STRUCTURE GEOTECHNICAL REPORT

BRIDGE REPLACEMENT
TILTON ROAD OVER I-74

Section (92-11HB-4)BR
Vermilion County, Illinois
Job No. P-95-013-98/D-95-013-98
Contract No. 90922
PTB 188-023
Existing Structure No. 092-0087
Proposed Structure No. 092-0204

Prepared For:
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1-7-2020
Exp. 11-30-2021

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1.0 Project Description and Scope

1.1 Introduction

The geotechnical investigation summarized herein was performed for the proposed bridge at Tilton Road over I-74 in Vermilion County, Illinois. See Appendix A for Location Map. The purpose of this report is to provide geotechnical design and construction recommendations to aid in the structure planning, final design plans and specification preparation.

1.2 Existing Structure Information

Built in 1962, the existing structure is a six span, 33WF152 steel stringer bridge with a 7" concrete deck supported on concrete stub abutments and 3 column concrete piers. The bridge is on a curved alignment with kinked stringers. The abutments are founded on 2 rows of concrete piles with the front row having a 1:6 batter (H:V). All piers are multi-column with crashwalls, supported on spread footings. The existing bridge back to back abutments is 357'-7 3/8" and is constructed on a 40.95° skew. The out-to-out bridge width is 39'-0". The six span structure spans over I-74 eastbound and westbound interstate lanes as well as 2 collector lanes, 1 on each side of the interstate lanes.

The existing bridge has a sufficiency rating of 46.3 with a deck rating of 4, poor condition with advanced deterioration, superstructure rating of 3, serious condition with significant section loss, and a substructure rating of 4, poor condition with advanced deterioration. The open joints over Piers 2 and 4 have severe corrosion.

1.3 Proposed Structure Information

The proposed structure is a four span bridge with six W33 rolled steel beams supporting a concrete deck on a 41.18° skew. Anticipated span lengths are approximately 55'/75'/75'/55'. MSE walls are being considered in front of each abutment. Beams are spaced at 7'-5" centers with 3'-3½" overhangs. The roadway cross section consists of a 5'-0" min. shoulder, 2 – 12'-0" radial lanes, 5'-2¼" min. varies shoulder, and a 5'-0" sidewalk. Out to out of bridge is 43'-8". The proposed bridge is raised approximately 1.9' from existing grade at both abutments to meet the 16'-9" minimum clearance over I-74.

Tilton Road will be closed during construction of the proposed structure. Traffic is to be detoured. For further proposed structure information, see Appendix B for Type, Size, and Location Plan (TS&L).

2.0 Field Exploration

2.1 Subsurface Exploration and Testing

The subsurface investigation consisted of three borings (B-1 through B-3) drilled by the Illinois Department of Transportation in April and May of 2003. B-1 and B-3 were taken near the north and south abutment locations respectively. B-2 was taken in the I-74 median. Soil boring exploration was performed using a hollow stem auger and rock core logging was performed using rotary core with water flush. See Appendix C for Subsurface Data Profile Plot and Appendix D for Soil Boring and Rock Core Logs.

Table 2.1 - Boring Log Summary

Boring Location	Station	Offset	Ground Surface Elevation
B-1 (N. Abut.)	50+29	7.8 ft. RT	636.60
B-2 (Median)	52+15	25.0 ft. RT	615.10
B-3 (S. Abut.)	53+95	6.0 ft. LT	636.10

In addition to the borings discussed above, an additional 6 borings were drilled near the north abutment in November 2018 to assist in determining the presence of voids and fractures. See Section 3.5 - Mining Activity.

2.2 Subsurface Conditions

Groundwater conditions recorded in the borings were first encountered in Boring B-3 at Elev. 621.1. Groundwater elevations were not recorded at Boring B-1 and Boring B-2. Temperature, seasonal variations, and recent rainfall conditions may influence the levels of groundwater table. Without extended periods of observation, the measurement of groundwater conditions herein may not give a true indication of typical groundwater levels. Volume of water depends on the permeability of the soils.

The borings generally encountered sand and silty loam layers from depths 0 to 20 feet having SPT (N) values ranging from 4 to 16 blows per foot, Q_u values of 0.8 to 4.1tsf, and moisture contents ranging between 9% and 22%. At approximate depth of 20 to 24 feet, a sand layer was encountered with N values with approximately 35 blows per foot and moisture contents ranging between 7% and 11%. Below the soil at a depth of around 24 feet, the borings encounter a grey massive shale layer with Q_u values of 2 to 18 tsf, R% values from 0% to 100%, RQD% values from 0% to 82%, and moisture contents ranging between 9% and 17%. Boring B-1 indicates voids via lost circulation and minor resistance in drilling from depths 52.5 to 80 ft (End of Boring). Boring B-2 does not show a presence of voids during drilling. Boring B-3 shows the grey shale having coal seams and mixed layers ranging from depths 57 to 75 ft (End of Boring).

3.0 Geotechnical Evaluations and Recommendations

3.1 Settlement

Based on the provided preliminary plan and profile, the anticipated difference between the existing and proposed elevations at the abutments is 1.9 feet. MSE wall with select backfill over shale is anticipated at the abutments; while, spread footings on shale are anticipated at the piers. The proposed 4 span structure mimics the 4 center spans of the existing structure, in which the existing piers are founded on spread footings. Shale settlement is expected to be minimal due to similarly subjected prior bearing pressures. Select backfill settlement is expected to the minimal due to the lift and compacting requirements. Thus, settlement analyses were not performed.

3.2 Slope Stability

Slope stability analyses of the end slopes for the new bridge abutments were performed. Based on the proposed plans, the end slopes will be cut and an MSE wall will be constructed at each abutment. Analyses were performed at both the north and south abutments using the engineering soil properties from the subsurface exploration data. For preliminary MSE wall geometry, see Section 4.1 below. The slope stability analyses were performed using the software program StablPro. The Bishop's method analysis was used to search for the critical circular failure surface to calculate the factor of safety for the slope.

A live load surcharge of 250 psf was considered at both abutments. Examining the potential for a spread footing at the south abutment, a uniform 4,000 psf was applied over the 6 ft length nearest the MSE wall. From the soil borings, the current embankment is silty/sandy loam with Qu values ranging from 0.8 tsf to 4.1 tsf. By inspection, the long term drained soil conditions control over the short term cohesive undrained conditions for the embankment. The shallow gray massive shale was conservatively grouped into 2 layers with the top layer being treated as a weak shale layer with Qu = 2 tsf and a stronger layer below with Qu ranging from 9 tsf for the south abutment and 12 tsf for the north abutment, indicative of the soil borings.

See Table 3.1 below for slope stability factors of safety at each abutment. Each abutment location achieved the minimum factor of safety of 1.5 for static conditions. Based on the Seismic Performance Zone determined below (SPZ 1), seismic slope stability analyses were not performed. See Appendix E for individual output of the analyses presented in the table.

Table 3.1 - Summary of Slope Stability Factors of Safety

Location	Required Minimum Factor of Safety	Estimated Factor of Safety
South Abutment	1.5	2.8
North Abutment	1.5	3.2

3.3 Seismic Considerations

LRFD Seismic Soil Site Class Definition was determined based on the methodology described in IDOT AGMU 9.1 and the IDOT BBS 149 form for Seismic Site Class Determination. See Appendix F for determination.

Further seismic parameters were determined using the figures and tables provided in AASHTO LRFD Bridge Design Specifications, Article 3.10 for Earthquake Effects, EQ. These parameters are based on a 1000 Year Return Period with a Probability of Exceedance of 7% in 75 years. See table below for a summary of seismic parameters.

Table 3.2 - Summary of Seismic Parameters

Parameter	Value
Seismic Soil Site Class	C
Spectral Acceleration Coefficient at period of 0.2 sec., Ss	0.143g
Spectral Acceleration Coefficient at period of 1.0 sec., S1	0.055g
Site Factor, Short Period, Fa	1.2
Site Factor, Long Period, Fv	1.7
Design Spectral Acceleration at 0.2 sec. (SDS)	0.172g
Design Spectral Acceleration at 1.0 sec. (SD1)	0.094g
Seismic Performance Zone	SPZ 1

The Spectral Acceleration Coefficient at T=1.0 sec. (SD1) and Seismic Performance Zone were confirmed using Bridge Manual Planning Section 2.3.10.3.

3.4 Scour

Scour is not applicable because this is a grade separation structure.

3.5 Mining Activity

Indicative of loss of circulation in the rock core log at Boring B-1, mining activity is present at the north abutment. An additional investigation was performed to address concerns related to mine subsidence risk. Refer to the Mine Subsidence Study performed by Kaskaskia Engineer Group, LLC (April 2019) for further details. After review of the Mine Subsidence Study, IDOT District 5 and the Bridge Office Foundations Unit recommend shortening the bridge length by utilizing MSE walls, moving the north abutment away from the mine impacted zone and avoiding costly cased shaft foundations extending below the coal layer. Standard deep foundations are assumed practical for design, not free of foundation settlement risk but determined to be the best risk adverse vs cost option.

3.6 Lateral Pile/Pier Response

The table below provides soil parameters to structural engineer for lateral or displacement analysis of the foundations. The values were estimated based on the descriptions given in the soil boring logs. No specific analyses were performed on the soil to determine the estimated parameters.

The designer shall be cognizant of the selected abutment foundation type and the interaction with the surrounding select backfill and shale. In addition, consideration shall be given to current and

future lateral resistance of the degrading shale at the north abutment.

Table 3.3 – Recommended Soil Parameters for Lateral Pile Load Analysis

Soil Description	γ (pcf)	Short Term		Long Term		K (pci)	ε_{50}
		c' (psf)	θ (deg.)	c' (psf)	θ (deg.)		
Select Backfill	120	0	30	0	30	50	N/A
Gray Massive Shale	130	2000	0	50	35	100	0.005

3.7 Liquefaction

According to IDOT AGMU Memo 10.1, liquefaction is not applicable in Seismic Performance Zone 1.

4.0 Foundation Recommendations

4.1 MSE Walls

In an effort to minimize bridge length, MSE walls are proposed in front of each abutment. Wall height from top of exposed panel line to theoretical top of leveling pad line is approximately 18 feet at the south abutment and 21 feet at the north abutment. Limits of the reinforced soil mass shall extend a minimum of 0.7 times the height of the wall.

The top of MSE wall leveling pad/bottom of soil reinforcement is located 3'-6" below finished grade at the face of the MSE wall per IDOT Bridge Manual Fig. 3.11.1-2. The ground line at the proposed south MSE wall is approximately at Elev. 615.9. Coincidently, gray massive shale is encountered at Elev. 615.6 in Boring 3 at the south abutment. The ground line at the proposed north MSE wall is approximately at Elev. 614.0 and gray massive shale is encountered at Elev. 612.1 in Boring 1 at the north abutment. Because shale is considered a frost susceptible rock, excavation down to the specified frost depth of 3'-6" is recommended. See Appendix B for finished grade line at front face of wall.

Assuming a shale undrained shear strength of 2.0 ksf, the factored bearing resistance for the MSE wall leveling pad is 4.8 ksf.

4.2 Abutments

Preliminary superstructure loads for the proposed structure configuration discussed above were provided by Thouvenot, Wade & Moerchen, Inc. Including the approach slab and abutment self-weight, each abutment will experience an estimated Total Factored Load of 1,100 kips at the bottom of abutment.

4.2.1 General Feasibility

Spread footings and deep foundations including H-piling and drilled shafts are considered at the abutments. See Sections 4.2.2 through 4.2.4 further abutment discussion. The existing abutments are founded on concrete piles embedded into shale.

Spread footings are generally less expensive and simplifies construction in comparison to deep foundations. Although deep foundation skilled laborers and equipment will be required at the north abutment regardless. Consideration shall be given to the final bearing fixity configuration and adjacent substructure stiffness in relation to transferring lateral forces across the structure.

Integral abutments are preferred to eliminate joints in the bridge deck. IDOT ABD Memo 19.8 for Integral Bridge Policies and Details allows the use of integral abutment structures with MSE walls when determined to be the most feasible option.

4.2.2 Spread Footing

Assuming the spread footing rests on the MSE wall select fill with an effective friction angle of 30 degrees, the factored bearing resistance is 3.4 ksf. Evaluating the factored loads and factored bearing resistance, a 58 foot long by 6 foot wide spread footing abutment is determined feasible.

Using a service uniform vertical pressure of 1.0 ksf, the unit factored sliding resistance is 0.46 ksf. Passive pressure is neglected but may be considered when the applied loading acts towards the approach. In regard to sliding resistance, the selection of bearing type is critical when considering the use of spread footing abutments.

The designer shall indicate a maximum horizontal service sliding force as well as a vertical surcharge load in the Contract plans to assist the MSE wall supplier during design. Centerline of abutment bearing shall be 3'-6" min from the face of panel. See Bridge Manual Figure 3.11.1.4-3 for further spread footing abutment details.

4.2.3 H-Piles

Deep foundation piles are another suitable foundation option based on the assumed loads at the abutments. Due to the presence of shallow shale at the subject site and H-piles being most effective in point bearing applications, H-piles are recommended over metal shell piles.

Tables 4.1 and 4.2 below summarize the nominal required bearing (R_N), factored resistance available (R_F), estimated pile length and estimated pile tip elevation. R_N indicates the resistance of the pile during driving, which assists the Contractor from causing damage to the pile. R_F represents the net long term axial geotechnical resistance available to support the factored structure loads. The estimated pile lengths shown in the table include a 2 foot pile embedment into the abutment. Analyses have been performed using the IDOT Static Method of Estimating Pile Length. See Appendix G

Table 4.1 - H-Pile Capacity at the South Abutment

Pile Size	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Estimated Pile Length (ft.)	Estimated Pile Tip Elevation (ft.)
HP12x53	104	57	21	610.75
	248	137	23	608.75
	382	210	25	606.75
HP12x84	114	63	21	610.75
	262	144	23	608.75
	399	219	25	606.75
	501	276	27	604.75
HP14x73	127	70	21	610.75
	301	165	23	608.75
	475	261	25	606.75
HP14x117	141	77	21	610.75
	318	175	23	608.75
	495	272	25	606.75
	621	342	27	604.75

Table 4.2 - H-Pile Capacity at the North Abutment

Pile Size	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Estimated Pile Length (ft.)	Estimated Pile Tip Elevation (ft.)
HP12x53	86	47	23	609.5
	230	127	25	607.5
	370	203	27	605.5

HP12x84	95	52	23	609.5
	243	134	25	607.5
	386	212	27	605.5
	488	269	29	603.5
HP14x73	105	58	23	609.5
	279	154	25	607.5
	453	249	27	605.5
HP14x117	118	65	23	609.5
	296	163	25	607.5
	473	260	27	605.5
	606	333	29	603.5

Note the South Abutment HP12x53 and HP14x73 piles reach maximum pile driveable length at 25 feet and 26 feet, respectively, being limited by the maximum structural nominal required bearing of the pile. Similarly, the North Abutment HP12x53 and HP14x73 piles reach maximum pile driveable length at 26 feet and 27 feet, respectively. The factored resistance available values shown in the table are intended to provide the designer with a range of feasible options for the anticipated vertical loading. Piles will need to be evaluated for lateral resistance in final design.

Piles shall be driven at the top of MSE wall leveling pad/bottom of soil reinforcement. Preliminary ground surface elevation against pile during driving is assumed at Elev. 612.0 at the south abutment and Elev. 610.5 at the north abutment. The top of the MSE wall elevation shall be the bottom of the abutment cap elevation. The top of coping elevation shall be 6" above the bottom of abutment cap elevation.

Per IDOT ABD Memo 19.8, a corrugated metal pipe or HDPE pipe pile sleeve shall be placed around each pile for the full height of the MSE select backfill. The void between the pile and pile sleeve shall be filled with bentonite. Minimum space between the pile and pile sleeve shall be 3" or as required by design to accommodate the total pile movement. Settlement of the MSE wall soil reinforcement, while minimal, could potentially cause additional vertical forces on the piles. Using pile sleeves at both abutments limits the effects of downdrag on the piles.

One test pile is recommended at each abutment location. Pile shoes are not required. H-piles shall be spaced no closer than three pile diameters, center to center. Wingwalls parallel with the abutment cap shall be used to control the remainder of the soil slope. The distance between face of the MSE wall to the face of the abutment cap shall be 3'-0" minimum. See ABD Memo 19.8, Figure 23 for further details of MSE Walls at Integral Abutments.

4.2.4 Drilled Shafts

Drilled shafts are also a feasible option for the abutments. Tables 4.3 and 4.4 below summarize the nominal shaft resistance available for side and tip resistance, factored shaft resistance available, and estimated tip elevation for various shaft diameters and socket depths into the shallow underlying shale. Analyses have been performed using the IDOT Axial Capacity of Drilled Shafts in Soft Shale spreadsheet presenting geotechnical axial resistance and estimated settlement. See Appendix H.

Table 4.3 – Drilled Shaft Capacity at the South Abutment

Shaft Diameter	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE	Nominal Shaft Resistance Available (kips) TIP	Factored Shaft Resistance Available (kips)	Tip Elevation (ft.)
24-inch	5	105	47	76	607.0
	10	144	72	108	602.0
	15	203	218	211	597.0
	20	378	220	299	592.0
30-inch	5	131	72	102	607.0
	10	180	112	146	602.0
	15	253	340	296	597.0
	20	472	342	407	592.0
36-inch	5	158	111	134	607.0
	10	216	213	215	602.0
	15	304	487	395	597.0
48-inch	5	210	211	211	607.0
	10	288	490	389	602.0
	15	405	856	631	597.0

Table 4.4 – Drilled Shaft Capacity at the North Abutment

Shaft Diameter	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) SIDE	Nominal Shaft Resistance Available (kips) TIP	Factored Shaft Resistance Available (kips)	Tip Elevation (ft.)
24-inch	5	19	23	21	605.5
	10	39	24	31	600.5
	15	101	291	196	595.5
	20	343	342	342	590.5
30-inch	5	24	36	30	605.5
	10	49	119	84	600.5
	15	127	468	297	595.5
	20	429	532	480	590.5
36-inch	5	29	51	40	605.5
	10	58	249	153	600.5
	15	152	685	418	595.5
48-inch	5	39	89	64	605.5
	10	78	607	342	600.5
	15	203	1237	720	595.5

The factored shaft resistance available values shown in the table are intended to provide the designer with a range of feasible shaft diameter to rock socket depths for the anticipated vertical loading. Note as the diameter of the shaft increases, the potential settlement also increases. In additional to vertical loading, shafts will need to be evaluated for lateral resistance in final design.

Similar to the driven pile, drilled shaft construction is anticipated to start with the ground line at the top of MSE wall leveling pad/bottom of soil reinforcement (Elev. 612.0 at the south abutment, Elev. 610.5 at the north abutment), constructed prior to MSE wall installation. Shale bedrock is present at this starting ground line for both abutments. Side resistance is neglected above this elevation.

A minimum shaft spacing of three times the shaft diameter center-to center is recommended for group efficiency effects and construction considerations. Clear horizontal distance between the back of the panels and the front edge of the shaft shall be 18 inches minimum.

Removable forms and permanent casing are both viable drilled shaft forming options at the south abutment. Using permanent smooth steel pipe casing will minimize downdrag effects from MSE wall soil reinforcement settlement at both abutments.

4.3 Piers

Preliminary superstructure loads for the proposed structure configuration discussed above were provided by Thouvenot, Wade & Moerchen, Inc. Including the self-weight of a multi-column pier, Piers 1 and 3 will experience an estimated Total Factored Load of 2,100 kips. While, Pier 2 has an estimated Total Factored Load of 2,200 kips.

Due to competent shale near the ground line at the pier foundations, spread footings are the most appropriate foundation type. In addition, the existing piers are founded on spread footings.

With bottom of footing elevation at 610.0 assuming a shale undrained shear strength of 2.0 ksf, the factored bearing resistance is 4.8 ksf and the factored sliding resistance is 1.7 ksf. Evaluating the factored loads and factored bearing resistance, a preliminary spread footing size of 46 foot long by 10 foot wide is determined feasible. Pier footings shall be constructed at or below the existing bottom of footing elevations with no ground improvement/treatment anticipated.

5.0 Construction Considerations

5.1 Construction Activities

All construction activities shall be performed in accordance with the current IDOT Standard Specifications for Road and Bridge Construction and any pertinent Special Provisions or Policies.

5.2 Temporary Soil Retention System / Sheet Piling

A temporary soil retention system or sheet piling may be required to construct the pier footings and MSE wall. At the median, the distance from ground surface to the bottom of proposed pier spread footing is approximately 5 feet. The designer shall verify the excavation depth at each substructure location and evaluate the proposed I-74 traffic staging to determine if temporary shoring is required.

5.3 Foundation Construction

Conventional pile driving and/or drilled shaft equipment and methodologies shall be assumed.

5.4 Excavation

Excavation shall be performed in accordance with IDOT Standard Specifications Section 202. Substructure construction shall occur after removal of the existing structure is complete.

The existing contract plans indicate a 36" culvert pipe near each proposed abutment location. The designer shall coordinate potential conflicts in final design.

A Joint Utility Locating Information for Excavators (J.U.L.I.E.) locate shall be performed prior to commencing construction activities to determine underground utilities within the project limits. In addition, IDOT shall be contacted to locate private utilities.

At foundation and structural fill locations, the exposed subgrade shall be proofrolled to aid in locating any unstable and unsuitable materials. Unstable and unsuitable materials shall be removed and replaced with compacted structural fill.

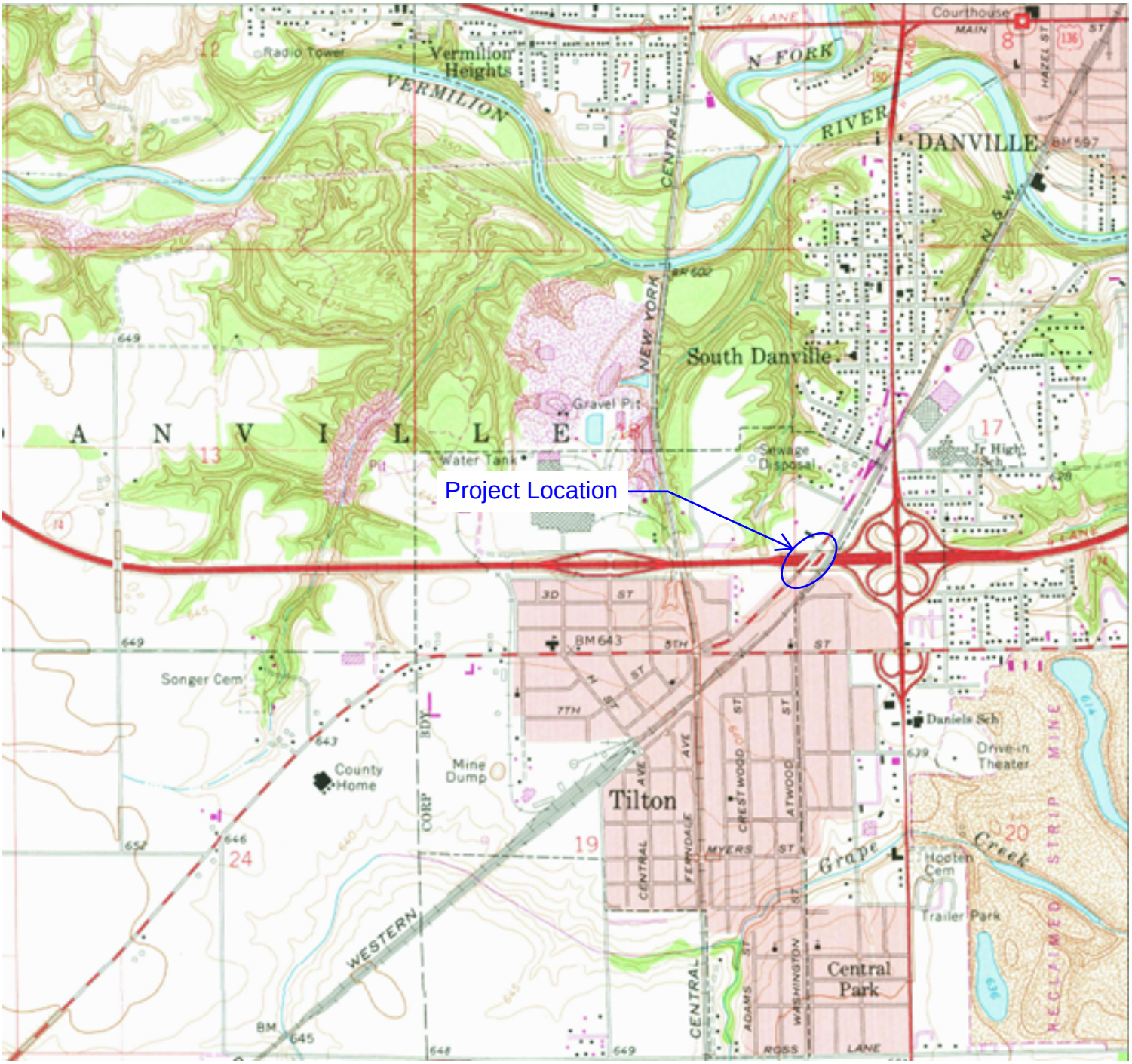
6.0 Limitations

The analysis and discussion provided herein are for the exclusive use of IDOT and Thouvenot, Wade & Moerchen, Inc. They are based upon the subsurface data obtained at boring locations within the bridge area and are specific to the project described, our understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care.

The Structure Geotechnical Report (SGR) herein was developed during the planning phase of the project. Due to drilled shaft deep foundations determined feasible in the SGR, a Geotechnical Design Memorandum will be required per IDOT AGMU 12.0.

Appendix A

Location Map



CIVIL DESIGN, INC. WBE / DBE EFFINGHAM, IL LICENSE #184.003222	LOCATION MAP	TILTON ROAD OVER I-74 VERMILION COUNTY, IL

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Appendix B

Type, Size, and Location Plan (TS&L) and Plan and Profile (P+P)

Bench Mark: K 300 1986 Bench Mark Disk in the SE corner of SN 092-0087. Elevation = 636.30.

Existing Structure: SN 092-0087 was originally constructed in 1962 as a six-span (3 units with 2 continuous spans each) rolled steel beam bridge supported by stub abutments on concrete piles and multi-column reinforced concrete piers on spread footings. 357'-7⅜" back to back abutments. 39'-0" out-to-out deck. Structure to be removed and replaced. Traffic is to be detoured.

No Salvage.

HIGHWAY CLASSIFICATION

Tilton Rd. (C55735#4005)	F.A.I. 74
Functional Class: Local	Functional Class: Interstate
ADT: 1,550 (2018); 1,850 (2038)	ADT: 24,400 (2018); 26,800 (2038)
ADTT: 46 (2018); 55 (2038)	ADTT: 7,686 (2018); 8,442 (2038)
DHV: 155 (2038)	DHV: 1,935 (2038)
Design Speed: 35 m.p.h.	Design Speed: 75 m.p.h.
Posted Speed: 30 m.p.h.	Posted Speed: 70 m.p.h.
2-Way Traffic	2-Way Traffic
Directional Distribution: 55:45	Directional Distribution: 55:45

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)

PRECAST UNITS

f'c = 4,500 psi (Precast Panels)
f'c = 6,000 psi (Precast Bridge Approach Slab)

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) = 0.094g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.172g
Soil Site Class = C

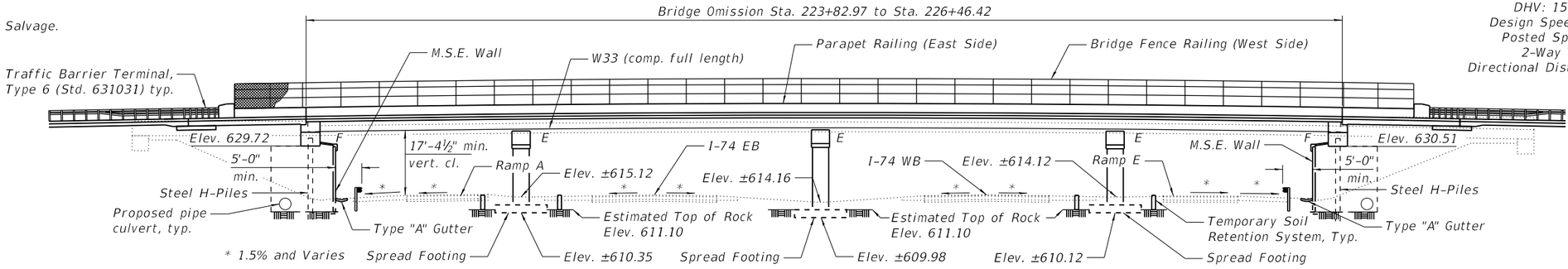
DESIGN SPECIFICATIONS

2017 AASHTO LRFD Bridge Design Specifications, 8th Edition

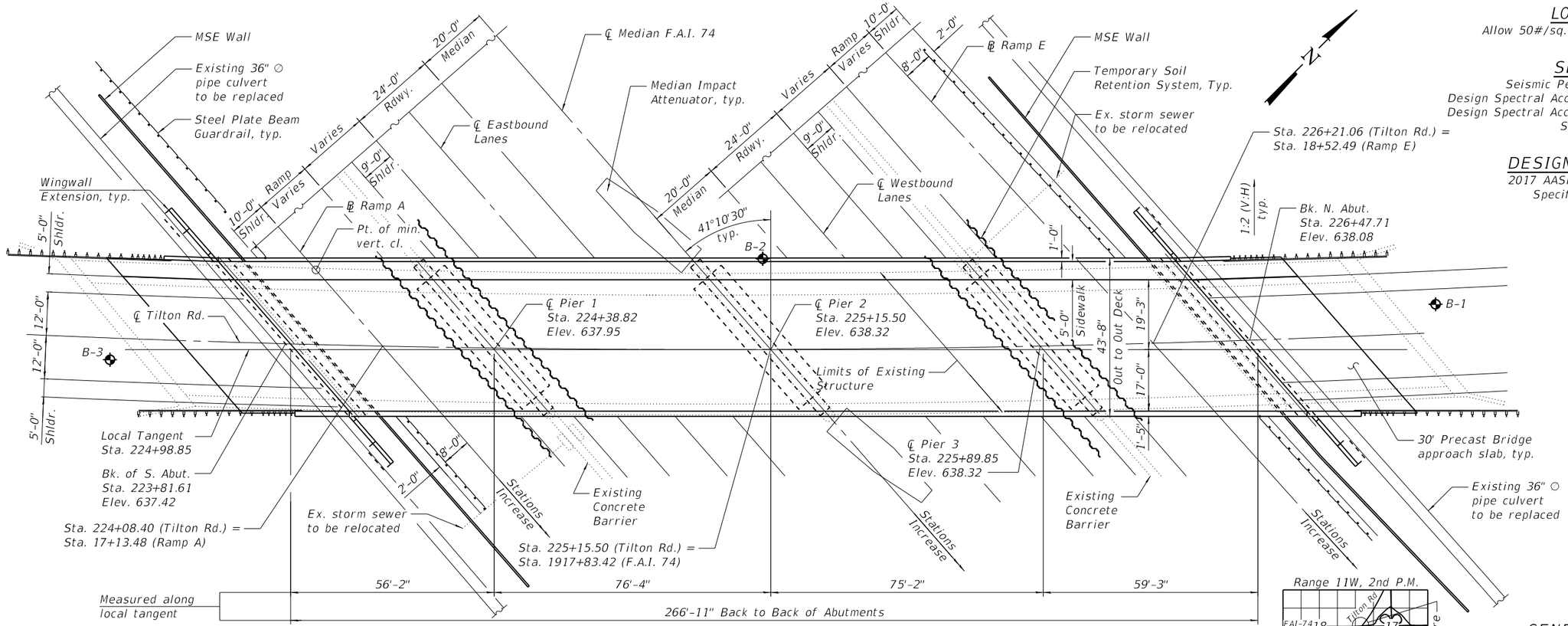
CURVE DATA

PI STA. = 227+37.18
Δ = 18° 10' 36" (LT)
D = 1° 20' 11"
R = 4,287.62'
T = 685.87'
L = 1,360.21'
E = 54.51'
P.C. STA. = 220+51.31
P.T. STA. = 234+11.52

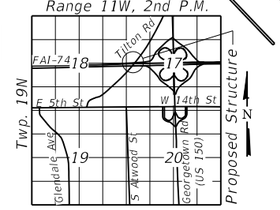
ELEVATION



PLAN



LOCATION SKETCH



GENERAL PLAN & ELEVATION
TILTON ROAD OVER I-74
F.A.I. 74 - SEC. (92-11HB-4)BR
VERMILION COUNTY
STATION 225+15.50
STRUCTURE NO. 092-0204

MODEL: TSL
FILE NAME: P:\2018\1803404 CADD - DWG\4.4 Str\cTSL\092020\4-90922-TSL-001.dgn

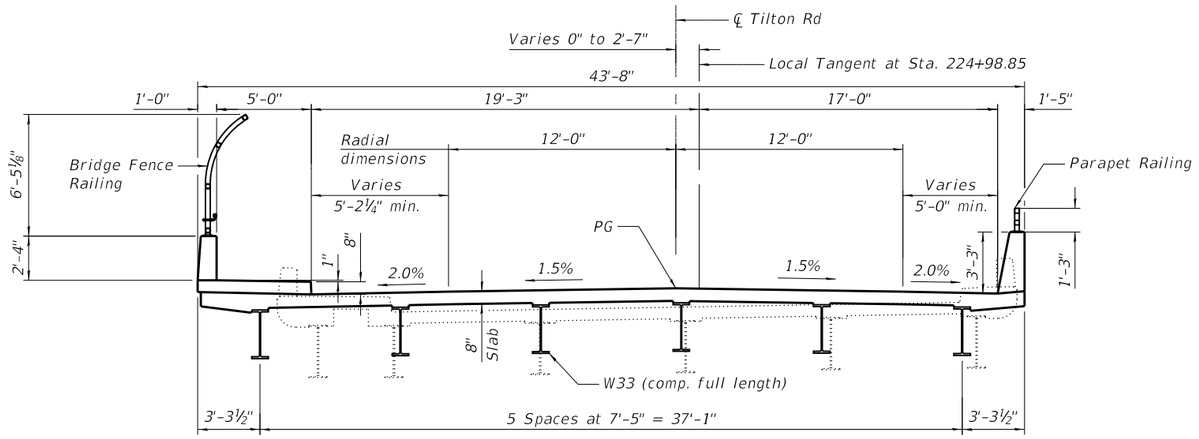
TWM ENGINEERING GEOSPATIAL SERVICES
TWM, INC. WWW.TWM-INC.COM
IL DESIGN FIRM LICENSE NO: 184-001220

USER NAME = bpoiter	DESIGNED - BWP	REVISED -
	CHECKED - ALN	REVISED -
PLOT SCALE = 0.166667 ' / in.	DRAWN - BWP	REVISED -
PLOT DATE = 12/24/2019	CHECKED - ALN	REVISED -

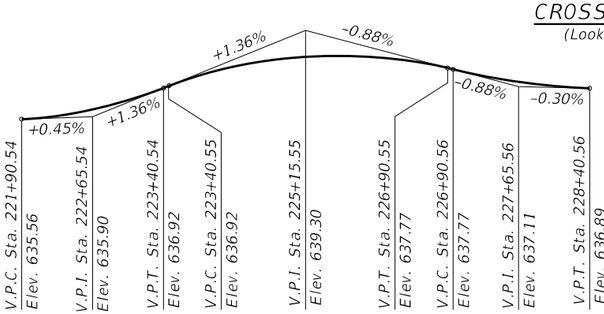
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 4 SHEETS

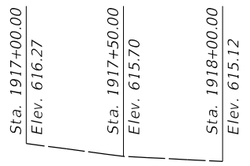
F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-11HB-4)BR	VERMILION	4	1
		CONTRACT NO. 90922		
	ILLINOIS	FED. AID PROJECT		



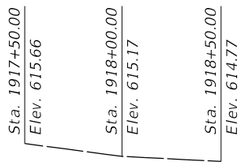
CROSS SECTION
(Looking North)



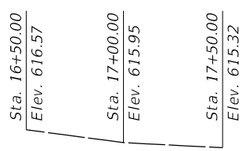
PROFILE GRADE
(along ℄ Tilton Road)



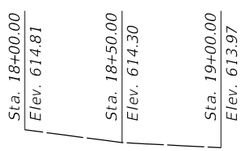
PROFILE GRADE
(along ℄ I-74 Eastbound)



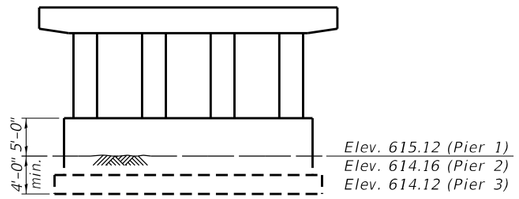
PROFILE GRADE
(along ℄ I-74 Westbound)



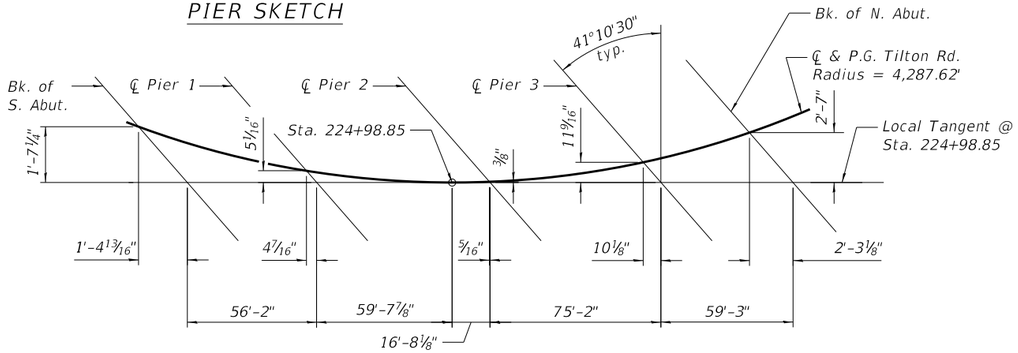
PROFILE GRADE
(along ℄ Ramp A)



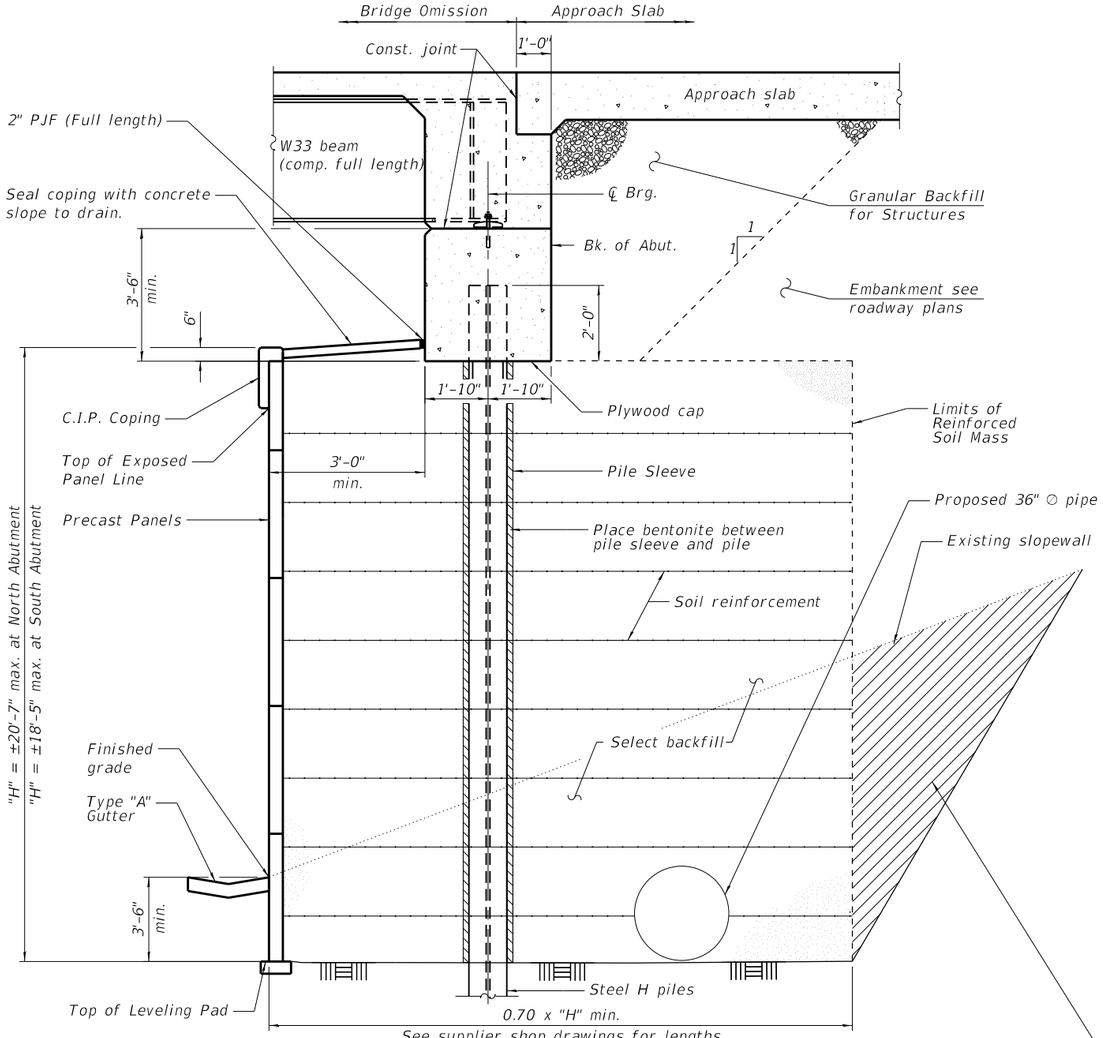
PROFILE GRADE
(along ℄ Ramp E)



PIER SKETCH

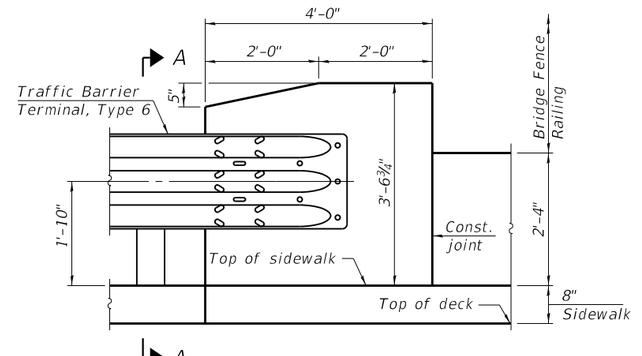


OFFSET SKETCH

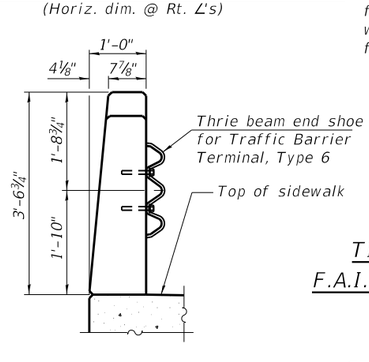


SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. @ Rt. ∠'s)

Overexcavation beyond structure excavation. This area not measured for payment. Backfill overexcavation with same material used for select fill used in MSE wall.



TYPE 6 RAIL ATTACHMENT
(West Parapet)



SECTION A-A

DETAILS
TILTON ROAD OVER I-74
F.A.I. 74 – SEC. (92-11HB-4)BR
VERMILION COUNTY
STATION 225+15.50
STRUCTURE NO. 092-0204

MODEL: TSL
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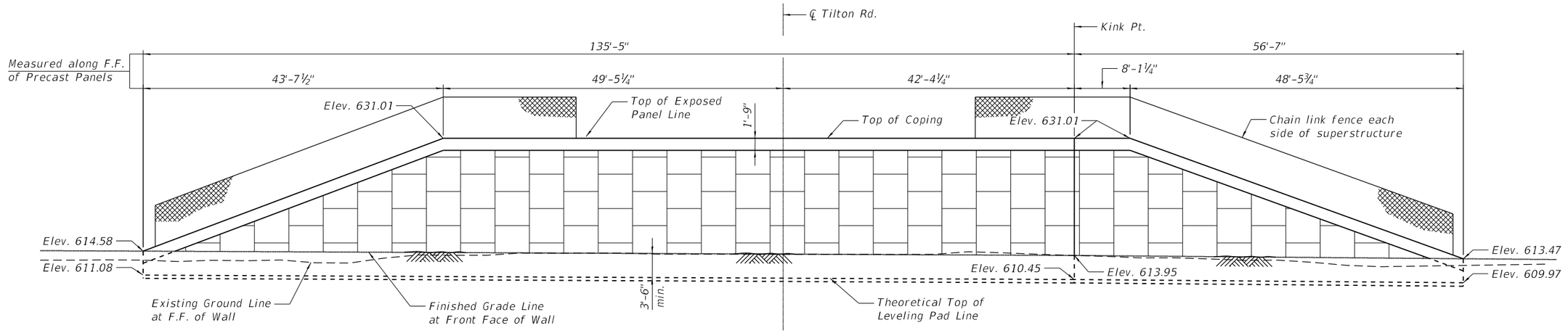
TWM ENGINEERING & GEOSPATIAL SERVICES
TWM, INC. WWW.TWM-INC.COM
IL DESIGN FIRM LICENSE NO: 184-001220

USER NAME = bpoiter	DESIGNED - BWP	REVISED -
	CHECKED - ALN	REVISED -
PLOT SCALE = 0.166667 ' / in.	DRAWN - BWP	REVISED -
PLOT DATE = 12/24/2019	CHECKED - ALN	REVISED -

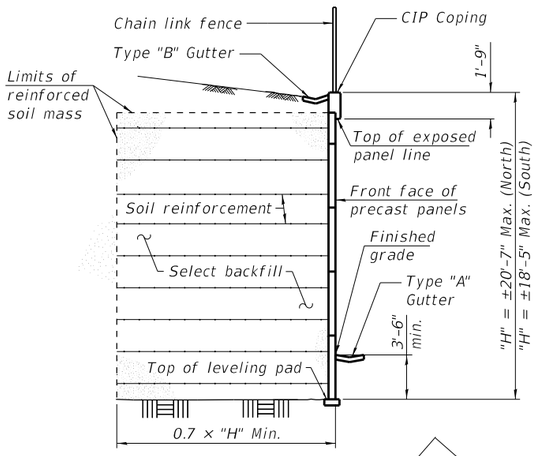
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 4 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-11HB-4)BR	VERMILION	4	2
		CONTRACT NO. 90922		
	ILLINOIS FED. AID PROJECT			



UNFOLDED ELEVATION OF NORTH WALL



SECTION THRU MSE WALL

PLAN OF NORTH WALL

Notes:
1. Wall offsets are measured from the ℄ of Tilton Road to the front face of precast panels.

NORTH WALL
TILTON ROAD OVER I-74
F.A.I. 74 – SEC. (92-11HB-4)BR
VERMILION COUNTY
STATION 225+15.50
STRUCTURE NO. 092-0204

MODEL: Default
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TWM ENGINEERING GEOSPATIAL SERVICES
TWM, INC. WWW.TWM-INC.COM
IL DESIGN FIRM LICENSE NO: 184-001220

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	CHECKED - BWP	REVISED -	
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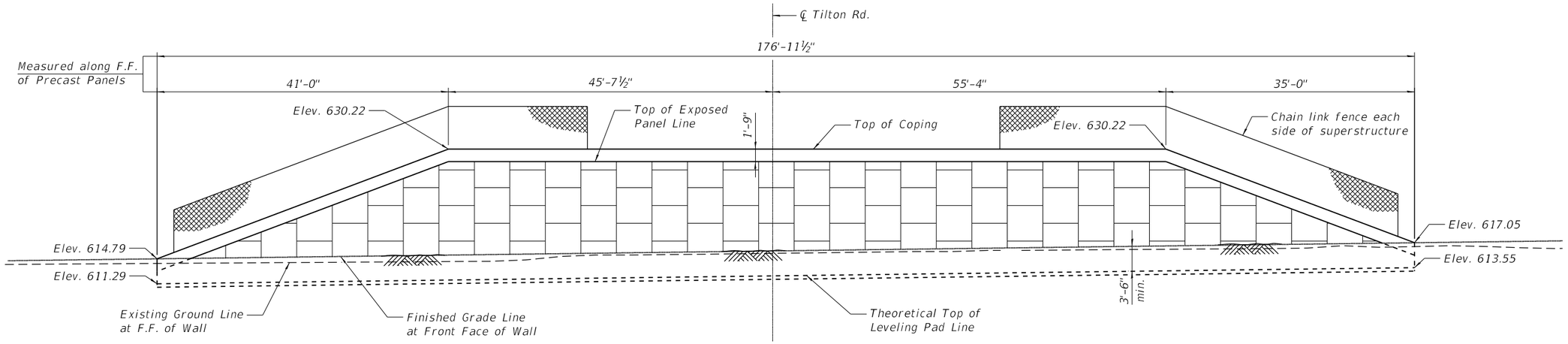
PLOT DATE = 12/24/2019	CHECKED - BWP	REVISED -	

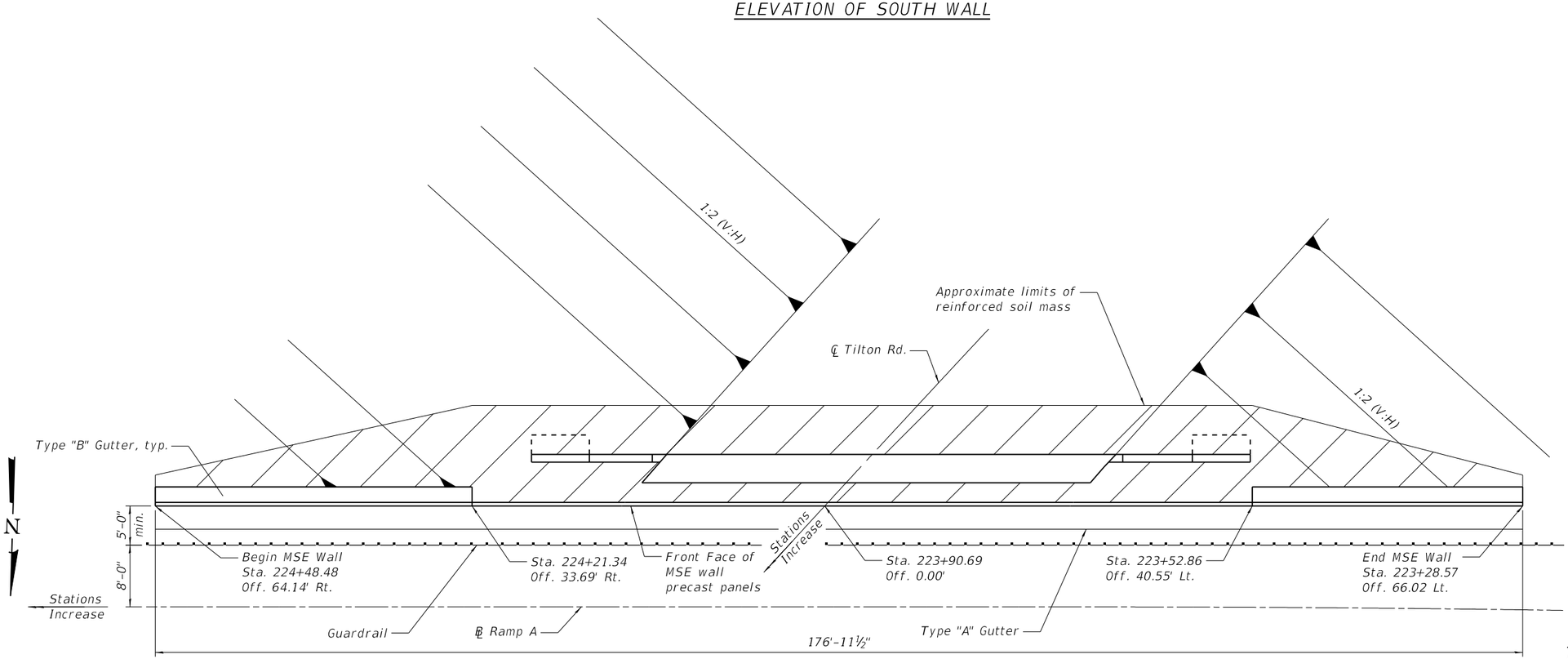
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 3 OF 4 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-11HB-4)BR	VERMILION	4	3
		CONTRACT NO. 90922		
	ILLINOIS FED. AID PROJECT			



ELEVATION OF SOUTH WALL



PLAN OF SOUTH WALL

Notes:
1. Wall offsets are measured from the ℄ of Tilton Road to the front face of precast panels.

SOUTH WALL
TILTON ROAD OVER I-74
F.A.I. 74 – SEC. (92-11HB-4)BR
VERMILION COUNTY
STATION 225+15.50
STRUCTURE NO. 092-0204

MODEL: Default
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			CHECKED - BWP	REVISED -	
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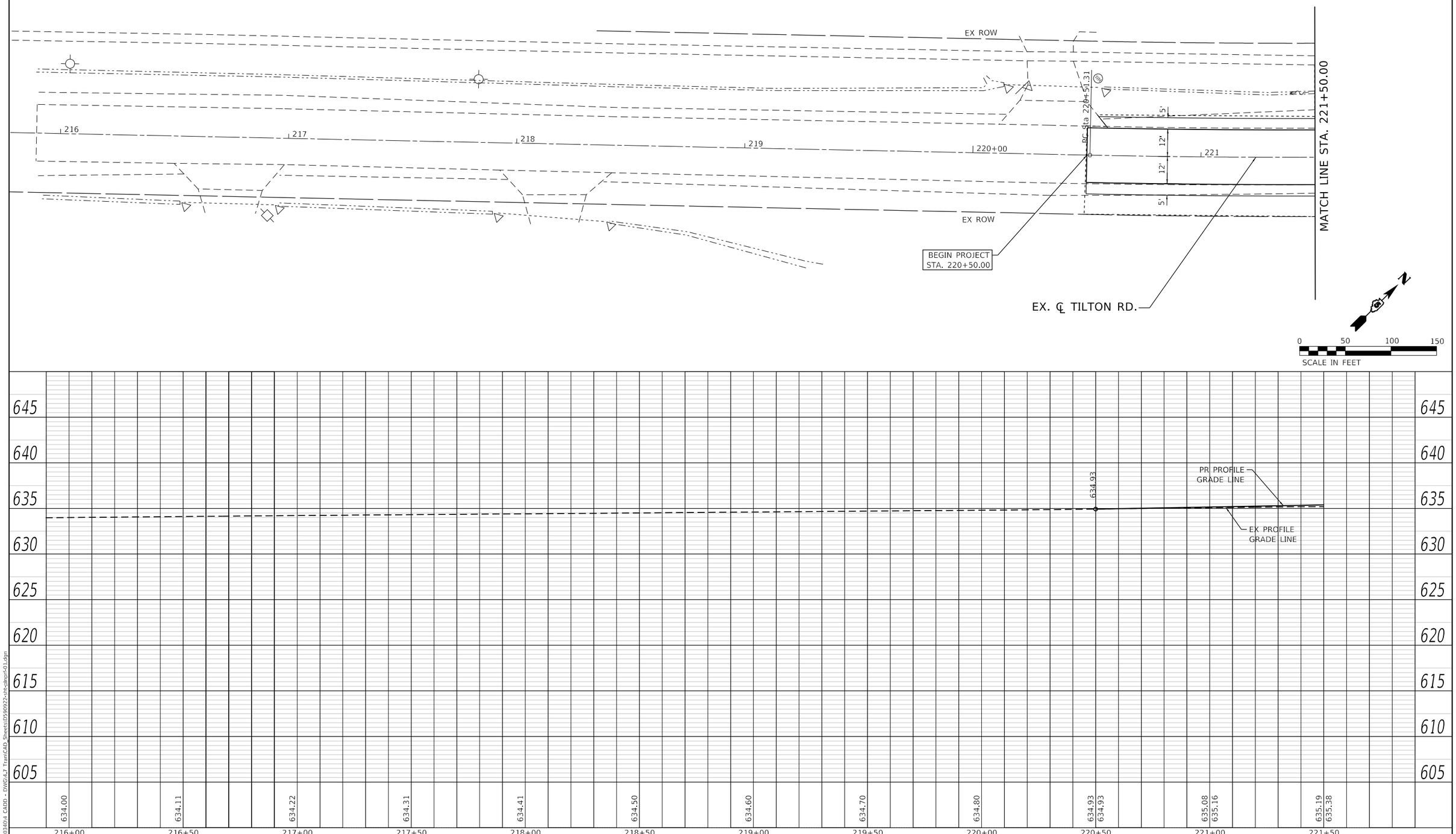
		PLOT DATE = 12/24/2019	CHECKED - BWP	REVISED -	

SHEET 4 OF 4 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-11HB-4)BR	VERMILION	4	4
		CONTRACT NO. 90922		
	ILLINOIS	FED. AID PROJECT		

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

PROFILE
SURVEYED
PLOTTED
CROSS CHECKED
NOTE BOOK
NO.
DATE
BY
B.M. NOTED
STRUCTURE NOTATNS CHKD



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	DRAWN - JWS	REVISED -
PLOT SCALE = 40.0000 ' / in.	CHECKED - SJK	REVISED -
PLOT DATE = 6/18/2019	DATE - APRIL 2019	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PLAN AND PROFILE
TILTON RD.

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-11HN-4)BR	VERMILION		
		CONTRACT NO. 90922		
	ILLINOIS	FED. AID PROJECT		

PT. OF MIN CLEARANCE
TILTON RD. STA. 223+86.52, 23.79' LT =
IL 1 RAMP A STA. 16+81.20. 0.0' LT

PR PCC SIDEWALK

EX ROW

PR TBT-T6 & TBT-T1 (SPL) TAN
(TYPICAL ALL 4 QUADS)

MATCH LINE STA. 221+50.00

EX. ℄ I-74

PROPOSED SN 092-0204

EXISTING SN 092-0087

PR PCC
SIDEWALK

STA. 227+25.00
BK. N. PAVEMENT
CONNECTOR (HMA)

MATCH LINE STA. 227+50.00

STA. 226+74.43
BK. N. APPROACH SLAB

STA. 223+00.00
BK. S. PAVEMENT
CONNECTOR (HMA)

EX. ℄ TILTON RD.

STA. 223+51.36
BK. S. APPROACH SLAB

PI Sta 227+37.18

0 50 100 150
SCALE IN FEET

K = 165
150.00' V.C.

+90.54 EL. 635.56

VPI STA. 222+65.54
ELEVATION 635.90

+8.45%

+1.36%

+40.55 EL. 636.92

+40.54 EL. 636.92

VPI STA. 225+15.55
ELEVATION 639.30

+1.36%

-0.88%

PR. PROFILE
GRADE LINE

EX. PROFILE
GRADE LINE

+90.56 EL. 637.77

+90.55 EL. 637.76

SSD = 472'
K = 157
350.00' V.C.

PT. OF MIN CLEARANCE
IL 1 RAMP A EX EOP = 616.18'
TILTON ROAD PGL = 637.48'

635.19 635.38 | 635.26 635.61 | 635.32 635.94 | 635.38 636.42 | 635.46 637.05 | 635.58 637.62 | 635.70 638.03 | 635.81 638.28 | 635.92 638.37 | 636.03 638.30 | 636.14 638.07 | 636.19 637.69

221+50 222+00 222+50 223+00 223+50 224+00 224+50 225+00 225+50 226+00 226+50 227+00

645 640 635 630 625 620 615 610 605

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

PROFILE: SURVEYED, PLOTTED, CHECKED, PCC, B.M. NOTED, STRUCTURE NOTATIONS CHKD, NOTE BOOK, NO., BY, DATE

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PLOT DATE = 6/18/2019	DATE - APRIL 2019	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PLAN AND PROFILE
TILTON RD.

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-11HN-4)BR	VERMILION		
		CONTRACT NO. 90922		
	ILLINOIS FED. AID PROJECT			

PR PCC SIDEWALK

PR. PIPE CULVERTS, CLASS A, TYPE 1, 15" W/ FES

EX ROW

MATCH LINE STA. 227+50.00

EX. ℄ TILTON RD.

228

229

230+00

231

232

233

END PROJECT
STA. 229+00.00

EX ROW

N

0 50 100 150
SCALE IN FEET

K = 259
150.00' V.C.

+10.56 EL. 636.89

PR PROFILE GRADE LINE

636.71

EX PROFILE GRADE LINE

-1.88%

-0.30%

VPI STA. 227+65.56
ELEVATION 637.11

645 640 635 630 625 620 615 610 605

636.41 637.31 | 636.56 637.04 | 636.66 636.86 | 636.71 636.71 | 636.74 | 636.73 | 636.70 | 636.64 | 636.58 | 636.52 | 636.45 | 636.38

227+50 228+00 228+50 229+00 229+50 230+00 230+50 231+00 231+50 232+00 232+50 233+00

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

PROFILE
SURVEYED
PLOTTED
GRADES CHECKED
BM. NOTED
STRUCTURE NO'S CHKD
NOTE BOOK
NO.
BY
DATE

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TWM

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	DRAWN - JWS	REVISED -
PLOT SCALE = 40.0000 ' / in.	CHECKED - SJK	REVISED -
PLOT DATE = 6/18/2019	DATE - APRIL 2019	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PLAN AND PROFILE
TILTON RD.

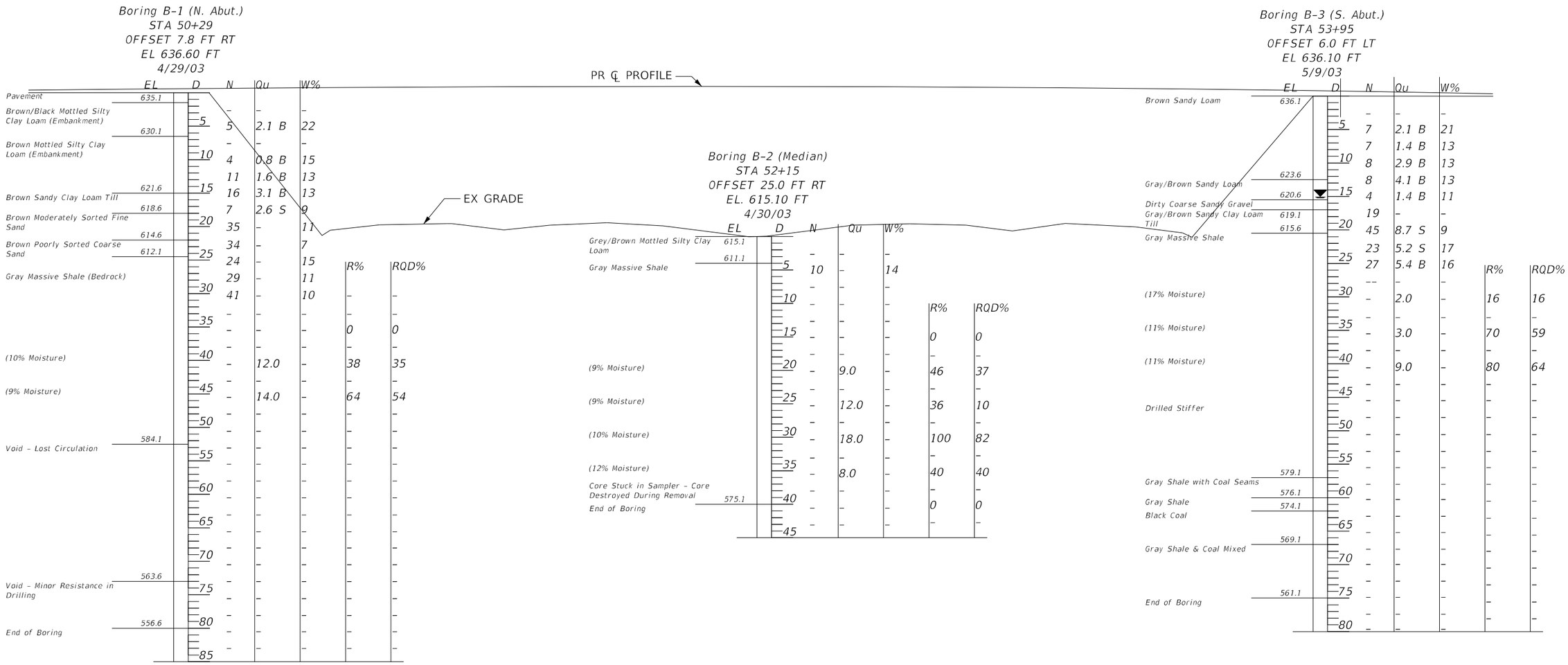
SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-11HN-4)BR	VERMILION		
		CONTRACT NO. 90922		
	ILLINOIS FED. AID PROJECT			

Appendix C

Subsurface Data Profile Plot

Note: Boring Stationing and Offsets shown in reference to Tilton Road profile.



LEGEND

EL = Elevation (FT)
D = Depth Below Existing Ground Surface (FT)
N = SPT N-VALUE (AASHTO T206)
Qu = Unconfined Compressive Strength in tons per sq. ft. (tsf)
Failure Mode (B=bulge, S=shear, P=penetrometer)
W% = Moisture Content Percentage
R% = Recovery Percentage
RQD% = Rock Quality Designation Percentage

▼ = Groundwater Level First Encountered
▽ = Groundwater Upon Completion
▽ = Groundwater After 24 to 72 hours
Soil profile is for illustrative purposes only. Actual conditions will vary.

SUBSURFACE DATA PROFILE
I-74 UNDER TILTON ROAD
ROUTE FAI 74 (I-74)
SECTION (92-11HB-4)BR
VERMILION COUNTY
SN 092-0087 (EXIST.)

FILE NAME = P:\Effingham\3287 - Tilton Road Bridge DS\SGR\Subsurface Data Profile\Subsurface Data Profile.dgn	USER NAME = tziegler	DESIGNED - WMK	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
	PLOT SCALE = 2.0000 ' / In.	DRAWN - WMK	REVISED -	
Default	PLOT DATE = 12/18/2019	CHECKED - TJZ	REVISED -	
		DATE - 10/29/18	REVISED -	SHEET 1 OF 1 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-11HB-4)BR	VERMILION	1	1
		ILLINOIS	FED. AID PROJECT	

Appendix D

Soil Boring and Rock Core Logs

Illinois Department of Transportation
Division of Highways
IDOT - Region 3/Dist 5

SOIL BORING LOG

Date 4/29/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**

COUNTY Vermilion **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Automatic

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 1 North Abut.
Station 50+29
Offset 7.8 ft Rt.
Ground Surface Elev. 636.6 ft

Surface Water Elev. ft
Stream Bed Elev. ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Pavement			
635.1			
Brown/Black Mottled Silty Clay Loam (Embankment)	2		
	2 3	2.1 B	22
-5			
630.1			
Brown Mottled Silty Clay Loam (Embankment)	1		
	2 2	0.8 B	15
-10			
	1		
	3 8	1.6 B	13
	2		
	6 10	3.1 B	13
621.6 -15			
Brown Sandy Clay Loam Till	3		
	3 4	2.6 S	9
618.6			
Brown Moderately Sorted Fine Sand	9		
	16 19		11
-20			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Brown Moderately Sorted Fine Sand *(continued)*	9		
614.6	17 17		7
Brown Poorly Sorted Coarse Sand	7		
612.1	12 12		15
Gray Massive Shale (Bedrock) -25	7		
	13 16		11
	13		
	17 24		10
606.6 -30			
Borehole continued with rock coring.			
-35			
-40			

An assumed centerline elevation of 100.00 and station of 10+00 is used when this information is not available.

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

ROCK CORE LOG

Date 4/29/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**, GPS:

COUNTY Vermilion **CORING METHOD** Rotary Core With Water Flush

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 1 North Abut.
Station 50+29
Offset 7.80ft Rt.
Ground Surface Elev. 636.6 **ft**

CORING BARREL TYPE & SIZE BWD4
Core Diameter 1.6 **in**
Top of Rock Elev. 612.10 **ft**
Begin Core Elev. 602.10 **ft**

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray Massive Shale 606.60						
	-35	1	0	0	8	
(10% Moisture)	-40	2	38	35	6	12
(9% Moisture) 591.60	-45	3	64	54	2	14
Begin Wash Bore	-50					

Color pictures of the cores No
Cores will be stored for examination until Job Completion
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

ROCK CORE LOG

Date 4/29/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**, GPS:

COUNTY Vermilion **CORING METHOD** Rotary Core With Water Flush

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 1 North Abut.
Station 50+29
Offset 7.80ft Rt.
Ground Surface Elev. 636.6 **ft**

CORING BARREL TYPE & SIZE BWD4
Core Diameter 1.6 **in**
Top of Rock Elev. 612.10 **ft**
Begin Core Elev. 602.10 **ft**

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray Massive Shale *(continued)*					
584.10					
Void - Lost Circulation					
-55					
-60					
-65					
-70					

Color pictures of the cores No
Cores will be stored for examination until Job Completion
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

ROCK CORE LOG

Date 4/29/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**, GPS:

COUNTY Vermilion **CORING METHOD** Rotary Core With Water Flush

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 1 North Abut.
Station 50+29
Offset 7.80ft Rt.
Ground Surface Elev. 636.6 ft

CORING BARREL TYPE & SIZE BWD4
Core Diameter 1.6 in
Top of Rock Elev. 612.10 ft
Begin Core Elev. 602.10 ft

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Void - Lost Circulation *(continued)*					
563.60					
Void - Minor Resistance in Drilling					
-75					
556.60 -80					
End of Boring					
-85					
-90					

Color pictures of the cores No
Cores will be stored for examination until Job Completion
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

BBS, form 138 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
IDOT - Region 3/Dist 5

SOIL BORING LOG

Date 4/30/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**

COUNTY Vermilion **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Automatic

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 2 Median
Station 52+15
Offset 25.0 ft Rt.
Ground Surface Elev. 615.1 ft

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

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

		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray/Brown Mottled Silty Clay Loam	615.1				
	611.1		1		
Gray Massive Shale			2		14
		-5	8		
	605.1	-10			
Borehole continued with rock coring.					
		-15			
		-20			

An assumed centerline elevation of 100.00 and station of 10+00 is used when this information is not available.

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
Illinois Department of Transportation

ROCK CORE LOG

Date 4/30/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**, GPS:

COUNTY Vermilion **CORING METHOD** Rotary Core With Water Flush

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 2 Median
Station 52+15
Offset 25.00ft Rt.
Ground Surface Elev. 615.1 ft

CORING BARREL TYPE & SIZE BWD4
Core Diameter 1.6 in
Top of Rock Elev. 610.60 ft
Begin Core Elev. 600.60 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray Massive Shale 605.10						
	-15	1	0	0	6	
(9% Moisture)	-20	2	46	37	5	9
(9% Moisture)	-25	3	36	10	16	12
(10% Moisture)	-30	4	100	82	6	18

Color pictures of the cores No
Cores will be stored for examination until Job Completion
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

ROCK CORE LOG

Date 4/30/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**, GPS:

COUNTY Vermilion **CORING METHOD** Rotary Core With Water Flush

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 2 Median
Station 52+15
Offset 25.00ft Rt.
Ground Surface Elev. 615.1 ft

CORING BARREL TYPE & SIZE BWD4
Core Diameter 1.6 in
Top of Rock Elev. 610.60 ft
Begin Core Elev. 600.60 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray Massive Shale *(continued)*						
(12% Moisture)	-35	5	40	40	4	8
Core Stuck in Sampler - Core Destroyed During Removal	575.10 -40	6	0	0	5	
End of Boring	-45					
	-50					

Color pictures of the cores No
Cores will be stored for examination until Job Completion
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Illinois Department of Transportation
Division of Highways
IDOT - Region 3/Dist 5

SOIL BORING LOG

Date 5/9/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**

COUNTY Vermilion **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Automatic

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 3 South Abut.
Station 53+95
Offset 6.0 ft Lt.
Ground Surface Elev. 636.1 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 621.1 ft
Upon Completion Wash Bore ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Brown Sandy Loam 636.1			
	2		
-5	3 4	2.1 B	21
	2		
	3 4	1.4 B	13
	1		
-10	3 5	2.9 B	13
	2		
623.6	3 5	4.1 B	13
Gray / Brown Sandy Loam			
	1		
▼-15	2 2	1.4 B	11
620.6			
Dirty Coarse Sandy Gravel	4		
619.1	7 12		
Gray / Brown Sandy Clay Loam Till			
	17		
-20	25 20	8.7 S	9

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
615.6			
Gray Massive Shale	6		
	9 14	5.2 S	17
	6		
	11 16	5.4 B	16
611.1 -25			
Borehole continued with rock coring.			
-30			
-35			
-40			

An assumed centerline elevation of 100.00 and station of 10+00 is used when this information is not available.

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

ROCK CORE LOG

Date 5/9/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**, GPS:

COUNTY Vermilion **CORING METHOD** Rotary Core With Water Flush

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 3 South Abut.
Station 53+95
Offset 6.00ft Lt.
Ground Surface Elev. 636.1 ft

CORING BARREL TYPE & SIZE BWD4
Core Diameter 1.6 in
Top of Rock Elev. 615.60 ft
Begin Core Elev. 606.60 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray Massive Shale	611.10						
(17% Moisture)		-30	1	16	16	1.5	2
(11% Moisture)		-35	2	70	59	1.5	3
(11% Moisture)	596.10	-40	3	80	64	1.5	9
Begin Wash Bore		-45					

Color pictures of the cores No
Cores will be stored for examination until Job Completion
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

ROCK CORE LOG

Date 5/9/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**, GPS:

COUNTY Vermilion **CORING METHOD** Rotary Core With Water Flush

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 3 South Abut.
Station 53+95
Offset 6.00ft Lt.
Ground Surface Elev. 636.1 ft

CORING BARREL TYPE & SIZE BWD4
Core Diameter 1.6 in
Top of Rock Elev. 615.60 ft
Begin Core Elev. 606.60 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray Massive Shale *(continued)*						
Drilled Stiffer	-50					
	-55					
	579.10					
Gray Shale with Coal Seams	576.10 -60					
Gray Shale	574.10					
Black Coal	-65					

Color pictures of the cores No
Cores will be stored for examination until Job Completion
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

ROCK CORE LOG

Date 5/9/03

ROUTE FAI-74 **DESCRIPTION** Tilton Road over I-74 **LOGGED BY** CNA

SECTION (91-11HB-4)BR **LOCATION** SE, **SEC.** 18, **TWP.** 19N, **RNG.** 11W, 2nd **PM**, GPS:

COUNTY Vermilion **CORING METHOD** Rotary Core With Water Flush

STRUCT. NO. 092-0087
Station 52+12.89 (Tilton Rd.)

BORING NO. 3 South Abut.
Station 53+95
Offset 6.00ft Lt.
Ground Surface Elev. 636.1 ft

CORING BARREL TYPE & SIZE BWD4
Core Diameter 1.6 in
Top of Rock Elev. 615.60 ft
Begin Core Elev. 606.60 ft

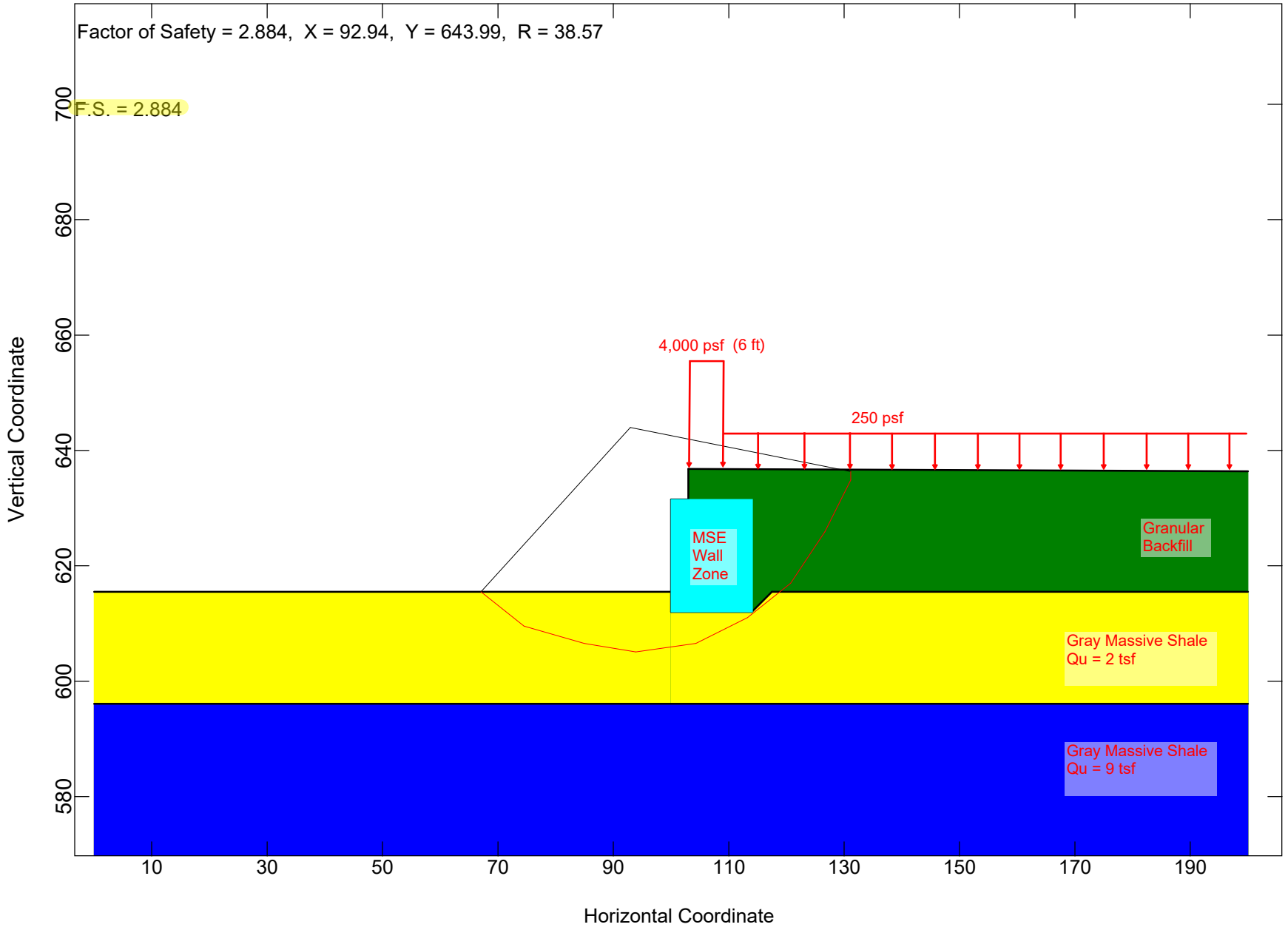
	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Black Coal *(continued)*						
569.10						
Gray Shale & Coal Mixed	-70					
561.10	-75					
End of Boring	-80					
	-85					

Color pictures of the cores No
Cores will be stored for examination until Job Completion
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

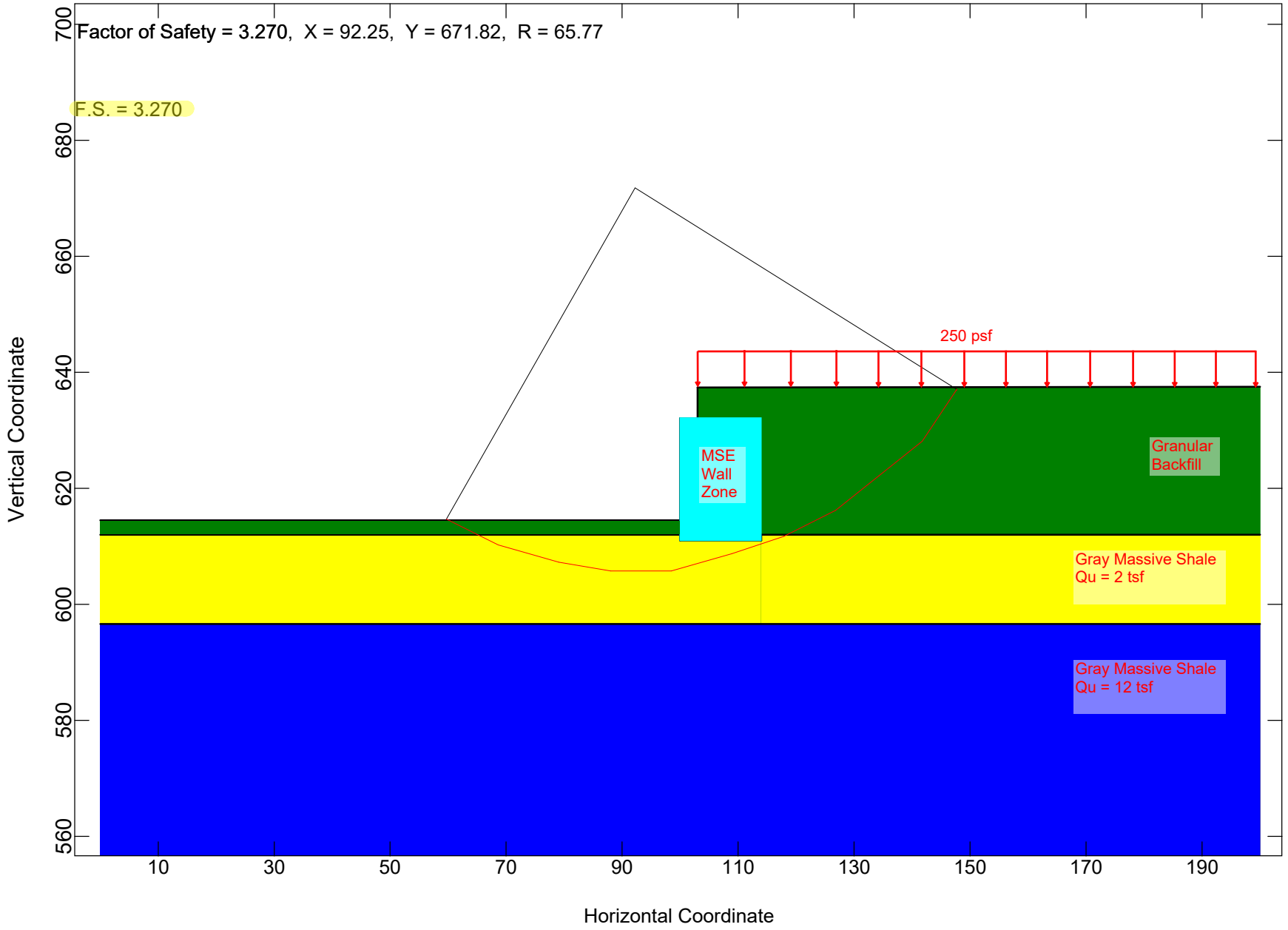
Appendix E

Global Stability Analysis

Slope Stability - Tilton Rd. over I-74, South Abutment, Spread Footing Conditions



Slope Stability - Tilton Rd. over I-74, North Abutment



Appendix F

Seismic Site Class Determination

Illinois Department of Transportation

SEISMIC SITE CLASS DETERMINATION

PROJECT TITLE=====Tilton Rd over I-74

Substructure 1

Base of Substruct. Elev. (or ground surf for bents	631.51	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-1	
Top of Boring Elev.	636.6	ft.
Approximate Fixity Elev.	625.51	ft.

Individual Site Class Definition:

N (bar):	54 (Blows/ft.)	Soil Site Class C	
N_{ch} (bar):	79 (Blows/ft.)	Soil Site Class C	<----Controls
s_u (bar):	4.63 (ksf)	Soil Site Class C	

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	635.1	1.50	5	2.10	
	632.6	2.50	5	2.10	
	630.1	2.50	5	2.10	B
	626.6	3.50	4	0.80	
1.4	624.1	2.50	11	1.60	
3.9	621.6	2.50	16	3.10	B
6.9	618.6	3.00	7	2.60	B
8.9	616.6	2.00	35		
10.9	614.6	2.00	35		B
13.4	612.1	2.50	34		B
15.4	610.1	2.00	24		
17.4	608.1	2.00	29		
18.9	606.6	1.50	41		B
102.0	523.5	83.10	100	5.00	R

Substructure 2

Base of Substruct. Elev. (or ground surf for bents	610	ft.
Pile or Shaft Dia.		inches
Boring Number	B-2	
Top of Boring Elev.	615.1	ft.
Approximate Fixity Elev.	610	ft.

Individual Site Class Definition:

N (bar):	69 (Blows/ft.)	Soil Site Class C	<----Controls
N_{ch} (bar):	69 (Blows/ft.)	Soil Site Class C	
s_u (bar):	(ksf)	NA, H < 0.1*H (Soil)	

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	613.1	2.00	10		
	611.1	2.00	10		B
1.9	608.1	3.00	10		
4.9	605.1	3.00	10		B
100.0	510.0	95.10	100	5.00	R

Substructure 3

Base of Substruct. Elev. (or ground surf for bents	629.72	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-3	
Top of Boring Elev.	636.1	ft.
Approximate Fixity Elev.	623.72	ft.

Individual Site Class Definition:

N (bar):	51 (Blows/ft.)	Soil Site Class C	
N_{ch} (bar):	93 (Blows/ft.)	Soil Site Class C	
s_u (bar):	2.08 (ksf)	Soil Site Class C	<----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	633.6	2.50	7		
	631.1	2.50	7	2.10	
	628.6	2.50	7	1.40	
	626.1	2.50	8	2.90	
0.1	623.6	2.50	8	4.10	B
3.1	620.6	3.00	4	1.40	B
4.6	619.1	1.50	19		B
8.1	615.6	3.50	45	5.00	B
10.6	613.1	2.50	23	5.00	
12.6	611.1	2.00	27	5.00	B
99.7	524.0	87.10	100	2.00	R

Substructure 4

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.
Approximate Fixity Elev.		ft.

Individual Site Class Definition:

N (bar):	(Blows/ft.)	NA	
N_{ch} (bar):	(Blows/ft.)	NA	
s_u (bar):	(ksf)	NA	

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

Global Site Class Definition: Substructures 1 through 3

N (bar):	58 (Blows/ft.)	Soil Site Class C	
N_{ch} (bar):	80 (Blows/ft.)	Soil Site Class C	<----Controls
s_u (bar):	3.87 (ksf)	Soil Site Class C	

Appendix G

Driven Pile Analysis

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment
REFERENCE BORING ========== 3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 631.72 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 612.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 612.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 612.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 160.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 60.00 KIPS

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
418 KIPS	**382** KIPS	**210** KIPS	**25** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area========= 0.108 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
611.75	0.25			Shale	12.4		134.8	18.1		***31.5***	31	0	0	17	20
610.75	1.00			Shale	49.4	122.5	184.3	72.3	13.4	***103.7***	104	0	0	57	21
609.75	1.00			Shale	49.4	122.5	233.7	72.3	13.4	***176.0***	176	0	0	97	22
608.75	1.00			Shale	49.4	122.5	283.1	72.3	13.4	***248.2***	248	0	0	137	23
607.75	1.00			Shale	49.4	122.5	332.5	72.3	13.4	***320.5***	320	0	0	176	24
606.75	1.00			Shale	49.4	122.5	***381.9***	72.3	13.4	392.7	382	0	0	210	25
605.75	1.00			Shale	49.4	122.5	***431.3***	72.3	13.4	465.0	~~431~~	~~0~~	~~0~~	~~237~~	~~26~~
604.75	1.00			Shale	49.4	122.5	***480.7***	72.3	13.4	537.2	~~481~~	~~0~~	~~0~~	~~264~~	~~27~~
603.75	1.00			Shale	49.4	122.5	***530.2***	72.3	13.4	609.5	~~530~~	~~0~~	~~0~~	~~292~~	~~28~~
602.75	1.00			Shale		122.5			13.4						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment
REFERENCE BORING ========== 3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 631.72 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 612.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 612.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 612.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 160.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 60.00 KIPS

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
664 KIPS	**552** KIPS	**304** KIPS	*** Below Boring

PILE TYPE AND SIZE ========== Steel HP 12 X 84
Plugged Pile Perimeter========== 4.100 FT. Unplugged Pile Perimeter========== 5.942 FT.
Plugged Pile End Bearing Area========== 1.051 SQFT. Unplugged Pile End Bearing Area========= 0.171 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
611.75	0.25			Shale	12.8		143.6	18.5		***39.8***	40	0	0	22	20
610.75	1.00			Shale	51.1	130.9	194.7	74.0	21.3	***113.8***	114	0	0	63	21
609.75	1.00			Shale	51.1	130.9	245.8	74.0	21.3	***187.8***	188	0	0	103	22
608.75	1.00			Shale	51.1	130.9	296.9	74.0	21.3	***261.8***	262	0	0	144	23
607.75	1.00			Shale	51.1	130.9	347.9	74.0	21.3	***335.8***	336	0	0	185	24
606.75	1.00			Shale	51.1	130.9	***399.0***	74.0	21.3	409.9	399	0	0	219	25
605.75	1.00			Shale	51.1	130.9	***450.1***	74.0	21.3	483.9	450	0	0	248	26
604.75	1.00			Shale	51.1	130.9	***501.2***	74.0	21.3	557.9	501	0	0	276	27
603.75	1.00			Shale	51.1	130.9	***552.2***	74.0	21.3	631.9	552	0	0	304	28
602.75	1.00			Shale		130.9			21.3						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment
REFERENCE BORING ========== 3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 631.72 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 612.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 612.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 612.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 160.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 60.00 KIPS

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
578 KIPS	**538** KIPS	**296** KIPS	**26** FT.

PILE TYPE AND SIZE ========== Steel HP 14 X 73
Plugged Pile Perimeter========== 4.700 FT. Unplugged Pile Perimeter========== 6.975 FT.
Plugged Pile End Bearing Area========== 1.379 SQFT. Unplugged Pile End Bearing Area========= 0.149 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
611.75	0.25			Shale	14.6		186.4	21.7		***40.2***	40	0	0	22	20
610.75	1.00			Shale	58.5	171.8	245.0	86.9	18.5	***127.1***	127	0	0	70	21
609.75	1.00			Shale	58.5	171.8	303.5	86.9	18.5	***214.0***	214	0	0	118	22
608.75	1.00			Shale	58.5	171.8	362.1	86.9	18.5	***300.9***	301	0	0	165	23
607.75	1.00			Shale	58.5	171.8	420.6	86.9	18.5	***387.8***	388	0	0	213	24
606.75	1.00			Shale	58.5	171.8	479.2	86.9	18.5	***474.7***	475	0	0	261	25
605.75	1.00			Shale	58.5	171.8	***537.7***	86.9	18.5	561.6	538	0	0	296	26
604.75	1.00			Shale	58.5	171.8	***596.2***	86.9	18.5	648.5	~~596~~	~~0~~	~~0~~	~~328~~	~~27~~
603.75	1.00			Shale	58.5	171.8	***654.8***	86.9	18.5	735.3	~~655~~	~~0~~	~~0~~	~~360~~	~~28~~
602.75	1.00			Shale		171.8			18.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment
REFERENCE BORING ========== 3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 631.72 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 612.00 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 612.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 612.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 160.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 60.00 KIPS

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
929 KIPS	**681** KIPS	**375** KIPS	*** Below Boring

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area========= 0.239 SQFT.

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 UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
611.75	0.25			Shale	15.1		198.1	22.2		***51.9***	52	0	0	29	20
610.75	1.00			Shale	60.4	183.0	258.6	88.7	29.8	***140.6***	141	0	0	77	21
609.75	1.00			Shale	60.4	183.0	319.0	88.7	29.8	***229.2***	229	0	0	126	22
608.75	1.00			Shale	60.4	183.0	379.4	88.7	29.8	***317.9***	318	0	0	175	23
607.75	1.00			Shale	60.4	183.0	439.8	88.7	29.8	***406.5***	407	0	0	224	24
606.75	1.00			Shale	60.4	183.0	500.2	88.7	29.8	***495.2***	495	0	0	272	25
605.75	1.00			Shale	60.4	183.0	***560.6***	88.7	29.8	583.8	561	0	0	308	26
604.75	1.00			Shale	60.4	183.0	***621.1***	88.7	29.8	672.5	621	0	0	342	27
603.75	1.00			Shale	60.4	183.0	***681.5***	88.7	29.8	761.2	681	0	0	375	28
602.75	1.00			Shale		183.0			29.8						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== 1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 632.51 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 610.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 610.50 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 160.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 60.00 KIPS

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
418 KIPS	**370** KIPS	**203** KIPS	**27** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area========= 0.108 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
609.50	1.00			Shale	49.4		171.9	72.3		***85.7***	86	0	0	47	23
608.50	1.00			Shale	49.4	122.5	221.3	72.3	13.4	***157.9***	158	0	0	87	24
607.50	1.00			Shale	49.4	122.5	270.7	72.3	13.4	***230.2***	230	0	0	127	25
606.50	1.00			Shale	49.4	122.5	320.1	72.3	13.4	***302.4***	302	0	0	166	26
605.50	1.00			Shale	49.4	122.5	***369.6***	72.3	13.4	374.7	370	0	0	203	27
604.50	1.00			Shale	49.4	122.5	***419.0***	72.3	13.4	446.9	~~419~~	~~0~~	~~0~~	~~230~~	~~28~~
603.50	1.00			Shale	49.4	122.5	***468.4***	72.3	13.4	519.2	~~468~~	~~0~~	~~0~~	~~258~~	~~29~~
602.50	1.00			Shale	49.4	122.5	***517.8***	72.3	13.4	591.4	~~518~~	~~0~~	~~0~~	~~285~~	~~30~~
601.50	1.00			Shale	49.4	122.5	***567.2***	72.3	13.4	663.7	~~567~~	~~0~~	~~0~~	~~312~~	~~31~~
600.50	1.00			Shale		122.5			13.4						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== 1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 632.51 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 610.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 610.50 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 160.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 60.00 KIPS

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
664 KIPS	**591** KIPS	**325** KIPS	*** Below Boring

PILE TYPE AND SIZE ========== Steel HP 12 X 84
Plugged Pile Perimeter========== 4.100 FT. Unplugged Pile Perimeter========== 5.942 FT.
Plugged Pile End Bearing Area========== 1.051 SQFT. Unplugged Pile End Bearing Area========= 0.171 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
609.50	1.00			Shale	51.1		182.0	74.0		***95.3***	95	0	0	52	23
608.50	1.00			Shale	51.1	130.9	233.0	74.0	21.3	***169.3***	169	0	0	93	24
607.50	1.00			Shale	51.1	130.9	284.1	74.0	21.3	***243.3***	243	0	0	134	25
606.50	1.00			Shale	51.1	130.9	335.2	74.0	21.3	***317.3***	317	0	0	175	26
605.50	1.00			Shale	51.1	130.9	***386.2***	74.0	21.3	391.4	386	0	0	212	27
604.50	1.00			Shale	51.1	130.9	***437.3***	74.0	21.3	465.4	437	0	0	241	28
603.50	1.00			Shale	51.1	130.9	***488.4***	74.0	21.3	539.4	488	0	0	269	29
602.50	1.00			Shale	51.1	130.9	***539.5***	74.0	21.3	613.4	539	0	0	297	30
601.50	1.00			Shale	51.1	130.9	***590.5***	74.0	21.3	687.4	591	0	0	325	31
600.50	1.00			Shale		130.9			21.3						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== 1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 632.51 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 610.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 610.50 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 160.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 60.00 KIPS

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
578 KIPS	**523** KIPS	**288** KIPS	**28** FT.

PILE TYPE AND SIZE ========== Steel HP 14 X 73
Plugged Pile Perimeter========== 4.700 FT. Unplugged Pile Perimeter========== 6.975 FT.
Plugged Pile End Bearing Area========== 1.379 SQFT. Unplugged Pile End Bearing Area========= 0.149 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			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.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
609.50	1.00			Shale	58.5		230.3	86.9		***105.4***	105	0	0	58	23
608.50	1.00			Shale	58.5	171.8	288.9	86.9	18.5	***192.3***	192	0	0	106	24
607.50	1.00			Shale	58.5	171.8	347.4	86.9	18.5	***279.2***	279	0	0	154	25
606.50	1.00			Shale	58.5	171.8	406.0	86.9	18.5	***366.1***	366	0	0	201	26
605.50	1.00			Shale	58.5	171.8	464.5	86.9	18.5	***453.0***	453	0	0	249	27
604.50	1.00			Shale	58.5	171.8	***523.1***	86.9	18.5	539.8	523	0	0	288	28
603.50	1.00			Shale	58.5	171.8	***581.6***	86.9	18.5	626.7	~~582~~	~~0~~	~~0~~	~~320~~	~~29~~
602.50	1.00			Shale	58.5	171.8	***640.2***	86.9	18.5	713.6	~~640~~	~~0~~	~~0~~	~~352~~	~~30~~
601.50	1.00			Shale	58.5	171.8	***698.7***	86.9	18.5	800.5	~~699~~	~~0~~	~~0~~	~~384~~	~~31~~
600.50	1.00			Shale		171.8			18.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== 1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 632.51 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 610.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 610.50 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 160.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 60.00 KIPS

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
929 KIPS	**727** KIPS	**400** KIPS	*** Below Boring

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area========= 0.239 SQFT.

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 UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D 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.)
609.50	1.00			Shale	60.4		243.5	88.7		***118.4***	118	0	0	65	23
608.50	1.00			Shale	60.4	183.0	303.9	88.7	29.8	***207.1***	207	0	0	114	24
607.50	1.00			Shale	60.4	183.0	364.3	88.7	29.8	***295.7***	296	0	0	163	25
606.50	1.00			Shale	60.4	183.0	424.7	88.7	29.8	***384.4***	384	0	0	211	26
605.50	1.00			Shale	60.4	183.0	485.1	88.7	29.8	***473.0***	473	0	0	260	27
604.50	1.00			Shale	60.4	183.0	***545.5***	88.7	29.8	561.7	546	0	0	300	28
603.50	1.00			Shale	60.4	183.0	***606.0***	88.7	29.8	650.3	606	0	0	333	29
602.50	1.00			Shale	60.4	183.0	***666.4***	88.7	29.8	739.0	666	0	0	367	30
601.50	1.00			Shale	60.4	183.0	***726.8***	88.7	29.8	827.6	727	0	0	400	31
600.50	1.00			Shale		183.0			29.8						

Appendix H

Drilled Shaft Analysis

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN SHALE < 100 KSF

STRUCTURE ========== SN 092-0204
SUBSTRUCTURE & REFERENCE BORING ==== S. Abutment - Boring #3

ESTIMATED TOP OF SHALE ELEVATION ===== 612.00 FT
DRILLED SHAFT DIAMETER IN SHALE ======= 48 IN.
FACTORED AXIAL LOAD ================== 1100 KIPS

DRILLED SHAFT DIA.'S FOR DESIGN TABLE

24	IN.
30	IN.
36	IN.
48	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	NOMINAL SIDE RESIST. (KIPS)	CUMULATIVE SIDE RESIST. (KIPS)	DEPTH CORR. FACTORS k	DEPTH CORR. FACTORS d_c	NOMINAL TIP RESIST. (KIPS)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RANGE OF SERVICE LOADING AND CORRESPONDING SETTLEMENT: LOAD (KIPS)	SETTLEMENT (IN.)	LOAD (KIPS)	SETTLEMENT (IN.)
5.00	607.00	5.00	10.8	4.8	210	210	0.896	1.18	211	422	211	100	0.10	170	0.18
10.00	602.00	5.00	4.0	10.5	78	288	1.190	1.24	490	778	389	190	0.12	325	0.21
15.00	597.00	5.00	6.0	18.0	117	405	1.310	1.26	856	1262	631	300	0.12	550	0.24
20.00	592.00	5.00	18.0		351	756									
25.00	587.00	5.00	18.0		351	1106									

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN SHALE < 100 KSF

Drilled Shaft Design Table for S. Abutment - Boring #3

Estimated Top of Shale Elevation: 612.00

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL TOTAL SIDE RESIST. (KIPS)	NOMINAL TIP RESIST. (KIPS)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RANGE OF SERVICE LOADING AND CORRESPONDING SETTLEMENT			
						LOAD (KIPS)	SETTLEMENT (IN.)	LOAD (KIPS)	SETTLEMENT (IN.)
24 in. Diameter Drilled Shaft									
5	607	105	47	152	76	30	0.04	70	0.09
10	602	144	72	216	108	50	0.05	90	0.09
15	597	203	218	421	211	100	0.06	170	0.10
20	592	378	220	597	299	140	0.06	240	0.10
30 in. Diameter Drilled Shaft									
5	607	131	72	203	102	50	0.06	90	0.11
10	602	180	112	292	146	70	0.06	120	0.11
15	597	253	340	593	296	140	0.07	240	0.13
20	592	472	342	814	407	200	0.07	350	0.13
36 in. Diameter Drilled Shaft									
5	607	158	111	269	134	60	0.07	110	0.13
10	602	216	213	429	215	100	0.08	180	0.14
15	597	304	487	790	395	190	0.09	325	0.16
48 in. Diameter Drilled Shaft									
5	607	210	211	422	211	100	0.10	170	0.18
10	602	288	490	778	389	190	0.12	325	0.21
15	597	405	856	1262	631	300	0.12	550	0.24

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN SHALE < 100 KSF

STRUCTURE ========== SN 092-0204
SUBSTRUCTURE & REFERENCE BORING ==== N. Abutment - Boring #1

ESTIMATED TOP OF SHALE ELEVATION ===== 610.50 FT
DRILLED SHAFT DIAMETER IN SHALE ======= 48 IN.
FACTORED AXIAL LOAD ================== 1100 KIPS

DRILLED SHAFT DIA.'S FOR DESIGN TABLE

24	IN.
30	IN.
36	IN.
48	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	NOMINAL SIDE RESIST. (KIPS)	CUMULATIVE SIDE RESIST. (KIPS)	DEPTH CORR. FACTORS k	DEPTH CORR. FACTORS d_c	NOMINAL TIP RESIST. (KIPS)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RANGE OF SERVICE LOADING AND CORRESPONDING SETTLEMENT LOAD (KIPS)	SETTLEMENT (IN.)	LOAD (KIPS)	SETTLEMENT (IN.)
5.00	605.50	5.00	2.0	2.0	39	39	0.896	1.18	89	128	64	30	0.12	60	0.25
10.00	600.50	5.00	2.0	13.0	39	78	1.190	1.24	607	685	342	170	0.15	275	0.26
14.00	596.50	4.00	2.0	25.5	31	109	1.292	1.26	1210	1319	659	325	0.16	550	0.30
15.00	595.50	1.00	24.0	26.0	93	203	1.310	1.26	1237	1440	720	350	0.15	600	0.28
19.00	591.50	4.00	24.0		374	577									
20.00	590.50	1.00	28.0		109	686									
24.00	586.50	4.00	28.0		436	1122									
26.50	584.00	2.50	28.0		273	1395									

Drilled Shaft Design Table for N. Abutment - Boring #1

Estimated Top of Shale Elevation: 610.50

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL TOTAL SIDE RESIST. (KIPS)	NOMINAL TIP RESIST. (KIPS)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RANGE OF SERVICE LOADING AND CORRESPONDING SETTLEMENT			
						LOAD (KIPS)	SETTLEMENT (IN.)	LOAD (KIPS)	SETTLEMENT (IN.)
24 in. Diameter Drilled Shaft									
5	605.5	19	23	43	21	10	0.05	20	0.11
10	600.5	39	24	63	31	10	0.03	30	0.10
14	596.5	55	291	345	173	80	0.07	140	0.14
15	595.5	101	291	393	196	90	0.07	160	0.12
19	591.5	288	341	630	315	150	0.07	275	0.12
20	590.5	343	342	684	342	170	0.07	275	0.11
30 in. Diameter Drilled Shaft									
5	605.5	24	36	60	30	10	0.05	30	0.15
10	600.5	49	119	168	84	40	0.08	70	0.14
14	596.5	68	452	520	260	130	0.10	210	0.17
15	595.5	127	468	594	297	140	0.09	240	0.16
19	591.5	360	531	891	446	220	0.08	375	0.15
20	590.5	429	532	960	480	240	0.08	400	0.14
36 in. Diameter Drilled Shaft									
5	605.5	29	51	80	40	20	0.09	40	0.19
10	600.5	58	249	307	153	70	0.09	130	0.19
14	596.5	82	665	747	374	180	0.11	300	0.21
15	595.5	152	685	837	418	200	0.11	350	0.20
19	591.5	432	762	1194	597	275	0.09	500	0.18
20	590.5	514	763	1277	638	300	0.09	550	0.18
48 in. Diameter Drilled Shaft									
5	605.5	39	89	128	64	30	0.12	60	0.25
10	600.5	78	607	685	342	170	0.15	275	0.26
14	596.5	109	1210	1319	659	325	0.16	550	0.30
15	595.5	203	1237	1440	720	350	0.15	600	0.28