Illinois Department of Transportation

Memorandum

To:	Carl Puzey Attn: Brad Hessing
From:	Michael A. Short By: Jeremy Brown
Subject:	Structure Geotechnical Report Disposition *
Date:	August 12, 2021

* Route: FAP 587 (US 34)
Section: (18B)ES
Structure No.: 050-0262
County: LaSalle
Contract No.: 66J00

Attached is the Structure Geotechnical Report for the subject project. This disposition is to provide revisions to the SGR for SN: 050-0262 which was submitted to the Bureau of Bridges and Structures for review by Jeremy Brown of IDOT District 3. The responses below are direct responses to the speed letter that was provided from the Bridge Office.

1. The revised design scour elevation table has been inserted into the report.
2. Calculations have been removed from the report and the spreadsheets are attached.
3. The spreadsheets for estimating pile lengths have been removed and a table of H-pile options has been inserted.
4. Rock core strengths have been adjusted to represent the 5-foot core runs in the spreadsheets.
5. The requested changes in comment 5 have been made and the drilled shaft axial capacity spreadsheets have been updated.
6. Lateral analysis parameters have been included in the report.
7. TEMPORARY SHEET PILING pay item is recommended in the report.
8. A copy of the approved TS&L is included in the SGR.
9. Updated the section discussing the need for cofferdams.

JB:bs/StructureGeotechReport_#66J00

Illinois Department of Transportation

Abbreviated Structure Geotechnical Report

Original Report Date: 12/11/2020 **Proposed SN:** 050-0262 **Route:** FAP 587 (US 34)
Revised Date: 8/12/2021 **Existing SN:** 050-0039 **Section:** (18B)ES
Geotechnical Engineer: Jeremy Brown (IDOT D3) **County:** LaSalle
Structural Engineer: James Clinard PE, SE (Chamlin & Associates) **Contract:** 66J00

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing): The proposed stucture will be a 2-lane, 3-span girder bridge on integral abutments, with an approximate length of 135 feet. The structure will have a 34 degree left forward skew. Load information provided by Lin Engineering indicates factored loads of 715 kips at the abutments and 1,010 kips at the two piers. Staged construction will be utilized for construction of the new bridge. A copy of the approved TS&L is attached.

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): There was little subsurface information available from construction of the existing structure. Soil borings and rock cores were obtained at the abutments in 2018 and 2020 respectively. The existing structure is on closed abutments on spread footings and has two piers also on spread footings. Copies of the boring logs are attached.

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 roadway profile will be raised slightly, with no more than 2 foot of fill anticipated near the abutments. No significant increase in embankment loading should result from the replacement of the bridge. A site visit was performed and no settlement was visible. No additional analysis is warranted.

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 roadway side slopes will range from 2H:1V to 3H:1V. Based on the preliminary plans, fills along the side slopes will not exceed 3 feet. The maximum embankment height will be 12 feet. A slope stability analysis for the new abutment side slopes was performed using Slide. A factor of safety (FOS) of 1.5 is required for fill areas. The calculated FOS for the west and east abutment side slopes are 3.8 and 4.7 respectively. See attached SLIDE analyses.

The proposed end slopes will be constructed using Class A-4 Rip Rap and constructed at a 2H:1V slope. Typically a slope stability analysis would be conducted on the end slopes, however in this situation the calculations would be the same as the side slopes, but given the lower finished grade and the Rip Rap slopewall, the end slopes will have a higher FOS than the side slopes.

Based on this information, slope failure is not a concern on the side slopes or end slopes.

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:
Per the Hydraulic Report, the total pier scour depths for Q100 and Q200 are 8.17 ft and 9.09 ft respectively. The following scour table was provided by the Bureau of Bridges and Structures using the IDOT Scour Analysis spreadsheet. Copies of the spreadsheets are attached.

Event/Limit State	Design Scour Elevations (ft.)				Item 113
	W. Abut	Pier 1	Pier 2	E. Abut.	
Q100	683.70	666.40	666.40	683.70	5
Q200	683.70	665.50	665.50	683.70	
Design	683.70	666.40	666.40	683.70	
Check	683.70	665.50	665.50	683.70	

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: Seismic Soil Site Class = C. The SDS = 0.126 g. The SD1 = 0.069 g. The Seismic Performance Zone (SPZ) for this bridge = 1, therefore a liquefaction analysis was not performed.

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: Soil borings 01 (W. Abut.) and 02 (E. Abut.) along with rock cores 01a (S.W. Quad.) and 02a (N.E. Quad.) were used to design the foundations for the proposed structure. Due to field conditions, it was not possible to obtain borings close to the piers. Use 657.15 for the top of rock elevation for the west abutment and west pier foundation designs and 653.12 for the top of rock elevation for the east abutment and east pier foundation designs. The top of rock elevations from boring 02 (E. Abut.) and rock core 02a (N.E. Quad) differ by approximately 4 feet and it is recommended to use the lower elevation of 653.12 as a more conservative design.

Integral abutments are feasible for the proposed structure. The abutments should utilize conventional construction methods to drive piles to refusal into the limestone. H-piles with pile shoes are recommended for both abutments because of the need to drive through the weathered limestone and setting into the denser but highly fractured material another foot. Metal shell piles are not recommended because of the risk of damage when driving to the limestone bedrock. See the attached integral abutment feasibility analysis and pile tables for the design, resistances, and recommended pile lengths. The bedrock elevation is consistent through the location of the proposed structure, therefore test piles are not necessary.

The approved TS&L shows drilled and set piles as the chosen foundation design for the proposed piers. Drilled shafts are also an acceptable alternative for the pier foundations. Due to the quality of the rock cores that were retrieved, it was not possible to achieve the unconfined compressive strength (Qu) of the cores in every run. For the rock core runs that were not able to be tested, the Qu from the following layer was used. Per the IDOT Bridge Manual, the rock socket diameter shall be 24 inches for HP12 and HP14 steel H-Piles. Tip resistance is recommended for the design of the drilled and set piles due to the low RQD of the rock samples at both core locations. Drilling to a depth of 6-feet into the bedrock at both pier locations is recommended for each pile socket to reach the less fractured, tighter jointed limestone which will provide adequate support for the set piles. The IDOT drilled shaft axial capacity in rock spreadsheet was used to calculate a factored unit tip resistance of 99 ksf at the west pier and 95 ksf at the east pier. These resistances were calculated at a depth of 6 feet below their respective top of rock elevations. The resistance factors used for tip and side resistance calculations are 0.5 and 0.55 respectively. Drilled shaft axial capacity spreadsheets and rock core logs are attached.

Lateral Load Soil Parameters

Soil Type	Angle of Internal Friction (degrees)	Average Undrained Cohesion (ksf)	Static Soil Modulus k (pci)	Soil Strain Parameter E50	Total Unit Wt. (pcf)	Effective Unit Wt. (pcf)
Medium Dense - Fine Course Sand	32	0	60	0	115	52.6
Very Stiff Silty Clay Loam Till	-	1.4	1000	0.005	122	59.6
Stiff Silty Loam Till	-	1.0	500	0.007	120	57.6

Calculate the estimated water surface elevation and determine the need for cofferdams (type 1 or 2), and seal coat: There will be two solid wall piers that will require in stream work. Because the EWSE of 677.60 is less than 6 ft. above the bottom of the concrete of the pier foundation, a type I cofferdam is recommended. From the data shown in the soil boring logs, it should not be an issue driving the sheet piling to the design depth at this location.

Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns: The preliminary plans indicate that construction of the proposed bridge will require complete removal of the existing structure using staged construction, therefore portions of the bridge will remain in use during installation of the new structure. Temporary sheet piling will be necessary for staged

construction. The soils within the embedment depth do not exceed 4.5 tsf, therefore temporary sheet piling is feasible and the pay item TEMPORARY SHEET PILING should be used.

Benchmark: BM #4 – Cut square on top of northwest wingwall of SN 050-0039; Sta. 608+78.77, 17.04' Lt, Elev. 689.53.

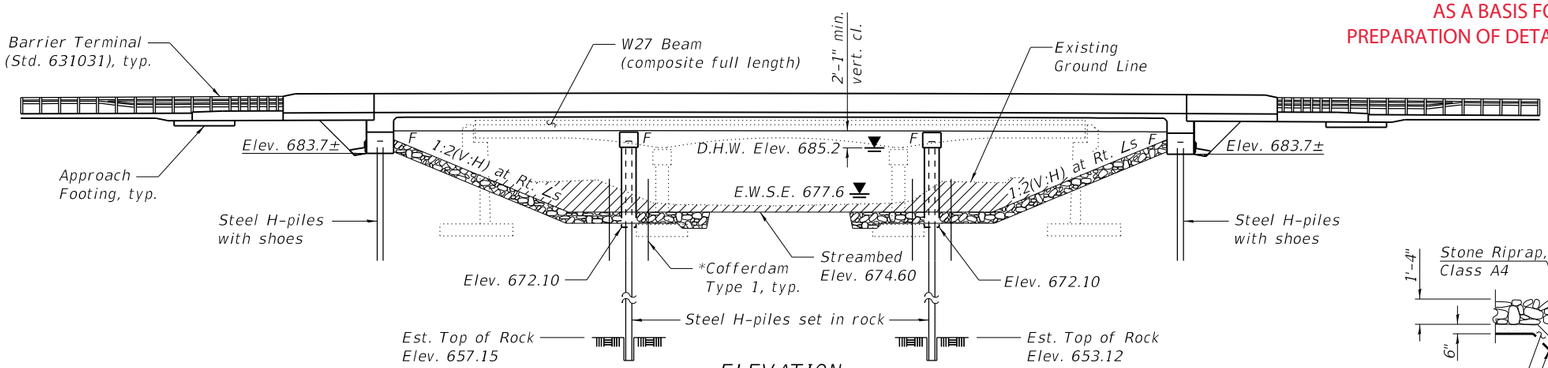
Existing Structure: SN 050-0039, built in 1952 as FA Rte. 19, Section 18B at Sta. 609+19. The structure is a three-span variable depth concrete tee-beam superstructure supported by closed concrete abutments on spread footing and concrete multi-column piers on spread footing. Back to back abutment length is 103'-9", out to out bridge width is 35'-8", with a left ahead skew of 34 degrees. Structure to be removed and replaced utilizing stage construction, while maintaining one lane of traffic at all times.

No Salvage.

APPROVED

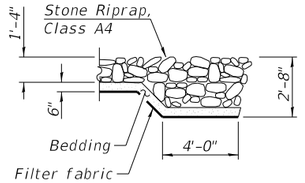
APRIL 29, 2021

AS A BASIS FOR
PREPARATION OF DETAILED PLANS

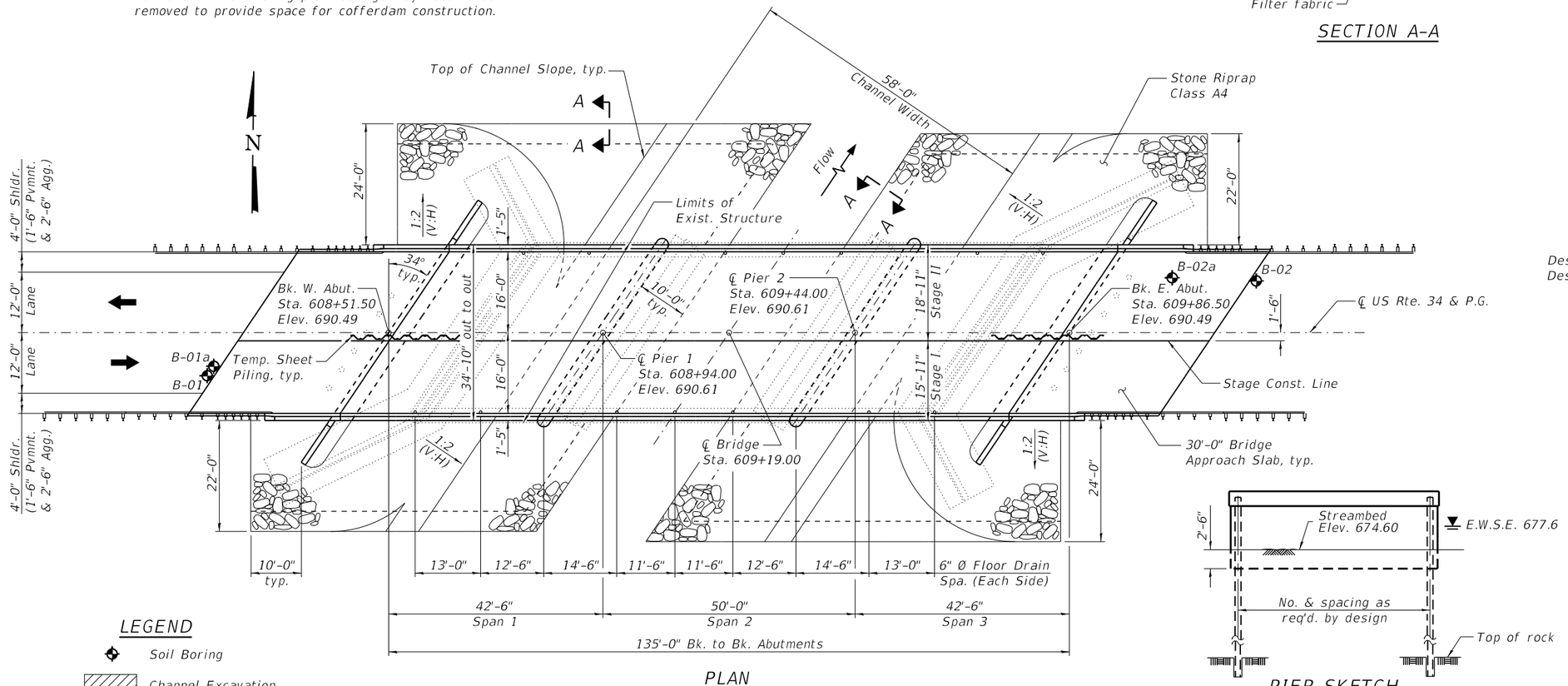


ELEVATION

*Portions of the existing pier footings may need to be removed to provide space for cofferdam construction.



SECTION A-A



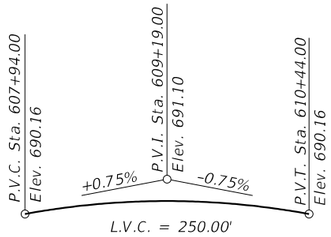
PLAN

LEGEND

Soil Boring

Channel Excavation

PIER SKETCH



US RTE. 34 PROFILE GRADE

(Along ℄ Roadway)

HIGHWAY CLASSIFICATION

F.A.P. Rte. 587 – US Rte. 34
Functional Class: Minor Arterial
ADT: 2466 (2023); 3186 (2043)
ADTT: 478 (2023); 618 (2043)
DHV: 328 (2043)
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

DESIGN STRESSES

FIELD UNITS

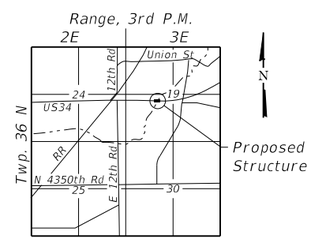
f'c = 3,500 psi (Substructure)
f'c = 4,000 psi (Superstructure)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

LOADING HL-93

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

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.069g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.126g
Soil Site Class = C



LOCATION SKETCH

GENERAL PLAN & ELEVATION
US ROUTE 34 OVER SUTPHENS RUN
F.A.P. ROUTE 587 – SEC. (18B)ES
LASALLE COUNTY
STA. 609+19.00
STRUCTURE NO. 050-0262

LIN ENGINEERING, LTD.
Consulting Engineers
Springfield, Illinois

USER NAME =	DESIGNED - VPT	REVISED -	
	CHECKED - RJM	REVISED -	
PLOT SCALE =	DRAWN - DAS	REVISED -	
PLOT DATE = 4/27/2021	CHECKED - RJM	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
587	(18B)ES	LASALLE		
		CONTRACT NO. 66J00		
	ILLINOIS	FED. AID PROJECT		

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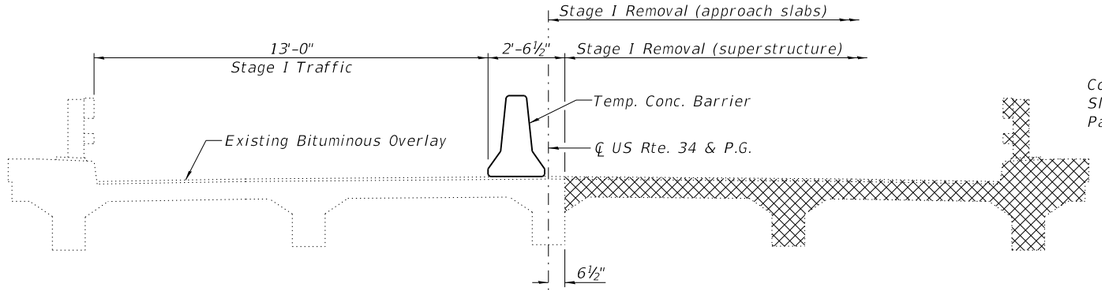

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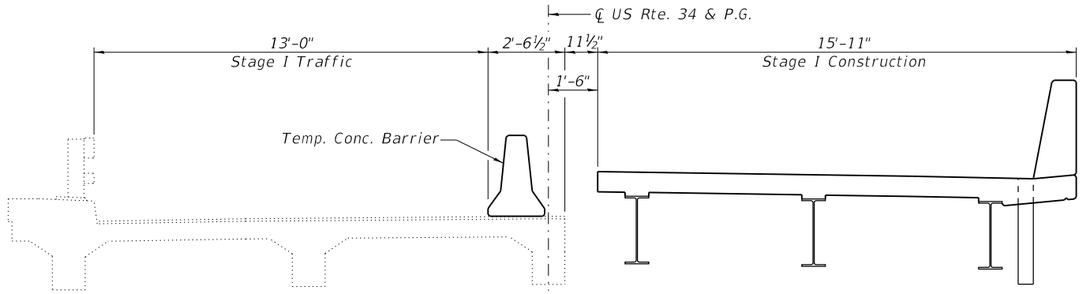
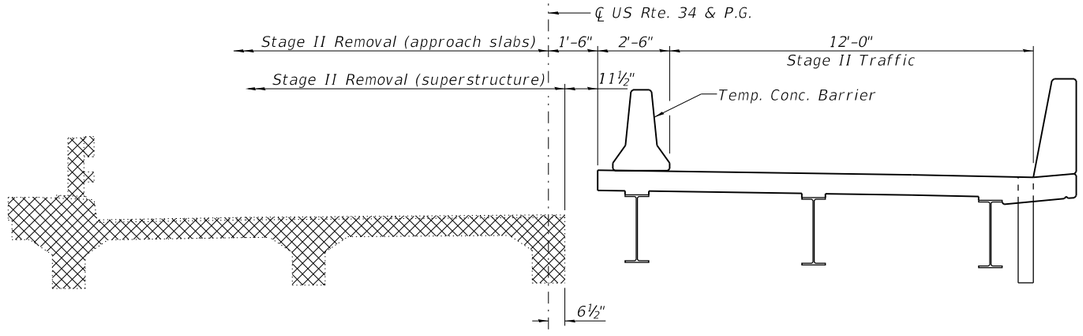


STAGE I CONSTRUCTION



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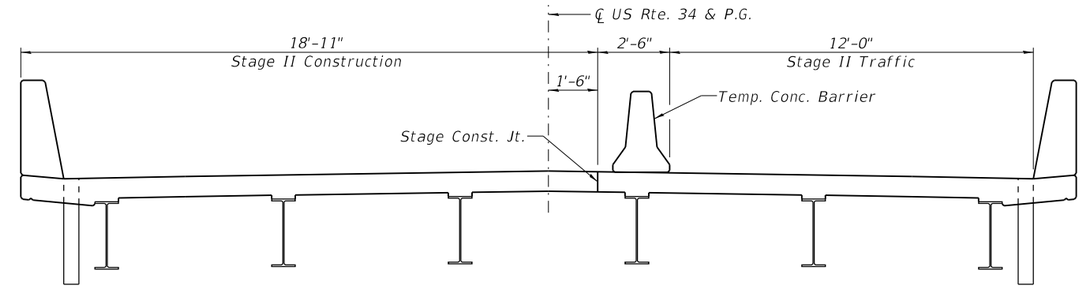
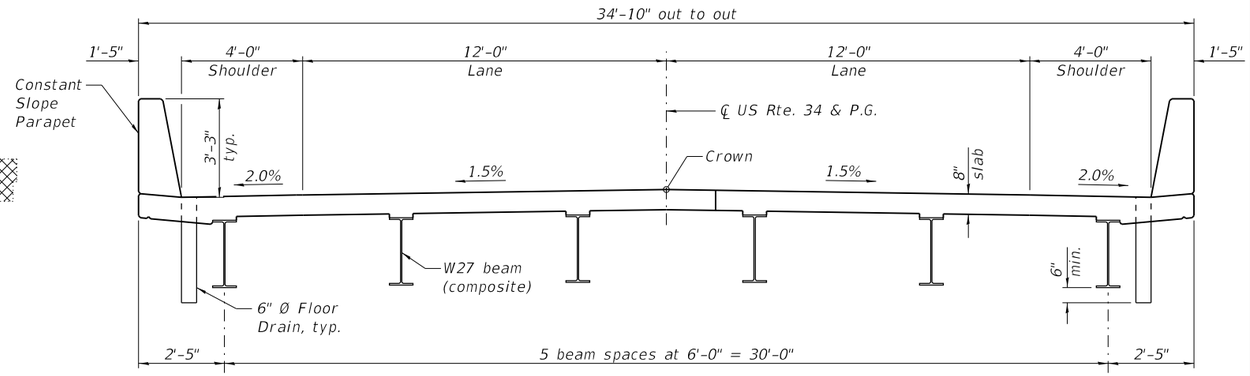


STAGE II CONSTRUCTION



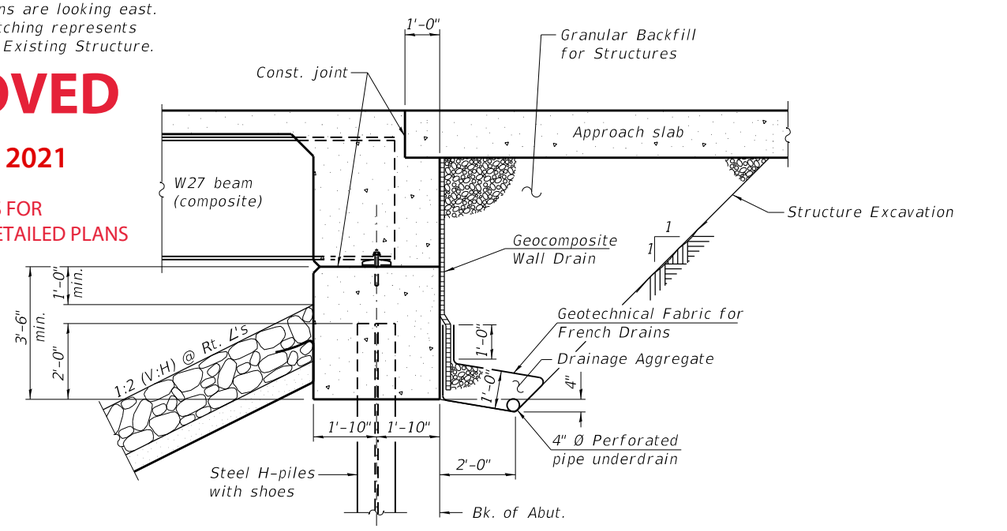
PROPOSED CROSS SECTION

Notes:
All sections are looking east.
Cross Hatching represents Removal of Existing Structure.

APPROVED

APRIL 29, 2021

AS A BASIS FOR
PREPARATION OF DETAILED PLANS



SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. @ Rt. L's)

WATERWAY INFORMATION

Drainage Area = 27.2 sq. mi.
Exist. Overtopping Elev. 689.03 @ Sta. 609+92
Prop. Overtopping Elev. 689.66 @ Sta. 612+00

Flood	Freq. Yr.	Q C.F.S.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	1690	472	665	683.8	0.4	0.3	684.2	684.1
Design	50	2640	576	793	685.2	0.6	0.5	685.8	685.7
Base	100	3070	609	841	685.7	0.7	0.5	686.4	686.2
Scour Check	200	3500	634	885	686.1	1.3	0.6	687.4	686.7
Max. Calc.	500	4090	647	943	686.7	1.1	0.8	687.8	687.5

10-year velocity thru existing structure = 3.6 fps
10-year velocity thru proposed structure = 2.5 fps

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.) W. Abut.	Pier 1	Pier 2	E. Abut.	Item 113
Q100	683.7	666.4	666.4	683.7	5
Q200	683.7	665.5	665.5	683.7	
Design	683.7	666.4	666.4	683.7	
Check	683.7	665.5	665.5	683.7	

DETAILS
US ROUTE 34 OVER SUTPHENS RUN
F.A.P. ROUTE 587 - SEC. (18B)ES
LASALLE COUNTY
STA. 609+19.00
STRUCTURE NO. 050-0262

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LIN ENGINEERING, LTD.
Consulting Engineers
Springfield, Illinois

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	CHECKED - RJM	REVISED -	
PLOT SCALE =	DRAWN - DAS	REVISED -	
PLOT DATE = 4/27/2021	CHECKED - RJM	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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		CONTRACT NO. 66J00		
	ILLINOIS FED. AID PROJECT			

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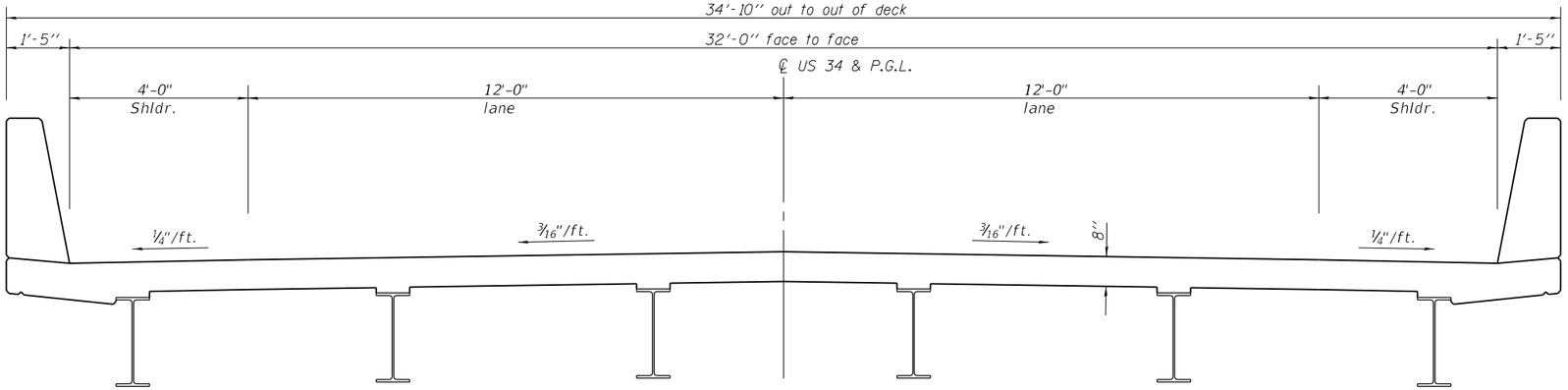
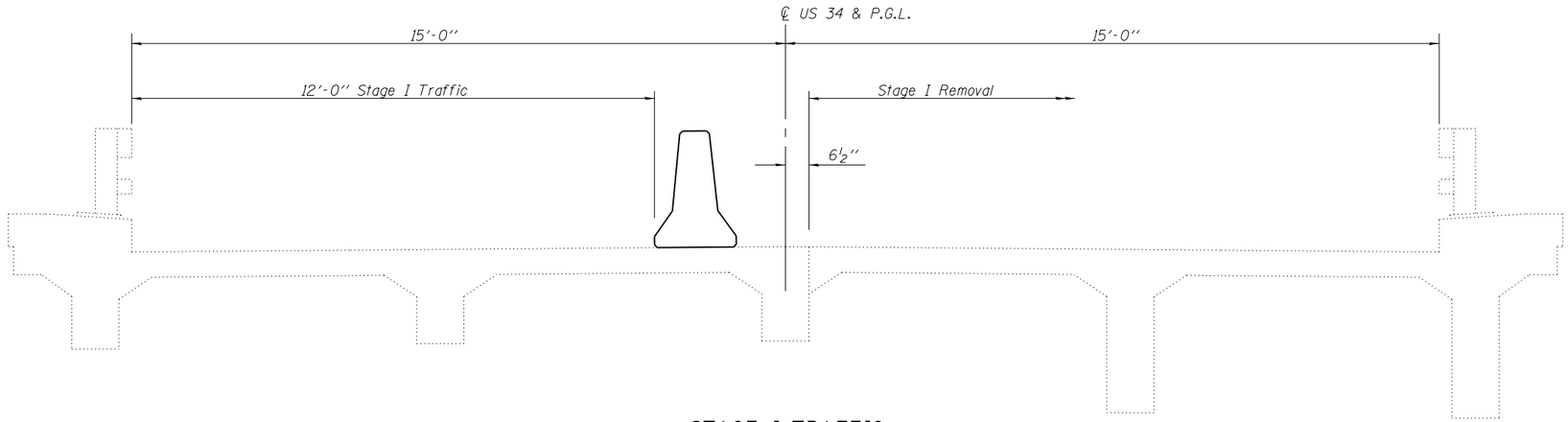
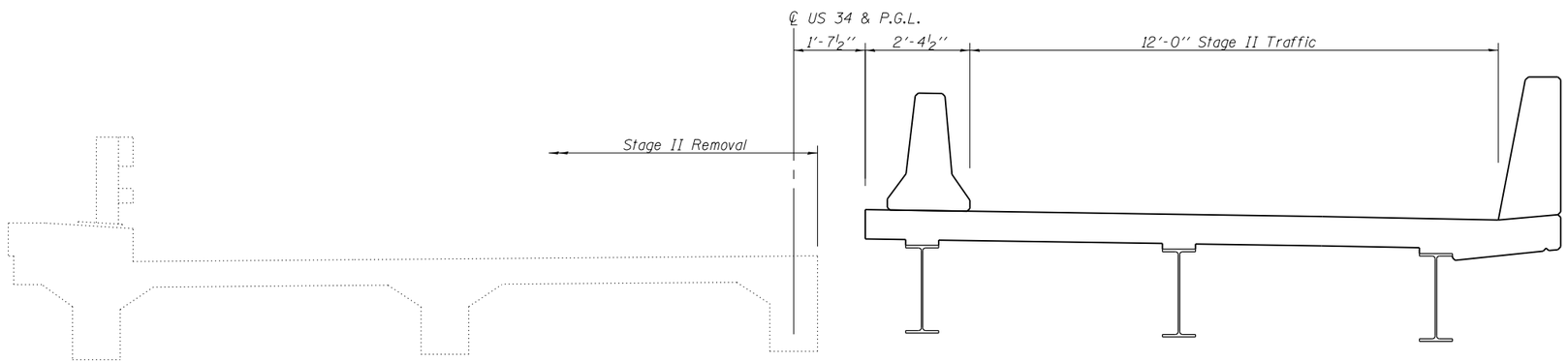


CROSS SECTION

(Looking East)



STAGE I TRAFFIC



STAGE II TRAFFIC

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	CHECKED -	REVISED -			587	18-B	LaSalle		
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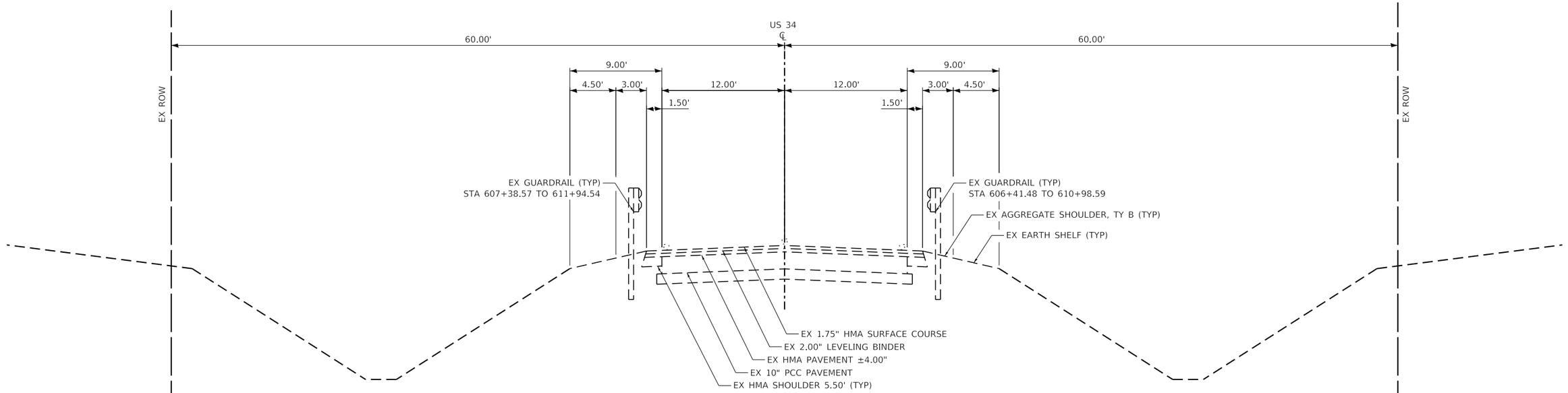
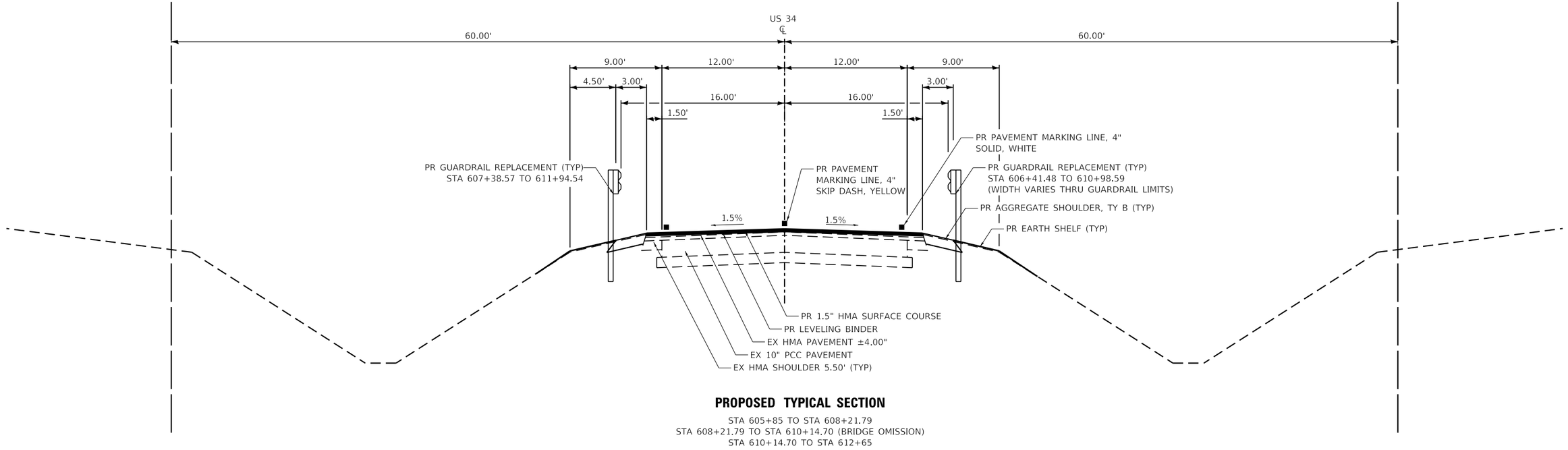


EXISTING TYPICAL SECTION

STA 605+85 TO STA 608+21.79
STA 608+21.79 TO STA 610+14.70 (BRIDGE OMISSION)
STA 610+14.70 TO STA 612+65



PROPOSED TYPICAL SECTION

STA 605+85 TO STA 608+21.79
STA 608+21.79 TO STA 610+14.70 (BRIDGE OMISSION)
STA 610+14.70 TO STA 612+65

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PLOT DATE = 3/27/2020	DATE - 03/06/2020	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

EXISTING AND PROPOSED TYPICAL SECTIONS
US ROUTE 34

SCALE: NONE | SHEET 1 OF 1 SHEETS | STA. 605+85 TO STA. 612+65

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
587	(18B)ES	LASALLE	1	1
		CONTRACT NO. 66J00		
	ILLINOIS	FED. AID PROJECT		

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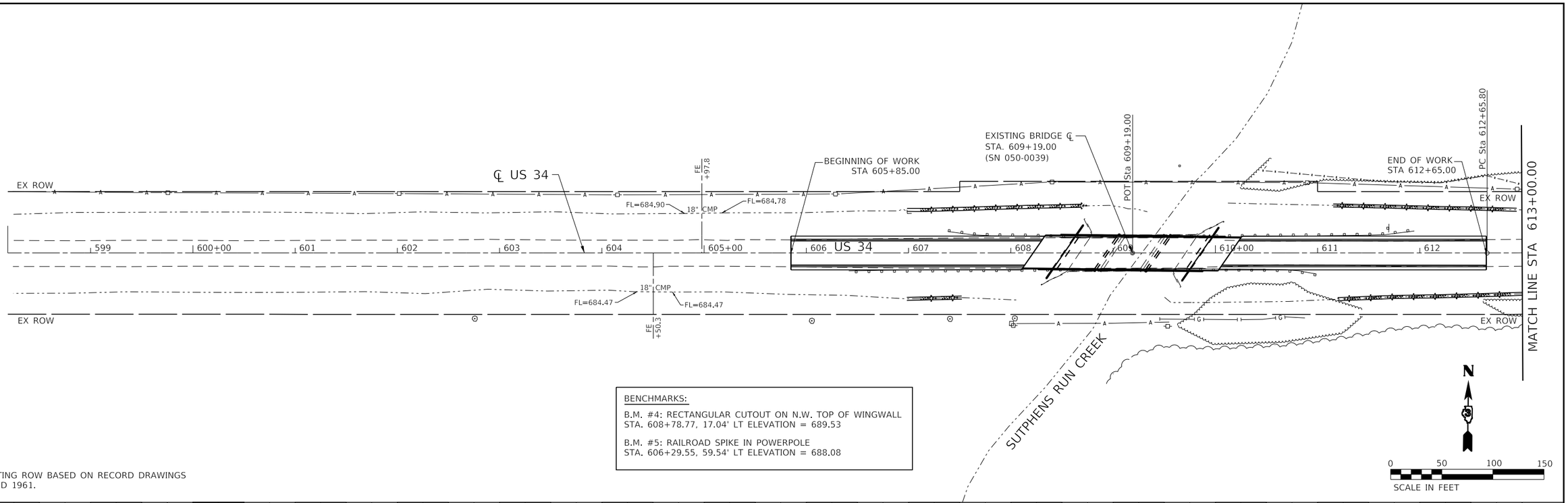
SURVEYED
PLOTTED
ALIGNMENT CHECKED
RT. OF WAY CHECKED
CADD FILE NAME
NOTE BOOK
NO.
DATE
BY



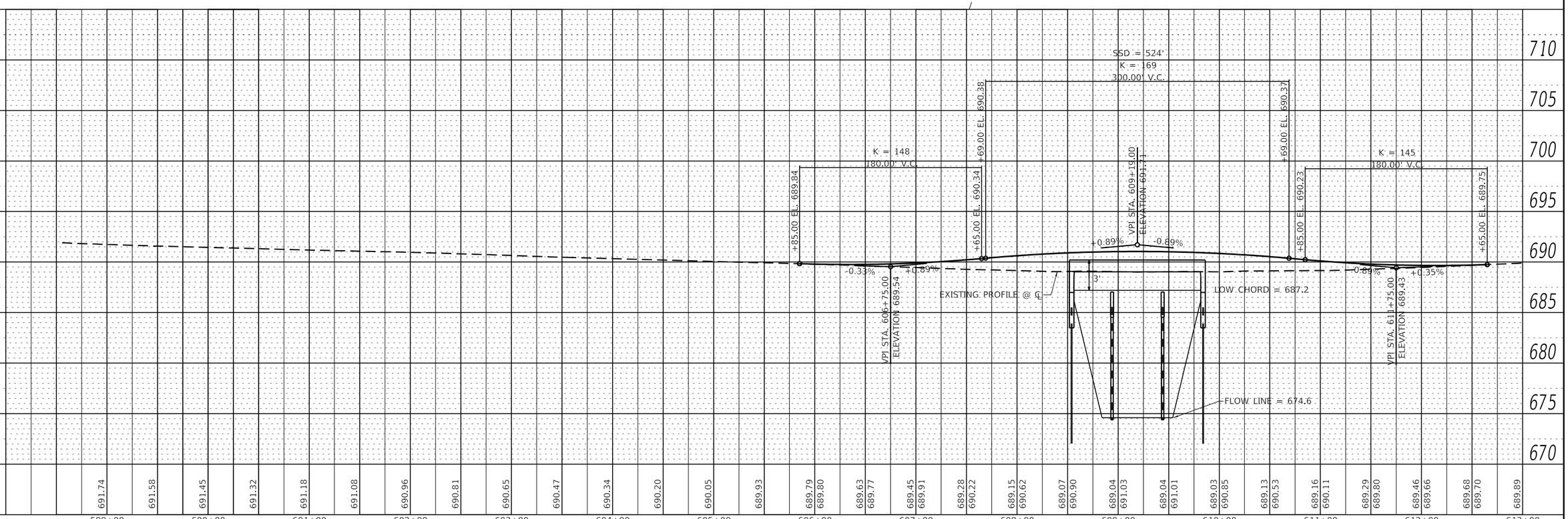
BENCHMARKS:

B.M. #4: RECTANGULAR CUTOUT ON N.W. TOP OF WINGWALL
STA. 608+78.77, 17.04' LT ELEVATION = 689.53

B.M. #5: RAILROAD SPIKE IN POWERPOLE
STA. 606+29.55, 59.54' LT ELEVATION = 688.08

NOTES:
1. EXISTING ROW BASED ON RECORD DRAWINGS DATED 1961.

PROFILE
SURVEYED
PLOTTED
PLOTTED CHECKED
NOTE BOOK
B.M. NOTED
NO.
STRUCTURE NO
TA'NS
CHKD



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PLOT DATE = 3/27/2020	DATE 03/06/2020	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

US 34 OVER SUTPHENS RUN CREEK
PLAN AND PROFILE

SCALE: H=50, V=5 | SHEET 1 OF 2 SHEETS | STA. 598+19.00 TO STA. 613+00.00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
587	(18B)ES	LASALLE	2	1
		CONTRACT NO. 66J00		
	ILLINOIS FED. AID PROJECT			

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Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/29/18

ROUTE FAP 587 (US 34) **DESCRIPTION** US 34 over Sutphens Run, 12.35 miles East of IL 251 **LOGGED BY** Larry Myers

SECTION 18-B **LOCATION** SW 1/4, **SEC.** 19, **TWP.** 36N, **RNG.** 3E, 3rd **PM**, **Latitude** 41.57779, **Longitude** -88.928289

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0039 (Exist.)
Station 609+19

BORING NO. 01 (W. Abut.)
Station 608+17
Offset 9.0 ft Rt.
Ground Surface Elev. 689.06 ft

Surface Water Elev. 676.27 ft
Stream Bed Elev. 675.53 ft

Groundwater Elev.:
First Encounter 676.1 ft ▼
Upon Completion 662.1 ft ▽
After ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Cored Ashpalt & Concrete Road, Augered Brown Silty Clay Loam Fill			
686.56			
Stiff to Very Stiff Brown, Black, Gray Silty Clay Loam Fill	2		
	3 3	2.0 P	21
-5	3		
	4 4	2.0 P	22
	2		
	3 5	2.5 P	11
680.06			
Medium Brown & Gray Fine Sand to Medium Gravel - Loamy			
-10	4		
	4 6		8
▼	6		
	9 10		13
-15	6		
	8 9		14
672.06			
Dense to Medium Gray & Brown Fine Sand to Coarse Gravel - Slightly Loamy	7		
	13 20		15
-20			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	13		
Dense to Medium Gray & Brown Fine Sand to Coarse Gravel - Slightly Loamy *(continued)*	10 13		10
666.56			
Very Stiff to Gray Silty Clay Loam / Silty Loam Till with Silt Layers	4		
	5 6	2.0 P	12
-25	4		
	7 9	4.1 S	9
662.06 ▽			
Stiff Gray Silty Loam Till with Silt Layers	3		
	4 4	2.0 B	12
-30	2		
	3 3	1.4 B	10
656.06	7		
Weathered Limestone Surface	100/2"		8
655.06			
Auger Refusal @ 34.0 Ft. End of Boring			
-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, form 137 (Rev. 8-99)

SOIL BORING 050-0039.GPJ IL_DOT.GDT 12/10/18

Illinois Department of Transportation
Division of Highways
IDOT

ROCK CORE LOG

Date 10/28/20

ROUTE FAP 587 (US 34) **DESCRIPTION** US 34 over Sutphens Run, 12.35 miles East of IL 251 **LOGGED BY** Larry Myers

SECTION 18-B **LOCATION** SW 1/4, **SEC.** 19, **TWP.** 36N, **RNG.** 3E, 3rd **PM**,
Latitude 41.57778, **Longitude** -88.92825

COUNTY LaSalle **CORING METHOD** Split Barrel Wire Line

STRUCT. NO. 050-0039 (Exist.)
Station 609+19

BORING NO. 01a (S.W. Quad.)
Station 608+19
Offset 8.0 ft Rt.
Ground Surface Elev. 689.15 ft

CORING BARREL TYPE & SIZE N W/L 2
Core Diameter 1.9 in
Top of Rock Elev. 657.15 ft
Begin Core Elev. 657.15 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Till with Large Limestone Pieces	657.15		1	68	8	3.4	
	656.15						925.4
Orange & Tan Highly Jointed Limestone with Numerous Vertical Fractures, some Rubbled Layers, some Loose Joints filled with Green Weathered Shale, 1 Thin Seam of Shale & White Sandstone at 33 Ft.		-35					
	652.15						
Same Material with Higher number of Sandstone Filled Seams - All Loose Joints		-40	2	97	23	8.4	1263.1
	647.15						724.9
End of Boring		-45					
		-50					

ROCK CORE 050-0039.GPJ IL_DOT.GDT 11/18/20

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/29/18

ROUTE FAP 587 (US 34) **DESCRIPTION** US 34 over Sutphens Run, 12.35 miles East of IL 251 **LOGGED BY** Larry Myers

SECTION 18-B **LOCATION** NW 1/4, **SEC.** 19, **TWP.** 36N, **RNG.** 3E, 3rd **PM**, **Latitude** 41.577845, **Longitude** -88.927526

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 050-0039 (Exist.)
Station 609+19

BORING NO. 02 (E. Abut.)
Station 610+24
Offset 9.0 ft Lt.
Ground Surface Elev. 689.01 ft

Surface Water Elev. 676.27 ft
Stream Bed Elev. 675.61 ft

Groundwater Elev.:
First Encounter 676.0 ft ▼
Upon Completion 671.0 ft ▽
After ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Cored Bituminous & Concrete Pavement, Augered Black & Brown Silty Clay Loam Fill			
686.51			
Very Stiff Black, Brown & Gray Silty Clay Loam Fill	3		
	4 5	2.5 P	21
-5	6		
	5 6	3.5 P	14
	3		
	4 5	3.5 P	25
679.51			
Stiff Dark Gray Silty Clay Loam Till	-10 2		
	2 2	2.0 P	16
677.01			
Loose to Dense Gray & Brown Fine Sand to Coarse Gravel - Slightly Loamy ▼	3		
	4 5		17
-15	9		
	14 19		13
▽	12		
	14 16		10
-20			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Loose to Dense Gray & Brown Fine Sand to Coarse Gravel - Slightly Loamy *(continued)*	7		
	9 12		13
667.01			
Very Stiff Gray Silty Clay Loam Till	9		
	8 5	2.0 P	15
664.51			
-25 Loose Gray Fine Sand & Silt	7		
	2 2		18
662.01			
Stiff to Hard Gray Silty Loam / Silty Clay Loam Till with Layers of Fine Gravel	2		
	3 4	1.4 B	12
-30	12		
	16 13	4.4 S	13
656.01	12		
Weathered Limestone Surface	100/4"		14
654.51			
-35 Auger Refusal @ 34.5 Ft. End of Boring			
-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, form 137 (Rev. 8-99)

SOIL BORING 050-0039.GPJ IL_DOT.GDT 12/10/18

Illinois Department of Transportation
Division of Highways
IDOT

ROCK CORE LOG

Date 10/29/20

ROUTE FAP 587 (US 34) **DESCRIPTION** US 34 over Sutphens Run, 12.35 miles East of IL 251 **LOGGED BY** Larry Myers

SECTION 18-B **LOCATION** NW 1/4, **SEC.** 19, **TWP.** 36N, **RNG.** 3E, 3rd **PM**,
Latitude 41.57783, **Longitude** -88.92756

COUNTY LaSalle **CORING METHOD** Split Barrel Wire Line

STRUCT. NO. 050-0039 (Exist.)
Station 609+19

BORING NO. 02a (N.E. Quad.)
Station 610+04
Offset 8.0 ft Lt.
Ground Surface Elev. 689.12 ft

CORING BARREL TYPE & SIZE N W/L 2
Core Diameter 1.9 in
Top of Rock Elev. 653.12 ft
Begin Core Elev. 653.12 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Orange & White Limestone - Numerous Loose Joints, Numerous Vertical Fractures some Joints filled with Green Weathered Shale & White Sand - Minor Thin White Sandstone Layers	-40	1	80	0	7	
	648.12					
Same Limestone		2	95	21	8	659.8
12 inch Layer of White Sandstone with Green Shale - Ribbons & Layers Throughout at 44.5 - 45.5 Ft.	-45					
	643.12					
White & Orangish Limestone with Minor Shale Seams - Limited Vertical Fractures, Minor Sandstone Seams		3	98	40	11.4	1780.9
	-50					179.1
	638.12					149.6
End of Boring	-55					

ROCK CORE 050-0039.GPJ IL_DOT.GDT 11/18/20

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

BBS, form 138 (Rev. 8-99)

050-0039 US 34 Earlville

Hole #1 SW Quad

Run #1 & 2

Depth: 32' to 42'

32 Run 1

32.63' | 1

1

1

32.67' | 2

2

40.9' | 3

3

4

11/06/2020 10:05

SN 050-0039
US 34 Earlville
Hole #2 N.E. Quad.
Depth: 36' to 46'
Run #1 & 2

Run 1
36

41.2 1
1
43.5 2
2
44.7 3
3

11/06/2020 10:18

SN: 050-0039
US34 Earlville
Hole #2 NE Quad
Depth: 46' to 51'
Run #3

Run 3 46.3' to 51'

46.3' | 4

47.8' | 5

49.3' | 6

44.8' | 7

11/06/2020 10:31

Illinois Department of Transportation

SEISMIC SITE CLASS DETERMINATION

PROJECT TITLE=====050-0262 US 34 over Sutphens Run

Substructure 1

Base of Substruct. Elev. (or ground surf for bents	683.5	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-01 (W Abut)	
Top of Boring Elev.	689.06	ft.
Approximate Fixity Elev.	677.5	ft.

Individual Site Class Definition:

N (bar): 40 (Blows/ft.) Soil Site Class D <----Controls
N_{ch} (bar): 21 (Blows/ft.) Soil Site Class D
s_u (bar): 3.97 (ksf) Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	686.6	2.50	5	1.00	B
	684.6	2.00	6	2.00	
	682.1	2.50	8	2.00	
	680.1	2.00	8	2.50	B
0.4	677.1	3.00	10		
2.9	674.6	2.50	19		
5.4	672.1	2.50	17		B
7.9	669.6	2.50	33		
10.9	666.6	3.00	23		B
12.9	664.6	2.00	11	2.00	
15.4	662.1	2.50	16	4.10	B
17.9	659.6	2.50	8	2.00	
21.4	656.1	3.50	6	1.40	B
22.4	655.1	1.00	600	4.50	R
100.0	577.5	77.60	600	4.50	

Substructure 2

Base of Substruct. Elev. (or ground surf for bents	683.5	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-02 (E Abut)	
Top of Boring Elev.	689.01	ft.
Approximate Fixity Elev.	677.5	ft.

Individual Site Class Definition:

N (bar): 40 (Blows/ft.) Soil Site Class D <----Controls
N_{ch} (bar): 13 (Blows/ft.) Soil Site Class E
s_u (bar): 4.16 (ksf) Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	686.5	2.50	5	1.00	B
	684.5	2.00	9	2.50	
	682.0	2.50	11	3.50	
	679.5	2.50	9	3.50	B
0.5	677.0	2.50	4	2.00	B
3.0	674.5	2.50	9		
5.5	672.0	2.50	33		
8.0	669.5	2.50	30		
10.5	667.0	2.50	21		B
13.0	664.5	2.50	13	2.00	B
15.5	662.0	2.50	4		B
18.0	659.5	2.50	7	1.40	
21.5	656.0	3.50	29	4.40	B
23.0	654.5	1.50	300	4.50	R
100.0	577.5	77.00	300	4.50	

Substructure 3

Base of Substruct. Elev. (or ground surf for bents	674.6	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-01 (W Pier)	
Top of Boring Elev.	675.53	ft.
Approximate Fixity Elev.	668.6	ft.

Individual Site Class Definition:

N (bar): 47 (Blows/ft.) Soil Site Class D
N_{ch} (bar): NA (Blows/ft.) NA
s_u (bar): 4.01 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	674.6	0.97	19		
	672.1	2.50	17		B
	669.6	2.50	33		
2.0	666.6	3.00	23		B
4.0	664.6	2.00	11	2.00	
6.5	662.1	2.50	16	4.10	B
9.0	659.6	2.50	8	2.00	
12.5	656.1	3.50	6	1.40	B
13.5	655.1	1.00	600	4.50	R
100.0	568.6	86.50	600	4.50	

Substructure 4

Base of Substruct. Elev. (or ground surf for bents	674.6	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-02 (E Pier)	
Top of Boring Elev.	675.61	ft.
Approximate Fixity Elev.	668.6	ft.

Individual Site Class Definition:

N (bar): 48 (Blows/ft.) Soil Site Class D
N_{ch} (bar): NA (Blows/ft.) NA
s_u (bar): 4.22 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	674.5	1.11	9		
	672.0	2.50	33		
	669.5	2.50	30		
1.6	667.0	2.50	21		B
4.1	664.5	2.50	13	2.00	B
6.6	662.0	2.50	4		B
9.1	659.5	2.50	7	1.40	
12.6	656.0	3.50	29	4.40	B
14.1	654.5	1.50	300	4.50	R
100.0	568.6	85.90	300	4.50	

Global Site Class Definition: Substructures 1 through 4

N (bar): 44 (Blows/ft.) Soil Site Class D
N_{ch} (bar): (Blows/ft.) NA, H < 0.1*H (Total)
s_u (bar): 4.09 (ksf) Soil Site Class C <----Controls

Latitude, Longitude: 41.57770107, -88.92776537

Date	10/15/2020, 2:04:44 PM
Design Code Reference Document	ASCE7-16
Risk Category	I
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S_S	0.145	MCE_R ground motion. (for 0.2 second period)
S_1	0.069	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.189	Site-modified spectral acceleration value
S_{M1}	0.104	Site-modified spectral acceleration value
S_{DS}	0.126	Numeric seismic design value at 0.2 second SA
S_{D1}	0.069	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	B	Seismic design category
F_a	1.3	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.076	MCE_G peak ground acceleration
F_{PGA}	1.3	Site amplification factor at PGA
PGA_M	0.098	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.145	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.15	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.069	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.079	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.967	Mapped value of the risk coefficient at short periods
C_{R1}	0.882	Mapped value of the risk coefficient at a period of 1 s

SCOUR ANALYSIS FOR NON-GRANULAR CONDITIONS

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/28/2015

STRUCTURE NUMBER	050-0262	
SUBSTRUCTURE UNIT	PIER 1 (West)	
BORING LOCATION RELATIVE TO SUBSTRUCURE UNIT	NEAR	
BOTTOM OF SUBSTRUCTURE ELEVATION	672.1	
GROUND SURFACE ELEVATION AT SUBSTRUCTURE	674.6	
Q100 SCOUR DEPTH AT SUBSTRUCTURE PER APPROVED HYDRAULIC REPORT (HR Q100)	8.17	FT
Q200 SCOUR DEPTH AT SUBSTRUCTURE PER APPROVED HYDRAULIC REPORT (HR Q200)	9.09	FT

LAYER NO.	BOTTOM OF LAYER ELEV. (FT)	DEPTH BELOW SURFACE (FT)	LAYER THICK. (FT)	Qu VALUE (TSF)	ROCK TYPE (IF APPLICABLE)	SCOUR REDUCTION (%)	SCOUR RESISTANCE OF LAYER (FT)	REMAINING Q100 SCOUR BELOW LAYER (FT)	REMAINING Q200 SCOUR BELOW LAYER (FT)
1	672.1	2.5	2.5	0.00		0%	2.54	5.63	6.55
2	669.6	5.0	2.5	0.00		0%	2.50	3.13	4.05
3	666.6	8.0	3.0	3.00		50%	6.00	0.00	0.00
4	664.6	10.0	2.0	2.00		50%	4.00		
5	662.1	12.5	2.5	4.10		50%	5.00		
6	659.6	15.0	2.5	2.00		50%	5.00		
			3.5	1.40		25%	4.67		

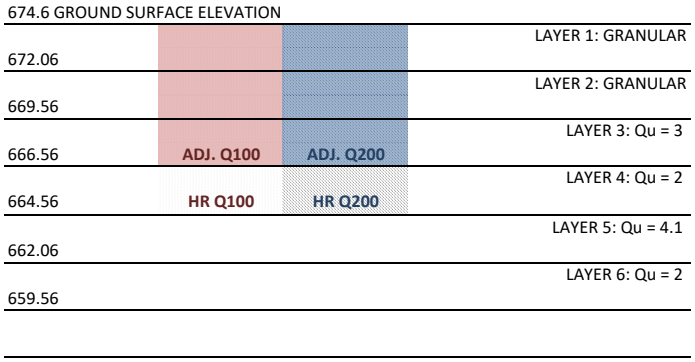
STRENGTH LIMIT STATE ADJUSTED SCOUR (ADJ. Q100)

UNADJUSTED Q100 SCOUR DEPTH	666.4	FT
LAYER IN WHICH ADJUSTED Q100 SCOUR STOPS	LAYER 3	
DEPTH INTO LAYER 3 AT WHICH SCOUR STOPS	1.6	FT
DEPTH BELOW GROUND SURFACE TO ADJUSTED Q100 SCOUR	6.6	FT
TOTAL % ADJUSTMENT OF Q100 SCOUR = [1-(6.61/8.17)]*100	19.2%	
Q100 SCOUR ELEVATION	**668.0**	FT

EXTREME EVENT II ADJUSTED SCOUR (ADJ. Q200)

UNADJUSTED Q200 SCOUR DEPTH	665.5	FT
LAYER IN WHICH ADJUSTED Q200 SCOUR STOPS	LAYER 3	
DEPTH INTO LAYER 3 AT WHICH SCOUR STOPS	2.0	FT
DEPTH BELOW GROUND SURFACE OF ADJUSTED Q200 SCOUR	7.1	FT
TOTAL % ADJUSTMENT OF Q200 SCOUR = [1-(7.06/9.09)]*100	22.3%	
Q200 SCOUR ELEVATION	**667.5**	FT

SCOUR FIGURE



LEGEND FOR SCOUR FIGURE

- ADJUSTED Q100 SCOUR
- RAW Q100 SCOUR PER APPROVED HYDRAULIC REPORT
- ADJUSTED Q200 SCOUR
- RAW Q200 SCOUR PER APPROVED HYDRAULIC REPORT

SCOUR ANALYSIS FOR NON-GRANULAR CONDITIONS

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/28/2015

STRUCTURE NUMBER	050-0262	
SUBSTRUCTURE UNIT	PIER 2 (East)	
BORING LOCATION RELATIVE TO SUBSTRUCURE UNIT	NEAR	
BOTTOM OF SUBSTRUCTURE ELEVATION	672.1	
GROUND SURFACE ELEVATION AT SUBSTRUCTURE	674.6	
Q100 SCOUR DEPTH AT SUBSTRUCTURE PER APPROVED HYDRAULIC REPORT (HR Q100)	8.17	FT
Q200 SCOUR DEPTH AT SUBSTRUCTURE PER APPROVED HYDRAULIC REPORT (HR Q200)	9.09	FT

LAYER NO.	BOTTOM OF LAYER ELEV. (FT)	DEPTH BELOW SURFACE (FT)	LAYER THICK. (FT)	Qu VALUE (TSF)	ROCK TYPE (IF APPLICABLE)	SCOUR REDUCTION (%)	SCOUR RESISTANCE OF LAYER (FT)	REMAINING Q100 SCOUR BELOW LAYER (FT)	REMAINING Q200 SCOUR BELOW LAYER (FT)
1	672.1	2.5	2.5	0.00		0%	2.50	5.67	6.59
2	669.6	5.0	2.5	0.00		0%	2.50	3.17	4.09
3	667.1	7.5	2.5	0.00		0%	2.50	0.67	1.59
4	664.6	10.0	2.5	2.00		50%	5.00	0.00	0.00
5	662.1	12.5	2.5	0.00		0%	2.50		
6	659.6	15.0	2.5	1.40		25%	3.33		

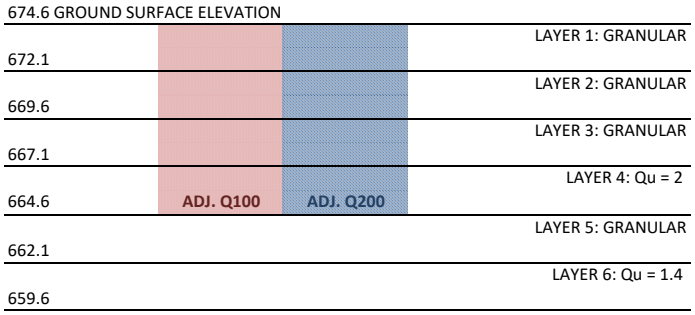
STRENGTH LIMIT STATE ADJUSTED SCOUR (ADJ. Q100)

UNADJUSTED Q100 SCOUR DEPTH	666.4	FT
LAYER IN WHICH ADJUSTED Q100 SCOUR STOPS	LAYER 4	
DEPTH INTO LAYER 4 AT WHICH SCOUR STOPS	0.3	FT
DEPTH BELOW GROUND SURFACE TO ADJUSTED Q100 SCOUR	7.8	FT
TOTAL % ADJUSTMENT OF Q100 SCOUR = [1-(7.84/8.17)]*100	4.1%	
Q100 SCOUR ELEVATION	**666.8**	FT

EXTREME EVENT II ADJUSTED SCOUR (ADJ. Q200)

UNADJUSTED Q200 SCOUR DEPTH	665.5	FT
LAYER IN WHICH ADJUSTED Q200 SCOUR STOPS	LAYER 4	
DEPTH INTO LAYER 4 AT WHICH SCOUR STOPS	0.8	FT
DEPTH BELOW GROUND SURFACE OF ADJUSTED Q200 SCOUR	8.3	FT
TOTAL % ADJUSTMENT OF Q200 SCOUR = [1-(8.29/9.09)]*100	8.7%	
Q200 SCOUR ELEVATION	**666.3**	FT

SCOUR FIGURE

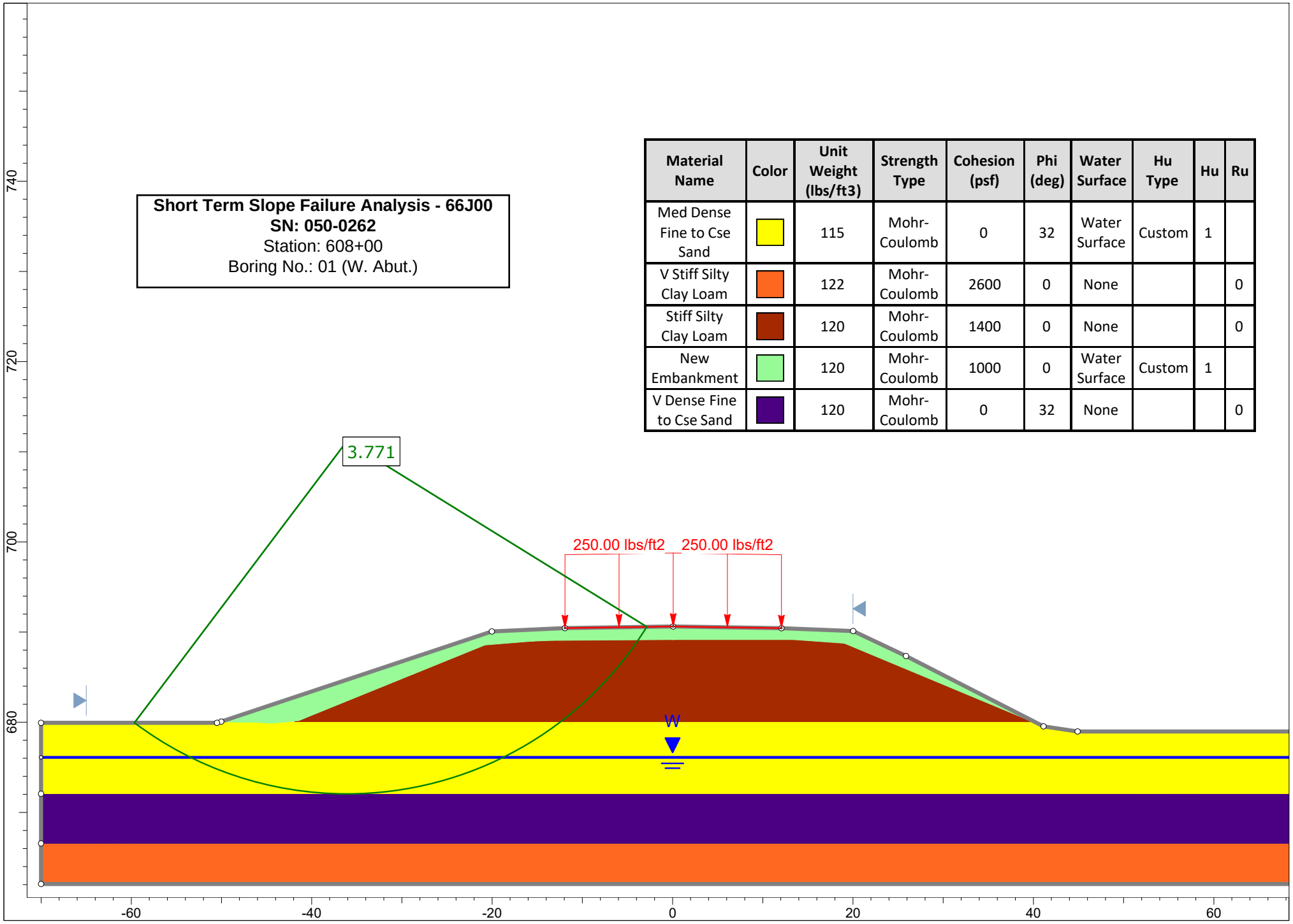


LEGEND FOR SCOUR FIGURE

- ADJUSTED Q100 SCOUR
- RAW Q100 SCOUR PER APPROVED HYDRAULIC REPORT
- ADJUSTED Q200 SCOUR
- RAW Q200 SCOUR PER APPROVED HYDRAULIC REPORT

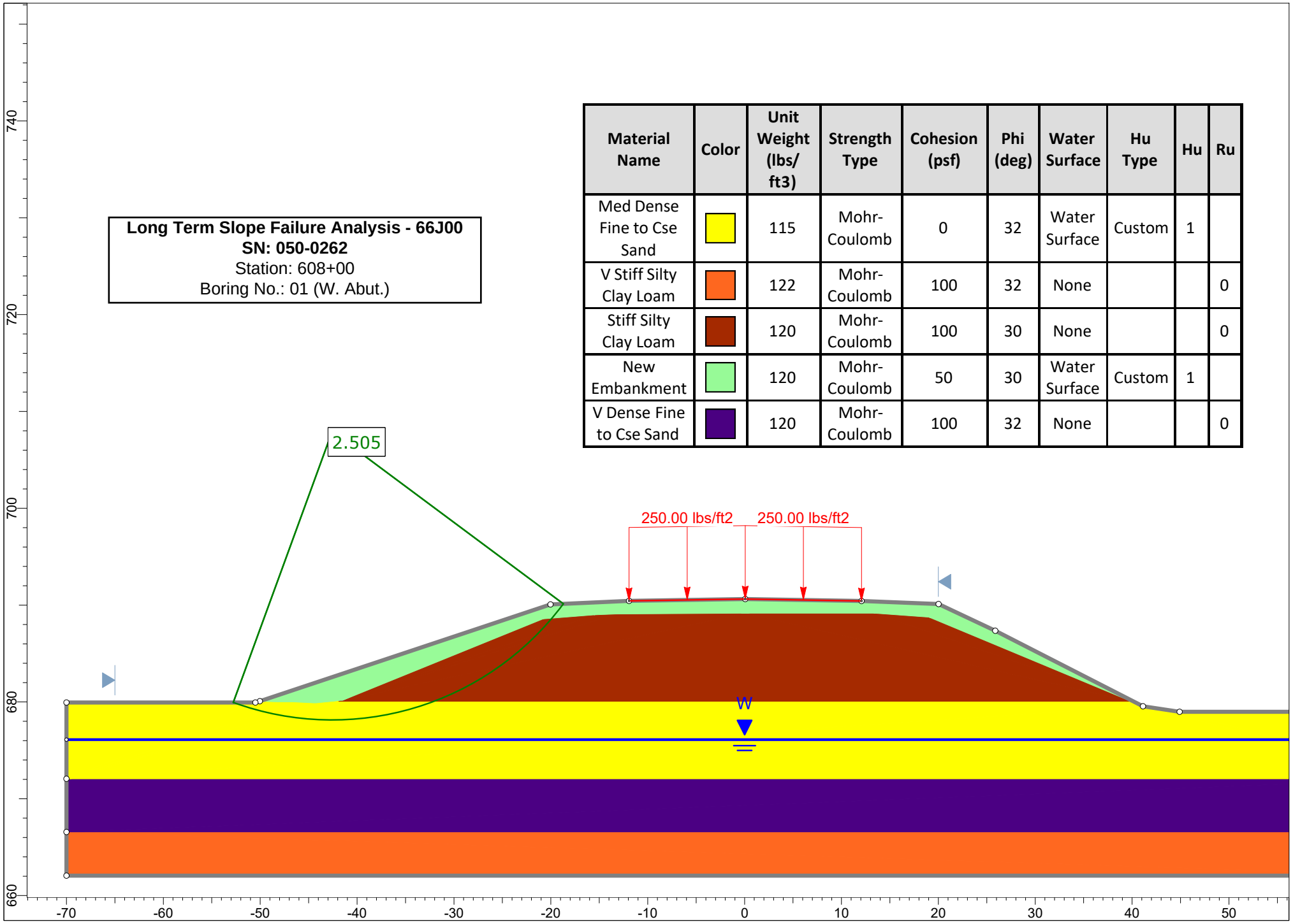
Short Term Slope Failure Analysis - 66J00
SN: 050-0262
Station: 608+00
Boring No.: 01 (W. Abut.)

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Med Dense Fine to Cse Sand		115	Mohr-Coulomb	0	32	Water Surface	Custom	1	
V Stiff Silty Clay Loam		122	Mohr-Coulomb	2600	0	None			0
Stiff Silty Clay Loam		120	Mohr-Coulomb	1400	0	None			0
New Embankment		120	Mohr-Coulomb	1000	0	Water Surface	Custom	1	
V Dense Fine to Cse Sand		120	Mohr-Coulomb	0	32	None			0



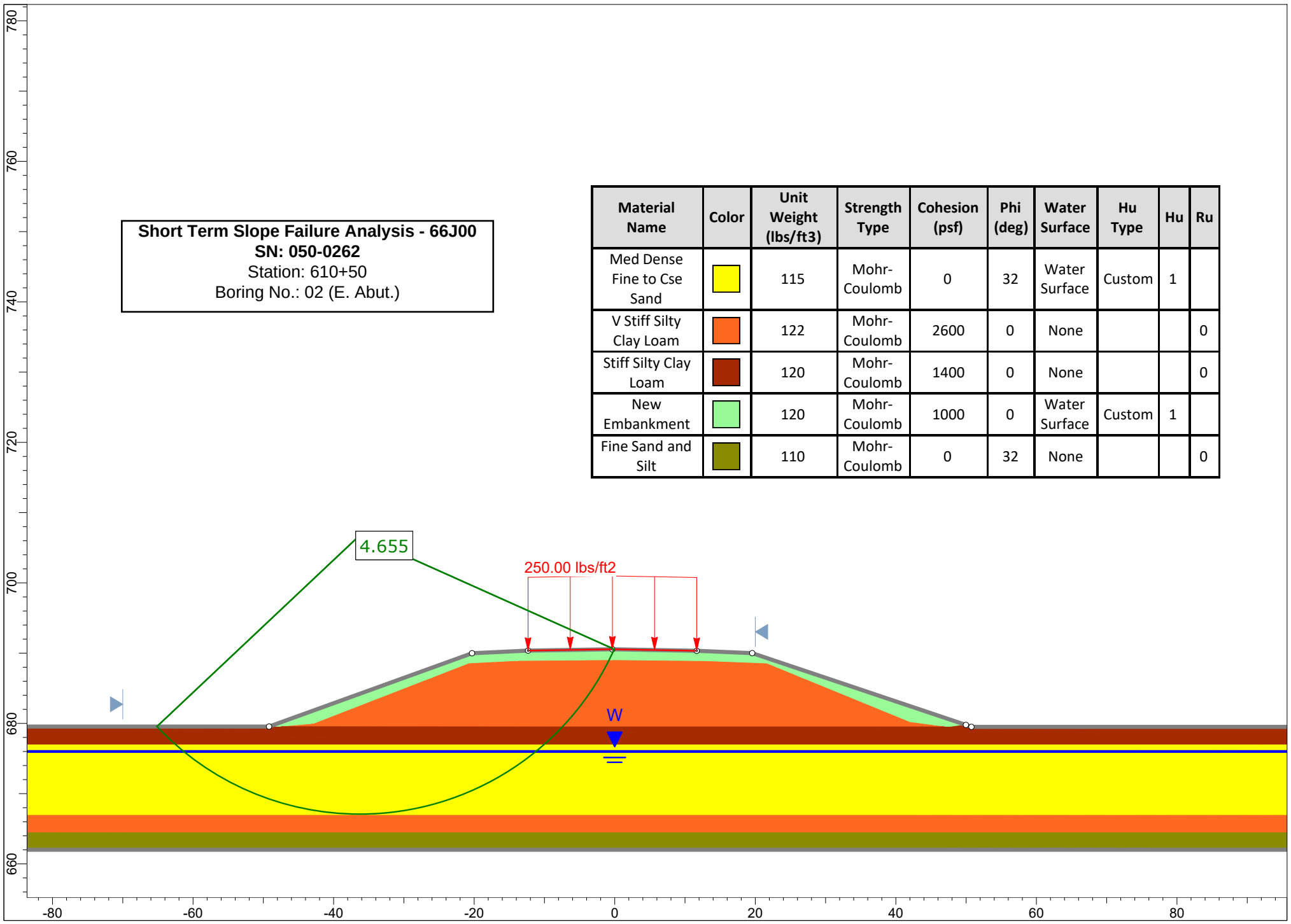
Long Term Slope Failure Analysis - 66J00
SN: 050-0262
Station: 608+00
Boring No.: 01 (W. Abut.)

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Med Dense Fine to Cse Sand		115	Mohr-Coulomb	0	32	Water Surface	Custom	1	
V Stiff Silty Clay Loam		122	Mohr-Coulomb	100	32	None			0
Stiff Silty Clay Loam		120	Mohr-Coulomb	100	30	None			0
New Embankment		120	Mohr-Coulomb	50	30	Water Surface	Custom	1	
V Dense Fine to Cse Sand		120	Mohr-Coulomb	100	32	None			0



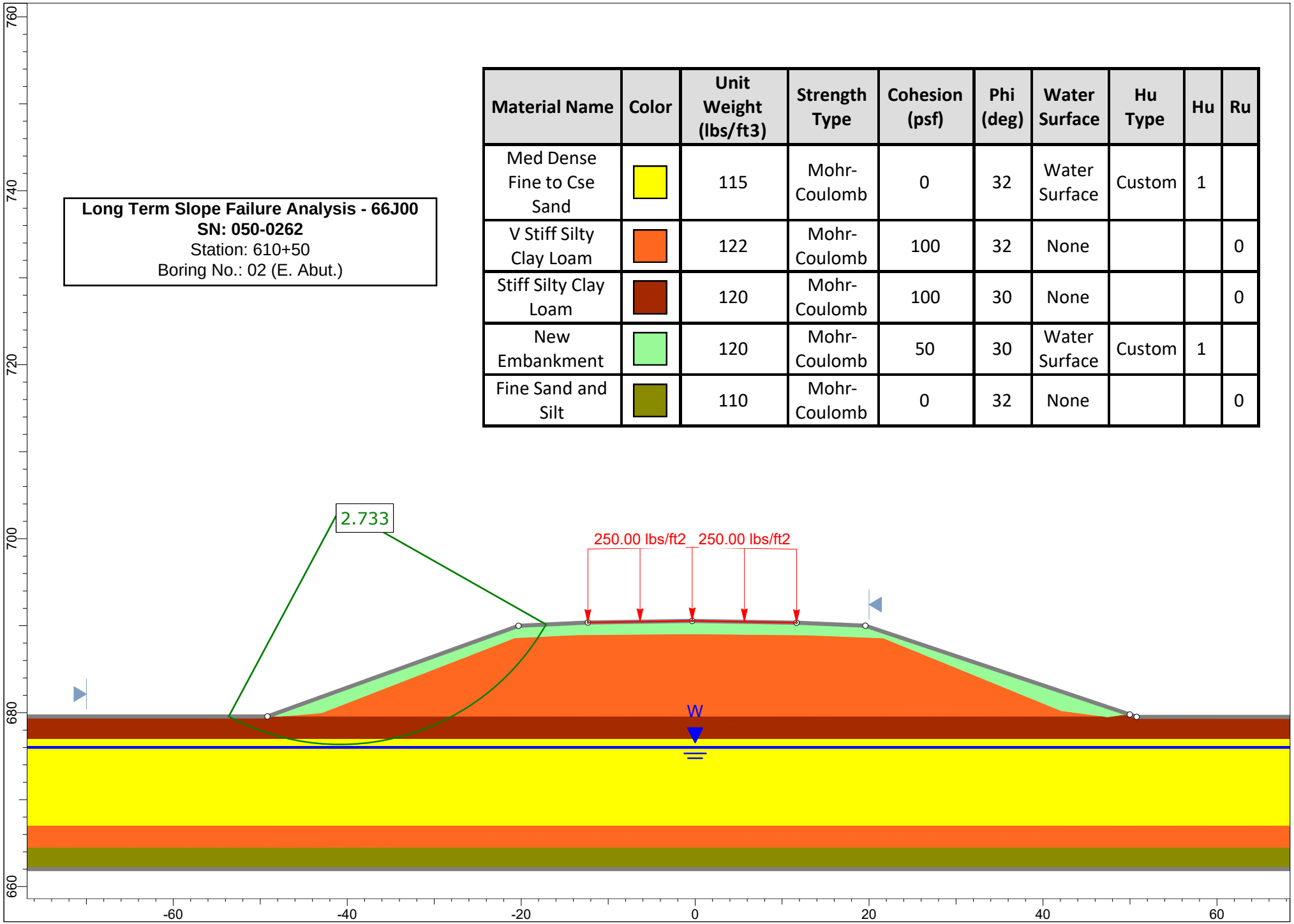
Short Term Slope Failure Analysis - 66J00
SN: 050-0262
Station: 610+50
Boring No.: 02 (E. Abut.)

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Med Dense Fine to Cse Sand		115	Mohr-Coulomb	0	32	Water Surface	Custom	1	
V Stiff Silty Clay Loam		122	Mohr-Coulomb	2600	0	None			0
Stiff Silty Clay Loam		120	Mohr-Coulomb	1400	0	None			0
New Embankment		120	Mohr-Coulomb	1000	0	Water Surface	Custom	1	
Fine Sand and Silt		110	Mohr-Coulomb	0	32	None			0



Long Term Slope Failure Analysis - 66J00
SN: 050-0262
Station: 610+50
Boring No.: 02 (E. Abut.)

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Med Dense Fine to Cse Sand		115	Mohr-Coulomb	0	32	Water Surface	Custom	1	
V Stiff Silty Clay Loam		122	Mohr-Coulomb	100	32	None			0
Stiff Silty Clay Loam		120	Mohr-Coulomb	100	30	None			0
New Embankment		120	Mohr-Coulomb	50	30	Water Surface	Custom	1	
Fine Sand and Silt		110	Mohr-Coulomb	0	32	None			0



Illinois Department of Transportation

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

Modified 10/30/17

GENERAL DATA

STRUCTURE NUMBER	050-0262 W Abutment		TOTAL STRUCTURE LENGTH	134.42	FT
STRUCTURE TYPE	MULTI-SPAN		NUMBER OF SPANS	3	
STRUCTURE SKEW	34	DEGREES	END SPAN LENGTH	40.00	FT
SUPER. DATA IN REFERENCE TO SUB. DATA	ABUT 1		ADJACENT INTERIOR SPAN LENGTH	50.00	FT

SUPERSTRUCTURE POSITIVE MOMENT REGION DATA (END OR MAIN SPAN)

BEAM TYPE	WIDE FLANGE	
WIDE FLANGE	W27X102	
BEAM SPACING PERP. TO CL	6.00	FT
SLAB THICKNESS	8.00	IN
SLAB F'C	4.00	KSI

SUPERSTRUCTURE POSITIVE MOMENT REGION DATA (ADJACENT SPAN)

WIDE FLANGE	W27X102	
BEAM SPACING PERP. TO CL	6.00	FT
SLAB THICKNESS	8.00	IN
SLAB F'C	4.00	KSI

ABUTMENT #1 DATA

ABUTMENT NAME	West	
ABUTMENT REFERENCE BORING	B-1	
BOTTOM OF ABUTMENT ELEVATION	683.5	FT
ESTIMATED NUMBER OF PILES AT ABUT.	6	
PILE SPACING PERP. TO CL	5	FT

ABUTMENT #2 DATA

ABUTMENT NAME	East	
ABUTMENT REFERENCE BORING	B-2	
BOTTOM OF ABUTMENT ELEVATION	683.5	FT
ESTIMATED NUMBER OF PILES AT ABUT.	6	
PILE SPACING PERP. TO CL	5	FT

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #1

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
682.56	0.94	2.0		
680.06	2.50	2.5		
677.56	2.50		10	2.4
675.06	2.50		19	2.9
673.50	1.56		17	2.8

10.00 FT = TOTAL DEPTH ENTERED

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #2

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
682.01	1.49	3.5		
679.51	2.50	3.5		
677.01	2.50	2.0		
674.51	2.50		9	2.3
673.50	1.01		33	3.3

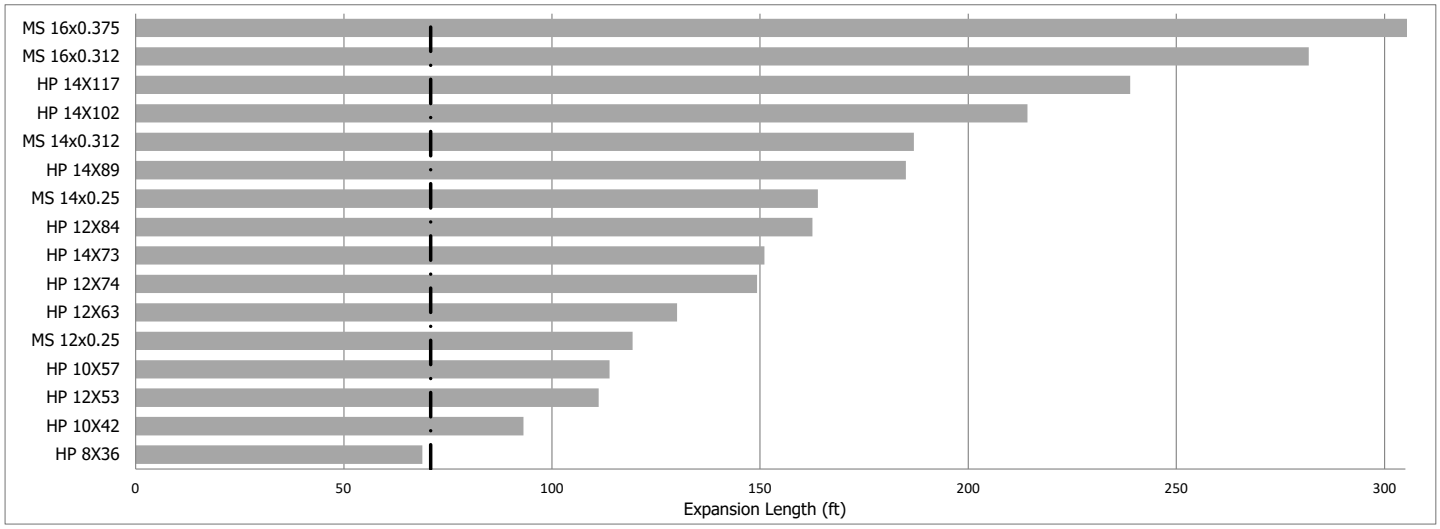
10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1	2.59	TSF	WEIGHTED AVERAGE Qu FOR ABUTMENT #2	2.82	TSF
PILE STIFFNESS MODIFIER FOR ABUTMENT #1 = 1/(1.45-[0.3*2.59])	1.48		PILE STIFFNESS MODIFIER FOR ABUTMENT #2 = 1/(1.45-[0.3*2.82])	1.65	

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [1.48*6*0+1.65*6*134.42]/[1.48*6+1.65*6] = 70.86 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [1.65*6*0+1.48*6*134.42]/[1.65*6+1.48*6] = 63.56 FT

ABUT 1 (West) - EXPANSION LENGTH LIMIT CHART - 34.0 DEG. SKEW



— · — · · = *Estimated expansion length for the indicated abutment. Piles with an expansion length greater than this are suitable for consideration.*
(Note: The same size pile should be used at both abutments.)

Pile Design Table for W. Abutment – Boring B-01 SN: 050-0262			
Pile Size	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length* (Ft.)
Steel HP 8x36	286	157	32
Steel HP 10x42	335	184	32
Steel HP 10x57	454	250	32
Steel HP 12x53	418	230	32
Steel HP 12x63	497	273	32
Steel HP 12x74	589	324	32
Steel HP 12x84	664	365	32
Steel HP 14x73	578	318	32
Steel HP 14x89	705	388	32
* Estimated pile length is based on a pile cut off elevation of 685.59 ft. (accounting for the embedment depth of 2 ft. inside the substructure), a bottom of substructure elevation of 683.59 ft., and a top of rock elevation of 657.15.			

Pile Design Table for E. Abutment – Boring B-02 SN: 050-0262			
Pile Size	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length* (Ft.)
Steel HP 8x36	286	157	36
Steel HP 10x42	335	184	36
Steel HP 10x57	454	250	36
Steel HP 12x53	418	230	36
Steel HP 12x63	497	273	36
Steel HP 12x74	589	324	36
Steel HP 12x84	664	365	36
Steel HP 14x73	578	318	36
Steel HP 14x89	705	388	36
* Estimated pile length is based on a pile cut off elevation of 685.59 ft. (accounting for the embedment depth of 2 ft. inside the substructure), a bottom of substructure elevation of 683.59 ft., and a top of rock elevation of 653.12.			

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 050-0262
SUBSTRUCTURE & REFERENCE BORING ======= W. Pier B-01a (SW Quad.)
GROUND SURFACE ELEVATION ========== 689.15 FT
GROUND WATER ELEVATION ========== 676.10 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 657.15 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 24 IN.
FACTORED AXIAL LOAD ========== 168 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ====== 4.0 KSI

FOUNDATION REDUNDANCY ==== REDUNDANT

Drilled Shaft Dia.'s for Design Table

24	IN.
30	IN,
	IN.
	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE: NOM. RESIST. (KIPS)	SIDE RESISTANCE: Σ NOM. RESIST. (KIPS)	SIDE RESISTANCE: Σ FACT. RESIST. (KIPS)	SIDE RESISTANCE: SETTLEMENT Q_{C1} (KIPS)	SIDE RESISTANCE: SETTLEMENT w_{C1} (IN.)	SIDE RESISTANCE: SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE: NOM. RESIST. (KIPS)	TIP RESISTANCE: FACT. RESIST. (KIPS)	TIP RESISTANCE: SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE: R_P/R_n	COMBINED SIDE & TIP RESISTANCE: NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE: FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE: SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE: SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE: SETTLEMENT w_{Rn} (IN.)
1.00	656.15	1.00	1850.0	Limestone	30	Fractured	8	Open	No	26	26	14	124	0.036	-0.204	1850.0	1086	543	1.005	0.00	26	14	124	0.036	-0.204
2.00	655.15	1.00	1850.0	Limestone	20	Fractured	8	Open	No	26	51	28	251	0.088	-0.242	1750.0	659	330	0.618	0.00	51	28	251	0.088	-0.242
3.00	654.15	1.00	1850.0	Limestone	15	Fractured	8	Open	No	26	77	42	380	0.132	-0.272	1650.0	484	242	0.390	0.00	77	42	380	0.132	-0.272
4.00	653.15	1.00	1850.0	Limestone	15	Fractured	8	Open	No	26	103	57	512	0.168	-0.289	1550.0	475	237	0.346	0.00	103	57	512	0.168	-0.289
5.00	652.15	1.00	1850.0	Limestone	20	Fractured	8	Open	No	26	128	71	648	0.191	-0.289	1450.0	614	307	0.405	0.00	128	71	648	0.191	-0.289
6.00	651.15	1.00	1450.0	Limestone	20	Fractured	23	Open	No	66	195	107	766	0.207	-0.253	1450.0	625	312	0.370	0.00	195	107	766	0.207	-0.253
7.00	650.15	1.00	1450.0	Limestone	30	Fractured	23	Open	No	66	261	144	893	0.208	-0.208										
8.00	649.15	1.00	1450.0	Limestone	25	Fractured	23	Open	No	66	328	180	1020	0.219	-0.184										
9.00	648.15	1.00	1450.0	Limestone	30	Fractured	23	Open	No	66	394	217	1155	0.224	-0.159										
10.00	647.15	1.00	1450.0	Limestone	30	Fractured	23	Open	No	66	460	253	1294	0.232	-0.140										

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

Drilled Shaft Design Table for W. Pier B-01a (SW Quad.)

Estimated Top of Rock Elevation: 657.15

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
24 in. Diameter Drilled Shaft							
1	656.15	1086	543	TIP	--	--	1.005
2	655.15	659	330	TIP	--	--	0.618
3	654.15	484	242	TIP	--	--	0.390
4	653.15	475	237	TIP	--	--	0.346
5	652.15	614	307	TIP	--	--	0.405
6	651.15	625	312	TIP	--	--	0.370
7	650.15	261	144	SIDE	893	0.208	-0.208
8	649.15	328	180	SIDE	1020	0.219	-0.184
9	648.15	394	217	SIDE	1155	0.224	-0.159
10	647.15	460	253	SIDE	1294	0.232	-0.140
30 in. Diameter Drilled Shaft							
1	656.15	1641	820	TIP	--	--	1.191
2	655.15	1005	503	TIP	--	--	0.686
3	654.15	745	372	TIP	--	--	0.466
4	653.15	736	368	TIP	--	--	0.397
5	652.15	959	479	TIP	--	--	0.477
6	651.15	244	134	SIDE	943	0.229	-0.321
7	650.15	326	180	SIDE	1096	0.229	-0.266
8	649.15	409	225	SIDE	1248	0.240	-0.236
9	648.15	492	271	SIDE	1408	0.244	-0.206
10	647.15	575	316	SIDE	1572	0.251	-0.183

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 050-0262
SUBSTRUCTURE & REFERENCE BORING ======= E. Pier B-02a (NE Quad.)
GROUND SURFACE ELEVATION ========== 689.12 FT
GROUND WATER ELEVATION ========== 676.10 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 653.12 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 24 IN.
FACTORED AXIAL LOAD ========== 168 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ====== 4.0 KSI

FOUNDATION REDUNDANCY ==== REDUNDANT

Drilled Shaft Dia.'s for Design Table

24	IN.
30	IN,
	IN.
	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	Σ NOM. RESIST. (KIPS)	Σ FACT. RESIST. (KIPS)	SETTLEMENT Q_{C1} (KIPS)	SETTLEMENT w_{C1} (IN.)	SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
1.00	652.12	1.00	1320.0	Limestone	20	Fractured	1	Open	No	3	3	2	98	0.045	-0.406	1320.0	544	272	0.407	0.00	3	2	98	0.045	-0.406
2.00	651.12	1.00	1320.0	Limestone	20	Fractured	1	Open	No	3	6	4	198	0.089	-0.405	1320.0	555	277	0.426	0.00	6	4	198	0.089	-0.405
3.00	650.12	1.00	1320.0	Limestone	15	Fractured	1	Open	No	3	10	5	299	0.125	-0.434	1320.0	429	214	0.326	0.00	10	5	299	0.125	-0.434
4.00	649.12	1.00	1320.0	Limestone	25	Fractured	1	Open	No	3	13	7	404	0.136	-0.398	1320.0	729	364	0.639	0.00	13	7	404	0.136	-0.398
5.00	648.12	1.00	1320.0	Limestone	30	Fractured	1	Open	No	3	16	9	513	0.140	-0.358	1320.0	911	456	0.923	0.00	16	9	513	0.140	-0.358
6.00	647.12	1.00	1320.0	Limestone	20	Fractured	21	Open	No	65	81	45	622	0.157	-0.311	1320.0	597	298	0.680	0.00	81	45	622	0.157	-0.311
7.00	646.12	1.00	1320.0	Limestone	15	Fractured	21	Open	No	65	146	80	731	0.177	-0.282	1865.0	576	288	0.630	0.00	146	80	731	0.177	-0.282
8.00	645.12	1.00	1320.0	Limestone	15	Fractured	21	Open	No	65	211	116	842	0.196	-0.258	2410.0	690	345	0.771	0.00	211	116	842	0.196	-0.258
9.00	644.12	1.00	1320.0	Limestone	15	Fractured	21	Open	No	65	276	152	955	0.215	-0.237	2955.0	801	400	0.952	0.00	276	152	955	0.215	-0.237
10.00	643.12	1.00	1320.0	Limestone	10	Fractured	21	Open	No	65	341	187	1067	0.236	-0.222	3500.0	628	314	0.614	0.00	341	187	1067	0.236	-0.222
11.00	642.12	1.00	3500.0	Limestone	20	Fractured	40	Open	No	75	416	229	1296	0.272	-0.208	3500.0	1243	622	1.154	0.00	416	229	1296	0.272	-0.208
12.00	641.12	1.00	3500.0	Limestone	15	Fractured	40	Open	No	75	491	270	1530	0.312	-0.200										
13.00	640.12	1.00	3500.0	Limestone	10	Fractured	40	Open	No	75	566	311	1767	0.356	-0.194										
14.00	639.12	1.00	3500.0	Limestone	30	Fractured	40	Open	No	75	640	352	2035	0.381	-0.176										
15.00	638.12	1.00	3500.0	Limestone	30	Fractured	40	Open	No	75	715	393	2318	0.408	-0.161										

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

Drilled Shaft Design Table for E. Pier B-02a (NE Quad.)

Estimated Top of Rock Elevation: 653.12

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
24 in. Diameter Drilled Shaft							
1	652.12	544	272	TIP	--	--	0.407
2	651.12	555	277	TIP	--	--	0.426
3	650.12	429	214	TIP	--	--	0.326
4	649.12	729	364	TIP	--	--	0.639
5	648.12	911	456	TIP	--	--	0.923
6	647.12	597	298	TIP	--	--	0.680
7	646.12	576	288	TIP	--	--	0.630
8	645.12	690	345	TIP	--	--	0.771
9	644.12	801	400	TIP	--	--	0.952
10	643.12	628	314	TIP	--	--	0.614
11	642.12	1243	622	TIP	--	--	1.154
12	641.12	491	270	SIDE	1530	0.312	-0.200
13	640.12	566	311	SIDE	1767	0.356	-0.194
14	639.12	640	352	SIDE	2035	0.381	-0.176
15	638.12	715	393	SIDE	2318	0.408	-0.161
30 in. Diameter Drilled Shaft							
1	652.12	849	425	TIP	--	--	0.524
2	651.12	867	433	TIP	--	--	0.568
3	650.12	670	335	TIP	--	--	0.442
4	649.12	1138	569	TIP	--	--	0.819
5	648.12	1424	712	TIP	--	--	1.211
6	647.12	1128	564	TIP	--	--	0.984
7	646.12	998	499	TIP	--	--	0.863
8	645.12	1141	571	TIP	--	--	1.034
9	644.12	1282	641	TIP	--	--	1.084
10	643.12	981	491	TIP	--	--	0.701
11	642.12	520	286	SIDE	1584	0.297	-0.268
12	641.12	613	337	SIDE	1863	0.339	-0.259
13	640.12	707	389	SIDE	2146	0.384	-0.253
14	639.12	801	440	SIDE	2458	0.407	-0.231
15	638.12	894	492	SIDE	2784	0.431	-0.213