

Geotechnical Evaluation
GB 1 Subgrade Analysis

I-70/I-71 West Interchange
W-07-109

Prepared For:

MS Consultants, Inc.
2221 Schrock Road
Columbus, Ohio 43229

May 2010

**GEOTECHNICAL EVALUATION
GB 1 SUBGRADE ANALYSIS**

**I-70/I-71 WEST INTERCHANGE
W-07-109**

PREPARED FOR:

**MS CONSULTANTS, INC.
2221 SCHROCK ROAD
COLUMBUS, OHIO 43229**

MAY 2010

PREPARED BY:

**BURGESS & NIPLE, INC.
5085 REED ROAD
COLUMBUS, OHIO 43220**

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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, I-71 South, and SR 315 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/I-71 West Interchange (West Interchange) located at the convergence of SR 315, I-70, and I-71. The project site location is shown on **Figure 1**, contained in **Appendix A** (all figures referenced in this report are contained in **Appendix A**). The area generally extends in a west to east direction from Sullivant Avenue to the CSX Railroad overpass, south along I-71 to Greenlawn Avenue, and north along SR 315 to Broad Street. Subgrade improvements for other segments of the project area will be submitted in separate GB 1 subgrade analysis reports. The proposed mainline I-70, I-71, SR 315, and associated ramps within the interchange are included. The locations of the proposed West Interchange mainline roadways and ramps are shown on **Figures 2 through 8**. Soil borings used to analyze subgrade soils and conditions in 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 in the project area 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 West Interchange, 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 West Interchange are located on **Figures 2** through **8**. **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, some of the borings drilled for retaining wall design at various locations within the West Interchange 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 installation, 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:

$$N_{60} = N_m \times (ER/60) \quad \text{where: } N_m = \text{the measured N value } (N_2 + N_3)$$

ER = drill rod energy ratio as a percent for the specific rig used

N_{60} = 60% energy ratio

Six different drill rigs were used to obtain soil samples for the entire I-70, I-71, and SR 315 reconstruction area. DLZ provided the various ERs for each boring installed. The ERs for the equipment used in this west interchange project area are listed below:

Notation on GB 1 Analysis	Drill Rod Energy Ratio
A	61
B	62
C	63
E	86

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 Illinoian- 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 should be encountered near Elevation 650 within the West Interchange. This would suggest the depth to bedrock is ranges from approximately 10 to 120 feet below the existing site grades and would not affect pavement subgrade design.

The Scioto River is located at the east edge of the project area (between the West Interchange and the South Trench segments of the 70/71 Innerbelt). Bridge sections of I-70 and associated ramps will span the Scioto River. There are no other significant drainage features located within the West Interchange area. The topography of the site varies significantly throughout this area as a result of the existing roadways and river valley. The original surface grades in this area were generally between Elevations 660 and 700 prior to construction of the existing West Interchange.

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 **Figures 3 through 8**. For a detailed description of the conditions encountered at each boring location, refer to each individual boring log, contained in **Appendix E**.

The soil borings located within the West Interchange area encountered competent glacial till soils or dense granular outwash material. In general, the test borings penetrated about 7 to 60 feet below existing grades. Surface materials in the area included topsoil or concrete pavement. **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. 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. Primarily fine grained (generally cohesive) soils were encountered near surface. The SPT blow counts ranged from medium to 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 medium stiff to stiff. Bedrock was not encountered in any of the borings. The moisture content of the soil samples exhibiting cohesive properties was typically -5 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 8.5 to 48.5 feet below ground surface (bgs). Most borings were reported as "dry" to depths up to 17.5 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 West Interchange for I-70/I-71. The proposed mainline I-70, I-71, SR 315, and ramps were included. **Table 1** included in **Appendix B** lists the soil borings used for the subgrade analysis for each segment evaluated. As required by ODOT guidelines, 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. Calculations programmed into the spreadsheet will generate the recommended subgrade stabilization measures, where necessary. Input data required from each soil boring are as follows:

- Boring number
- Boring location
- Sample depths (based on proposed subgrade elevation)
- N_2 and N_3 (blow counts for second and third 6-inch intervals)
- drill rig ER (energy ratio)
- 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 using the SPT. $N_M = N_2 + N_3$, 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, soil moisture content, 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/I-71 West Interchange Area

As required by GB 1, the following is a tabulation of the results for the entire I-70/I-71 West Interchange project area:

Average NL for entire West Interchange area	11.9
Average PI to the nearest whole number	13
Design California Bearing Ratio (CBR) to the nearest whole number (as an average not a percent)	8
Average moisture content to the nearest whole number	12

The GB 1 analysis spreadsheet output for the entire West Interchange 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 6 to 13 as indicated in **Table 3**. The GB 1 spreadsheet calculations did not calculate a Group Index or a design CBR for fourteen of the thirty three road or ramp sections.

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 to affect pavement design.
- Maximum undercut depth was set at 6 feet from design subgrade since the undercut will be backfilled 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-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 low blow counts and/or excessive moisture in the samples collected. Fifteen of the twenty one areas for undercut were specified based on low N_{60} and excessive moisture content. Six areas were identified on only a low N_{60} . The extent and need for subgrade improvement is dependent on the actual subgrade conditions during site preparation and construction. Each area recommended for undercut or stabilization must be confirmed in the field by proof rolling to identify the actual extent of each area requiring stabilization.

Table 4 is a tabulation of the areas for subgrade improvement/stabilization. Methods of undercutting or stabilization are summarized below and identified on **Table 4** along with the area and extent of application of each method.

1. Item 204 proofroll and undercut to the specified depth (to a maximum depth of 6.0 feet). Replace with ODOT 204 embankment, granular material ODOT 703.16C, Type B, C, or D and with ODOT 712.09 geotextile fabric Type D.
2. Cement stabilization to the specified depths of 12, 14, or 16 inches.
3. Lime stabilization to the specified depth of 12 or 14 inches.

The following sections summarize the subgrade stabilization measures recommended for individual roadway segments or ramps. Individual sections are not included for Ramps E4, G6, H5, or M2 since each ramp was all bridge or there were no soil borings adjacent to the new ramp alignments.

Roadways I-70 Eastbound, I-71 Southbound, SR 315 Southbound, and ramps B1, E1, E2, E3, F2, F4, F5, G1, G2, G3, G4, H2, H4, K1, and M1 are not included in following summary paragraphs since undercutting, cement stabilization, or lime stabilization are not required for construction of these mainline roads or ramps according to the GB 1 analysis.

3.3 GB 1 Analysis I-70 Eastbound and I-70 Westbound

Eight soil borings were used to determine subgrade stabilization needs for the proposed I-70 Eastbound lanes. Nine soil borings were used to determine subgrade stabilization needs for the proposed I-70 Westbound lanes. The calculated design CBRs for these portions of the project area are 8 (I-70 Eastbound) and 9 (I-70 Westbound).

The GB 1 analysis identified one area for undercutting along I-70 Westbound (B-003). This area is listed on **Table 4** and shown on **Figure 4**. For estimating purposes it would be reasonable to assume an average 5'-10" undercut is required in the vicinity of B-003 from Stations 633+20 to 636+00. Global cement stabilization or lime stabilization is not listed as an option for the area.

3.4 GB 1 Analysis I-71 Northbound and I-71 Southbound

Two soil borings were used to determine subgrade stabilization needs for the proposed I-71 Northbound lanes. Two soil borings were used to determine subgrade stabilization needs for the proposed I-71 Southbound lanes. The GB 1 analysis did not calculate a design CBR for either of these portions of the project area.

The GB 1 analysis identified one area for undercutting (B-089) along I-71 Northbound. This area is listed on **Table 4** and shown on **Figure 8**. For estimating purposes it would be reasonable to assume an average 6'-0" undercut is required in the vicinity of B-089 from Stations 765+00 to 768+70. Global cement stabilization to a depth of 14 inches is listed as an option on the GB 1 analysis but is not considered practical due to the limited area that requires stabilization on the southern end of the project area.

3.5 GB 1 Analysis SR 315 Northbound and SR 315 Southbound

Two soil borings were used to determine subgrade stabilization needs for the proposed SR 315 Northbound lanes. One soil boring was used to determine subgrade stabilization needs for the proposed SR 315 Southbound lanes. The design CBR for the SR 315 Northbound lanes is 13. The GB 1 analysis did not calculate a design CBR for SR 315 Southbound lanes.

The GB 1 analysis identified one area for undercutting (B-139) along SR 315 Northbound. This area is listed on **Table 4** and shown on **Figure 3**. For estimating purposes it would be reasonable to assume an average 6'-0" undercut is required in the vicinity of B-139 from Stations 268+00 to 273+38. Global cement stabilization to a depth of 12 inches is listed as an option on the GB 1 analysis but is not considered practical due to the limited area that requires stabilization on the north end of the project area.

3.6 GB 1 Analysis Ramp A1

Three soil borings were used to determine subgrade stabilization needs for the proposed Ramp A1 in the project area. Ramp A1 is shown on **Figure 4**. The calculated design CBR for this portion of the project area is 7.

The GB 1 analyses identified one area for undercutting or cement stabilization (B-002). This area is listed on **Table 4** and shown on **Figure 4**. For estimating purposes it would be reasonable to assume an average 2'-6" undercut is required in the vicinity of B-002 from Stations 528+20 – 532+40. Cement stabilization to a depth of 14 inches is listed as an option for the area around B-002. However the section is relatively short and it would not appear practical to perform the cement stabilization option.

3.7 GB 1 Analysis Ramp C1

Four soil borings were used to determine subgrade stabilization needs for the proposed Ramp C1 in the project area. Ramp C1 is shown on **Figures 4** and **5**. The calculated design CBR for this portion of the project area is 8. According to the GB 1 analysis, undercutting or stabilization is required in the area of B-005-1. For estimating purposes it would be reasonable to assume an average 4'-6" undercut is required for Ramp C1 in the vicinity of B-005-1 from Stations 640+90 to 644+20. Lime stabilization to a depth of 12 inches or cement stabilization to a depth of 16 inches are also options for Ramp C1 based on the soils encountered in B-005-1.

3.8 GB 1 Analysis Ramp D1

Four soil borings were used to determine subgrade stabilization needs for the proposed Ramp D1 in the project area. Ramp D1 is shown on **Figure 4**. The calculated design CBR

for this portion of the project area is 7. The GB 1 analysis identified one area for undercutting (B-001-2). This undercut area is listed on **Table 4** and shown on **Figure 4**.

For estimating purposes it would be reasonable to assume an average 3'-6" undercut is required from Station 520+10 to Station 524+80. Cement stabilization is listed as an option, however the section is relatively short and it would not appear practical to perform the cement stabilization option.

3.9 GB 1 Analysis Series E Ramps

There are three Series E ramps in the project area (E1, E2, and E3). Twelve soil borings were used to determine subgrade stabilization needs for Series E ramps. Series E ramps are shown on **Figures 3, 5, and 6**. The GB 1 analysis calculated a design CBR for Ramps E1 and E2 (8 for Ramp E1, 6 for Ramp E2). From the results of the GB-1 analysis, undercutting or stabilization is not required on any of the Series E ramps.

3.10 GB 1 Analysis Series F Ramps

There are six Series F ramps in the project area (F1, F2, F3, F4, F5, and F6). Fourteen soil borings were used to determine subgrade stabilization needs for Series F ramps. Series F ramps are shown on **Figures 5, 6, 7, and 8**. The GB 1 analysis calculated a design CBR for Ramps F2, F3, and F4 (8 for Ramp F2, 8 for Ramp F3, 7 for Ramp F4). The GB 1 analysis identified one area for undercutting along Ramp F1 (B-105), three areas along Ramp F3 (B-099-0, B-099-1, and B-113-0), and one area along Ramp F6 (B-105). These undercut areas are tabulated in **Table 4** and shown on **Figures 7 and 8**.

For estimating purposes it would be reasonable to assume an average 5'-0" undercut is required from Station 227+00 to Station 231+50 for Ramp F1. An average 6'-0" undercut is required from Station 106+00 to 121+00 for Ramp F3. An average 2'-9" undercut is required from Station 125+20 to Station 137+00 for Ramp F3. An average undercut of 5'-0" is required from Station 326+60 to Station 329+00 for Ramp F6. Lime stabilization is listed as an option for one segment of the Series F ramps and cement stabilization is listed as an option for three of the four segments.

3.11 GB 1 Analysis Ramp G5

There are six Series G ramps in the project area (G1, G2, G3, G4, G5, and G6). Twelve soil borings were used to determine subgrade stabilization needs for Series G ramps. Series G ramps are shown on **Figures 3, 6** and **7**. The GB 1 analysis calculated a design CBR for Ramps G4 and G5 (9 for Ramp G4, 11 for Ramp G5). The GB 1 analysis identified two areas along Ramp G5 for undercutting (B-135, B-139). These undercut areas are listed in **Table 4** and shown on **Figure 3**.

For estimating purposes it would be reasonable to assume an average 3'-0" undercut is required from Station 162+00 to Station 166+00 for Ramp G5. An average 6'-0" undercut is required from Station 166+00 to 172+00 for Ramp G5. Lime stabilization to a depth of 14 inches is listed as an option for this portion of Ramp G5 but is not considered practical due to the relatively short segment of roadway.

3.12 GB 1 Analysis Series H Ramps

There are six Series H ramps in the project area (H1, H2, H3, H4, H6, and H7). Fifteen soil borings were used to determine subgrade stabilization needs for the Series H ramps. Series H ramps are shown on **Figures 3, 5,** and **6**. The GB 1 analysis calculated a design CBR for Ramps H1, H3, H6, and H7 (8 for Ramp H1, 9 for Ramp H3, 7 for Ramp H6, and 8 for Ramp H7). The GB 1 analysis identified one area for undercutting along each of Ramps H1 (B-136), H3 (B-114), H6 (B-114), and H7 (B-129). These undercut areas are tabulated in **Table 4** and shown on **Figures 3** and **6**.

For estimating purposes it would be reasonable to assume an average 6'-0" undercut is required from Station 161+50 to Station 164+00 for Ramp H1. An average 3'-6" undercut is required from Station 123+00 to 128+50 for Ramp H3. An average 3'-2" undercut is required from Station 125+00 to Station 128+00 for Ramp H6. An average undercut of 5'-9" is required from Station 134+60 to Station 137+75 for Ramp H7. Lime stabilization to a depth of 12 inches or cement stabilization to a depth of 12 inches are listed as options for the segments on Ramps H1, H3, and H6. However these sections are relatively short and it would not appear practical to perform the cement or lime stabilization options.

GB 1 Analysis Ramp K2

Soil borings were used to determine subgrade stabilization needs for the proposed Ramp K2 in the project area. Ramp K2 is shown on **Figures 7 and 8**. The calculated design CBR for this portion of the project area is 7. The GB 1 analysis identified three areas for undercutting (B-090, B-093, B-097). These undercut areas are listed on **Table 4** and shown on **Figures 7 and 8**.

For estimating purposes it would be reasonable to assume an average 5'-6" undercut is required from Station 192+30 to Station 196+25, an average 6'-0" undercut is required from Station 196+25 to 201+00, and an average 1'-0" undercut is required from Station 204+00 to Station 216+00. Cement stabilization is listed as an option for all three segments and lime stabilization is not listed as an option for one of the segments in the area around B-090. However, these sections are relatively short and it would not appear practical to perform cement or lime stabilization options.

GB 1 Analysis Ramp L1

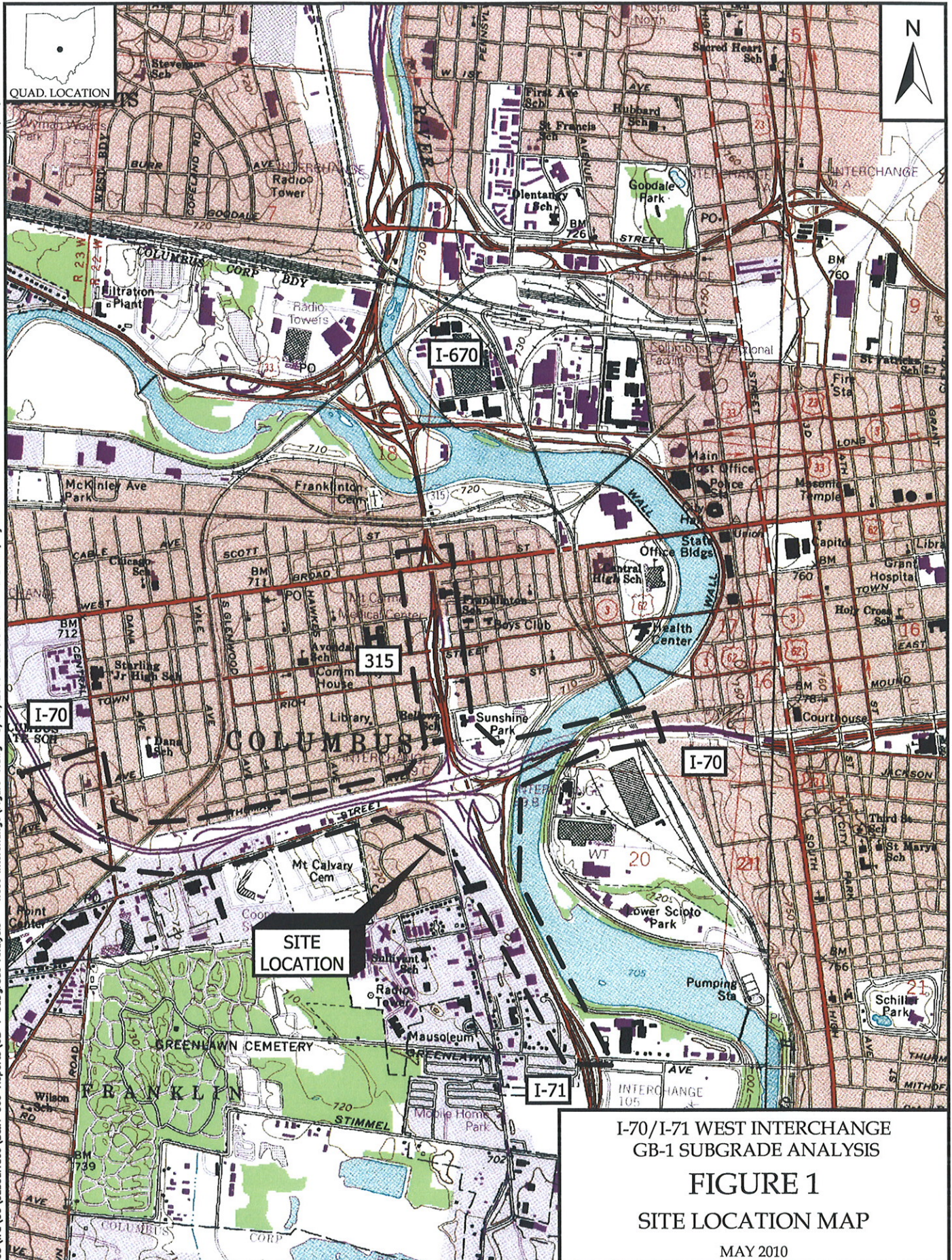
Soil borings were used to determine subgrade stabilization needs for the proposed Ramp L1 in the project area. Ramp L1 is shown on **Figure 8**. The calculated design CBR for this portion of the project area is 7. According to the GB 1 analysis, undercutting or stabilization is required in the area of B-091. For estimating purposes it would be reasonable to assume an average 5'-6" undercut is required for Ramp L1 in the vicinity of Station 766+50 to 773+00. Cement stabilization to a depth of 16 inches is also listed as an option for Ramp L1 based on the soils encountered in B-091. However, this section is relatively short and it would not appear practical to perform the cement or lime stabilization options.

Pavement Subgrade Recommendations

Table 4 lists the recommended subgrade stabilization improvement/treatments for the West Interchange area. All recommendations are based on the Subgrade Version 9.09 as provided by ODOT and described in GB 1. Undercutting is required in twenty one areas, approximately 28 percent of the project area (21 of 76 locations). Cement stabilization is an option in six areas, approximately 25 percent of the project area (19 of 76 locations). Lime stabilization was listed as an option in only 8 percent of the West Interchange project site

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I-70/I-71 WEST INTERCHANGE
GB-1 SUBGRADE ANALYSIS

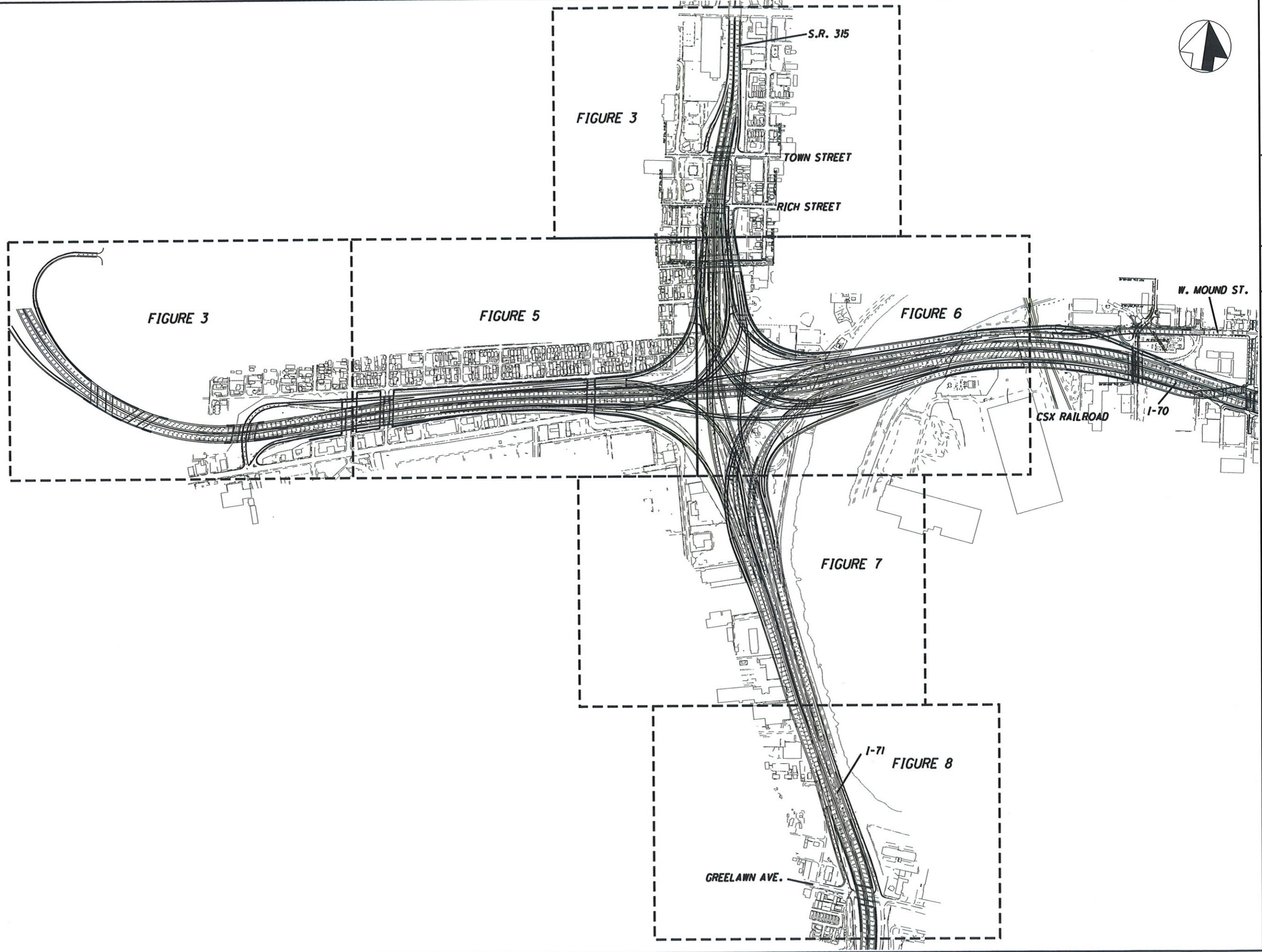
FIGURE 1

SITE LOCATION MAP

MAY 2010

BURGESS & NIPLE
Engineers • Environmental Scientists • Geologists

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



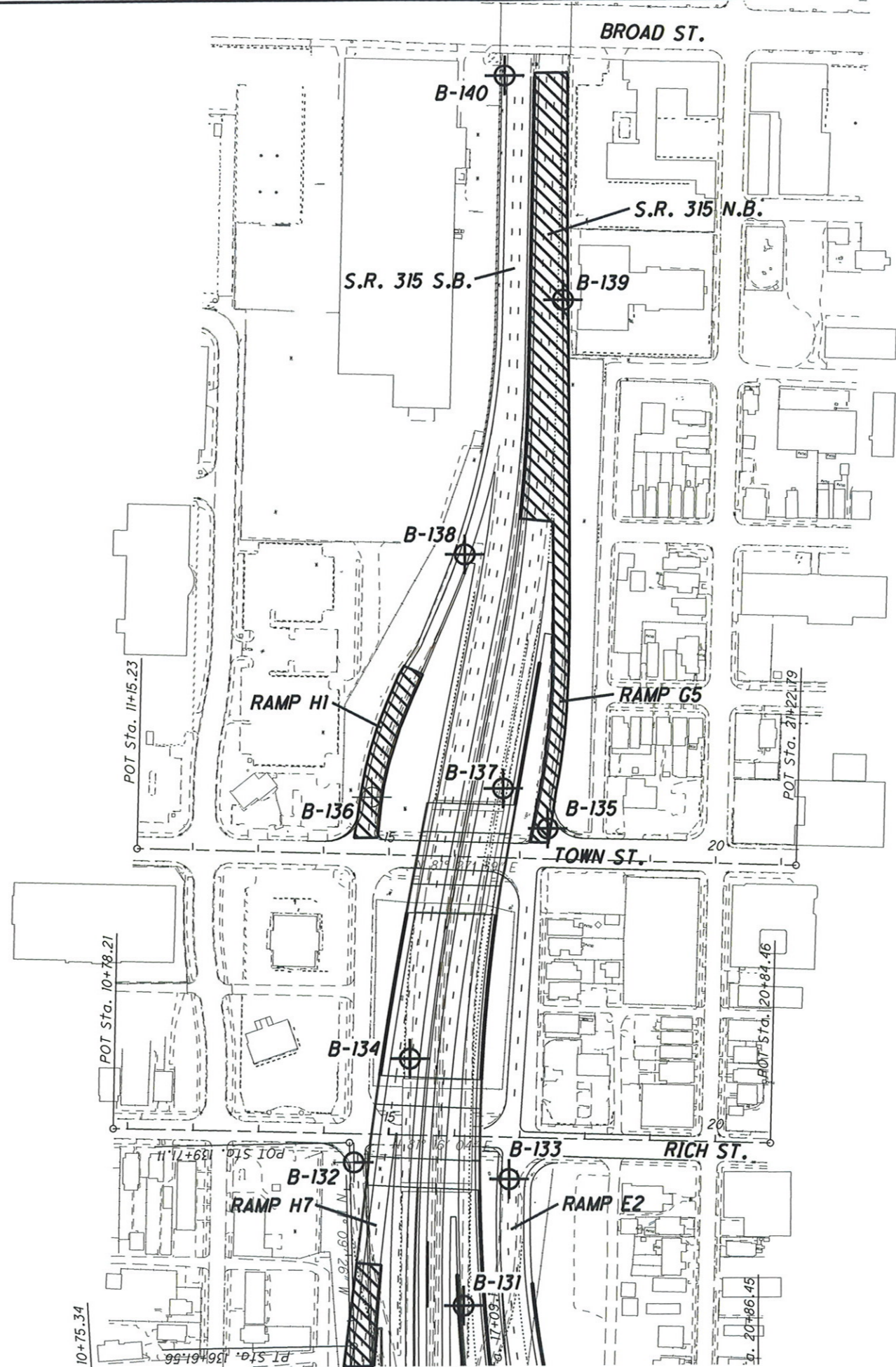
DESIGNED	DATE
CWG	
CHECKED	STRUCTURE FILE NUMBER
VEA	
DRAWN	DATE
RVZ	
CHECKED	STRUCTURE FILE NUMBER
VEA	

FRANKLIN COUNTY

GB-1 SUBGRADE ANALYSIS
I-70/I-71 WEST INTERCHANGE
SOIL BORING LOCATIONS

FRA-70-8.93
FIGURE 2





SOIL BORING LOCATION
 UNDERCUT AREAS



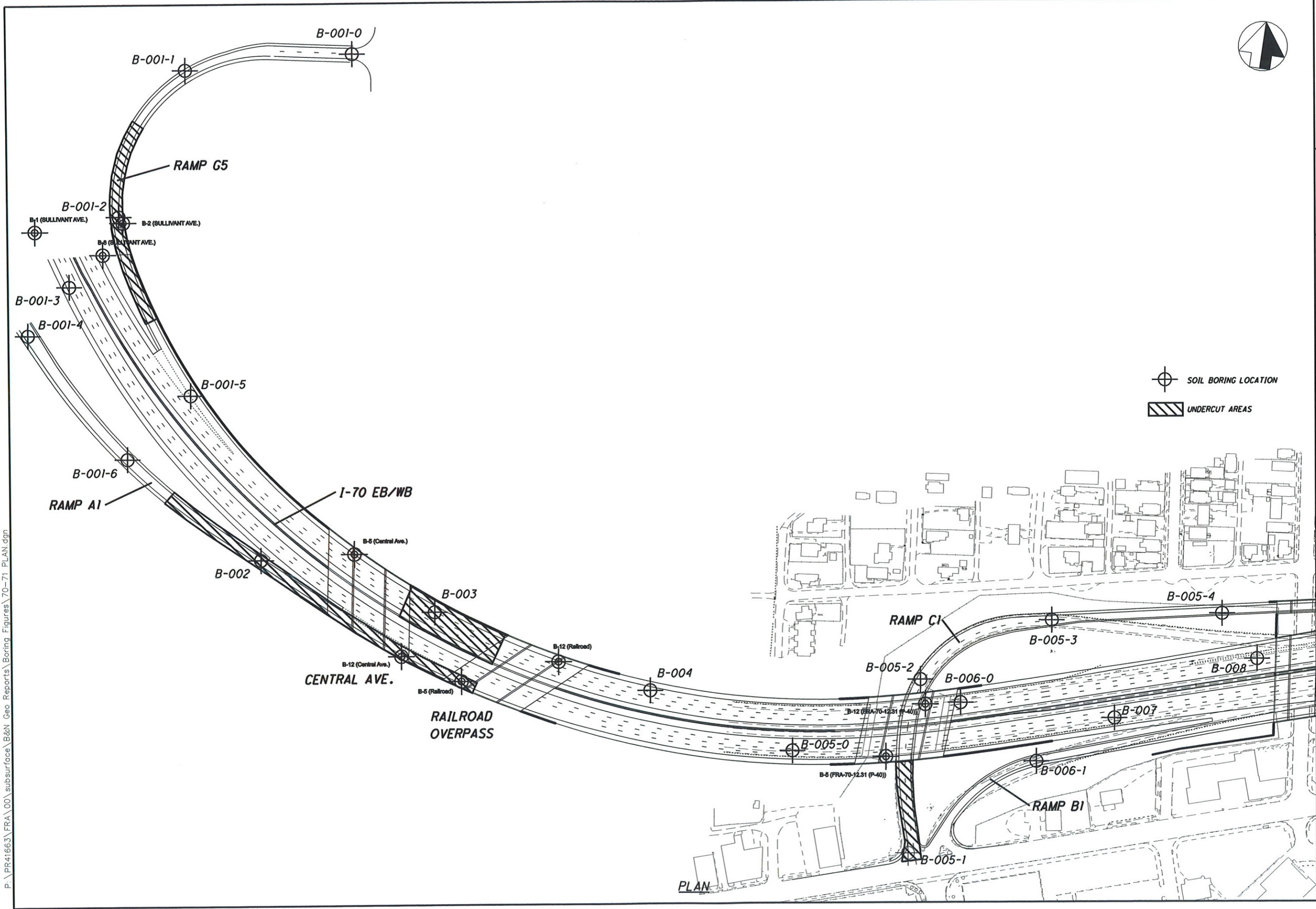
FRA-70-8.93 FIGURE 3	FRANKLIN COUNTY		DATE REVIEWED DRAWN RYZ DESIGNED CWG CHECKED VEA	STRUCTURE FILE NUMBER REVISED REVISED
	GB-1 SUBGRADE ANALYSIS I-70/1-71 WEST INTERCHANGE NORTH PORTION			
3 / 8	BUSINESS & INFRA			

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

FRANKLIN COUNTY

**GB-1 SUBGRADE ANALYSIS
I-70/I-71 WEST INTERCHANGE
WEST PORTION**

**FRA-70-8.93
FIGURE 4**

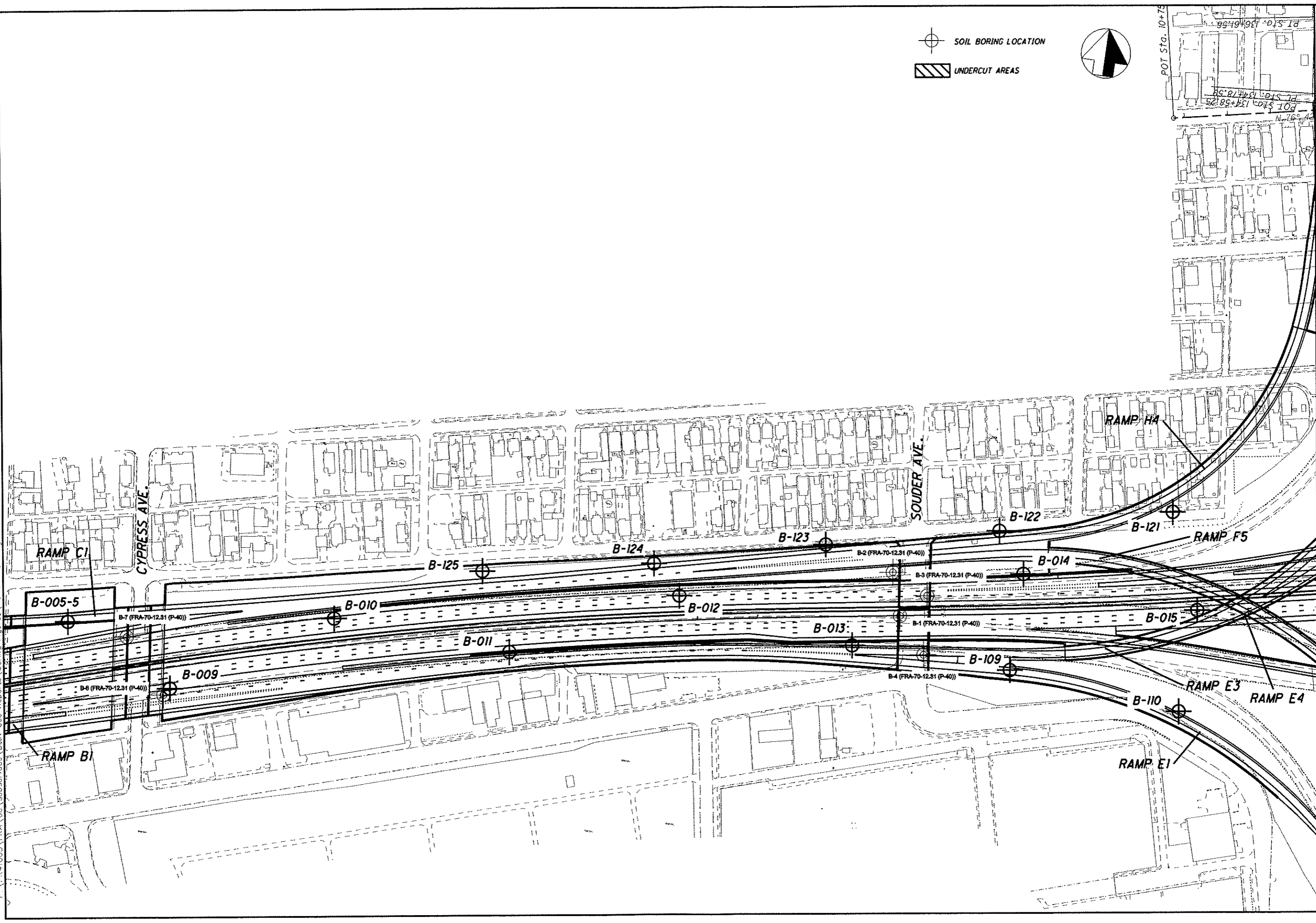
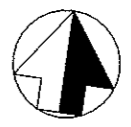


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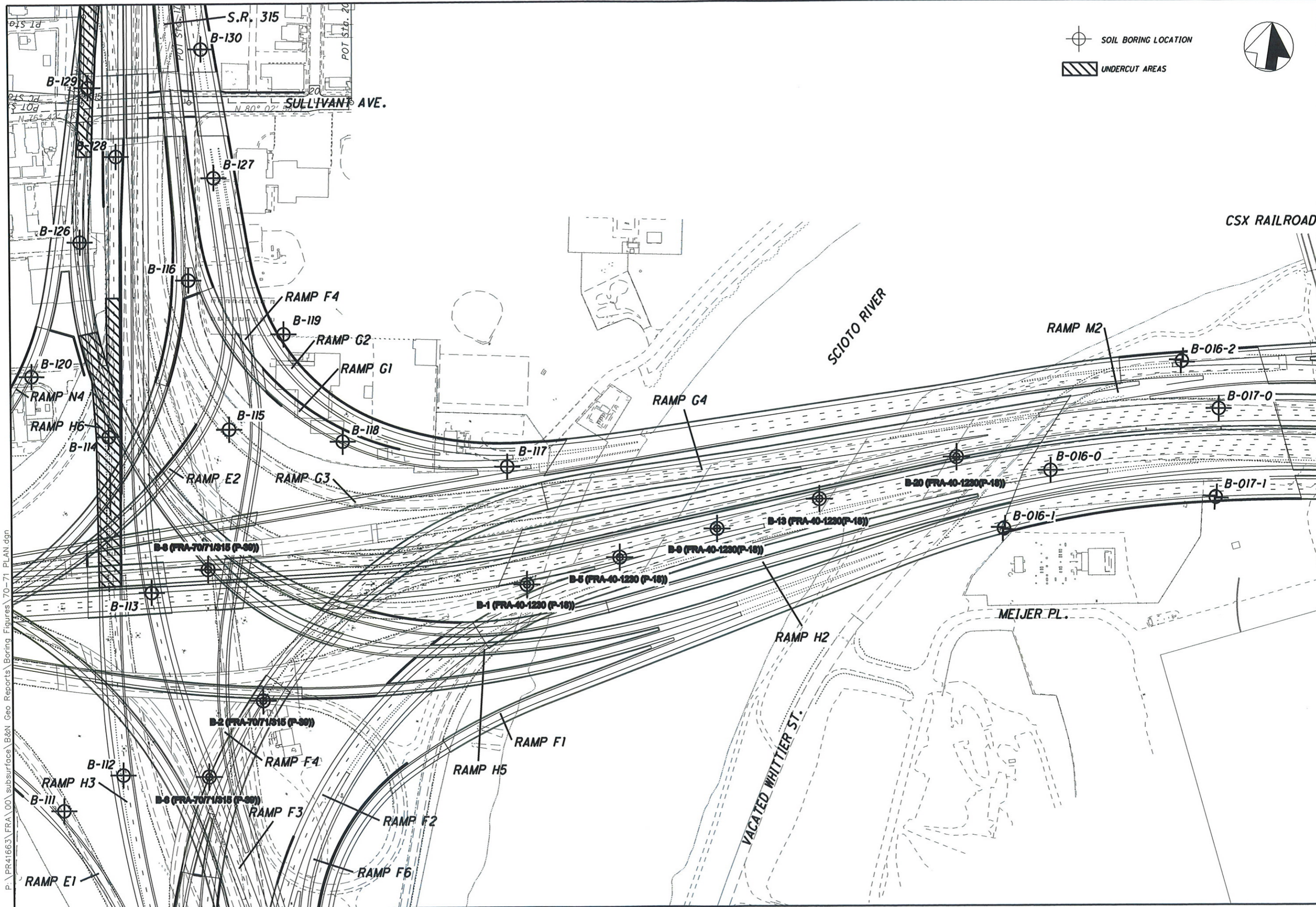
PLAN

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SOIL BORING LOCATION
UNDERCUT AREAS



905 Reed Road Columbus, OH 43228 BRUNNEN & NIPLE	DATE	REVISION	DATE	REVISION
	STRUCTURE FILE NUMBER	RYZ	VEA	VEA
DESIGNED CWG		CHECKED YEA		DRAWN RYZ
FRANKLIN COUNTY				
GB-1 SUBGRADE ANALYSIS I-70/I-71 WEST INTERCHANGE WEST-CENTRAL PORTION				
FRA-70-9.83 FIGURE 5				
5		8		



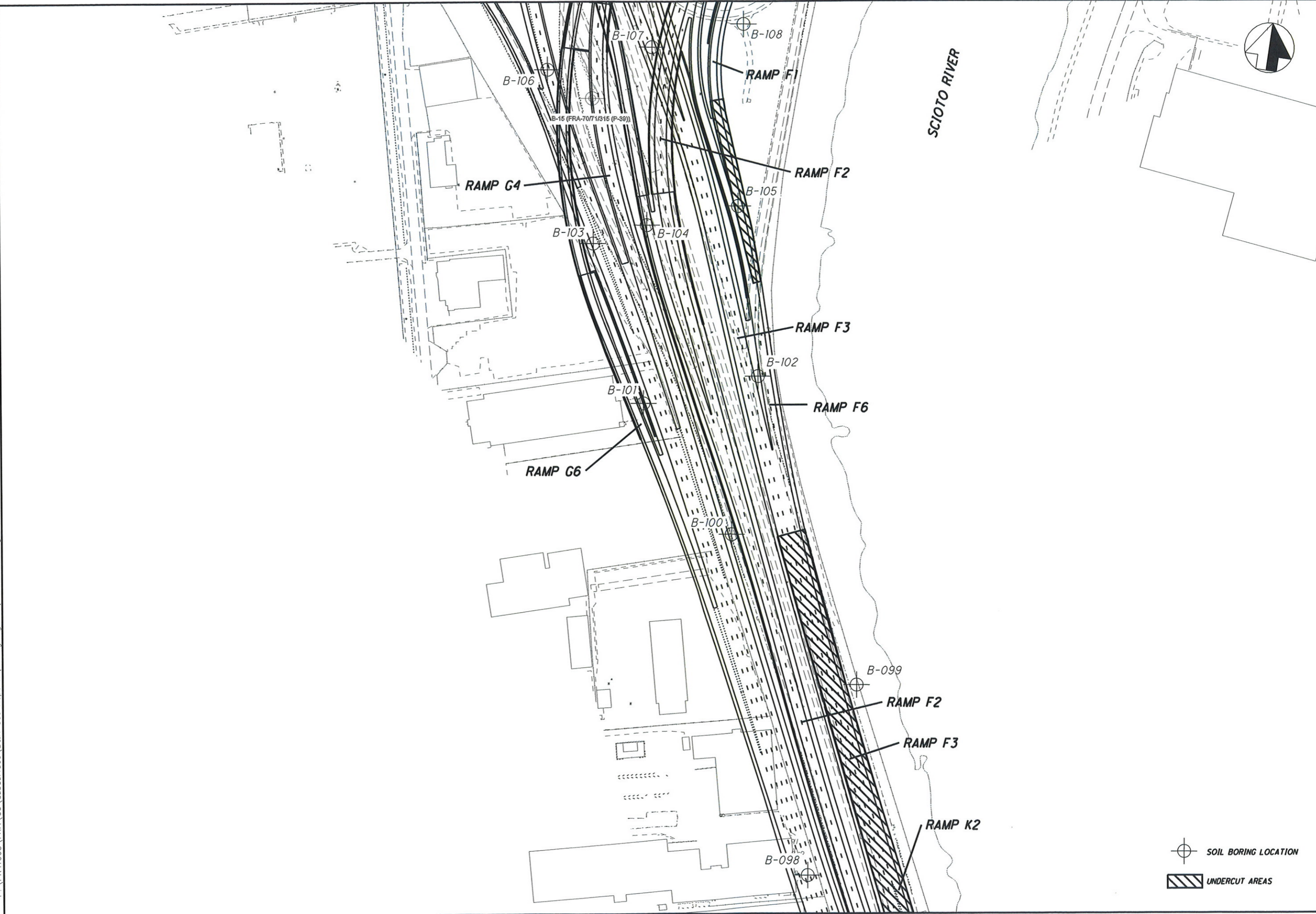
SOIL BORING LOCATION
 UNDERCUT AREAS



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 BUSINESS & MAPLE 5015 Reed Road Columbus, OH 43227	DATE: _____ REVIEWED: _____ DRAWN: _____ DESIGNED: _____
	STRUCTURE FILE NUMBER: _____ CHECKED: _____ REVISION: _____ VEA: _____
FRANKLIN COUNTY	GB-1 SUBGRADE ANALYSIS 1-70/1-71 WEST INTERCHANGE EAST-CENTRAL PORTION
FRA-70-8.93 FIGURE 6	6 / 8

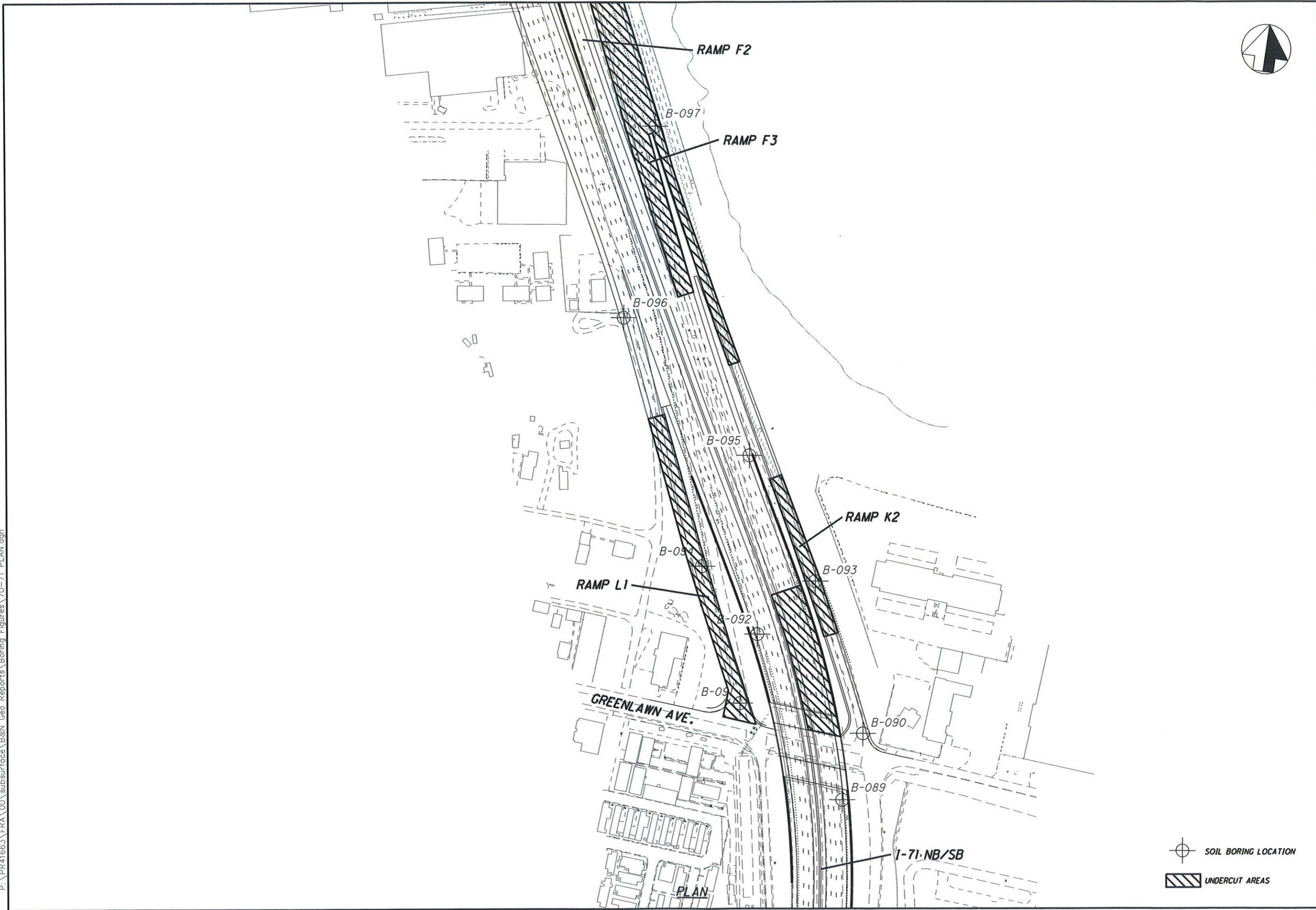
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SOIL BORING LOCATION
UNDERCUT AREAS

FRANKLIN COUNTY		GB-1 SUBGRADE ANALYSIS 1-71/1-70 WEST INTERCHANGE SOUTH-CENTRAL PORTION		FRA-70-8.93 FIGURE 7		7 / 8		MURPHY & NUPLE 505 Reed Road Columbus, OH 43220	
DESIGNED	CWG	CHECKED	VEA	DRAWN	RVZ	REVIEWED	DATE	STRUCTURE FILE NUMBER	

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SOIL BORING LOCATION
UNDERCUT AREAS

FRANKLIN COUNTY	DESIGNED	CWG	CHECKED	VEA
	DRAWN	RVZ	REVISED	
	REVIEWED	DATE	STRUCTURE FILE NUMBER	
GB-1 SUBGRADE ANALYSIS		FRANKLIN COUNTY		
1-70/1-71 WEST INTERCHANGE		FRANKLIN COUNTY		
SOUTH PORTION		FRANKLIN COUNTY		
FRA-70-8.93		FRANKLIN COUNTY		
FIGURE 8		FRANKLIN COUNTY		
8 / 8		FRANKLIN COUNTY		

REYNOLDS & RIPLEY
5055 Reed Road
Columbus, OH 43229

APPENDIX B

TABLES

**Table 1
Soil Boring Locations**

Project Segment	Station Range	Total Number of Borings	Boring I.D.s
Entire West Interchange area	N/A	76	B-001-0, B-001-1, B-001-2, B-001-3, B-001-4, B-001-5, B-001-6, B-002, B-003, B-004, B-005-0, B-005-1, B-005-2, B-005-3, B-005-4, B-006-0, B-006-1, B-007, B-008, B-009, B-010, B-011, B-012, B-013, B-014, B-015, B-016-0, B-016-2, B-017-0, B-089, B-090, B-091, B-092, B-093, B-094, B-095, B-096-0, B-096-1, B-097, B-098-0, B-098-1, B-099-0, B-099-1, B-100, B-101, B-102, B-103, B-104, B-105, B-106, B-107, B-108, B-111, B-112, B-113-0, B-114, B-115, B-116, B-117, B-118-0, B-118-1, B-119, B-126, B-127, B-128, B-129, B-130, B-131-1, B-132, B-133, B-135, B-136, B-137, B-138, B-139, B-140
SR 315 (NB)	262+41 – 273+38	2	B-137, B-139
SR 315 (SB)	262+97 – 272+36	1	B-140
I-71 (NB)	748 – 779	2	B-089, B-095
I-71 (SB)	748 – 779	2	B-092, B-096-1
I-70 (EB)	622+30 – 717+00	8	B-001-3, B-005-0, B-007, B-009, B-011, B-013, B-015, B-016-0
I-70 (WB)	622+30 – 717+00	9	B-001-5, B-003, B-004, B-006-0, B-008, B-010, B-012, B-014, B-017-0
Ramp A1	522+84 – 532+14	3	B-001-4, B-001-6, B-002
Ramp B1	545+14 – 563+49	1	B-006-1
Ramp C1	640+90 – 665+32	4	B-005-1, B-005-2, B-005-3, B-005-4
Ramp D1	513+88 – 531+14	4	B-001-0, B-001-1, B-001-2, B-001-5
Ramp E1	450+60 – 499+27	3	B-009, B-011, B-111
Ramp E2	681+75 – 704+12	4	B-115, B-127, B-130, B-133
Ramp E3	572+86 – 610+56	5	B-013, B-015, B-116, B-131-1, B-137
Ramp E4	577+75 – 605+87	0	No borings, bridge section
Ramp F1	218+39 – 260+00	2	B-105, B-108
Ramp F2	664+25 – 712+20	1	B-098-1
Ramp F3	100+00 – 162+41	7	B-099-0, B-099-1, B-102, B-107, B-113-0, B-128, B-137
Ramp F4	228+75 – 252+51	1	B-102
Ramp F5	752+95 – 808+61	1	B-104
Ramp F6	326+60 – 336+40	1	B-105

Project Segment	Station Range	Total Number of Borings	Boring I.D.s
Ramp G1	473+54 – 498+02	3	B-117, B-118-0, B-118-1
Ramp G2	475+85 – 498+98	2	B-117, B-119
Ramp G3	477+75 – 816	3	B-014, B-016-2, B-117
Ramp G4	874+25 – 928+93	2	B-098-0, B-100
Ramp G5	161+51 – 172+70	2	B-135, B-139
Ramp G6	788+52 – 811+52	0	No borings, bridge section
Ramp H1	161+19 – 169+72	2	B-136, B-138
Ramp H2	768+45 - 810+75	2	B-126, B-129
Ramp H3	100+22 – 145+67	6	B-101, B-103, B-106, B-112, B-114, B-128
Ramp H4	673+53 – 698+87	1	B-129
Ramp H5	584+55 – 706+15	0	No borings, bridge section
Ramp H6	123+24 – 134+58	2	B-114, B-126
Ramp H7	134+58 – 139+71	2	B-129, B-132
Ramp K2	193+07 – 214+26	3	B-090, B-093, B-097
Ramp L1	766+29 – 782+24	3	B-091, B-094, B-096-0
Ramp M1	612+77 – 616+00	1	B-016-2
Ramp M2	826+44 – 835+89	0	No borings

Soils information from 16 borings (B-001-5, B-009, B-011, B-013, B-014, B-015, B-016-2, B-102, B-105, B-114, B-117, B-126, B-129, B-134-1, B-137, and B-139) 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 or Asphalt-Concrete Thickness	Asphalt Thickness (inches)	Base Material Thickness (inches)	Water Level (feet)	Total Depth (feet)
I-70 (Eastbound)						
B-001-3	-	24	-	5	-	8.5
B-005-0	-	15	-	-	-	10
B-007	-	15	-	3	-	7.5
B-009	-	11	-	6	-	10
B-011	-	15	-	-	-	15
B-013	-	7	-	10	-	10
B-015	-	12	-	6	-	17.5
B-016-0	-	8	-	-	-	25
I-70 (Westbound)						
B-001-5	-	18	-	-	-	10
B-003	-	15	-	18	-	10
B-004	-	18	-	-	-	7.5
B-006-0	-	13	-	5	-	12.5
B-008	-	16	-	18	-	10
B-010	-	14	-	4	-	-
B-012	-	16	-	2	-	12
B-014	-	15	-	-	-	17.5
B-017-0	-	17	-	4	-	15
S.R 315 (Northbound and Southbound)						
B-137	-	11	-	-	-	10
B-139	-	16	-	-	8.5	10
B-140	-	12	-	6	-	7.5
I-71 Northbound						
B-089	-	6	-	12	37.6	60
B-095	-	12	-	-	-	10
I-71 Southbound						
B-092	-	8	-	10	37.1	50
B-096-1	-	6	-	5	-	10

Boring I.D.	Topsoil Thickness (inches)	Concrete or Asphalt-Concrete Thickness	Asphalt Thickness (inches)	Base Material Thickness (inches)	Water Level (feet)	Total Depth (feet)
Ramp A1						
B-001-4	-	12	-	-	-	7.0
B-001-6	-	12	-	-	-	10.0
B-002	-	13	-	-	-	10.0
Ramp B1						
B-006-1	-	12	-	-	-	10.0
Ramp C1						
B-005-1	-	12	-	18	-	8.8
B-005-2	-	11	-	-	-	11.1
B-005	-	-	12	6	-	10.0
B-005-4	5	-	-	-	11.0	18.9
Ramp D1						
B-001-0	-	12	-	12	-	7.0
B-001-1	3	-	-	-	-	8.8
B-001-2	-	17	-	-	-	10.0
B-001-5	-	18	-	-	-	10.0
Ramp E1						
B-009	-	11	-	6	-	10.0
B-011	-	15	-	-	-	15.0
B-111	-	6	-	6	-	30.0
Ramp E2						
B-115	-	5	-	13	18.5	25.0
B-127	4	-	-	-	16.0	40.0
B-130	4	-	-	-	16.0	17.5
B-133	-	11	-	-	-	12.5
Ramp E3						
B-013	-	17	-	-	-	10.0
B-015	-	12	-	6	-	17.5
B-116	-	8	-	3	13.5	49.3
B-131-1	6	-	-	-	25.5	55.0
B-137	-	11	-	-	-	10.0
Ramp F1						
B-105	3	-	-	-	-	10.0
B-108	7	-	-	-	17.6	25.0
Ramp F2						
B-098-1	-	5	-	13	-	10.0

Boring I.D.	Topsoil Thickness (inches)	Concrete or Asphalt-Concrete Thickness	Asphalt Thickness (inches)	Base Material Thickness (inches)	Water Level (feet)	Total Depth (feet)
Ramp F3						
B-099-0	-	15	-	-	-	20.0
B-099-1	6	-	-	-	-	12.5
B-102	-	15	-	-	-	12.5
B-107	-	10	-	8	14.4	20.0
B-113-0	-	-	-	-	16.5	45.0
B-128	-	11	-	7	-	10.0
B-137	-	11	-	-	-	10.0
Ramp F4						
B-102	-	15	-	-	-	12.5
Ramp F5						
B-104	4	-	-	-	19.4	30.0
Ramp F6						
B-105	3	-	-	-	-	10.0
Ramp G1						
B-117	-	12	-	-	-	10.0
B-118-0	2	-	-	-	27.5	30.0
B-118-1	-	5	-	-	17.0	45.0
Ramp G2						
B-117	-	12	-	-	-	10.0
B-119	-	4	-	-	15.8	20.0
Ramp G3						
B-014	-	15	-	-	-	17.5
B-016-2	-	12	-	-	48.5	55
B-117	-	12	-	-	-	10.0
Ramp G4						
B-098-0	4	-	-	-	-	10.0
B-100	-	5	-	5	13.4	15
Ramp G5						
B-135	-	12	-	-	-	7.0
B-139	-	16	-	-	-	10.0
Ramp H1						
B-136	-	12	-	6	-	7.0
B-138	-	12	-	2	-	10.0
Ramp H2						
B-126	-	6	-	-	-	12.5
B-129	3	-	-	-	-	15

Boring I.D.	Topsoil Thickness (inches)	Concrete or Asphalt-Concrete Thickness	Asphalt Thickness (inches)	Base Material Thickness (inches)	Water Level (feet)	Total Depth (feet)
Ramp H3						
B-101	3	-	-	-	-	10.0
B-103	-	7	-	11	-	15
B-106	3	-	-	-	-	21.8
B-112	5	-	-	-	9	12.5
B-114	-	9	-	6	-	10.5
B-128	-	11	-	7	-	10
Ramp H4						
B-129	3	-	-	-	-	15.0
Ramp H6						
B-114	-	9	-	6	-	10.5
B-126	-	6	-	-	-	12.5
Ramp H7						
B-129	3	-	-	-	-	15
B-132	-	11	-	-	11	12.5
Ramp K2						
B-090	-	13	-	6	-	7.0
B-093	-	10	-	-	-	10.0
B-097	-	14	-	6	-	15.0
Ramp L1						
B-091	-	12	-	-	-	7.0
B-094	-	9	-	6	-	12.5
B-096-0	-	1	-	-	-	10.0
Ramp M1						
B-016-2	-	12	-	-	48.5	55.0

Soils information from 16 borings (B-001-5, B-009, B-011, B-013, B-014, B-015, B-016-2, B-102, B-105, B-114, B-117, B-126, B-129, B-134-1, B-137, and B-139) 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 West Interchange Area								
I-70 EB	8	22.2	13.5	10.0	9.9	10.5	3.85	8
I-70 WB	9	20.4	13.3	9.2	10.1	10.6	3.08	9
I-71 NB	2	15.4	9.0	14.2	15.0	14.0	--	--
I-71 SB	2	15.8	8.5	13.0	15.0	13.0	--	--
315 NB	2	21.6	12.0	4.5	9.7	8.4	0.25	13
315 SB	1	21.8	12.0	--	6.4	6.0	--	--
Ramp A1	3	22.5	12.0	10.3	12.3	11.4	5.70	7
Ramp B1	1	35.5	24.0	9.0	6.5	7.0	--	--
Ramp C1	4	17.3	7.0	11.8	24.4	15.7	4.80	8
Ramp D1	4	24.9	16.0	12.8	12.1	12.5	5.91	7
Ramp E1	3	31.0	18.0	13.4	11.4	11.3	5.50	8
Ramp E2	4	13.6	9.0	16.2	12.0	11.0	9.00	6
Ramp E3	5	27.2	13.4	6.0	7.0	7.7	--	--
Ramp F1	2	8.9	5.5	16.7	18.3	12.8	--	--
Ramp F2	1	33.5	19.0	16.0	9.7	9.5	4.00	8
Ramp F3	8	18.5	10.0	12.3	13.0	11.4	4.86	8
Ramp F4	1	10.0	4.0	17.0	19.5	16.0	7.5	7
Ramp F5	1	16.0	11.0	14.0	13.4	13.0	--	--
Ramp F6	1	8.8	4.0	15.5	19.4	15.0	--	--
Ramp G1	3	21.6	11.0	21.0	9.5	8.2	--	--
Ramp G2	2	25.1	19.5	--	5.3	6.0	--	--
Ramp G3	3	19.8	16.7	11.3	8.5	9.8	--	--
Ramp G4	2	27.5	10.5	16.0	9.8	8.0	2.67	9
Ramp G5	2	15.5	8.0	8.0	11.0	9.4	1.13	11
Ramp H1	2	24.6	12.0	19.7	13.6	11.1	5.14	8
Ramp H2	2	26.6	16.0	11.0	8.4	9.0	--	--
Ramp H3	6	35.0	17.8	12.6	11.3	10.0	3.53	9
Ramp H4	1	15.3	8.0	11.0	13.3	12.0	--	--
Ramp H6	2	29.5	18.0	19.3	9.7	9.5	6.75	7
Ramp H7	2	15.8	10.0	11.7	11.5	11.0	4.13	8
Ramp K2	3	11.8	6.0	17.6	18.7	13.8	5.92	7
Ramp L1	3	11.0	6.0	17.1	19.5	13.6	7.25	7
Ramp M1	1	14.0	10.0	14.5	18.0	14.5	--	--

** - The GB 1 analysis spreadsheets did not calculate an average Group Index or a Design CBR for I-71 Northbound, I-71 Southbound, or 315 Southbound, Ramps B1, E3, F1, F5, F6, G1, G2, G3, H2, H4, and M1. Soil samples for these borings were more than 6 feet below design subgrade or soils were all classified as non-plastic.

Table 4
GB 1 Subgrade Improvements/Treatments

	Project Segment	Controlling Soil Borings (with Depth Below Subgrade Of Problem Soil Sample)	Station Range	C/M/N	Undercut Approx. Depth (feet)	LS Option Depth (inches)	CS Option Depth (inches)
1	I-70 Westbound	B-003 (4.8-6.3')	633+20 – 636+00	N	5.8		
2	I-71 Northbound	B-089 (4.0-7.5')	765+00 – 768+70	N	6.0		14
3	SR 315 Northbound	B-139 (1.4-6.9')	268+00 – 273+38	M/N	6.0'		12
4	Ramp A1	B-002 (2.0-3.5')	528+20 – 532+40	N	2.5'		14
5	Ramp C1	B-005-1 (1.5-4.5')	640+90 – 644+20	M/N	4.5	12	16
6	Ramp D1	B-001-2 (1.9-3.5')	520+10 – 524+80	M/N	3.5		14
7	Ramp F1	B-105 (1-5')	227+00 – 231+50	M/N	5		14
8	Ramp F3	B-099-0 (2.4-8.4)	106+00 – 121+00	M/N	6		12
9	Ramp F3*	B-099-1 (1.9-3.4)	106+00 – 121+00	N	2.9		14
10	Ramp F3	B-113-0 (1.3-2.8')	125+20 – 137+00	M/N	2.8	12	
11	Ramp F6	B-105 (1-5')	326+60 – 329+00	M/N	5		14
12	Ramp G5	B-135 (1.0-2.5')	162+00 – 166+00	N	3		14
13	Ramp G5	B-139 (3.0-6.0')	166+00 – 172+00	M/N	6		14
14	Ramp H1	B-136 (0.3-6.3')	161+50 – 164+00	M/N	6	12	12
15	Ramp H3	B-114 (0-3.7')	123+00 – 128+50	M/N	3.5	12	12
16	Ramp H6	B-114 (0-3.2')	125+00 – 128+00	M/N	3.2	12	12
17	Ramp H7	B-129 (2.3-5.3)	134+60 – 137+75	N	5.8		14
18	Ramp K2	B-090 (0-5.5')	192+30 – 196+25	M/N	5.5	14	12
19	Ramp K2	B-093 (0.4-6.4')	196+25 – 201+00	M/N	6.0		16

	Project Segment	Controlling Soil Borings (with Depth Below Subgrade Of Problem Soil Sample)	Station Range	C/M/N	Undercut Approx. Depth (feet)	LS Option Depth (inches)	CS Option Depth (inches)
20	Ramp K2	B-097 (0-1')	204+00 – 216+00	M/N	1.0		12
21	Ramp L1	B-091 (1.0-5.5')	766+50 – 773+00	M/N	5.5'		16

Undercut:
N = Low N₆₀

C = Classification of Soil Stabilization:
M = Excess Moisture

CS = Cement Stabilization
LS = Lime Stabilization

*Station 106+00 to Station 121+00 should be undercut 6 feet based on Boring B-099-0 rather than 2.9 feet based on B-099-1.

APPENDIX C

**GB 1 MODEL ANALYSIS OUTPUT - ENTIRE I-70/I-71 WEST INTERCHANGE
PROJECT AREA**

I-70/I-71 West Interchange Complete 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			
39	B-097	Ramp K2 Sta. 209+00	1 2 3 4	0.0 1.0 2.5 4.0	1.0 2.5 4.0 5.5	-2.0	7 8 7 1	6 6 5 2	13 14 12 3	B	13	31 NP NP 31	21 NP NP 15	10 NP NP 16	31 13 9 23	20 9 9 26	51 22 9 49	20 9 5 25	16 6 6 16	4a 1b 1a 6b	3 0 0 5	cut 1.97 feet		MN		12			1	undercut 1' no undercut at 4'. 1a, 1b soils will bridge	
40	B-098-0	Ramp G4 Sta. 884+05	1A 2 3 4	2.0 3.5 5.0 7.0	3.5 5.0 6.5 8.5	1.0	4 10 18 13	6 15 15 17	10 25 33 30	E	14	44 NP NP NP	21 NP NP NP	23 NP NP NP	24 12 12 12	25 12 12 12	49 12 6 3	21 6 6 3	18 6 6 6	7-6 1a 1a 1a	8 0 0 0	fill 1 foot no lab sample 3,4									
41	B-098-1	Ramp F2	1 2 3 4	4.4 6.9 9.4 11.9	5.9 8.4 10.9 13.4	3.4	17 8 12 27	18 11 17 22	35 19 29 49	A	36	33 NP NP NP	17 NP NP NP	16 NP NP NP	23 12 12 12	23 12 12 26	46 12 12 49	16 15 4 4	16 10 6 6	6b 4a 1a 1a	4 0 0 0	fill 3.4 feet no lab samples 2 and 4									
42	B-099-0	Ramp F3 Sta. 117+74	1 2 3 4	2.4 3.9 5.4 6.9	3.9 5.4 6.9 8.4	0.9	4 3 2 3	6 2 2 2	10 5 4 5	B	10	25 NP 27 25	17 NP 16 18	8 NP 11 7	20 17 25 17	19 17 42 32	39 9 18 14	12 6 14 13	19 9 18 13	4a 1b 6a 4a	1 0	fill 0.9 feet all fill materials		MN N MN N		12 -- -- --			1 5 5 5	Undercut maximum of 6.0 feet	
43	B-099-1	Ramp F3 Sta. 117+74	1 2 3 4	1.9 4.4 6.9 9.4	3.4 5.9 8.4 10.9	0.9	4 8 7 4	5 9 4 6	9 17 11 10	B	9	23 NP NP NP	16 NP NP NP	7 NP NP NP	27 6 6 6	19 18 6 6	45 10 6 6	11 9 7 6	11 6 6 6	4a 1a 1a 1a	2 0	fill 0.9 feet no lab samples 2, 4				14			1	Undercut to depth of 2.9 feet	
44	B-100	Ramp G4 Sta. 892+50	1 2 3 4	8.0 9.5 11.0 12.5	9.5 11.0 12.5 14.0	6.5	5 2 2 23	4 5 5 32	9 7 7 55	B	9	NP NP NP 24	NP NP NP 15	NP NP NP 9	9 9 18 30	9 18 18 23	9 18 18 53	12 6 6 10	6 6 6 10	1a 1a 1b 4a		fill 6.5 feet no lab sample 1		N MN MN		16 16		1 3 3	No undercut under 6.5 feet of fill		
45	B-101	Ramp H3 Sta. 107+06	1 2 3 4	3.1 5.6 8.1 10.6	4.6 7.1 9.6 12.1	2.1	9 15 34 35	8 15 35 28	17 30 69 63	A	17	30 NP NP NP	18 NP NP NP	12 NP NP NP	43 10 10 34	34 10 10 77	77 3 3 7	14 6 6 6	14 6 6 6	6a 1a 1a 1a	9 0	fill 2.1 feet no lab sample 2,4									
46	B-102	Ramp F3, F4 Sta. 124+69	2 3 4 4	3.4 4.9 6.4 7.9	4.9 6.4 7.9 9.4	2.1	10 5 2 2	8 5 2 5	18 10 4 7	B	19	33 NP NP NP	16 NP NP NP	17 NP NP NP	26 18 18 22	23 18 18 16	49 14 16 16	14 18 24 22	16 16 16 16	6b 6b 6b 6b	5 10	fill 2.1 feet no samples 2, 3, 4		MN MN				5 3	No undercut upper 6.4 feet of soil will bridge		
47	B-103	Ramp H3 Sta. 110+97	3 4 5 6	0.0 1.4 2.9 4.4	1.4 2.9 4.4 5.9	-4.6	4 11 20 2	6 9 11 13	10 20 31 22	A	10	32 23 24 31	16 16 19 17	16 7 5 14	40 33 23 26	33 21 13 27	73 54 36 53	14 12 10 13	16 11 14 12	6b 4a 4a 4a	10 4 0 5	cut 4.6 feet no lab sample 6									
48	B-104	Ramp F5 Sta. 798+57	1 2 3 4	27.5 30.0 32.5 35.0	29.0 31.5 34.0 36.5	26.5	10 10 4 8	9 8 7 8	10 18 11 16	A	19	31 NP NP NP	17 NP NP NP	14 NP NP NP	26 26 27 27	53 53 53 53	13 13 22 10	14 14 14 14	14 14 14 14	6a 6a 6a 6a		26.5 feet fill no lab samples for 1, 3, 4		MN				1	No undercut under 26.5 feet of fill		
49	B-105	Ramp F1, F6 Sta. 229+00	1 2 3 4	8.5 10.0 13.5 16.0	10.0 12.5 15.0 17.5	7.5	3 2 4 4	5 2 9 6	8 4 13 10	B	8	37 30 30 30	18 18 18 18	19 12 12 12	38 25 18 43	36 18 18 43	74 43 18 14	21 18 18 14	16 16 14 14	6b 6b 6a 6a		fill 7.5 feet no lab samples 2,4		MN N MN		14 12		2 5 1	undercut 5' prior to 7.5 feet fill		
50	B-106	Ramp H3 Sta. 115+2	7 8 9 10	0.0 1.0 2.5 4.0	1.0 2.0 3.5 4.5	-14.5	7 19 50 50	18 50 50 50	25 69 50 50	A	25	30 23 NP NP	15 14 NP NP	15 9 NP NP	36 22 6 6	38 19 41 6	74 41 6 6	14 10 14 6	14 10 6 6	6a 4a 1b 1b	10 1 0 0	cut 14.5 feet gravel in samples 8, 9, and 10 no lab sample 10		M					1	No undercut excess moistur in 1b soil does not need remo	
51	B-107	Ramp F3 Sta. 132+91	1 2 3 4	2.0 3.5 5.0 6.5	3.5 5.0 6.5 8.0	0.5	16 13 5 3	13 11 4 2	29 24 9 5	A	29	34 NP NP NP	17 NP NP NP	17 NP NP NP	24 16 16 16	29 53 16 16	53 53 16 16	13 16 16 6	16 16 6 6	6b 6b 6b 1b	6 10 10	fill 0.5 feet fill material to 13 feet no lab samples 2,3		N MN		--			1 5	No undercut upper 5' soils will bridge	
52	B-108	Ramp F1 Sta. 233+23	2 3	22.8 25.3	24.3 26.8	21.8	8 4	4 3	12 7	B	12	NP NP NP	NP NP NP	NP NP NP	18 18 18	18 18 18	9 9 9	6 6 6	6 6 6	1b 1b 1b		fill 21.8 feet no lab sample 2,3		N				2	No undercut 21' fill		

APPENDIX D

**GB 1 MODEL ANALYSIS OUTPUT - INDIVIDUAL ROADWAY SEGMENTS
FOR I-70/I-71 WEST INTERCHANGE**

Subgrade Analysis
V. 9.09 08/10/07

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

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	2	3	0	0	10	0	0	0	11	0	0	8	2	0	0	0	0						
6%			8%		28%				31%			22%		6%									
0.0%											41.7%							58.3%					

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

% Borings	
N ₁ ≤ 5	0%
N ₁ ≤ 10	33%
N ₁ ≥ 20	0%
M+	22%
R	0%

% Surface	
11%	
0%	11%
% Borings	
22%	
0%	22%

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

9 Total Borings

Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI			
	20.4	13.3	9.2	22.9	10.1	10.6	3.08			
Maximum	44	17	36	18	18	39.6	45	78	22	16
Minimum	8	8	18	13	4	7	11.3	7	4.1	6

I-70/I-71 West Interchange I-70 Westbound W-07-109				Standard Penetration				Physical Characteristics				Moisture		Classification		Comments					
#	B #	Boring Location	Depth To Fill	n ₂	n ₃	N _m	Rig	N ₆₀	N _L	LL	PL	PI	% Silt	% Clay	P 200	M	M _{OPT}	Class	GI		

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

1	B-001-5	I-70 Westbound Sta. 626+56	1	1.2	2.7	-0.3	8	9	17	A	17	21	13	8	37	25	62	9	10	4a	5	cut 0.3 feet
			2	2.7	4.2		9	9	18		18	22	15	7	26	17	44	8	10	4a	2	
			3	4.2	5.7		9	9	18		18	24	14	10	40	26	66	11	10	4a	6	
			4	5.7	7.2		15	14	29		29	22	14	8	38	24	62	10	10	4a	6	no lab sample #4
2	B-003	I-70 Westbound Sta. 634+52	1	3.3	4.8	1.8	5	6	11	B	11	NP	NP	NP	11		11	6	6	1a	0	fill 1.8 feet
			2	4.8	6.3		4	5	9		9							10	10	4a	5	no lab sample #2 and #4
			3	6.3	7.8		9	19	28		29	23	15	8	23	15	38	7	10	4a	10	
			4	7.8	9.3		15	16	31		32	9						10	10	4a	10	
3	B-004	I-70 Westbound Sta. 639+96	1	0.3	1.8	-1.2	5	6	11	A	11	31	16	15	32	34	66	15	16	6b	8	cut 1.2 feet
			2	1.8	3.3		12	10	22		22	19	14	5	29	23	52	9	10	4a	3	
			3	3.3	4.8		8	8	16		16								14	6a	8	
			4	4.8	6.3		5	5	10		10	10							14	6a	8	
4	B-006-0	I-70 Westbound Sta. 647+58	1	0.0	0.5	-2.5	5	8	13	A	13	29	16	13	30	33	63	14	14	6a	7	cut 2.5 feet
			2	0.5	2.0		6	7	13		13	26	16	10	20	18	38	11	11	4a	1	
			3	2.0	3.5		6	7	13		13	30	17	13	29	29	59	15	14	6a	6	
			4	3.5	5.0		6	7	13		13	27	16	11	34	35	69	17	14	6a	7	
5	B-008	I-70 Westbound Sta. 654+56	1	2.5	4.2	1.2	7	8	15	B	16	NP	NP	NP	9		9	5	6	1a	0	fill 1.2 feet
			2	4.2	5.7		21	12	33		34	NP	NP	NP	27		27	7	10	2-4	0	
			3	5.7	7.2		31	12	43		44	NP	NP	NP	27		27	7	10	2-4	0	
			4	7.2	8.7		11	16	27		28	16						10	10	2-4	0	no lab sample 4
6	B-010	I-70 Westbound Sta. 663+51	1	0.0	1.4	-1.6	5	11	16	A	16	18	13	5	16	13	29	9	10	2-4	0	cut 1.6 feet
			2	1.4	2.9		19	22	41		42	19	14	5	16	12	28	10	10	2-4	0	samples 1,2,3 fill
			3	2.9	4.4		21	16	37		38	18	14	4	14	12	26	4	10	2-4	0	
			4	4.4	5.9		10	10	20		20	27	14	13	34	31	65	14	10	4a	7	
7	B-012	I-70 Westbound Sta. 671+42	1	2.1	3.6	0.6	7	11	18	A	18	25	14	11	29	25	54	13	14	6a	4	fill 0.6 feet
			2	3.6	5.1		9	22	31		32	19	13	6	11	12	23	8	6	1b	0	
			3	5.1	6.6		19	12	31		32	23	15	8	27	19	47	10	10	4a	10	
			4	6.6	8.1		7	8	15		15	15						13	14	6a	10	no lab sample 4
8	B-014	I-70 Westbound Sta. 679+49	4	0.4	1.9	-7.1	10	9	19	B	20	NP	NP	NP	27		27	7	10	2-4	0	cut 7.1 feet
			5	1.9	3.4		13	11	24		25	NP	NP	NP	26		26	9	10	2-4	0	
			6	3.4	4.9		11	9	20		21	20	15	5	15	11	26	9	10	2-4	0	
			7	4.9	6.4		8	7	15		16	16						10	10	2-4	0	no lab sample 7
9	B-017-0	I-70 Westbound Sta. 713+60	1	11.0	12.5	9.2	5	4	9	B	9	NP	NP	NP				16	11	6a		fill 9.2
			2	13.0	14.5		8	8	16		17	NP	NP	NP	7		7	5	6	1b		retaining wall boring
			3	14.5	16.0		3	5	8		8	NP	NP	NP	8		8	6	6	1b		no lab sample 1
			4	16.0	17.5		3	5	8		8	36	18	18	33	45	78	22	16	6b		
10																						
11																						
12																						

Class	GI	Problem	LS	CS	UC Class	UC MN	Analysis
		N					undercut to 4 prior to fill
		MN		14		2	no undercut under 9.2 feet of fill
		N		14		2	
		MN		14		2	

Subgrade Analysis

V. 9.09 08/10/07

Design CBR **13**
Item 320 **No**
Global CS **Option**
Global LS **No**

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	1	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0
38%			13%		13%		13%		13%			13%			25.0%		
0.0%																	

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

% Borings	
N ₁ ≤ 5	0%
N ₁ ≤ 10	50%
N ₁ ≥ 20	0%
M+	50%
R	0%

% Surface	
0%	
0%	0%
% Borings	
50%	

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

Average		N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI
21.6		12.0		4.5	8.1	9.7	8.4	0.25
55		16	23	18	5	38.4	10	38.4
14.9		14	5	6				
8		8	22	18	4	12.3	6.1	12.3
5		6						

I-70/I-71 West Interchange 315 Northbound W-07-109

#	B #	Boring Location	Depth To	Cut Fill	Standard Penetration				Physical Characteristics						Moisture		Classification		Comments
					n ₂	n ₃	N _m	Rig	N ₆₀	N _L	LL	PL	PI	% Silt	% Clay	P 200	M	M _{OPT}	

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

1	B-137	S.R. 315 Northbound Sta. 262+80	1 2 3 4	4.3 6.8 9.3 11.8	5.8 8.3 10.8 13.3	3.3	7 28 16 13	9 26 14 14	16 54 30 27	A	16	55	31	27	16	NP	NP	NP	12	12	6	6	6	6	6	6	1a	0	fill 3.3' 11" concrete
2	B-139	S.R. 315 Northbound Sta. 269+87	2 3 4 5	0.0 1.4 2.9 5.4	1.4 2.9 4.4 6.9	-3.1	8 6 4 6	6 2 6 6	14 8 10 12	B	14	8	10	12	8	NP	NP	NP	28	28	10	8	14	11	10	6	3a	0	cut 3.1' fill sand to 8.5'
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

Undercut to maximum depth of 6'

Subgrade Analysis

V. 9.09 08/10/07

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

7

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	1	0	1	0	0	0	0	5	0	0	3	3	0	2	0	0
0.0%	6%	6%		6%					31%			19%	19%		13%		
				18.8%				81.3%									

Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI
	24.9	16.0	12.8	26.2	12.1	12.5	5.91
Maximum	64	24	53	39.6	23.3	21	13
Minimum	9	9	19	8.1	5.9	6	0

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

N _i <= 5	0%
N _i <= 10	25%
N _i >= 20	25%
M+	25%
R	0%

25%	
0%	25%
% Borings	
25%	
0%	25%

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

4 Total Borings

I-70/I-71 West Interchange Ramp D1 W-07-109

#	B #	Boring Location	Depth To	Cut Fill	Standard Penetration			Physical Characteristics					Moisture		Classification		Comments
					n ₂	n ₃	N _m	Rig	N ₆₀	N _L	LL	PL	PI	% Silt	% Clay	P 200	

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

1	B-001-0	Ramp D1 Sta. 514+44	1 2 3 4	0.0 1.1 2.6 4.1	0.6 2.6 4.1 5.6	-1.4	12 14 8 9	50 10 11 5	62 24 19 14	B	64 25 20 14	19 43 NP 32	16 24 NP 17	3 19 NP 15	10 20 8 18	6 39 8 23	17 60 8 42	6 23 7 15	6 21 6 14	1b 7-6 1a 6a	0 9 0 3	cut 1.4 feet 50 for 2", gravel all samples fill	
2	B-001-1	Ramp D1 Sta. 518+51	2 3 4 5	0.7 2.2 4.2 5.7	2.2 3.7 5.7 9.2	-3.3	8 10 19 50	16 15 18 50	24 25 37 51	A	24 25 38 51	32 53 31 24	18 22 31 14	39 15 33 54	72 14 19 9	14 14 19 10	6 23 8 10	6 21 8 9	6 14 7-6 3a 4a	9 13 0	cut 3.3 feet no lab sample 4 or 5		
3	B-001-2	Ramp D1 Sta. 522+21	1 2 3 4	1.9 3.5 5.0 6.5	3.5 5.0 6.5 8.0	0.5	3 4 7 8	6 6 9 10	9 10 16 18	B	9 10 17 19	29 16 13	30 30	60	18	14	16 16 16	6 10 10	6a 6b 6b	6 10 10	fill 0.5 feet no lab sample 4		
4	B-001-5	Ramp D1 Sta. 526+80	1 2 3 4	4.0 5.5 7.0 8.5	5.5 7.0 8.5 10.0	2.5	8 9 9 15	9 9 9 14	17 18 18 29	A	17 18 18 29	21 22 24 22	13 15 14 14	8 7 10 8	37 26 40 38	25 17 26 24	62 44 66 62	9 8 11 10	10 10 10 10	4a 4a 4a 4a	5	fill 2.5 feet	
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Undercut
3.5 feet

Subgrade Analysis
V. 9.09 08/10/07

Design CBR
Item 320 No
Global CS Option
Global LS No

5 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	6	0	1	4	0	0	0	2	0	0	1	0	0	0	0	0
0.0%		30%	30%	5% 20%		85.0%			10%		5%		15.0%				

Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI
	27.2	13.4	6.0	16.6	7.0	7.7	
Maximum	55	20	21	14	8	27.3	21.3
Minimum	8	8	18	13	4	12	11.9
			48.6	13	14		
			4	6			

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	40%
N _L ≥ 20	20%
M+	20%
R	0%

% Surface	
20%	
0%	20%
% Borings	
40%	

0%	40%	0%	40%
----	-----	----	-----

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

I-70/I-71 West Interchange Ramp E3 W-07-109															Standard Penetration			Physical Characteristics						Moisture		Classification		Comments
#	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								

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

1	B-013	Ramp E3 Sta. 575+75	1 10.5 12.0 2 12.0 13.5 3 13.5 15.0 4 15.0 16.5	9.0	11 12 23	23	A	23		NP NP NP	14 14	14	6 6	6 6	1b	fill 9.0 feet
2	B-015	Ramp E3 Sta. 582+50 bridge section	1 17.8 19.3 2 19.8 21.3 3 22.3 23.8 4 23.8 25.3	16.3	24 27 51	52	A	52					9 10	2-4	fill 16.3 feet no lab samples 1 and 2	
3	B-116	Ramp E3 593+57	1 47.4 48.9 2 49.9 51.4 3 52.4 53.9 4 54.9 56.4	46.5	4 4 8	8	B	8		NP NP NP	13 13	13	10 6	1a	retaining wall boring fill 46.5 feet samples 1 and 2 are fill material	
4	B-131-1	Ramp E3 Sta. 600+19	1 9.0 10.5 2 11.5 13.0 3 14.0 15.5 4 16.5 18.0	8.0	8 11 19	20	B	20					5 6	1b	retaining wall boring fill 8 feet no lab samples 1, 2, 3	
5	B-137	Ramp E3 Sta. 163+03	1 2.7 4.2 2 5.2 6.7 3 7.7 9.2 4 10.2 11.7	1.8	7 9 16	16	A	16		NP NP NP	12 12	12	6 6	1a	fill 1.8 feet no lab samples 2, 3, 4	
6																
7																
8																
9																
10																
11																
12																

	N
	MN

		14		1
		14		2

No undercut upper 1b soils will bridge
No undercut Placing 46.5 feet of fill

Subgrade Analysis

V. 9.09 08/10/07

Design CBR	7
Item 320	No
Global CS	No
Global LS	No

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	0	0	0	0	4	0	0	0	0
0.0%									100.0%								

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

N ₁ ≤ 5	100%
N ₁ ≤ 10	100%
N ₁ ≥ 20	0%
M+	100%
R	0%

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	

1	Total Borings	Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI
		Maximum	10.0	4.0	17.0	22.6	19.5	16.0	7.50
		Minimum	4	4	17	26	24	16	10
			33	16	17	26	22.6	48.6	5

I-70/I-71 West Interchange Ramp F4 W-07-109				Standard Penetration				Physical Characteristics				Moisture		Classification		Comments			
#	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

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

1	B-102	Ramp F4 Sta. 124+69	1 2 3 4	3.4 4.9 6.4 7.9	4.9 6.4 7.9 9.4	2.1		10 5 2 2	8 5 2 5	18 10 4 7	B	19 10 4 7	4	33	16	17	26	23	49	14 18 24 22	16 16 16 16	6b 6b 6b 6b	5 10	fill 2.1 feet no lab samples 2, 3, 4	
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

no undercut
upper 6.4 feet
soil 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	3	0	0	0	0	0			
0.0%									25%				75%				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%	100%

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

Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI
	16.0	11.0	14.0	26.8	13.4	13.0	
Maximum	19	11	31	17	14	25.5	26.8
Minimum	11	11	31	17	14	25.5	26.8

I-70/I-71 West Interchange Ramp F5 W-07-109		Standard Penetration				Physical Characteristics						Moisture		Classification		Comments						
#	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	Comments

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

1	B-104	Ramp F5 Sta. 798+57	1	27.5	29.0	26.5	10	9	19	A	19							9	10	4a		26.5 feet fill no lab samples for 1, 3, 4
			2	30.0	31.5		10	8	18		18	31	17	14	26	27	52	13	14	6a		
			3	32.5	34.0		4	7	11		11							22	14	6a		
			4	35.0	36.5		8	8	16		16	11						10	14	6a		
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

No undercut
upper 6 feet
of soil will
bridge
under 26.5
feet of fill

Subgrade Analysis

V. 9.09 08/10/07

Design
CBR
 Item 320 No
 Global CS No
 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	0	0	0	2	2	0	0	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 ₁ ≤ 5	100%
N ₁ ≤ 10	100%
N ₁ ≥ 20	0%
M+	100%
R	0%

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

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

Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI
8.8	4.0		15.5	27.4	19.4	15.0	
13	4	37	18	19	37.8	36.3	74.1
4	4	30	18	12	24.7	18.4	43.1
					17.7		14

I-70/I-71 West Interchange Ramp F6 W-07-109				Standard Penetration					Physical Characteristics					Moisture		Classification		Comments			
#	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	

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

1	B-105	Ramp F6 Sta. 328+90	1 2 3 4	6.8 9.3 11.8 14.3	8.3 10.8 13.3 15.8	5.8			3 2 4 4	5 2 9 6	8 4 13 10	B	8 4 13 10	4	37 30	18 18	19 12	38 25	36 18	74 43	21 18 18 21	16 16 14 14	6b 6b 6a 6a		fill 5.8 feet no lab samples 2, 4	
2																										
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										
11																										
12																										

	MN
	N
	MN
	MN

		14		2
				5
		12		1
				1

Undercut to 5.0 feet prior to 5.8 foot fill

Subgrade Analysis

V. 9.09 08/10/07

Design
CBR
Item 320
Global CS
Global LS

9
No
Option
No

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	5	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
63%		13%		75.0%						13%		25.0%					
0.0%																	

Class @ Surface	
2-5	0
4b	0
5	0
7-5	0
7-6	1
8a	0
8b	0
R	0

% Borings	
N ₁ ≤ 5	0%
N ₁ ≤ 10	50%
N ₁ ≥ 20	0%
M+	50%
R	0%

% Surface	
50%	
0%	50%
% Borings	
50%	
0%	50%

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

2 Total Borings

Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI
	27.5	10.5	16.0	23.9	9.8	8.0	2.67
Maximum	57	14	44	21	23	29.8	25
Minimum	7	7	24	15	9	8.7	22.8
					8.7	3	6

I-70/I-71 West Interchange Ramp G4 W-07-109				Standard Penetration				Physical Characteristics						Moisture		Classification		Comments			
#	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	

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

1	B-098-0	Ramp G4 Sta. 884+05	1A 2 3 4	2.0 3.5 5.0 7.0	3.5 5.0 6.5 8.5	1.0		E	14		44	21	23	24	25	49	21	18	7-6	8	fill 1 foot
									36		NP	NP	NP	12		12	6	6	1a	0	no lab sample 3, 4
									47								4	6	1a		
									43	14							3	6	1a		
2	B-100	Ramp G4 Sta. 892+50	1 2 3 4	8.0 9.5 11.0 12.5	9.5 11.0 12.5 14.0	6.5		B	9					9		9	4	6	1a		fill 6.5 feet
									7		NP	NP	NP	18		18	12	6	1a		no lab sample 1
									7		NP	NP	NP	30	23	53	15	10	4a		
									57	7	24	15	9								
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					

No undecut under 6.5 feet of fill

Subgrade Analysis
V. 9.09 08/10/07

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

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	2	0	1	2	0	1	0	1	0	0	1	0	0	0	0	0
	25%		13%		25%		13%		13%		13%		25.0%				
0.0%	75.0%																

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

N ₁ ≤ 5	0%
N ₁ ≤ 10	100%
N ₁ ≥ 20	0%
M+	50%
R	0%

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

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

2 Total Borings

Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI			
15.5	8.0	8.0	13.1	11.0	9.4	1.13				
50	8	31	18	14	38.4	28.3	61.7	15	14	
Minimum	8	8	20	15	2	11.7	6.6	18.3	6.5	6

I-70/I-71 West Interchange Ramp G5 W-07-109		Standard Penetration			Physical Characteristics								Moisture		Classification		Comments					
#	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
	N
	N MN

LS	CS	UC Class	UC MN
	14		2
	14		2
	12		1

Analysis

1	B-135	Ramp G5 Sta. 162+07	1	0.0	1.0	-1.5	8	5	13	B	13	27	17	10	17	12	29	10	10	2-4	0	cut 1.5 feet	
			2	1.0	2.5		4	4	8		8	23	18	5	12	7	18	7	6	1b	0		
			3	2.5	4.0		9	2	11		11	20	18	2	13	8	21	7	6	1b	0		
			4	4.0	5.5		5	5	10		10	28	15	13	19	14	32	12	10	2-6	1		
2	B-139	Ramp G5 Sta. 170+00	1	0.0	1.5	-1.5	23	25	48	B	50	31	17	14	33	28	62	15	14	6a	7	cut 1.5 feet	
			2	1.5	3.0		8	6	14		14	NP	NP	NP	28		28	10	8	3a	0		
			3	3.0	4.5		6	2	8		8	NP	NP	NP	38		38	14	11	4a	1		
			4	4.5	6.0		4	6	10		10	22	18	4	22	10	32	15	10	2-4	0		
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Undercut to 3 feet
undercut maximum of 6.0 feet

Subgrade Analysis
V. 9.09 08/10/07

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

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	4	0	0	1	0	0	0	0	0	0	0	1	0	2	0	0
		50%			13%						13%			25%			
0.0%		62.5%						37.5%									

Class @ Surface	
2-5	0
4b	0
5	0
7-5	0
7-6	1 50%
8a	0
8b	0
R	0

% Borings	
N _L ≤ 5	0%
N _L ≤ 10	0%
N _L ≥ 20	0%
M+	50%
R	0%

% Surface	
50%	
0%	50%
% Borings	
50%	
50%	50%
0%	50%

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

Average		N ₆₀	N _L	PI			Clay			M	M _{OPT}	GI
24.6		12.0	19.7	37.8			13.6			11.1	5.14	
Maximum		53	13	42	24	21	44.5	48.9	93.4	24.9	21	
Minimum		11	11	39	18	18	17.1	12	17.1	5.2	6	

2 Total Borings

I-70/I-71 West Interchange Ramp H1 W-07-109					Standard Penetration				Physical Characteristics					Moisture		Classification		Comments			
#	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	

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

1	B-136	Ramp H1 Sta. 162+5	1 2 3 4	0.3 1.8 3.3 4.8	1.8 3.3 4.8 6.3	-0.7	7 7 6 5	7 7 6 6	14 14 12 11	B	14	42 41 39 NP	24 21 18 NP	18 20 21 NP	45 42 38 17	49 47 43 17	93 89 80 17	25 24 21 9	21 18 16 6	7-6 7-6 6b 1b	12 12 12 0	cut 0.7 feet	
2	B-138	Ramp H1 Sta. 166+11	1 2 3 4	1.1 2.6 4.1 5.6	2.6 4.1 5.6 7.1	-0.1	20 7 18 22	18 6 22 29	38 13 40 51	B	39	NP NP NP NP	NP NP NP NP	NP NP NP NP	17 21 19 22	12 12 19 22	29 21 19 22	13 7 5 5	10 6 6 6	2-4 1b 1b 1b	0 0 0 0	cut 0.1 feet	
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

	MN
	MN
	MN
	MN

				1
12				1
12				1
	12			1

Undercut maximum of 6 feet

Subgrade Analysis

V. 9.09 08/10/07

Design	
CBR	
Item 320	Option
Global CS	Option
Global LS	No

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	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0
38%		13%		50.0%						25%		25%					
0.0%		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 ₁ ≤ 5	0%
N ₁ ≤ 10	50%
N ₁ ≥ 20	50%
M+	0%
R	0%

% Surface	
0%	
0%	0%
% Borings	
50%	
0%	50%

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

2	Total Borings	Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI
		Maximum	26.6	16.0	11.0	26.2	8.4	9.0	
		Minimum	59	24	33	18	15	39.4	30
			8	8	21	15	6	11.6	18.9
								11.6	3.7
									6

I-70/I-71 West Interchange Ramp H2 W-07-109				Standard Penetration				Physical Characteristics						Moisture		Classification		Comments			
#	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	

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

1	B-126	Ramp H2 Sta. 781+20	1 2 3 4	40.0 42.5 45.0 47.5	41.5 44.0 46.5 49.0	39.0			20 27 15 9	22 30 10 14	42 57 25 23	B	43 59 26 24	24	NP NP NP	NP NP NP	13 12	13 12	4 7 4 4	6 6 6 6	1a 1a 1a 1b	fill 39.0 feet bridge section no lab sample 2,4				
2	B-129	Ramp H2 Sta. 777+80	1 2 3 4	31.2 33.7 35.2 36.7	32.7 35.2 36.7 38.2	30.2			5 12 8 4	5 10 11 4	10 22 19 8	B	10 23 20 8	8			21 28 33	15 16 18	6 12 15	32 39 29	19 30 30	51 69 59	9 14 17	10 14 14	4a 4a 6a 6a	fill 30.2 feet bridge section no lab sample 1
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										
11																										
12																										

No undercut under 30 feet of fill

Subgrade Analysis

V. 9.09 08/10/07

Design
CBR
 Item 320 No
 Global CS Option
 Global LS No

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	2	0	0	2	0	0	0	0	0
0.0%									50%				50%				
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 ₁ ≤ 5	0%
N ₁ ≤ 10	100%
N ₁ ≥ 20	0%
M+	0%
R	0%

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

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

Total Borings		Average		N ₆₀	N _L	PI		Clay		M	M _{OPT}	GI	
1		15.3	8.0	15.3	8.0	11.0	26.3	13.3	12.0				
		23	8	33	18	15	39	30	69	17	14		
		8	8	21	15	6	29	19	51	9	10		

I-70/I-71 West Interchange Ramp H4 W-07-109				Standard Penetration				Physical Characteristics						Moisture		Classification		Comments			
#	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	

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

1	B-129	Ramp H4 Sta. 766+80	1 2 3 4	30.2 33.7 35.2 36.7	32.7 35.2 36.7 38.2	30.2			5 12 8 4	5 10 11 4	10 22 19 8	B	10 23 20 8	8	8	21 28 33	15 16 18	6 12 15	32 39 29	19 30 30	51 69 59	9 14 17	10 10 14 14	4A 4A 6A 6A		fill 30.2 feet bridge section no lab sample 1	
2																											
3																											
4																											
5																											
6																											
7																											
8																											
9																											
10																											
11																											
12																											

No undercut under 30 feet of fill soils

Subgrade Analysis
V. 9.09 08/10/07

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

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	2	0	0	0	0	0	0	0	2	0	0	4	0	0	0	0	0
0.0%									25.0%				75.0%				

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

N _i ≤ 5	0%
N _i ≤ 10	50%
N _i ≥ 20	0%
M+	50%
R	0%

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

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

Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI
	15.8	10.0	11.7	25.4	11.5	11.0	4.13
Maximum	30	12	33	18	15	39.4	30.3
Minimum	8	8	21	14	6	6.5	18.9

2 Total Borings

I-70/I-71 West Interchange Ramp H7 W-07-109					Standard Penetration				Physical Characteristics					Moisture		Classification		Comments			
#	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
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LS	CS	UC Class	UC MN
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Analysis

1	B-129	Ramp H7 Sta. 134+99	2	0.0	0.8	-4.2	12	10	22	B	23	21	15	6	32	19	51	9	10	4a	3	cut 4.2 feet
			3	0.8	2.3		8	11	19		20	28	16	12	39	30	69	14	14	6a	8	
			4	2.3	3.8		4	4	8		8	33	18	15	29	30	59	17	14	6a	7	
			5	3.8	5.3		4	4	8	8	8	31	17	14	32	30	62	15	14	6a	7	
2	B-132	Ramp H7 Sta. 139+46	1	0.0	1.0	-1.5	14	15	29	B	30	NP	NP	NP	7		7	2	6	1a	0	cut 1.5 feet
			2	1.0	2.5		6	6	12		12	NP	NP	NP	13		13	3	6	1a	0	
			3	2.5	4.0		6	7	13		13	30	17	13	33	19	52	13	14	6a	5	
			4	4.0	5.5		5	7	12	12	12	24	14	10	25	24	49	19	10	4a	3	
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

undercut to 6 feet to remove weak soils
no undercut upper 4 feet of 1a and 6a soil will bridge

Subgrade Analysis
V. 9.09 08/10/07

Design CBR **7**
Item 320 **No**
Global CS **Option**
Global LS **No**

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	2	0	0	0	0	0	0	1	0	0	0	6	0	2	0	0		
8%		17%		25.0%								75.0%							

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

% Borings	
N ₁ ≤ 5	33%
N ₁ ≤ 10	100%
N ₁ ≥ 20	0%
M+	100%
R	0%

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

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

3 Total Borings		Average	N ₆₀	N _L	PI	Clay	M	M _{OPT}	GI			
		11.8	6.0	17.6	30.2	18.7	13.8	5.92				
		Maximum	20	9	41	21	22	47.8	47.2	94.6	27	18
		Minimum	3	3	31	15	10	8.9	8.5	8.9	4.8	6

I-70/I-71 West Interchange Ramp K2 W-07-109																			
#	B #	Boring Location	Depth To	Cut Fill	Standard Penetration					Physical Characteristics					Moisture		Classification		Comments
					n ₂	n ₃	N _m	Rig	N ₆₀	N _L	LL	PL	PI	% Silt	% Clay	P 200	M	M _{OPT}	

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

Analysis

1	B-090	Ramp K2 Sta. 194+40	1 2 3 4	0.0 1.0 2.5 4.0	1.0 2.5 4.0 5.5	-1.5	11 4 6 5	6 5 7 9	17 9 13 14	A	17 9 13 14	9	NP 41 40 37	NP 21 20 19	NP 20 20 18	20 48 45 44	20 47 47 44	12 27 23 23	6 18 16 16	1b 7-6 6b 6b	0 12 12 11	cut 1.5 feet	
2	B-093	Ramp K2 Sta. 198+0	1 2 3 4	0.4 1.9 3.4 4.9	1.9 3.4 4.9 6.4	-0.6	3 6 6 8	3 4 5 11	6 10 11 19	B	6 10 11 20	6	35 33 34 41	17 17 16 19	18 16 18 22	27 23 24 43	26 19 22 42	53 42 47 23	21 18 16 18	16 16 16 13	7 3 5 13	cut 0.6 feet	
3	B-097	Ramp K2 Sta. 209+00	1 2 3 4	0.0 1.0 2.5 4.0	1.0 2.5 4.0 5.5	-2.0	7 8 7 1	6 6 5 2	13 14 12 3	B	13 14 12 3	3	31 NP NP 31	21 NP NP 15	10 NP NP 16	31 13 9 23	20 9 9 26	51 22 5 50	20 9 6 25	16 6 6 16	4a 1b 1a 6b	3 0 0 5	cut 1.97 feet
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

	M				1
	MN	14			2
	MN	12			1
	MN		12		1
	MN		16		3
	MN		12		1
	M				1
	MN		12		1
	MN		--		5

undercut to 5.5 feet

undercut to maximum depth of 6 feet

undercut 1 foot no undercut at 4'. upper 1b and 1a soils will bridge

Subgrade Analysis

V. 9.09 08/10/07

Design CBR
Item 320 No
Global CS Option
Global LS No

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	0	0	0	3	1	0	0	0	0
												75%		25%			
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 ₁ <= 5	0%
N ₁ <= 10	100%
N ₁ >= 20	0%
M+	100%
R	0%

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

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

Total Borings		N ₆₀		N _L		PI		Clay		M		M _{OPT}		GI	
Average	Maximum	Minimum	14.0	10.0	14.5	27.5	18.0	14.5	18.0	14.5	18.0	14.5	18.0	14.5	18.0
1	18	10	33	19	15	48.3	33.8	82.1	24	16	18.0	14.5	18.0	14.5	18.0
1	10	10	32	17	14	25.9	21.2	47.1	14	14	14	14	14	14	14

I-70/I-71 West Interchange Ramp M1 W-07-109															Standard Penetration		Physical Characteristics					Moisture		Classification		Comments
#	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					

1	B-016-2	Ramp M1 Sta. 612+00	1	10.4	11.9	9.4	5	5	10	B	10	33	19	14	48	34	82	17	14	6a		fill 9.44 feet
			2	12.9	14.4		8	8	16		17	32	17	15	26	21	47	14	14	6a		no lab samples 3,4
			3	15.4	16.9		5	12	17		18							17	14	6a		
			4	17.9	19.4		4	7	11		11							24	16	6b		
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

Problem	
w/ Class	w/ MN

Treatments			
LS	CS	UC Class	UC MN

Analysis

no undercut soils under 9.4 feet fill

APPENDIX E

BORING LOGS

I-70/I-71 WEST INTERCHANGE

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-001-0

Location: Sta. 514+43.93, 10.87 ft Rt. of Ramp D1 BL

Date Drilled: 9/9/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Drive Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ●			
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay		
1.0	713.9	12	3	1			Asphalt Concrete - 2" Portland Cement Concrete - 10"		50	21	--	13	10	6			
2.5	712.4	50/2				2.25	POSSIBLE FILL: Very dense brown GRAVEL WITH SAND (A-1-b), trace to little silt, trace clay; damp.		12	12	--	17	20	39			
4.0	710.9	14	5	2			POSSIBLE FILL: Very stiff brown CLAY (A-7-6), some fine to coarse sand, little gravel; damp.		78	5	--	9	--	8			
5.5	709.4	8	2	3			@ 2.5', encountered obstruction; offset boring 20 feet west and resumed sampling.		26	16	--	17	18	23			
7.0	707.9	9	3	4			POSSIBLE FILL: Medium dense brown GRAVEL (A-1-a), little to some fine to coarse sand, trace to little silt; damp.										
							POSSIBLE FILL: Medium dense brown SILT AND CLAY (A-6a), some fine to coarse sand, some gravel; damp.										
							Bottom of Boring - 7.0'										

10

15

20

25

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-001-1 Location: Sta. 518+50.99, 13.18 ft Rt. of Ramp D1 BL

Date Drilled: 9/9/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Drive	Press / Core	Hand Penetro-meter (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	DESCRIPTION	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Plasticity Index - ○					
											% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay				
0.3	728.8																				
	728.5																				
		12			1		2.5			Very stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, little to some gravel, contains roots; damp.											
		11	18																		
		10			2		3.5														
		8	13																		
4.0	724.8	16																			
		12			3		2.0			Stiff to very stiff brown CLAY (A-7-6), some fine to coarse sand, little gravel; damp.											
		10	9																		
		15			4					Dense brown COARSE AND FINE SAND (A-3a), some gravel, trace silt; damp.											
		20	15																		
		19			5		4.0			Very stiff to hard brown SANDY SILT (A-4a), trace to little gravel; damp.											
8.5	720.3	50/3	3																		
8.8	720.0																				
										Bottom of Boring - 8.8'											



Client: ms consultants
LOG OF: Boring B-001-6
 Location: Sta. 526+14.34, 8.67 ft Lt. of Ramp A1 BL

Date Drilled: 8/31/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive / Core	Hand Penetro- meter (tsf)	DESCRIPTION	Graphic Log	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % -			
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		LL	PL	Non-Plastic - NP
1.0	752.5																
2.0	751.5	7	9	1	4.5+	Asphalt Concrete - 3"	[Cross-hatched]		10	10	---	18	38	24			
3.0		8	10	2	4.5+	Portland Cement Concrete - 9"	[Horizontal lines]		11	11	---	18	37	23			
4.0		11	12	3	4.0	Hard brown SANDY SILT (A-4a), some fine to coarse sand, trace to little gravel; damp.	[Diagonal lines]		9	12	---	18	36	25			
5.0		12	13														
6.0		7	10	4	4.0												
7.0		7	10														
8.5	744.0																
9.0		3															
10.0	742.5	2	7	5	1.5	Stiff brownish gray SILT and CLAY (A-6a), trace fine to coarse sand, trace to little gravel; damp to moist.	[Diagonal lines]										
15.0																	
20.0																	
25.0																	

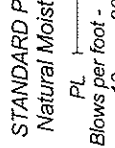
Bottom of Boring - 10.0'

LOG OF: Boring B-002

Location: Sta. 530+53.16, 12.62 ft Lt. of Ramp A1 BL

Date Drilled: 8/31/2009

Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.	Drive Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP			
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		PL	LL	
1.1	767.6						Asphalt Concrete - 3"	15	11	---	14	32	28				
3.5	766.5	4	11	1		3.75	Portland Cement Concrete - 10"										
	764.1	9	11	2		4.5+	FILL: Very stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; contains asphalt fragments; damp.										
		11	18				FILL: Hard brown SANDY SILT (A-4a), some fine to coarse sand; trace to little gravel, damp.										
8.5	759.1	7	15	3		4.5+		9	12	---	15	37	27				
10.0	757.6	9	18	4		3.75	FILL: Very stiff brown SILTY CLAY (A-6b), little to some gravel, little fine to coarse sand; contains asphalt fragments; damp.										
		12					Bottom of Boring - 10.0'										



Client: ms consultants

Project: FRA-70-8.93

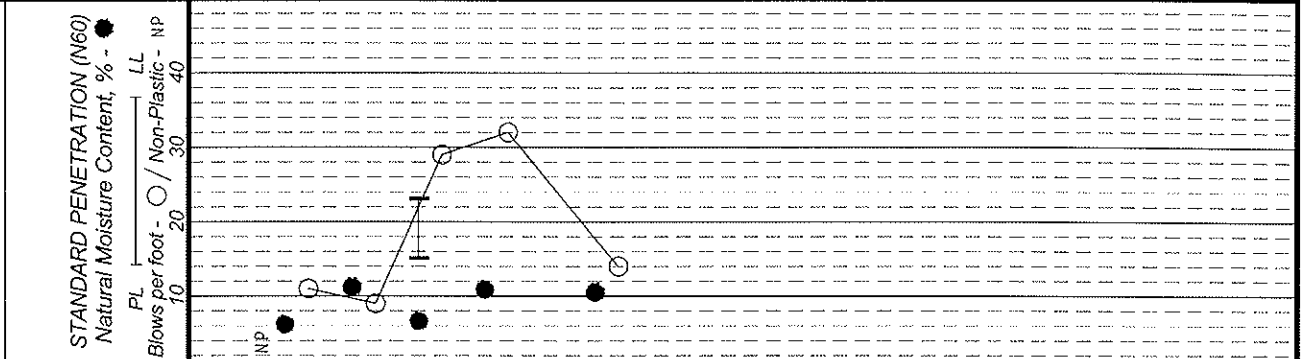
Job No. 0221-1004.01

LOG OF: Boring B-003

Location: Sta. 634+51.82, 54.64 ft Lt. of I-70 CL

Date Drilled: 9/9/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % -					
							% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		PL	LL			
1.3	759.0					Asphalt Concrete - 9" Aggregate Base 6"												
3.0	757.3	19 5 6	10	1		FILL: Loose to medium dense brown GRAVEL (A-1-a), some fine to coarse sand, little silt; damp.	56	23	---	10	---	11						
5.0		9 4 5	4	2		FILL: Stiff brown SANDY SILT (A-4a), "and" gravel, some fine to coarse sand; damp.	36	13	---	13	---	15						
7.0		9 19	18	3		@ 4.5'-6.0', contains brick fragments.												
10.0	750.3	25 15 16	18	4														
		6 7	7	5		Bottom of Boring - 10.0'												



GRADATION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	56	23	---	10	---	11
	36	13	---	13	---	15

Graphic Log

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

FIELD NOTES:

Asphalt Concrete - 9"
Aggregate Base 6"

FILL: Loose to medium dense brown GRAVEL (A-1-a), some fine to coarse sand, little silt; damp.

FILL: Stiff brown SANDY SILT (A-4a), "and" gravel, some fine to coarse sand; damp.

@ 4.5'-6.0', contains brick fragments.

Bottom of Boring - 10.0'

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

LOG OF: Boring B-004 Location: Sta. 639+95.8, 54.87 ft Lt. of I-70 CL Date Drilled: 9/9/2009

Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP							
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay						
751.4																				
1.5	749.9					Asphalt Concrete - 8" Aggregate Base - 10"	[Cross-hatched]													
3.0	748.4	4 5 6 12		1	2.0	Stiff brown SILTY CLAY (A-6b), some fine to coarse sand, trace gravel; damp.	[Horizontal lines]	9	11	---	14	32	34							
4.5	746.9	9 12 10 10		2	3.0	Very stiff brown SANDY SILT (A-4a), little gravel; damp.	[Vertical lines]	17	14	---	18	29	22							
5.5	745.4	8 8 18		3	2.25	Very stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; damp.	[Diagonal lines]	15	12	---	17	31	25							
7.5	743.9	4 5 5 13		4	2.5	Bottom of Boring - 7.5'	[Diagonal lines]	12	15	---	18	32	23							

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-005-1 Location: Sta. 642+37.60, 9.86 ft Rt. of Ramp C1 BL Date Drilled: 9/9/2009

Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % -						
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		PL	LL				
1.0	707.4																			
3.0	704.4	10	4	1	--		Asphalt Concrete - 3" Portland Cement Concrete - 9"	47	25	--	12	--	16							
4.5	702.9	5	2	2	--		POSSIBLE FILL: Loose to medium dense brown GRAVEL WITH SAND (A-1-b), little silt; moist.	21	24	--	16	20	19							
6.0	701.4	5	3	3	0.5		POSSIBLE FILL: Medium stiff brown SILT AND CLAY (A-6a), "and" fine to coarse sand, some gravel; damp. Soft to medium stiff dark brown CLAY (A-7-6), some fine to coarse sand, trace gravel; contains trace organic material; moist.	2	5	--	17	45	31							
8.8	698.6	50/3	3	4			Gray LIMESTONE fragments.													
10				5			Bottom of Boring - 8.8'													

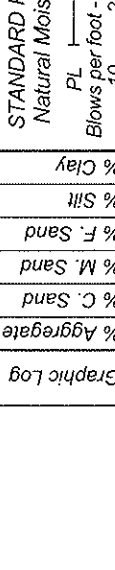


LOG OF: Boring B-005-3

Location: Sta. 649+79.81, 7.42 ft Rt. of Ramp C1 BL

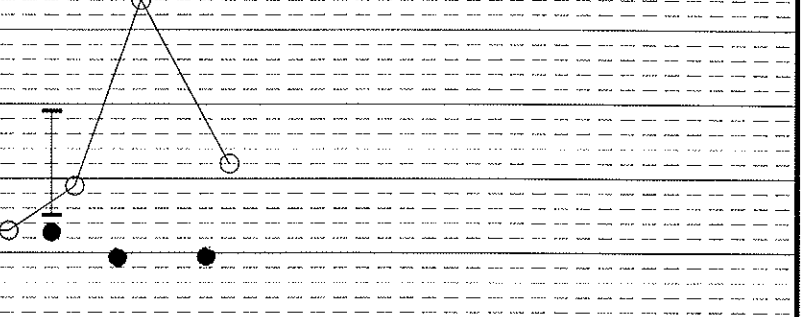
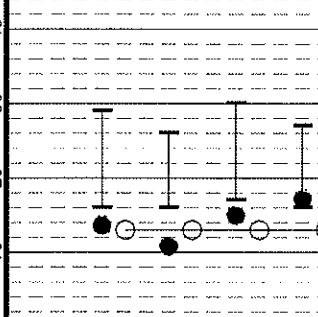
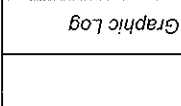
Date Drilled: 9/9/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetro-meter (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP	
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay
1.5	710.8								2	5	13	36	44		
3.0	709.3	5	13	1	4.5+		Asphalt Concrete - 2" Portland Cement Concrete - 10" Aggregate Base - 6"		18	16	20	28	18		
5.0		7	18	2	--		Hard brown SILTY CLAY (A-6b), little fine to coarse sand, trace gravel; damp.		19	18	21	23	19		
		11	18	3	--		Very stiff to hard brown SANDY SILT (A-4a), little gravel; damp.		18	14	23	26	19		
		15	18	4	4.5+										
		12	14	18											
		2		5	2.5		@ 8.5'-10.0', dark brown.								
10.0	702.3	6	16												
		9													
							Bottom of Boring - 10.0'								
15.0															
20.0															
25.0															

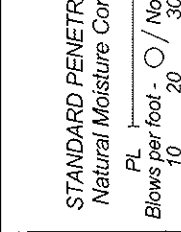


LOG OF: Boring B-006-0 Location: Sta. 647+57.29, 45.02 ft Lt. of I-70 CL Date Drilled: 9/9/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % -			
							% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		PL	LL	
1.5	729.9	5			3.5	Asphalt Concrete - 4" Portland Cement Concrete - 9" Aggregate Base - 5"	8	13	---	16	30	33				
3.0	728.4	8	13	1	2.5	Very stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; damp.	27	21	---	14	20	18				
4.5	726.9	7	18	2	2.0	Very stiff brown SANDY SILT (A-4a), some fine to coarse sand, some gravel; damp.	16	12	---	14	29	29				
5.5		6	17	3	2.0	Very stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, trace to little gravel; damp to moist.	6	11	---	14	34	35				
6.5		7	13	4	4.0		9	12	---	15	33	31				
8.0		6	18	5	4.0											
10.0	720.4	14	18	6												
11.0	720.4	29	18	7		Medium dense brown SANDY SILT (A-4a), some gravel; contains rock fragments; damp.										
12.5	718.9	15	13			Bottom of Boring - 12.5'										
15.0																
20.0																
25.0																



Client: ms consultants		Project: FRA-70-8.93		Job No. 0221-1004.01														
LOG OF: Boring B-006-1		Location: Sta. 549+02.00, 10.42 ft Rt. of Ramp B1 BL		Date Drilled: 8/31/2009														
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP					
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay				
1.0	711.7	7				Asphalt Concrete - 3"	[Hatched Pattern]	33	16	---	17	19	15					
2.5	710.2	15	10	1		Portland Cement Concrete - 9"	[Vertical Lines]											
		8				FILL: Medium dense brown SANDY SILT (A-4a), some fine to coarse sand, some gravel; contains asphalt and rock fragments; damp. Medium dense to dense brown and gray GRAVEL WITH SAND (A-1-b), some silt; damp. @ 8.5'-10.0', very dense.												
		22	18	2														
		25																
		46	18	3														
		26																
		18																
		11																
		17	12	4														
		6																
		27																
		47	14	5														
10.0	702.7	28				Bottom of Boring - 10.0'												



Client: ms consultants

Job No. 0221-1004.01

Project: FRA-70-8.93

Date Drilled: 8/31/2009

Location: Sta. 650+87.85, 44.45 ft. of I-70 CL

LOG OF: Boring B-007

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetro-meter (tsf)	FIELD NOTES:	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP						
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay					
1.5	723.1						Asphalt Concrete - 4" Portland Cement Concrete - 11" Aggregate Base - 3"													
4.5	718.6	7, 6, 8, 5, 6, 7	3, 5	1, 2	4.5+, 1.5		Hard brown SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp. @ 3.0'-4.5', stiff, some gravel.													
6.0	717.1	4, 10, 25	18	3	4.0		Very stiff to hard brown SILTY CLAY (A-6b), some fine to coarse sand, little gravel; damp.													
7.5	715.6	17, 13, 7	18	4	3.75		Very stiff brown SANDY SILT (A-4a), "and" fine to coarse sand, little gravel; damp.													
							Bottom of Boring - 7.5'													

Client: ms consultants

Project: FRA-70-8.93

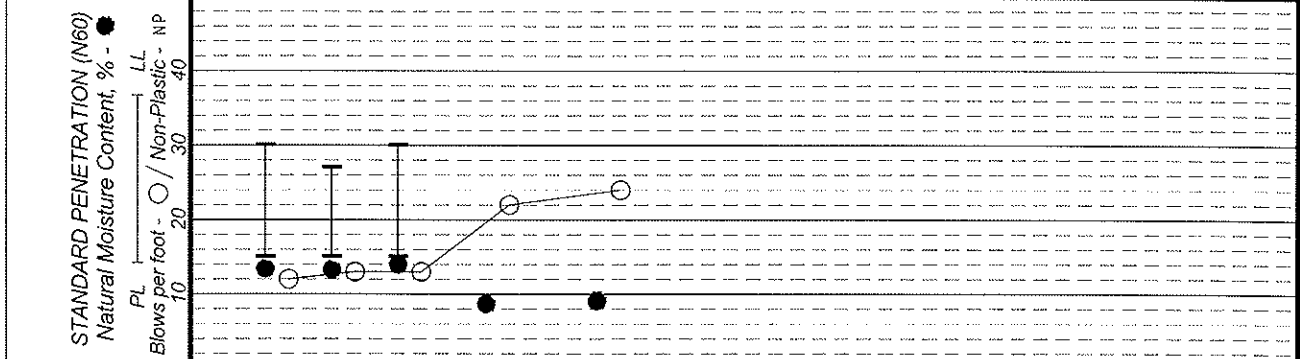
Job No. 0221-1004.01

LOG OF: Boring B-009

Location: Sta. 659+59.27, 61.71 ft Rt. of I-70 CL

Date Drilled: 8/31/2009

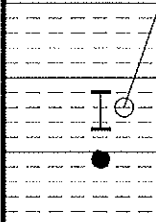
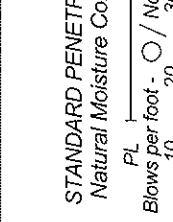
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive / Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ●			
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay		
1.4	726.0							6	7	---	14	37	36			
5.0		7 5	7	1	4.5+	Asphalt Concrete - less than 1" Portland Cement Concrete - 10" Aggregate Base - 6"										
6.0		6 7	18	2	2.5	Very stiff to hard brown SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; damp.		6	10	---	17	36	31			
8.5		5 8	18	3	2.25	@ 4.0'-5.5', some gravel. @ 4.5'-5.5', sand seam.		23	8	---	12	30	27			
10.0		10 12	12	4	4.0											
10.0	716.0	11 13	18	5	4.0	@ 8.5'-10.0', contains rock fragments.										
						Bottom of Boring - 10.0'										



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

LOG OF: Boring B-010 Location: Sta. 663+51.19, 49.61 ft. of I-70 CL Date Drilled: 9/9/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, %	
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay
1.5	727.0					Asphalt Concrete - 4" Portland Cement Concrete - 10" Aggregate Base - 4"	[Pattern]	25	26	---	20	16	13	
2.0	725.5	5		1		POSSIBLE FILL: Medium dense to dense brown GRAVEL WITH SAND AND SILT (A-2-4), little clay; damp.	[Pattern]	29	25	---	18	16	12	
3.0		14		2			[Pattern]	23	29	---	22	14	12	
4.0		19		3			[Pattern]	6	10	---	19	34	31	
5.0	721.0	25		4			[Pattern]	18	16	---	16	25	25	
6.0		21		5	4.5+	Hard gray SANDY SILT (A-4a), little to some gravel; damp to moist.	[Pattern]	18	16	---	16	25	25	
7.0		10		6			[Pattern]	6	10	---	19	34	31	
8.0		10		7			[Pattern]	18	16	---	16	25	25	
9.0		17			4.5+	Dense brown GRAVEL WITH SAND (A-1-b), little silt; damp.	[Pattern]	18	16	---	16	25	25	
10.0		24					[Pattern]	18	16	---	16	25	25	
11.0	716.0	18				Bottom of Boring - 12.5'	[Pattern]	18	16	---	16	25	25	
12.0		17					[Pattern]	18	16	---	16	25	25	
13.0		18					[Pattern]	18	16	---	16	25	25	
14.0		17					[Pattern]	18	16	---	16	25	25	
15.0		22					[Pattern]	18	16	---	16	25	25	
16.0		20					[Pattern]	18	16	---	16	25	25	
17.0		22					[Pattern]	18	16	---	16	25	25	
18.0		20					[Pattern]	18	16	---	16	25	25	
19.0		20					[Pattern]	18	16	---	16	25	25	
20.0		20					[Pattern]	18	16	---	16	25	25	
21.0		20					[Pattern]	18	16	---	16	25	25	
22.0		20					[Pattern]	18	16	---	16	25	25	
23.0		20					[Pattern]	18	16	---	16	25	25	
24.0		20					[Pattern]	18	16	---	16	25	25	
25.0		20					[Pattern]	18	16	---	16	25	25	



Water seepage at: None
Water level at completion: None

FIELD NOTES:

Bottom of Boring - 12.5'

Client: ms consultants

Project: FRA-70-8.93

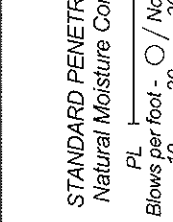
Job No. 0221-1004.01

LOG OF: Boring B-012

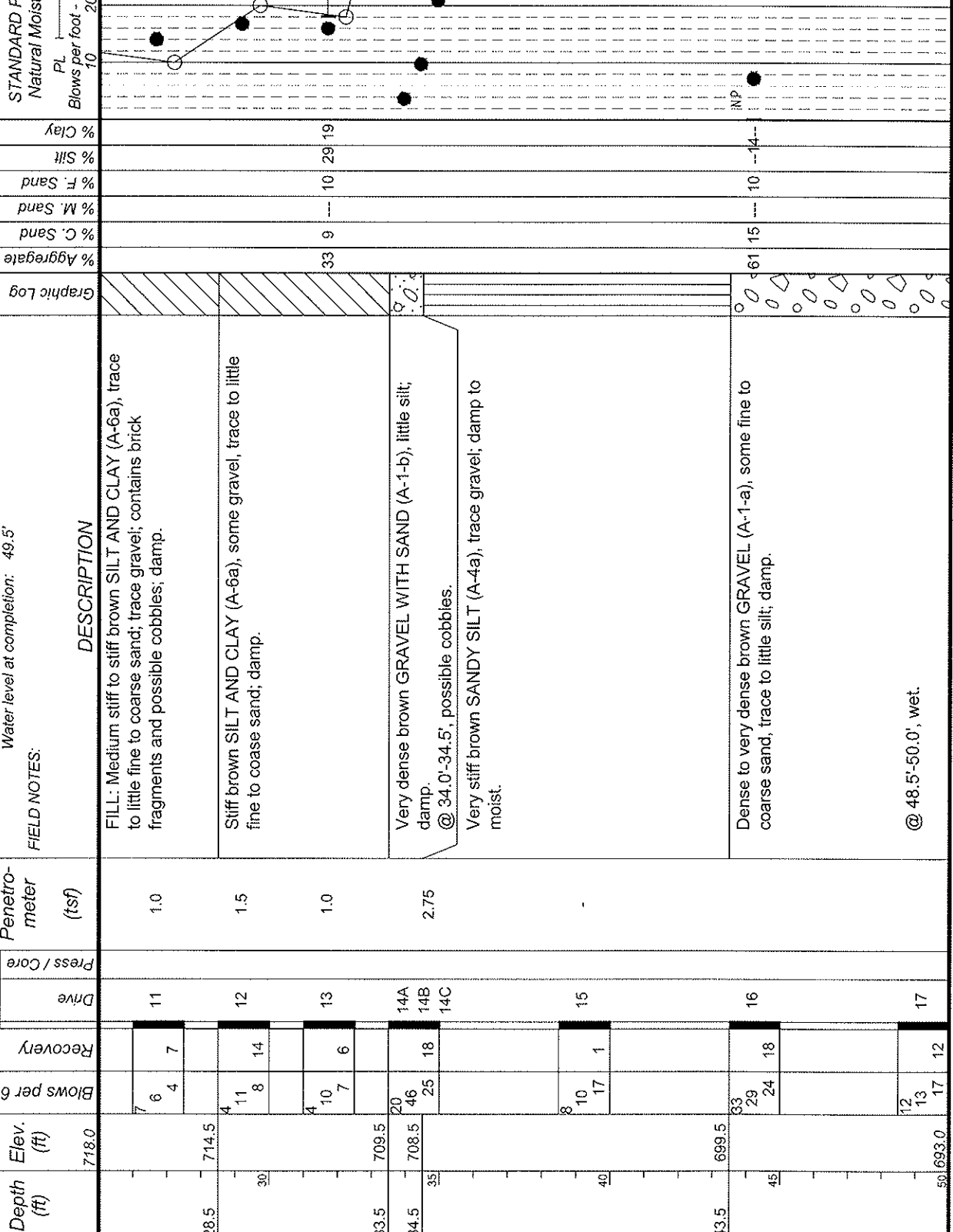
Location: Sta. 671+56.66, 41.70 ft Lt. of I-70 CL

Date Drilled: 9/8/2009 to 9/9/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % -			
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	PL	LL
1.5	718.6					Asphalt Concrete - 4" Portland Cement Concrete - 12" Aggregate Base - 2"	[Hatched Pattern]	15	14	---	18	28	25			
3.0	715.6	5, 7, 11, 11		1	2.5	Very stiff gray SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; damp.	[Dotted Pattern]	42	20	---	15	11	12			
4.5	714.1	5, 9, 22, 16		2	4.0	Dense brown GRAVEL WITH SAND (A-1-b), little silt, little clay; damp.	[Dotted Pattern]	19	20	---	15	27	19			
6.0	712.6	5, 19, 12, 18		3	4.5+	Very stiff to hard brown SANDY SILT (A-4a). some fine to coarse sand, little gravel; damp.	[Dotted Pattern]									
11.0	707.6	8, 7, 8, 18		4	3.5	Very stiff to hard brown SILT AND CLAY (A-6a), little fine to coarse sand, trace to little gravel; damp.	[Dotted Pattern]									
15.0	703.6	1, 2, 4, 17		5		Medium dense to dense brown GRAVEL WITH SAND (A-1-b), little silt; damp.	[Dotted Pattern]									
15.0	703.6	15, 14, 12, 18		6												
15.0	703.6	12, 22, 22, 18		7												
20						Bottom of Boring - 15.0'										
25																



Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.	Hand Penetrometer (tsf)	FIELD NOTES	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - Blows per foot - ○ / Non-Plastic - NP							
							% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay								
718.0																				
28.5	714.5	7, 6, 4	7	11	1.0	FILL: Medium stiff to stiff brown SILT AND CLAY (A-6a), trace to little fine to coarse sand; trace gravel; contains brick fragments and possible cobbles; damp.														
30		11, 8	14	12	1.5	Stiff brown SILT AND CLAY (A-6a), some gravel, trace to little fine to coarse sand; damp.														
33.5	709.5	10, 7	6	13	1.0		33	9		10	29	19								
34.5	708.5	20, 46, 25	18	14A, 14B, 14C	2.75	Very dense brown GRAVEL WITH SAND (A-1-b), little silt; damp. @ 34.0'-34.5', possible cobbles. Very stiff brown SANDY SILT (A-4a), trace gravel; damp to moist.														
40		8, 10, 17	1	15	-															
43.5	699.5	33, 29, 24	18	16		Dense to very dense brown GRAVEL (A-1-a), some fine to coarse sand, trace to little silt; damp.	61	15		10	--	14								
50	693.0	12, 13, 17	12	17		@ 48.5'-50.0', wet.														



Client: ms consultants
 Project: FRA-70-8.93

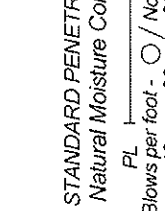
Job No. 0221-1004.01

LOG OF: Boring B-016-2
 Location: Sta. 611+18.31, 21.66 ft Rt. of Ramp M1 BL
 Date Drilled: 9/25/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive / Core	Hand Penetro- meter (tsf)	FIELD NOTES: Water seepage at: 48.5' Water level at completion: 49.5'	WATER OBSERVATIONS:	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP LL 30 40 PL 10 20 30 40										
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay											
55.0	693.0	8 13 17	30	18		Dense brown COARSE AND FINE SAND (A-3a), trace gravel, trace to little silt; wet.																		
						Bottom of Boring - 55.0'																		

Graphic Log

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															
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	FIELD NOTES:	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP									
							% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay								
1.8	735.9	5	6	1	2.5	Asphalt Concrete - 6" Portland Cement Concrete - 11" Aggregate Base - 4" Very stiff brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; moist.															
3.5	734.2	2	8	2		Loose to medium dense brown GRAVEL WITH SAND (A-1-b), trace silt; damp.															
6.5	731.2	3	3	3		Medium stiff to stiff brown SILTY CLAY (A-6b), trace to little fine to coarse sand, trace gravel; damp to moist.															
9.5	728.2	4	5	4		Stiff to very stiff gray CLAY (A-7-6), trace fine to coarse sand, trace gravel; moist.															
13.5	724.2	5	6	5		Stiff brown and gray SILTY CLAY (A-6b), little fine to coarse sand, little gravel; moist.															
15.0	722.7	9	16	8	1.5	Bottom of Boring - 15.0'															



GRADATION				
% Aggregate	40	47	---	6
% C. Sand	44	43	---	5
% M. Sand	3	9	---	10
% F. Sand	---	---	---	---
% Silt	---	---	---	33
% Clay	---	---	---	45

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

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

DESCRIPTION

Asphalt Concrete - 6"
Portland Cement Concrete - 11"
Aggregate Base - 4"
Very stiff brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; moist.

Loose to medium dense brown GRAVEL WITH SAND (A-1-b), trace silt; damp.

Medium stiff to stiff brown SILTY CLAY (A-6b), trace to little fine to coarse sand, trace gravel; damp to moist.

Stiff to very stiff gray CLAY (A-7-6), trace fine to coarse sand, trace gravel; moist.

Stiff brown and gray SILTY CLAY (A-6b), little fine to coarse sand, little gravel; moist.

Bottom of Boring - 15.0'

Graphic Log

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

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

DESCRIPTION

Asphalt Concrete - 6"
Portland Cement Concrete - 11"
Aggregate Base - 4"
Very stiff brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; moist.

Loose to medium dense brown GRAVEL WITH SAND (A-1-b), trace silt; damp.

Medium stiff to stiff brown SILTY CLAY (A-6b), trace to little fine to coarse sand, trace gravel; damp to moist.

Stiff to very stiff gray CLAY (A-7-6), trace fine to coarse sand, trace gravel; moist.

Stiff brown and gray SILTY CLAY (A-6b), little fine to coarse sand, little gravel; moist.

Bottom of Boring - 15.0'

Graphic Log

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

Date Drilled: 9/2/2009 to 9/10/2009

Location: Sta. 763+90.54, 58.15 ft Rt. of I-71 CL

LOG OF: Boring B-089

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: 38.5' Water level at completion: 37.6' (includes drilling water)	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP PL 10 20 30 40 LL							
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay						
677.5																					
55		11 9 12	10	17																	
57.0	670.5																				
60.0	667.5	27 48 50/3	15	18																	
65																					
70																					
75																					

Medium dense brown COARSE AND FINE SAND (A-3a), little silt, trace gravel; wet.

Very dense gray GRAVEL WITH SAND, SILT, AND CLAY (A-2-6); wet.

Bottom of Boring - 60.0'

Client: ms consultants		Project: FRA-70-8.93		Job No. 0221-1004.01										
LOG OF: Boring B-090			Date Drilled: 9/2/2009											
Location: Sta. 194+40.24, 3.34 ft Lt. of Ramp K2 BL		WATER OBSERVATIONS:		GRADATION										
Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N60) Natural Moisture Content, % -
1.6	703.9	12				Asphalt Concrete - 4"	[Hatched]	54	18	---	8	--20	---	10
2.5	703.0	6	10	1		Portland Cement Concrete - 9" Aggregate Base - 6"	[Stippled]	0	0	---	5	48	47	20
4.0	701.5	4	18	2	2.75	Medium dense brown GRAVEL WITH SAND (A-1-b), little silt; moist.	[Horizontal Lines]	0	1	---	7	45	47	30
		5	18	3	4.25	Stiff dark brown CLAY (A-7-6), trace fine sand; damp.	[Vertical Lines]	0	0	---	12	44	44	40
		6		4	4.25	Hard dark brown SILTY CLAY (A-6b), trace to little fine to coarse sand; damp.	[Vertical Lines]	0	0	---				
7.0	698.5	9	18	4		Bottom of Boring - 7.0'	[Vertical Lines]							

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-091

Location: Sta. 766+65.07, 0.63 ft Rt. of Ramp L1 BL

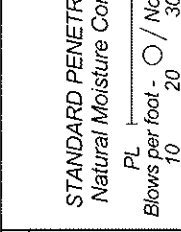
Date Drilled: 9/1/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Plasticity Index (PI) - ○	
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay
1.0	704.2	8			-		Asphalt Concrete - 4" Portland Cement Concrete - 8"		21	14	---	12	31	22	
2.5	702.7	7	18	1			FILL: Hard brown SILT AND CLAY (A-6a), some fine to coarse sand, some gravel; damp.		48	40	---	5	--	7	
4.0	701.2	3	12	2			POSSIBLE FILL: Loose brown GRAVEL WITH SAND (A-1-b), trace silt; damp.		0	1	---	15	44	40	
5.0	698.2	5	18	3	2.25		Stiff to very stiff brown SILTY CLAY (A-6b), little fine to coarse sand; damp.		0	1	---	14	45	40	
7.0	698.2	5	18	4	1.75		Bottom of Boring - 7.0'								

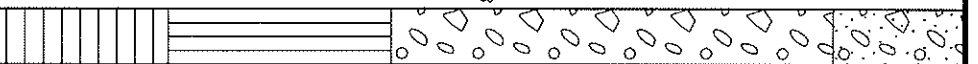
Client: ms consultants		Project: FRA-70-8.93		Job No. 0221-1004.01												
LOG OF: Boring B-092		Location: Sta. 768+06.42, 47.29 ft Lt. of I-71 CL		Date Drilled: 9/1/2009 to 9/9/2009												
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP			
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay		
1.5	724.9					Asphalt Concrete - 8" Aggregate Base - 10"	[Hatched Pattern]	36	17	---	11	20	16			
3.5	721.4	7 4 4	5	1	--	FILL: Very stiff brown SANDY SILT (A-4a), "and" gravel, some fine to coarse sand; damp.	[Horizontal Lines]	22	9	---	14	24	31			
5		8 7 6	12	2	2.0	FILL: Very stiff brown SILTY CLAY (A-6b), some fine to coarse sand, some gravel; moist.	[Horizontal Lines]									
11.0	713.9	11 8 11	13	3	2.0	@ 8.5'-10.0', contains numerous gravel fragments.	[Horizontal Lines]									
13.5	711.4	11 17 16	14	4	2.5		[Horizontal Lines]									
16.0	708.9	8 10 50/5	6	5	--	FILL: Very dense brown and gray GRAVEL (A-1-a), some fine to coarse sand, little silt; damp.	[Horizontal Lines]	60	17	---	11	--	12			
15		12 22	15	6	--	FILL: Hard brown SANDY SILT (A-4a), some fine to coarse sand, some gravel; contains numerous gravel fragments; damp.	[Horizontal Lines]									
20		18 20 17	17	7	3.5	Very stiff to hard dark brown SILT AND CLAY (A-6a), some fine to coarse sand, trace to little gravel; damp to moist.	[Horizontal Lines]	10	13	---	11	37	29			
25	699.9	15 13 16	18	8	4.5		[Horizontal Lines]									
		50/6	0	9	--		[Horizontal Lines]									
		9 10	13	10	3.25		[Horizontal Lines]									



Client: ms consultants		Project: FRA-70-8.93		Job No. 0221-1004.01															
LOG OF: Boring B-092		Location: Sta. 768+06.42, 47.29 ft Lt. of I-71 CL		Date Drilled: 9/1/2009 to 9/9/2009															
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. / Drive	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % -						
							% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		PL	LL				
699.9																			
32.0	692.9	10		11	3.25	Very stiff brown SILTY CLAY (A-6b), little fine to coarse sand, trace gravel; damp to moist.	0	0	---	13	45	42							
		8	12		--	Note: terminated sampling on 9/2/09 @ 30.0 feet. Resumed sampling on 9/9/09.													
		9																	
30		6	1	12															
		7																	
		6																	
37.0	687.9	3		13	3.75	Very stiff brown SANDY SILT (A-4a), "and" gravel; damp.	87	6	---	3	---	---							
		14	11																
		13																	
		18																	
		13	10	14		Dense to very dense brown GRAVEL (A-1-a), trace fine to coarse sand, trace silt; wet.													
		20																	
40		13																	
		13																	
		20																	
		18	8	15															
		32																	
		31																	
45		31																	
		32																	
		31																	
		31	8	15															
47.0	677.9	36		16		Very dense gray GRAVEL WITH SAND (A-1-b), little silt; wet.													
		33																	
		33	12			Bottom of Boring - 50.0'													
50.0	674.9	33																	



Graphic Log



WATER OBSERVATIONS:
Water seepage at: 38.5'
Water level at completion: 37.1'

FIELD NOTES:
Very stiff brown SILTY CLAY (A-6b), little fine to coarse sand, trace gravel; damp to moist.

Note: terminated sampling on 9/2/09 @ 30.0 feet. Resumed sampling on 9/9/09.

Very stiff brown SANDY SILT (A-4a), "and" gravel; damp.

Dense to very dense brown GRAVEL (A-1-a), trace fine to coarse sand, trace silt; wet.

Very dense gray GRAVEL WITH SAND (A-1-b), little silt; wet.

Bottom of Boring - 50.0'

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-093

Location: Sta. 198+00.46, 2.64 ft Lt. of Ramp K2 BL

Date Drilled: 9/2/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetro-meter (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	Graphic Log	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Plasticity Index, % - ○							
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay								
0.8	714.9																					
		3		1	0.75		Asphalt Concrete - 4" Portland Cement Concrete - 6"															
		3	3	2	0.5		POSSIBLE FILL: Medium stiff brown SILTY CLAY (A-6b), some fine to coarse sand, little to some gravel; moist.															
		6	3	3	0.75																	
		5	4	4	2.25																	
5.5	710.2	6		5	-		Very stiff brown CLAY (A-7-6), trace to little fine to coarse sand, trace gravel; moist. @ 7.0'-8.5'; contains rock fragments.															
		8	18	4	1.0																	
		13	7	6																		
8.5	707.2	10		5			Stiff gray SILTY CLAY (A-6b), little to some fine to coarse sand, trace to little gravel; contains rock fragments; damp.															
		5	18	6																		
10.0	705.7	8		18			Bottom of Boring - 10.0'															

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-096-0		Location: Sta. 766+00.65, 0.16 ft Rt. of Ramp L1 BL		Date Drilled: 8/21/2009														
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP				
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		PL	LL		
0.1	709.0					Asphalt Concrete - 1"												
6.0	703.1	4	6	1	3.25	Very stiff brown SANDY SILT (A-4a), some fine to coarse sand, trace gravel; damp to moist.		1	5	---	16	52	26					
8.5	700.6	6	4	2	4.0	Hard brown CLAY (A-7-6), trace fine sand; damp.		0	0	---	1	25	74					
10.0	699.1	8	20	4	4.5+	Medium dense brown GRAVEL WITH SAND (A-1-b), little silt; damp.												
						Bottom of Boring - 10.0'												

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-097 Location: Sta. 209+00.49, 0.96 ft Rt. of Ramp K2 BL Date Drilled: 9/2/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Drive	Press / Core	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	Graphic Log	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP				
											% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay					
1.7	718.5	17							Asphalt Concrete - 4" Portland Cement Concrete - 10" Aggregate Base - 6"		10	17	---	22	31	20					
3.0	717.2	6	12	1			--		FILL: Stiff brown SANDY SILT (A-4a), "and" fine to coarse sand, trace to little gravel; contains trace asphalt and brick fragments; damp.		40	25	---	13	13	9					
4.5	715.7	6	12	2					FILL: Medium dense brown GRAVEL WITH SAND (A-1-b), little silt, trace clay; damp.		47	15	---	6	--9--						
6.0	714.2	5	10	3			0.75		FILL: Medium dense brown GRAVEL (A-1-a), some fine to coarse sand, trace silt; damp.		8	8	---	34	24	26					
8.5	711.7	2	10	4					FILL: Medium stiff brown SILTY CLAY (A-6b), "and" fine to coarse sand, trace gravel; contains cinders; damp to moist.												
10	711.7	4	18	5			0.5		Medium stiff brown SILT AND CLAY (A-6a), little to some fine to coarse sand, trace gravel; damp to moist.												
13.5	706.7	3	18	6			0.75														
15.0	705.2	11	15	7					Very dense brown GRAVEL WITH SAND (A-1-b), little silt, damp.												
15.0	705.2	11	15	7					Bottom of Boring - 15.0'												

Client: ms consultants

Job No. 0221-1004.01

LOG OF: Boring B-098-0

Date Drilled: 11/13/2009

Project: FRA-70-8.93

Location: Sta. 884+05.45, 38.63 ft Lt. of Ramp G4 BL

Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	Graphic Log	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP			
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay				
0.3	717.2																	
1.5	716.0	4		1A	4.0		Topsoil - 4"		42	31	12	15	35					
2.5	715.0	6	14	1B			POSSIBLE FILL: Medium dense brown GRAVEL WITH SAND (A-1-b), little silt; damp.		16	14	11	24						
		10	15	2			POSSIBLE FILL: Very stiff to hard brown CLAY (A-7-6), some fine to coarse sand, little gravel; contains rust stains; moist.		70	12	5	12						
		19	18	3			POSSIBLE FILL: Dense to very dense light brown GRAVEL (A-1-a), little fine to coarse sand, little silt; damp.											
		17	18	4														
		12	13	5														
		15	16															
		18	23															
10.0	707.5	26	14	5														
							Bottom of Boring - 10.0'											

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-099-0 Location: Sta. 117+73.55, 36.20 ft Rt. of Ramp F3 BL Date Drilled: 9/2/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP				
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay			
1.3	722.1					Asphalt Concrete - 5" Portland Cement Concrete - 10"											
3.0	719.1	7 4 6 10		1		FILL: Medium dense brown SANDY SILT (A-4a), little gravel; contains brick fragments; moist.			11	13	--	37	20	19			
4.5	717.6	8 3 2 10		2		FILL: Loose brown GRAVEL WITH SAND (A-1-b), little silt; damp.			44	19	--	20	--	17			
6.0	716.1	5 2 2 18		3	1.0	FILL: Medium stiff to stiff brown SILT AND CLAY (A-6a), "and" fine to coarse sand, little gravel; contains asphalt, brick, and coal fragments; damp.			15	15	--	28	25	17			
8.5	713.6	2 3 2 8		4	0.75	FILL: Medium stiff brown SANDY SILT (A-4a), some gravel; damp.			21	26	--	21	17	15			
11.0	711.1	2 2 2 15		5	0.75	Medium stiff brown SANDY SILT (A-4a), trace to little gravel; moist.											
15		2 2 2 9		6	0.5	Medium stiff gray SILT AND CLAY (A-6a), some to "and" fine to coarse sand, trace to little gravel; moist.			5	6	--	31	33	25			
20.0	702.1	2 2 7		9	0.75	Bottom of Boring - 20.0'											

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-100 Location: Sta. 892+04.61, 35.89 ft Rt. of Ramp G4 BL Date Drilled: 9/1/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % -							
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	PL	LL	NP			
0.8	715.8					Asphalt Concrete - 5" Aggregate Base - 5"														
		9		1		POSSIBLE FILL: Loose brown GRAVEL (A-1-a), some fine to coarse sand, trace to little silt; damp to moist.														
		5	10	2																
		2	4	3																
6.0	710.6	2	2	4		Stiff gray SANDY SILT (A-4a), some fine to coarse sand, some gravel; moist.														
		23	12	5	1.0															
7.5	709.1	17		6		Very dense gray GRAVEL WITH SAND (A-1-b), little silt; damp.														
		28	12	7																
9.0	707.6	3		8		Stiff brown SILTY CLAY (A-6b), little to some fine to coarse sand, little gravel; contains rock fragments; damp to moist.														
		6	6	9	2.0															
		18	10	10		Bottom of Boring - 15.0'														
		12		11	1.0															
15.0	701.6	8		12																
		13	5	13	1.0															
		24		14																
		24	5	15																

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-101

Location: Sta. 107+06.13, 18.27 ft Rt. of Ramp H3 BL

Date Drilled: 8/21/2009

Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.	Drive Press / Core	Hand Penetrometer (tsf)	FIELD NOTES:	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % -					
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		PL	LL			
0.3	706.9																		
	706.6						Topsoil - 3"												
		12		1		4.5+	POSSIBLE FILL: Hard brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp.	5	6	--	12	43	34						
		9	11																
3.5	703.4						POSSIBLE FILL: Dense to very dense brown GRAVEL (A-1-a), little fine to coarse sand, trace to little silt; damp.												
		24		2															
		15	9																
		15																	
		5																	
		34		3				75	9	--	6	--	10						
		35	11																
		17																	
10.0	696.9						Bottom of Boring - 10.0'												
		35	12	4															
		28																	
		15																	
		20																	

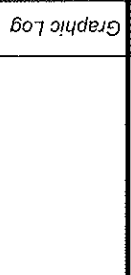
Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-102 Location: Sta. 124+68.96, 28.50 ft Rt. of Ramp F3 BL Date Drilled: 9/3/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Drive	Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % -						
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	PL	LL			
1.3	718.9							Asphalt Concrete - 7"												
	717.6							Portland Cement Concrete - 8"												
		10		1			1.75	FILL: Stiff brown SILTY CLAY (A-6b), some to "and" fine to coarse sand, little gravel; contains few brick fragments; damp.	15	15	21	23								
		8	10																	
		6	5	2			1.5													
		5	18																	
		6	2	3			1.0	FILL: Medium stiff to stiff brown SANDY SILT (A-4a), trace to little gravel; contains few brick fragments; damp to moist.	19	15	26	18								
		2	18																	
		6	2	4			1.0													
		2	5																	
8.5	710.4																			
		2	4	5			1.0	Bottom of Boring - 12.5'												
		7	12																	
		5	10																	
		10	7																	
		5	10																	
		7	3																	
		15																		
		20																		
		25																		



Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

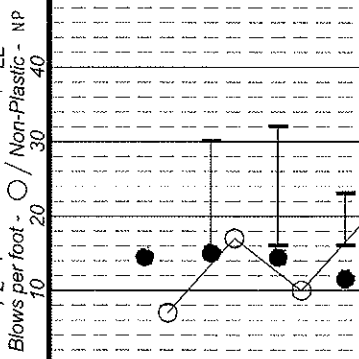
LOG OF: Boring B-103

Location: Sta. 110+97.39, 4.35 ft Rt. of Ramp H3 BL

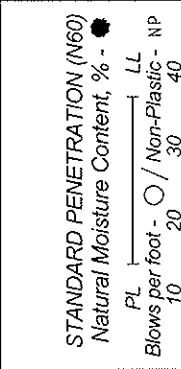
Date Drilled: 9/1/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetro-meter (tsf)	FIELD NOTES:	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % -				
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	Plasticity Chart		
1.5	714.6	3					Asphalt Concrete - 7" Aggregate Base - 11"											
3.0		4	15	1	3.0		Very stiff gray SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; damp.											
4.5	711.6	7	10	2	3.75													
6.0	710.1	4	6	3	3.25		Stiff to very stiff gray SILTY CLAY (A-6b), some fine to coarse sand, trace gravel; damp.											
9.0		11	9	4	4.5+													
11.0		20	11	5	--		Very stiff to hard gray SANDY SILT (A-4a), some fine to coarse sand, trace to little gravel; damp. @ 7.5'-9.0', brown, some gravel.											
13.0		9	13	6	2.75													
15.0	701.1	12	10	7	4.25		Bottom of Boring - 15.0'											
19.0		40	19	8	--													

Bottom of Boring - 15.0'



Client: ms consultants		Project: FRA-70-8.93		Job No. 0221-1004.01													
LOG OF: Boring B-104		Location: Sta. 798+57.35, 0.55 ft Rt. of Ramp F5 BL		Date Drilled: 9/4/2009													
Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ●					
							Drive	Press / Core	% Aggregate	% C. Sand	% M. Sand		% F. Sand	% Silt	% Clay	PL	LL
0.3	710.2					Topsoil - 4"											
3.5	706.7	13 10 9	18	1		Medium dense gray SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.											
5		11 10 8	12	2	3.0	Stiff to very stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, little to some gravel; damp.			20	15	13	25	27				
		3 4 7	12	3	2.0	@ 6.0'-7.5', dark brown, contains trace organic material.											
11.0	699.2	10 8 8	3	4	1.5												
13.5	696.7	6 7 8	13	5	4.0	Very stiff to hard brown SILTY CLAY (A-6b), little to some fine to coarse sand; damp.			0	2	18	37	43				
15		13 11 14	12	6		Medium dense brown GRAVEL (A-1-a), some fine to coarse sand, little silt; damp.											
20		12 10 8	12	7													
21.0	689.2	15 11 12	12	8					57	18	10	15					
23.5	686.7	3 6 12	10	9		Medium dense brown COARSE AND FINE SAND (A-3a), little silt, little gravel; wet.											
25	685.2	5 5	9	10		Medium dense to dense brown GRAVEL (A-1-a), little fine to coarse sand, trace silt; wet.											



Client: ms consultants

Project: FRA-70-8.93

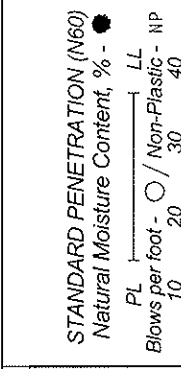
Job No. 0221-1004.01

Location: Sta. 798+57.35, 0.55 ft Rt. of Ramp F5 BL

Date Drilled: 9/4/2009

LOG OF: Boring B-104

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	FIELD NOTES:	WATER OBSERVATIONS:	Graphic Log	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ●		
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay			
685.2						Medium dense to dense brown GRAVEL (A-1-a), little fine to coarse sand, trace silt; wet.	Water seepage at: 22.5' Water level at completion: 19.4'										
8		5															
12		12	6	11													
18		20															
19		19	8	12													
30.0	680.2																
Bottom of Boring - 30.0'																	



Client: ms consultants

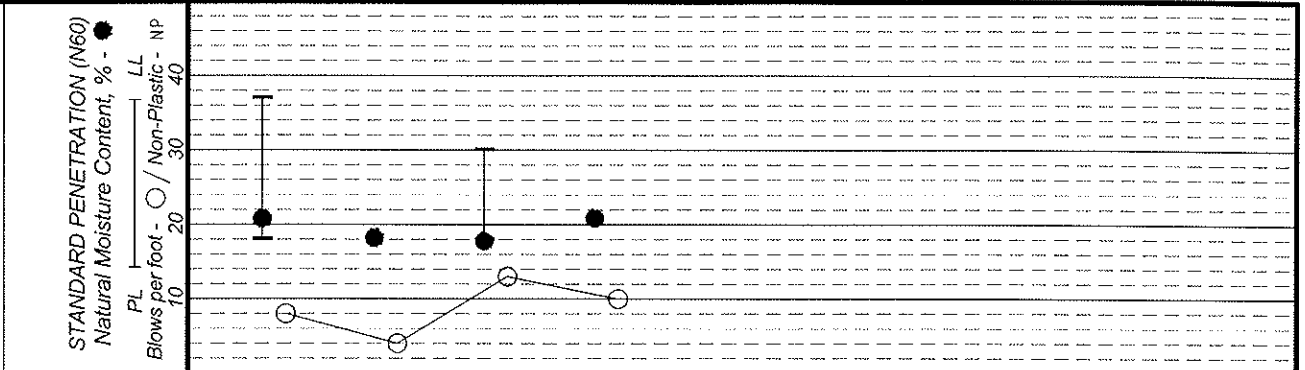
Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-105 Location: Sta. 128+92.42, 78.61 ft Rt. of Ramp F3 BL

Date Drilled: 9/3/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP						
							% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		PL	LL				
0.3	715.4					Topsoil - 3"													
2.3		5	18	1	1.75	POSSIBLE FILL: Stiff dark brown SILTY CLAY (A-6b), little fine to coarse sand, trace gravel; moist.	9	5	---	12	38	36							
5.2		2	10	2	1.5		@ 1.0'-5.0', contains brick fragments.	18	20	---	19	25	18						
6.0	709.7	2		3	1.0	POSSIBLE FILL: Stiff dark brown SILT AND CLAY (A-6a), some to "and" fine to coarse sand, little to some gravel; damp to moist.													
10.0	705.7	4	18	4	1.0		Bottom of Boring - 10.0'												



Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - Blows per foot - ○ / Non-Plastic - NP						
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay					
0.3	719.0																			
	718.7																			
3.5	715.5	5 6 8	9	1	3.0		Topsoil - 3"													
		5 6 9	18	2	4.5+		FILL: Very stiff brown SANDY SILT (A-4a), some fine to coarse sand, trace gravel; contains few brick fragments; damp.													
		5 6 10	18	3	3.5		Very stiff to hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; damp.													
		4 9 13	18	4	4.25															
11.0	708.0	9 8 10 11	17	5	3.5		Very stiff gray SILTY CLAY (A-6b), some fine to coarse sand, trace to little gravel; moist.													
14.0	705.0	9 6	3	6	2.5															
15.5	703.5	4 7 18	12	7	4.5+		Hard gray SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; contains rock fragments; damp.													
17.0	702.0	19 50/3	9	8	2.75		Very stiff gray SANDY SILT (A-4a), some gravel; damp.													
		49 50/3	7	9			Very dense gray GRAVEL WITH SAND (A-1-b), trace silt; contains rock fragments; damp.													
		50/4	4	10																
21.8	697.2	44 50/3	8	11			Bottom of Boring - 21.8'													

Client: ms consultants

Job No. 0221-1004.01

Project: FRA-70-8.93

Date Drilled: 9/2/2009 to 9/8/2009

Location: Sta. 132+91.15, 3.71 ft Rt. of Ramp F3 BL

LOG OF: Boring B-107

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Drive	Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP	
										% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay
1.5	706.5							Portland Cement Concrete - 10" Aggregate Base - 8"		18	18	11	24	29		
3.0	703.5	15 16	13 14	1			3.5	FILL: Very stiff brown SILTY CLAY (A-6b), some fine to coarse sand, little gravel; contains brick fragments; damp. FILL: Red Brick Fragments		43	20	21	16	16		
6.0	700.5	12 13 11 18	5 8	2 3				FILL: Very loose to loose brown GRAVEL WITH SAND (A-1-b), little silt; contains brick fragments; damp.								
11.0	695.5	3 2 11		4				FILL: Red Brick Fragments								
13.5	693.0	1 2 3	5	5				FILL: Red Brick Fragments								
16.0	690.5	1 2 2 12		6 7				Loose brown COARSE AND FINE SAND (A-3a), little silt, trace gravel; wet. Medium dense brown GRAVEL WITH SAND, SILT, AND CLAY (A-2-6); wet.								
20.0	686.5	3 5 8 6	8	8				Bottom of Boring - 20.0'								

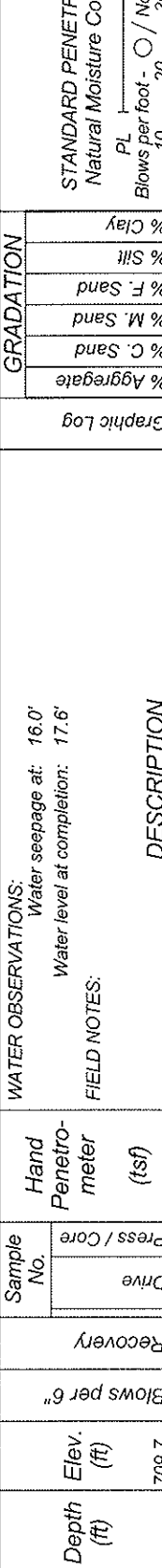
Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-108 Location: Sta. 233+22.63, 2.05 ft Lt. of Ramp F1 BL Date Drilled: 9/3/2009

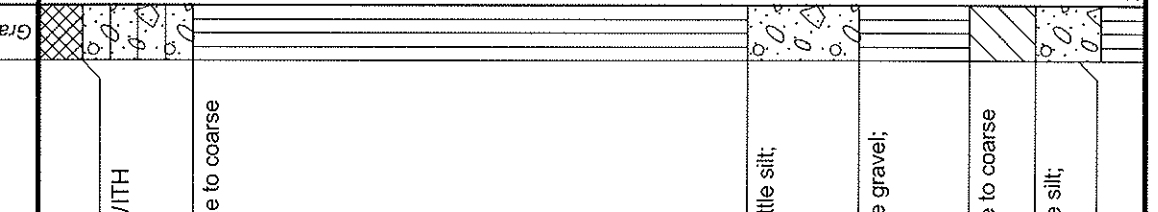
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetro-meter (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP		
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	
0.6	709.7					Topsoil - 7"		49	20	13	18				
4.0	709.1	4		1		POSSIBLE FILL: Loose to medium dense brown GRAVEL WITH SAND (A-1-b), little silt; damp.									
5.0		4	1	2											
6.0	703.7	1		3	1.0	Medium stiff to stiff dark brown SILT AND CLAY (A-6a), little fine to coarse sand; possible buried topsoil; damp.									
8.5	701.2	5		4	2.25	Very stiff brown SILTY CLAY (A-6b), some fine to coarse sand, trace to little gravel; damp.		1	4	26	33	36			
10.0		4		5											
13.5	696.2	5		6	3.0	Dense to very dense brown GRAVEL (A-1-a), little fine to coarse sand, trace to little silt; damp.		73	13	5	9				
15.0		20	3	7											
20.0		6	8	8		@ 16.0' becomes wet.									
25.0	684.7	7	18	10		Bottom of Boring - 25.0'									



Client: ms consultants		Project: FRA-70-8.93		Job No. 0221-1004.01															
LOG OF: Boring B-111		Location: Sta. 487+15.21, 19.28 ft Lt. of Ramp E1 BL		Date Drilled: 9/1/2009															
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive / Core	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - PL Blows per foot - O / Non-Plastic - NP					
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay				
1.0	734.9																		
3.5	733.9																		
5.0	731.4																		
10.0																			
15.0																			
16.0	718.9																		
18.5	716.4																		
21.0	713.9																		
22.5	712.4																		
24.0	710.9																		
25.0	709.9																		

DESCRIPTION

Asphalt Concrete - 6"
Aggregate Base - 6"
POSSIBLE FILL: Medium dense brown GRAVEL WITH SAND, SILT, AND CLAY (A-2-6); damp.
Very stiff to hard gray SANDY SILT (A-4a), some fine to coarse sand, trace to little gravel; damp.
@ 6.0'-7.5', stiff.
@ 13.5', becomes brown.
Very dense brown GRAVEL WITH SAND (A-1-b), little silt; damp.
Very dense brown SANDY SILT (A-4a), little to some gravel; damp.
Very stiff brown SILTY AND CLAY (A-6a), some fine to coarse sand, trace gravel; moist.
Very dense gray GRAVEL WITH SAND (A-1-b), little silt; damp.
Stiff to very stiff gray SANDY SILT (A-4a); damp.



Client: ms consultants

Job No. 0221-1004.01

LOG OF: Boring B-111

Location: Sta. 487+15.21, 19.28 ft Lt. of Ramp E1 BL

Date Drilled: 9/1/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None FIELD NOTES:	DESCRIPTION	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP	
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		
709.9								13	12	---	17	30	28		
		10	10	12	3.75		Stiff to very stiff gray SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.								
		11	12	13	1.5										
		9	3	14	1.5		@ 25.5'-27.0', contains rock fragments.								
		5	18												
30.0	704.9	9					Bottom of Boring - 30.0'								

Client: ms consultants

Project: FRA-70-8.93

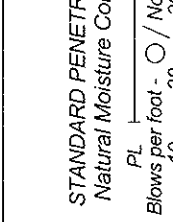
Job No. 0221-1004.01

LOG OF: Boring B-113-0

Location: Sta. 141+02.20, 5.63 ft Lt. of Ramp F3 BL

Date Drilled: 9/2/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Drive Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % -						
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay					
707.7																				
5.0	702.7	11	18	1		3.0	FILL: Very stiff to hard brown SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; damp.		19	16	---	17	27	21						
6.5	701.2	12	18	2		4.5+	FILL: Hard brown SILTY CLAY (A-6b), little fine to coarse sand; moist.		0	1	---	12	46	41						
8.0	699.7	6	12	3		2.75	FILL: Stiff to very stiff brown CLAY (A-7-6), some fine to coarse sand, trace gravel; moist.		7	10	---	16	27	40						
10		11	12	4			FILL: Medium dense to dense brown GRAVEL WITH SAND AND SILT (A-2-4), trace clay; damp.		45	15	---	10	21	9						
13.5	694.2	10	11	5			@ 11.0'-12.5', very dense.													
15		12	11	6			FILL: Very dense brown SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.													
18.5	689.2	18	13	7			@ 16.0', becomes wet.													
20		29	11	8			Dense brown GRAVEL WITH SAND (A-1-b), some fine to coarse sand, little to some silt; wet.		57	20	---	7	--	16--						
25	682.7	13	9	9																



WATER OBSERVATIONS:
Water seepage at: 17.5'
Water level at completion: 16.5'

FIELD NOTES:

Graphic Log

GRADATION

STANDARD PENETRATION (N60)
Natural Moisture Content, % -

Blows per foot - O / Non-Plastic - NP

PL 10 20 30 40
LL 30 40

Client: ms consultants

Project: FRA-70-8.93

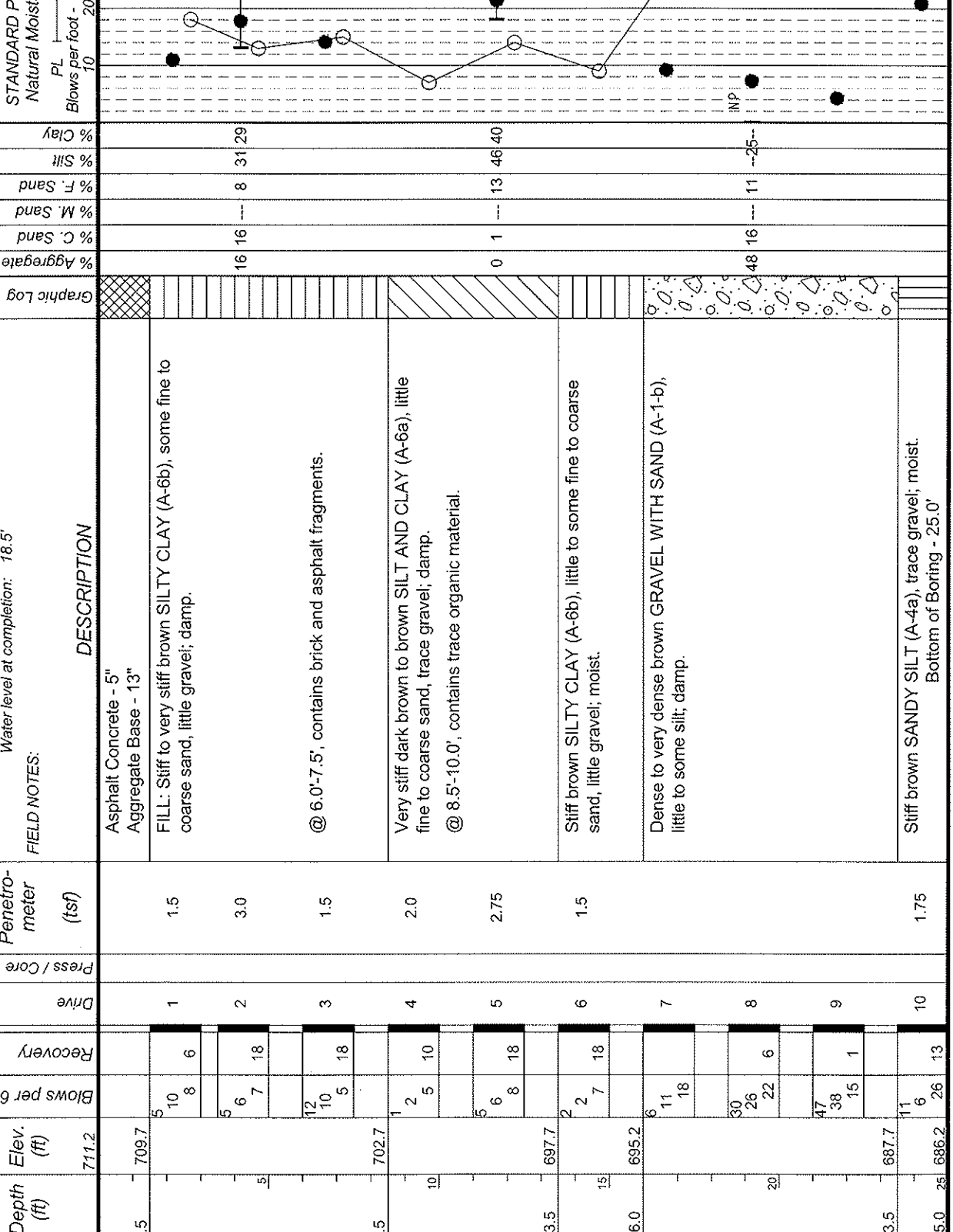
Job No. 0221-1004.01

LOG OF: Boring B-115

Location: Sta. 691+54.36, 2.68 ft Rt. of Ramp E2 BL

Date Drilled: 9/3/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP									
							% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay										
1.5	711.2																					
5	709.7	5			1	Asphalt Concrete - 5" Aggregate Base - 13"																
6		10	6		1.5	FILL: Stiff to very stiff brown SILTY CLAY (A-6b), some fine to coarse sand, little gravel; damp. @ 6.0'-7.5', contains brick and asphalt fragments.	16	16	---	8	31	29										
7		6	18		3.0																	
12		10	18		1.5																	
8.5	702.7	1			2.0	Very stiff dark brown to brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp. @ 8.5'-10.0', contains trace organic material.	0	1	---	13	46	40										
10		2	10		2.75																	
5		6	18		1.5																	
13.5	697.7	2			1.5	Stiff brown SILTY CLAY (A-6b), little to some fine to coarse sand, little gravel; moist.																
15		2	18																			
6		11	18																			
16.0	695.2	6				Dense to very dense brown GRAVEL WITH SAND (A-1-b), little to some silt; damp.	48	16	---	11	--	25										
20		30	6																			
26		26	6																			
23.5	687.7	47				Stiff brown SANDY SILT (A-4a), trace gravel; moist. Bottom of Boring - 25.0'																
25.0		38	1																			
26		15	1																			
25.0	686.2	11			1.75																	
25.0		6	13																			



Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-116

Location: Sta. 593+56.87, 22.96 ft Rt. of Ramp E3 BL

Date Drilled: 9/21/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: 13.5' Water level at completion: 19.2' (includes drilling water)	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP							
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay						
682.0																					
28.5	678.5	8 19 13	10	11	-		Dense gray GRAVEL WITH SAND (A-1-b), little silt; wet.		74	16	---	5	---	5							
30		9 23 22	12	12	-		Dense gray GRAVEL (A-1-a), little to some fine to coarse sand, trace to little silt; wet.		68	16	---	5	---	5							
35		15 23 23	9	13	-																
40		20 29 24	10	14	-																
42.0	665.0																				
45		21 28 47	8	15	4.5+		Hard gray SANDY SILT (A-4a), trace gravel; damp.														
49.3	657.7	27 50/3	9	16	4.5+																
50																					

Bottom of Boring - 49.3'

Client: ms consultants

Project: FRA-70-8.93

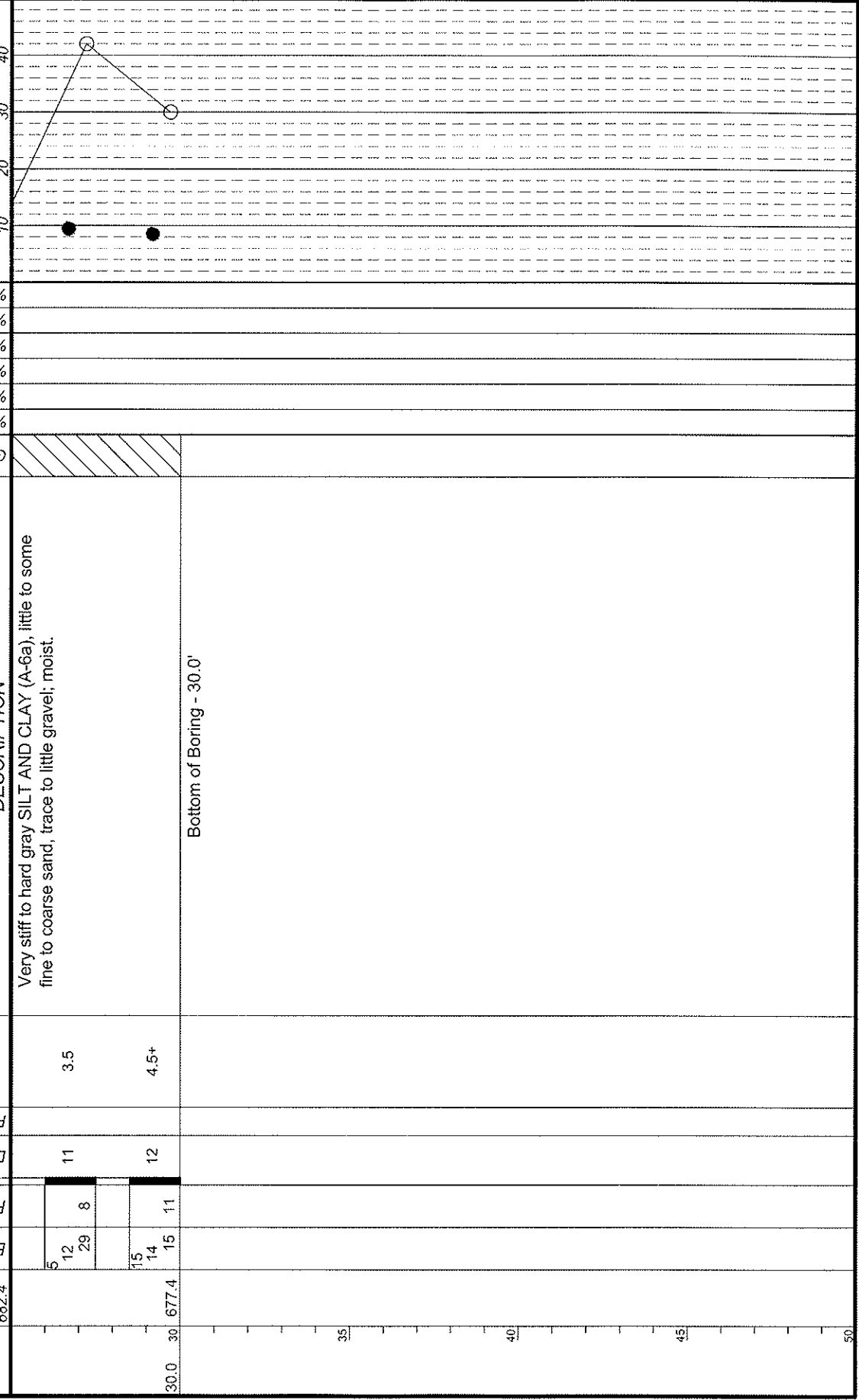
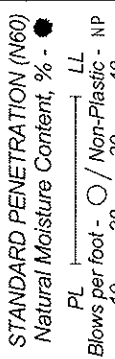
Job No. 0221-1004.01

LOG OF: Boring B-118-0

Location: Sta. 486+76.28, 8.60 ft Rt. of Ramp G1 BL

Date Drilled: 9/21/2009

Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.		Hand Penetrometer (tsf)	FIELD NOTES:	WATER OBSERVATIONS:	Graphic Log	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % -			
				Drive	Press / Core					% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay				
682.4								Water seepage at: 20.5' Water level at completion: 27.5'											
5		12			11		3.5												
29		8																	
15		15			12		4.5+												
14		15																	
15		11																	
30.0	677.4																		
Bottom of Boring - 30.0'																			



Project: FRA-70-8.93

Job No. 0221-1004.01

Client: ms consultants

LOG OF: Boring B-118-1

Location: Sta. 490+03.71, 1.73 ft Rt. of Ramp G1 BL

Date Drilled: 9/22/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % -				
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	PL	LL	
0.4	709.3					Asphalt Concrete - 5"											
2.0	708.9	2	14	1	1.0	FILL: Medium stiff to stiff brown SILT AND CLAY (A-6a), little fine to coarse sand, trace to little gravel; contains brick fragments; damp.											
3.0		3															
4.0		4	3	2													
5.0		6															
6.0	703.3	12	14	3		Dense to very dense brown GRAVEL WITH SAND (A-1-b), little silt; damp.			55	16	---	13	---	16			
10.0		10	3	4													
15.0		15	14	6													
16.0	693.3	10	3	7	2.5	Very stiff brown SILT (A-4b), little fine sand, trace clay; wet.			0	2	---	4	---	76	18		
18.5	690.8	3	18	8													
20.0		4	5	9	1.0	Medium stiff to stiff gray SILT AND CLAY (A-6a), little fine to coarse sand; moist.											
21.0	688.3	3	5	10		Medium dense brown COARSE AND FINE SAND (A-3a), little silt, little gravel; wet.											
23.5	685.8	2	7	11													
25.0	684.3	9	5	12		Medium dense brown GRAVEL (A-1-a); wet.											



Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-118-1 Location: Sta. 490+03.71, 1.73 ft Rt. of Ramp G1 BL Date Drilled: 9/22/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive / Core	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: 15.5' Water level at completion: 17.0'	FIELD NOTES:	Graphic Log	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP					
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay		PL	LL			
684.3									66	16	6									
30		6 11 19	8	11																
		34 50/5	9	12																
35		19 24 16	8	13																
40		11 14 8	9	14																
45.0	664.3	7 20 15	10	15																
50																				

DESCRIPTION

Medium dense to dense brown GRAVEL (A-1-a), some fine to coarse sand, little silt; wet.

@ 28.5'-29.4', very dense.

Bottom of Boring - 45.0'

Client: ms consultants

Job No. 0221-1004.01

Project: FRA-70-8.93

Date Drilled: 9/21/2009

Location: Sta. 492+95.87, 11.65 ft Lt. of Ramp G2 BL

LOG OF: Boring B-119

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: 16.0' Water level at completion: 15.8'	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP						
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	PL	LL			
0.3	708.2								47	30	7									
11.0	697.2	19, 15, 12	10	1			Asphalt Concrete - 4" Medium dense to dense brown GRAVEL WITH SAND (A-1-b), little silt; damp.		63	17	5									
15.0		18, 17, 14	10	2			Medium dense to dense brown GRAVEL (A-1-a), some fine to coarse sand, little silt; damp.													
20.0	688.2	4, 5, 5	6	3			@ 16.0', becomes wet.													
		30, 27, 16	1	4			Bottom of Boring - 20.0'													

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

LOG OF: Boring B-126 Location: Sta. 131+33.60, 9.85 ft Rt. of Ramp H6 BL Date Drilled: 9/16/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Drive Press / Core	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP					
										% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay				
0.5	707.0								Asphalt Concrete - 6"	65	16	6	13							
5		20 20 22	12	1				Medium dense to dense brown GRAVEL (A-1-a), little silt; damp.		68	15	6	11							
10		21 27 30	13	2				@ 3.5'-5.0', very dense.												
12.5	695.0	24 15 10	12	3																
		5 9 14	15	4																
		20 18	13	5																
15																				
20																				
25																				

Bottom of Boring - 12.5'

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-127

Location: Sta. 697+34.07, 5.65 ft Lt. of Ramp E2 BL

Date Drilled: 9/18/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: 16.0' Water level at completion: 20.6' (prior to adding water) 18.0' (includes drilling water)	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - Blows per foot - ○ / Non-Plastic - NP					
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	PL	LL		
0.3	710.8																		
3.5	707.6	7 8	2	1	1.0					68	11	7							
5		6 3 8	8	2															
8.5	702.6	5 6 4 4	4	3															
10		6 4 4	5	4															
15		14 11 16	1	5															
15		50/4	4	6						56	17	7							
20		12 13 9	3	7															
20		13 12 18	10	8															
25	686.1	18 19 18	11	9						43	35	8							
25	686.1	11 14 16	6	10															

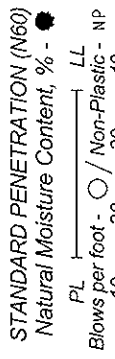
Topsoil - 4"
FILL: Stiff brown SANDY SILT (A-4a), little gravel; damp.

Medium dense brown GRAVEL (A-1-a), little fine to coarse sand, little silt; damp.

Loose to medium dense brown GRAVEL WITH SAND (A-1-b), little to some silt; damp.

@ 13.5'-15.0', 18.5'-25.0', dense to very dense.

@ 16.0', becomes wet.



Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-127 Location: Sta. 697+34.07, 5.65 ft Lt. of Ramp E2 BL Date Drilled: 9/18/2009

Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No.	Hand Penetrometer (tsf)	WATER OBSERVATIONS: Water seepage at: 16.0' Water level at completion: 20.6' (prior to adding water) 18.0' (includes drilling water)	FIELD NOTES:	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP	
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay
37.0	674.1								15	58	15	12			
30		28 22 25	11												
		11 14 17	12												
35		14 19 21	13												
40.0	671.1	17 23 27	14												
45															
50															

Dense brown GRAVEL WITH SAND (A-1-b), little silt; wet.

Very dense gray COARSE AND FINE SAND (A-3a), little silt, trace to little gravel; wet.

Bottom of Boring - 40.0'

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-128

Location: Sta. 151+15.37, 55.09 ft Lt. of Ramp F3 BL

Date Drilled: 9/8/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive / Press / Core	Hand Penetrometer (tsf)	FIELD NOTES	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● PL Blows per foot - ○ / Non-Plastic - NP						
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay					
1.5	719.7					Portland Cement Concrete - 11" Aggregate Base - 7"														
3.5	717.7	12 24 24	10	1		POSSIBLE FILL: Dense brown GRAVEL (A-1-a), some fine to coarse sand, little silt; moist.					56	17	10	--	--					
6.0	715.2	6 8 14 13		2	--	POSSIBLE FILL: Very stiff brown SANDY SILT (A-4a), some fine to coarse sand, little gravel; damp.					20	21	11	26	22					
10.0	711.2	6 18 10 10 14	12	3 4	1.5 3.25	POSSIBLE FILL: Stiff to very stiff brown SILT AND CLAY (A-6a), some fine to coarse sand, little to some gravel; contains rock fragments; damp.														
						Bottom of Boring - 10.0'														

Client: ms consultants

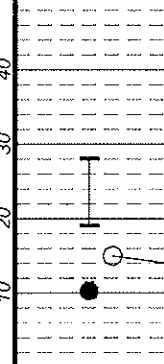
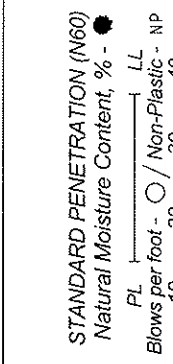
Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-130 Location: Sta. 700+03.56, 10.02 ft Rt. of Ramp E2 BL

Date Drilled: 9/18/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP							
							% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay								
0.3	708.6																			
3.5	708.3 / 705.1	5, 7, 8, 10		1		FILL: Medium dense brown GRAVEL WITH SAND AND SILT (A-2-4), little clay; damp.	31	26	---	12	20	11								
		4, 8, 5, 3		2		Medium dense to dense brown GRAVEL (A-1-a), some fine to coarse sand, little silt; damp.														
		5, 3, 3, 1		3																
		5, 3, 2, 1		4		@ 8.5'-10.0', contains rock fragments.														
		10, 6, 4, 7		5						6										
		30, 20, 14, 10		6																
		11, 17, 19, 12		7		@ 16.0', becomes wet.														
17.5	691.1					Bottom of Boring - 17.5'														



WATER OBSERVATIONS:
Water seepage at: 16.0'
Water level at completion: 15.6'

FIELD NOTES:
Topsoil - 4"
Bottom of Boring - 17.5'

Standard Penetration Test (N60) results and Natural Moisture Content (%) data points.

Gradation data table:

% Aggregate	31
% C. Sand	26
% M. Sand	---
% F. Sand	12
% Silt	20
% Clay	11

Soil description: FILL: Medium dense brown GRAVEL WITH SAND AND SILT (A-2-4), little clay; damp.

Soil description: Medium dense to dense brown GRAVEL (A-1-a), some fine to coarse sand, little silt; damp.

Soil description: @ 8.5'-10.0', contains rock fragments.

Soil description: @ 16.0', becomes wet.

Bottom of Boring - 17.5'

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-131-1 Location: Sta. 600+19.21, 34.07 ft Rt. of Ramp E3 BL Date Drilled: 9/3/2009 to 9/10/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % -				
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	PL	LL	
694.7								69	12	---	5	---	14				
32.0	687.7	7 13 10	10	11		Medium dense to dense brown GRAVEL (A-1-a), little fine to coarse sand, little silt; wet.											
		19 17 14	9	12													
		7 8 11	10	13		Medium dense gray GRAVEL WITH SAND (A-1-b), trace silt; wet.											
42.0	677.7	16 11 13	18	14				34	46	---	11	---	9				
		9 11 11	0	15		Note: terminated sampling on 9/3/09 @ 35.0 feet. Resumed sampling on 9/10/09. @ 38.5', 4.0 feet sand heave; washed out.											
		32 50/5	9	16		Very dense gray GRAVEL (A-1-a), some fine to coarse sand, trace silt; wet.											
50.0	669.7	30 19 37	18	17				68	21	---	5	---	6				

Client: ms consultants

Job No. 0221-1004.01

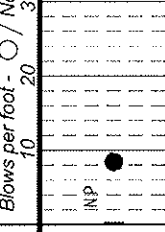
Project: FRA-70-8.93

LOG OF: Boring B-133

Location: Sta. 703+54.90, 2.15 ft Lt. of Ramp E2 BL

Date Drilled: 9/3/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	FIELD NOTES	WATER OBSERVATIONS: Water seepage at: None Water level at completion: None	Graphic Log	GRADATION						STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP				
									% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay					
0.9	709.4																		
2.5	708.5	29		1		Asphalt Concrete - 3" Portland Cement Concrete - 8"													
4.0	706.9	25	12	2	3.0	POSSIBLE FILL: Very dense brown GRAVEL WITH SAND (A-1-b), little silt; damp.													
5.0	705.4	24	18	3	2.25	POSSIBLE FILL: Very stiff brown SANDY SILT (A-4a), trace gravel; damp.													
7.0	705.4	14	18	4	2.0	Very stiff to hard brown SILTY CLAY (A-6b), little to some fine to coarse sand, trace gravel; damp.													
8.5	700.9	7	18	5	4.5	@ 6.0'-7.5', dark brown.													
11.0	698.4	11	18	6	1.5	Stiff brown SANDY SILT (A-4a), trace gravel; damp.													
12.5	696.9	14	3	7		Medium dense brown GRAVEL (A-1-a), little fine to coarse sand, trace silt; damp.													
		13				Bottom of Boring - 12.5'													



Client: ms consultants

Project: FRA-70-8.93

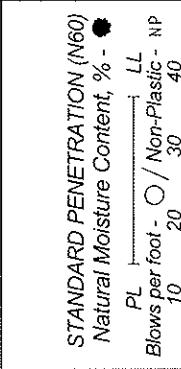
Job No. 0221-1004.01

LOG OF: Boring B-135

Location: Sta. 162+07.02, 6.41 ft Rt. of Ramp G5 BL

Date Drilled: 9/3/2009

Depth (ft)	Elev. (ft)	Blows per ft	Recovery	Sample No. Drive / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % -				
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	PL	LL	
1.0	705.2	17				Asphalt Concrete - 4"	[Hatched]										
2.5	703.7	5	5	1		Portland Cement Concrete - 8"	[Hatched]	41	20	---	10	17	12				
		4	13	2		Medium dense brown GRAVEL WITH SAND AND SILT (A-2-4), little clay; damp.	[Dotted]	54	19	---	8	12	7				
5.5	700.7	2	5	3		Loose to medium dense brown GRAVEL WITH SAND (A-1-b), little silt, trace clay; damp.	[Dotted]	54	16	---	9	13	8				
7.0	699.2	5	3	4		Loose to medium dense brown GRAVEL WITH SAND, SILT, AND CLAY (A-2-6); moist.	[Dotted]	42	15	---	11	18	14				
						Bottom of Boring - 7.0'											



Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-136

Location: Sta. 162+04.63, 3.58 ft Rt. of Ramp H1 BL

Date Drilled: 9/8/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No. Drive / Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % - ● Blows per foot - ○ / Non-Plastic - NP		
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay	
1.5	704.2	7	8	1	4.5+	Asphalt Concrete - 3" Portland Cement Concrete - 9" Aggregate Base - 6"		0	2	5	44	49	10	25	25
2.5	703.2	7	8	2	2.5	POSSIBLE FILL: Hard dark brown ORGANIC CLAY (A-8b), trace fine to coarse sand; moderately organic; moist.		0	2	9	42	47	10	25	25
4.0	701.7	7	18	3	3.0	Very stiff brown CLAY (A-7-6), little fine to coarse sand; slightly organic; moist.		0	1	18	38	43	10	25	25
5.5	700.2	6	18	4		Very stiff brown SILTY CLAY (A-6b), little fine to coarse sand; moist.		60	12	11	--	--	NP	NP	NP
7.0	698.7	6	2			Medium dense brown GRAVEL WITH SAND (A-1-b), little silt; damp. Bottom of Boring - 7.0'									

S-1: LOI @ 440 deg. C = 5.5%
LOI @ 750 deg. C = 7.7%

Client: ms consultants

Project: FRA-70-8.93

Job No. 0221-1004.01

LOG OF: Boring B-139

Location: Sta. 269+86.70, 43.95 ft Rt. of SR 315 CL

Date Drilled: 9/4/2009

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery	Sample No.	Hand Penetrometer (tsf)	DESCRIPTION	Graphic Log	GRADATION					STANDARD PENETRATION (N60) Natural Moisture Content, % -								
								% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt		% Clay							
1.3	702.8					Asphalt Concrete - 4" Portland Cement Concrete - 12"	[Hatched]														
3.0	701.1	10 23	12	1	4.0	POSSIBLE FILL: Very stiff to hard brown SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; damp.	[Diagonal Lines]	11	16		12	33	28								
4.5	699.6	16 8	12	2	--	POSSIBLE FILL: Loose to medium dense brown COARSE AND FINE SAND (A-3a), some silt, little gravel; damp.	[Dotted]	18	18		36	--	26								
5	695.6	8 6	18	3	--	POSSIBLE FILL: Soft to medium stiff brown SANDY SILT (A-4a), little to some gravel; damp.	[Horizontal Lines]	13	11		38	--	38								
8.5	694.1	3 4 6	18	4	0.5	Medium dense brown GRAVEL WITH SAND (A-1-b), little silt, trace clay; wet.	[Vertical Lines]	24	28		16	22	10								
10.0	694.1	5 6	10	5		Bottom of Boring - 10.0'	[Dotted]	53	18		8	15	6								

