# STRUCTURE GEOTECHNICAL REPORT

## FAU 6578– Over FAI 474

Existing SN 072-0126
Proposed SN 072-0254

**FAU 6578**
**SECTION 72-3HB-4**
**PEORIA COUNTY, ILLINOIS**
**JOB NO. P-94-037-12**
**PTB 194/035**
**KEG NO. 20-1019.05**

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**August 10, 2021**
**Revised May 4, 2022**

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05/04/2022
Exp. 11/30/2023

Kaskaskia
Engineering Group, LLC

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Exhibit C – Type, Size, and Location Plan (TS&L)
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Exhibit E – Subsurface Profile
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## 1.0 Project Description and Scope

### 1.1 Introduction

The geotechnical study summarized in this report was performed by Kaskaskia Engineering Group, LLC (KEG) for a proposed bridge carrying South Airport Road (FAU 6578) over I-474 in Peoria County, Illinois. The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to present design and construction recommendations for the proposed structure.

### 1.2 Project Description

The project consists of the replacement of a two-span steel girder bridge (SN 072-0126) carrying South Airport Road (FAU 6578) over I-474 in Peoria County, Illinois.

The general location of the proposed structure is shown on a Location Map, Exhibit A. The project is located approximately 0.5 miles northeast of the Greater Peoria Airport and 1.15 miles south of the intersection IL 116/FAI 474 on Airport Road (FAU 6578). The site lies within the limits of the Fourth Principal Meridian (T. 8N R. 7E) within the Bloomington Ridged Plain of the Till Plains Section of the Central Lowland Province.

### 1.3 Proposed Structure Information

The proposed structure will consist of a two-span steel girder bridge, which will be built on a $9^o$-03’45” skew and will provide 12 ft.-wide driving lanes, 10 ft.-wide shoulders, and a 22 ft.-wide median with a total width of 92 ft. -10-inches out-to-out. The proposed bridge centerline station will be at 194+48.04 on Airport Road. The bridge will consist of two spans; 123’-6” and 128’-6” and will measure 252 ft. back-to-back of abutments. A Type, Size, and Location Plan (TS&L) is included in Exhibit C.

Further substructure details will be based on the findings of this Structure Geotechnical Report (SGR).

## 2.0 Field Exploration

### 2.1 Subsurface Exploration and Testing

The site exploration plan was developed by IDOT and completed by Terracon. Four standard penetration test (SPT) borings, designated SB-1, SB-2, SB-3, and SB-4 were drilled from July 7 through July 9, 2020. Boring Locations are shown on Exhibit B – Boring Plan. Detailed information regarding the nature and thickness of the soils encountered and the results of the field sampling and laboratory testing are shown on the Boring Logs, Exhibit D. The soil profile for the above mentioned borings can be found in Subsurface Profile, Exhibit E.

### 2.2 Subsurface Conditions

Table 2.2.1 shows the depth below the ground surface elevation (GSE) where each boring was terminated and the estimated GSE.

**Table 2.2.1 – Borings Depths and GSE**

| Boring | Depth (ft) | Ground Surface Elevation (ft) |
|---|---|---|
| SB-1 | 37.5 | 640.02 |
| SB-2 | 40 | 638.63 |
| SB-3 | 22.5 | 616.62 |
| SB-4 | 27.5 | 617.68 |

In general the borings included a mix of the following soil types: clays, silts, sands, loam, shale, and sandstone. A Summary of the general condition of the subsurface is described in Table 2.2.2.

**Table 2.2.2 – Subsurface Profile Summary**

| Soil Type | N-Values (bpf) | $Q_u$ (tsf) | WC (%) | Boring |
|---|---|---|---|---|
| **Clay Loam Fill** | 0 to 10 | - | 17 | SB-1, SB-2, SB-3 |
| **Clay Loam** | 4 to 38 | 0.3 to 3.3 | 12 to 26 | SB-3, SB-4 |
| **Silty Clay Loam** | 3 to 12 | 0.2 to 1.4 | 21 to 28 | SB-1, SB-2 |
| **Sandy Clay Loam** | 50/1” | - | 20 | SB-2 |
| **Sandy Loam** | 50/1” to 50/5” | - | 13 to 17 | SB-3, SB-4 |
| **Shale** | 50/2” to 50/3” | 1.6 | 14 to 18 | SB-1, SB-3 |
| **Sandstone** | 50/1” to 50/3” | - | 15 to 21 | SB-1, SB-2 |

Groundwater was encountered in Boring SB-4 at 17.5 ft. below GSE at an elevation of El. 600.2 ft. It should be noted that the groundwater level is subject to seasonal and climatic variations. In addition, without extended periods of observation, measurement of true groundwater levels may not be possible. Bedrock was encountered in all four borings.

## 3.0 Geotechnical Evaluations

### 3.1 Settlement

Since no significant grading or changes to the existing embankments are expected at the proposed structure, it is estimated that the existing embankments will experience no settlement. Therefore, no settlement calculations were performed for the proposed structure.

### 3.2 Slope Stability

A stability analysis using SLOPE/W was performed using the proposed roadway and bridge geometry on the TS&L and soil characteristics from Boring SB-1 and SB-2. Two conditions were modeled for each scenario: end-of-construction and long-term stability. A critical factor of safety (FOS) was calculated for each condition. According to current standard of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability. The slope stability analyses indicated that the required minimum FOS for all conditions were met.

In order to model the end-of-construction condition, full cohesion and a friction angle of 0 degrees were assumed. Nominal values for cohesion were used with full friction angle to model the long-term condition to analyze the theoretical condition where pore water pressure has dissipated. Nominal value was 100 psf for the cohesive soils, with friction angles between 28 and 30 degrees.

The Bishop Circular Method, which generates circular-shaped failure surfaces, was used to calculate the critical failure surfaces and FOS for the proposed conditions. The FOS obtained in the analysis is shown in Table 3.2. SLOPE/W program output from this analysis can be found in SLOPE/W Slope Stability Analysis, Exhibit F.

**Table 3.2 – Slope Stability Critical FOS**

| Location (2H:1V Slope) | Critical FOS | |
|---|---|---|
| | End-of Construction | Long Term |
| South Abutment | 2.2 | 1.6 |
| North Abutment | 3.1 | 1.6 |

## 3.3 Scour

The proposed structure will not cross a river or other tributary; therefore, scour is not an issue.

## 3.4 Seismic Considerations

The determination of Seismic Site Class was based on the method described by IDOT AGMU Memo 09.1 - Seismic Site Class Definition and the IDOT provided spreadsheet titled: '*Seismic Site Class Determination*.' Using these resources, the controlling global site class for this project is Soil Site Class D.

Additional seismic parameters were calculated for use in design of the structure. Published information and mapping from the USGS, including software directly applicable to the AASHTO Guide Specifications for LRFD Seismic Bridge Design, was used to develop the parameters for the bridge location. The values, based on Soil Site Class D, are summarized below.

**Table 3.4 - Summary of Seismic Parameters**

| Parameter | Value |
|---|---|
| Soil Site Class | D |
| Spectral Response Acceleration, 0.2 Sec, $S_{DS}$ | 0.176g (Site Class D) |
| Spectral Response Acceleration, 1.0 Sec, $S_{D1}$ | 0.113g (Site Class D) |
| Seismic Performance Zone | 1 |

As indicated in the table above, the Seismic Performance Zone is 1, based on $S_{D1}$ and Table 3.15.2 in the IDOT Bridge Manual, the Soil Site Class D, and Figure 2.3.10-2 in the IDOT Bridge Manual.

## 4.0 Foundation Evaluations and Design Recommendations

## 4.1 Bearing Resistance

The soil encountered in the borings at the anticipated bearing elevation of the pier and working platform consists of a sandy loam that transitions into a highly weathered sandstone. The bearing elevation of the existing pier ranges from 601.5 to 608.25. Assuming the existing pier is replaced in-kind, or to the deepest elevation of El 601.5; the soil characteristics from Boring SB-4 at the assumed bearing elevation has an approximate cohesion value of 3,300 psf. The allowable bearing resistance, using AASHTO LRFD methods with a Bearing Resistance Factor of 0.5, at the approximate bottom elevation of the replacement pier (El. 601.5), is estimated to be 9,100 psf. Sliding resistance is calculated as the lessor of the cohesion or one half of the vertical stress. See Exhibit G for calculations performed.

**Table 4.1 – Factored Bearing and Sliding Resistances**

| Substructure Unit | Factored Bearing Resistance (psf) | Factored Sliding Resistance (psf) |
|---|---|---|
| Pier 1 | 9,100 | 625 |

If the bearing elevation changes after final design, KEG should be informed to review that the above recommendations still apply.

## 4.2 Driven Piles

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads. The IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths (Pile Length/Pile Type, Exhibit H).

The preliminary design loads, as provided by The Upchurch Group are provided in Table 4.2 below.

**Table 4.2 - Preliminary Design Loads**

| Substructure Unit | Factored Reactions (kips) |
|---|---|
| South Abutment | 3,400 |
| Pier 1 | 7,200 |
| North Abutment | 3,400 |

The estimated pile lengths for the H-pile types are shown in Tables 4.2.1 thru 4.2.6 below. The Nominal Required Bearing ($R_N$) represents the resistance the pile will experience during driving, and will assist the contractor in selecting a proper hammer size. The Factored Resistance Available ($R_F$) documents the net long-term axial factored pile capacity available at the top of the pile to support factored substructure loadings.

### Table 4.2.1 - Estimated Pile Lengths for HP 10x42 Steel H-Piles

| Substructure Unit | $R_n$ Nominal Required Bearing (kips) | $R_F$ Factored Resistance Available (LRFD) (kips) | Estimated Pile Length (ft.) | Assumed Pile Cut-off Elevation (ft.) |
|---|---|---|---|---|
| South Abutment<br>SB-1 | 335 | 184 | 27 | 633.9 |
| Pier 1<br>SB-4 | 335 | 184 | 16 | 612.5 |
| North Abutment<br>SB-2 | 335 | 184 | 31 | 632.7 |

### Table 4.2.2 - Estimated Pile Lengths for HP 12x53 Steel H-Piles

| Substructure Unit | $R_n$ Nominal Required Bearing (kips) | $R_F$ Factored Resistance Available (LRFD) (kips) | Estimated Pile Length (ft.) | Assumed Pile Cut-off Elevation (ft.) |
|---|---|---|---|---|
| South Abutment<br>SB-1 | 418 | 230 | 27 | 633.9 |
| Pier 1<br>SB-4 | 418 | 230 | 16 | 612.5 |
| North Abutment<br>SB-2 | 418 | 230 | 31 | 632.7 |

### Table 4.2.3 - Estimated Pile Lengths for HP 12x63 Steel H-Piles

| Substructure Unit | $R_n$ Nominal Required Bearing (kips) | $R_F$ Factored Resistance Available (LRFD) (kips) | Estimated Pile Length (ft.) | Assumed Pile Cut-off Elevation (ft.) |
|---|---|---|---|---|
| South Abutment<br>SB-1 | 497 | 273 | 28 | 633.9 |
| Pier 1<br>SB-4 | 497 | 273 | 17 | 612.5 |
| North Abutment<br>SB-2 | 497 | 273 | 31 | 632.7 |

### Table 4.2.4 - Estimated Pile Lengths for HP 14x73 Steel H-Piles

| Substructure Unit | $R_n$ Nominal Required Bearing (kips) | $R_F$ Factored Resistance Available (LRFD) (kips) | Estimated Pile Length (ft.) | Assumed Pile Cut-off Elevation (ft.) |
|---|---|---|---|---|
| South Abutment<br>SB-1 | 578 | 318 | 28 | 633.9 |
| Pier 1<br>SB-4 | 578 | 318 | 17 | 612.5 |
| North Abutment<br>SB-2 | 578 | 318 | 31 | 632.7 |

### Table 4.2.5 - Estimated Pile Lengths for HP 14x89 Steel H-Piles

| Substructure Unit | $R_n$ Nominal Required Bearing (kips) | $R_F$ Factored Resistance Available (LRFD) (kips) | Estimated Pile Length (ft.) | Assumed Pile Cut-off Elevation (ft.) |
|---|---|---|---|---|
| South Abutment<br>SB-1 | 705 | 387 | 28 | 633.9 |
| Pier 1<br>SB-4 | 705 | 387 | 17 | 612.5 |
| North Abutment<br>SB-2 | 705 | 387 | 32 | 632.7 |

### Table 4.2.6 - Estimated Pile Lengths for HP 14x117 Steel H-Piles

| Substructure Unit | $R_n$ Nominal Required Bearing (kips) | $R_F$ Factored Resistance Available (LRFD) (kips) | Estimated Pile Length (ft.) | Assumed Pile Cut-off Elevation (ft.) |
|---|---|---|---|---|
| South Abutment<br>SB-1 | 929 | 511 | 30 | 633.9 |
| Pier 1<br>SB-4 | 929 | 511 | 19 | 612.5 |
| North Abutment<br>SB-2 | 929 | 511 | 34 | 632.7 |

As shown in the Tables above and in Pile Length/Pile Type, Exhibit H, downdrag and liquefaction have not been included at the substructure locations.

KEG recommends one test pile be performed, at a minimum. A test pile is performed prior to production driving so that actual, on-site field data can be gathered to determine pile driving requirements for the project. This also is the manner in which the contractor's proposed equipment and methodologies identified in their Pile Installation Plan can be assessed.

The piles are expected to be driven into penetrable shale and weathered sandstone and pre-coring should not be required to reach estimated embedment depths. KEG recommends using pile shoes to facilitate driving and protect piles from damage.

## 4.3 Drilled Shafts

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads. The preliminary design loads, as provided by The Upchurch Group are provided in Table 4.2. Based on the subsurface exploration, competent sandstone is encountered around elevation El. 597.68.

Recommendations for drilled shafts with varying sockets extending to various depths into the underlying competent sandstone, developing capacity from side and/or tip resistance, are provided for design support of the pier. The provided capacities are based on boring information, empirical values of weathered sandstone strength properties and utilizing the IDOT Drilled Shaft Axial Capacity in Rock spreadsheet as provided by IDOT BBS Foundations and Geotechnical Unit. LRFD Resistance Factors of 0.55 for side resistance and 0.5 for tip resistance are incorporated into the allowable capacities, respectively.

Table 4.3 – Estimated Drilled Shaft Axial Capacity for Pier (SB-4) below contains a summary of Factored Shaft Resistances available for various socket diameters based on socket depths into the underlying sandstone. IDOT Drilled Axial Capacity Input sheets and Design Tables are included in Exhibit I, for additional information.

**Table 4.3 - Estimated Drilled Shaft Axial Capacity for Pier (SB-4)**

| Diameter Socket | Socket Depth (ft.) | Nominal Shaft Resistance Available (kips) TIP | Factored Shaft Resistance Available (kips) TIP | Nominal Shaft Resistance Available (kips) SIDE | Factored Shaft Resistance Available (kips) SIDE | Tip Elevation (ft.) |
|---|---|---|---|---|---|---|
| 36 | 4 | 1480 | 740 | 401 | 221 | 593.68 |
| | 8 | 1587 | 793 | 802 | 441 | 589.68 |
| | 12 | 1682 | 841 | 1204 | 662 | 585.68 |
| 42 | 4 | 2015 | 1007 | 468 | 257 | 593.68 |
| | 8 | 2160 | 1080 | 936 | 515 | 589.68 |
| | 12 | 2289 | 1145 | 1404 | 772 | 585.68 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 48 | 4 | 2632 | 1316 | 535 | 294 | 593.68 |
| | 8 | 2821 | 1410 | 1070 | 588 | 589.68 |
| | 12 | 2990 | 1495 | 1605 | 883 | 585.68 |
| 60 | 4 | 4112 | 2056 | 669 | 368 | 593.68 |
| | 8 | 4407 | 2204 | 1337 | 736 | 589.68 |
| | 12 | 4672 | 2336 | 2006 | 1103 | 585.68 |

## 4.4 Lateral Pile Response

Generally, the geotechnical engineer provides soil parameters to the structural engineer so that an L-Pile program, or other approved software, can be used for the lateral or displacement analysis of the foundations. Table 4.4.1 and Table 4.4.2 are included for the structural engineer's use in determining lateral pile response.

**Table 4.4.1 - Soil Parameters for Lateral Pile Load Analysis**

| Boring | Elev. at Bottom of Layer | γ (pcf) | Short Term | | Long Term | | N | Assumed % fines < #200 | K (pci) | ε50 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Φ (deg.) | c (psf) | Φ (deg.) | c (psf) | | | | |
| SB-01 | 630.02 | 115 | - | 1070 | 28 | 100 | 6 | 65 | 500 | 0.007 |
| | 620.02 | 120 | - | 450 | 28 | 100 | 5 | 65 | 30 | 0.02 |
| | 609.02 | 115 | - | 1750 | 28 | 100 | 19 | 65 | 500 | 0.007 |
| SB-02 | 628.63 | 115 | - | 1500 | 28 | 100 | 10 | 65 | 500 | 0.007 |
| | 613.63 | 120 | - | 1000 | 28 | 100 | 6 | 65 | 100 | 0.01 |
| | 605.63 | 115 | - | 1700 | 28 | 100 | 10 | 65 | 500 | 0.007 |
| | 602.63 | 120 | 30 | - | 30 | - | 50/1" | - | 225 | - |
| SB-03 | 610.62 | 115 | - | 2200 | 28 | 100 | 8 | 65 | 1000 | 0.005 |
| | 598.12 | 120 | 30 | - | 30 | - | 50/3" | - | 225 | - |
| SB-04 | 607.68 | 115 | - | 2400 | 28 | 150 | 20 | 65 | 1000 | 0.005 |
| | 597.68 | 120 | 30 | - | 30 | - | 50/2" | - | 225 | - |

**Table 4.4.2 - Rock Parameters for Lateral Pile Load Analysis**

| Rock Type | Weak Rock | | | Strong Rock | |
|---|---|---|---|---|---|
| | y (psf) | RQD | Qu (tsf) | y (psf) | Qu (tsf) |
| Shale | 135 | 0 | 10 | - | - |
| Sandstone | 125 | 0 | 10 | - | - |

## 5.0 Construction Considerations

### 5.1 Construction Activities

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

Should any design considerations assumed by KEG change, KEG should be contacted to determine if the recommendations stated in this report still apply.

### 5.2 Temporary Sheeting and Soil Retention

Temporary Shoring may be required at various stages of this project, due to the proposed staged-construction layout shown in the TS&L. Temporary Sheet Piling Design Guide and Charts are not feasible due to the cohesive nature of the soils present underneath the proposed structure.

Therefore a Temporary Soil Retention System is required to support the structure during construction. An Illinois-licensed Structural Engineer is required to design and seal the design of Temporary Soil Retention Systems, if deemed necessary.

### 5.3 Site and Soil Conditions

Provisions of the Standard Specifications should adequately address site and soil conditions.

## 6.0 Computations

Computations and analyses for special circumstances, if any, are included as exhibits. Please refer to each section of the report for reference to the exhibit containing any such calculations or analysis used.

## 7.0 Geotechnical Data

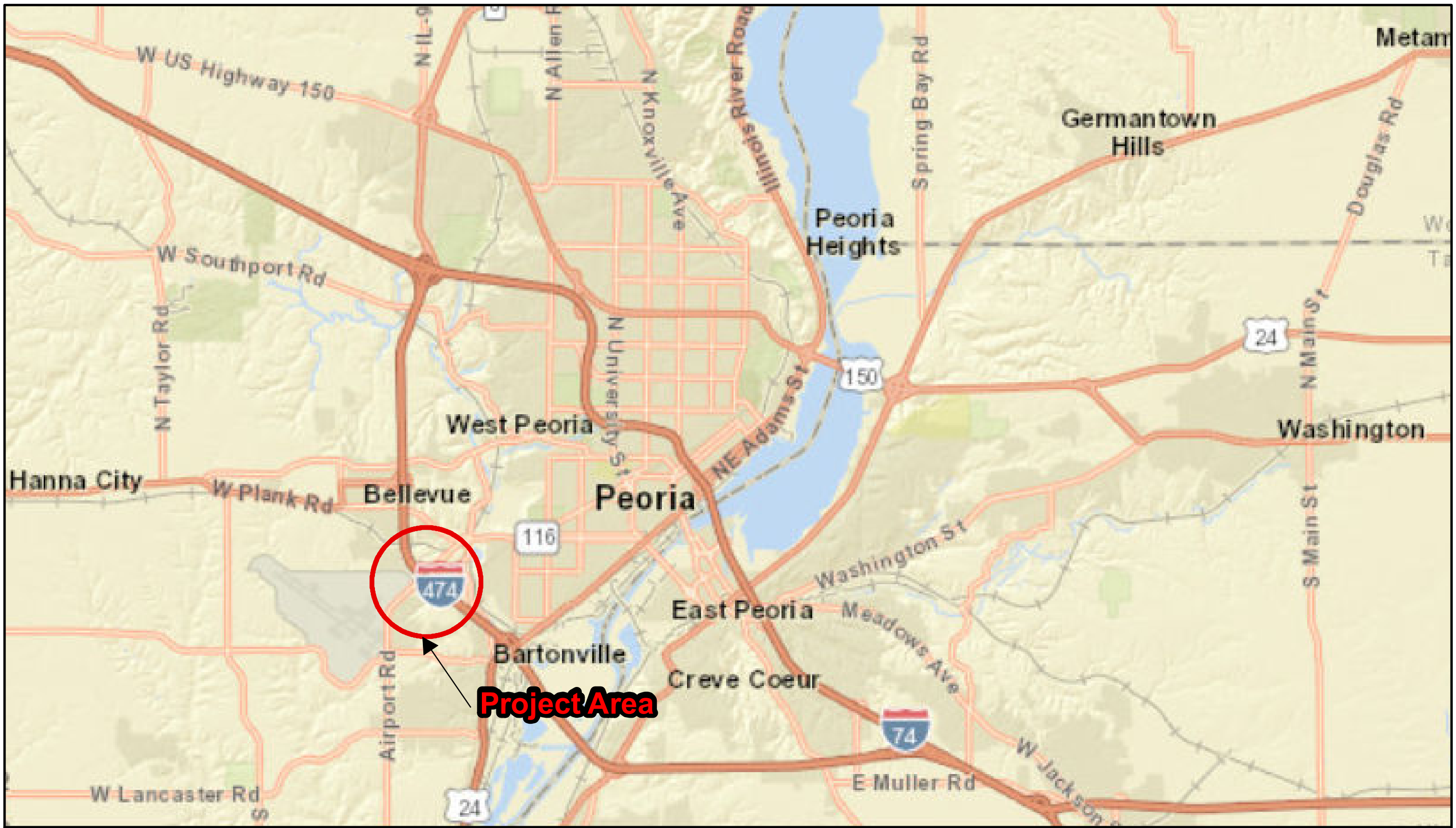
Soil boring logs can be found in Exhibit D. The Subsurface Profile can be found in Exhibit E.

## 8.0 Limitations

The recommendations provided herein are for the exclusive use of the Illinois Department of Transportation (IDOT) District 4. They are specific only to the project described and are based on the subsurface information obtained by IDOT at four boring locations within the structure area, KEG's understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. KEG should be contacted if conditions encountered during construction are not consistent with those described.

# EXHIBIT A

# LOCATION MAP



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# LOCATION MAP

**Airport Road (FAU 6578) over I-474 (FAI 474)**
**Section 72-3HB-4**
**Structure No. 072-0126**
**Peoria County, Illinois**

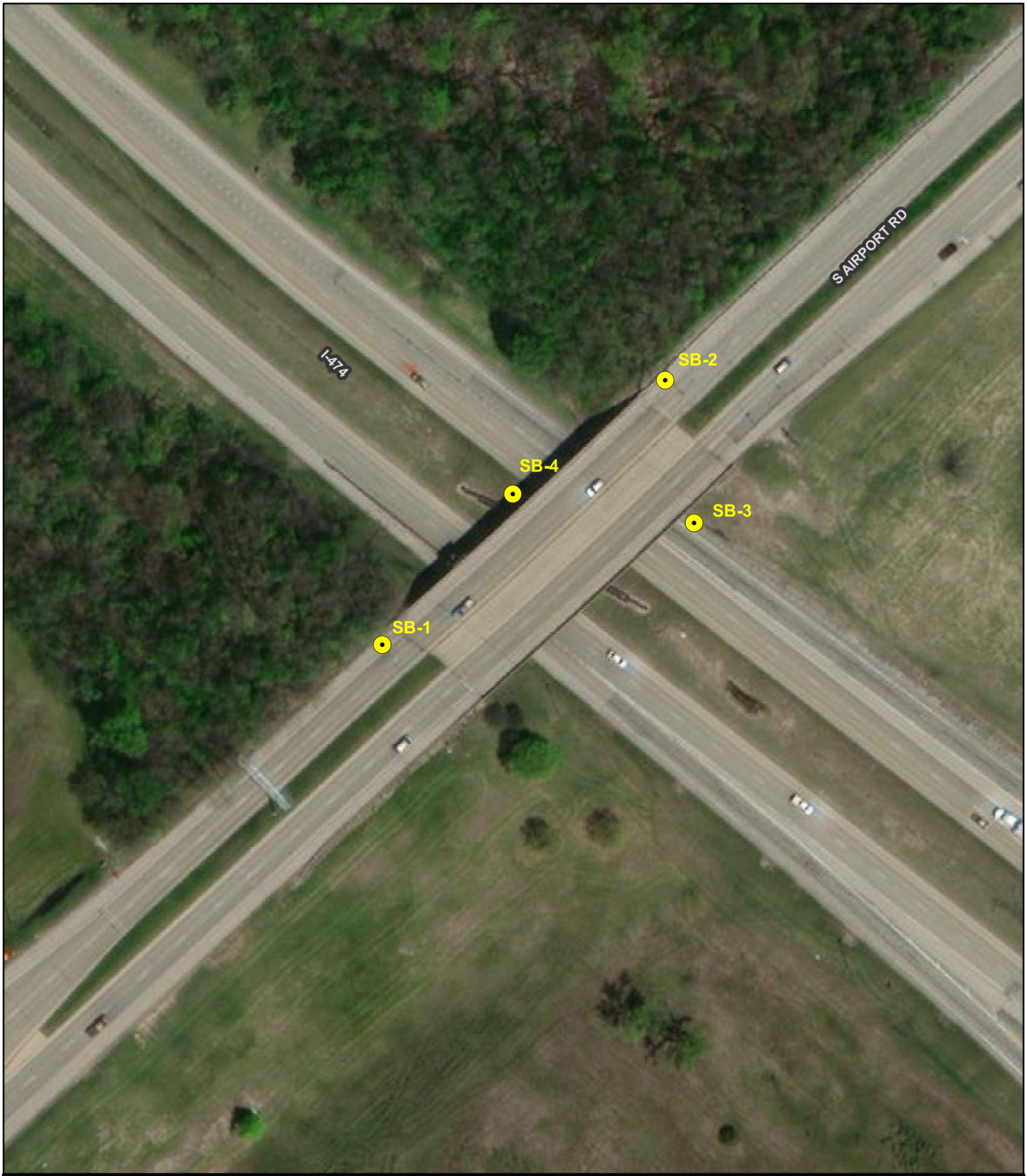
**Exhibit No.**

# A

KEG JOB #19-1033.03

# EXHIBIT B

# BORING PLAN



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## BORING PLAN

**Airport Road (FAU 6578) over I-474 (FAI 474)**
**Section 72-3HB-4**
**Structure No. 072-0126**
**Peoria County, Illinois**

**Exhibit No.**

**B**

KEG JOB #19-1033.03

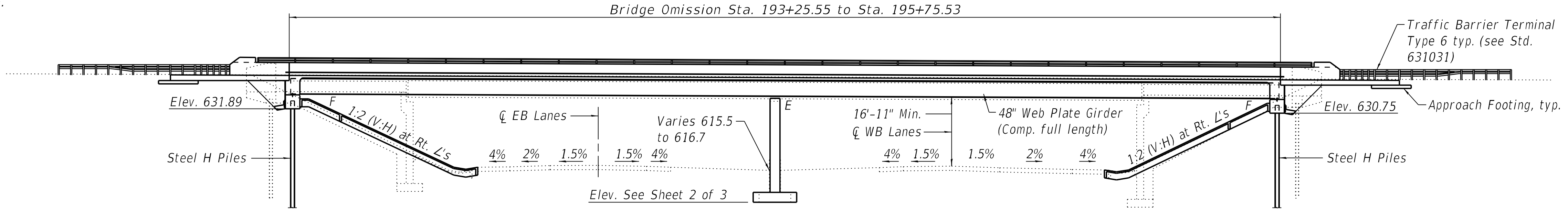
# EXHIBIT C

# TYPE, SIZE, AND LOCATION PLAN (TS&L)

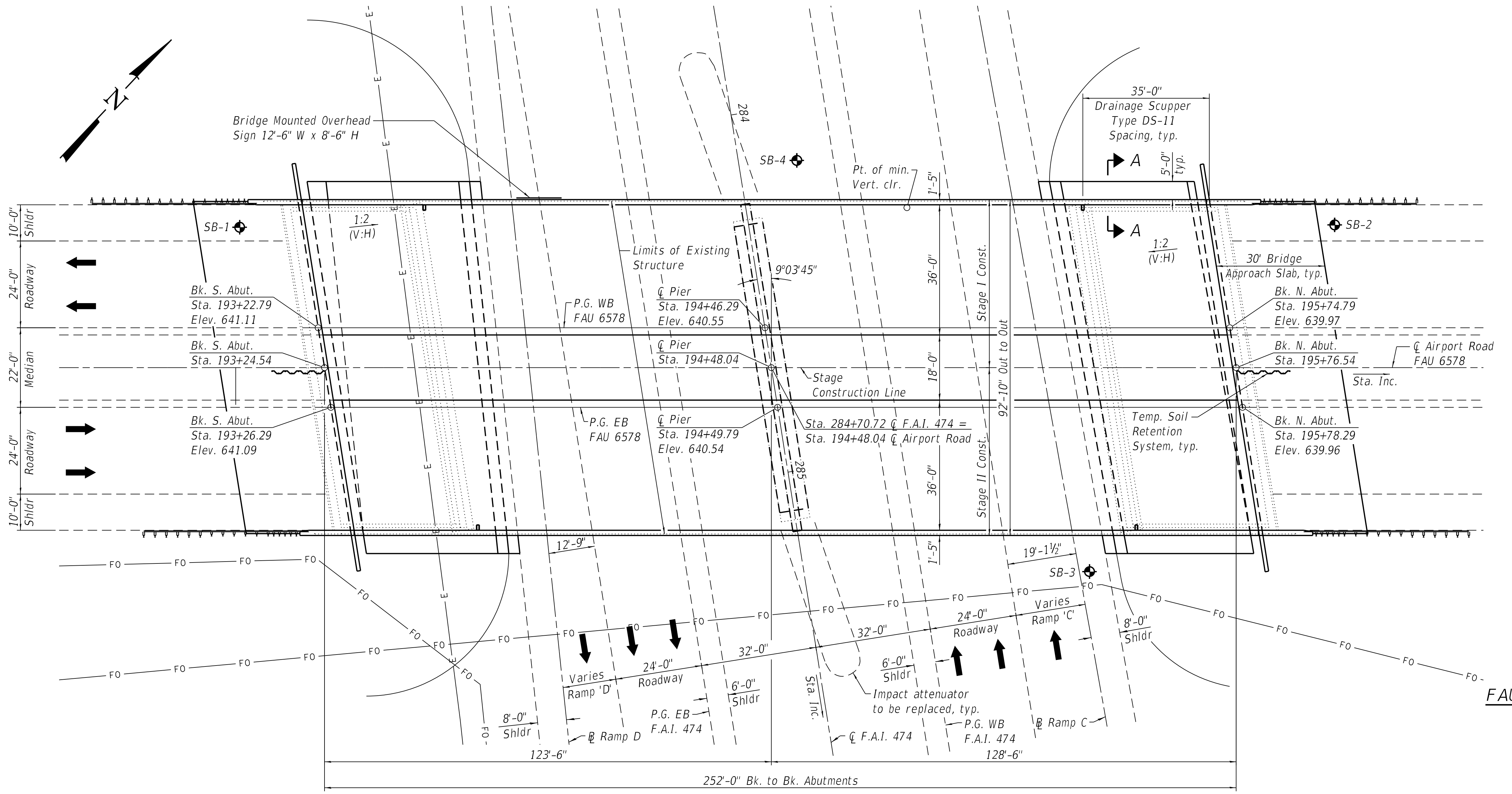
*Bench Mark: 5' x 5' Concrete monument with copperweld disc stamped F-14 located 365' right of ℄ F.A.I. 474 Sta. 290+20 at east edge of field and 2' east of fence line, Elev. 635.736.*

*Existing Structure: Existing structure S.N. 072-0126 built in 1978 as FAI 474, Section (72-3)I. The Structure is a two span 48" web plate steel girder bridge with a reinforced concrete deck supported on reinforced concrete vaulted abutments with PPC I-beams, and RC Pier. The abutments and piers have spread footing foundations and the approach bents are supported on steel H-Piles. The existing structure is skewed 9°03'25" right forward, Bk to Bk Approach Bents 261'-5", Out to Out superstructure width 92'-0" with 18'-0" raised median and longitudinal expansion joint. HMA overlay of bridge deck in 2012. Structure to be removed and replaced. Traffic will be maintained using crossovers.*

*No Salvage.*



ELEVATION



PLAN

## HIGHWAY CLASSIFICATION

FAU 6578
Functional Class: Minor Arterial
ADT: 11100 (2017); 13500 (2037)
ADTT: 545 (2017); 665 (2037)
DHV: 1110 (555 One-Way)
Design Speed: 50 m.p.h.
Posted Speed: 45 m.p.h.
2 -Way Traffic
Directional Distribution: 50:50

## HIGHWAY CLASSIFICATION

F.A.I. 474
Functional Class: Interstate
ADT: 29200 (2017); 35600 (2037)
ADTT: 3975 (2017); 4843 (2037)
DHV: 3920 (2037)
Design Speed: 70 m.p.h.
Posted Speed: 70 m.p.h.
2 -Way Traffic
Directional Distribution: 50:50

## 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)

## LOADING HL-93

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

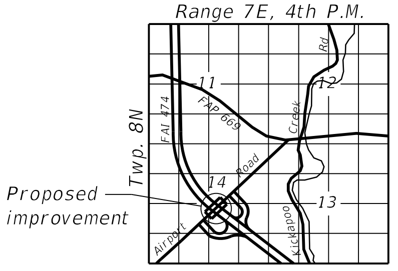
## SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.113g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.176g
Soil Site Class = D

## DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

Note:
See Sheet 2 of 3 for Section A-A.



LOCATION SKETCH

# GENERAL PLAN & ELEVATION
# FAU 6578 (AIRPORT ROAD) OVER F.A.I. 474
# SECTION 72-3HB-4
# PEORIA COUNTY
# STA. 284+70.72
# STRUCTURE NO. 072-0254

MODEL: Default
FILE NAME: P:\Civil_IDOT_DIST4\PTB 194-035 var PH I-II 3120032\WO 3 Airport Road TS&L 3120032-03\TSL\TSL.dgn

**The Upchurch Group**
architects engineers surveyors
Professional Design Firm Corporation License No. 184-003401
123 North 15th Street
Mattoon, IL 61938
Phone: 217.235.3177
e-mail: upchurchgroup@upchurchgroup.com

| | | |
|---|---|---|
| USER NAME = | DESIGNED - MJS | REVISED - |
| | CHECKED - SJF | REVISED - |
| PLOT SCALE = | DRAWN - SAE | REVISED - |
| PLOT DATE = | CHECKED - SJF | REVISED - |

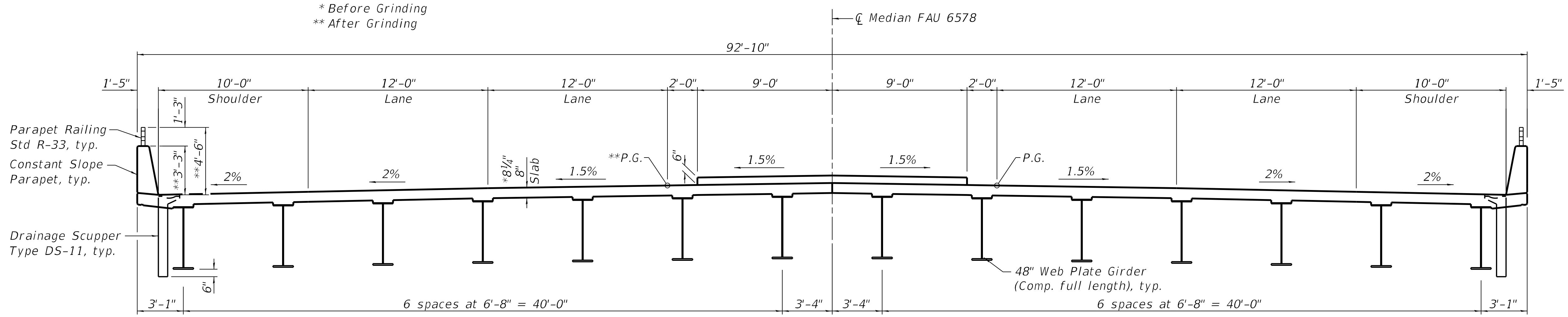
**STATE OF ILLINOIS**
**DEPARTMENT OF TRANSPORTATION**

SHEET 1 OF 3 SHEETS

| F.A.U. RTE. | SECTION | COUNTY | TOTAL SHEETS | SHEET NO. |
|---|---|---|---|---|
| 6578 | 72-3HB-4 | PEORIA | 3 | 1 |
| | | CONTRACT NO. 68886 | | |

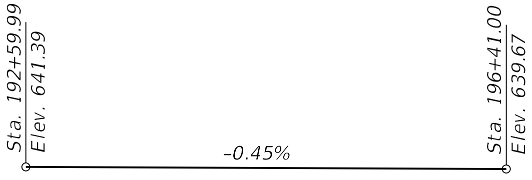
ILLINOIS FED. AID PROJECT

5/23/2022 12:48:19 PM



## CROSS SECTION

(Looking North)

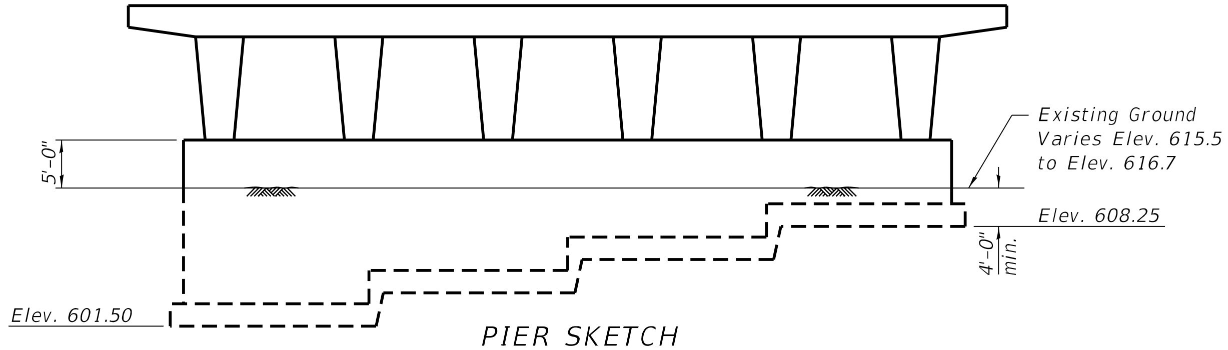


## PROFILE GRADE FAU 6578

(At median edge)

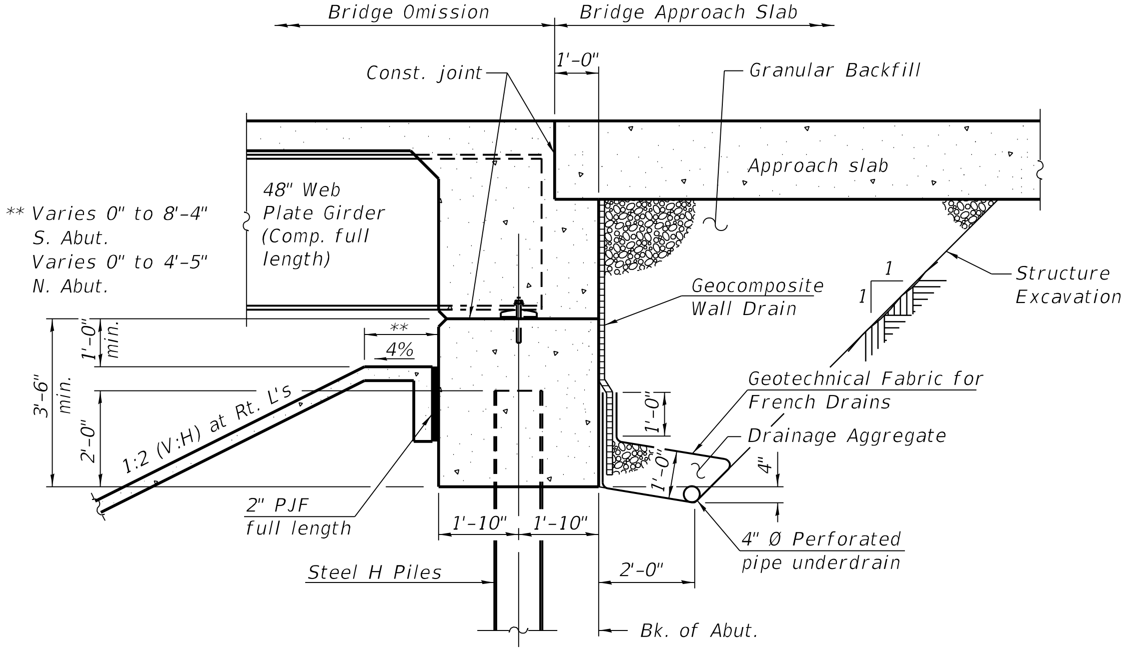
## PROFILE GRADE F.A.I. 474

(At median edge)



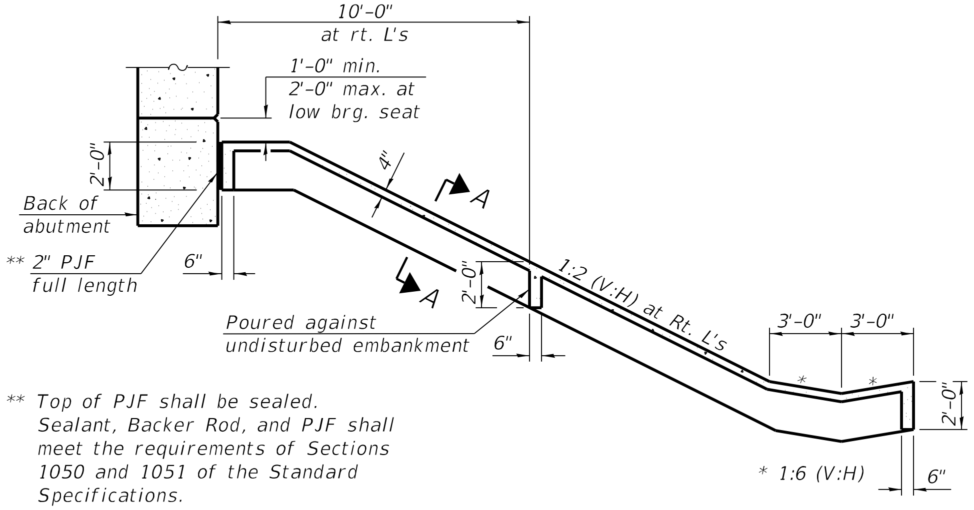
## PIER SKETCH

(Looking North)



## SECTION THRU INTEGRAL ABUTMENT

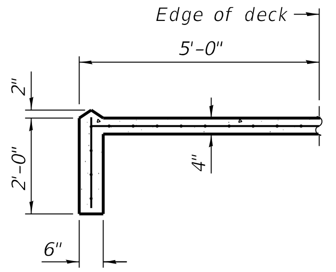
(Horiz. dim. @ Rt. ∠'s)



** Top of PJF shall be sealed. Sealant, Backer Rod, and PJF shall meet the requirements of Sections 1050 and 1051 of the Standard Specifications.

## SECTION THRU CONCRETE SLOPEWALL

Slopewall shall be reinforced with galvanized welded wire fabric 6" x 6" - W4.0 x W4.0 weighing 58 lbs. per 100 sq. ft.



## SECTION A-A

## DETAILS
## FAU 6578 (AIRPORT ROAD) OVER F.A.I. 474
## SECTION 72-3HB-4
## PEORIA COUNTY
## STA. 284+70.72
## STRUCTURE NO. 072-0254

MODEL: Default
FILE NAME: P:\Civil_IDOT_DIST4\PTB 194-035 var PH I-II 3120032\WO 3 Airport Road TS&L 3120032-03\TSL\TSL.dgn

**The Upchurch Group**
architects engineers surveyors
Professional Design Firm Corporation License No. 184-003401
123 North 15th Street
Mattoon, IL 61938
Phone: 217.235.3177
e-mail: upchurchgroup@upchurchgroup.com

USER NAME =
PLOT SCALE =
PLOT DATE =

DESIGNED - MJS
CHECKED - SJF
DRAWN - SAE
CHECKED - SJF

REVISED -
REVISED -
REVISED -
REVISED -

**STATE OF ILLINOIS**
**DEPARTMENT OF TRANSPORTATION**

SHEET 2 OF 3 SHEETS

| F.A.U. RTE. | SECTION | COUNTY | TOTAL SHEETS | SHEET NO. |
|---|---|---|---|---|
| 6578 | 72-3HB-4 | PEORIA | 3 | 2 |

CONTRACT NO. 68886

ILLINOIS FED. AID PROJECT

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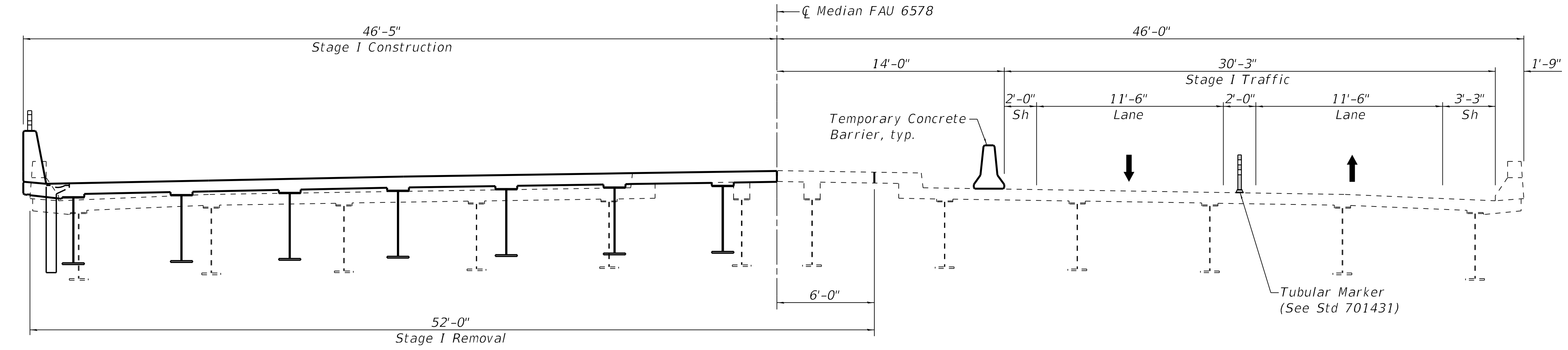
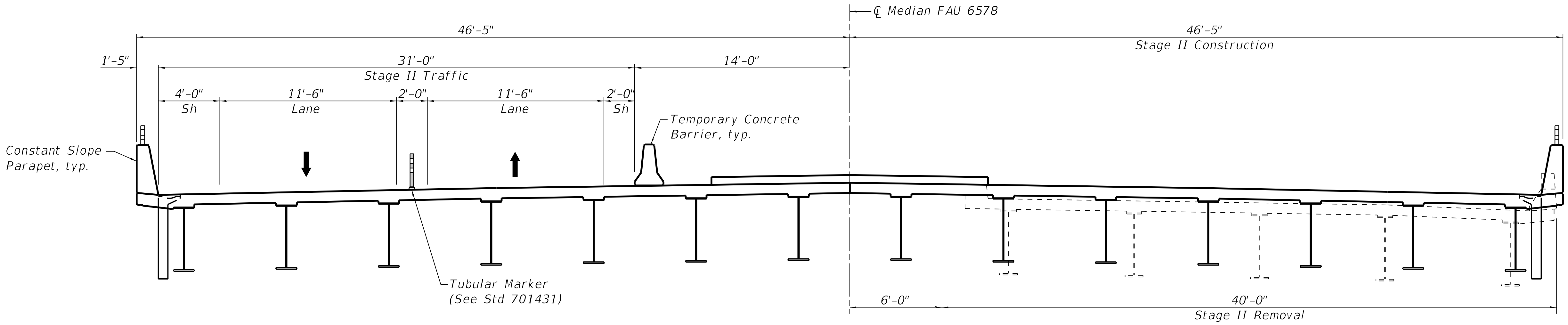


## STAGE I CONSTRUCTION

(Looking North)



## STAGE II CONSTRUCTION

(Looking North)

STAGE CONSTRUCTION
FAU 6578 (AIRPORT ROAD) OVER F.A.I. 474
SECTION 72-3HB-4
PEORIA COUNTY
STA. 284+70.72
STRUCTURE NO. 072-0254

MODEL: Default
FILE NAME: P:\Civil_IDOT_DIST4\PTB 194-035 var PH I-II 3120032\WO 3 Airport Road TS&L 3120032-03\TSL\TSL.dgn

**The Upchurch Group**
architects engineers surveyors
Professional Design
Firm Corporation
License No. 184-003401
123 North 15th Street
Mattoon, IL 61938
Phone: 217.235.3177
e-mail: upchurchgroup@upchurchgroup.com

| | | |
|---|---|---|
| USER NAME = | DESIGNED - MJS | REVISED - |
| | CHECKED - SJF | REVISED - |
| PLOT SCALE = | DRAWN - SAE | REVISED - |
| PLOT DATE = | CHECKED - SJF | REVISED - |

**STATE OF ILLINOIS**
**DEPARTMENT OF TRANSPORTATION**

SHEET 3 OF 3 SHEETS

| F.A.U. RTE. | SECTION | COUNTY | TOTAL SHEETS | SHEET NO. |
|---|---|---|---|---|
| 6578 | 72-3HB-4 | PEORIA | 3 | 3 |
| | | CONTRACT NO. 68886 | | |
| | ILLINOIS | FED. AID PROJECT | | |

5/23/2022 1:17:52 PM

# EXHBIT D

# BORING LOGS

**Illinois Department of Transportation**
Division of Highways
Terracon

# SOIL BORING LOG

**Page** 1 **of** 1

**Date** 7/8/20

**ROUTE** FAI 474 (I-474) **DESCRIPTION** Structure boring for bridge replacement **LOGGED BY** BT (Terracon)

**SECTION** 73-3HB-2 **LOCATION** Airport Road over I-474, **SEC.** 14, **TWP.** 8N, **RNG.** 7E, 4th **PM**, **Latitude** 40d 40' 22" N, **Longitude** 89d 40' 12" W

**COUNTY** Peoria **DRILLING METHOD** Solid Stem/ Rotary **HAMMER TYPE** AUTO SPT Hammer

**STRUCT. NO.** 072-0126
**Station** 284+70.45

**BORING NO.** SB-1
**Station** 284+09
**Offset** 139.0 ft RT
**Ground Surface Elev.** 640.02 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 (%) |
|---|---|---|---|---|---|
| FILL- ASPHALT FRAGMENTS, CRUSHED STONE, AND CLAY | 639.02 | | | | |
| FILL- CLAY LOAM: grayish brown, with sand and gravel | | | 4<br>4<br>6 | | 17 |
| | 637.02 | | | | |
| CLAY LOAM: brown, moist, very stiff to soft, with traces of sand | | -5 | 3<br>3<br>3 | 2.2 | 21 |
| | | | 3<br>3<br>3 | 0.7 | 22 |
| - with silt seams 8.5 to 10 feet | 630.02 | -10 | 1<br>3<br>3 | 0.3 | 19 |
| SILTY CLAY LOAM: brown, moist, soft to medium stiff, with silt seams | | | 2<br>3<br>3 | 0.4 | 27 |
| | | -15 | 2<br>3<br>3 | 0.2 | 27 |
| | | | 2<br>2<br>2 | 0.5 | 28 |
| | 620.02 | -20 | 4<br>1<br>2 | 0.7 | 23 |

| | | DEPTH (ft) | BLOWS (/6") | UCS Qu (tsf) | MOIST (%) |
|---|---|---|---|---|---|
| CLAY LOAM: brown, moist, stiff to very stiff, with sand | | | 1<br>2<br>4 | 1.2 | 21 |
| | | -25 | 3<br>5<br>6 | 2.9 | 21 |
| | | | 4<br>7<br>15 | 1.6 | 22 |
| - with traces of coal fragments 28.5 to 31 feet | | -30 | 10<br>19<br>19 | 1.3 | 21 |
| | 609.02 | | | | |
| SHALE: gray, moist, completely weathered, extremely weak, with traces of sand | 607.52 | | 24<br>50/3 | 1.6 | 18 |
| SANDSTONE: light gray, moist, completely weathered, very weak | | -35 | 50/3 | | 19 |
| | 602.52 | | 50/3 | | 18 |
| 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)**

**Illinois Department of Transportation**
Division of Highways
Terracon

# SOIL BORING LOG

Page 1 of 1

Date 7/7/20

**ROUTE** FAI 474 (I-474) **DESCRIPTION** Structure boring for bridge replacement **LOGGED BY** BT (Terracon)

**SECTION** 73-3HB-2 **LOCATION** Airport Road over I-474, **SEC.** 14, **TWP.** 8N, **RNG.** 7E, 4th **PM**, **Latitude** 40d 40' 24" N, **Longitude** 89d 40' 9" W

**COUNTY** Peoria **DRILLING METHOD** Solid Stem/ Rotary **HAMMER TYPE** AUTO SPT Hammer

**STRUCT. NO.** 072-0126
**Station** 284+70.45

**BORING NO.** SB-2
**Station** 284+56
**Offset** 160.0 ft LT
**Ground Surface Elev.** 638.63 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 (%)** |
|---|---|---|---|---|
| FILL- CLAY LOAM: grayish brown, with sand and gravel 637.63 | | | | |
| CLAY LOAM: dark brown, moist, stiff, with traces of sand | | 4<br>5<br>8 | | 15 |
| - brown at 3.5 feet | -5 | 4<br>4<br>5 | 1.3 | 17 |
| | | 3<br>4<br>8 | 1.8 | 25 |
| 628.63 | -10 | 3<br>3<br>4 | 1.4 | 19 |
| SILTY CLAY LOAM: brown, moist, stiff to medium stiff, with silt seams | | 3<br>5<br>7 | 1.4 | 21 |
| | -15 | 3<br>3<br>2 | | 22 |
| | | 2<br>2<br>3 | | 25 |
| | -20 | 2<br>2<br>2 | | 26 |

| | **DEPTH (ft)** | **BLOWS (/6")** | **UCS Qu (tsf)** | **MOIST (%)** |
|---|---|---|---|---|
| SILTY CLAY LOAM: brown, moist, stiff to medium stiff, with silt seams *(continued)* | | 1<br>2<br>3 | | 26 |
| 613.63 | -25 | 3<br>3<br>3 | 0.6 | 25 |
| CLAY LOAM: brown, moist, medium stiff to very stiff, with sand | | 2<br>2<br>3 | 0.8 | 21 |
| | -30 | 5<br>7<br>8 | 2.6 | 23 |
| 605.63 | | | | |
| SANDY CLAY LOAM: brown, moist, stiff, with sand and traces of shale fragments | -35 | 88<br>50/1 | | 20 |
| 602.63<br>SANDSTONE: light gray, moist, completely weathered, very weak | | 100/5 | | 20 |
| 598.63 | -40 | 100/4 | | 18 |

End of Boring

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

**BBS, form 137 (Rev. 8-99)**

SOIL BORING WO 50 AIRPORT RD.GPJ IL_DOT.GDT 7/30/20

**Illinois Department of Transportation**
Division of Highways
Terracon

# SOIL BORING LOG

**Page** 1 **of** 1

**Date** 7/8/20

**ROUTE** FAI 474 (I-474) **DESCRIPTION** Structure boring for bridge replacement **LOGGED BY** BT (Terracon)

**SECTION** 73-3HB-2 **LOCATION** Airport Road over I-474, **SEC.** 14, **TWP.** 8N, **RNG.** 7E, 4th **PM**, **Latitude** 40d 40' 23" N, **Longitude** 89d 40' 9" W

**COUNTY** Peoria **DRILLING METHOD** Solid Stem/ Rotary **HAMMER TYPE** AUTO SPT Hammer

**STRUCT. NO.** 072-0126
**Station** 284+70.45

**BORING NO.** SB-3
**Station** 285+40
**Offset** 78.0 ft LT
**Ground Surface Elev.** 616.62 **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 (%) |
|---|---|---|---|---|
| FILL- CLAY LOAM: grayish brown, with sand and gravel<br>615.12 | | 4 | | |
| CLAY LOAM: dark brown, moist, medium stiff to very stiff, with traces of sand | | 2<br>2 | | 20 |
| - brown at 3.5 feet | | 2 | | |
| | -5 | 4<br>8 | 2.2 | 22 |
| 610.62 | | 24 | | |
| SANDY LOAM: brown, moist, very dense | | 74/6 | | 13 |
| | | 50 | | |
| | -10 | 50/2 | | 13 |
| | | 50/3 | | |
| | | | | 12 |
| | | 50/3 | | |
| | -15 | | | 13 |
| 600.62 | | | | |
| SANDY LOAM: brown, moist, very dense, with sandstone fragments | | 50/3 | | |
| | | | | 13 |
| 598.12 | | | | |
| SHALE: gray, with sand | | 50/2 | | |
| | -20 | | | 14 |

| | DEPTH (ft) | BLOWS (/6") | UCS Qu (tsf) | MOIST (%) |
|---|---|---|---|---|
| SHALE: gray, with sand *(continued)*<br>595.62 | | | | |
| SANDY LOAM: brown and gray, moist, very dense, with shale | | 50/2 | | |
| 594.12 | | | | 13 |
| End of Boring | -25 | | | |
| Note: Rock cores were planned but not attempted due to poor cementation of materials. | -30 | | | |
| | -35 | | | |
| | -40 | | | |

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

**BBS, form 137 (Rev. 8-99)**

SOIL BORING WO 50 AIRPORT RD.GPJ IL_DOT.GDT 7/30/20

**Illinois Department of Transportation**
Division of Highways
Terracon

# SOIL BORING LOG

**Page** 1 **of** 1

**Date** 7/9/20

**ROUTE** FAI 474 (I-474) **DESCRIPTION** Structure boring for bridge replacement **LOGGED BY** BT (Terracon)

**SECTION** 73-3HB-2 **LOCATION** Airport Road over I-474, **SEC.** 14, **TWP.** 8N, **RNG.** 7E, 4th **PM**,
**Latitude** 40d 40' 23" N, **Longitude** 89d 40' 11" W

**COUNTY** Peoria **DRILLING METHOD** Solid Stem/ Rotary **HAMMER TYPE** AUTO SPT Hammer

**STRUCT. NO.** 072-0126
**Station** 284+70.45

**BORING NO.** SB-4
**Station** 284+15
**Offset** 16.0 ft LT
**Ground Surface Elev.** 617.68 ft

**Surface Water Elev.** ft
**Stream Bed Elev.** ft

**Groundwater Elev.:**
**First Encounter** 600.2 ft ▼
**Upon Completion** ft
**After** Hrs. ft

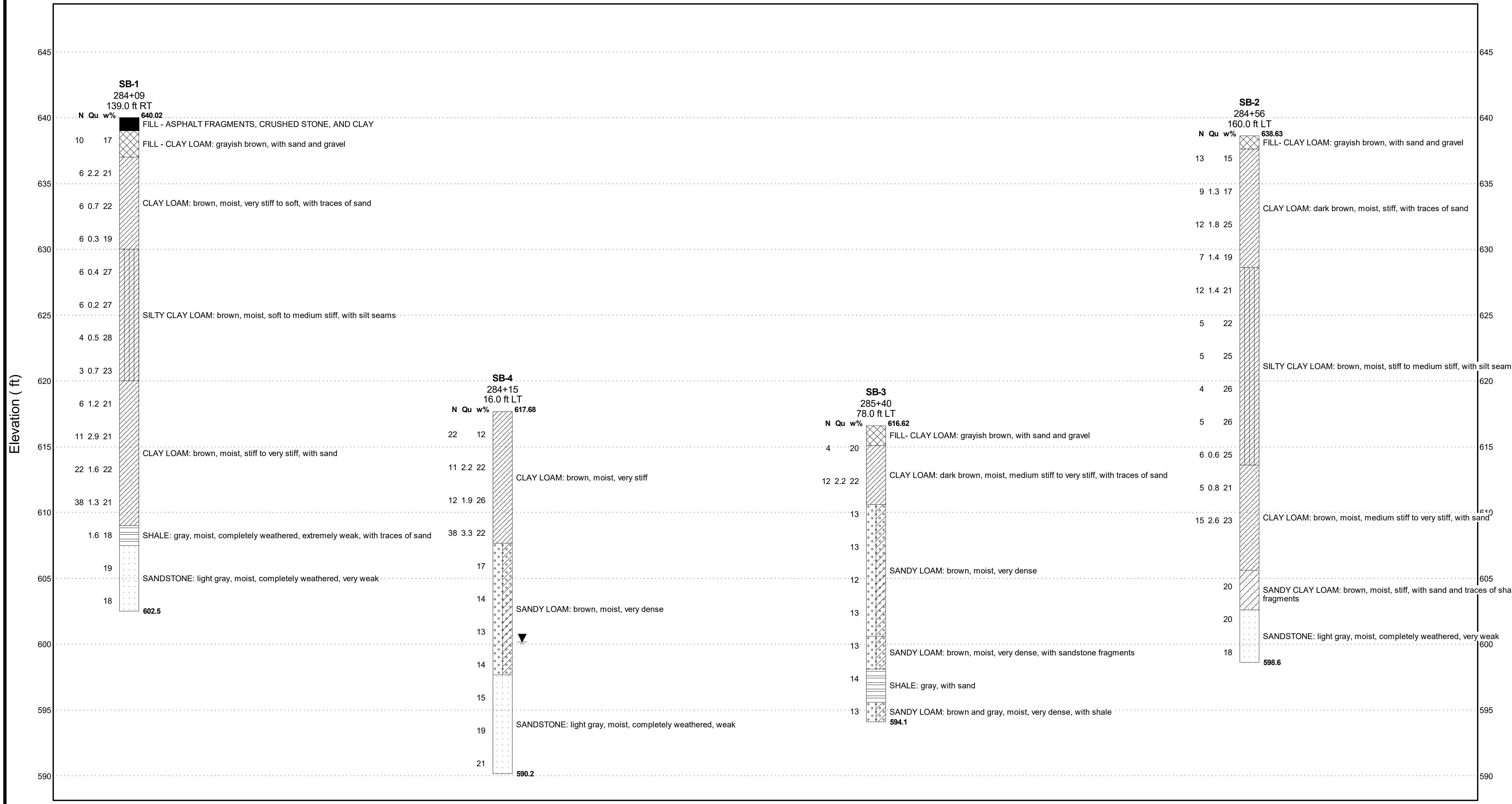
| | | DEPTH (ft) | BLOWS (/6") | UCS Qu (tsf) | MOIST (%) |
|---|---|---|---|---|---|
| CLAY LOAM: brown, moist, very stiff | | | 10 | | |
| | | | 10<br>12 | | 12 |
| | | | 4 | | |
| | | -5 | 4<br>7 | 2.2 | 22 |
| | | | 3 | | |
| | | | 4<br>8 | 1.9 | 26 |
| | | | 8 | | |
| | 607.68 | -10 | 13<br>25 | 3.3 | 22 |
| SANDY LOAM: brown, moist, very dense | | | 50/1 | | |
| | | | | | 17 |
| | | | 50/5 | | |
| | | -15 | | | 14 |
| | | | 50/2 | | |
| | | | | | 13 |
| | | ▼ | 50/2 | | |
| | 597.68 | -20 | | | 14 |

| | | DEPTH (ft) | BLOWS (/6") | UCS Qu (tsf) | MOIST (%) |
|---|---|---|---|---|---|
| SANDSTONE: light gray, moist, completely weathered, weak | | | 50/2 | | |
| | | | | | 15 |
| | | | 50/2 | | |
| | | -25 | | | 19 |
| | | | 50/1 | | |
| | 590.18 | | | | 21 |
| End of Boring | | -30 | | | |
| Note: Rock cores were planned but not attempted due to poor cementation of materials. | | -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)**

# EXHIBIT E

# SUBSURFACE PROFILE



**Illinois Department of Transportation**
Division of Highways

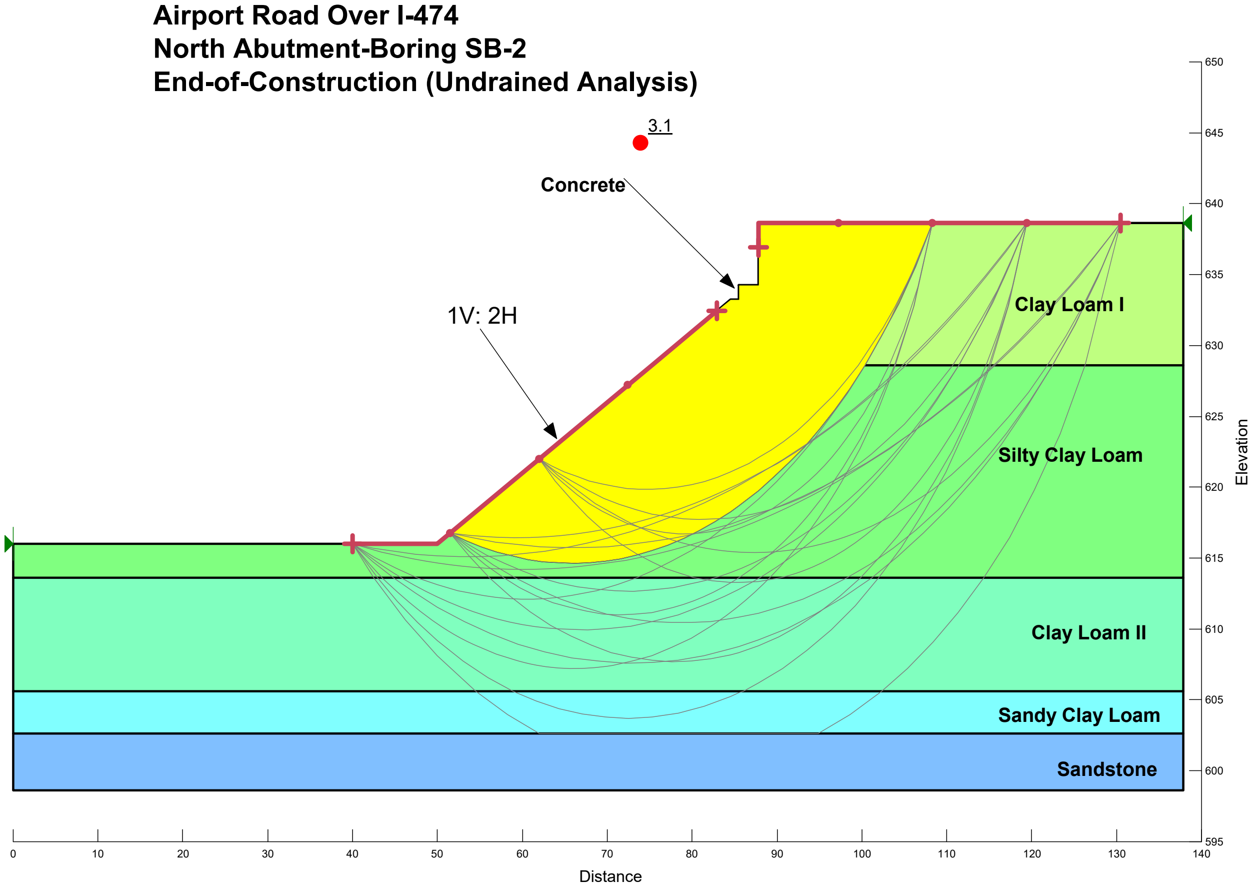
## NOT TO HORIZONTAL SCALE

## SUBSURFACE DATA PROFILE

Route: FAI 474 (I-474)
Section: 73-3HB-2
County: Peoria

# EXHIBIT F

## SLOPE W SLOPE STABILITY ANALYSIS



**Airport Road Over I-474**
**North Abutment-Boring SB-2**
**End-of-Construction (Undrained Analysis)**

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 2,000 psf
Phi': 0 °

Name: Clay Loam I
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 1,500 psf
Phi': 0 °

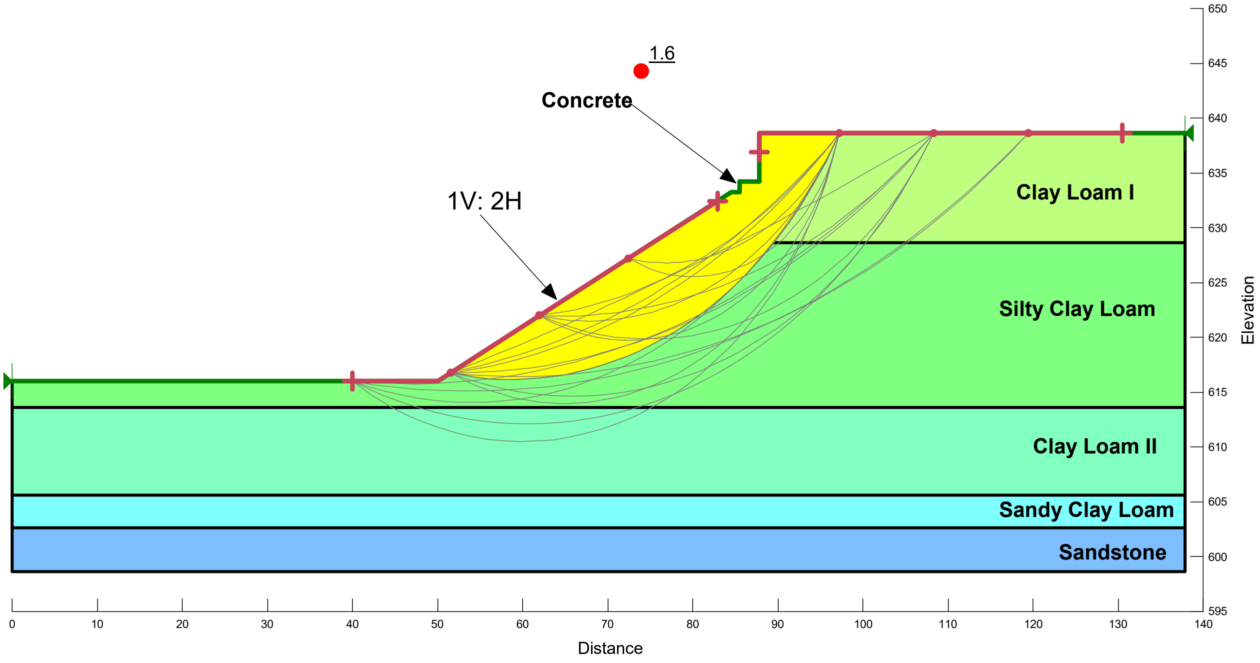
Name: Silty Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 0 °

Name: Clay Loam II
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 1,700 psf
Phi': 0 °

Name: Sandy Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Sandstone
Model: Bedrock (Impenetrable)

# Airport Road Over I-474
# North Abutment-Boring SB-2
# Long-Term (Drained Analysis)



Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 2,000 psf
Phi': 0 °

Name: Clay Loam I
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

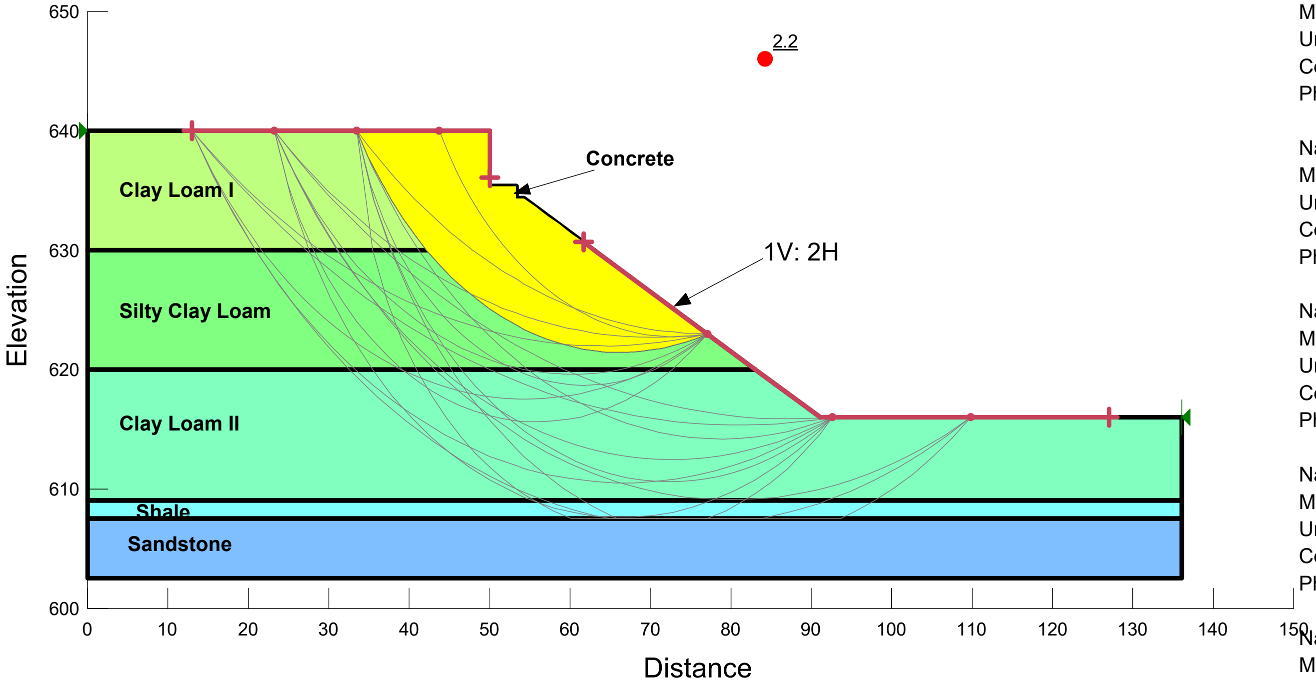
Name: Silty Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Clay Loam II
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Sandy Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Sandstone
Model: Bedrock (Impenetrable)

## Airport Road Over I-474
## South Abutment-Boring SB-1
## End-of-Construction (Undrained Analysis)



Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 20,000 psf
Phi': 0 °

Name: Clay Loam I
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 1,070 psf
Phi': 0 °

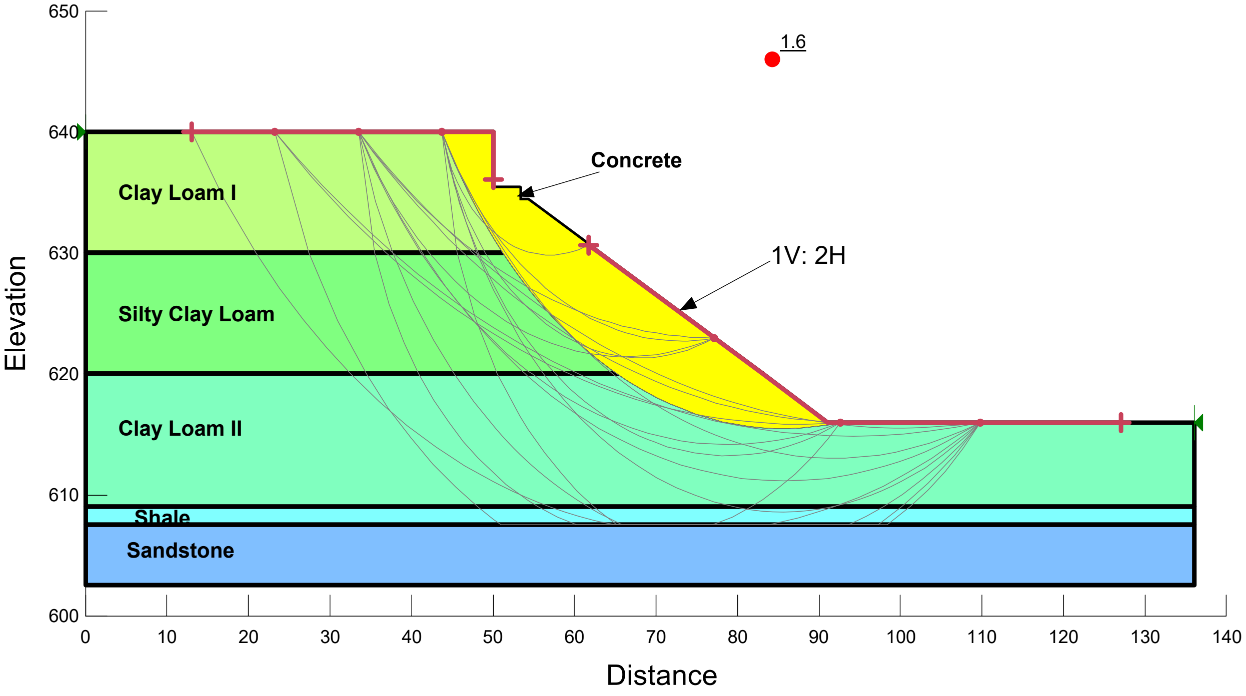
Name: Silty Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 450 psf
Phi': 0 °

Name: Clay Loam II
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 1,750 psf
Phi': 0 °

Name: Shale
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 1,600 psf
Phi': 12 °

Name: Sandstone
Model: Bedrock (Impenetrable)

**Airport Road Over I-474**
**South Abutment-Boring SB-1**
**Long-Term (Drained Analysis)**



Unit Weight: 150 pcf
Cohesion': 20,000 psf
Phi': 0 °

Name: Clay Loam I
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Silty Clay Loam
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Clay Loam II
Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Shale
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 12 °

Name: Sandstone
Model: Bedrock (Impenetrable)

# EXHIBIT G

# BEARING RESISTANCE CALCULATIONS

Kaskaskia
Engineering Group, LLC

208 E. Main Street
Suite 100
Belleville, Illinois 62220
618.233.5877 *phone*
618.233.5977 *fax*
www.kaskaskiaeng.com

Project Title: Airport Rd. over I-474 Sheet: 1 of 1
Project Number: 19-1033.03
Calculated By: CO Date: 07/26/2021
Checked By: MDM Date: 07/27/2021
Comments:

Bearing capacity for continuous:

$$q_u = cN_c + \gamma D_f N_q + \cancelto{0}{0.5\gamma' B N_\gamma}$$

$\phi = 0$

$\Rightarrow N_\gamma = 0$

$N_c = 5.14$

$N_q = 1$

$$q_u = (3300 \text{ psf})(5.14) + (125 \text{ pcf})(10 \text{ ft})(1)$$

$$q_u = 18,212 \text{ psf}$$

$c = 3300$ psf

$\gamma = 125$ pcf

$D_f = 10'$

Multiply by factor of 0.5

$$(0.5)(18,212 \text{ psf}) = \boxed{9,106 \text{ psf}}$$

Sliding resistance:

Cohesion: 3,300 psf

$\frac{1}{2}$ vertical stress $= \frac{1}{2}\gamma d = \frac{1}{2} \cdot 125 \cdot 10 = 625$ psf

Lesser of two options

$$\boxed{625 \text{ psf}} < 3,300 \text{ psf}$$

# EXHIBIT H

# PILE LENGTH/PILE TYPE

Illinois Department of Transportation

# IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE===================================== South Abutment
REFERENCE BORING ================================= SB-01
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. ================================= 633.90 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 628.90 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================= ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) =============== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ============== 3400 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 92.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 295.65 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 110.87 KIPS

PILE TYPE AND SIZE ============= Steel HP 10 X 42
Plugged Pile Perimeter========================== 3.300 FT. Unplugged Pile Perimeter============== 4.858 FT.
Plugged Pile End Bearing Area=================== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

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

| Maximum Nominal Req'd Bearing of Pile | Maximum Nominal Req.d Bearing of Boring | Maximum Factored Resistance Available in Boring | Maximum Pile Driveable Length in Boring |
|---|---|---|---|
| **335** KIPS | **282** KIPS | **155** KIPS | **27** FT. |

| BOT. OF LAYER ELEV. (FT.) | LAYER THICK. (FT.) | UNCONF. COMPR. STRENGTH (TSF.) | S.P.T. N VALUE (BLOWS) | GRANULAR OR ROCK LAYER DESCRIPTION | NOMINAL 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.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 628.50 | 0.40 | 0.40 | | | 0.4 | | 2.3 | 0.6 | | ***0.9*** | 1 | 0 | 0 | 0 | 5 |
| 626.00 | 2.50 | 0.20 | | | 1.4 | 1.9 | 6.5 | 2.0 | 0.2 | ***3.2*** | 3 | 0 | 0 | 2 | 8 |
| 623.50 | 2.50 | 0.50 | | | 3.2 | 4.8 | 11.7 | 4.7 | 0.6 | ***8.2*** | 8 | 0 | 0 | 5 | 10 |
| 621.00 | 2.50 | 0.70 | | | 4.3 | 6.7 | 20.8 | 6.4 | 0.8 | ***15.2*** | 15 | 0 | 0 | 8 | 13 |
| 618.50 | 2.50 | 1.20 | | | 6.8 | 11.4 | 43.7 | 10.0 | 1.4 | ***27.2*** | 27 | 0 | 0 | 15 | 15 |
| 616.00 | 2.50 | 2.90 | | | 12.3 | 27.7 | ***43.7*** | 18.1 | 3.5 | 43.8 | 44 | 0 | 0 | 24 | 18 |
| 613.50 | 2.50 | 1.60 | | | 8.3 | 15.3 | ***49.1*** | 12.2 | 1.9 | 55.6 | 49 | 0 | 0 | 27 | 20 |
| 609.00 | 4.50 | 1.30 | | | 12.9 | 12.4 | 134.4 | 19.0 | 1.6 | ***83.8*** | 84 | 0 | 0 | 46 | 25 |
| 608.50 | 0.50 | | | Shale | 20.6 | 84.8 | 154.9 | 30.3 | 10.7 | ***114.0*** | 114 | 0 | 0 | 63 | 25.4 |
| 607.50 | 1.00 | | | Shale | 41.1 | 84.8 | 249.0 | 60.5 | 10.7 | ***181.3*** | 181 | 0 | 0 | 100 | 26.4 |
| 606.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | 317.5 | 100.9 | 17.4 | ***282.1*** | 282 | 0 | 0 | 155 | 27.4 |
| 605.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | 386.0 | 100.9 | 17.4 | ***383.0*** | ~~383~~ | ~~*0*~~ | ~~*0*~~ | ~~*211*~~ | ~~*28.4*~~ |
| 604.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***454.5*** | 100.9 | 17.4 | 483.9 | ~~455~~ | ~~*0*~~ | ~~*0*~~ | ~~*250*~~ | ~~*29.4*~~ |
| 603.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***523.1*** | 100.9 | 17.4 | 584.7 | ~~523~~ | ~~*0*~~ | ~~*0*~~ | ~~*288*~~ | ~~*30.4*~~ |
| 602.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***591.6*** | 100.9 | 17.4 | 685.6 | ~~592~~ | ~~*0*~~ | ~~*0*~~ | ~~*325*~~ | ~~*31.4*~~ |
| 601.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***660.1*** | 100.9 | 17.4 | 786.5 | ~~660~~ | ~~*0*~~ | ~~*0*~~ | ~~*363*~~ | ~~*32.4*~~ |
| 600.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***728.6*** | 100.9 | 17.4 | 887.3 | ~~729~~ | ~~*0*~~ | ~~*0*~~ | ~~*401*~~ | ~~*33.4*~~ |
| 599.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***797.1*** | 100.9 | 17.4 | 988.2 | ~~797~~ | ~~*0*~~ | ~~*0*~~ | ~~*438*~~ | ~~*34.4*~~ |
| 598.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***865.6*** | 100.9 | 17.4 | 1089.1 | ~~866~~ | ~~*0*~~ | ~~*0*~~ | ~~*476*~~ | ~~*35.4*~~ |
| 597.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***934.2*** | 100.9 | 17.4 | 1190.0 | ~~934~~ | ~~*0*~~ | ~~*0*~~ | ~~*514*~~ | ~~*36.4*~~ |
| 596.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***1002.7*** | 100.9 | 17.4 | 1290.8 | ~~1003~~ | ~~*0*~~ | ~~*0*~~ | ~~*551*~~ | ~~*37.4*~~ |
| 595.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***1071.2*** | 100.9 | 17.4 | 1391.7 | ~~1071~~ | ~~*0*~~ | ~~*0*~~ | ~~*589*~~ | ~~*38.4*~~ |
| 594.50 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***1139.7*** | 100.9 | 17.4 | 1492.6 | ~~1140~~ | ~~*0*~~ | ~~*0*~~ | ~~*627*~~ | ~~*39.4*~~ |
| 593.50 | 1.00 | | | Sandstone | | 137.7 | | | 17.4 | | | | | | |

Illinois Department of Transportation

# IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE=================================== Pier
REFERENCE BORING ================================ SB-04
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. ================================ 612.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 611.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================= ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) =============== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ============== 7200 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 92.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 626.09 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 234.78 KIPS

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.

***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 | **333** KIPS | **183** KIPS | **16** FT. |

| BOT. OF LAYER ELEV. (FT.) | LAYER THICK. (FT.) | UNCONF. COMPR. STRENGTH (TSF.) | S.P.T. N VALUE (BLOWS) | GRANULAR OR ROCK LAYER DESCRIPTION | NOMINAL 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) | | | | | |
| 610.18 | 1.32 | 1.90 | | | 5.9 | | 41.5 | 8.6 | | ***12.5*** | 13 | 0 | 0 | 7 | 2 |
| 607.68 | 2.50 | | 38 | Hard Till | 4.3 | 35.6 | 165.0 | 6.2 | 3.9 | ***31.8*** | 32 | 0 | 0 | 17 | 5 |
| 605.18 | 2.50 | | 100 | Very Fine Silty Sand | 30.1 | 154.8 | 224.0 | 44.0 | 16.9 | ***79.0*** | 79 | 0 | 0 | 43 | 7 |
| 602.68 | 2.50 | | 100 | Very Fine Silty Sand | 30.1 | 183.7 | 254.1 | 44.0 | 20.1 | ***123.0*** | 123 | 0 | 0 | 68 | 10 |
| 600.18 | 2.50 | | 100 | Very Fine Silty Sand | 30.1 | 183.7 | 284.2 | 44.0 | 20.1 | ***167.0*** | 167 | 0 | 0 | 92 | 12 |
| 597.68 | 2.50 | | 100 | Very Fine Silty Sand | 30.1 | 183.7 | 329.7 | 44.0 | 20.1 | ***212.7*** | 213 | 0 | 0 | 117 | 15 |
| 596.68 | 1.00 | | | Sandstone | 82.4 | 199.1 | 412.0 | 120.4 | 21.8 | ***333.2*** | 333 | 0 | 0 | 183 | 15.8 |
| 595.68 | 1.00 | | | Sandstone | 82.4 | 199.1 | 494.4 | 120.4 | 21.8 | ***453.6*** | ~~454~~ | ~~*0*~~ | ~~*0*~~ | ~~*249*~~ | ~~*16.8*~~ |
| 594.68 | 1.00 | | | Sandstone | 82.4 | 199.1 | 576.7 | 120.4 | 21.8 | ***574.0*** | ~~574~~ | ~~*0*~~ | ~~*0*~~ | ~~*316*~~ | ~~*17.8*~~ |
| 593.68 | 1.00 | | | Sandstone | 82.4 | 199.1 | ***659.1*** | 120.4 | 21.8 | 694.4 | ~~659~~ | ~~*0*~~ | ~~*0*~~ | ~~*362*~~ | ~~*18.8*~~ |
| 592.68 | 1.00 | | | Sandstone | 82.4 | 199.1 | ***741.4*** | 120.4 | 21.8 | 814.8 | ~~741~~ | ~~*0*~~ | ~~*0*~~ | ~~*408*~~ | ~~*19.8*~~ |
| 591.68 | 1.00 | | | Sandstone | 82.4 | 199.1 | ***823.8*** | 120.4 | 21.8 | 935.3 | ~~824~~ | ~~*0*~~ | ~~*0*~~ | ~~*453*~~ | ~~*20.8*~~ |
| 590.68 | 1.00 | | | Sandstone | 82.4 | 199.1 | ***906.1*** | 120.4 | 21.8 | 1055.7 | ~~906~~ | ~~*0*~~ | ~~*0*~~ | ~~*498*~~ | ~~*21.8*~~ |
| 589.68 | 1.00 | | | Sandstone | 82.4 | 199.1 | ***988.5*** | 120.4 | 21.8 | 1176.1 | ~~989~~ | ~~*0*~~ | ~~*0*~~ | ~~*544*~~ | ~~*22.8*~~ |
| 588.68 | 1.00 | | | Sandstone | 82.4 | 199.1 | ***1070.9*** | 120.4 | 21.8 | 1296.5 | ~~1071~~ | ~~*0*~~ | ~~*0*~~ | ~~*589*~~ | ~~*23.8*~~ |
| 588.18 | 0.50 | | | Sandstone | | 199.1 | | | 21.8 | | | | | | |

Illinois Department of Transportation

# IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE=================================== North Abutment
REFERENCE BORING ================================ SB-02
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. ================================= 632.70 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 627.70 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ================= ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) =============== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ============== 3400 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 92.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 295.65 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 110.87 KIPS

PILE TYPE AND SIZE ============= Steel HP 10 X 42
Plugged Pile Perimeter========================== 3.300 FT.
Unplugged Pile Perimeter============== 4.858 FT.
Plugged Pile End Bearing Area=================== 0.680 SQFT.
Unplugged Pile End Bearing Area======== 0.086 SQFT.

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

| Maximum Nominal Req'd Bearing of Pile | Maximum Nominal Req.d Bearing of Boring | Maximum Factored Resistance Available in Boring | Maximum Pile Driveable Length in Boring |
|---|---|---|---|
| **335** KIPS | **329** KIPS | **181** KIPS | **31** FT. |

| BOT. OF LAYER ELEV. (FT.) | LAYER THICK. (FT.) | UNCONF. COMPR. STRENGTH (TSF.) | S.P.T. N VALUE (BLOWS) | GRANULAR OR ROCK LAYER DESCRIPTION | NOMINAL 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) | | | | | |
| 626.10 | 1.60 | 1.40 | | | 4.8 | | 14.4 | 7.1 | | ***8.3*** | 8 | 0 | 0 | 5 | 7 |
| 623.60 | 2.50 | 1.00 | | | 5.9 | 9.5 | 20.2 | 8.6 | 1.2 | ***17.0*** | 17 | 0 | 0 | 9 | 9 |
| 621.10 | 2.50 | 1.00 | | | 5.9 | 9.5 | 26.1 | 8.6 | 1.2 | ***25.6*** | 26 | 0 | 0 | 14 | 12 |
| 618.60 | 2.50 | 1.00 | | | 5.9 | 9.5 | ***32.0*** | 8.6 | 1.2 | 34.2 | 32 | 0 | 0 | 18 | 14 |
| 616.10 | 2.50 | 1.00 | | | 5.9 | 9.5 | ***34.0*** | 8.6 | 1.2 | 42.4 | 34 | 0 | 0 | 19 | 17 |
| 613.60 | 2.50 | 0.60 | | | 3.8 | 5.7 | ***39.7*** | 5.6 | 0.7 | 48.2 | 40 | 0 | 0 | 22 | 19 |
| 611.10 | 2.50 | 0.80 | | | 4.9 | 7.6 | 61.7 | 7.2 | 1.0 | ***57.5*** | 58 | 0 | 0 | 32 | 22 |
| 608.60 | 2.50 | 2.60 | | | 11.4 | 24.8 | ***64.6*** | 16.8 | 3.1 | 73.3 | 65 | 0 | 0 | 36 | 24 |
| 606.10 | 2.50 | 1.70 | | | 8.6 | 16.2 | 184.1 | 12.7 | 2.1 | ***100.0*** | 100 | 0 | 0 | 55 | 27 |
| 603.60 | 2.50 | | 100 | Hard Till | 17.8 | 127.1 | 212.5 | 26.2 | 16.1 | ***127.5*** | 128 | 0 | 0 | 70 | 29 |
| 602.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | 281.0 | 100.9 | 17.4 | ***228.4*** | 228 | 0 | 0 | 126 | 30.1 |
| 601.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | 349.5 | 100.9 | 17.4 | ***329.3*** | 329 | 0 | 0 | 181 | 31.1 |
| 600.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***418.1*** | 100.9 | 17.4 | 430.1 | ~~418~~ | ~~*0*~~ | ~~*0*~~ | ~~*230*~~ | ~~*32.1*~~ |
| 599.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***486.6*** | 100.9 | 17.4 | 531.0 | ~~487~~ | ~~*0*~~ | ~~*0*~~ | ~~*268*~~ | ~~*33.1*~~ |
| 598.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***555.1*** | 100.9 | 17.4 | 631.9 | ~~555~~ | ~~*0*~~ | ~~*0*~~ | ~~*305*~~ | ~~*34.1*~~ |
| 597.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***623.6*** | 100.9 | 17.4 | 732.7 | ~~624~~ | ~~*0*~~ | ~~*0*~~ | ~~*343*~~ | ~~*35.1*~~ |
| 596.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***692.1*** | 100.9 | 17.4 | 833.6 | ~~692~~ | ~~*0*~~ | ~~*0*~~ | ~~*381*~~ | ~~*36.1*~~ |
| 595.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***760.6*** | 100.9 | 17.4 | 934.5 | ~~761~~ | ~~*0*~~ | ~~*0*~~ | ~~*418*~~ | ~~*37.1*~~ |
| 594.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***829.1*** | 100.9 | 17.4 | 1035.4 | ~~829~~ | ~~*0*~~ | ~~*0*~~ | ~~*456*~~ | ~~*38.1*~~ |
| 593.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***897.7*** | 100.9 | 17.4 | 1136.2 | ~~898~~ | ~~*0*~~ | ~~*0*~~ | ~~*494*~~ | ~~*39.1*~~ |
| 592.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***966.2*** | 100.9 | 17.4 | 1237.1 | ~~966~~ | ~~*0*~~ | ~~*0*~~ | ~~*531*~~ | ~~*40.1*~~ |
| 591.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***1034.7*** | 100.9 | 17.4 | 1338.0 | ~~1035~~ | ~~*0*~~ | ~~*0*~~ | ~~*569*~~ | ~~*41.1*~~ |
| 590.60 | 1.00 | | | Sandstone | 68.5 | 137.7 | ***1103.2*** | 100.9 | 17.4 | 1438.8 | ~~1103~~ | ~~*0*~~ | ~~*0*~~ | ~~*607*~~ | ~~*42.1*~~ |
| 589.60 | 1.00 | | | Sandstone | | 137.7 | | | 17.4 | | | | | | |

EXHIBIT I

# DRILLED SHAFT AXIAL CAPACITY

Illinois Department of Transportation

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

STRUCTURE ================================ 072 - 0126
SUBSTRUCTURE & REFERENCE BORING ======= Pier 1 - SB-4
GROUND SURFACE ELEVATION =============== 617.68 FT
GROUND WATER ELEVATION ================= 600.20 FT
ESTIMATED TOP OF ROCK ELEVATION ========= 597.68 FT
DRILLED SHAFT DIAMETER IN ROCK =========== 36 IN.
FACTORED AXIAL LOAD ====================== 7200 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ====== 3.5 KSI

FOUNDATION REDUNDANCY ==== REDUNDANT

| | | | | | | | | | | SIDE RESISTANCE | | | | | | | TIP RESISTANCE | | | COMBINED SIDE & TIP RESISTANCE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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? | 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) | NOM. RESIST. (KIPS) | FACT. RESIST. (KIPS) | SETTL. $w_{Rn}$ (IN.) | $R_P/R_n$ | NOM. RESIST. (KIPS) | FACT. RESIST. (KIPS) | SETTLEMENT $Q_{C1}$ (KIPS) | SETTLEMENT $w_{C1}$ (IN.) | SETTLEMENT $w_{Rn}$ (IN.) |
| 2.00 | 595.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 201 | 110 | 136 | 0.047 | 0.361 | 418.0 | 1421 | 711 | 0.823 | 0.74 | 780 | 400 | 216 | 0.047 | 0.341 |
| 4.00 | 593.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 401 | 221 | 274 | 0.077 | 0.399 | 418.0 | 1480 | 740 | 0.877 | 0.61 | 1023 | 532 | 406 | 0.079 | 0.373 |
| 6.00 | 591.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 602 | 331 | 414 | 0.096 | 0.420 | 418.0 | 1535 | 768 | 0.929 | 0.52 | 1243 | 652 | 577 | 0.099 | 0.393 |
| 8.00 | 589.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 802 | 441 | 556 | 0.111 | 0.435 | 418.0 | 1587 | 793 | 0.971 | 0.45 | 1453 | 767 | 742 | 0.116 | 0.408 |
| 10.00 | 587.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 1003 | 552 | 699 | 0.125 | 0.447 | 418.0 | 1635 | 818 | 1.012 | 0.39 | 1658 | 879 | 902 | 0.130 | 0.421 |
| 12.00 | 585.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 1204 | 662 | 845 | 0.137 | 0.458 | 418.0 | 1682 | 841 | 1.052 | 0.35 | 1858 | 989 | 1062 | 0.143 | 0.434 |
| 14.00 | 583.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 1404 | 772 | 992 | 0.148 | 0.467 | 418.0 | 1726 | 863 | 1.109 | 0.32 | 2056 | 1098 | 1220 | 0.156 | 0.445 |
| 16.00 | 581.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 1605 | 883 | 1141 | 0.160 | 0.477 | | | | | | | | | | |
| 18.00 | 579.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 1805 | 993 | 1291 | 0.171 | 0.486 | | | | | | | | | | |
| 20.00 | 577.68 | 2.00 | 418.0 | Sandstone | 35 | Fractured | 50 | Open | No | 201 | 2006 | 1103 | 1444 | 0.183 | 0.495 | | | | | | | | | | |

Illinois Department
of Transportation

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

**Drilled Shaft Design Table for Pier 1 - SB-4**

*Estimated Top of Rock Elevation: 597.68* (Page 1 of 1)

| 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.) |
| **36** | **in. Diameter Drilled Shaft** | | | | | | |
| 2 | 595.68 | 1421 | 711 | TIP | -- | -- | 0.823 |
| 4 | 593.68 | 1480 | 740 | TIP | -- | -- | 0.877 |
| 6 | 591.68 | 1535 | 768 | TIP | -- | -- | 0.929 |
| 8 | 589.68 | 1587 | 793 | TIP | -- | -- | 0.971 |
| 10 | 587.68 | 1658 | 879 | SIDE + TIP | 902 | 0.130 | 0.421 |
| 12 | 585.68 | 1858 | 989 | SIDE + TIP | 1062 | 0.143 | 0.434 |
| 14 | 583.68 | 2056 | 1098 | SIDE + TIP | 1220 | 0.156 | 0.445 |
| 16 | 581.68 | 1605 | 883 | SIDE | 1141 | 0.160 | 0.477 |
| 18 | 579.68 | 1805 | 993 | SIDE | 1291 | 0.171 | 0.486 |
| 20 | 577.68 | 2006 | 1103 | SIDE | 1444 | 0.183 | 0.495 |
| **42** | **in. Diameter Drilled Shaft** | | | | | | |
| 2 | 595.68 | 1935 | 967 | TIP | -- | -- | 0.979 |
| 4 | 593.68 | 2015 | 1007 | TIP | -- | -- | 1.029 |
| 6 | 591.68 | 2089 | 1045 | TIP | -- | -- | 1.078 |
| 8 | 589.68 | 2160 | 1080 | TIP | -- | -- | 1.125 |
| 10 | 587.68 | 2226 | 1113 | TIP | -- | -- | 1.171 |
| 12 | 585.68 | 2296 | 1218 | SIDE + TIP | 1259 | 0.154 | 0.494 |
| 14 | 583.68 | 1638 | 901 | SIDE | 1150 | 0.159 | 0.534 |
| 16 | 581.68 | 1872 | 1030 | SIDE | 1321 | 0.171 | 0.544 |
| 18 | 579.68 | 2106 | 1158 | SIDE | 1494 | 0.183 | 0.553 |
| 20 | 577.68 | 2340 | 1287 | SIDE | 1669 | 0.194 | 0.562 |
| **48** | **in. Diameter Drilled Shaft** | | | | | | |
| 2 | 595.68 | 2527 | 1263 | TIP | -- | -- | 1.117 |
| 4 | 593.68 | 2632 | 1316 | TIP | -- | -- | 1.174 |
| 6 | 591.68 | 2729 | 1365 | TIP | -- | -- | 1.228 |
| 8 | 589.68 | 2821 | 1410 | TIP | -- | -- | 1.302 |
| 10 | 587.68 | 2908 | 1454 | TIP | -- | -- | 1.331 |
| 12 | 585.68 | 2990 | 1495 | TIP | -- | -- | 1.369 |
| 14 | 583.68 | 1872 | 1030 | SIDE | 1308 | 0.170 | 0.600 |
| 16 | 581.68 | 2140 | 1177 | SIDE | 1502 | 0.182 | 0.610 |
| 18 | 579.68 | 2407 | 1324 | SIDE | 1697 | 0.194 | 0.620 |
| 20 | 577.68 | 2675 | 1471 | SIDE | 1895 | 0.205 | 0.629 |
| **60** | **in. Diameter Drilled Shaft** | | | | | | |
| 2 | 595.68 | 3948 | 1974 | TIP | -- | -- | 1.380 |
| 4 | 593.68 | 4112 | 2056 | TIP | -- | -- | 1.434 |
| 6 | 591.68 | 4264 | 2132 | TIP | -- | -- | 1.512 |
| 8 | 589.68 | 4407 | 2204 | TIP | -- | -- | 1.617 |
| 10 | 587.68 | 4543 | 2272 | TIP | -- | -- | 1.649 |
| 12 | 585.68 | 2006 | 1103 | SIDE | 1386 | 0.176 | 0.716 |
| 14 | 583.68 | 2340 | 1287 | SIDE | 1623 | 0.190 | 0.730 |
| 16 | 581.68 | 2675 | 1471 | SIDE | 1862 | 0.203 | 0.742 |
| 18 | 579.68 | 3009 | 1655 | SIDE | 2103 | 0.216 | 0.753 |
| 20 | 577.68 | 3343 | 1839 | SIDE | 2346 | 0.228 | 0.763 |