gray GRAVEL WITH SAND (A-1-b), "and" fine to coarse sand, little silt; wet.								50+ ○
95															
97.0	654.5														
		50/5	5	29		3.25	Very stiff gray SANDY SILT (A-4a), some fine to coarse sand, some gravel; possible cobbles; moist.								50+ ○
100	651.5														

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-034 | Location: Sta. 752+71.04, 96.62 ft Lt. of I-70 CL | Date Drilled: 8/7/2008 to 8/14/2008

WATER OBSERVATIONS:
Water seepage at: 5.5', 10.5', 20.5', 25.5', 62.0'
Water level at completion: 43.3' (measured inside casing)
FIELD NOTES: At beginning of shift: 8/8 28.5', BOH 45.0'
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP
	651.5						Very dense gray GRAVEL WITH SAND (A-1-b), little to some silt; wet.								
105		37 50/5	6	30			@ 100.0'-105.0', possible cobbles.								50+ ○
110		30 33 33	18	31					25	47	---	16	--12--		NP ● 69 ○
115.0 115	636.5	23 42 50/3	12	32											50+ ○
115.5	636.0	50/3	3	33			Severely weathered gray SHALE.								50+ ○
120		Core 60"	Rec 39"	RQD 55%	R-1		Shale, dark gray, highly to severely weathered, weak, thinly laminated, fissile, calcareous, pyritic, jointed, fractured, tight, slightly rough, RQD 69%, Loss 12%. Contains occasional large (up to 1" diameter) pyritic inclusion. @ 116.6'-117.0', encountered thin limestone bed. @ 117.5'-119.2', 121.1'-121.7', possible lost recovery.								
125	626.5	Core 60"	Rec 53"	RQD 77%	R-2		@ 121.7', moderately fractured, highly weathered.								

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-034 | *Location:* Sta. 752+71.04, 96.62 ft Lt. of I-70 CL | *Date Drilled:* 8/7/2008 to 8/14/2008

WATER OBSERVATIONS:
Water seepage at: 5.5', 10.5', 20.5', 25.5', 62.0'
Water level at completion: 43.3' (measured inside casing)
At beginning of shift: 8/8 28.5, BOH 45.0'

FIELD NOTES: *Advanced boring using 4.0" diameter flush joint casing.*

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	626.5														
		Core 60"	Rec 60"	RQD 57%	R-3		Shale, dark gray, highly to severely weathered, weak, thinly laminated, fissile, calcareous, pyritic, jointed, fractured, tight, slightly rough, RQD 69%, Loss 12%. Contains occasional large (up to 1" diameter) pyritic inclusion. @ 126.7'-127.2', 129.8'-130.4', 131.1'-131.5', high angle fractures.									
130							@ 130.0' -130.3', qu = 3978 psi								
		Core 60"	Rec 60"	RQD 85%	R-4		@ 133.5'-133.7', encountered thin limestone bed.								
135															
135.5	616.0						Bottom of Boring - 135.5'								
140															
145															
150															

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-035 | *Location:* Sta. 752+66.77, 72.74 ft Rt. of I-70 CL | *Date Drilled:* 7/7/2008

WATER OBSERVATIONS:
Water seepage at: 9.2'-15.0'
Water level at completion: 9.2'

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft) 732.3	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP
1.8	730.5	7 15 26	15	1			Asphalt Concrete Pavement - 8" Portland Cement Concrete - 10" Aggregate Base - 3"								
3.0	729.3	9 25 26	15	2			Dense brown FINE SAND (A-3), trace silt, trace gravel; contains silty clay seams; damp.								
6.0	726.3	10 25 27	15	3			Very dense brown GRAVEL WITH SAND (A-1-b), trace to little silt; damp.		37	36	---	17	--10--		NP
7.5	724.8	5 14 18	13	4			Dense to very dense brown FINE SAND (A-3), trace to little gravel; damp.		12	20	---	60	--8--		
		10 24 27	13	5			Dense to very dense brown GRAVEL WITH SAND (A-1-b), trace to little silt; wet.		49	28	---	15	--9--		NP
		11 22 25	13	6					34	36	---	20	--10--		NP
		12 23 27	15	7											
15.0	717.3	10 22 34	13	8											
							Bottom of Boring - 15.0'								

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-036 | *Location:* Sta. 755+56.04, 101.17 ft Rt. of I-70 CL | *Date Drilled:* 7/14/2008 to 7/16/2008

WATER OBSERVATIONS:
Water seepage at: 14.0'
Water level at completion: 11.8' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	734.7						Asphalt Concrete - 9.5" Portland Cement Concrete - 11" Aggregate Base - 4"								
2.0	732.7	16 22 27	13	1			Dense to very dense brown GRAVEL WITH SAND (A-1-b), trace to little silt; damp to moist.								
		20 24 25	13	2											
5		12 15 23	14	3					17	43	---	23	--17--		NP ●
		14 24 38	14	4					22	44	---	21	--12--		NP ● 63
		16 23 25	14	5					32	36	---	20	--12--		NP ●
10		19 32 34	15	6					36	34	---	17	--13--		NP ● 67
11.0	723.7	10 25 26	15	7			Very dense brown COARSE AND FINE SAND (A-3a), little silt, trace gravel; moist.		1	41	---	44	--14--		NP ● 52
		17 29 31	16	8			Dense to very dense brown GRAVEL WITH SAND (A-1-b), little silt; moist to wet.								61
15		4 22 27	14	9			@ 14.0', becomes wet.								
		6 18 21	15	10											
		9 20 21	13	11											
		28 32 50/5	14	12					37	31	---	16	--16--		NP ● 50+
20															
		17 30 35	12	13											66
		18 28 29	13	14											
25	709.7														58

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-036 | *Location:* Sta. 755+56.04, 101.17 ft Rt. of I-70 CL | *Date Drilled:* 7/14/2008 to 7/16/2008

WATER OBSERVATIONS:
Water seepage at: 14.0'
Water level at completion: 11.8' (includes drilling water)
FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	709.7														
		19 32 33	18	15			Very dense brown COARSE AND FINE SAND (A-3a), little silt, trace to little gravel; wet.								66
28.5	706.2														
30		14 30 41	14	16		2.5	Stiff to very stiff gray SANDY SILT (A-4a), some to "and" fine to coarse sand, trace to little gravel; moist. @ 29.0'-29.5', sandy silt seam.		5	12	---	38	42	3	NP ● 72
35		24 42 50/5	14	17		--	@ 33.5'-34.9', contains sand seams.		10	23	---	25	35	7	NP ● 50+
40		29 50/4	10	18		1.0	@ 39.0'-39.3', silt seam.								50+
42.0	692.7														
45		17 49 39	14	19			Very dense gray GRAVEL WITH SAND (A-1-b), trace to little silt; wet. @ 45.0'-55.0', difficult drilling.		43	33	---	14	--10--		NP ● 90
50	684.7	23 42 50/5	12	20			@ 48.5', 2.3 feet sand heave.								50+

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-036 | Location: Sta. 755+56.04, 101.17 ft Rt. of I-70 CL | Date Drilled: 7/14/2008 to 7/16/2008

WATER OBSERVATIONS:
Water seepage at: 14.0'
Water level at completion: 11.8' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	684.7						Very dense gray GRAVEL WITH SAND (A-1-b), trace to little silt; wet.								
55		45 50/4	9	21			@ 53.5'-54.3', contains silty clay seams.								50+
60		19 35 45	12	22					30	38	---	21	--10--		NP ● 82
65		33 50/5	11	23			@ 63.5', 1.9 feet sand heave. @ 63.5'-64.4', brown.								50+
70		20 39 50/5	13	24											50+
75	659.7	35 46 50/6	13	25											50+

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-036 | *Location:* Sta. 755+56.04, 101.17 ft Rt. of I-70 CL | *Date Drilled:* 7/14/2008 to 7/16/2008

WATER OBSERVATIONS:
Water seepage at: 14.0'
Water level at completion: 11.8' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	659.7						Very dense gray GRAVEL WITH SAND (A-1-b), trace to little silt; wet.								
		49 50/3	8	26			@ 78.5', 0.9 feet sand heave.								50+
80															
		28 46 48	11	27					42	35	---	11	--12--		INP ● 96
85															
		50/1	0	28			@ 88.5'-93.5', encountered boulders.								50+
90															
93.5	641.2														
		27 50/3	8	29			Severely weathered gray SHALE.								50+
94.9	639.8														
96.6	638.1	Core 68"	Rec 68"	RQD 93%	R1		Shale, blue-gray, highly weathered, very weak to weak, laminated, friable, fissile, pyritic, jointed, moderately fractured to fractured, tight, slightly rough, RQD 100%, Loss 0%. Contains dark gray, well cemented shale zones [thin, dark bands]. Dark shale zones are typically 1-2 inches thick, spaced at intervals of 12 to 18 inches.								
100	634.7						Interbedded Shale (90%) and Limestone (10%)								

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-036 | Location: Sta. 755+56.04, 101.17 ft Rt. of I-70 CL | Date Drilled: 7/14/2008 to 7/16/2008

WATER OBSERVATIONS:
Water seepage at: 14.0'
Water level at completion: 11.8' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	634.7													
105		Core 60"	Rec 60"	RQD 83%	R2		Interbedded Shale (90%) and Limestone (10%) RQD 74% Loss 0%; Shale, dark gray, highly weathered, weak, laminated, friable, fissile, pyritic, jointed, moderately fractured to fractured, tight, slightly rough; Limestone, gray, moderately weathered, strong, thinly bedded, pyritic, slightly rough. @ 103.7' - 104.2', qu = 1442 psi							
110		Core 60"	Rec 60"	RQD 60%	R3									
115		Core 60"	Rec 60"	RQD 68%	R4									
115.6	619.1						Bottom of Boring - 115.6'							
120														
125														

GRADATION

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40

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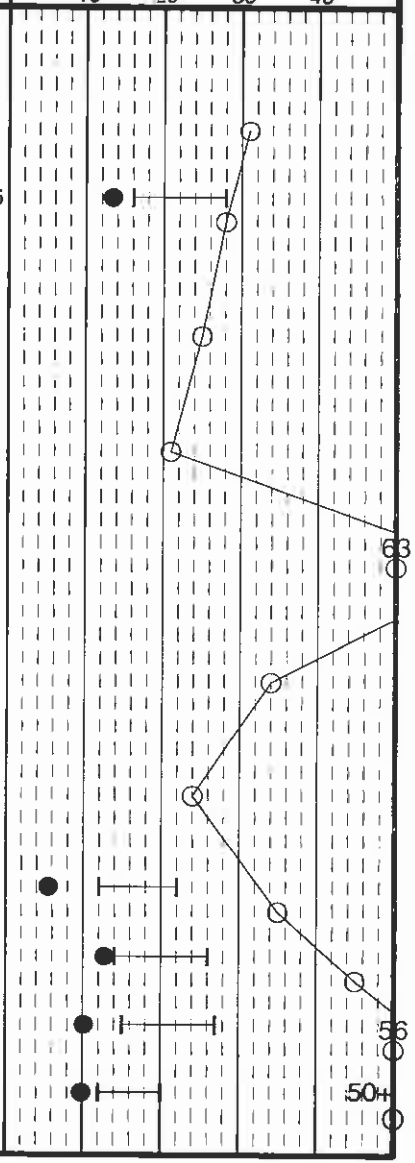
Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-037 | *Location:* Sta. 756+80.53, 69.18 ft Lt. of I-70 CL | *Date Drilled:* 7/21/2008 to 7/24/2008

WATER OBSERVATIONS:
Water seepage at: 21.0', 25.4', 33.0', 40.5'
Water level at completion: 25.6' (prior to coring)
51.6' (includes drilling water)
FIELD NOTES: Advanced boring using 3.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	749.1													
1.8	747.3	5 13 16	0	1		--	Asphalt Concrete - 6.5" Portland Cement Concrete - 9.5" Aggregate Base - 5"							
5		9 13 14	5	2		1.75	Stiff brown and gray SANDY SILT (A-4a), some fine to coarse sand, some gravel; increased moisture content due to pavement coring; moist to wet.		29	15	---	17	24	15
		6 10 14	1	3		--								
8.5	740.6													
10		3 8 12	2	4		--	Very stiff gray SILT AND CLAY (A-6a), little to some fine to coarse sand, little gravel; damp to moist.							
		4 35 25	18	5		3.75								
13.5	735.6													
15		10 16 16	2	6		4.25	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.							
		10 11 12	1	7		--								
20.0	729.1	7 12 21	18	8		4.5+			8	11	---	22	40	19
		10 21 22	5	9		0.75	Hard gray SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; damp.		18	14	---	20	32	16
23.0	726.1	12 24 29	18	10		4.5+	@ 20.0'-21.5', stiff, wet; possible sand and gravel seam.		13	12	---	21	36	18
		19 48 50/5	2	11		4.5+	Hard gray SANDY SILT (A-4a), trace to little gravel; contains sand seams; damp.		10	15	---	28	32	15
25	724.1	16												

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



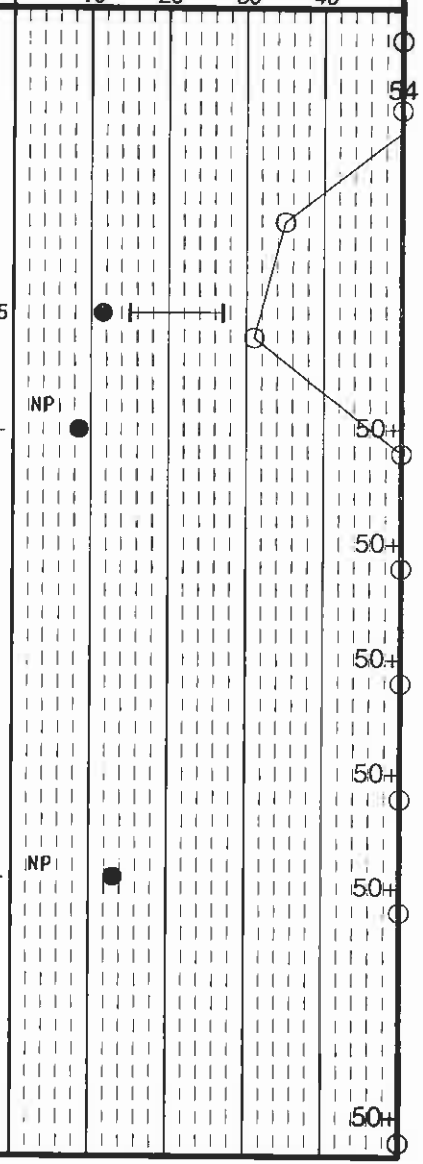
DLZ Ohio, Inc. * 6121 Huntley Road, Co ous, Ohio 43229 * (614) 888-0040

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-037 | *Location:* Sta. 756+80.53, 69.18 ft Lt. of I-70 CL | *Date Drilled:* 7/21/2008 to 7/24/2008

WATER OBSERVATIONS:
Water seepage at: 21.0', 25.4', 33.0', 40.5'
Water level at completion: 25.6' (prior to coring)
51.6' (includes drilling water)
FIELD NOTES:
Advanced boring using 3.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) / Natural Moisture Content, % - ● / PL ⊢ LL / Blows per foot - ○ / Non-Plastic - NP
25.4	723.7	24 24	18	12A 12B		4.0	Hard gray SANDY SILT (A-4a), trace to little gravel; damp.								
		16 24 27	1	13			Very dense gray COARSE AND FINE SAND (A-3a), some silt, little gravel; wet.								
28.5	720.6														
30		14 16 17	18	14		2.5	Very stiff gray SILT AND CLAY (A-6a), some fine to coarse sand, trace to little gravel; damp.								
		5 12 17	18	15		4.0			6	10	---	18	41	25	
33.5	715.6														
35		19 45 50/5	12	16			Very dense gray GRAVEL WITH SAND (A-1-b), little silt; wet.		36	36	---	12	--15--		NP
		16 50/5	5	17			@ 36.0'-36.9', contains cobble fragments.								
38.5	710.6														
40		42 50/3	5	18		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.								
41.0	708.1														
		31 50/4	10	19			Very dense gray COARSE AND FINE SAND (A-3a), trace to little silt; wet.								
		42 50/5	10	20					0	8	---	75	--17--		NP
45															
		50/3	3	21			@ 48.5'-48.8', possible cobbles.								
50	699.1														



DLZ Ohio, Inc. * 6121 Huntley Road, Co ...us, Ohio 43229 * (614) 888-0040

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-037 | *Location:* Sta. 756+80.53, 69.18 ft Lt. of I-70 CL | *Date Drilled:* 7/21/2008 to 7/24/2008

WATER OBSERVATIONS:
Water seepage at: 21.0', 25.4', 33.0', 40.5'
Water level at completion: 25.6' (prior to coring)
51.6' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	699.1														
		29 50/5	11	22		4.5+	Hard gray SILT (A-4b), little fine to coarse sand, trace gravel; damp.		3	3	---	10	63	21	50+
55															
57.0	692.1														
		25 50/3	3	23			Very dense gray GRAVEL WITH SAND (A-1-b), some fine to coarse sand, trace silt; wet. @ 59.0'-75.0', encountered cobbles and boulders.								50+
60															
62.0	687.1														
		45 50/5	4	24			Very dense gray COARSE AND FINE SAND (A-3a), little to some silt, little gravel; wet.		17	24	---	39	--20--		NP 50+
65															
		50/3	3	25											50+
70															
		50/4	1	26			@ 73.5'-73.8', drove sampler on gravel; poor recovery.								50+
75	674.1														

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-037 | Location: Sta. 756+80.53, 69.18 ft Lt. of I-70 CL | Date Drilled: 7/21/2008 to 7/24/2008

WATER OBSERVATIONS:
Water seepage at: 21.0', 25.4', 33.0', 40.5'
Water level at completion: 25.6' (prior to coring)
51.6' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	674.1														
80		47 50/4	5	27			Very dense gray COARSE AND FINE SAND (A-3a), little gravel, trace silt; wet.								50+
85		50/4	1	28			@ 75.0'-100.0', difficult advancement of casing due to gravel and boulders.								50+
90		27 50/5	5	29											50+
92.0	657.1														
95		14 14 34	3	30			Very dense gray GRAVEL (A-1-a); wet.								○
100	649.1	50/4	1	31											50+

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-037 | *Location:* Sta. 756+80.53, 69.18 ft Lt. of I-70 CL | *Date Drilled:* 7/21/2008 to 7/24/2008

WATER OBSERVATIONS:
Water seepage at: 21.0', 25.4', 33.0', 40.5'
Water level at completion: 25.6' (prior to coring), 51.6' (includes drilling water)
FIELD NOTES:
Advanced boring using 3.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	649.1						Very stiff to hard gray SILTY CLAY (A-6b), trace fine to coarse sand; moist.							
105		23 32 35	18	32		2.75			0	1	---	3	49	47
108.5	640.6													
		50/5	5	33		4.5+	Severely weathered gray SHALE.							
110.0 110	639.1													
		Core 60"	Rec 60"	RQD 60%	R1		Interbedded Shale (92%) and Limestone (8%) RQD 76% LOSS 0%; Shale, dark gray, highly weathered, weak, laminated, calcareous, moderately fractured to fractured; Limestone, light gray, moderately weathered, moderately strong to strong, thinly bedded.							
115														
		Core 60"	Rec 60"	RQD 83%	R2		@ 110.8'-111.2', 111.7'-111.8', 113.2'-113.5', 119.6'-120.0', 122.9'-123.0', high angle fractures.							
120														
		Core 60"	Rec 60"	RQD 77%	R3		@ 121.2' - 121.7', qu = 1546 psi @ 122.1'-125.4', highly to severely weathered.							
125	624.1													

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40
70
50+

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-037 | *Location:* Sta. 756+80.53, 69.18 ft Lt. of I-70 CL | *Date Drilled:* 7/21/2008 to 7/24/2008

WATER OBSERVATIONS:
Water seepage at: 21.0', 25.4', 33.0', 40.5'
Water level at completion: 25.6' (prior to coring)
51.6' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	624.1														
		Core 60"	Rec 60"	RQD 82%	R4		Interbedded Shale (92%) and Limestone (8%) RQD 76% LOSS 0%; Shale, dark gray, highly weathered, weak, laminated, calcareous, moderately fractured to fractured; Limestone, light gray, moderately weathered, moderately strong to strong, thinly bedded. @ 125.9'-126.0', high angle fracture.								
130.0 130	619.1						Bottom of Boring - 130.0'								
135															
140															
145															
150															

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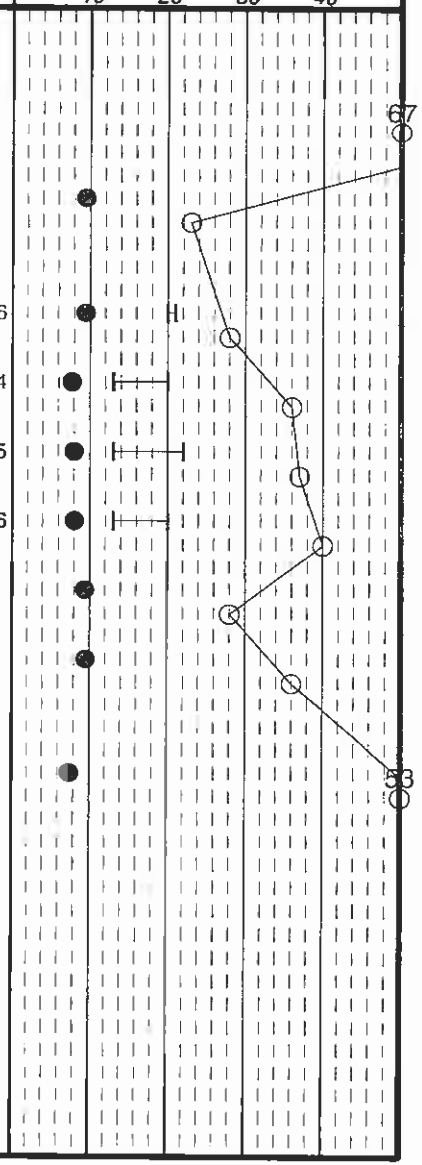
Client: ms consultants	*Project:* FRA-70-8.93	*Job No.* 0221-1004.01
LOG OF: Boring B-039	*Location:* Sta. 760+57.45, 102.65 ft Rt. of I-70 CL	*Date Drilled:* 7/17/2008

WATER OBSERVATIONS:
Water seepage at: None
Water level at completion: None
FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft) 739.5	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
							Asphalt Concrete - 8"							
1.8	737.7						Portland Cement Concrete - 8"							
							Aggregate Base - 5"							
		7												
		36		1A		4.5+								
		30	13	1B		4.5+	Hard gray SANDY SILT (A-4a), little gravel, trace clay; damp.							
		9					@ 1.8'-3.0', contains concrete fragments.							
		11		2		4.5+								
5		12	17											
		3												
		12		3		4.5	@ 7.1', encountered 1-inch thick sand seam.		20	15	---	19	30	16
		15	15											
		11												
		16		4		4.5+			17	15	---	25	28	14
		19	18											
		8												
10		14		5		4.5+			14	15	---	25	31	15
		22	18											
		12												
		18		6		4.5+			14	16	---	25	28	16
12.0	727.5	21	18											
		7					Medium dense gray COARSE AND FINE SAND (A-3a), some silt, trace gravel; moist.							
		12		7A										
13.5	726.0	15	13	7B										
		22					Hard gray SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.							
		16		8		4.5+								
15		19	15											
		7												
		19		9		4.5+								
17.5	722.0	33	16											
							Bottom of Boring - 17.5'							
20														
25														

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢—⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-041 | *Location:* Sta. 762+58.90, 115.94 ft Lt. of I-70 CL | *Date Drilled:* 6/23/2008 to 6/25/2008

WATER OBSERVATIONS:
Water seepage at: 13.0'-15.5', 52.0'-92.0'
Water level at completion: 37.1' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) / Natural Moisture Content, % - ● / PL ⊢ LL / Blows per foot - ○ / Non-Plastic - NP
	759.7														10 20 30 40
1.5	758.2						Asphalt Concrete Pavement - 8" Aggregate Base - 5"								
		10 8 4	6	1			Medium dense brown GRAVEL (A-1-a), trace to little fine to coarse sand, trace to little silty clay; damp to moist.		71	11	---	7	--11--		NP
4.5	755.2	1 4 14	2	2			@ 3.2', encountered large rock fragments.		98	1	---	1	--0--		NP
5		5 7 8	18	3		3.0	Very stiff to hard brown SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.		13	14	---	16	31	26	
		5 6 9	14	4		3.0									
10		4 11 15	13	5		4.5+	@ 8.5', becomes gray.								
		7 12 15	18	6		4.5+			12	11	---	20	37	20	
13.0	746.7														
15		17 38 31	18	7			Very dense brown and gray GRAVEL WITH SAND (A-1-b), some silt; wet.		21	32	---	23	--23--		NP
15.5	744.2						Hard gray SANDY SILT (A-4a), little gravel; damp to moist.								
		7 10 16	18	8		4.5+									
20		8 12 20	18	9		4.5+			12	13	---	22	33	20	
		9 15 23	18	10		4.5+									
25	734.7	8 25 34	6	11		4.5+									

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Client: ms consultants	Project: FRA-70-8.93	Job No. 0221-1004.01
LOG OF: Boring B-041	Location: Sta. 762+58.90, 115.94 ft Lt. of I-70 CL	Date Drilled: 6/23/2008 to 6/25/2008

WATER OBSERVATIONS:
Water seepage at: 13.0'-15.5', 52.0'-92.0'
Water level at completion: 37.1' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	734.7						Hard gray SANDY SILT (A-4a), little gravel; damp to moist.								
		7 23 34	18	12		4.5+									○ 60
30		15 34 42	18	13		4.5+									○ 80
35		10 22 30	18	14		4.5+			12	14	---	19	36	19	● ⊢—⊣ ○ 55
40		12 30 42	18	15		4.5+									○ 76
45		15 45 31	10	16		4.5+									○ 80
50	709.7	12 28 41	18	17		4.5+									○ 78

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-041 | *Location:* Sta. 762+58.90, 115.94 ft Lt. of I-70 CL | *Date Drilled:* 6/23/2008 to 6/25/2008

WATER OBSERVATIONS:
Water seepage at: 13.0'-15.5', 52.0'-92.0'
Water level at completion: 37.1' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	709.7														
52.0	707.7						Hard gray SANDY SILT (A-4a), little gravel; damp to moist.								
55		18 30 49	18	18			Very dense brown and gray GRAVEL WITH SAND (A-1-b), little gravel, trace to little silty clay; wet. @ 52.0'-58.5', cobbles and boulders.		38	30	---	21	--11--		NP; 83
60		50/5	5	19											50+
65		6 30 38	18	20											72
67.0	692.7														
70		11 18 40	8	21			Very dense black, brown, and gray GRAVEL (A-1-a), little fine to coarse sand, trace silty clay; wet.		78	13	---	5	--4--		NP; 61
75	684.7	48 50/4	7	22											50+

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-041 | *Location:* Sta. 762+58.90, 115.94 ft Lt. of I-70 CL | *Date Drilled:* 6/23/2008 to 6/25/2008

WATER OBSERVATIONS:
Water seepage at: 13.0'-15.5', 52.0'-92.0'
Water level at completion: 37.1' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	684.7														
77.0	682.7						Very dense black, brown, and gray GRAVEL (A-1-a), little fine to coarse sand, trace silty clay; wet.								
		6 18 33	4	23			Very dense brown and gray GRAVEL WITH SAND AND SILT (A-2-4); wet.								54
80															
82.0	677.7														
		50/5	3	24			Very dense gray COARSE AND FINE SAND (A-3a), some silty clay, trace gravel; possible cobbles; wet.								50+
85															
		37 50/5	11	25					5	17	---	44	--34--		NP 50+
90															
92.0	667.7														
		50/5	5	26			Very dense brownish gray SANDY SILT (A-4a), trace gravel; damp.								50+
95															
		33 50/5	11	27					9	8	---	21	42	20	NP 50+
100	659.7														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-041 | *Location:* Sta. 762+58.90, 115.94 ft Lt. of I-70 CL | *Date Drilled:* 6/23/2008 to 6/25/2008

WATER OBSERVATIONS:
Water seepage at: 13.0'-15.5', 52.0'-92.0'
Water level at completion: 37.1' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) / Natural Moisture Content, % - ● / PL ⊢ LL / Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	659.7														
		40 50/5	5	28			Very dense brownish gray SANDY SILT (A-4a), some gravel; damp.								50+
105															
		50/5	5	29					21	17	---	21	27	14	NP ● 50+
110															
112.0	647.7														
		17 27 34	3	30			Stiff to very stiff brown and gray SILTY CLAY (A-6b), trace fine to coarse sand, trace gravel; moist.		2	3	---	2	55	38	● 64
115.0 115	644.7														
		Core 60"	Rec 60"	RQD 80%	R1		Shale, blue-gray, weak, highly weathered, thinly laminated, slightly calcareous, jointed, moderately to highly fractured, tight, with typical narrow fractures, slightly rough; RQD 42%, Loss 0%. Contains dark gray, well cemented shale zones [thin, dark bands]. Dark shale zones are typically 1-2 inches thick, spaced at intervals of 12 to 18 inches.								
120															
		Core 60"	Rec 60"	RQD 25%	R2										
125	634.7														

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-041 | *Location:* Sta. 762+58.90, 115.94 ft Lt. of I-70 CL | *Date Drilled:* 6/23/2008 to 6/25/2008

WATER OBSERVATIONS:
Water seepage at: 13.0'-15.5', 52.0'-92.0'
Water level at completion: 37.1' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.0" diameter flush joint casing.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	634.7														
127.5	632.2						Shale, blue-gray, weak, highly weathered, thinly laminated, slightly calcareous, jointed, moderately to highly fractured, tight, with typical narrow fractures, slightly rough; RQD 42%, Loss 0%. Contains dark gray, well cemented shale zones [thin, dark bands]. Dark shale zones are typically 1-2 inches thick, spaced at intervals of 12 to 18 inches.									
130		Core 120"	Rec 120"	RQD 58%	R3		Interbedded Shale [93%] and Limestone [7%], RQD 78%, Loss 0%; Shale, dark gray, weak, highly weathered, thinly laminated, calcareous, jointed, highly fractured with typical, tight, slightly rough shear fractures; Limestone, light gray, strong, slightly weathered, pyritic, unfractured. @ 133.5' - 134.0', qu = 1695 psi									
135.0 135	624.7						Bottom of Boring - 135.0'								
140															
145															
150															

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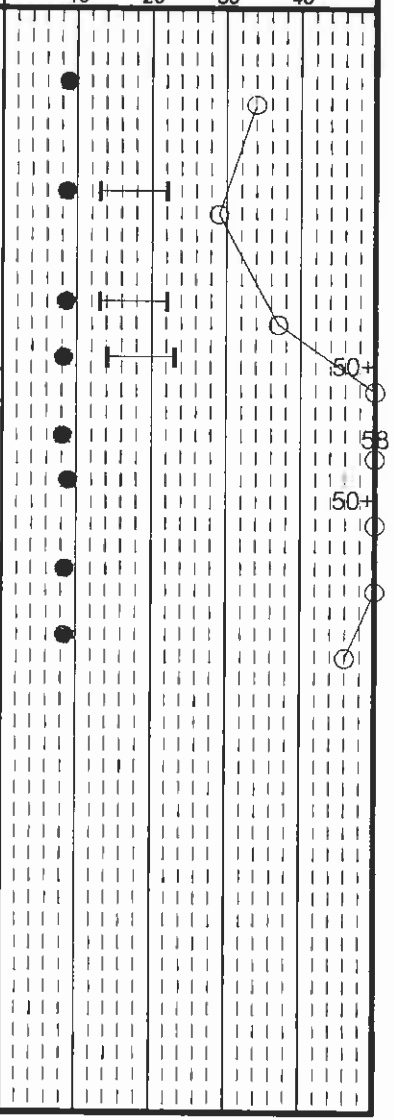
Client: ms consultants	Project: FRA-70-8.93	Job No. 0221-1004.01
LOG OF: Boring B-042	Location: Sta. 764+57.07, 41.06 ft Lt. of I-70 CL	Date Drilled: 7/21/2008

WATER OBSERVATIONS:
Water seepage at: None
Water level at completion: None

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0.2	741.5						Topsoil - 2"							
		6 14 18	18	1		4.5+	Hard gray SANDY SILT (A-4a), some to "and" fine to coarse sand, little clay, trace gravel; damp.							
		6 11 17	18	2		4.5+			8	14	—	24	35	19
5		6 14 21	18	3		4.5+			8	14	—	20	36	22
		19 50/5	11	4		4.5+			8	15	--	20	36	21
		14 28 27	18	5		4.5+								
10		50/5	3	6		4.5+								
		9 20 28	18	7		4.5+								
		12 20 24	18	8		4.5+								
15.0	726.7						Bottom of Boring - 15.0'							
20														
25														

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

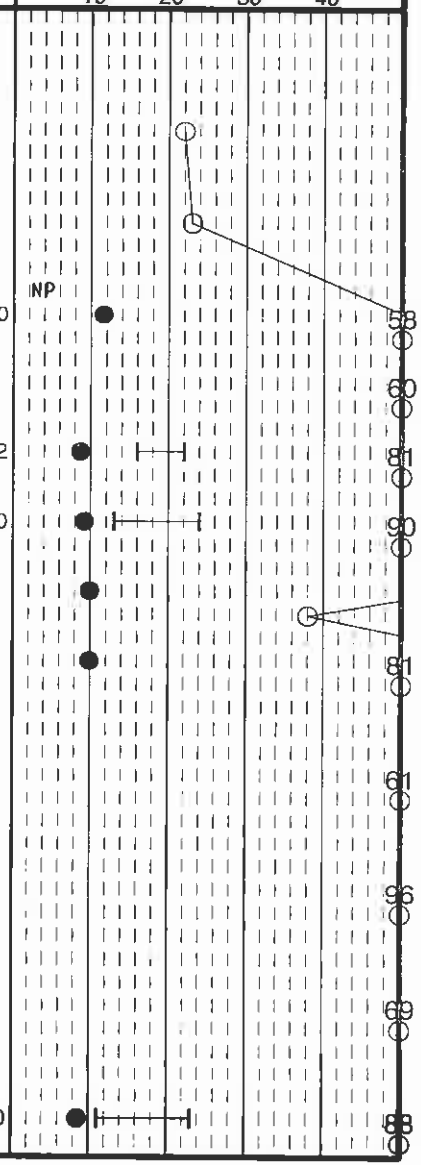
LOG OF: Boring B-043 | *Location:* Sta. 765+56.96, 96.30 ft Rt. of I-70 CL | *Date Drilled:* 7/16/2008 to 7/20/2008

WATER OBSERVATIONS:
Water seepage at: 37.0', 77.0'
Water level at completion: 14.4' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	743.1													
1.9	741.2	3					Asphalt Concrete - 9" Portland Cement Concrete - 9" Aggregate Base - 5"							
		8 13	13	1			Medium dense brown GRAVEL WITH SAND, SILT, AND CLAY (A-2-6), some silty clay; damp.							
3.5	739.6													
		7 7 15	10	2		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.							
5														
6.0	737.1													
		7 25 30	18	3			Very dense grayish brown SANDY SILT (A-4a), some fine to coarse sand, trace gravel; moist.		13	13	---	26	38	10
		7 12 45	1	4			@ 7.5'-9.0', rock blocking sampler.							
9.0	734.1													
10		10 31 46	18	5		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.		9	13	---	19	37	22
10.5	732.6													
		12 40 46	18	6		4.5+	Hard gray SILT AND CLAY (A-6a), some to "and" fine to coarse sand, trace to little gravel; damp.		7	21	---	19	33	20
		7 12 24	18	7		4.5+								
		12 28 49	10	8		4.5+	@ 13.5'-15.0', contains sand seams.							
15														
		7 19 39	18	9		4.5+								
		39 49 42	18	10		4.5+								
20														
		12 24 42	18	11		4.5+								
		17 42 42	18	12		4.5+			17	12	---	18	33	20
25	718.1													

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40



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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-043 | Location: Sta. 765+56.96, 96.30 ft Rt. of I-70 CL | Date Drilled: 7/16/2008 to 7/20/2008

WATER OBSERVATIONS:
Water seepage at: 37.0', 77.0'
Water level at completion: 14.4' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	718.1														
		20 42 50/5	17	13		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.								50+ ○
		24 34 45	18	14		4.5+									83 ○
30															
		11 30 40	18	15		4.5+									74 ○
35															
		13 28 45	10	16		--	@ 38.5', becomes wet.								77 ○
40															
42.0	701.1						Very dense gray GRAVEL WITH SAND (A-1-b), trace silt; wet.								
		17 34 38	18	17					22	42	---	27	--9--		NP ● 76 ○
45															
		13 31 39	18	18											74 ○
50	693.1														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-043 | *Location:* Sta. 765+56.96, 96.30 ft Rt. of I-70 CL | *Date Drilled:* 7/16/2008 to 7/20/2008

WATER OBSERVATIONS:
Water seepage at: 37.0', 77.0'
Water level at completion: 14.4' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) / Natural Moisture Content, % - ● / PL — LL / Blows per foot - ○ / Non-Plastic - NP
	693.1						Dense gray GRAVEL (A-1-a), some fine to coarse sand, trace silt; wet. (GEOLOGIST'S DESCRIPTION - sample lost)								
55		12 12 21	18	19			@ 50.0'-60.0', difficult drilling, possible boulders. @ 55.0'-60.0', encountered gas pockets.								
57.0	686.1														
							Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp.								
60		35 43 50/5	8	20		4.5+									50+
		50/1	1	21		--	@ 63.5', rock blocking sampler.								
65															50+
							@ 63.5'-70.0', possible cobbles.								
70		14 33 36	4	22		4.5+			17	19	---	26	28	10	NP ● 73
75	668.1	17 23 28	18	23		4.5									54

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-043 | *Location:* Sta. 765+56.96, 96.30 ft Rt. of I-70 CL | *Date Drilled:* 7/16/2008 to 7/20/2008

WATER OBSERVATIONS:
Water seepage at: 37.0', 77.0'
Water level at completion: 14.4' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	668.1						Very dense gray FINE SAND (A-3), trace gravel; wet.								
80		13 28 50/5	17	24			@ 78.5', 2.0 feet sand heave.								50+ ○
82.0	661.1														
							Very dense gray GRAVEL WITH SAND (A-1-b), some fine to coarse sand, little silt; wet.								
85		40 42 42	18	25											88 ○
		34 42 48	10	26											95 ○
90															
93.5	649.6	50/5	3	27			Severely weathered gray SHALE.								
95.0	95 648.1														50+ ○
		Core 60"	Rec 60"	RQD 85%	R1		Shale, blue-gray, weak, highly weathered, thinly laminated, slightly calcareous, pyritic, jointed, moderately to fractured, tight, slightly rough; RQD 88%, Loss 0%. Contains dark gray, well cemented shale zones [thin, dark bands]. Dark shale zones are typically 1-2 inches thick, spaced at intervals of 12 to 18 inches.								
100	643.1														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-043 | *Location:* Sta. 765+56.96, 96.30 ft Rt. of I-70 CL | *Date Drilled:* 7/16/2008 to 7/20/2008

WATER OBSERVATIONS:
Water seepage at: 37.0', 77.0'
Water level at completion: 14.4' (includes drilling water)

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	643.1														
		Core 60"	Rec 60"	RQD 82%	R2		Shale, blue-gray, weak, highly weathered, thinly laminated, slightly calcareous, pyritic, jointed, moderately to fractured, tight, slightly rough; RQD 88%, Loss 0%. Contains dark gray, well cemented shale zones [thin, dark bands]. Dark shale zones are typically 1-2 inches thick, spaced at intervals of 12 to 18 inches.									
105							@ 104.3' - 104.7', qu = 1612 psi								
		Core 60"	Rec 60"	RQD 97%	R3										
110.3 110	632.8														
		Core 60"	Rec 60"	RQD 87%	R4		Shale, dark gray, moderately to highly weathered, weak, thinly laminated, fissile, friable, pyritic, calcareous, jointed, fractured to moderately fractured, tight, slightly rough; RQD 87%, Loss 0%.								
115.0 115	628.1														
							Bottom of Boring - 115.0'								
120															
125															

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-044 | *Location:* Sta. 767+54.82, 120.59 ft Lt. of I-70 CL | *Date Drilled:* 6/16/2008 to 6/19/2008

WATER OBSERVATIONS:
Water seepage at: 13.5'-14.2', 23.5'-25.0'
Water level at completion: 19.1' (beginning of shift, 9/17/08) 20.8' (includes drilling water)
FIELD NOTES: Advanced boring using 4.25" diameter hollowstem augers to 47.0'; 4.0" casing from 47.0' to 115.5'.

Depth (ft)	Elev. (ft) 764.6	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ / Non-Plastic - NP
1.3	763.3	10 9 7	8	1		--	Asphalt Concrete Pavement - 2" Portland Cement Concrete - 4" Aggregate Base - 10"								
3.5	761.1	9 8 5	8	2		--	POSSIBLE FILL: Stiff to very stiff brown SILTY CLAY (A-6b), little to some fine to coarse sand, trace gravel; moist.		2	7	---	16	33	42	
5.5	759.1	4 5 11	18	3		2.5	POSSIBLE FILL: Very stiff mottled olive-brown and gray CLAY (A-7-6), little fine to coarse sand, trace gravel; moist.		2	5	---	10	43	40	
11.0	753.6	5 8 12	18	4		4.0	Very stiff brown SANDY SILT (A-4a), trace gravel, some clay; damp.		8	8	---	13	40	31	
		7 15 16	18	5		2.0	@ 11.0'-16.0', encountered very difficult drilling, dense till, possible cobbles. Recovered rock fragments in split spoon.		1	5	---	10	83	--	
13.0	751.6	12 13 21	17	6			Dense brown GRAVEL WITH SAND AND SILT (A-2-4); damp.		44	15	---	9	24	8	
14.0	750.6	18 50/2	8	7A		--	Stiff gray SILT AND CLAY (A-6a), some fine to coarse sand, little to some gravel; damp to moist.		21	14	---	18	28	19	INP 50+
15.0	749.6			7B			Very dense brown GRAVEL (A-1-a), little silty clay; moist to wet. @ 14.2', refusal of splitspoon.								
18.0	746.6	21 20 20	16	8		4.0	Very stiff to hard gray SANDY SILT (A-4a), little to some clay, trace to little gravel; damp.		10	11	---	20	38	21	
		9 14 18	16	9		3.5	Very stiff to hard gray SILT AND CLAY (A-6a), little to some clay, little gravel; damp to moist.		13	11	---	20	36	20	
		14 17 19	18	10		2.75	@ 20.5', moist to wet.								
25	739.6	17 28 35	18	11		--									

Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-044 | *Location:* Sta. 767+54.82, 120.59 ft Lt. of I-70 CL | *Date Drilled:* 6/16/2008 to 6/19/2008

WATER OBSERVATIONS:
Water seepage at: 13.5'-14.2', 23.5'-25.0'
Water level at completion: 19.1' (beginning of shift, 9/17/08) 20.8' (includes drilling water)

FIELD NOTES: *Advanced boring using 4.25" diameter hollowstem augers to 47.0'; 4.0" casing from 47.0' to 115.5'.*

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) / Natural Moisture Content, % - ● / PL ⊢ LL / Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	739.6														
		12 20 24	17	12		3.0	Very stiff to hard gray SILT AND CLAY (A-6a), little to some clay, little gravel; damp. @ 26.0', contains few thin (less than 1") fine to medium grained sand seams.							
28.0	736.6														
30		13 15 25	18	13		4.0	Very stiff to hard gray SANDY SILT (A-4a), little to some clay, little gravel; damp.		18	12	---	20	27	23	
35		35 34 32	4	14		--	@ 33.9', encountered possible cobble or boulder.								69
							@36.0', pulled augers to change lead. Lead auger bit destroyed. Could not advance further with 500-600 psi down pressure. Changed tools to drill with casing.								
39.6	725.0	14 37 48	18	15A		3.5									
40				15B		--	Very dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace gravel; wet.								89
42.0	722.6														
45		21 42 50/5	17	16		4.5+	Hard gray SANDY SILT (A-4a), "and" fine to coarse sand, trace gravel; damp.		8	13	---	21	35	23	NP 50+
47.0	717.6														
							Very dense gray GRAVEL WITH SAND (A-1-b), some silty clay; wet.								
50	714.6	10 20 42	6	17					46	20	---	12	--23--		66

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-044 | *Location:* Sta. 767+54.82, 120.59 ft Lt. of I-70 CL | *Date Drilled:* 6/16/2008 to 6/19/2008

WATER OBSERVATIONS:
Water seepage at: 13.5'-14.2', 23.5'-25.0'
Water level at completion: 19.1' (beginning of shift, 9/17/08) 20.8' (includes drilling water)
FIELD NOTES: Advanced boring using 4.25" diameter hollowstem augers to 47.0'; 4.0" casing from 47.0' to 115.5'.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	714.6														
52.0	712.6						Very dense gray GRAVEL WITH SAND (A-1-b), some silty clay; wet.								
							Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace to little gravel; damp.								
55		14 42 43	6	18		4.5+									○ 89
60		20 35 38	18	19		4.5+			10	12	---	22	32	24	● ⊢ ○ 77
							@ 62.0 to 67.0', very stiff.								
65		14 22 31	18	20		2.5									● ○ 56
70		15 26 42	18	21		4.5+									● ○ 72
75	689.6	22 26 34	18	22		4.5+									● ○ 63

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-044 | Location: Sta. 767+54.82, 120.59 ft Lt. of I-70 CL | Date Drilled: 6/16/2008 to 6/19/2008

WATER OBSERVATIONS:
Water seepage at: 13.5'-14.2', 23.5'-25.0'
Water level at completion: 19.1' (beginning of shift, 9/17/08)
20.8' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.25" diameter hollowstem augers to 47.0'; 4.0" casing from 47.0' to 115.5'.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP (10 20 30 40)
	689.6														
80		19 33 42	18	23		4.5+	Hard gray SANDY SILT (A-4a), some fine to coarse sand, trace to little gravel; damp.		7	11	---	20	40	22	79
85		10 29 38	3	24		--	@ 84.0'-90.0', encountered possible cobbles.								70
87.0	677.6														
90		19 38 48	4	25			Very dense gray GRAVEL (A-1-a), some fine to coarse sand, little silty clay; wet.		67	13	---	8	--12--		NP 90
92.0	672.6														
95		10 13 23	18	26		3.25	Very stiff gray SILT AND CLAY (A-6a); moist.		0	0	---	0	53	47	
97.0	667.6														
100	664.6	15 20 42	18	27		4.5+	Hard gray SANDY SILT (A-4a), trace fine to coarse sand, trace gravel; moist.								65

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-044 | Location: Sta. 767+54.82, 120.59 ft Lt. of I-70 CL | Date Drilled: 6/16/2008 to 6/19/2008

WATER OBSERVATIONS:
Water seepage at: 13.5'-14.2', 23.5'-25.0'
Water level at completion: 19.1' (beginning of shift, 9/17/08) 20.8' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.25" diameter hollowstem augers to 47.0'; 4.0" casing from 47.0' to 115.5'.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) / Natural Moisture Content, % - ● (PL — LL; Blows per foot - ○ / Non-Plastic - NP; 10 20 30 40)
	664.6														
105		13 14 14	18	28		2.5	Hard gray SILT (A-4b), trace fine to coarse sand, trace gravel; moist. @ 102', very stiff, grayish brown.	+ +	2	1	---	6	59	32	●—○
107.0	657.6														
110.0 110	654.6	42 50/3	9	29		4.5+	Hard brown and gray CLAY (A-7-6), varved; damp.								50+
111.5	653.1	20 37 50/3		30			Shale, grayish brown, very weak, severely weathered, thinly laminated.								50+
114.9 115	649.7	Core 60"	Rec 60"	RQD 73%	R1		Shale [90%] interbedded and Siltstone [10%], RQD 76%, Loss 0%; Shale, blue-gray, very weak to weak, severely weathered, laminated, slightly calcareous, jointed, moderately fractured, tight, slightly rough, typical clay-filled fractures; Siltstone, gray to dark gray, strong, slightly weathered, laminated, argillaceous. @ 112.0', high angle fracture, clay filled with fine and coarse grained sand.								
120		Core 60"	Rec 60"	RQD 77%	R2		Shale, blue-gray, weak, moderately to highly weathered, laminated, slightly calcareous, jointed, slightly fractured, tight, slightly rough, clay filled fractures; RQD 77%, Loss 0%. Contains dark gray, well cemented shale zones [thin, dark bands]. Dark shale zones are typically 1-2 inches thick, spaced at intervals of 12 to 18 inches. @ 114.4', 115.3', 116.7', 118.4', and 119.4', high angle fractures. @ 117.6' - 118.0', qu = 1202 psi								
125	639.6														

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Client: ms consultants | *Project:* FRA-70-8.93 | *Job No.* 0221-1004.01

LOG OF: Boring B-044 | *Location:* Sta. 767+54.82, 120.59 ft Lt. of I-70 CL | *Date Drilled:* 6/16/2008 to 6/19/2008

WATER OBSERVATIONS:
Water seepage at: 13.5'-14.2', 23.5'-25.0'
Water level at completion: 19.1' (beginning of shift, 9/17/08) 20.8' (includes drilling water)

FIELD NOTES:
Advanced boring using 4.25" diameter hollowstem augers to 47.0'; 4.0" casing from 47.0' to 115.5'.

Depth (ft)	Elev. (ft) 639.6	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL ⊢ LL Blows per foot - ○ / Non-Plastic - NP 10 20 30 40
		Core 120"	Rec 120"	RQD 79%	R3		Shale, blue-gray, weak, moderately to highly weathered, laminated, slightly calcareous, jointed, slightly fractured, tight, slightly rough, clay filled fractures; RQD 77%, Loss 0%. Contains dark gray, well cemented shale zones [thin, dark bands]. Dark shale zones are typically 1-2 inches thick, spaced at intervals of 12 to 18 inches.							
130															
131.5	633.1						Bottom of Boring - 131.5'								
135															
140															
145															
150															

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Client: ms consultants | Project: FRA-70-8.93 | Job No. 0221-1004.01

LOG OF: Boring B-045 | Location: Sta. 768+75.91, 91.18 ft Rt. of I-70 CL | Date Drilled: 7/17/2008

WATER OBSERVATIONS:
Water seepage at: None
Water level at completion: None

FIELD NOTES:
Advanced boring using 3.25" diameter hollowstem augers.

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	745.8													
1.1	744.7						Asphalt Concrete - 8" Aggregate Base - 5"							
		7 9 9	14	1		4.5+	Hard gray SANDY SILT (A-4a), little clay, trace to little gravel; damp.							
		7 9 9	10	2		4.5+								
5		3 7 11	12	3		4.0	@ 5.6', sand and gravel seam.		12	14	—	22	32	20
		12 15 19	18	4		4.5+			9	24	—	21	30	16
8.0	737.8	13 16 17	18	5		4.5+	Hard gray SILT AND CLAY (A-6a), some to "and" fine to coarse sand, trace gravel; damp. @ 8.0'-9.5', contains sand seams.		7	15	---	20	37	21
10		9 11 16	14	6		4.5+								
		16 27 27	6	7		–								
15.0	730.8	10 24 23	12	8		4.5+								
15							Bottom of Boring - 15.0'							
20														
25														

STANDARD PENETRATION (N60)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○ / Non-Plastic - NP
10 20 30 40