November 23, 2011
exp 11/30/2011

Structure Geotechnical Report

F.A.I. Route 74
Section 81-1HVB
Rock Island County
Job No. P-92-032-01
Contract No. 64C08
PTB No. N/A
Retaining Wall IL-RW18
Structure Number 081-6019

November 2011

Prepared for:
Illinois Department of
Transportation, District 2
819 Depot Avenue
Dixon, Illinois 61021

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Table of Contents

Tables

1. Project Description

This report provides geotechnical data and recommendations for the proposed Retaining Wall IL-RW18, which is part of the Central Section of the I-74 over the Mississippi River Project. The project includes reconstruction of I-74 between 14th Avenue in Moline, Illinois and Lincoln Road in Bettendorf, Iowa. The retaining wall covered by this structure geotechnical report will be a new structure, constructed to retain fill for the proposed Ramp 6th-C roadway.

Nearby project features that have an impact on the design or construction of the proposed retaining wall include the Ramp 6th-C over BNSF Railroad and 4th Avenue Bridge (S.N. 081-0186), the Ramp 6th-C roadway, and the 4th Avenue roadway. Geotechnical recommendations for the bridge are presented in a separate structure geotechnical report prepared by Jacobs Civil Inc. Geotechnical recommendations for the ramp and street will be contained in soil survey reports prepared by Hanson Professional Services Inc. (Hanson).

This report supersedes the structure geotechnical report prepared by CH2M HILL in September 2009.

2. Location

The proposed Retaining Wall IL-RW18 is located in the north central portion of Rock Island County, within Section 32 of Township 18 North, Range 1 West. It is located between Ramp 6th-C Sta. 330+75.5 and 332+60.0. The wall separates Ramp 6th-C on the high side from 4th Avenue and the John Deere property on the low side.

3. Proposed Structure

The general structure type was determined by a previous value engineering study. The proposed grade separation will be a single-span bridge with mechanically stabilized earth (MSE) walls serving as the abutments. The MSE wall has a U-shaped configuration in plan, which is typical for Illinois Department of Transportation (IDOT) structures. The walls terminate in the embankment slopes along Ramp 6th-C. Along the south side, IL-RW18 continues along the right shoulder of Ramp 6th-C for 188′-5½″ beyond the corner point. This provides space for a generator yard that will be constructed by John Deere prior to the construction of the proposed wall.

The bridge and wall geometry are configured for a mixed abutment, where the vertical bridge loads are supported by piles passing through the reinforced soil mass. The MSE wall will resist lateral loads applied to the bridge abutments. Based on information provided by the structure designer, the bridge's lateral load applied to the abutment by the superstructure will be approximately 0.9 kips per foot width.

A wall using precast panels with the minimum reinforced soil mass width is preferred for cost and construction schedule. The wall will have a height, measured from the theoretical top of leveling pad to the finished grade line, between 24.3 and 26.9 feet along the abutment and between 3.5 and 30.4 feet along the wings. With this range of heights, a typical MSE wall section would have an equivalent uniform bearing pressure varying from 2,900 to 4,000 psf under the bridge and 1,000 to 5,600 psf along the wings.

Construction of the wall will be governed by a performance specification. The MSE wall supplier will be responsible for the internal stability of the reinforced soil mass. This report provides geotechnical recommendations for external stability and global stability, which are the responsibility of the wall designer.

4. Site Investigation

The footprint of the proposed retaining wall lies within an existing parking lot. The parking lot has an asphaltic concrete surface with a thickness ranging from 2 to 4 inches. The existing topography is flat, with a change of elevation from 575.6 feet to 576.8 feet.

The field exploration completed for the proposed structure was accomplished in three phases. The first two phases were completed in December 2005 and September 2007 by another consultant. IDOT provided the data collected from those two phases. The third phase was completed in June to July 2010 by Hanson. The primary purpose of the third phase was to collect additional samples of the shallow, softer soils for strength and consolidation testing. A representative from Hanson logged the boring and performed a general site reconnaissance during the third phase.

Three borings were drilled in the first two phases and two borings were drilled in the third phase. The maximum spacing between borings was approximately 100 feet. Standard Penetration Test samples generally were collected at 2.5 ft. intervals in all borings. Four Shelby tube samples were collected at representative locations in cohesive strata. All borings were drilled to bedrock. A 20 ft. long core sample of the bedrock was collected in Boring PRMPC02 and a 27.6 ft. long core sample was collected in Boring PRMPC-03. The boring depths ranged from 16.0 ft. to 46.0 ft.

The boring locations are shown on the Boring Location Plan included in the Appendix. Boring logs are included in the Appendix.

5. Laboratory Investigation

Soil samples from the first and second phase borings were tested by others. The testing of samples collected from the first and second phase borings does not meet IDOT's current minimum requirements for structure borings. Unconfined strength and moisture content tests were completed on a small fraction of the samples. Index testing was completed on two representative samples.

The soil samples obtained from the third phase borings were delivered to Hanson's soils laboratory and subjected to a testing program. Natural moisture content and visual classification tests were competed on all samples. Unconfined compressive strength tests, using a Rimac spring tester, were also completed when possible. One consolidated undrained triaxial test envelope, one unconsolidated undrained triaxial test envelope, and one consolidation test were performed on Shelby tube samples.

The locations of the index tests, triaxial tests, and consolidation tests are indicated on the subsurface data profile. Laboratory test data is included in the Appendix.

6. Subsurface Profile

A subsurface data profile is presented in the Appendix for use by the structure designer. The data profile includes all of the borings that were drilled near the proposed structure.

The subsurface profile consists of deposits of fill material, loessial, and alluvial soils overlying bedrock. Bedrock was encountered in all of the borings between Elev. 556.5 and Elev. 561.0 or 15 to 20 ft below existing grade. Typically the bedrock was sandstone or siltstone, although a thin layer of shale was encountered at PRMPC-03. The materials above the bedrock were highly variable between the various borings.

Fill was encountered in two of the borings. It extended from the ground surface to 6.5 ft depth in RW18-1 and 19.5 ft depth in PRMPC02. The fill material was random, consisting of layers of stiff clayey silt, soft sand clay, loose to dense sand, and miscellaneous debris.

Silty and sandy soils of suspected alluvial origin were encountered in the three borings drilled near the proposed abutment. These soils were also found below the loessial soils in PRMP6THC-02. Although similar in origin, these soils were quite variable in classification and consistency. Typically, they were soft to stiff clayey silts or sandy silts or loose to dense sands. Unconfined strengths ranged from 0.4 to 1.1 tsf, with an average of 0.6 tsf. It is believed that the unconfined tests underestimate the true strength of this material. A typical sample that was tested under in-situ confining pressure had an undrained strength of 1.8 tsf.

Medium stiff to stiff silty clay soils of loessial origin were encountered in PRMP6THC-02. These soils were found to a depth of 6.5 ft below the ground surface. Unconfined strengths were approximately 0.9 tsf. Natural moisture contents ranged from 15 to 18 percent.

Groundwater was generally encountered at a depth of 10 and 14 feet within the silty and sandy soils of suspected alluvial origin. The groundwater elevations recorded on the boring logs are summarized in Table 7.1. Stabilized readings were not taken in any of the borings. For comparison, the water level in the Mississippi River, approximately 0.3 miles to the north of the site, is usually about Elev. 561.0.

Table 6.1 Groundwater Elevations

Boring No.	During Drilling	At End of Boring	24-hour Reading
ILR1301	-	-	-
PRMP6thC-02	-	566.5	-
PRMPC02	-	-	-
PRMPC-03	562.3	-	-
RW18-1	-	564.0	-

The Illinois State Geological Survey Directory of Coal Mines does not list any mines in the immediate vicinity of the site.

Although an environmental investigation was beyond the scope of this report, evidence of potential contamination was encountered during the geotechnical investigation. Petroleum odors and construction debris were encountered in the borings.

7. Geotechnical Evaluations

A previous value engineering study determined that an MSE wall was preferred at this site. Due to the interdependence of this structure and the Ramp 6th-C over BNSF Railroad and 4th Avenue Bridge, other types of retaining wall construction were not considered during the development of this SGR.

The native soils have an allowable bearing capacity of 3,700 psf from Sta. 330+75 to 332+00 and 3,000 psf from Sta. 332+00 to 332+60. These capacities consider all soil layers within the zone of influence. The native soils have an undrained sliding resistance of 1,800 psf to the north of Sta. 332+00 and 920 psf to the south of Sta. 322+00. The drained sliding resistance is 0.58 and 0.53 times the effective vertical stress for north and south segments, respectively. If it were constructed directly on the native soils, a large portion of the proposed wall would not meet the Standard Specifications for Highway Bridges (AASHTO) requirements for bearing pressure

and sliding stability. The taller portions of the wall would exceed the allowable bearing capacity by as much as 1,900 psf.

Slope stability analyses of the wall's highest point along the abutment and a critical section along the west wingwall were completed to determine the overall stability of the wall. Results of those analyses are included in the Appendix. A 1.48 factor of safety was computed at the abutment assuming that embankment material is used for backfill behind the reinforced soil mass. If the slope stability analysis considered the select backfill that will be used behind the wingwalls, the factor of safety would exceed the minimum 1.50 necessary to satisfy AASHTO requirements for a wall supporting another structure. The 1.58 factor of safety computed at the west wingwall section satisfies the AASHTO requirements.

The estimated total settlement under the weight of the proposed wall is 4 to 9 inches near the abutment where silty soils are found. A total settlement of 2 to 4 inches is anticipated towards the south end of the wall where silty clay soils are found. The silty soils are expected to consolidate quickly, with 90% of primary consolidation reached in 10 weeks. The silty clay soils will consolidate more slowly. 90% consolidation is expected in 25 weeks. There is great difference in the settlement characteristics at the north and south ends of the wall, primarily due to the underlying soils. Differential settlements are likely considering the unknown nature of the transition from the silty soils to the silty clay soils.

The native cohesive soils found at this site are relatively weak and will not support the weight of a conventional MSE wall. They are also compressible and subject to large settlements. Typically, the alternative solutions are to either reduce the wall's bearing pressure or to increase the foundation soils' strength. Several potential treatment options were considered. Widening the reinforced soil mass and raising the wall in stages are not feasible for this wall. Removal and replacement of the foundation soils, the use of lightweight aggregate, and ground improvement with aggregate columns are possible solutions.

Removal and replacement of the softer soils would need to extend to a depth of 12 to 15 feet below existing grade. There is insufficient right-of-way on the west side of the wall to allow an open excavation. There may also be environmental concerns with the materials to be removed. The costs of removing a large quantity of unsuitable soil, installing temporary shoring, and disposing of potentially contaminated materials render the removal and replacement alternative uneconomical when compared to the other possible solutions.

The use of lightweight granular backfill with a total unit weight of 80 pcf or less would reduce the applied bearing pressures to acceptable values. Lightweight aggregate with a total unit weight of 35 pcf or less would be required to reduce the total settlement to 4 inches. The lightweight aggregate must be used within the reinforced soil mass and within the backfill behind the reinforced soil mass. It is estimated that more almost 7,000 cubic yards of lightweight aggregate would be needed. The cost of this material is not economical when compared to other possible solutions.

Vibrator compacted aggregate columns tipped on the bedrock could increase the allowable bearing capacities above the applied bearing pressures and reduce the total settlement to an acceptable level. Our preliminary analyses indicate that relatively short columns with an area replacement ratio of no more than 25 percent would be sufficient. Although ground improvement with tamper compacted aggregate columns was not expressly investigated, it is expected that the wall also could be successfully constructed using that technology. The cost of aggregate column ground improvement is expected to be lower than the other feasible solutions.

8. Design Recommendations

When designing for the external stability of the MSE wall, it should be assumed that the reinforced soil mass will be composed of a granular select backfill and the fill behind the reinforced soil mass will be embankment material

as defined by the IDOT Standard Specifications for Road and Bridge Construction (IDOT Standard Specifications). Both materials should be assumed to have a total unit weight of 125 pcf. The active earth pressure coefficient of the embankment fill could vary greatly depending on the actual material used, but should be assumed to be 0.36 for design. Near the wall corners, where the backfill will be the select material placed behind the other face, an active earth pressure coefficient of 0.28 may be used.

Aggregate column ground improvement is the recommended treatment option. The results are highly dependent upon the equipment and techniques used to install the aggregate columns. The contractors that perform this type of work routinely design the improvement to specific geotechnical performance requirements. The lump sum cost of the treatment is expected to be approximately $140,000.

We recommend that the approximate horizontal limits of the aggregate column ground improvement be defined as an area bounded by a line 4 ft. beyond the perimeter of the entire reinforced soil mass. Within the ground improvement limits, the contractor should be required to satisfy the following performance requirements:

1. Minimum factor of safety of 1.5 against global slope stability failure of permanent condition.
2. Minimum factor of safety of 2.0 against equivalent uniform service bearing pressure failure if a load test is performed.
3. Minimum factor of safety of 2.5 against equivalent uniform service bearing pressure failure if a load test is not performed.
4. Total settlement measured at the base of the wall not to exceed 4.0 inches.
5. Total settlement measured on the pavement not to exceed 1.0 inch.
6. Differential settlement measured along the base of the wall not to exceed 1/100.
7. Primary consolidation of the soil within the depth of the ACGI to be at least 90 percent complete when the bridge piles are to be driven. Any required waiting periods shall be coordinated with the bridge construction schedule.

It should be noted that global stability performance requirement can be satisfied without any improvement to the native subgrade. The bearing pressure and settlement requirements will control the design of the aggregate column ground improvement. The provision allowing for a lower factor of safety if a load test is performed has been included for consistency with other walls on the I-74 project.

With the ground improvement, a conventional precast panel MSE wall is feasible. The theoretical top of leveling pad or base of reinforced soil mass may be located at the minimum embedment required by IDOT (3'-6" below finished grade). Any removals or other excavation below the reinforced soil mass should be backfilled with either the select backfill used in the reinforced soil mass or the granular material used as a drainage layer or working platform for the aggregate column ground improvement design. Fill used below the reinforced soil mass should either be porous granular embankment or structural fill placed with moisture and density control. General embankment fill should not be used within a prism from 2 ft. in front of the wall to the back of the reinforced soil mass, extending down at a 2V:1H slope. Material behind the reinforced soil mass may be embankment fill in accordance with the IDOT Standard Specifications.

The external stability design should be completed using the parameters defined above. In areas with ground improvement, the applied bearing pressures should not be compared to allowable bearing capacities of the native soils. Instead, the estimated applied bearing pressures will be given as a performance requirement for the aggregate column ground improvement. The minimum length to height ratio specified by AASHTO (0.70) will be acceptable for the entire wall.

9. Construction Considerations

The construction of MSE walls and aggregate column ground improvement are not covered by the IDOT Standard Specifications. Guide Bridge Special Provisions No. 38, Mechanically Stabilized Earth Retaining Walls (Revised: October 15, 2011), and No. 71, Aggregate Column Ground Improvement (Revised: October 15, 2011), should be included in the construction documents. These special provisions require that the contractor take responsibility for the final design of much of the structure.

The general contractor will hire a specialty contractor to design and install the aggregate column ground improvement. He will also hire an MSE wall supplier to complete the MSE wall design and furnish the materials. The interdependence of the ground improvement and MSE wall designs must be considered when developing the plans. The MSE wall supplier will typically design a wall with a horizontal base with vertical steps at convenient locations. This results in a wall that is slightly taller and wider than the theoretical size shown on the construction plans. The wall supplier may also use different assumptions for unit weight and lateral earth pressure on the reinforced soil mass. Because of these factors, the target bearing pressure for the ground improvement contractor should be 5% to 10% higher than the theoretical value calculated during preliminary design.

The ground improvement contractor will need to assign strength and consolidation properties to the native soils in order to design the aggregate columns. All of the soils laboratory data in the Appendix to this report should be included in the contract documents. Usually, this is accomplished by adding a "Geotechnical Investigation Laboratory Data" section to the special provisions.

The piles for the Ramp 6th-C Bridge (S.N. 081-0186), which are located within the reinforced soil mass for this wall, will interfere with the placement and compaction of the select backfill. The piles must either be driven prior to placing the select backfill or driven through sleeves after placing the select backfill. Refer to the structure geotechnical report for the bridge structure for specific recommendations.

Aggregate columns should be installed before the bridge piles are driven; however, the piles should not be driven through the aggregate of an installed column. The construction plans should require that the specialty contractor's aggregate column layout provide clearance for the bridge piles.

References

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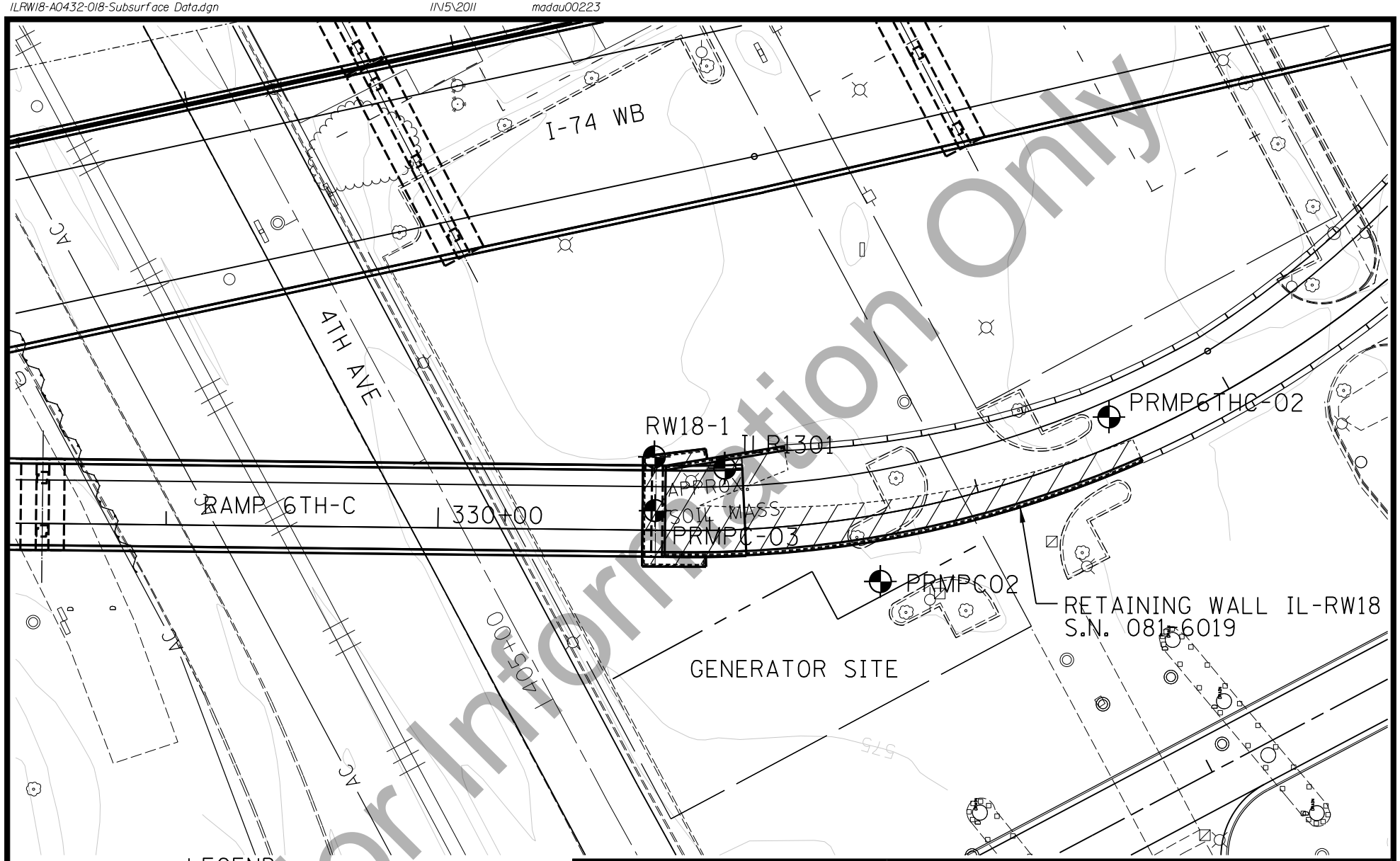
U.S. Department of Transportation, Federal Highway Administration (1997, August). *Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines* (Publication No. FHWA-SA-96-071).

Appendix

Boring Location Plan
Subsurface Data Profile
Boring Logs
Soils Laboratory Test Results
Summary of Slope Stability Analysis

ILRW18-A0432-018-Subsurface Data.dgn IN\5\2011 madau00223



HANSON

BORING LOCATION PLAN

RAMP 6TH-C RETAINING WALL IL-RW18
S.N. 081-6019
ROCK ISLAND COUNTY, ILLINOIS

08H0120E 11/15/11

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

ILR1301
Sta. 331+06, 23' LT

	N	Qu	w%	
575.95				
575.45				3" Of Asphalt - Surface 3" Asphalt
	13			Silty Sand (SM) - grayish brown, slightly moist, medium dense, fine to coarse grained, non-plastic plasticity.
	5			Grayish brown, slightly moist, medium dense, fine to coarse, non plastic, fines dark gray, loose, low plasticity.
	2		23.0	Same as above, dark gray, loose, low plasticity fines
	4			yellowish brown, very loose, Same as above very moist (LL=32, PI=12)
	4			wet, loose, Same as above, more silt
563.95				
	6		13.0	Sandy Silt (SM) - Grayish brown, moist, medium to stiff, low plasticity, fine to medium grained
	13			grayish brown, moist, firm, fine to medium grained, Same as above, stiff, grey brown siltstone at tip (4' total count pocket pen)
559.95				
	50/6"			Sandstone - grayish brown, stiff, No recovery 1" of laminated siltstone/ sandstone in the shoe
	50/2"			
				No recovery 1 1/2" of laminated grey sandstone in tip
546.95				
				Bottom of hole = 29.0 feet

RW18-1
Sta. 330+79, 27' LT

	N	Qu	w%		
576.00					
575.80					ASPHALT
	11		13		FILL - Very dark brown, moist, stiff, clayey SILT with fine-grained sand and gravel, coal and cinders
	6		25		
		1.10B	20		
569.50					
			21	Q	Brown and gray, moist, medium stiff, SILT with trace very fine-grained sand
			24	C	(LL=26, PI=7)
			22		
			23	R	
			23		
Oh					
564.00	6		22		Brownish gray, wet, loose, silty, fine-to medium-grained SAND
562.50					Gray, wet, soft, SILT with fine-grained sand, petroleum odor
	4	0.30P	29		(LL=23, PI=5)
560.50					
559.50	50/5"	3.50P	7		Gray, WEATHERED SILTSTONE
					Bottom of hole = 16.5 feet

PRMPC-03
Sta. 330+80, 7' LT

	N	Qu	w%	
575.80				
575.47				PAVEMENT - asphalt concrete (4" thick)
	14	2.5P		SILT - yellowish brown to brown and orange-brown mottled to gray, little to some clay, powdery, slightly to medium plastic, medium stiff to stiff, moist
	3	0.5P	16	- dark brown, little to some clay
	4	0.8P		- some clay, medium plastic
567.30				
	3	0.5P	21	CLAY - tan, brown and orange, little to some fine sand, soft to medium stiff, very moist to wet.
DD	4	1.0P		
562.30				
	2			SAND - black, fine to coarse, and dark gray medium to high plastic clay, very soft/loose, saturated.
559.80				[Note: strong petroleum odor and trace free product in saturated zone at 13.5'-15'; PID = 420 ppm]
	94	>4.5P		
557.40				SHALE - light gray, sandy (hard clay), no laminations, dry.
	Rec. = 98%			
	ROD = 55%			SANDSTONE - light brownish gray, fine grained, uniform grain size, well sorted, moderately well cemented, soft, localized black banding and light gray shale pod inclusions, primarily horizontal sandy rough fractures, non-distinct bedding with fractures at thin to thick bedded spacing, slightly weathered to fresh.
	Rec. = 100%			
	ROD = 69%			
	Rec. = 98%			- dark gray shale bed with numerous light gray sandstone partings and seams, soft, rock-like at 21' to 22.8'
	ROD = 83%			
				- 4" thick dark gray to black sandy shale seam at 25.7' to 26.0'
	Rec. = 100%			- brown spotted/speckled fine grained sandstone at 26' to 27.3'
	ROD = 85%			
	Rec. = 98%			
	ROD = 98%			
529.80				
				Bottom of hole = 46.0 feet

LEGEND

N	Standard Penetration Test N (blows/ft)
Qu	Unconfined Strength (tsf)
w%	Natural Moisture Content (%)
Q	Unconsolidated Undrained Triaxial Test
R	Consolidated Undrained Triaxial Test
C	Consolidation Test
DD ▽ 558.10	Water Surface Elevation Encountered in Boring DD = during drilling 24h = 24 hours after completion

SUBSURFACE DATA PROFILE
STRUCTURE NO. 081-6019

PROFESSIONAL DESIGN FIRM LICENSE #184-001084

HANSON
Hanson Professional Services Inc.

JOB NO. 08H0120E
DATE 11/15/11
SHEET NO. 1
2 SHEETS

F.A.I RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	81-1HVB	ROCK ISLAND	_	
		CONTRACT NO. 64C08		
FED. ROAD DIST. NO. _	ILLINOIS	FED. AID PROJECT		

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PRMPC02
Sta. 331+59, 24' RT

	N	Qu	w%	
575.95				3" asphalt concrete, underlain by 9" crushed gravel
574.95	9			Miscellaneous Fill - Poorly graded sand, brown, moist, fine to coarse, fill, underlain by 3" thick brick, clay, gravel mix
	42			Sand, gravel, silty clay mix
	21			Concrete pieces, gravel, sand
	10			Bricks, concrete rubble, gravel, silty clay, gray, brown, moist, soft, low plasticity
	7			Reddish brown silty sandy clay, moist, soft/loose, fine sand seams with alternating silty clay seams
	5			Gray sandy clay, moist/wet, soft, fine sand and fines with iron oxide streaks with poorly graded fine to medium sand seams
	13			Gray/black sandy clay, moist/wet, asphalt concrete with petroleum odor
556.45	50/2"			Sandstone - Auger refusal and
555.95	Rec. = 50% RQD = 17%			Sandstone - Light gray, fine grained, slightly weathered, weak to moderately strong, extremely to moderately fractured, Horizontal fractures, no staining, extremely close to close spacing, vertical fracture at bottom 3", black sandstone striations throughout, smooth undulating joints, thin silty infilling at 9" from the top, no infilling elsewhere
	Rec. = 100% RQD = 45%			Light gray, fine grained, slightly weathered, weak to moderately strong, extremely fractured to sound, with shale seams throughout, Coring rate: 4 minutes for 2.5'. Fractures are mostly horizontal, extremely close to moderate spacing, no staining, smooth undulating joint surfaces, highly fractured zones at 2'3" and 4'6" from top, zones have silty infilling coating with fractured pieces
	Rec. = 93% RQD = 83%			Light gray, fine grained, extremely fractured to sound, unweathered, moderately strong, shale seams scattered throughout. Coring rate: 14 minutes for 5'. Horizontal fractures, no staining, smooth undulating surfaces, discontinuities are extremely close to moderately spaced, shaley infilling (very thin) and coating at some joint surfaces, tightly healed joints
	Rec. = 97% RQD = 85%			moderately fractured to sound, unweathered. Coring rate: 6 minutes for 5'. Horizontal joints, no staining, smooth undulating joints, some joints are at 20 degrees, no infilling except at 37' where 2" thick soft silty infilling is present preventing rock wall contact, other joints are tightly healed, close to moderately spaced discontinuities
	Rec. = 77% RQD = 23%			Light gray, fine grained, no shale seams, extremely fractured to slightly fractured, moderately strong, slightly weathered, horizontal joints, no staining, no infilling, very close to close spacing, rough irregular surfaces, tightly healed joints
535.95				Bottom of hole = 40.0 feet

PRMP6THC-02
Sta. 332+55, 10' LT

	N	Qu	w%	
576.50				
576.10				ASPHALT
	11	0.95B	18	Very dark brown, moist, stiff, silty, sandy, lean CLAY
572.50		0.90B	15	Gray, moist, stiff, silty, sandy, lean CLAY
570.00				Gray with brown mottles, moist to wet, soft, silty lean CLAY
Oh ▽ 566.50	4	0.55B 0.43B	32 22	(LL=25, PI=11)
565.00				Gray, moist, medium dense, silty, clayey, fine-to medium-grained SAND, petroleum odor
562.50	30		13	Brown, wet, dense, medium-to coarse-grained SAND and GRAVEL
561.00	50/0"			Weathered Rock
560.50				Bottom of hole = 16.0 feet

LEGEND

N	Standard Penetration Test N (blows/ft)
Qu	Unconfined Strength (tsf)
w%	Natural Moisture Content (%)
[Q]	Unconsolidated Undrained Triaxial Test
[R]	Consolidated Undrained Triaxial Test
[C]	Consolidation Test
DD ▽ 558.10	Water Surface Elevation Encountered in Boring DD = during drilling 24h = 24 hours after completion

SUBSURFACE DATA PROFILE
STRUCTURE NO. 081-6019

PROFESSIONAL DESIGN FIRM LICENSE #184-001084

HANSON
Hanson Professional Services Inc.

JOB NO. 08H0120E
DATE 11/15/11

SHEET NO. 2
2 SHEETS

F.A.I RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	81-1HVB	ROCK ISLAND	_	
		CONTRACT NO. 64C08		
FED. ROAD DIST. NO. _	ILLINOIS	FED. AID PROJECT		

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 9/19/07

ROUTE I-74 **DESCRIPTION** New I-74 Bridge Over Mississippi River - Illinois Approach **LOGGED BY** F. Abreu

SECTION I-74 Bridge over Mississippi River **LOCATION** (N=564025.307, E=2459262.179), **SEC.** 32, **TWP.** 18N, **RNG.** 1W, 4th **PM**

COUNTY Rock Island **DRILLING METHOD** HSA, CME 55 **HAMMER TYPE** CME AUTOMATIC

STRUCT. NO. _____
Station _____

BORING NO. ILR1301
Station _____
Offset _____
Ground Surface Elev. 575.95 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter _____ ft
Upon Completion _____ ft
After _____ **Hrs.** _____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3" Of Asphalt 575.45 Surface 3" Asphalt				
Silty Sand (SM) grayish brown, slightly moist, medium dense, fine to coarse grained, non-plastic plasticity,		4		
Grayish brown, slightly moist, medium dense, fine to coarse, non plastic, fines		8 5		
dark gray, loose, low plasticity,		2		
Same as above, dark gray, loose, low plasticity fines	-5	2 3		
yellowish brown, very loose, Same as above very moist		0		
		1 1		23.0
wet, loose, Same as above, more silt		2		
		2 2		
563.95	-10			
Sandy Silt (SM) Grayish brown, moist, medium to stiff, low plasticity, fine to medium grained		1 2 2		
		0		
		3 3		13.0
grayish brown, moist, firm, fine to medium grained, Same as above, stiff, grey brown siltstone at tip (4' total count pocket pen)	-15	0 5 8		
559.95				
Sandstone grayish brown, stiff, No recovery 1" of laminated silt stone/sand stone in the shoe		50/6		
		30		
		50/2		
	-20			

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Sandstone grayish brown, stiff, No recovery 1" of laminated silt stone/sand stone in the shoe *(continued)* No recovery 1 1/2' of laminated grey sandstone in tip	-25			
546.95				
End of Boring	-30			
	-35			
	-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

HANSON

SOIL BORING LOG

Date 7/1/10

ROUTE F.A.I. 74 **DESCRIPTION** I-74 Over Mississippi River **LOGGED BY** JMB

SECTION 81B **LOCATION** NE¼ of SEC. 32, TWP. 18N, RNG. 1W, 4th P.M.

COUNTY Rock Island **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Auto

STRUCT. NO. _____
Station _____
BORING NO. PRMP 6th C-02
Station 332+55
Offset 10' Lt.
Ground Surface Elev. 576.5 ft

Surface Water Elev. _____
Stream Bed Elev. _____

Groundwater Elev.:
First Encounter _____ ft
Upon Completion 566.5 ft ▽
After _____ **Hrs.** _____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
ASPHALT 576.10				
Very dark brown, moist, stiff, silty, sandy, lean CLAY	2	4 5 6	0.95B	18
572.50	4		0.90B	15
Gray, moist, stiff, silty, sandy, lean CLAY	6			
570.00				
Gray with brown mottles, moist to wet, soft, silty, lean CLAY	8	2 2 2	0.55B	32
	10 ▽		0.43B	22
565.00				
Gray, moist, medium dense, silty, clayey, fine- to medium-grained SAND, petroleum odor	12			
562.50	14	7 10 20		13
Brown, wet, dense, medium- to coarse-grained SAND and GRAVEL				
561.00				
Weathered Rock 560.50	16	50/0"		
End of Boring				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 12/15/05

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY B. Karnik

SECTION I-74 Bridge over Mississippi River LOCATION (N=563968.083, E=2459220.495), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. _____
Station _____

BORING NO. PRMPC02
Station _____
Offset _____
Ground Surface Elev. 575.95 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter _____ ft
Upon Completion _____ ft
After _____ Hrs. _____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3" asphalt concrete, underlain by 9" crushed gravel 574.95				
Miscellaneous Fill Poorly graded sand, brown, moist, fine to coarse, fill, underlain by 3" thick brick, clay, gravel mix		5 4 5 14		
Sand, gravel, silty clay mix		28 24 18 8		
Concrete pieces, gravel, sand	-5	3 11 10 5		
Bricks, concrete rubble, gravel, silty clay, gray, brown, moist, soft, low plasticity		6 6 4 3		
Reddish brown silty sandy clay, moist, soft/loose, fine sand seams with alternating silty clay seams	-10	4 4 3 3		
Gray sandy clay, moist/wet, soft, fine sand and fines with iron oxide streaks with poorly graded fine to medium sand seams		3 3 3 2		
Gray/black sandy clay, moist/wet, asphalt concrete with petroleum odor		3 3 7 6		
	-15	8		
556.45				
Sandstone Auger refusal and 555.95	-20	50/2		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
CH2M HILL

ROCK CORE LOG

Date 12/15/05

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY B. Karnik

SECTION I-74 Bridge over Mississippi River LOCATION (N=563968.083, E=2459220.495), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island CORING METHOD NQ DOUBLE BARREL DIAMOND TIP

STRUCT. NO. _____
Station _____

CORING BARREL TYPE & SIZE _____

Core Diameter _____ in
Top of Rock Elev. 555.95 ft
Begin Core Elev. 555.95 ft

BORING NO. PRMPC02
Station _____
Offset _____
Ground Surface Elev. 575.95 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Sandstone Light gray, fine grained, slightly weathered, weak to moderately strong, extremely to moderately fractured Horizontal fractures, no staining, extremely close to close spacing, vertical fracture at bottom 3", black sandstone striations throughout, smooth undulating joints, thin silty infilling at 9" from the top, no infilling elsewhere	555.95	R-1	50	17		
Light gray, fine grained, slightly weathered, weak to moderately strong, extremely fractured to sound, with shale seams throughout, Coring rate: 4 minutes for 2.5' Fractures are mostly horizontal, extremely close to moderate spacing, no staining, smooth undulating joint surfaces, highly fractured zones at 2' 3" and 4' 6" from the top, zones have silty infilling coating with fractured pieces	-25	R-2	100	45		
Light gray, fine grained, extremely fractured to sound, unweathered, moderately strong, shale seams scattered throughout Coring rate: 14 minutes for 5' Horizontal fractures, no staining, smooth undulating surfaces, discontinuities are extremely close to moderately spaced, shaley infilling (very thin) and coating at some joint surfaces, tightly healed joints	-30	R-3	93	83		
moderately fractured to sound, unweathered Coring rate: 6 minutes for 5' Horizontal joints, no staining, smooth undulating joints, some joints are at 20 degrees, no infilling except at 37' where 2" thick soft silty infilling is present preventing rock wall contact other joints are tightly healed, close to moderately spaced discontinuities	-35	R-4	97	85		447.0
Light gray, fine grained, no shale seams, extremely fractured to slightly fractured, moderately strong, slightly weathered Horizontal joints, no staining, no infilling, very close to close spacing, rough irregular surfaces, tightly healed joints	535.95 -40	R-5	77	23		

End of Boring

Color pictures of the cores _____

Cores will be stored for examination until _____

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

BBS, form 138 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 9/4/07

ROUTE I-74 **DESCRIPTION** New I-74 Bridge Over Mississippi River - Illinois Approach **LOGGED BY** KJB

SECTION I-74 Bridge over Mississippi River **LOCATION** (N=564052.458, E=2459235.291), **SEC.** 32, **TWP.** 18N, **RNG.** 1W, 4th **PM**

COUNTY Rock Island **DRILLING METHOD** HSA, CME 55 **HAMMER TYPE** CME AUTOMATIC

STRUCT. NO. _____
Station 330+80

BORING NO. PRMPC-03
Station _____
Offset _____
Ground Surface Elev. 575.80 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter 562.3 ft ▼
Upon Completion _____ ft
After _____ **Hrs.** _____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
PAVEMENT - asphalt concrete (4" thick) 575.47				
SILT - yellowish brown to brown and orange-brown mottled to gray, little to some clay, powdery, slightly to medium plastic, medium stiff to stiff, moist		4 5 9	2.5 P	
		1		
- dark brown, little to some clay	-5	1 2	0.5 P	
		2		
		2 2	0.8 P	
- some clay, medium plastic 567.30		2		
CLAY - tan, brown and orange, little to some fine sand, soft to medium stiff, very moist to wet.	-10	1 2	0.5 P	
		WOH		
		1 3	1.0 P	
562.30 ▼				
SAND - black, fine to coarse, and dark gray medium to high plastic clay, very soft/loose, saturated.	-15	WOH 2 0		
[Note: strong petroleum odor and trace free product in saturated zone at 13.5'-15'; PID = 420 ppm] 559.80		20		
SHALE - light gray, sandy (hard clay), no laminations, dry.		34 60	>4.5 P	
557.40				
Borehole continued with rock coring.	-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

ROCK CORE LOG

Date 9/4/07

ROUTE I-74 **DESCRIPTION** New I-74 Bridge Over Mississippi River - Illinois Approach **LOGGED BY** KJB

SECTION I-74 Bridge over Mississippi River **LOCATION** (N=564052.458, E=2459235.291), **SEC.** 32, **TWP.** 18N, **RNG.** 1W, 4th **PM**

COUNTY Rock Island **CORING METHOD** NQ Core

STRUCT. NO.
Station 330+80

BORING NO. PRMPC-03
Station
Offset
Ground Surface Elev. 575.80 **ft**

CORING BARREL TYPE & SIZE NQ Wireline
Core Diameter 1.8 **in**
Top of Rock Elev. 559.80 **ft**
Begin Core Elev. 557.40 **ft**

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SANDSTONE - light brownish gray, fine grained, uniform grain size, well sorted, moderately well cemented, soft, localized black banding and light gray shale pod inclusions, primarily horizontal sandy rough fractures, non-distinct bedding with fractures at thin to thick bedded spacing, slightly weathered to fresh. 557.40	Run 1	98	55	1.5	
-20					
-dark gray shale bed with numerous light gray sandstone partings and seams, soft, rock-like at 21' to 22.8'	Run 2	100	69	0.8	
-25					
-4" thick dark gray to black sandy shale seam at 25.7' to 26.0'	Run 3	98	83	0.6	
-brown spotted/speckled fine grained sandstone at 26' to 27.3'					
-30					
	Run 4	100	85	0.6	
-35					
	Run 5	98	98	0.7	

Color pictures of the cores Yes
Cores will be stored for examination until
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Illinois Department of Transportation
Division of Highways
CH2M HILL

ROCK CORE LOG

Date 9/4/07

ROUTE I-74 **DESCRIPTION** New I-74 Bridge Over Mississippi River - Illinois Approach **LOGGED BY** KJB

SECTION I-74 Bridge over Mississippi River **LOCATION** (N=564052.458, E=2459235.291), **SEC.** 32, **TWP.** 18N, **RNG.** 1W, 4th **PM**

COUNTY Rock Island **CORING METHOD** NQ Core

STRUCT. NO.
Station 330+80

BORING NO. PRMPC-03
Station
Offset
Ground Surface Elev. 575.80 **ft**

CORING BARREL TYPE & SIZE NQ Wireline
Core Diameter 1.8 **in**
Top of Rock Elev. 559.80 **ft**
Begin Core Elev. 557.40 **ft**

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SANDSTONE - light brownish gray, fine grained, uniform grain size, well sorted, moderately well cemented, soft, localized black banding and light gray shale pod inclusions, primarily horizontal sandy rough fractures, non-distinct bedding with fractures at thin to thick bedded spacing, slightly weathered to fresh. *(continued)*					
-40					
-45					
529.80					
End of Boring					
-50					
-55					

Color pictures of the cores Yes
Cores will be stored for examination until
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

HANSON

SOIL BORING LOG

Date 6/30/10

ROUTE F.A.I. 74 **DESCRIPTION** I-74 Over Mississippi River **LOGGED BY** JMB

SECTION 81-1HVB **LOCATION** NE¼ of SEC. 32, TWP. 18N, RNG. 1W, 4th P.M.

COUNTY Rock Island **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Auto

STRUCT. NO. 081-6019
Station
BORING NO. RW 18-1
Station 330+79
Offset 27' Lt.
Ground Surface Elev. 576.0 ft

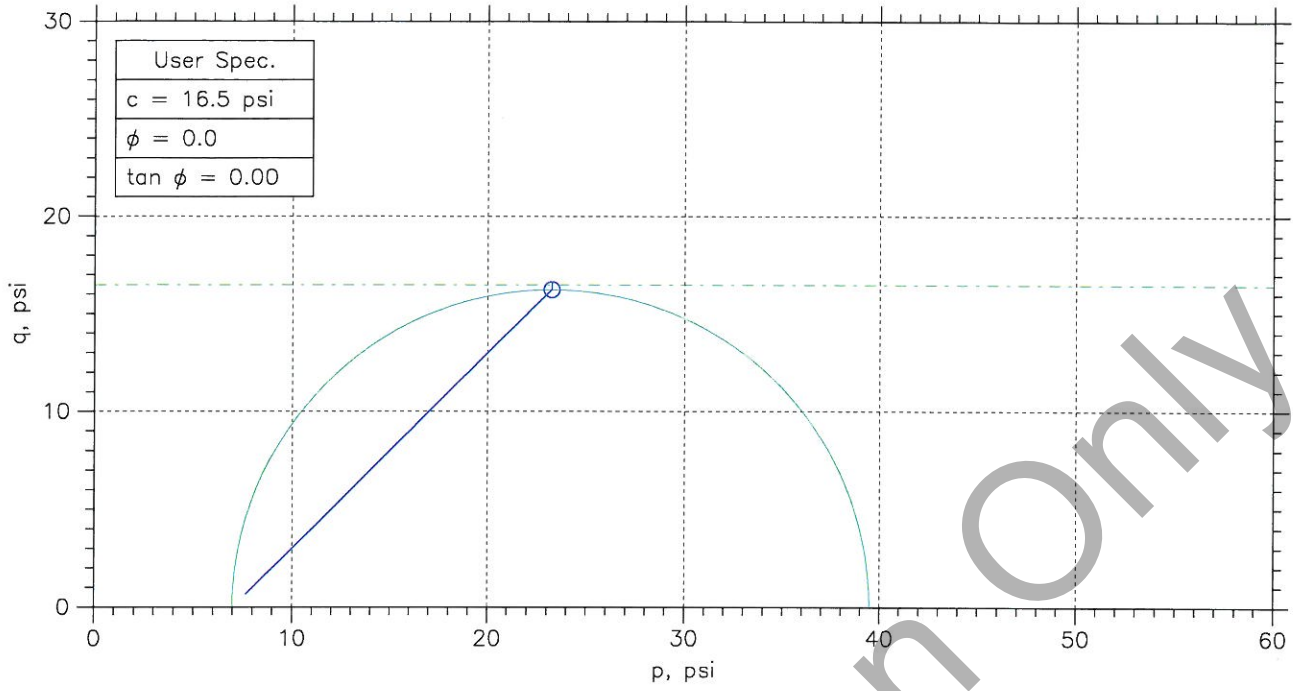
Surface Water Elev.
Stream Bed Elev.

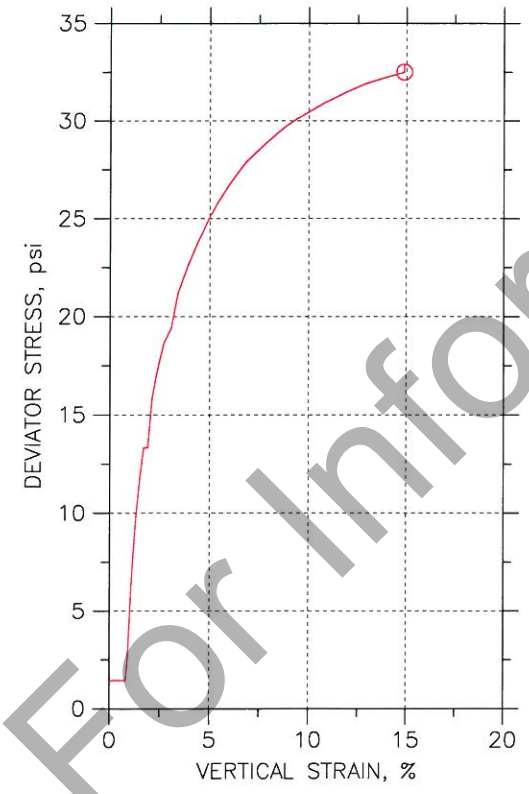
Groundwater Elev.:
First Encounter ft
Upon Completion 564.0 ft ▽
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
ASPHALT 575.80				
FILL - Very dark brown, moist, stiff, clayey SILT with fine-grained sand and gravel, coal and cinders	6 6 5		13	
2				
	2 3 3		25	
4				
569.50		1.10B	20	
Brown and gray, moist, medium stiff, SILT with trace very fine-grained sand			21	
8			21 22 23 23	
10				
564.00 ▽ 12	3 3 3		22	
Brownish gray, wet, loose, silty, fine- to medium-grained SAND				
562.50				
Gray, wet, soft, SILT with fine-grained sand, petroleum odor	2 2 2	0.30P	29	
14				
560.50				
Gray, WEATHERED SILTSTONE				
16				
559.50	50/5"	3.50P	7	
End of Boring				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850





Symbol	⏀			
Sample No.	3-2			
Test No.	1			
Depth	6.5-7.0			
Tested by	RIN			
Test Date	8/6/10			
Checked by	JCC			
Check Date				
Diameter, in	2.849			
Height, in	5.758			
Water Content, %	20.9			
Dry Density, pcf	106.8			
Saturation, %	100.6			
Void Ratio	0.549			
Confining Stress, psi	7			
Undrained Strength, psi	16.24			
Max. Dev. Stress, psi	32.49			
Strain at Failure, %	14.9			
Strain Rate, %/min	1			
Estimated Specific Gravity	2.65			
Liquid Limit	0			
Plastic Limit	0			
Plasticity Index	0			

HANSON

Project: I-74 Mississippi River

Location: Quad Cities

Project No.: 08H0120E

Boring No.: RW18-1

Sample Type: Tube

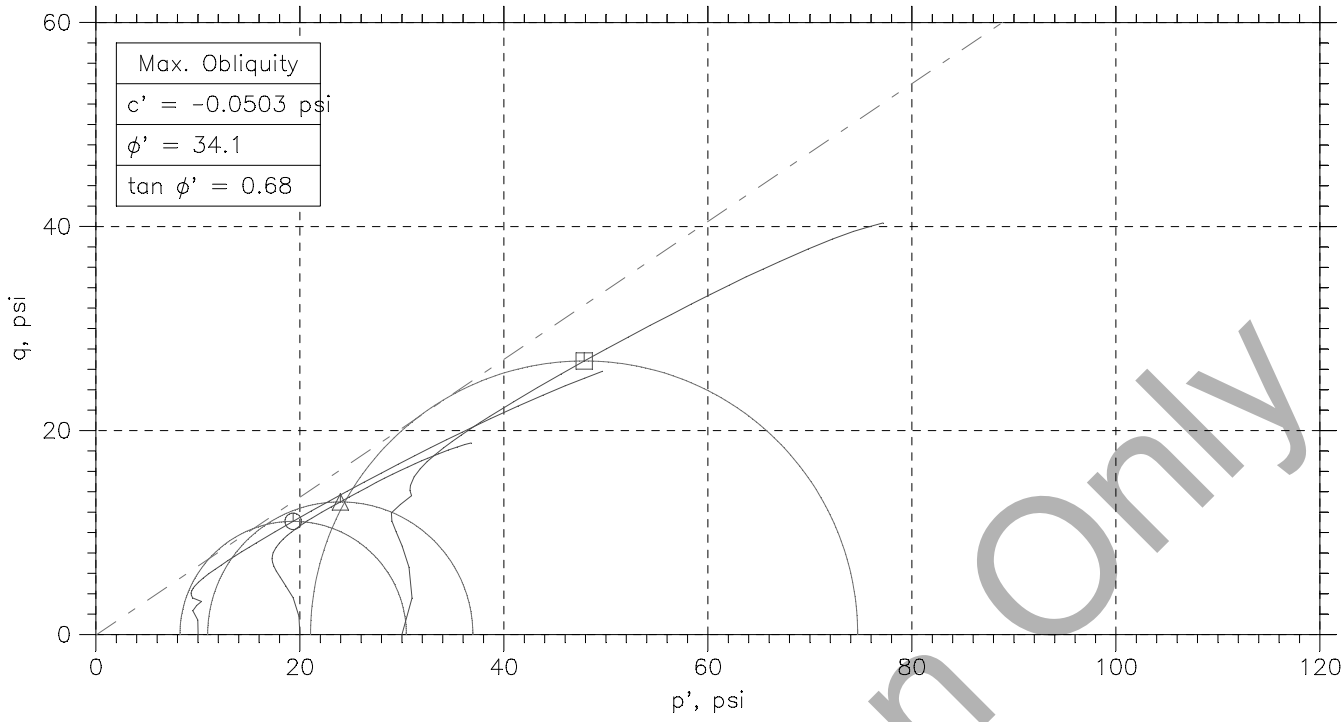
Description: Yel. brn. & gray vf. sandy silt.

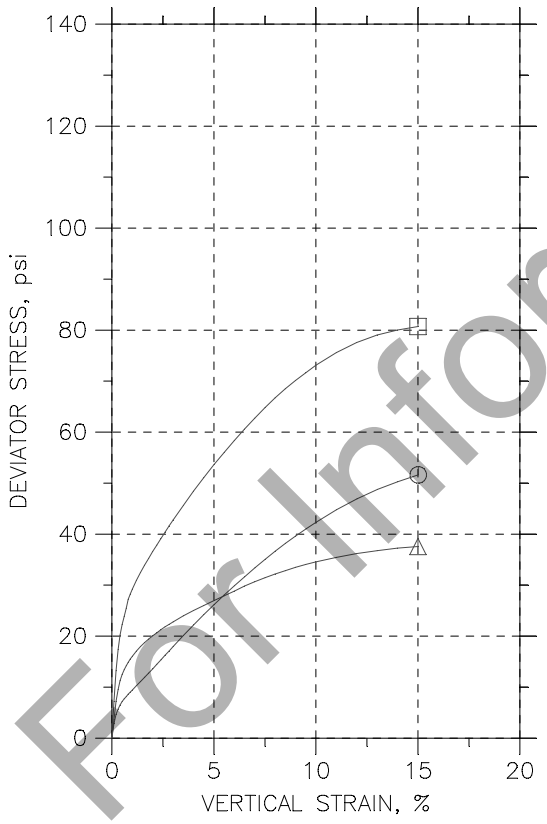
Remarks: 2500 # Load Cell Loadtrac II # 258112 LVDT55306

Phase calculations based on start of test.

Tue, 08-MAR-2011 10:34:19

CONSOLIDATED UNDRAINED TRIAXIAL TEST





Symbol		○	△	□	
Sample No.		4-2	4-3	4-4	
Test No.		1 of 3	2 of 3	3 of 3	
Depth		8.3-8.8	8.8-9.3	9.3-9.8	
Initial	Diameter, in	2.853	2.86	2.848	
	Height, in	5.621	5.863	5.677	
	Water Content, %	23.1	23.3	22.3	
	Dry Density, pcf	104.4	103.4	104.8	
	Saturation, %	104.6	102.8	102.1	
	Void Ratio	0.585	0.6	0.578	
Before Shear	Water Content, %	23.0	22.7	21.4	
	Dry Density, pcf	102.8	103.3	105.7	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.609	0.601	0.566	
	Back Press., psi	42.02	52.	21.99	
Ver. Eff. Cons. Stress, psi		9.98	19.99	30.01	
Shear Strength, psi		25.81	18.79	40.36	
Strain at Failure, %		15	15	15	
Strain Rate, %/min		0.0625	0.0625	0.0625	
B-Value		0.95	0.96	0.96	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		0	0	0	
Plastic Limit		0	0	0	

HANSON

Project: I-74 Mississippi River Br

Location: Quad Cities

Project No.: 08H0120E

Boring No.: RW18-01

Sample Type: Tube

Description: Yel. brn. & gray vf.-f. sandy silt.

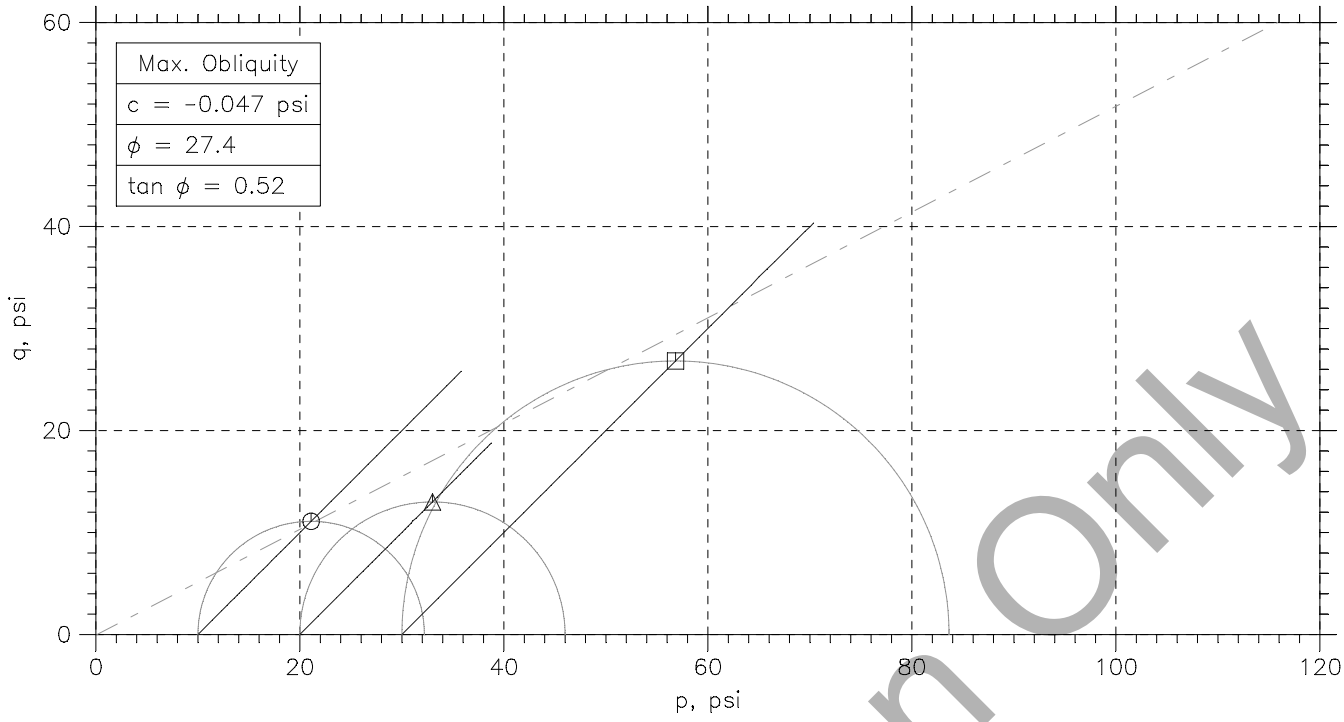
Remarks: 2500 # Load Cell Loadtrac II # 258112 FlowTrac II 13610 & 13610B & LVDT55306

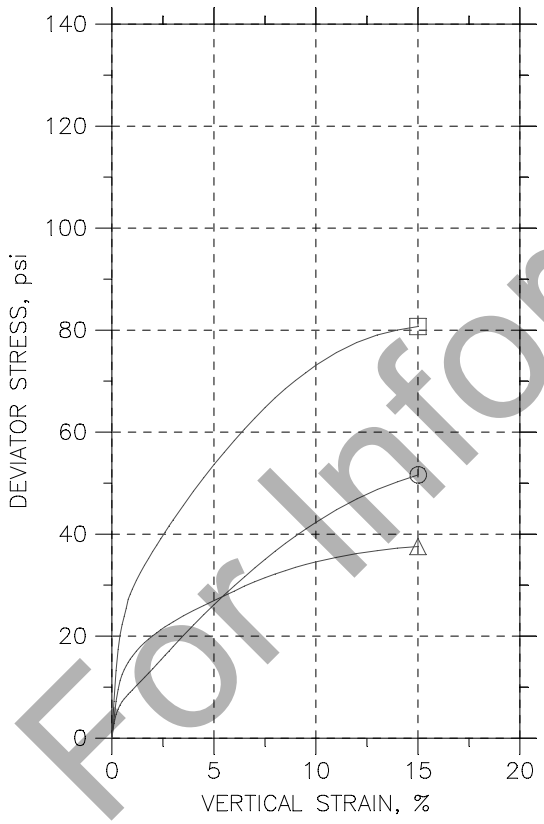
Phase calculations based on start of test.

* Saturation is set to 100% for phase calculations

Fri, 01-APR-2011 16:12:11

CONSOLIDATED UNDRAINED TRIAXIAL TEST





Symbol		○	△	□	
Sample No.		4-2	4-3	4-4	
Test No.		1 of 3	2 of 3	3 of 3	
Depth		8.3-8.8	8.8-9.3	9.3-9.8	
Initial	Diameter, in	2.853	2.86	2.848	
	Height, in	5.621	5.863	5.677	
	Water Content, %	23.1	23.3	22.3	
	Dry Density, pcf	104.4	103.4	104.8	
	Saturation, %	104.6	102.8	102.1	
	Void Ratio	0.585	0.6	0.578	
Before Shear	Water Content, %	23.0	22.7	21.4	
	Dry Density, pcf	102.8	103.3	105.7	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.609	0.601	0.566	
	Back Press., psi	42.02	52.	21.99	
Ver. Eff. Cons. Stress, psi		9.98	19.99	30.01	
Shear Strength, psi		25.81	18.79	40.36	
Strain at Failure, %		15	15	15	
Strain Rate, %/min		0.0625	0.0625	0.0625	
B-Value		0.95	0.96	0.96	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		0	0	0	
Plastic Limit		0	0	0	

HANSON

Project: I-74 Mississippi River Br

Location: Quad Cities

Project No.: 08H0120E

Boring No.: RW18-01

Sample Type: Tube

Description: Yel. brn. & gray vf.-f. sandy silt.

Remarks: 2500 # Load Cell Loadtrac II # 258112 FlowTrac II 13610 & 13610B & LVDT55306

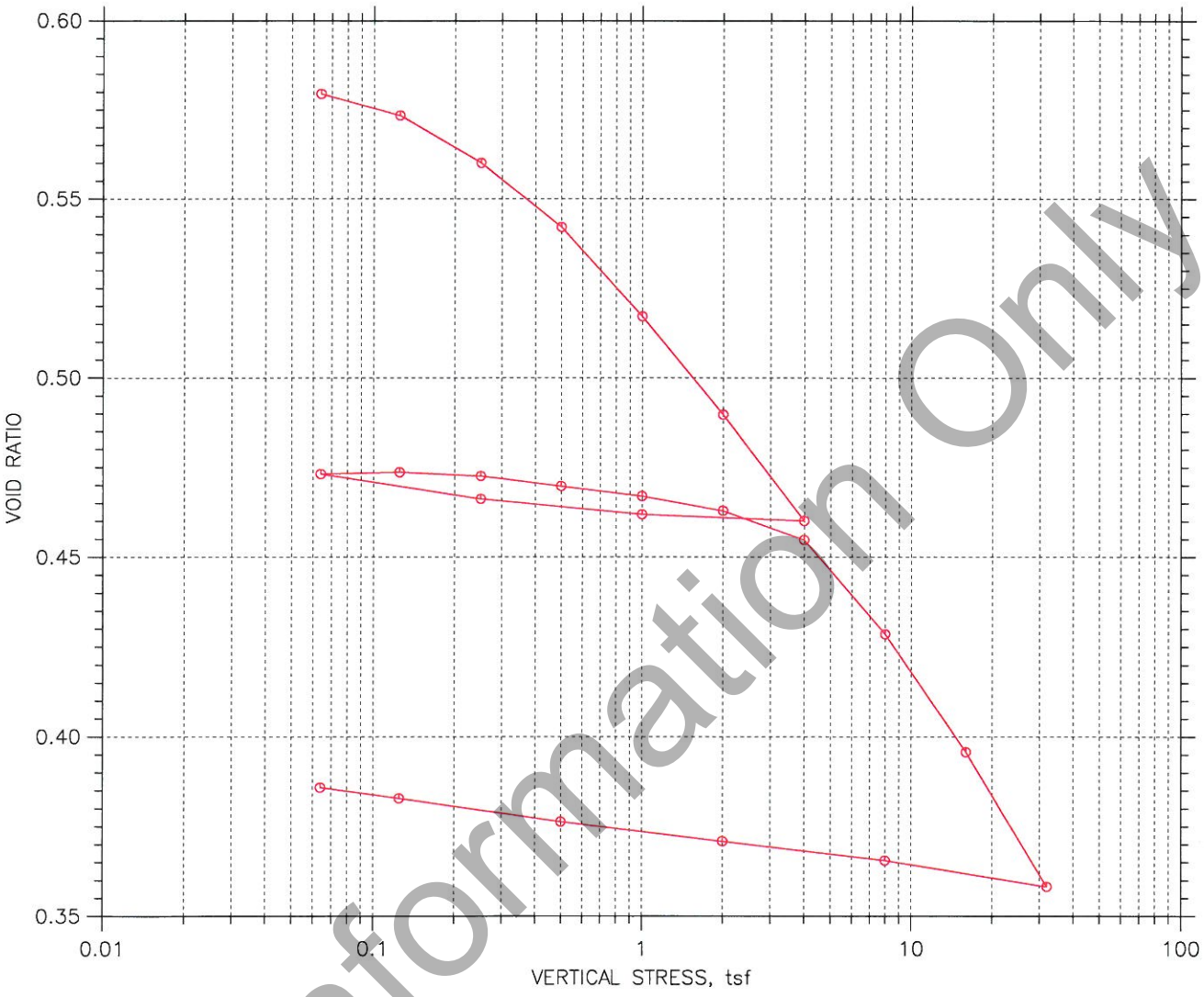
Phase calculations based on start of test.

* Saturation is set to 100% for phase calculations

Fri, 01-APR-2011 16:11:19

CONSOLIDATION TEST DATA

SUMMARY REPORT



				Before Test	After Test
Overburden Pressure: 0 tsf			Water Content, %	20.74	15.75
Preconsolidation Pressure: 0 tsf			Dry Unit Weight, pcf	104.6	119.4
Compression Index: 2.54639e-313			Saturation, %	94.51	108.15
Diameter: 2.5 in		Height: 0.998 in	Void Ratio	0.58	0.39
LL: 0	PL: 0	PI: 0	GS: 2.65		

HANSON	Project: I74	Location: Quad Cities	Project No.: 08H0120E
	Boring No.: RW18-01	Tested By: RIN	Checked By: JCC
	Sample No.: 4-1	Test Date: 8/3/10	Depth: 8.0-8.3
	Test No.: 1	Sample Type: Tube	Elevation:
	Description: Yel. brn. & gray vf.-f. sandy silt.		
	Remarks: LT107 2000# 2009 Calibration		

Thu, 05-AUG-2010 10:08:20

CONSOLIDATION TEST DATA

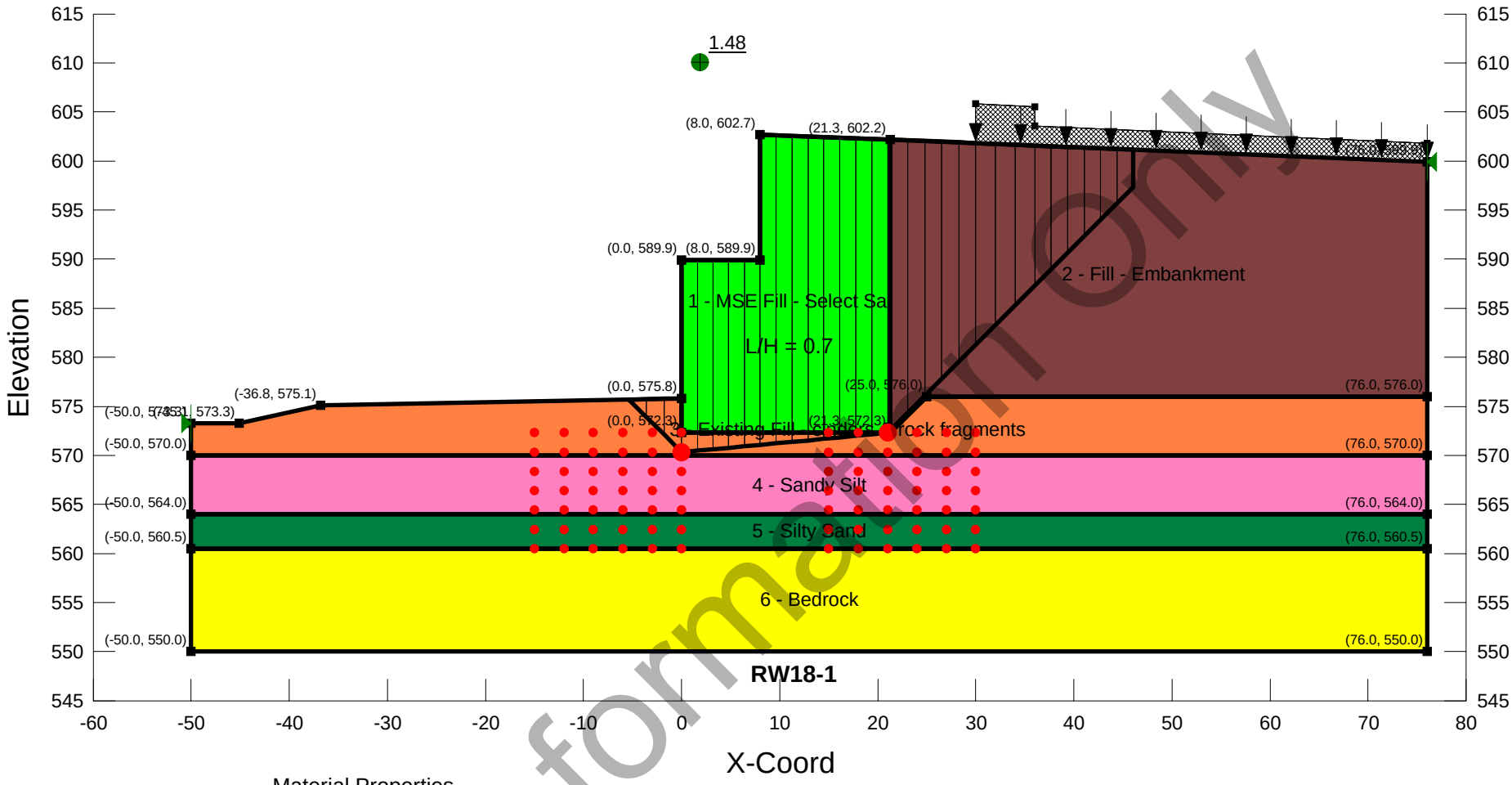
Project: I74
Boring No.: RW18-01
Sample No.: 4-1
Test No.: 1

Location: Quad Cities
Tested By: RIN
Test Date: 8/3/10
Sample Type: Tube

Project No.: 08H0120E
Checked By: JCC
Depth: 8.0-8.3
Elevation:

Soil Description: Yel. brn. & gray vf.-f. sandy silt.
Remarks: LT107 2000# 2009 Calibration

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. in^2/sec	Coefficient of Consolidation Log in^2/sec	Coefficient of Consolidation Ave. in^2/sec
1	0.064	0.00139	0.579	0.14	0.1	0.1	6.71e-003	9.51e-003	7.87e-003
2	0.125	0.005207	0.573	0.52	3.5	0.0	2.32e-004	0.00e+000	2.32e-004
3	0.25	0.01361	0.560	1.36	3.4	0.0	2.37e-004	0.00e+000	2.37e-004
4	0.5	0.02494	0.542	2.50	2.0	1.2	3.90e-004	6.50e-004	4.87e-004
5	1	0.04072	0.517	4.08	0.9	0.0	8.42e-004	0.00e+000	8.42e-004
6	2	0.058	0.490	5.81	0.5	0.0	1.64e-003	0.00e+000	1.64e-003
7	4	0.07668	0.460	7.68	0.5	0.0	1.57e-003	0.00e+000	1.57e-003
8	1	0.07557	0.462	7.57	0.0	0.0	7.73e-002	7.88e-002	7.80e-002
9	0.25	0.07283	0.466	7.30	0.2	0.1	3.05e-003	1.38e-002	4.99e-003
10	0.064	0.06845	0.473	6.86	1.9	0.0	3.78e-004	0.00e+000	3.78e-004
11	0.125	0.06816	0.474	6.83	0.1	0.1	8.04e-003	1.32e-002	9.99e-003
12	0.25	0.06882	0.473	6.90	0.2	0.0	3.15e-003	0.00e+000	3.15e-003
13	0.5	0.07059	0.470	7.07	0.2	0.0	3.01e-003	2.60e-002	5.39e-003
14	1	0.07236	0.467	7.25	0.1	0.0	1.10e-002	3.84e-002	1.71e-002
15	2	0.07492	0.463	7.51	0.0	0.0	2.23e-002	6.58e-002	3.33e-002
16	4	0.08004	0.455	8.02	0.1	0.0	6.11e-003	5.86e-002	1.11e-002
17	8	0.09658	0.429	9.68	0.2	0.0	3.96e-003	4.22e-002	7.24e-003
18	16	0.1173	0.396	11.75	0.1	0.0	1.12e-002	5.91e-002	1.88e-002
19	32	0.1409	0.358	14.12	0.1	0.0	1.06e-002	5.06e-002	1.75e-002
20	8	0.1363	0.366	13.66	0.0	0.0	6.27e-002	0.00e+000	6.27e-002
21	2	0.133	0.371	13.32	0.0	0.0	3.68e-002	0.00e+000	3.68e-002
22	0.5	0.1295	0.376	12.98	0.5	0.0	1.36e-003	0.00e+000	1.36e-003
23	0.125	0.1254	0.383	12.57	1.9	0.0	3.32e-004	0.00e+000	3.32e-004
24	0.064	0.1235	0.386	12.38	13.4	0.0	4.69e-005	0.00e+000	4.69e-005



Material Properties

Name: 1 - MSE Fill - Select Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 psf Phi: 34 °

Name: 2 - Fill - Embankment Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 1000 psf Phi: 0 °

Name: 3 - Existing Fill - cinders & rock fragments Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 1100 psf Phi: 0 °

Name: 4 - Sandy Silt Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 1800 psf Phi: 0 °

Name: 5 - Silty Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 psf Phi: 32 °

Name: 6 - Bedrock Model: Bedrock (Impenetrable)

SN 081-6019 IL-RW18
Case 2 - Through Abutment - Wedge
File Name: I-74 081-6019 - Through Abutment.gsz
Last Edited By: Robert Chantome
Date: 11/21/2011 2:45:14 PM

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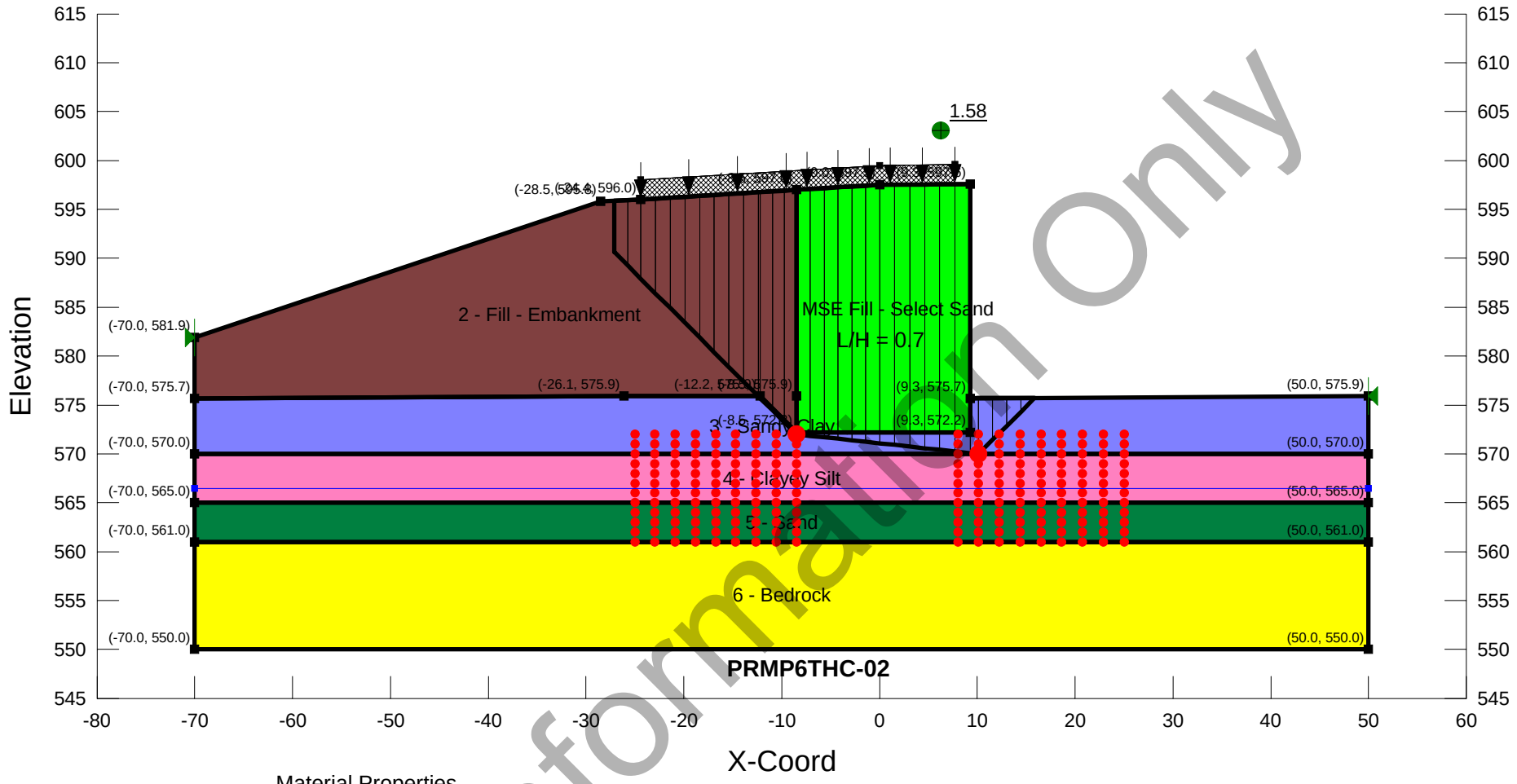

Material Properties

Name: 1 - MSE Fill - Select Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 psf Phi: 34 °

Name: 2 - Fill - Embankment Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 1000 psf Phi: 0 °

Name: 3 - Sandy Clay Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 925 psf Phi: 0 °

Name: 4 - Clayey Silt Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 1800 psf Phi: 0 °

Name: 5 - Sand Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 0 psf Phi: 33 °

Name: 6 - Bedrock Model: Bedrock (Impenetrable)

SN 081-6019 IL-RW18
Case 2 - Sta. 332+00 - Wedge
File Name: I-74 081-6019 - Sta 332+00.gsz
Last Edited By: Robert Chantome
Date: 11/21/2011 5:06:31 PM

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