Illinois Department of Transportation

Abbreviated Structure Geotechnical Report

Original Report Date:	10/21/2022	**Proposed SN:**	101-0207	**Route:**	FAU 5147 (Mulford Road)
Revised Date:	11/4/2022	**Existing SN:**	101-0131	**Section:**	(201-3)K and (4-1,5)R
Geotechnical Engineer:	Matt D. Masterson, PE			**County:**	Winnebago
Structural Engineer:	Matthew Hellenthal, PE, SE			**Contract:**	64C24

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing):

The new structure will be a two span plate girder bridge. The substructures will consist of pile-supported integral abutments and a multi-column pier with pile-supported footing. According to information provided by the structural designer, the estimated vertical factored substructure loads are 1,215 kips at south abutment, 3,231 kips at the pier and 1,547 kips at north abutment. See Location Map - Exhibit A. The TS&L drawing is attached as Exhibit C.

Discuss the existing boring data, existing plans foundation information, new subsurface exploration and need for any additional exploration to be provided with SGR Technical Memo (attach all data and subsurface profile plot):

Underground coal mine information available from ISGS indicates that the project area has not been undermined. Five boring logs were provided to Kaskaskia Engineering Group, LLC. by IDOT for borings B-1g through B-4g. Borings B-1g through B-3g were drilled in July 2008. Borings B-4g and B-4g Shelby tube (ST) were drilled in February and May 2016. Locations of the borings are as shown on the attached Boring Location Plan (Exhibit B).

In general, the subsurface condition can be stratified into three layers. The top layer consisting of sandy loam, silty clay loam, and clay loam, with occasional sand. The bottom of top layer is approximately El. 793, El. 791 and El. 797 at boring B-1g, B-2g and B-3g, respectively. Middle layer consists of sandy loam till with gravel with bottom at approximately El. 781, El. 781 and El. 775 at boring B-1g, B-2g and B-3g, respectively. All borings were terminated at third lower layer which consisted of very dense sand. The borings were terminated at El. 776.7, El. 774.7 and El. 762.7 at boring B-1g, B-2g and B-3g, respectively. See Boring Logs and Soil Profile - Exhibit D for additional details.

The subsurface conditions encountered at B-4g SPT boring match descriptions given above. The borings were terminated at El. 728 and El. 786.6 at SPT and ST borings, respectively.

Laboratory tests were performed on selected samples from Shelby tube boring B-4g (ST) and summary results are attached in Exhibit G.

Provide the location and maximum height of any new soil fill or magnitude of footing bearing pressure. Estimate the amount and time of the expected settlement. Indicate if further testing, analysis, and/or ground improvement/treatment is necessary:

The proposed structure will be built in the same location as the existing structure; therefore, settlement will not be a concern.

Identify any new cuts or fill slope angles and heights. Estimate the factor of safety against slope failure. Indicate if further testing, analysis or ground improvement/treatment is necessary:

The TS&L provided to KEG indicated new fill behind the North and South Abutments with a height of approximately 10 ft and a 1H:1V slope. The slope of the abutments will be 2H:1V. Stability analysis using SLOPE/W was performed using the proposed roadway and bridge geometry on the TS&L and soil characteristics from Borings B-3g and B-1g. Two conditions were modeled for each scenario: end-of-construction and long-term stability. A critical factor of safety (FOS) was calculated for each condition. According to current standard of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability. The slope stability analyses indicated that the required minimum FOS for all conditions were met.

To model the end-of-construction condition, full cohesion and a friction angle of 0 degrees were assumed. Nominal values for cohesion were used with full friction angle to model the long-term condition to analyze the theoretical condition where pore water pressure has dissipated. Nominal values were between 50 and 250 psf for the cohesive soils, with friction angles between 26 and 34 degrees.

The Bishop Circular Method, which generates circular-shaped failure surfaces, was used to calculate the critical failure surfaces and FOS for the proposed conditions. The FOS obtained in the analysis is summarized below. SLOPE/W program output from this analysis can be found in SLOPE/W Slope Stability Analysis, Exhibit E.

South Abutment: End of Construction=3.9   Long Term=1.5
North Abutment: End of Construction=3.0   Long Term=1.5

Indicate at each substructure, the 100-year and 200-year total scour depths in the Hydraulics report, the non-granular scour depth reduction, the proposed ground surface, and the recommended foundation design scour elevations:

N/A

Determining the seismic soil site class, the seismic performance zone, the 0.2 and 1.0 second design spectral accelerations and indicate if that the soils are liquefiable:

The seismic Site Class is D, the SPZ is 1, SDS = 0.135g, and SD1 = 0.080g. The soils are not considered to be liquefiable for the design earthquake.

Confirm feasibility of the proposed foundation or wall type and provide design parameters. Attach a pile design table indicating feasible pile types, various nominal required bearings, factored resistances available and corresponding estimated lengths at locations where piles will be used. Provide factored bearing resistance and unit sliding resistance at various elevations and confirm no ground improvement/treatment is necessary where spread footings are proposed. Estimated top of rock elevations as well as preliminary factored unit side and tip resistance values shall be indicated when drilled shafts are proposed:

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads. The IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths. The tables used to estimate the pile lengths and the Pile Calculations are attached in Exhibit F. The estimated pile lengths for applicable Metal Shell pile types are shown in the Pile Design Table below. The Nominal Required Bearing (RN) represents the resistance the pile will experience during driving and will assist the contractor in selecting a proper hammer size. The Factored Resistance Available (RF) documents the net long-term axial factored pile capacity available at the top of the pile to support factored substructure loadings.

Calculate the estimated water surface elevation and determine the need for cofferdams (type 1 or 2), and seal coat:

N/A

Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns:

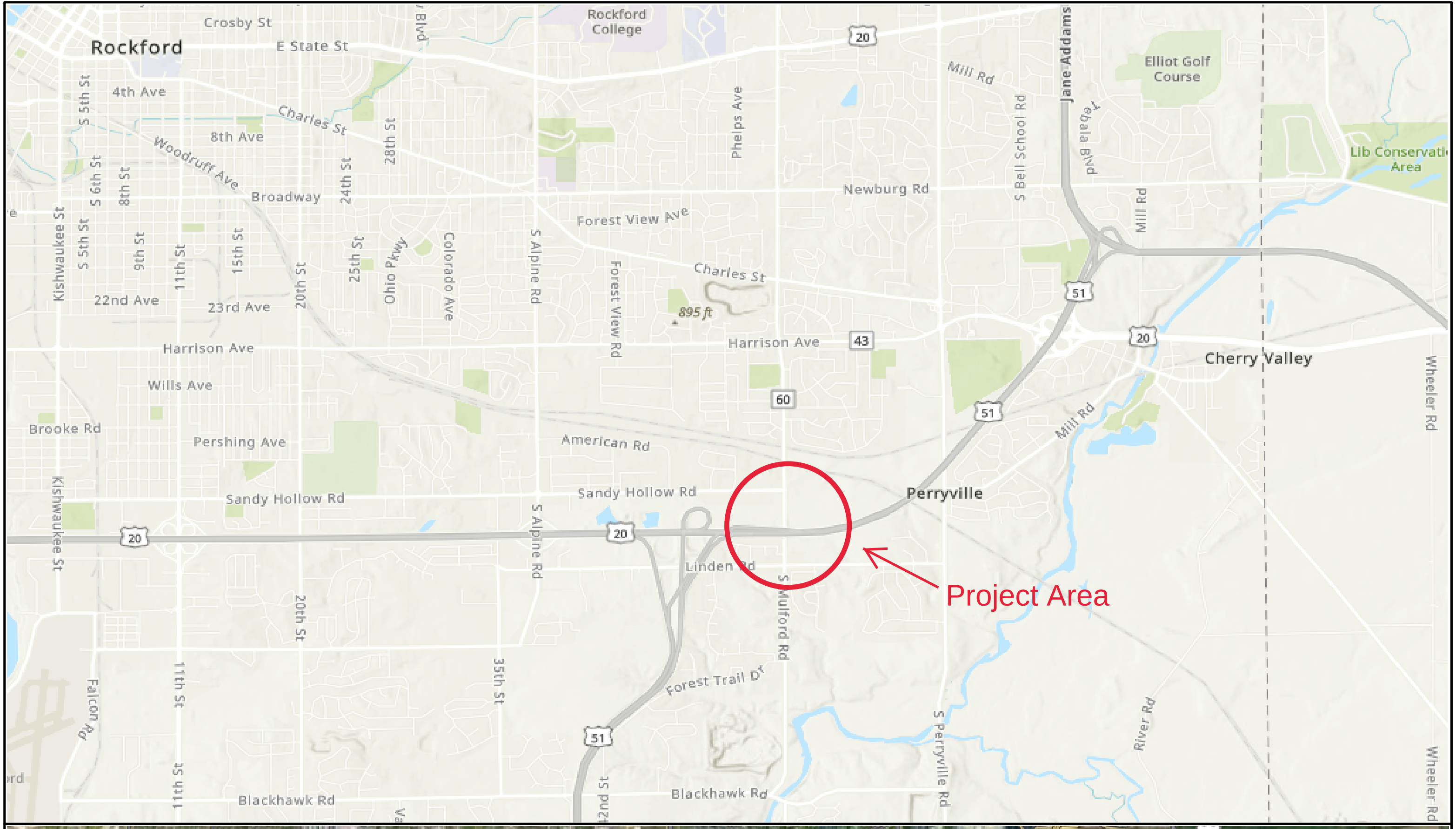
Temporary sheet piling will not be required since the bridge will be constructed using a full closure and a detour. Temporary Soil Retention Systems may be required for support of any required Stage construction for retained heights greater than 15 feet and should be designed in accordance with IDOT Design Guide 3.13.1 - Temporary Sheet Piling Design.

LICENSED PROFESSIONAL ENGINEER
MATT D. MASTERSON
NO. 062-061885
STATE OF ILLINOIS

11/04/2022
Exp. 11/30/2023

EXHIBIT A

LOCATION MAP



Kaskaskia Engineering Group, LLC

LOCATION MAP

Mulford Road Over I39/US 20
Winnebago County, Illinois

Exhibit No.

A

KEG JOB #19-1138.00

EXHIBIT B

BORING LOCATION PLAN

Kaskaskia Engineering Group, LLC

BORING LOCATION MAP

Mulford Road over I39/US20
Winnebago County, IL

Exhibit No.

B

KEG JOB #19-1138.00

EXHIBIT C

TYPE, SIZE AND LOCATION PLAN

BM: # 316 2" Aluminum Disk on Approx. ℄ of U.S. 20 – on pier base under Mulford Rd. – Elevation 805.75

Existing Structure (No. 101-0131): Originally constructed in 1963 under FA 194, Section 4-HB-2, the structure was a 4 span, concrete deck on steel beam superstructure with concrete piers and pile bent abutments. The structure was reconstructed in 1976 under FA 194, Section 201-3HB-3 as a 2 span concrete deck on continuous steel girder superstructure with concrete piers and closed sand filled pile bent abutments. The structure has a Bk. to Bk. = 274'-0" with an out-out of deck of 42'-0". The structure was repainted in 1999.

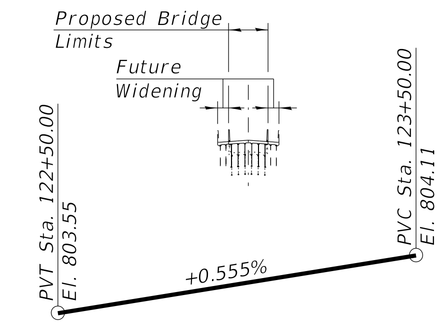
Roadway will be closed to traffic during construction, No Salvage.

APPROVED

NOVEMBER 17, 2021

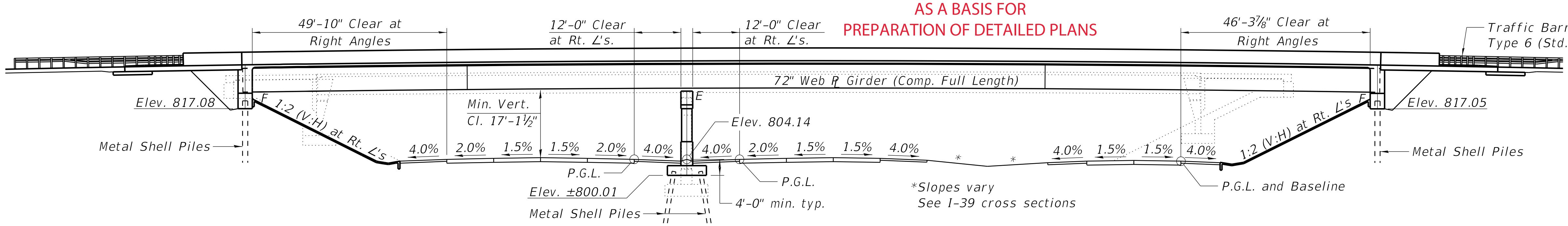
AS A BASIS FOR PREPARATION OF DETAILED PLANS

Note:
Up to ¼" inch may be ground off the bridge deck and the approach slabs.

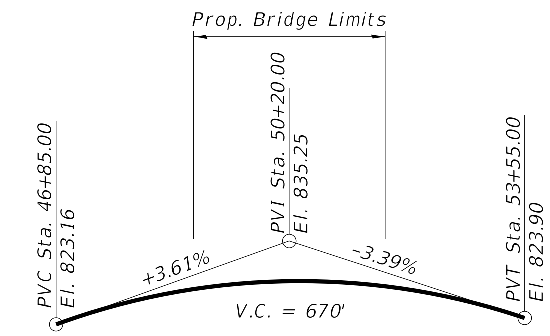


PROPOSED PROFILE

Along I-39 S.B.L. (Ramp BD) Outside E.O.P.

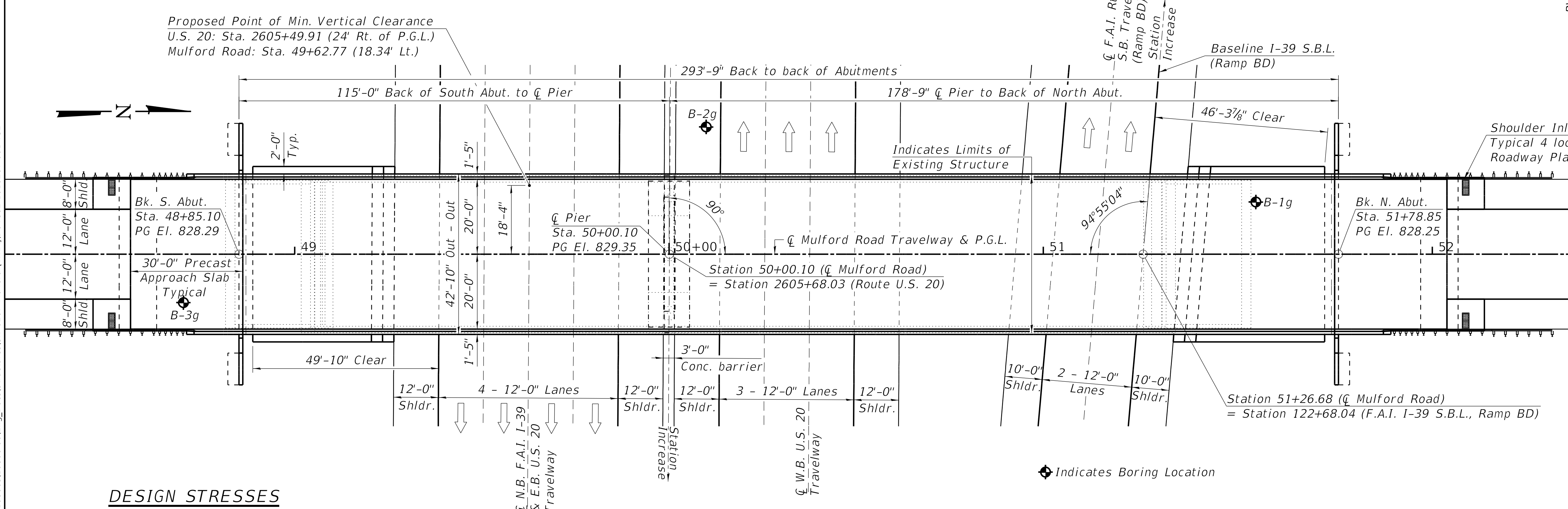


ELEVATION

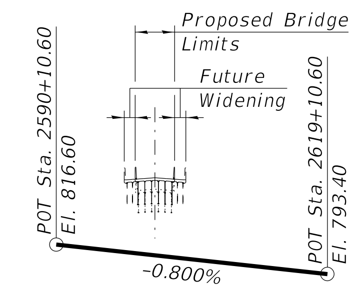


PROPOSED PROFILE

Along ℄ Mulford Road.
The profile grade shows the final elevations after grinding.



PLAN



PROPOSED PROFILE

Along I-39 NBL and US-20 Inside E.O.P.

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)*
* All Structural Steel shall be Metalized.

PRECAST UNITS

f'c = 6,000 psi (Precast Bridge Approach Slab)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.080 G
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.135 G
Soil Site Class = D

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

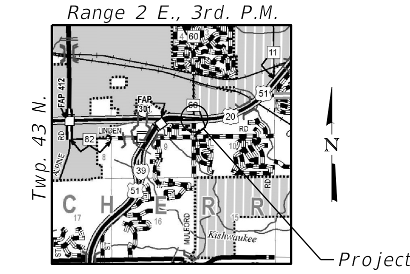
HIGHWAY CLASSIFICATION

F.A.I. Rte. 39
Functional Class: Interstate
ADT: 44,600 (2013); 106,610 (2040)
ADTT: 12,950 (2013); 32,000 (2040)
DHV: 10,600 (2040)
Design Speed: 70 m.p.h.
Posted Speed: 65 m.p.h.
2 -Way Traffic
Directional Distribution: 50:50

HIGHWAY CLASSIFICATION

F.A.U. Rte. 5147 – Mulford Road
Functional Class: Minor Arterial
ADT: 6,500 (2013); 35,750 (2040)
ADTT: 520 (2013); 2,860 (2040)
DHV: 3,575 (2040)
Design Speed: 45 m.p.h.
Posted Speed: 45 m.p.h.
2 -Way Traffic
Directional Distribution: 50:50

Range 2 E., 3rd. P.M.



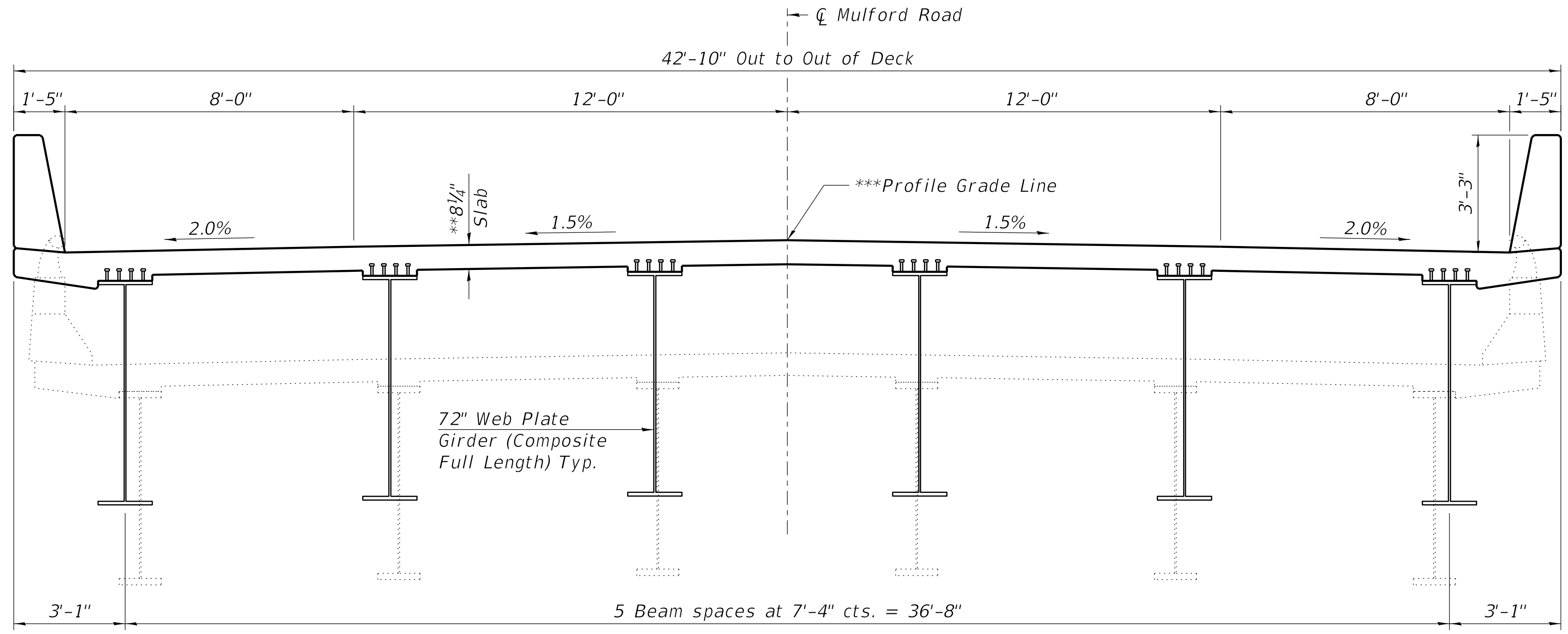
LOCATION SKETCH

GENERAL PLAN
MULFORD ROAD OVER I-39 & US 20
F.A.I. 39 – SEC. (201-3)K & (4-1,5)R
WINNEBAGO COUNTY
STA. 50+00.10
STRUCTURE NO. 101-0207

WILLETT HOFMANN & ASSOCIATES INC	USER NAME =	DESIGNED - BKC	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION		F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CHECKED - SM	REVISED -			39	(201-3)K & (4-1,5)R	WINNEBAGO	2	1
	PLOT SCALE =	DRAWN - FDL	REVISED -				WHA # 1390D19	CONTRACT NO. 64C62		
	PLOT DATE =	CHECKED - BKC	REVISED -		SHEET 1 OF 2 SHEETS		ILLINOIS	FED. AID PROJECT		

MODEL: 2D Drawing
FILE NAME: pw:\\benesch-pw.bentley.com:benesch-pw-01\Documents\10800s\10800.00\Eng_Docs\Structures\SN 0207 Mulford (WHA)\D64C62-1010207-001-TSL

11/16/2021 8:15:08 AM



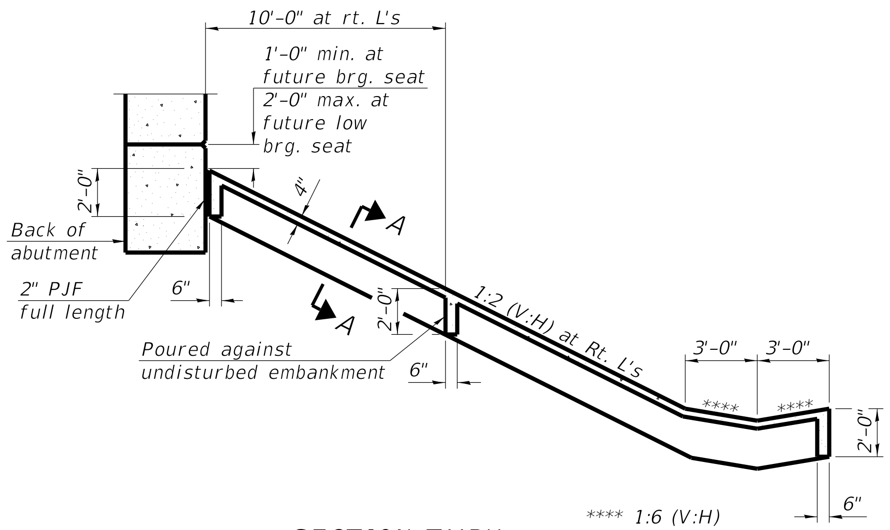
PROPOSED CROSS SECTION

** Prior to Grinding
*** After Grinding

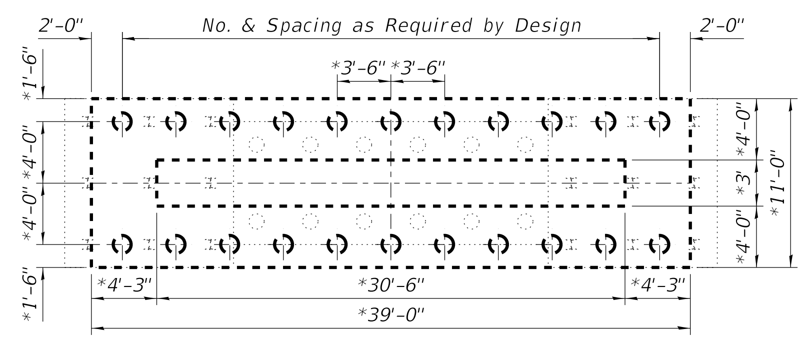
APPROVED

NOVEMBER 17, 2021

AS A BASIS FOR PREPARATION OF DETAILED PLANS

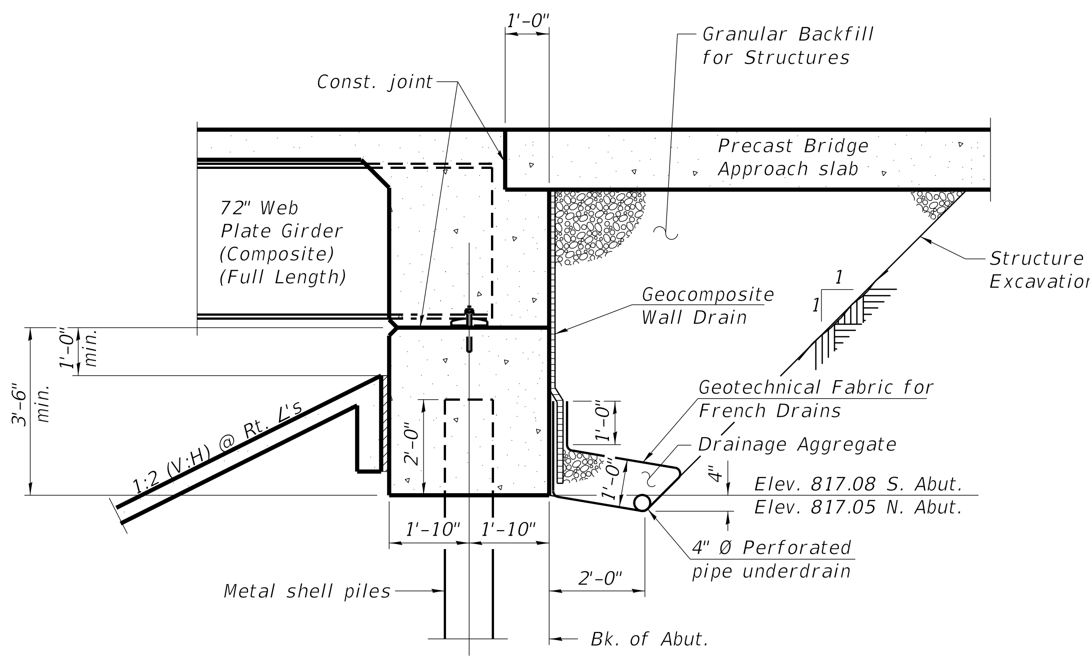


SECTION THRU CONCRETE SLOPEWALL



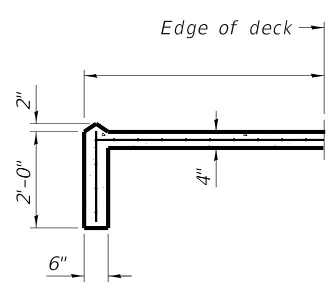
SECTION B-B

*May be Modified in Design

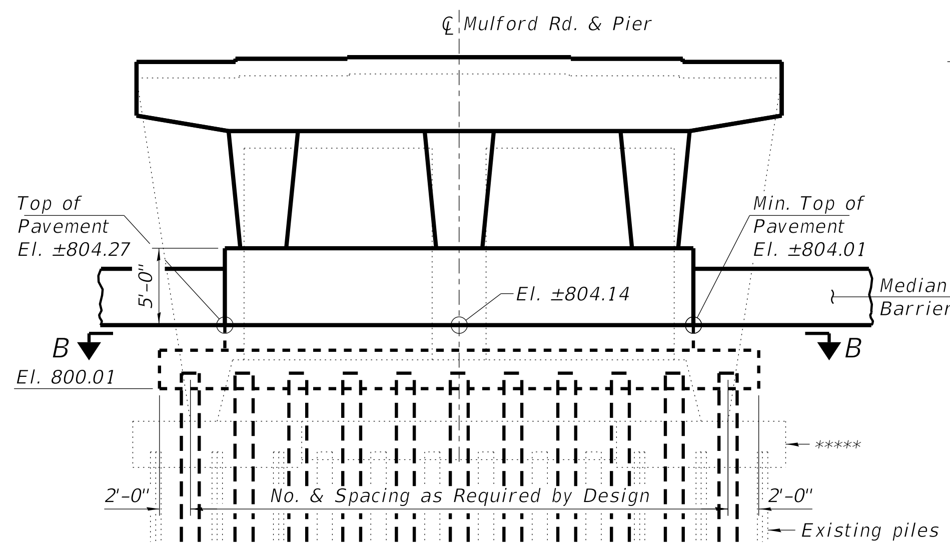


SECTION THRU INTEGRAL ABUTMENT

(Horiz. dim. @ Rt. L's)



SECTION A-A



PIER SKETCH

(Looking North)

*****Concrete region around proposed piles shall be removed prior to driving Metal Shell Piles.

DETAILS

MULFORD ROAD OVER I-39 & US 20

F.A.I. 39 - SEC. (201-3)K & (4-1,5)R

WINNEBAGO COUNTY

STA. 50+00.10

STRUCTURE NO. 101-0207

MODEL: $MODELNAME$
FILE NAME: $FILEL$

WILLETT HOFMANN & ASSOCIATES INC
ENGINEERING ARCHITECTURE LAND SURVEYING
809 EAST 2ND STREET, DIXON, IL 61021-0367
T: 815-284-3381 DESIGN FIRM: #184-000918

USER NAME =		DESIGNED -	BKC	REVISED -	
		CHECKED -	SM	REVISED -	
PLOT SCALE =		DRAWN -	FDL	REVISED -	
PLOT DATE =		CHECKED -	BKC	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
39	(201-3)K & (4-1,5)R	WINNEBAGO	2	2
	WHA # 1390D19	CONTRACT NO. 64C62		
	ILLINOIS	FED. AID PROJECT		

$DATE$ $TIME$

EHIIBIT D

BORING LOGS AND SOIL PROFILES

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation/D-2

SOIL BORING LOG

Date 7/25/08

ROUTE FAP 301 **DESCRIPTION** P92-111-06 Mulford Road Bridge over US 20 Bypass, .25 m. S. of Sandy Hollow Road **LOGGED BY** J. Strating

SECTION (201-3) K (4-1, 5) K **LOCATION** Cherry Valley Twp. - 9 NE, **SEC.**, **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** B-53 Diedrich Automatic

STRUCT. NO. ______
Station ______

BORING NO. B-1g
Station 51+57
Offset 14.00ft Lt CL
Ground Surface Elev. 825.70 ft

Surface Water Elev. ______ ft
Stream Bed Elev. 77.00 ft

Groundwater Elev.:
First Encounter 793.2 ft ▼
Upon Completion ______ ft
After ____ **Hrs.** ______ ft

Description	Elev. / Depth (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SOFT brown SANDY LOAM	823.20		0.3 P	14.0
SOFT tan/brown SANDY LOAM	821.70	1 / 1 / 2	0.3 P	15.0
	-5			
HARD tan SANDY LOAM TILL	819.20	6 / 9 / 9	4.5 P	8.0
VERY STIFF brown/gray CLAY LOAM	816.70	3 / 6 / 12	2.4 B	21.0
	-10			
HARD tan SANDY LOAM TILL	814.20	7 / 7 / 9	4.5 P	9.0
tan SANDY LOAM with large piece of GRAVEL in nose	811.70	2 / 6 / 8		11.0
	-15			
VERY STIFF brown/gray CLAY LOAM	809.20	3 / 6 / 9	2.4 B	20.0
VERY STIFF brown/gray CLAY LOAM	806.70	3 / 4 / 7	3.1 B	22.0
	-20			

Description	Elev. / Depth (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
VERY STIFF brown/gray CLAY LOAM with ORGANICS	804.20	5 / 7 / 11	3.5 B	19.0
VERY STIFF dark gray SILTY CLAY LOAM	801.70	5 / 7 / 9	3.3 B	21.0
	-25			
STIFF dark gray SILTY LOAM	799.20	2 / 4 / 6	1.3 B	28.0
STIFF gray CLAY LOAM	796.70	1 / 2 / 5	1.2 B	25.0
	-30			
MEDIUM gray/brown CLAY LOAM with SAND lens	794.20	2 / 3 / 6	1.0 P	21.0
	▼			
MEDIUM tan SANDY LOAM TILL	791.70	3 / 5 / 8	0.6 S	9.0
	-35			
VERY STIFF tan SANDY LOAM TILL	789.20	4 / 14 / 13	2.3 P	9.0
	786.70	13 / 20 / 25		8.0
	-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)

Illinois Department of Transportation
Division of Highways
Illinios Department of Transportation/D-2

SOIL BORING LOG

Date 7/25/08

ROUTE FAP 301 **DESCRIPTION** P92-111-06 Mulford Road Bridge over US 20 Bypass, .25 m. S. of Sandy Hollow Road **LOGGED BY** J. Strating

SECTION (201-3) K (4-1, 5) K **LOCATION** Cherry Valley Twp. - 9 NE, **SEC.**, **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** B-53 Diedrich Automatic

STRUCT. NO. ______
Station ______

BORING NO. B-1g
Station 51+57
Offset 14.00ft Lt CL
Ground Surface Elev. 825.70 ft

Surface Water Elev. ______ ft
Stream Bed Elev. 77.00 ft

Groundwater Elev.:
First Encounter 793.2 ft ▼
Upon Completion ______ ft
After ____ **Hrs.** ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
HARD tan SANDY LOAM TILL			25		
			42		
	784.20		61		
HARD tan SANDY LOAM TILL			100/9"		
	781.20	-45			
VERY DENSE brown dirty coarse SAND & GRAVEL			24		
			26		
	779.20		30		
VERY DENSE tan dirty SAND & GRAVEL			100/2"		
	776.70				
End of Boring		-50			
		-55			
		-60			

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
Illinois Department of Transportation/D-2

SOIL BORING LOG

Date 7/27/08

ROUTE FAP 301 DESCRIPTION P92-111-06 Mulford Road Bridge over US 20 Bypass, .25 m. S. of Sandy Hollow Road LOGGED BY W. Garza

SECTION (201-3) K (4-1, 5) K LOCATION Cherry Valley Twp. - 9 NE, **SEC.**, **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago DRILLING METHOD Hollow Stem Auger HAMMER TYPE B-53 Diedrich Automatic

STRUCT. NO. ______
Station ______

BORING NO. B-2g
Station 50+10
Offset 34.00ft Lt CL
Ground Surface Elev. 803.70 ft

Surface Water Elev. ______ ft
Stream Bed Elev. 77.00 ft

Groundwater Elev.:
First Encounter 793.7 ft ▼
Upon Completion 790.7 ft ▽
After ____ Hrs. ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
MEDIUM brown SILTY CLAY LOAM				0.5 P	18.0
	801.20				
STIFF tan SILTY CLAY LOAM			3		
			5	1.5 B	26.0
	799.70		6		
		-5			
MEDIUM brown SANDY LOAM			2		
			3	0.8 P	17.0
	797.20		5		
MEDIUM tan dirty SAND			2		
			4		14.0
	794.70		7		
		▼ -10			
LOOSE tan dirty SAND			7		
			3		11.0
	792.20		4		
VERY DENSE tan SANDY LOAM TILL with GRAVEL		▽	19		
			23		9.0
	789.70		33		
		-15			
VERY DENSE tan SANDY LOAM TILL with GRAVEL			17		
			27		
	787.20		31		
VERY DENSE tan SANDY LOAM TILL with GRAVEL			19		
			27		
	784.70		33		
		-20			

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
VERY DENSE tan SANDY LOAM TILL with GRAVEL			12		
			20		
	782.20		30		
VERY DENSE light brown fine SAND			13		
			21		
			30		
	779.20				
		-25			
VERY DENSE gray CLAY LOAM			21		
			22		13.0
			45		
	776.70				
VERY DENSE gray clean medium SAND			10		
			27		
	774.70		52		
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)

Illinois Department of Transportation
Division of Highways
Illinios Department of Transportation/D-2

SOIL BORING LOG

Date 7/28/08

ROUTE FAP 301 DESCRIPTION P92-111-06 Mulford Road Bridge over US 20 Bypass, .25 m. S. of Sandy Hollow Road LOGGED BY W. Garza

SECTION (201-3) K (4-1, 5) K LOCATION Cherry Valley Twp. - 9 NE, SEC., TWP. 43N, RNG. 2E

COUNTY Winnebago DRILLING METHOD Hollow Stem Auger HAMMER TYPE B-53 Diedrich Automatic

STRUCT. NO. ____
Station ____

BORING NO. B-3g
Station 48+70
Offset 15.00ft Rt CL
Ground Surface Elev. 824.20 ft

Surface Water Elev. ____ ft
Stream Bed Elev. 77.00 ft

Groundwater Elev.:
First Encounter 801.7 ft ▼
Upon Completion 805.2 ft ▽
After ____ Hrs. ____ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Shoulder					
HARD brown SANDY LOAM	821.70		16		
			11	4.0	11.0
	820.20		9	P	
MEDIUM tan SANDY LOAM		-5	3		
			4	0.8	10.0
	817.70		7	P	
STIFF tan SANDY LOAM with GRAVEL			4		
			11	1.0	13.0
	815.20		10	P	
VERY STIFF brown SILTY CLAY LOAM		-10	2		
			5	2.5	23.0
	812.70		7	B	
VERY STIFF brown SILTY CLAY LOAM			3		
			7	2.9	21.0
	810.20		11	B	
VERY STIFF gray SILTY CLAY		-15	5		
			8	3.5	18.0
	807.70		11	B	
VERY STIFF gray SILTY CLAY LOAM			5		
			7	2.5	22.0
	805.20 ▽		9	P	
		-20			

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
STIFF gray SILTY CLAY LOAM			2		
			3	1.5	25.0
	802.70		5	B	
SOFT gray SILTY CLAY LOAM	▼		1		
			1	0.3	29.0
			3	B	
	799.70				
LOOSE tan dirty moist SAND		-25	2		
			2		
			3		
	797.20				
MEDIUM tan SANDY LOAM TILL			1		
			3	0.6	10.0
	795.20		4	P	
MEDIUM tan SANDY LOAM TILL with SAND lens		-30	1		
			5	0.8	9.0
	792.70		9	P	
DENSE tan SANDY LOAM TILL with GRAVEL			10		
			17		9.0
	790.20		20		
VERY DENSE tan SANDY LOAM TILL with GRAVEL		-35	18		
			26		
	787.70		33		
VERY DENSE tan GRAVEL			100/2"		
Hard Drilling	785.20				
		-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)

Illinois Department of Transportation
Division of Highways
Illinios Department of Transportation/D-2

SOIL BORING LOG

Date 7/28/08

ROUTE FAP 301 DESCRIPTION P92-111-06 Mulford Road Bridge over US 20 Bypass, .25 m. S. of Sandy Hollow Road LOGGED BY W. Garza

SECTION (201-3) K (4-1, 5) K LOCATION Cherry Valley Twp. - 9 NE, SEC. , TWP. 43N, RNG. 2E

COUNTY Winnebago DRILLING METHOD Hollow Stem Auger HAMMER TYPE B-53 Diedrich Automatic

STRUCT. NO. ______
Station ______

BORING NO. B-3g
Station 48+70
Offset 15.00ft Rt CL
Ground Surface Elev. 824.20 ft

Surface Water Elev. ______ ft
Stream Bed Elev. 77.00 ft

Groundwater Elev.:
First Encounter 801.7 ft ▼
Upon Completion 805.2 ft ▽
After ___ Hrs. ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
DENSE tan SANDY LOAM TILL			25		
			19		
	782.70		11		
STIFF gray SANDY LOAM TILL			4		
			11	1.6	8.0
	780.20		15	B	
VERY STIFF gray SANDY LOAM TILL with GRAVEL		-45	6		
			9	2.5	8.0
	777.70		12	S	
STIFF gray SANDY LOAM TILL			5		
			9	1.5	10.0
	774.70		10	B	
MEDIUM gray fine SAND with medium GRAVEL		-50	2		
			6		
	772.70		23		
DENSE gray fine SAND			12		
			17		
	770.20		19		
VERY DENSE tan SAND with GRAVEL		-55	42		
	767.70		100/7"		
VERY DENSE tan SANDY LOAM TILL with SANDY GRAVEL lens			29		
	765.20		100/9"		
		-60			

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
VERY DENSE tan fine SAND			30		
	762.70		100/11"		
End of Boring					
		-65			
		-70			
		-75			
		-80			

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
IDOT

SOIL BORING LOG

Date 2/17/16

ROUTE FAI 39 & FAP 301 DESCRIPTION P92-111-06 Mulford Road over Byapss 20 LOGGED BY W. Garza

SECTION (201-3)K & 4-1,5)K LOCATION Cherry Valley Twp. - 10NW, SEC. , TWP. 43N, RNG. 2E

COUNTY Winnebago DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME-55

STRUCT. NO. ______
Station ______

Latitude 42° 13' 11.65"
Longitude -88° 59' 54.20"

Northing 2,024,824.8893
Easting 2,613,032.2599

BORING NO. B-4g
Station 2606+77
Offset 117.00ft Rt
Ground Surface Elev. 802.00 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter 793.0 ft ▼
Upon Completion 768.0 ft ▽
After ______ Hrs. ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
MEDIUM brown SILTY CLAY LOAM				0.7 P	23.0
	800.50				
STIFF tan SILTY CLAY LOAM			1		
			3	1.5	28.0
	799.00		3	B	
SOFT tan LOAM with SAND, medium GRAVEL lens			1		
		-5	2	0.4	25.0
			3	P	
	796.00				
LOOSE tan dirty SANDY GRAVEL			0		
			1		
			3		
	793.50	▼			
MEDIUM tan SANDY LOAM TILL			1		
		-10	3	0.5	11.0
	791.50		4	B	
STIFF tan SANDY LOAM TILL			2		
			3	2.0	10.0
	789.00		7	P	
DENSE, No Recovery, assume as above.			22		
		-15	17		
	786.50		22		
DENSE, No Recovery, assume as above.			11		
			12		
	784.00		22		
DENSE, VERY STIFF tan SANDY LOAM TILL			6		
		-20	10	2.8	

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
DENSE, VERY STIFF tan SANDY LOAM TILL *(continued)*			24	P	
	781.00				
DENSE tan fine SAND			13		
			29		
	779.00		18		
VERY DENSE tan fine SAND			34		
		-25	41		
	776.50		43		
MEDIUM/DENSE tan very fine SAND			14		
			11		
	774.00		19		
DENSE tan fine SAND with CLAY lens			3		
		-30	18		
			17		
	771.00				
VERY STIFF gray SANDY LOAM TILL with SAND lens			10		
			14	3.7	9.0
	769.00		21	S	
		▽			
HARD gray LOAM TILL			11		
		-35	15	6.0	12.0
	766.50		25	S	
HARD gray LOAM TILL with ORGANICS			12		
			16	5.9	12.0
	764.00		21	S	
HARD gray LOAM TILL			8		
		-40	45	4.8	10.0

Northing and Easting were calculated using the ILHP-WF coordinate system

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
IDOT

SOIL BORING LOG

Date 2/17/16

ROUTE FAI 39 & FAP 301 DESCRIPTION P92-111-06 Mulford Road over Byapss 20 LOGGED BY W. Garza

SECTION (201-3)K & 4-1,5)K LOCATION Cherry Valley Twp. - 10NW, **SEC.** , **TWP.** 43N, **RNG.** 2E

COUNTY Winnebago DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME-55

STRUCT. NO. ______
Station ______

Latitude 42° 13' 11.65"
Longitude -88° 59' 54.20"

Northing 2,024,824.8893
Easting 2,613,032.2599

BORING NO. B-4g
Station 2606+77
Offset 117.00ft Rt
Ground Surface Elev. 802.00 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter 793.0 ft ▼
Upon Completion 768.0 ft ▽
After ______ Hrs. ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
HARD gray LOAM TILL *(continued)*	761.50		23	S	
VERY DENSE gray SANDY LOAM TILL	759.00		19 60 26		
VERY DENSE light gray SANDY LOAM TILL	756.00	-45	23 100/8"		
VERY DENSE light gray weathered LIMESTONE	754.00		26 32 29		
VERY DENSE light gray weathered LIMESTONE	748.00	-50	25 27 67		
	743.00	-55			
		-60			
	738.00	-65			
	733.00				
No Refusal to 74.0'	728.00	-70			
End of Boring		-75 -80			

Northing and Easting were calculated using the ILHP-WF coordinate system

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
IDOT

SOIL BORING LOG

Date 5/19/16

ROUTE FAI 39 & FAP 301 DESCRIPTION P92-111-06 Mulford Road over Byapss 20 LOGGED BY W. Garza

SECTION (201-3)K & 4-1,5)K LOCATION , SEC. , TWP. , RNG.

COUNTY Winnebago DRILLING METHOD Shelby HAMMER TYPE Shelby

STRUCT. NO.
Station

Latitude
Longitude

Northing
Easting

BORING NO. B-4g Shelby
Station 2606+50
Offset 75.00ft Rt
Ground Surface Elev. 801.60 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
25" Recovery	799.10				
16" Recovery	796.60	-5			
21" Recovery	794.10				
22" Recovery	791.60	-10			
30" Recovery	789.10				
Lifted Truck @ 14' Pushed 20" 20" Recovery	786.60	-15			
End of Boring		-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)

B-4g
Sta. 48+86, 60' RT
02/17/2016

Elev.	N	Qu	w%	Description
802.0		0.7P	23.0	MEDIUM brown SILTY CLAY LOAM
	6	1.5B	28.0	STIFF tan SILTY CLAY LOAM
	5	0.4P	25.0	SOFT tan LOAM with SAND, medium GRAVEL lens
796.0	4			LOOSE tan dirty SANDY GRAVEL
793.5 ▽ DD / 793.0	7	0.5B	11.0	MEDIUM tan SANDY LOAM TILL
	10	2.0P	10.0	STIFF tan SANDY LOAM TILL
	39			DENSE, No recovery, assume as above.
	34			DENSE, No recovery, assume as above.
	34	2.8P		DENSE, VERY STIFF tan SANDY LOAM TILL
781.0	47			DENSE tan fine SAND
	84			VERY DENSE tan fine SAND
	30			MEDIUM/DENSE tan very fine SAND
	35			DENSE tan fine SAND with CLAY lens
771.0	35	3.7S	9.0	VERY STIFF gray SANDY LOAM TILL with SAND lens
Oh ▽ 768.0	40	6.0S	12.0	HARD gray LOAM TILL
	37	5.9S	12.0	HARD gray LOAM TILL with ORGANICS
	68	4.8S	10	HARD gray LOAM TILL
	86			VERY DENSE gray SANDY LOAM TILL
	100/8"			VERY DENSE light gray SANDY LOAM TILL
756.0	61			VERY DENSE light gray weathered LIMESTONE
	94			VERY DENSE light gray weathered LIMESTONE
748.0				
743.0				
738.0				
733.0				No Refusal to 74.0'
728.0				Bottom of Hole = 74.0 feet

B-4g Shelby
Sta. 49+27, 32' RT
05/19/2016

Elev.	N	Qu	w%	Description
801.6				SILTY CLAY LOAM
		3.54	21	SILTY CLAY
			8	GRAVELLY SAND
			20 [C]	SILTY CLAY (LL=49 PI=30)
		1.18	25 [C]	SILTY CLAY (LL=40 PI=21)
			11	
		0.61	31	SILTY CLAY
				SILTY CLAY LOAM
		0.25	20	SANDY LOAM
				SANDY LOAM
		0.15	15	SANDY LOAM
				Lifted Truck @ 14', Pushed 20".
786.6				Bottom of Hole = 15.0 feet

LEGEND

N	Standard Penetration Test N (blows/ft)
Qu	Unconfined Strength (tsf)
w%	Natural Moisture Content (%)
[C]	Consolidation Test
DD ▽ 507.20	Water Surface Elevation Encountered in Boring DD = during drilling Oh = at completion 24h = 24 hours after completion
(hatched line)	Approximate Finish Grade
(heavy line)	Bottom of Footing

FILE NAME =	USER NAME =	DESIGNED - RGC	REVISED	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	SUBSURFACE DATA PROFILE STRUCTURE NO. 101-0207	F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
HANSON		CHECKED - JLD	REVISED			5147	(201-3)K & (4-1,5)R	WINNEBAGO		
	PLOT SCALE =	DRAWN - EJM	REVISED					CONTRACT NO.		
© Copyright Hanson Professional Services Inc. 2016	PLOT DATE = 08/11/16	CHECKED - KKC	REVISED		SHEET NO. 1 OF 2 SHEETS		ILLINOIS FED. AID PROJECT			

B-3g
Sta. 48+73, 34' LT
07/28/2008

Elev.	N	Qu	w%	Description
824.2				Shoulder
	20	4.0P	11.0	HARD brown SANDY LOAM
	11	0.8P	10.0	MEDIUM tan SANDY LOAM
	21	1.0P	13.0	STIFF tan SANDY LOAM with GRAVEL
	12	2.5B	23.0	VERY STIFF brown SILTY CLAY LOAM
	18	2.9B	21.0	VERY STIFF brown SILTY CLAY LOAM
	19	3.5B	18.0	VERY STIFF gray SILTY CLAY
Oh 805.2	16	2.5P	22.0	VERY STIFF gray SILTY CLAY LOAM
DD 801.7	8	1.5B	25.0	STIFF gray SILTY CLAY LOAM
	4	0.3B	29.0	SOFT gray SILTY CLAY LOAM
799.7	5			LOOSE tan dirty moist SAND
797.2	7	0.6P	10.0	MEDIUM tan SANDY LOAM TILL
	14	0.8P	9.0	MEDIUM tan SANDY LOAM TILL with SAND lens
	37		9.0	DENSE tan SANDY LOAM TILL with GRAVEL
	59			VERY DENSE tan SANDY LOAM TILL with GRAVEL
	100/2"			VERY DENSE tan GRAVEL Hard Drilling
	30			DENSE tan SANDY LOAM TILL
	26	1.6B	8.0	STIFF gray SANDY LOAM TILL
	21	2.5S	8.0	VERY STIFF gray SANDY LOAM TILL with GRAVEL
	19	1.5B	10.0	STIFF gray SANDY LOAM TILL
774.7	29			MEDIUM gray fine SAND with medium GRAVEL
	36			DENSE gray fine SAND
	100/7"			VERY DENSE tan SAND with GRAVEL
	100/9"			VERY DENSE tan SANDY LOAM TILL with SANDY GRAVEL lens
	100/11"			VERY DENSE tan fine SAND
762.7				Bottom of Hole = 61.5 feet

B-2g
Sta. 50+12, 84' LT
07/27/2008

Elev.	N	Qu	w%	Description
803.7		0.5P	18.0	MEDIUM brown SILTY CLAY LOAM
	11	1.5B	26.0	STIFF tan SILTY CLAY LOAM
	8	0.8P	17.0	MEDIUM brown SANDY LOAM
DD 793.7	11		14.0	MEDIUM tan dirty SAND
Oh 790.7	7		11.0	LOOSE tan dirty SAND
	56		9.0	VERY DENSE tan SANDY LOAM TILL with GRAVEL
	58			VERY DENSE tan SANDY LOAM TILL with GRAVEL
	60			VERY DENSE tan SANDY LOAM TILL with GRAVEL
	50			VERY DENSE tan SANDY LOAM TILL with GRAVEL
	51			VERY DENSE light brown fine SAND
779.2	67		13.0	VERY DENSE gray CLAY LOAM
776.7	79			VERY DENSE gray clean medium SAND
774.7				Bottom of Hole = 29.0 feet

B-1g
Sta. 51+59, 65' LT
07/25/2008

Elev.	N	Qu	w%	Description
825.7		0.3P	14.0	SOFT brown SANDY LOAM
	3	0.3P	15.0	SOFT tan/brown SANDY LOAM
	18	4.5P	8.0	HARD tan SANDY LOAM TILL
	18	2.4B	21.0	VERY STIFF brown/gray CLAY LOAM
	16	4.5P	9.0	HARD tan SANDY LOAM TILL
	14		11.0	tan SANDY LOAM with large piece of GRAVEL in nose
	15	2.4B	20.0	VERY STIFF brown/gray CLAY LOAM
	11	3.1B	22.0	VERY STIFF brown/gray CLAY LOAM
	18	3.5B	19.0	VERY STIFF brown/gray CLAY LOAM with ORGANICS
	16	3.3B	21.0	VERY STIFF dark gray SILTY CLAY LOAM
	10	1.3B	28.0	STIFF dark gray SILTY LOAM
	7	1.2B	25.0	STIFF gray CLAY LOAM
DD 793.2	9	1.0P	21.0	MEDIUM gray/brown CLAY LOAM with SAND lens
	13	0.6S	9.0	MEDIUM tan SANDY LOAM TILL
	27	2.3P	9.0	VERY STIFF tan SANDY LOAM TILL
	45		8.0	
	103			HARD tan SANDY LOAM TILL
	100/9"			HARD tan SANDY LOAM TILL
781.2	56			VERY DENSE brown dirty coarse SAND & GRAVEL
	100/2"			VERY DENSE tan dirty SAND & GRAVEL
776.7				Bottom of Hole = 49.0 feet

LEGEND

N Standard Penetration Test N (blows/ft)
Qu Unconfined Strength (tsf)
w% Natural Moisture Content (%)
DD 507.20 ▽ Water Surface Elevation Encountered in Boring
DD = during drilling
Oh = at completion
24h = 24 hours after completion
Approximate Finish Grade
Bottom of Footing

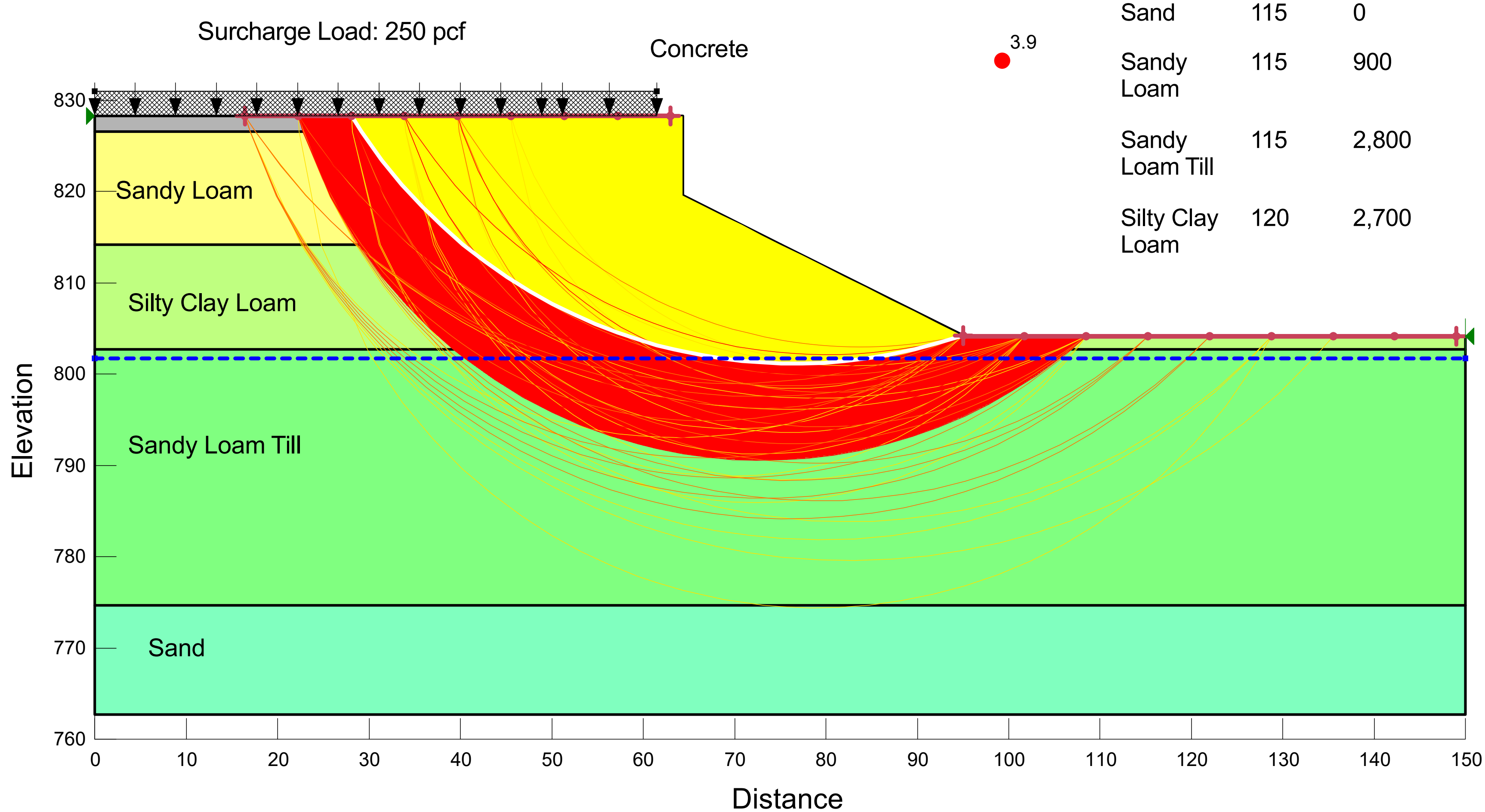
FILE NAME =	USER NAME =	DESIGNED - RGC	REVISED	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	SUBSURFACE DATA PROFILE STRUCTURE NO. 101-0207	F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
HANSON		CHECKED - JLD	REVISED			5147	(201-3)K & (4-1,5)R	WINNEBAGO		
	PLOT SCALE =	DRAWN - EJM	REVISED					CONTRACT NO.		
	PLOT DATE = 08/11/16	CHECKED - KKC	REVISED		SHEET NO. 2 OF 2 SHEETS			ILLINOIS FED. AID PROJECT		

EXHIBIT E

SLOPE STABLITY

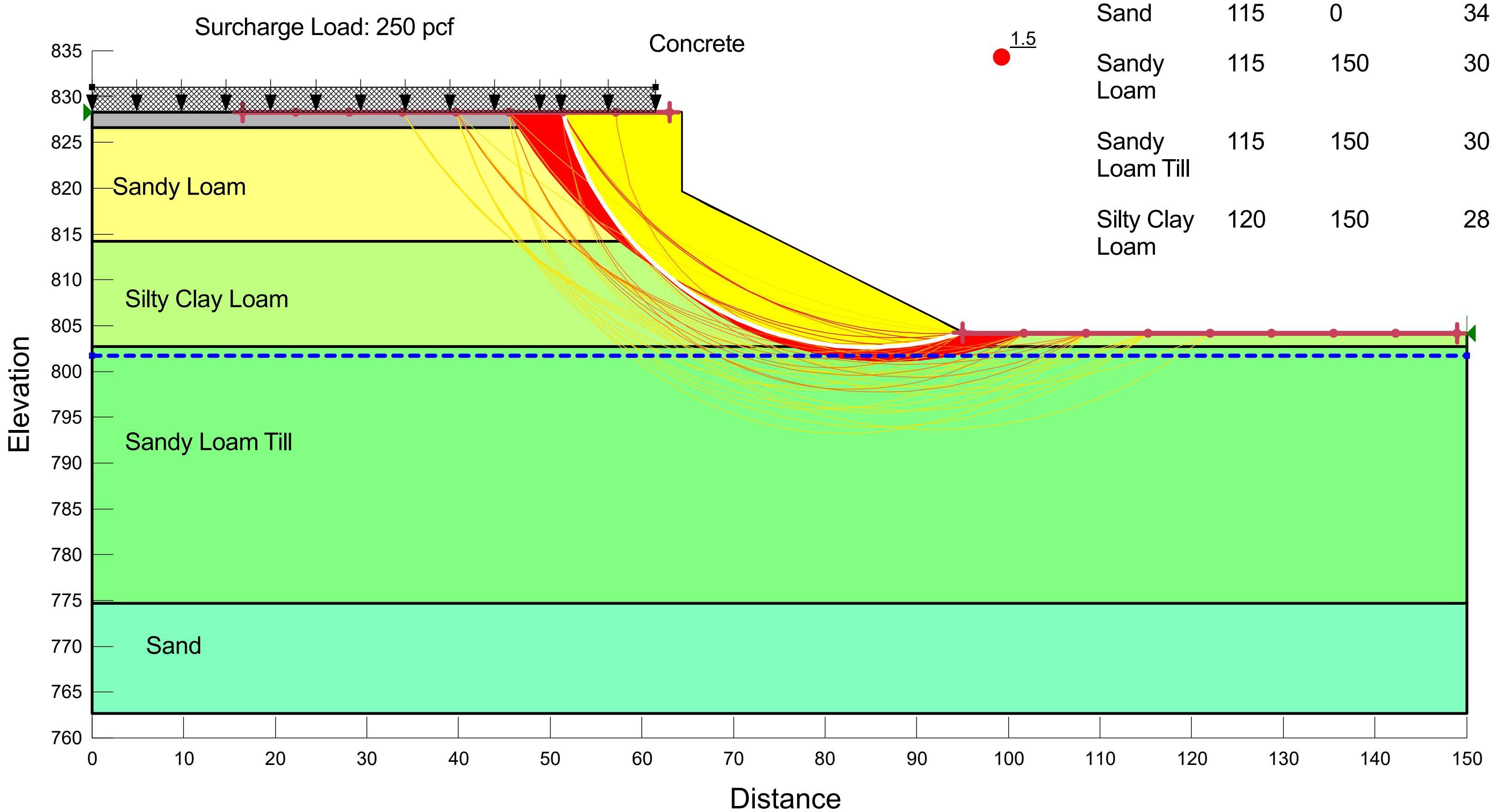
Mulford Road over I39 and US 20
South Abutment (Boring B-3g)
End-of-Construction (Undrained Analysis)

Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
Concrete	150	5,000	45
Fill	120	1,500	0
Sand	115	0	32
Sandy Loam	115	900	0
Sandy Loam Till	115	2,800	0
Silty Clay Loam	120	2,700	0



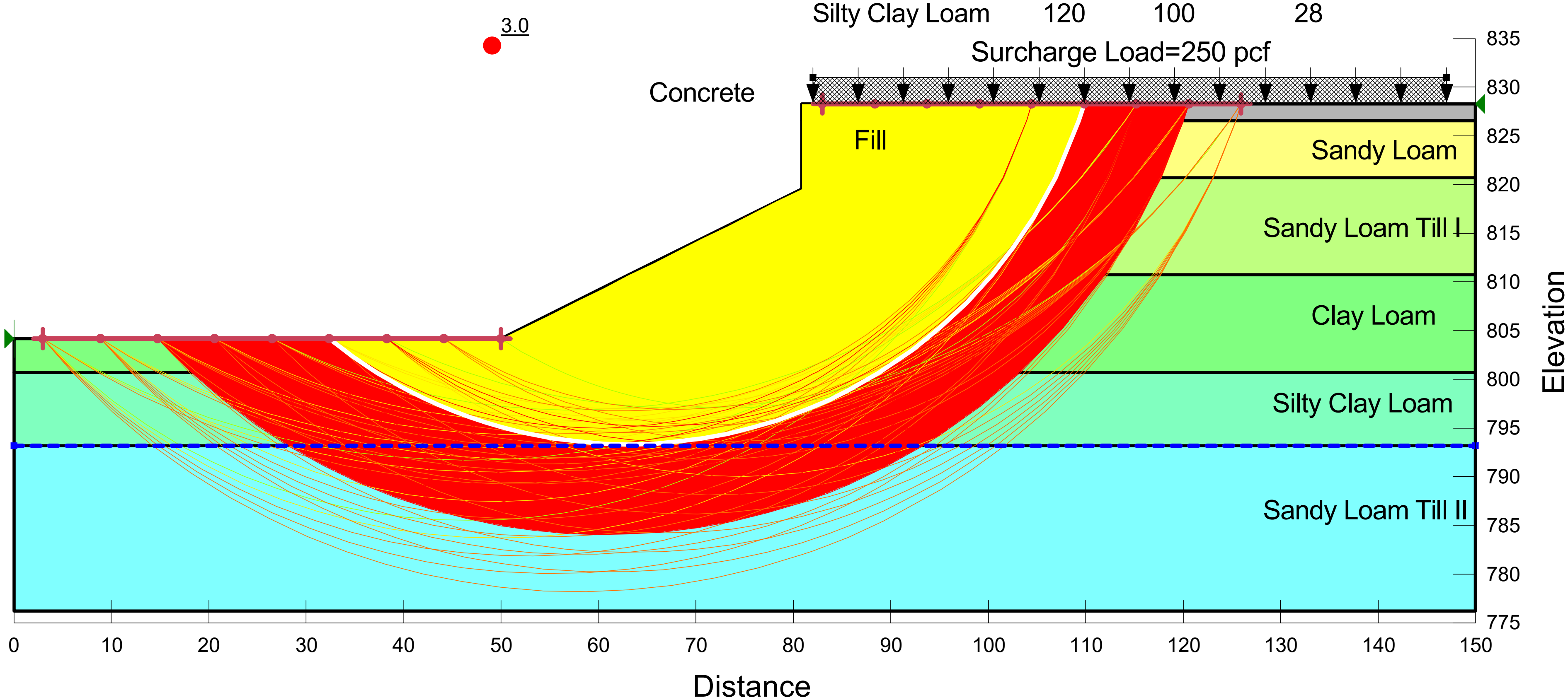
Mulford Road over I39 and US 20
South Abutment (Boring B-3g)
Long Term (Drained Analysis)

Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
Concrete	150	5,000	45
Fill	120	150	28
Sand	115	0	34
Sandy Loam	115	150	30
Sandy Loam Till	115	150	30
Silty Clay Loam	120	150	28



Mulford Road over I39 and US20
North Abutment (Boring B-1g)
End-of-Construction (Undrained Analysis)

Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
Clay Loam	120	3,000	0
Concrete	150	5,000	45
Fill	120	1,500	0
Sandy Loam	115	300	0
Sandy Loam Till I	115	3,200	0
Sandy Loam Till II	115	0	32
Silty Clay Loam	120	100	28



Mulford Road over I39 and US20
North Abutment (Boring B-1g)
Long Term (Drained Analysis)

Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
Clay Loam	120	150	28
Concrete	150	5,000	45
Fill	120	150	28
Sandy Loam	115	50	30
Sandy Loam Till I	115	150	30
Sandy Loam Till II	115	0	32
Silty Clay Loam	120	100	28

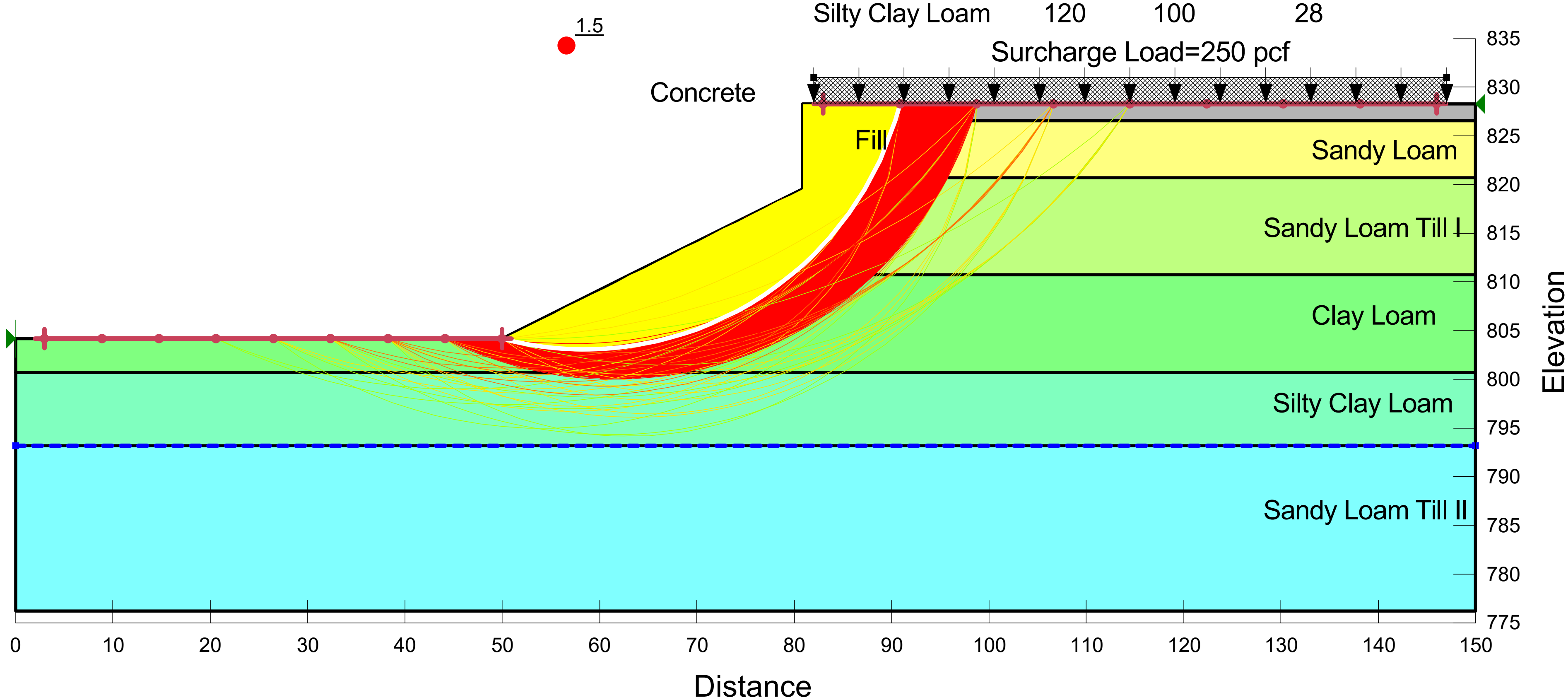


EXHIBIT F

PILE LENGTH TABLES AND CALCULATIONS

Pile Capacity

Metal Shell 12"Φ w/ 0.25" Walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-3g	392	216	31	820.29
Pier 1 B-2g	392	216	19	802.01
North Abutment B-1g	392	216	33	820.25

Metal Shell 14"Φ w/ 0.25" Walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-3g	459	252	31	820.29
Pier 1 B-2g	459	253	18	802.01
North Abutment B-1g	459	252	32	820.25

Metal Shell 14"Φ w/ 0.312" Walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-3g	570	313	31	820.29
Pier 1 B-2g	570	313	21	802.01
North Abutment B-1g	570	313	33	820.25

Metal Shell 16"Φ w/ 0.312" Walls

Substructure Unit	R_n Nominal Required Bearing (kips)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	Assumed Pile Cut-off Elevation (ft.)
South Abutment B-3g	654	360	31	820.29
Pier 1 B-2g	654	360	20	802.01
North Abutment B-1g	654	360	33	820.25

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE==================================== South Abutment
REFERENCE BORING ================================ B-3g
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. ================================== 820.29 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 818.29 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================= ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ============== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ============== 1215 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 113.47 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 42.55 KIPS

PILE TYPE AND SIZE ============= Metal Shell 12"Φ w/.25" walls
Pile Perimeter============================== 3.142 FT.
Pile End Bearing Area========================== 0.785 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
392 KIPS	**360** KIPS	**198** KIPS	**31** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
816.20	2.09	0.80			6.1		***14.7***	15	0	0	8	4
814.20	2.00	1.00			7.0	8.6	***34.6***	35	0	0	19	6
811.70	2.50	2.50			16.6	21.5	***54.6***	55	0	0	30	9
809.20	2.50	2.90			18.4	25.0	***78.1***	78	0	0	43	11
806.70	2.50	3.50	19		21.1	30.2	***90.6***	91	0	0	50	14
804.20	2.50	2.50			16.6	21.5	***98.5***	99	0	0	54	16
801.70	2.50	1.50			11.8	12.9	***100.0***	100	0	0	55	19
799.70	2.00	0.30			2.4	2.6	***124.5***	125	0	0	68	21
797.20	2.50		5	Medium Sand	3.6	24.7	***108.6***	109	0	0	60	23
794.20	3.00	0.60			6.8	5.2	***117.1***	117	0	0	64	26
791.70	2.50	0.80			7.3	6.9	***254.7***	255	0	0	140	29
789.20	2.50		37	Very Fine Silty Sand	23.9	137.2	***360.1***	360	0	0	198	31
786.70	2.50		59	Very Fine Silty Sand	48.3	218.8	***684.1***	~~684~~	~~0~~	~~0~~	~~376~~	~~34~~
784.20	2.50		100	Sandy Gravel	278.1	494.4	***579.0***	~~579~~	~~0~~	~~0~~	~~318~~	~~36~~
781.70	2.50		30	Very Fine Silty Sand	18.6	111.2	***500.2***	~~500~~	~~0~~	~~0~~	~~275~~	~~39~~
779.20	2.50	1.60			12.4	13.8	***520.3***	~~520~~	~~0~~	~~0~~	~~286~~	~~41~~
776.70	2.50	2.50			16.6	21.5	***528.2***	~~528~~	~~0~~	~~0~~	~~291~~	~~44~~
774.70	2.00	1.50			9.5	12.9	***668.1***	~~668~~	~~0~~	~~0~~	~~367~~	~~46~~
771.70	3.00		29	Sandy Gravel	36.0	143.4	***738.8***	~~739~~	~~0~~	~~0~~	~~406~~	~~49~~
769.20	2.50		36	Fine Sand	26.4	178.0	***1081.6***	~~1082~~	~~0~~	~~0~~	~~595~~	~~51~~
766.70	2.50		100	Medium Sand	163.8	494.4	***1245.3***	~~1245~~	~~0~~	~~0~~	~~685~~	~~54~~
764.20	2.50		100	Medium Sand	163.8	494.4	***1409.1***	~~1409~~	~~0~~	~~0~~	~~775~~	~~56~~
762.70	1.50		100	Fine Sand		494.4						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

Illinois Department of Transportation

SUBSTRUCTURE===================================== Pier 1
REFERENCE BORING ================================ B-2g
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. ================================== 802.01 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 800.01 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================= ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ============== ft

TOTAL FACTORED SUBSTRUCTURE LOAD =============== 3231 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 301.75 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 113.16 KIPS

PILE TYPE AND SIZE ============= Metal Shell 12"Φ w/.25" walls
Pile Perimeter============================== 3.142 FT.
Pile End Bearing Area=========================== 0.785 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
392 KIPS	**351** KIPS	**193** KIPS	**18** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
798.70	1.31	1.50			6.2		***13.1***	13	0	0	7	3
796.20	2.50	0.80			7.3	6.9	***47.8***	48	0	0	26	6
793.70	2.50		11	Very Fine Silty Sand	6.8	34.3	***46.2***	46	0	0	25	8
791.20	2.50		7	Very Fine Silty Sand	4.3	26.0	***232.2***	232	0	0	128	11
788.70	2.50		56	Very Fine Silty Sand	44.2	207.7	***283.8***	284	0	0	156	13
786.20	2.50		58	Very Fine Silty Sand	46.9	215.1	***338.2***	338	0	0	186	16
783.70	2.50		60	Very Fine Silty Sand	49.7	222.5	***350.8***	351	0	0	193	18
781.20	2.50		50	Very Fine Silty Sand	36.8	185.4	***454.3***	~~454~~	~~0~~	~~0~~	~~250~~	~~21~~
779.20	2.00		51	Fine Sand	37.9	252.1	***488.5***	~~488~~	~~0~~	~~0~~	~~269~~	~~23~~
776.70	2.50		67	Hard Till	41.0	248.4	***671.7***	~~672~~	~~0~~	~~0~~	~~369~~	~~25~~
774.70	2.00		79	Medium Sand		390.6						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE===================================== North Abutment
REFERENCE BORING ================================= B-1g
LRFD or ASD or SEISMIC =============================== LRFD
PILE CUTOFF ELEV. ==================================== 820.25 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 818.25 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================= ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) =============== ft

TOTAL FACTORED SUBSTRUCTURE LOAD =============== 1547 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 144.48 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 54.18 KIPS

PILE TYPE AND SIZE ============= Metal Shell 12"Φ w/.25" walls
Pile Perimeter============================== 3.142 FT.
Pile End Bearing Area=========================== 0.785 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
392 KIPS	**345** KIPS	**190** KIPS	**32** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
815.70	2.55	2.40			16.4		***55.2***	55	0	0	30	5
813.20	2.50	4.50	16		25.6	38.8	***93.9***	94	0	0	52	7
810.70	2.50		14	Very Fine Silty Sand	8.7	51.9	***71.3***	71	0	0	39	10
808.20	2.50	2.40			16.1	20.7	***93.5***	93	0	0	51	12
805.70	2.50	3.10	11		19.3	26.7	***116.2***	116	0	0	64	15
803.20	2.50	3.50	18		21.1	30.2	***135.5***	135	0	0	75	17
800.70	2.50	3.30	16		20.2	28.4	***138.4***	138	0	0	76	20
798.20	2.50	1.30			10.7	11.2	***148.3***	148	0	0	82	22
795.70	2.50	1.20			10.1	10.3	***156.6***	157	0	0	86	25
793.20	2.50	1.00			8.7	8.6	***161.9***	162	0	0	89	27
790.70	2.50	0.60			5.6	5.2	***182.2***	182	0	0	100	30
788.20	2.50	2.30			15.7	19.8	***344.9***	345	0	0	190	32
785.70	2.50		45	Very Fine Silty Sand	31.3	166.9	***591.3***	~~591~~	~~*0*~~	~~*0*~~	~~*325*~~	~~*35*~~
783.20	2.50		103	Very Fine Silty Sand	126.0	381.9	***706.2***	~~706~~	~~*0*~~	~~*0*~~	~~*388*~~	~~*37*~~
781.20	2.00		100	Very Fine Silty Sand	96.4	370.8	***708.6***	~~709~~	~~*0*~~	~~*0*~~	~~*390*~~	~~*39*~~
778.70	2.50		56	Sandy Gravel	115.0	276.9	***1041.1***	~~1041~~	~~*0*~~	~~*0*~~	~~*573*~~	~~*42*~~
776.70	2.00		100	Sandy Gravel		494.4						

EXHIBIT G

LAB TEST DATA

Wang Engineering

SUMMARY OF LABORATORY TEST RESULTS

Project: Ramp BD North, Ramp BD South, Perryville, Mulford
Client: WBK
Wang Job: 412-04-10

Prepared by: C. Iordache
Checked by: L. Iordache
Date: 8/1/2016

SAMPLE IDENTIFICATION				LABORATORY TESTS AND SOIL CLASSIFICATION														
Site	Boring	Sample	Top Depth	Water Content AASHTO T265	Atterberg Limits AASHTO T89 & T90			Visual Soil Classification IDOT 1999	Unconfined Compressive Strength AASHTO T208	One-Dimensional Consolidation AASHTO T216			UU Triaxial Compression AASHTO T296					
				w	LL	PL	PI	IDH	q_u	Cc	Cs	OCR	σ_1	S_u	σ_1	S_u	σ_1	S_u
			ft	%	%	%	%		tsf				psi	tsf	psi	tsf	psi	tsf
Mulford	B-4g	ST-2a	2.5	8				GRAVELLY SAND	NA									
Mulford	B-4g	ST-2b	3.5	20	49	19	30	SILTY CLAY		0.129	0.042	6.32						
Mulford	B-4g	ST-3a	5.0	25	40	19	21	SILTY CLAY	1.18	0.211	0.045	2.61						
Mulford	B-4g	ST-3b	6.0	11														
Mulford	B-4g	ST-4a	7.5	31				SILTY CLAY	0.61									
Mulford	B-4g	ST-4b	8.5					SILTY CLAY LOAM										
Mulford	B-4g	ST-5a	10.0	20				SANDY LOAM	0.25									
Mulford	B-4g	ST-5b	11.0					SANDY LOAM										
Mulford	B-4g	ST-6a	12.5	15				SANDY LOAM	0.15									
Mulford	B-4g	ST-6b	13.5					SANDY LOAM										
Perryville	B-6e	ST-1a	0.0					SANDY LOAM										
Perryville	B-6e	ST-1b	1.0	22				SILTY CLAY	1.58									
Perryville	B-6e	ST-2a	2.5	24	42	19	23	SILTY CLAY		0.197	0.063	3.08						
Perryville	B-6e	ST-2b	3.5					SILTY CLAY										
Perryville	B-6e	ST-3a	5.0	20				SILTY CLAY	1.03									

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ONE-DIMENSIONAL CONSOLIDATION TEST

AASHTO T 216 / ASTM D 2435

Project: SN 101-0207, Mulford
Client: Wills, Burke, Kelsey & Associates
Soil Sample ID: Boring B-4g, ST#3, 5 to 7.5 feet
Sample Description: Brown and gray SILTY CLAY

Tested by: M. Snider
Prepared by: M. Snider
Test date: 7/14/2016
WEI: 412-04-10

Initial sample height =	1.000	in
Initial sample mass =	154.09	g
Initial water content =	25.26%	
Initial dry unit weight =	95.87	pcf
Initial void ratio =	0.757	
Initial degree of saturation =	90.04%	
Final sample mass =	149.42	g
Final dry sample mass =	123.02	g
Final water content =	21.46%	
Final dry unit weight =	109.61	pcf
Final void ratio =	0.537	
Final degree of saturation =	100.00%	
Estimated specific gravity =	2.70	

Ring diameter =	2.495	in
Ring mass =	109.54	g
Initial sample and ring mass =	263.63	g
Tare mass =	84.94	g
Final ring and sample mass =	259.32	g
Mass of wet sample and tare =	234.36	g
Mass of dry sample and tare =	207.96	g
Initial dial reading =	0.01000	in
Final dial reading =	0.13531	in
LL=	40	%
PL=	19	%
% Sand=	n.a.	%
% Silt=	n.a.	%
% Clay=	n.a.	%
In-Situ Vertical Effective Stress =	750	psf

Compression and Swelling Indices

Compression index C_c = 0.200
Field corrected C_c = 0.211
Swelling index C_s = 0.045

Preconsolidation pressure,s_C
Casagrande Method = 1959 psf
Over-Consolidation Ratio (OCR) = 2.61

Load number	Vertical stress	Dial reading	System deflection	Vertical strain	Void ratio	C_v	Cae	Elapsed time
	psf	in	in	%		ft^2/day	%	min
1	100.0	0.01023	0.00010	0.03	0.757	N/A	N/A	480
2	200.0	0.01195	0.00023	0.22	0.753	0.1851	0.05	960
3	500.0	0.01765	0.00058	0.82	0.743	0.2816	0.15	1412
4	1000.0	0.02671	0.00090	1.76	0.726	0.2688	0.05	480
5	2000.0	0.04036	0.00135	3.17	0.702	0.2589	0.16	960
6	4000.0	0.06711	0.00193	5.90	0.654	0.2385	0.25	831
7	8000.0	0.10022	0.00253	9.27	0.594	0.1866	0.32	523
8	16000.0	0.13367	0.00324	12.69	0.534	0.1752	0.26	960
9	32000.0	0.16697	0.00413	16.11	0.474	0.1490	0.30	960
10	8000.0	0.16603	0.00295	15.90	0.478	N/A	N/A	960
11	2000.0	0.15622	0.00198	14.82	0.497	N/A	N/A	480
11	500.0	0.13676	0.00123	12.80	0.532	N/A	N/A	1200

Prepared by: ______________________ Date: ______________

Checked by: ______________________ Date: ______________

s:\netprojects\4120410\lab data\consolidation\set 3\ch13\lws_wang_mls_b4g_st3_20160729.xls

AASHTO R18

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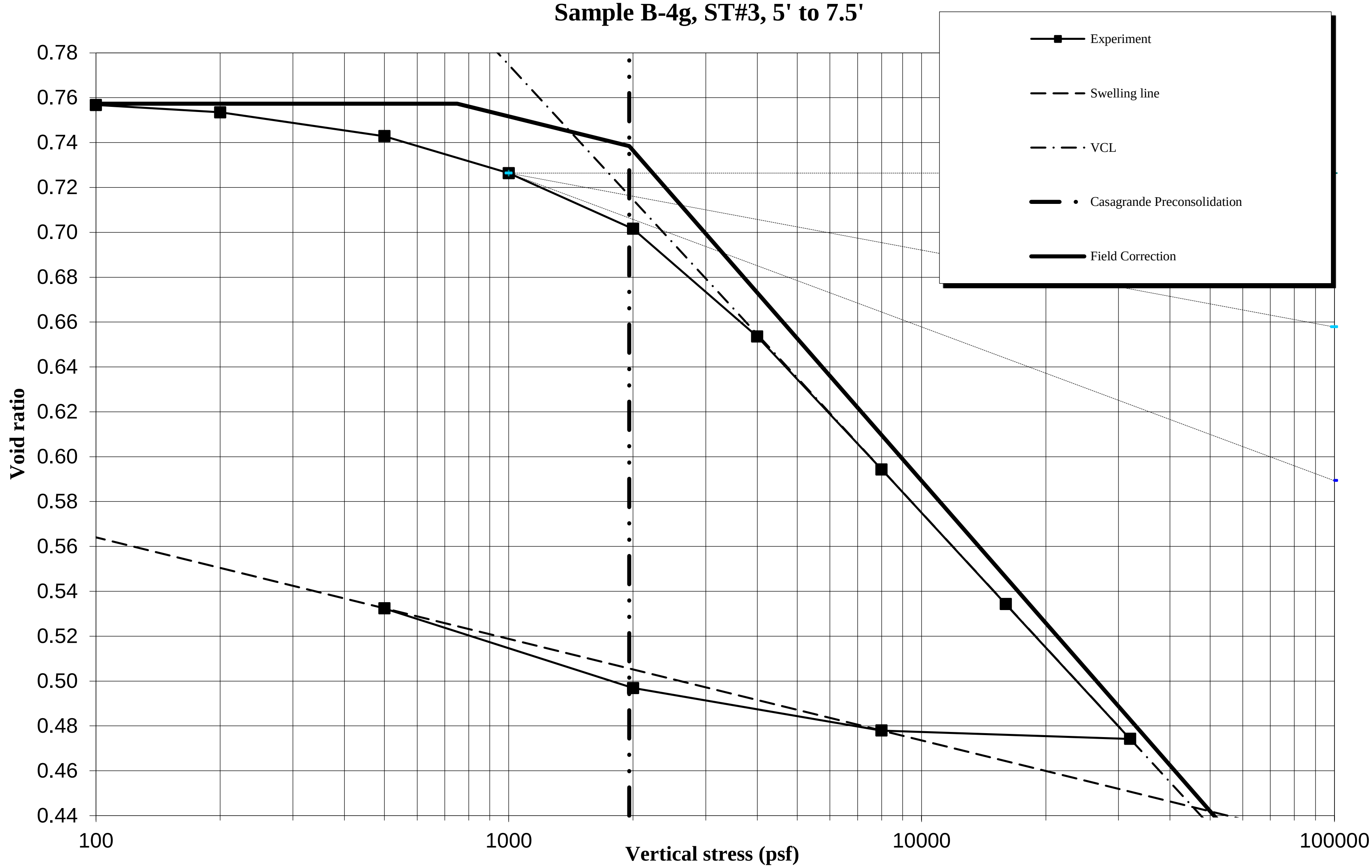
CONSOLIDATION CURVE

Sample B-4g, ST#3, 5' to 7.5'



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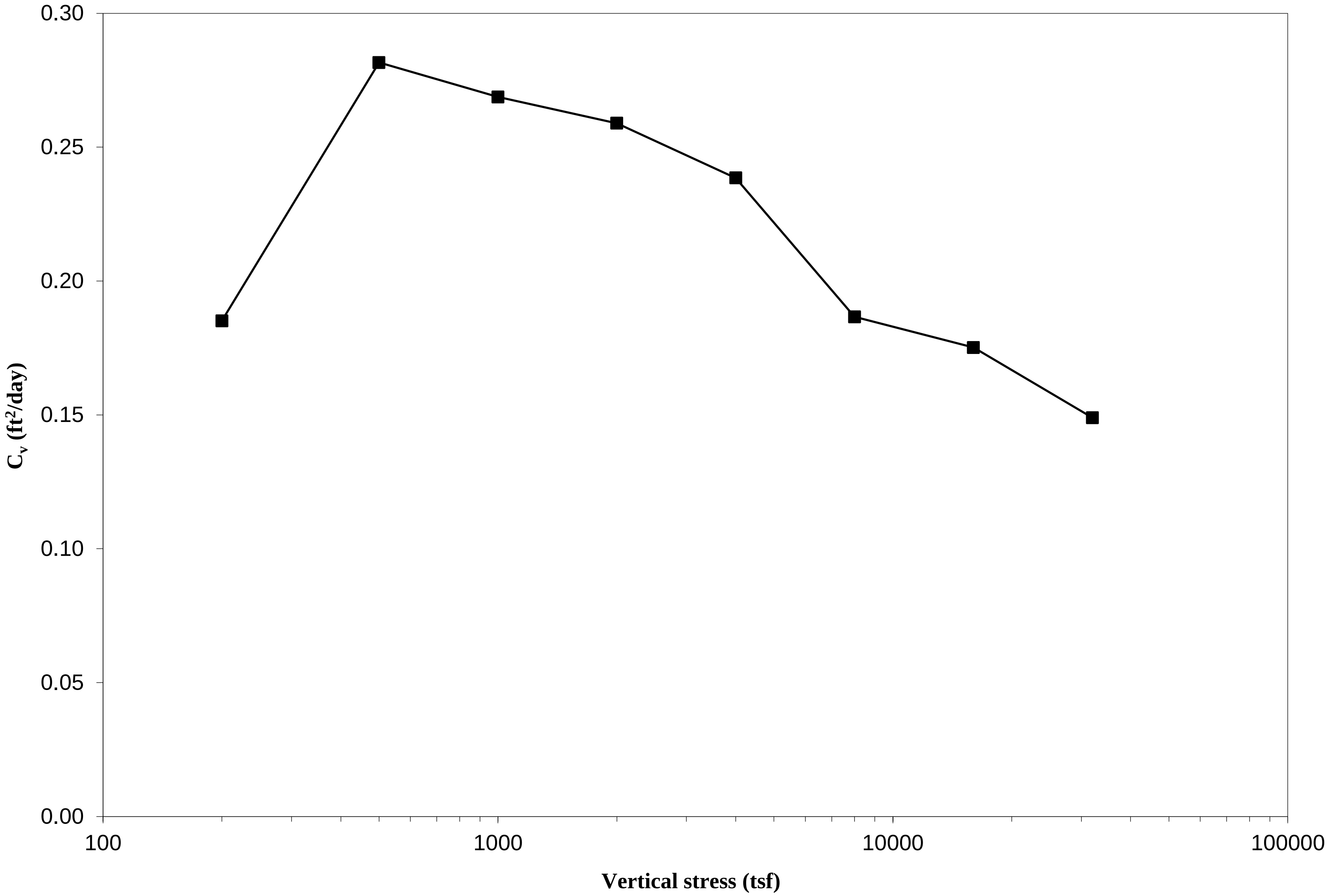
CONSOLIDATION COEFFICIENT (C_v) vs. VERTICAL STRESS

Sample B-4g, ST#3, 5' to 7.5'



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UNCONFINED COMPRESSIVE STRENGTH of COHESIVE SOIL

(AASHTO T 208 / ASTM D 2166)

Project: SN 101-0207 Mulford
Client: Wills, Burke, Kelsey Associates
WEI Job No.: 412-04-10
Soil Sample ID: B-4g, ST#3a, 5.0 to 6.5 feet
Type/Condition: ST/ Undisturbed
Liquid Limit (%): 40
Plastic Limit (%): 19

Analyst name: A. Mohammed
Date received: 6/3/2016
Test date: 7/14/2016
Sample description: Brown & Gray SILTY CLAY
Sand(%): NA
Silt(%): NA
Clay(%): NA

Average initial height h_0 = 6.09 in
Average initial diameter d_0 = 2.87 in
Height to diameter ratio= 2.12
Mass of wet sample = 1299.82 g
Mass of dry sample and tare = 1091.31 g
Mass of tare = 13.76 g
Specific gravity = 2.76 (estimated)

Initial water content w = 20.63% (specimen)
Initial unit weight g = 126.03 pcf
Initial dry unit weight g_d = 104.48 pcf
Initial void ratio e_0 = 0.65
Initial degree of saturation S_r = 88%
Average Rate of Strain= 1%/min
Unconfined compressive strength q_u = 1.18 tsf
Shear Strength= 0.59 tsf

Displacement (in) Δh	Force (lbs) F	Strain (%) e	Stress (tsf) s
0.00	0.00	0.00	0.00
0.03	24.89	0.49	0.28
0.06	41.48	0.99	0.46
0.09	57.04	1.48	0.63
0.12	66.37	1.97	0.73
0.15	74.66	2.46	0.81
0.18	82.96	2.96	0.90
0.21	89.18	3.45	0.96
0.24	95.40	3.94	1.02
0.27	97.48	4.43	1.04
0.30	99.55	4.93	1.06
0.35	105.77	5.75	1.11
0.40	107.85	6.57	1.12
0.45	112.00	7.39	1.16
0.50	114.07	8.21	1.17
0.55	116.14	9.03	1.18
0.60	117.18	9.85	1.18
0.65	117.18	10.68	1.17
0.70	117.18	11.50	1.16
0.80	117.18	13.14	1.14
0.90	117.18	14.78	1.11
1.00	97.48	16.42	0.91

NOTES: ______

Prepared by: ______ Date: ______

Checked by: ______ Date: ______

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