STRUCTURE GEOTECHNICAL REPORT

BRIDGE REPLACEMENT
I-74 OVER GRIFFIN STREET

Section (92-12HB-4)BR-1
Vermilion County, Illinois
Job No. P-95-056-20/D-95-032-10
Contract No. 70860
PTB 197-027
Existing Structure No. 092-0016 (EB)/092-0017 (WB)
Proposed Structure No. 092-0208 (EB)/092-0209 (WB)

Prepared For:
Thouvenot, Wade & Moerchen, Inc.
4940 Old Collinsville Road
Swansea, IL 62226
T: 618-624-4488

5-18-2022
Exp. 11-30-2023

Prepared By:
Civil Design, Inc.
Tyler Ziegler, P.E., S.E.
104 North Second Street, Suite A
Effingham, IL 62401
tziegler@civildesigninc.com T: 217-340-0349

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Table of Contents

1.0 Project Description and Scope

1.1 Introduction

The geotechnical investigation summarized herein was performed for the proposed bridges at I-74 over Griffin St. 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 1964, the existing eastbound and westbound structures are three span, continuous haunched concrete tee girder bridges with a 7" reinforced concrete deck supported on concrete pile bent spill through abutments and multi-column concrete piers. The abutments are founded on 2 rows of concrete piles with the front row battered. All piers are supported by spread footings on creosoted timber pile foundations. The existing bridge back to back abutments are 171'-6" and are constructed on a 0° 52' 0" left forward skew. The out-to-out bridge widths are 36'-0".

Both existing bridges have a sufficiency rating of 75.1 with a deck rating of 3, serious condition with significant section loss, superstructure rating of 5, fair condition with minor section loss, and a substructure rating of 7, good condition with minor problems.

1.3 Proposed Structure Information

The proposed structures are single span bridges with six 72" PPC IL beams supporting a concrete deck on a 0° 47' 11" left forward skew. Beams are spaced at 7'-2" centers with 3'-6" overhangs. Proposed back to back abutment lengths are 152'-8". Out to out of bridges are 42'-10". The roadway cross sections consist of a 6'-0" shoulder, 2 – 12'-0" lanes, and a 10'-0" shoulder. Proposed 4" concrete slopewalls are anticipated at each abutment. The proposed bridges are raised approximately ½" to 1" from existing grade at both abutments. The minimum vertical clearance from the profile grade of Griffin St. to bottom of proposed beams is 24'-8½". Staged construction will be utilized to maintain traffic. For further proposed structure information, see Appendix B for Type, Size, and Location Plan (TS&L) and Plan and Profile (P+P).

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 2,500 kips at the bottom of abutment.

2.0 Field Exploration

2.1 Subsurface Exploration and Testing

SCI Engineering, Inc. recently conducted a subsurface exploration for the project discussed herein. The subsurface investigation consisted of borings (B-1 through B-5) drilled in July and August of 2021. B-1 and B-2 were taken near the west and east abutment locations, respectively. B-3 and B-5 were taken below on Griffin St. south and north of the dual structures, respectively. B-4 was taken approximately 175' west of the existing structure just north of I-74 WB lanes. For the purpose of this report, only borings B-1 and B-2 are used as they are the nearest and most applicable to the proposed abutment locations. Soil boring exploration was performed by a CME-550X drill rig with hollow stem

augers and mud-rotary techniques. Shelby tube samples were taken in addition to SPT split-spoon samples. See Appendix C for Subsurface Data Profile Plot and Appendix D for Soil Boring Logs.

Table 2.1 - Boring Log Summary

Boring Location	Station	Offset	Ground Surface Elevation
B-1 (W. Abut.)	2032+60	2 ft. RT	580.0
B-2 (E. Abut.)	2034+76	2 ft. RT	580.0

2.2 Subsurface Conditions

Groundwater conditions recorded were first encountered in Boring B-1 at Elev. 566.5. Groundwater elevations were not recorded at 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.

Both borings, B-1 and B-2, encountered existing fill below the ground surface elevation to a depth of 32 feet. The existing fill generally consisted of gray and/or brown medium dense to dense sandy loam (A-1, A-2, A-3) or medium stiff to stiff clay loam (A-4, A-6). SPT (N) values ranged from 9 to 40 blows per foot with Qu values of 0.5 to 4.5 tsf and moisture contents ranging between 11% and 21%. Natural soil beneath the fill layer was generally fine to coarse grained, and medium dense to dense sand (A-1, A-3), transitioning to layers of medium stiff silt or clay loam (A-4, A-6). Generally, SPT (N) values ranged from 8 to 80 blows per foot, Q_u values of 0.4 to 3.6 tsf, and moisture contents ranging between 18% and 22%. Natural soil layers were present down to a clayey shale layer at tricone refusal depths of approximately 124 feet.

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 ½" to 1". Minimal earthwork is expected as the proposed grading mimics the existing. Settlement of the embankment has previously occurred due to existing conditions. By inspection, the proposed structure should result in less than 0.4 inches of settlement. Per IDOT Geotechnical Manual Section 6.9.2, driven pile capacity need not account for downdrag if total settlement of soil around the piling is less than 0.4 inches.

Regarding settlement of approach slabs, one end of the slab is supported by the pile supported abutment. The other end of the slab is supported by the existing embankment subgrades. Provided proper compaction according to IDOT Standard Specifications is performed during construction, settlement of the approach slab is not a concern.

3.2 Slope Stability

As previously discussed herein, the difference in proposed profile grade and embankment from the existing is minimal. The proposed 1:2 (V:H) sideslopes match the existing sideslopes and the height of the proposed slope is approximately 24 feet. The critical fill is generally medium dense to dense sandy and clay loams with an average SPT (N) value of 20 and an average Qu value of 1.1 tsf. Using the general rule of thumb equation below, determine a preliminary assessment of the slope stability factor of safety (FOS).

$$FOS = 6c/\gamma h = 6(1{,}100\ psf)/[(120\ pcf)(24')] = 2.3$$

A preliminary FOS of 2.3 is greater than the minimum FOS of 1.5. As validation, no known issues or concerns are present or have been present at the existing slopes which have been in place for over 57 years. In addition, the existing piles supporting the abutments and piers will remain in place and increase the nominal slope stability FOS by intersecting the circular failure planes. For the reasons discussed, a slope stability analysis was not performed as slope stability is not considered a concern given the circumstances at this bridge.

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 E 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	D
Spectral Acceleration Coefficient at period of 0.2 sec., Ss	0.140g
Spectral Acceleration Coefficient at period of 1.0 sec., S1	0.055g
Site Factor, Short Period, Fa	1.6
Site Factor, Long Period, Fv	2.4
Design Spectral Acceleration at 0.2 sec. (SDS)	0.224g
Design Spectral Acceleration at 1.0 sec. (SD1)	0.132g
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

Reviewing the Illinois State Geological Survey (ISGS) "Directory of Coal Mines in Illinois" for Vermilion County, no mining activity is present at the bridge location. The nearest underground mine proximity region is southwest of the nearby Vermilion River, 0.7 miles southwest of the project location. See Appendix F for ISGS Coal Mine Maps. In addition, no indication of subsurface mining activities were evident in soil borings B-1 through B-5.

3.6 Liquefaction

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

4.0 Foundation Recommendations

4.1 Integral Abutment Feasibility

Integral abutments are preferred to eliminate joints in the bridge decks, decreasing maintenance costs and increasing service life. The proposed structure length typically fits in the range of applicability for integral abutments; however, the soil at a critical depth of 10 feet below the abutment is very stiff (Weighted unconfined compressive strength, Qu > 3.0 tsf). According to the IDOT ABD Memo 12.3, the integral abutment study only pertains to soils with Qu less than 3.0 tsf.

To allow the use of integral abutments when Qu exceeds 3.0 tsf, IDOT ABD Memo 19.8 discusses the option of pre-coring pile locations to 10 ft below the abutment and backfilling with bentonite pellets, which reduces the soil pressures on the pile during expansion. To simulate the effects of bentonite, assume Qu = 1.5 tsf over the critical depth. The bentonite backfill option satisfies integral abutment applicability and is recommended at each abutment.

For results of the preliminary Integral Abutment Feasibility Analysis, see Appendix G. The designer shall verify integral abutment feasibility analysis with final configuration. Bridge Manual General Note #42 shall be placed on the appropriate abutment plan sheets. A 30" diameter precored hole shall be used for HP14 piles and a 24" diameter precored hole shall be used for all other piles. See IDOT ABD Memo 19.8 for further integral abutment design guidance.

4.2 Abutment Foundation Type

As discussed in Section 1.3, each abutment will experience an estimated Total Factored Load of 2,500 kips at the bottom of abutment. Per the preliminary TS&L, pile bent integral abutments are anticipated with the bottom of the west abutment at Elev. 570.71 and bottom of east abutment at Elev. 570.41.

The use of H-piles and metal shell piles were both evaluated. With tricone refusal at the bottom of borings B-1 and B-2, H-piles appear to be an acceptable pile type. Likewise, skin resistance provided by the sandy soil throughout the borings makes metal shell piles a viable option.

IDOT integral abutment policy requires one pile under each beam. Given the geometric configuration of the single span superstructure, using one pile under each beam causes large vertical loads on each pile. Of all the HP and metal shell options, the HP14x102, HP14x117 and MS16x0.375 appear to be the only piles that may be able to develop required factored resistance based on its maximum nominal required bearing. If necessary, additional piles may be placed at the midpoint between beams, which may allow for more pile applicability.

Investigating metal shell pile lengths based on estimated pile loads and geotechnical resistance with additional piles between beams, feasible metal shell pile lengths appear in the range of 35 feet to 45 feet. Approximate metal shell pile length of 40 feet with 11 piles per abutment is 440 feet of total pile per abutment. Alternatively, approximate H-pile length of 115 feet down to shale with 6 piles per abutment is 690 feet of total pile per abutment. Placing additional H-piles between beams was investigated; however, the reduced loads does not significantly reduce the pile length as H-piles are less efficient in skin resistance than metal shell piles. Also, H-piles not reaching rock are typically difficult to predict. Thus, metal shell piles placed under each beam and at midpoint between beams appears to be the most economical solution for this bridge.

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 for the strength limit state. 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 include a 2 foot embedment into the abutment. Analyses have been performed using the IDOT Static Method of Estimating Pile Length. See Appendix H.

The factored resistance available values shown in the tables are intended to provide the designer with a range of feasible options for the anticipated vertical loading.

Table 4.1 – Metal Shell Pile Capacity at the West Abutment

Pile Size	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Estimated Pile Length (ft.)	Estimated Pile Tip Elevation (ft.)
MS 14x0.312	386	212	33	540.0
	396	218	34	539.0
	547	301	42	531.0
	570	314	43	530.0
MS 16x0.312	462	254	32	537.0
	474	261	33	538.0

	486	267	34	539.0
	654	360	34	539.0
MS 16x0.375	486	267	34	539.0
	628	345	40	533.0
	703	387	45	528.0
	782	430	48	525.0

Table 4.2 – Metal Shell Pile Capacity at the East Abutment

Pile Size	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Estimated Pile Length (ft.)	Estimated Pile Tip Elevation (ft.)
MS 14x0.312	226	125	31	541.0
	486	267	37	535.0
	566	311	42	530.0
	570	314	42	530.0
MS16x0.312	270	148	31	541.0
	588	323	37	535.0
	654	360	40	532.0
MS 16x0.375	270	148	31	541.0
	588	323	37	535.0
	684	376	42	530.0
	719	395	45	527.0
	782	430	46	526.0

From boring B-2 (East Abutment), hard driving is anticipated near Elev. 540.0. Conical tips are recommended to ease drivability and reduce the possibility of pile damage. One test pile is recommended at each abutment location.

IDOT Bridge Manual 3.10.1.11 states piles shall be spaced no closer than three pile diameters, center to center. Placing a pile centered between beams creates a pile spacing of 3'-7". 14" piles satisfy the 3D spacing requirement. In the case of 16" piles, the center to center spacing is 2.7D. AASHTO LRFD Bridge Design Specifications Art. 10.7.1.2 states the center to center pile spacing should not be less than 2.5 pile diameters. If 16" piles are required by design, the designer shall coordinate with the IDOT Bureau of Bridges and Structures to verify agreement in this unique situation.

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

Temporary shoring will be required at the abutments during staged construction. From the preliminary TS&L, the distance from the proposed profile grade to the bottom of proposed abutment is approximately 11 feet, which represents the maximum soil retention anticipated. Investigating the subsurface conditions below the excavation line, the use of the IDOT temporary sheet piling design charts appears feasible at the abutments.

5.3 Foundation Construction

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

The existing abutment pile foundations have front battered piles. The existing plans have been reviewed and the batter ratio is unidentified. Assuming a 1:6 (H:V) front pile batter, the proposed abutment piles appear to miss the existing piles. If field conditions vary from this assumption, the interfering piles may need to be removed.

Placing additional piles centered between beams will cause 1 pile to be near the stage construction line. While this appears feasible, the designer shall verify the geometry in final design.

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.

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.

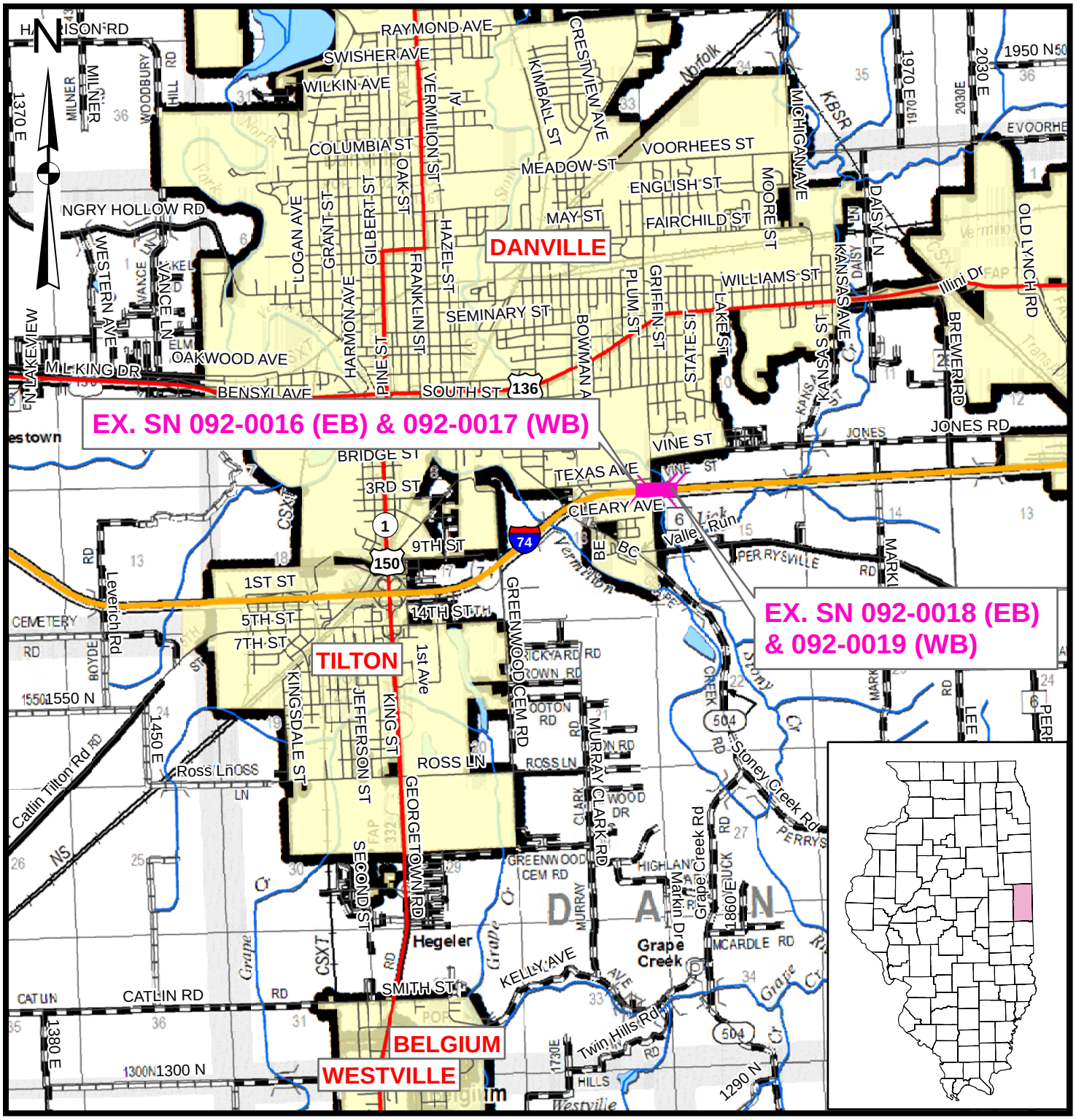
6.0 Limitations

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.

Appendix A

Location Map

FAI 74
SECTION (92-12HB-4)BR-1
VERMILION COUNTY
BRIDGE REPLACEMENT & BRIDGE DECK REPAIRS
OVER FAU 7046 (GRIFFIN ST.) AND STONY CREEK IN DANVILLE
EX. SN 092-0016, 0017 (REPLACE OVER GRIFFIN)
EX, SN 092-0018, 0019 (REPAIR OVER STONY)
CONTRACT 70860



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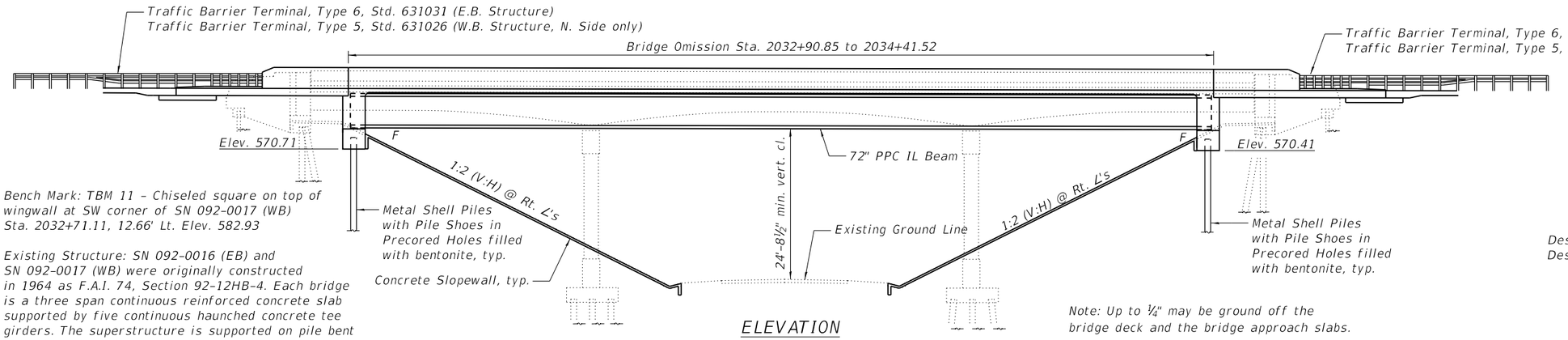
Appendix B

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



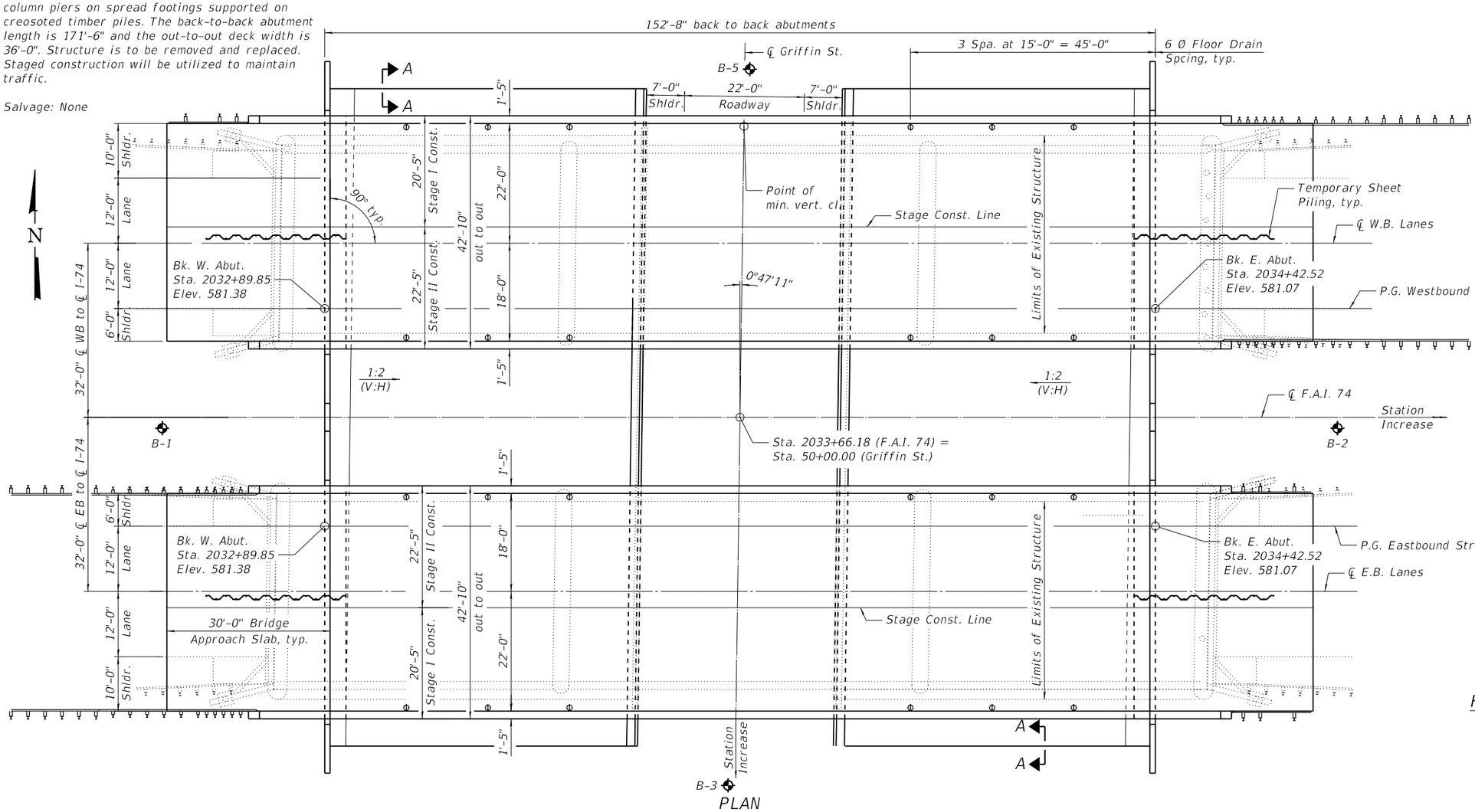
ELEVATION

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

Bench Mark: TBM 11 – Chiseled square on top of wingwall at SW corner of SN 092-0017 (WB) Sta. 2032+71.11, 12.66' Lt. Elev. 582.93

Existing Structure: SN 092-0016 (EB) and SN 092-0017 (WB) were originally constructed in 1964 as F.A.I. 74, Section 92-12HB-4. Each bridge is a three span continuous reinforced concrete slab supported by five continuous haunched concrete tee girders. The superstructure is supported on pile bent spill through abutments on concrete piles and multiple column piers on spread footings supported on creosoted timber piles. The back-to-back abutment length is 171'-6" and the out-to-out deck width is 36'-0". Structure is to be removed and replaced. Staged construction will be utilized to maintain traffic.

Salvage: None



PLAN

PROFILE GRADE

(Along ℄ I-74) *

* The profile grade shows the final elevations after grinding.

LOADING HL-93

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

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.132g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.224g
Soil Site Class = D

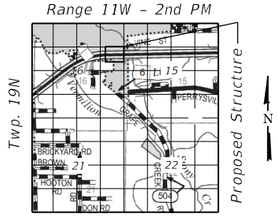
DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Concrete Superstructure)
fy = 60,000 psi (Reinforcement)

PRECAST PRESTRESSED UNITS

f'c = 8,500 psi
f'ci = 6,500 psi
fpu = 270,000 psi (0.6" Ø lax. strands)
fpbt = 202,300 psi (0.6" Ø lax. strands)



LOCATION SKETCH

GENERAL PLAN & ELEVATION
I-74 OVER GRIFFIN STREET
F.A.I. RTE. 74 - SEC. (92-12HB-4)BR-1
VERMILION COUNTY
STA. 2033+66.18
STRUCTURE NO. 092-0208 (EB)
STRUCTURE NO. 092-0209 (WB)

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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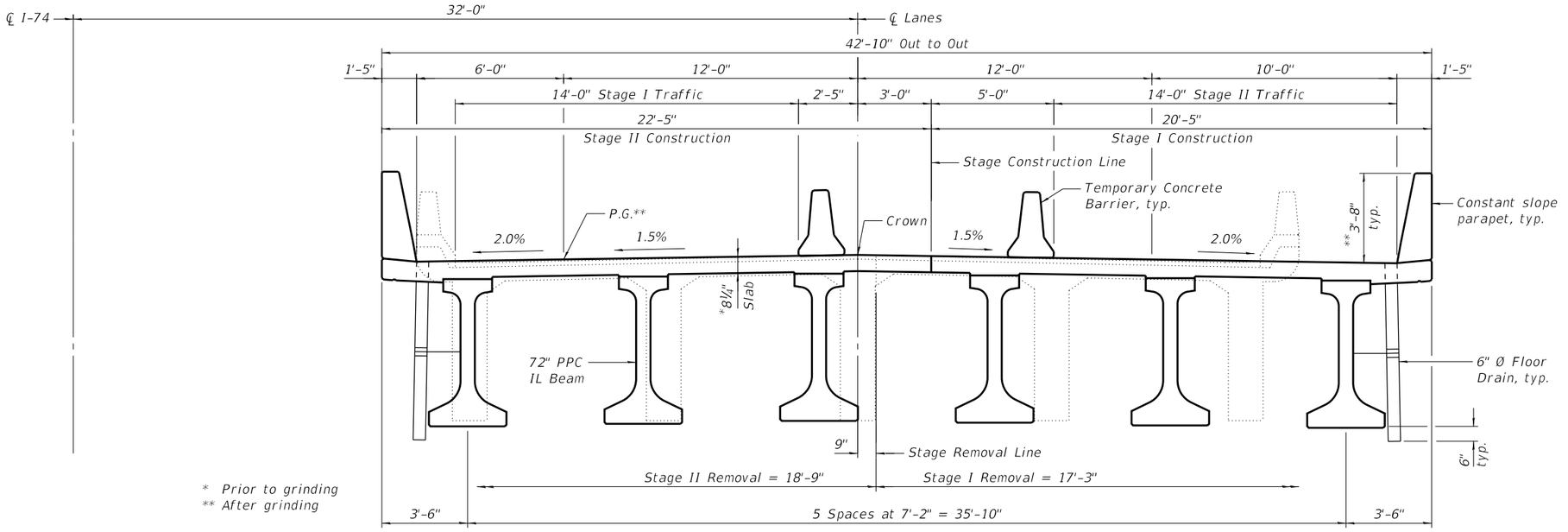
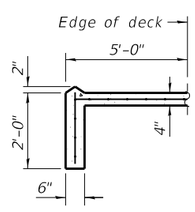
		CONTRACT NO. 70860		
	ILLINOIS	FED. AID PROJECT		



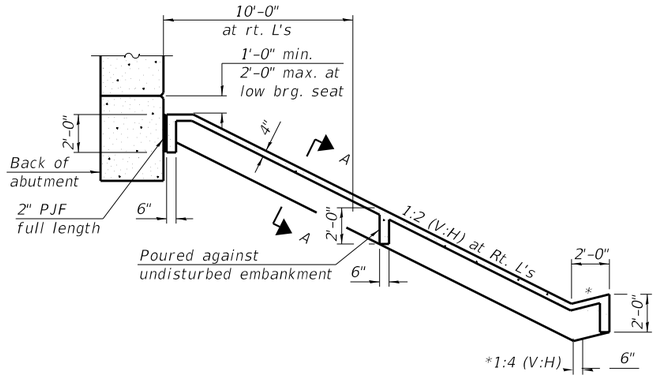
* Prior to grinding
** After grinding

CROSS SECTION

(Looking East, Eastbound Bridge; Looking West, Westbound Bridge)



SECTION A-A



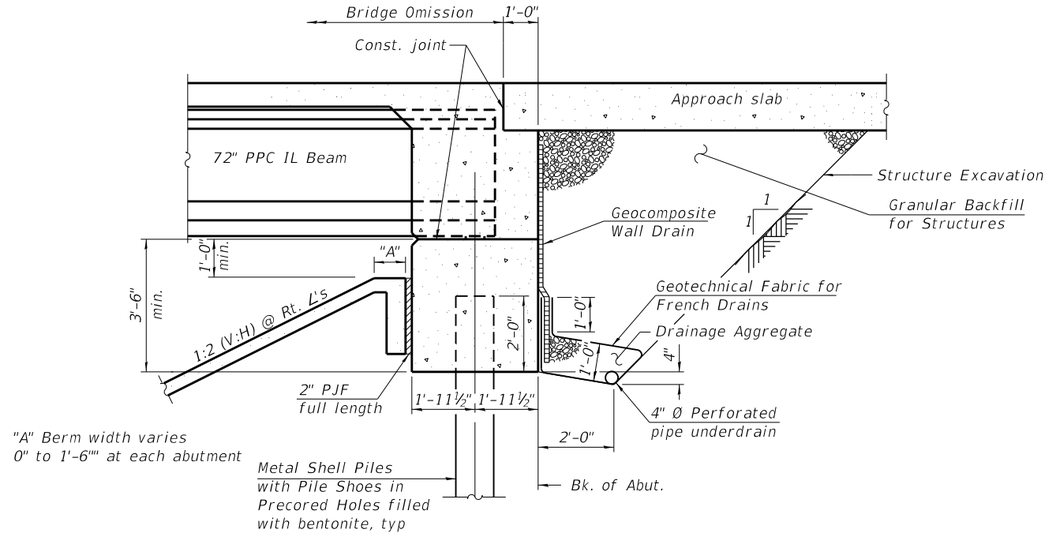
SECTION THRU CONCRETE SLOPEWALL

HIGHWAY CLASSIFICATION

F.A.I. Rte. 74 – I-74 EB
Functional Class: Interstate
ADT (one-way): 10,000 (2020); 11,000 (2040)
ADTT (one-way): 4,050 (2020); 4,455 (2040)
DHV (one-way): 770 (2040)
Design Speed: 75 m.p.h.
Posted Speed: 70 m.p.h.

F.A.I. Rte. 74 – I-74 WB
Functional Class: Interstate
ADT (one-way): 9,100 (2020); 10,000 (2040)
ADTT (one-way): 3,531 (2020); 3,880 (2040)
DHV (one-way): 810 (2040)
Design Speed: 75 m.p.h.
Posted Speed: 70 m.p.h.

F.A.U. 7046 – Griffin St.
Functional Class: Local Road
ADT: 550 (2019); 976 (2032)
ADTT: 17 (2019); 29 (2032)
Posted Speed: 30 mph
Two-Way Traffic



"A" Berm width varies 0" to 1'-6"" at each abutment

SECTION THRU INTEGRAL ABUTMENT

DETAILS
I-74 OVER GRIFFIN STREET
F.A.I. RTE. 74 – SEC. (92-12HB-4)BR-1
VERMILION COUNTY
STA. 2033+66.18
STRUCTURE NO. 092-0208 (EB)
STRUCTURE NO. 092-0209 (WB)

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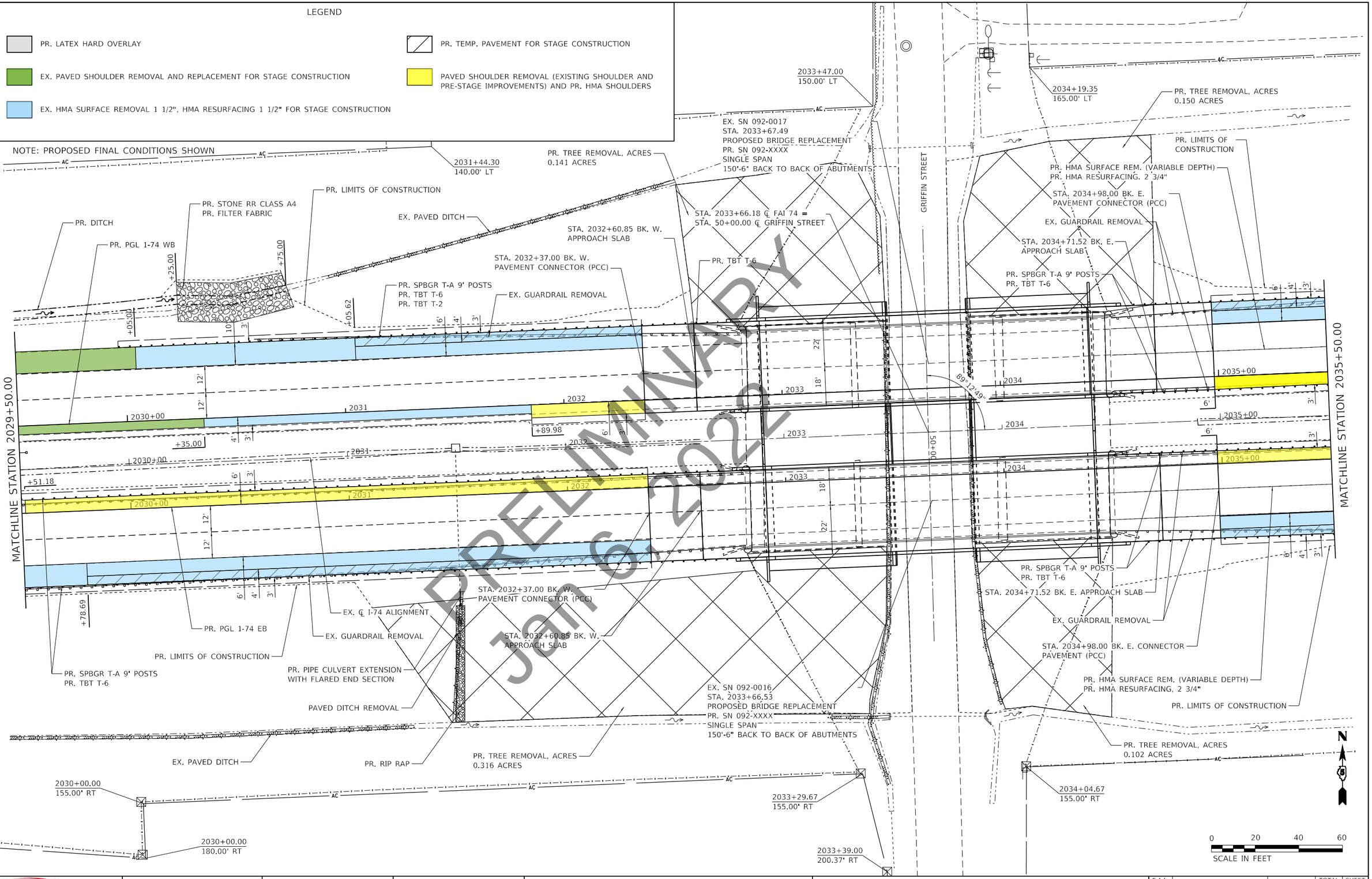
74	(92-12HB-4)BR-1	VERMILION		
		CONTRACT NO. 70860		
	ILLINOIS	FED. AID PROJECT		

LEGEND

- PR. LATEX HARD OVERLAY
- EX. PAVED SHOULDER REMOVAL AND REPLACEMENT FOR STAGE CONSTRUCTION
- EX. HMA SURFACE REMOVAL 1 1/2", HMA RESURFACING 1 1/2" FOR STAGE CONSTRUCTION
- PR. TEMP. PAVEMENT FOR STAGE CONSTRUCTION
- PAVED SHOULDER REMOVAL (EXISTING SHOULDER AND PRE-STAGE IMPROVEMENTS) AND PR. HMA SHOULDERS

NOTE: PROPOSED FINAL CONDITIONS SHOWN



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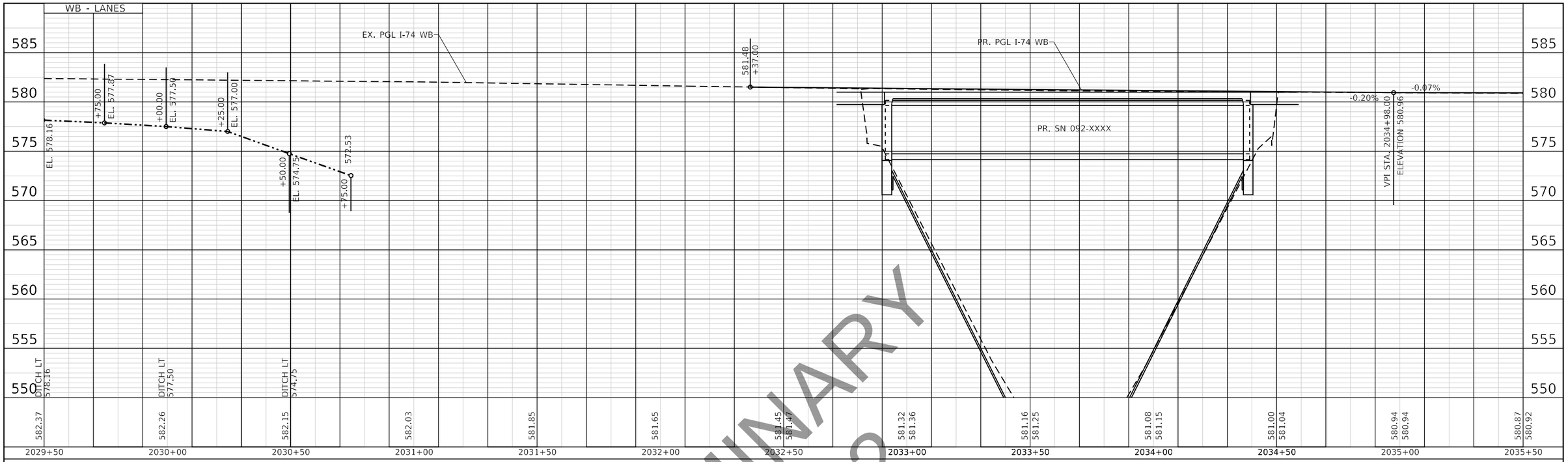
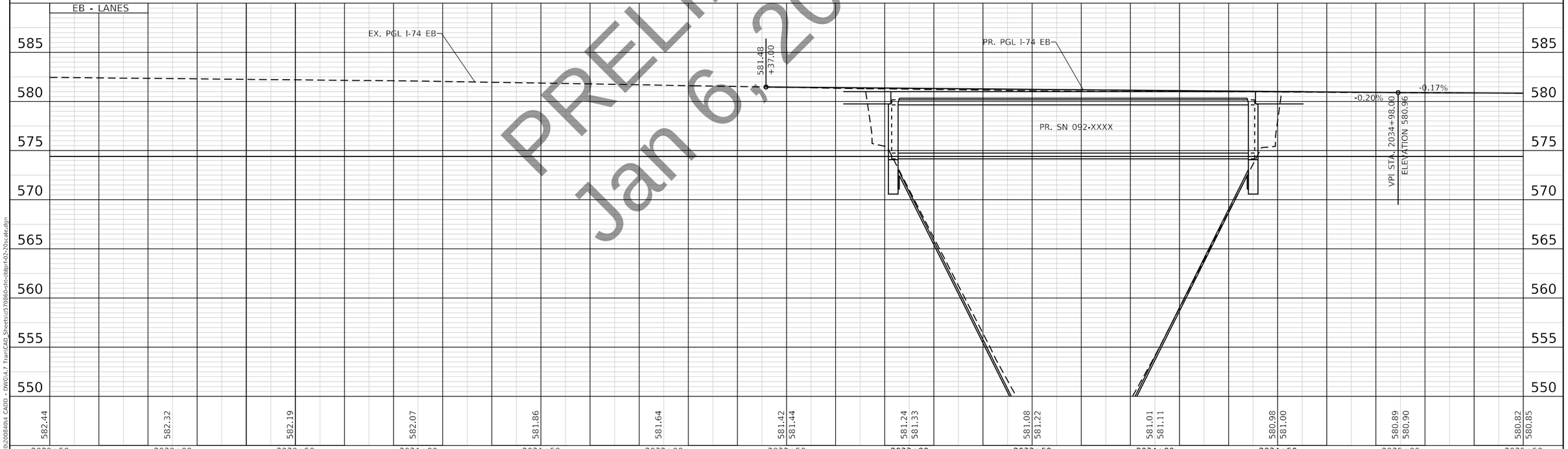
	ILLINOIS FED. AID PROJECT			





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.
BY
DATE

MODEL: Default
FILE NAME: P:\2020\20084404 CADD - DWG\4.7 Tram\CAD_Sheets\d570860sht-rdtlpr-02-20scale.dgn

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

USER NAME = bbillhartz	DESIGNED -	REVISED -
	DRAWN -	REVISED -
PLOT SCALE = 40.0000 ' / in.	CHECKED -	REVISED -
PLOT DATE = 1/6/2022	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PROFILE SHEET

SCALE: 1"=20' | SHEET 2 OF 4 SHEETS | STA. 2029+50.00 TO STA. 2035+50.00

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-12HB-4)BR-1	VERMILION		
		CONTRACT NO. 70860		
	ILLINOIS FED. AID PROJECT			

Appendix C

Subsurface Data Profile Plot

Note: Boring Stationing and Offsets shown in reference to ℄ F.A.I 74.

Boring B-1 (W. Abut.)
STA 2032+60
OFFSET 2 FT RT
EL 580.0 FT
7/21/21 - 7/23/21

PR ℄ PROFILE

EX GRADE

	EL	D	N	Qu	W%
Brown Sandy Loam (A-1), trace fine gravel, with dark brown, Loam (A-6), moist, stiff	580.0		9	0.5 P	17
Brown, clay loam (A-6), with brown, sandy clay loam (A-4), fine to coarse grained, trace fine gravel, moist, very stiff to hard	576.0	5	15	0.7 B	21
Brown Sandy Loam (A-3), fine to course grained, trace fine gravel, moist dense	569.5	10	40	>4.5 P	15
Brown, Clay Loam (A-4), moist, very stiff to stiff	567.0		17	>4.5 P	12
Brown, Sandy Clay Loam (A-2), fine grained, moist, medium dense	564.5	15	36	NC	-
Brown Clay Loam (A-6), moist very stiff to stiff	562.0		17	4.0 P	17
Brown, Sandy Loam (A-1), trace fine gravel, with Sandy Clay Loam (A-6), moist, very stiff	560.0	20	18	>4.5 P	11
Brown, Clay Loam (A-6), trace fine gravel, moist, stiff	554.5		12	1.2 B	16
Brown, Sand (A-3), fine/course grained, fine gravel, with brown, Sandy Clay Loam (A-4), trace fine gravel, moist, dense	552.0	25	29	4.0 P	-
Clay Loam: Dark brown, moist, medium stiff, (A-6)	548.0		30	3.5 P	-
Sand: Brown, fine to course grained, trace fine gravel, moist, medium dense, (A-1)	543.0	30	12	2.7 B	14
Sand: Gray, fine to coarse grained, moist, dense, (A-1)	540.0		27	4.5 P	-
Becomes medium dense		35	-	-	-
			8	0.5 S	22
	528.0	40	-	-	-
Sand: Gray, fine grained, moist, dense, (A-3)			30	NC	-
	523.0	45	-	-	-
Sand: Gray, fine to coarse grained, moist, dense, (A-1)			49	NC	-
		50	-	-	-
			29	NC	-
Sand: Gray, fine grained, moist, dense, (A-3)		55	-	-	-
	510.0		31	NC	-
Sand: Gray, fine to coarse grained, moist, dense, (A-1)		60	-	-	-
			37	NC	-
		65	-	-	-
			31	NC	-
Sand: Gray, fine grained, moist, dense, (A-3)	498.0	70	-	-	-
			38	NC	-
		75	-	-	-
			37	NC	-
Sand: Gray, fine to coarse grained, trace fine gravel, moist, medium dense, (A-1)		80	-	-	-
			35	NC	-
		85	-	-	-
			28	NC	-
Becomes very dense, some fine gravel, trace medium to coarse gravel		90	-	-	-
			22	NC	-
		95	-	-	-
			80	NC	-
Sand: Gray, fine grained, some fine gravel, trace medium to coarse gravel, moist, very dense, (A-1)	480.0	100	-	-	-
	478.0		50	NC	-
Silt: Gray, moist, hard, (A-4)		105	-	-	-
	473.0		55	4.0 P	-
Sand: Gray, fine grained, moist, dense, (A-3)		110	-	-	-
	468.0		44	NC	-
Silty Clay Loam: Gray, moist, very stiff (A-6)		115	-	-	-
	463.0		21	0.6 S	-
Sandy Loam: Gray to dark gray, fine grained, moist, dense (A-3)	460.5	120	-	-	-
Sand: Dark gray, fine to coarse grained, trace fine gravel, moist, dense (A-1)	459.0		32	NC	-
Clayey Shale: Gray	456.2		50/5"	NC	-
Tricone refusal at 123.8 feet. Borehole grouted upon completion		125	50/3"	NC	-
End of Boring			-	-	-

Boring B-2 (E. Abut.)
STA 2034+76
OFFSET 2 FT RT
EL 580.0 FT
7/29/21 - 8/3/21

	EL	D	N	Qu	W%
Brown, Sandy Loam (A-2), trace fine gravel and clay clumps, moist, stiff to very stiff	580.0		21	NC	-
		5	27	NC	-
			22	NC	-
	569.5	10	19	NC	-
Brown and gray, Sandy Clay (A-4), trave fine gravel, moist, stiff			27	<4.5 P	-
Brown, Sandy Loam (A-4), trace fine gravel, moist, very stiff	566.0	15	27	NC	-
			25	1.6 B	-
	560.0	20	33	NC	-
Brown, Sandy Loam (A-1), trace fine gravel, moist, medium dense	557.0		27	NC	-
Brown, Sandy Clay Loam (A-2), fine grained, trace fine gravel, moist, medium dense	555.0	25	10	0.5 S	-
Gray, Loam (A-4), moist, medium stiff	552.0		9	0.5 B	-
Brown, Sandy Loam (A-1), trace fine gravel, moist, medium dense	548.0	30	35	4.5 P	-
Silty Clay Loam: Gray, moist, (A-6)	545.5		-	-	-
Sandy Clay: Brown and Gray, moist, very stiff, (A-3)	544.0	35	20	0.5 B	18
Sand: Gray and brown, fine to course grained, moist, medium dense, (A-1)	540.0		10	NC	-
Sand: Gray and brown, fine to course grained, moist, dense, (A-3)		40	50/1"	NC	-
		45	-	-	-
			30	NC	-
Becomes brown and gray, trace fine gravel		50	-	-	-
			34	NC	-
	527.0	55	-	-	-
Sand: Gray, fine to course grained, trace fine to course gravel, moist, dense, (A-1)			33	NC	-
Very Dense		60	-	-	-
Sand: Gray, fine to course grained, moist, very dense, (A-3)	520.0		49	NC	-
		65	-	-	-
			55	NC	-
		70	-	-	-
			48	NC	-
		75	-	-	-
			50	NC	-
		80	-	-	-
			44	NC	-
Sand: Gray, fine to coarse, trace fine gravel, moist, very dense, (A-1)	498.0	85	-	-	-
			52	NC	-
		90	-	-	-
			46	NC	-
Sand: Gray, fine to coarse grained, moist, dense, (A-3)	488.0	95	-	-	-
			29	NC	-
Dark grey, very dense		100	-	-	-
			77	NC	-
		105	-	-	-
			59	NC	-
Gray, dense		110	-	-	-
			45	NC	-
		115	-	-	-
			45	NC	-
Silty Loam: Gray, moist, very stiff (A-4)	463.0	120	-	-	-
			28	NC	23
			50/3"	NC	-
No recovery	456.7	125	100/4"	NC	-
Tricone refusal at 123.3 feet. Borehole grouted upon completion			-	-	-
End of Boring					

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
▼ = Groundwater Level First Encountered
▽ = Groundwater Upon Completion
▽ = Groundwater After 24 to 72 hours

Soil profile is for illustrative purposes only. Actual conditions will vary.

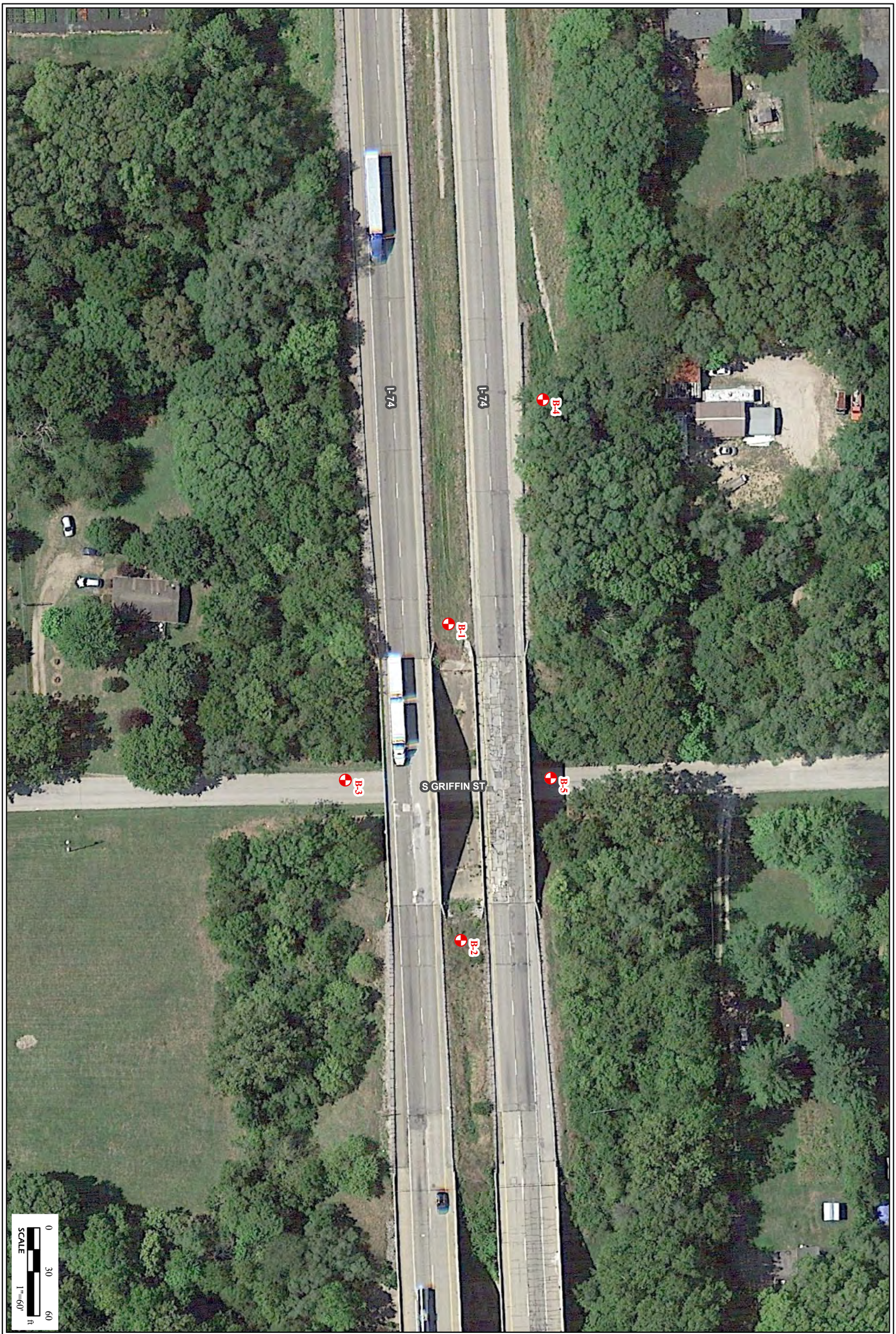
FILE NAME = X:\Effingham\4721 - IDOT PTB 197-027_D5_I-74 Danville Bridges\Reports\Griffin SGR\Subsurface Data Profile\Subsurface Data Profile.dgn	USER NAME = tziegler	DESIGNED - TW	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
Default	PLOT SCALE = 2.0000 ' / in.	DRAWN - TW	REVISED -	
	PLOT DATE = 1/18/2022	CHECKED - TJZ	REVISED -	
		DATE - 1/18/21	REVISED -	

SUBSURFACE DATA PROFILE
I-74 OVER GRIFFIN ST.
SHEET 1 OF 1 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	(92-12HB-4)BR-1	VERMILION	1	1
	ILLINOIS	FED. AID PROJECT		

Appendix D

Soil Boring Logs



JOB NUMBER	2020-0944.10	PROJECT NAME	GENERAL NOTES/LEGEND
DATE	08/2021	PTB 197, I-74 OVER GRIFFIN STREET AND STONY CREEK DANVILLE, ILLINOIS	APPROXIMATE SOIL BORING LOCATIONS
DRAWN BY	LFC		AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED: 09/2017.
CHECKED BY	TJC	AERIAL PHOTOGRAPH	DIMENSIONS AND LOCATIONS ARE APPROXIMATE; ACTUAL MAY VARY. DRAWING SHALL NOT BE USED OUTSIDE THE CONTEXT OF THE REPORT FOR WHICH IT WAS GENERATED.
FIGURE	2		

SCI Engineering, Inc.
650 Pierce Boulevard
O'Fallon, Illinois 62269

SOIL BORING LOG

Date 7/21-23/2021

ROUTE I-74 **DESCRIPTION** PTB 197 Item 27 I-74 over Griffin Street **LOGGED BY** SCI

SECTION (92-12HB-4)BR-1 **LOCATION** Danville, Illinois
Lat 40.114341 **Long** -87.602421

COUNTY Vermilion **DRILLING METHOD** HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 092-0017 (WB) 092-0016 (EB)
Station

BORING NO. B-1
Station 2032+60
Offset 2 ft RT
Ground Surface Elev. 580.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 566.5 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
FILL: Brown, SANDY LOAM (A-1), trace fine gravel, with dark brown, LOAM (A-6), moist, stiff *18.5% passing the No. 200 sieve.*		3 3 6	0.5 P	17
576.0 FILL: Brown, CLAY LOAM (A-6), with brown, SANDY CLAY LOAM (A-4), fine to coarse grained, trace fine gravel, moist, very stiff to hard	-5	1 3 12	0.7 B/20	21
		12 21 19	>4.5 P	15
	-10	6 10 7	>4.5 P	12
569.5 FILL: Brown, SANDY LOAM (A-3), fine to coarse grained, trace fine gravel, moist, dense		11 16 20	NC	--
567.0 FILL: Brown, CLAY LOAM (A-4), moist, very stiff to stiff ▼	-15	4 9 8	4.0 P	17
564.5 FILL: Brown, SANDY CLAY LOAM (A-2), fine grained, moist, medium dense *26.3% passing the No. 200 sieve.*		8 10 8	>4.5 P	11
562.0 FILL: Brown, CLAY LOAM (A-6), moist, very stiff to stiff *Atterberg Limits Test performed.*		1 5 7	1.2 B/20	16
560.0	-20			

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
FILL: Brown, SANDY LOAM (A-1), trace fine gravel, with SANDY CLAY LOAM (A-6), moist, very stiff *16.4% passing the No. 200 sieve.*		8 14 15	4.0 P	--
	-25	8 14 16	3.5 P	--
554.5 FILL: Brown, CLAY LOAM (A-6), trace fine gravel, moist, stiff		3 5 7	2.7 B/20	14
552.0 FILL: Brown, SAND (A-3), fine to coarse grained, with fine gravel, with brown, SANDY CLAY LOAM (A-4), trace fine gravel, moist, dense	-30	9 16 11	4.5 P	--
548.0 CLAY LOAM: Dark brown, moist, medium stiff, (A-6) *Grain Size Analysis performed.* *56.4% passing the No. 200 sieve.*	-35	3 3 5	0.5 S/10	22
543.0 SAND: Brown, fine to coarse grained, trace fine gravel, moist, medium dense, (A-1)		14 12 18	NC	--
540.0	-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

SCI Engineering, Inc.
650 Pierce Boulevard
O'Fallon, Illinois 62269

SOIL BORING LOG

Date 7/21-23/2021

ROUTE I-74 **DESCRIPTION** PTB 197 Item 27 I-74 over Griffin Street **LOGGED BY** SCI

SECTION (92-12HB-4)BR-1 **LOCATION** Danville, Illinois
Lat 40.114341 **Long** -87.602421

COUNTY Vermilion **DRILLING METHOD** HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 092-0017 (WB) 092-0016 (EB)
Station

BORING NO. B-1
Station 2032+60
Offset 2 ft RT
Ground Surface Elev. 580.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 566.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND: Gray, fine to coarse grained, moist, dense, (A-1) *Begin mud rotary at 40 feet*
-45	13 22 27	NC	--	
				Becomes medium dense
-50	14 14 15	NC	--	
				528.0
				SAND: Gray, fine grained, moist, dense, (A-3)
-55	10 13 18	NC	--	
				523.0
				SAND: Gray, fine to coarse grained, moist, dense, (A-1)
-60	15 17 20	NC	--	
				SAND: Gray, fine to coarse grained, moist, dense, (A-1) *(continued)*
-65	11 15 16	NC	--	
				510.0
-70	11 18 20	NC	--	SAND: Gray, fine grained, moist, dense, (A-3)
-75	11 14 23	NC	--	
-80	7 15 20	NC	--	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

SCI Engineering, Inc.
650 Pierce Boulevard
O'Fallon, Illinois 62269

SOIL BORING LOG

Date 7/21-23/2021

ROUTE I-74 **DESCRIPTION** PTB 197 Item 27 I-74 over Griffin Street **LOGGED BY** SCI

SECTION (92-12HB-4)BR-1 **LOCATION** Danville, Illinois
Lat 40.114341 **Long** -87.602421

COUNTY Vermilion **DRILLING METHOD** HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 092-0017 (WB) 092-0016 (EB)
Station

BORING NO. B-1
Station 2032+60
Offset 2 ft RT
Ground Surface Elev. 580.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 566.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine grained, moist, dense, (A-3) *(continued)*				SAND: Gray, fine grained, some fine gravel, trace medium to coarse gravel, moist, very dense, (A-1) *(continued)*			
498.0				478.0			
SAND: Gray, fine to coarse grained, trace fine gravel, moist, medium dense, (A-1)				SILT: Gray, moist, hard, (A-4)			
-85	9 11 17	NC	--	-105	16 23 32	4.0 P	
				473.0			
				SAND: Gray, fine grained, moist, dense, (A-3)			
-90	11 11 11	NC	--	-110	13 18 26	NC	
				468.0			
				SILTY CLAY LOAM: Gray, moist, very stiff (A-6)			
Becomes very dense, some fine gravel, trace medium to coarse gravel							
-95	19 32 48	NC	--	-115	4 8 13	0.6 S/15	
				463.0			
				SANDY LOAM: Gray to dark gray, fine grained, moist, dense (A-3)			
480.0 -100	13 20 30	NC	--	460.5 -120	8 14 18	NC	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

SCI Engineering, Inc.
650 Pierce Boulevard
O'Fallon, Illinois 62269

SOIL BORING LOG

Date 7/21-23/2021

ROUTE I-74 **DESCRIPTION** PTB 197 Item 27 I-74 over Griffin Street **LOGGED BY** SCI

SECTION (92-12HB-4)BR-1 **LOCATION** Danville, Illinois
Lat 40.114341 **Long** -87.602421

COUNTY Vermilion **DRILLING METHOD** HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 092-0017 (WB) 092-0016 (EB)
Station

BORING NO. B-1
Station 2032+60
Offset 2 ft RT
Ground Surface Elev. 580.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 566.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
SAND: Dark gray, fine to coarse grained, trace fine gravel, moist, dense (A-1) *(continued)*				
459.0 CLAYEY SHALE: Gray	50/5"	NC		
456.2 Tricone refusal at 123.8 feet. Borehole grouted upon completion.	50/3"	NC		
-125				
-130				
-135				
-140				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

SCI Engineering, Inc.
650 Pierce Boulevard
O'Fallon, Illinois 62269

SOIL BORING LOG

Date 7/29,30-8/2,3/2021

ROUTE I-74 **DESCRIPTION** PTB 197 Item 27 I-74 over Griffin Street **LOGGED BY** SCI

SECTION (92-12HB-4)BR-1 **LOCATION** Danville, Illinois
Lat 40.114359 **Long** -87.60165

COUNTY Vermilion **DRILLING METHOD** HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 092-0017 (WB) 092-0016 (EB)
Station

BORING NO. B-2
Station 2034+76
Offset 2 ft RT
Ground Surface Elev. 580.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter None. ft
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
FILL: Brown, SANDY LOAM (A-2), trace fine gravel and clay lumps, moist, stiff to very stiff *Grain Size Analysis performed.* *28.2% passing the No. 200 sieve.*	4 10 11	NC	--
	3 11 16	NC	--
-5			
	8 9 13	NC	--
	5 8 11	NC	--
-10			
569.5			
FILL: Brown and gray, SANDY CLAY (A-4), trace fine gravel, moist, stiff *Atterberg Limits test performed.*	8 12 15	<4.5 P	--
566.0			
FILL: Brown, SANDY LOAM (A-4), trace fine gravel, moist, very stiff *39.5% passing the No. 200 sieve.*	6 14 13	NC	--
-15			
	6 11 14	1.6 B/20	--
	7 14 19	NC	--
560.0 -20			
FILL: Brown, SANDY LOAM (A-1), trace fine gravel, moist, medium dense	13 11 16	NC	--
557.0			
FILL: Brown, SANDY CLAY LOAM (A-2), fine grained, trace fine gravel, moist, medium dense *27.8% passing the No. 200 sieve.*	5 7 3	0.5 S/15	--
555.0 -25			
FILL: Gray, LOAM (A-4), moist, medium stiff	5 3 6	0.5 B/20	--
552.0			
FILL: Gray, SANDY LOAM (A-1), trace crushed brick, with fine to coarse sand, moist, dense *Grain Size Analysis performed.* *23.0% passing the No. 200 sieve.*	10 16 19	4.5 P	--
-30			
548.0			
SILTY CLAY LOAM: Gray, moist, (A-6)	2 10 10	0.5 B/20	18
545.5 -35			
SANDY CLAY: Brown and gray, moist, very stiff, (A-3)			
544.0			
SAND: Gray and brown, fine to coarse grained, moist, medium dense, (A-1) *Grain Size Analysis performed.* *13.1% passing the No. 200 Sieve.*	4 4 6	NC	--
No recovery. Hard drilling.	38 50/1"	NC	--
540.0 -40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

SCI Engineering, Inc.
650 Pierce Boulevard
O'Fallon, Illinois 62269

SOIL BORING LOG

Date 7/29,30-8/2,3/2021

ROUTE I-74 **DESCRIPTION** PTB 197 Item 27 I-74 over Griffin Street **LOGGED BY** SCI

SECTION (92-12HB-4)BR-1 **LOCATION** Danville, Illinois
Lat 40.114359 **Long** -87.60165

COUNTY Vermilion **DRILLING METHOD** HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 092-0017 (WB) 092-0016 (EB)
Station

BORING NO. B-2
Station 2034+76
Offset 2 ft RT
Ground Surface Elev. 580.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter None. ft
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray and brown, fine to coarse grained, moist, dense, (A-3) *Hard drilling. Possible gravel or cobble deposit.*				
Becomes brown and gray, trace fine gravel	-45	10 14 16	NC	--
No recovery.	-50	15 16 18	NC	--
527.0				
SAND: Gray, fine to carse grained, trace fine to coarse gravel, moist, dense, (A-1)	-55	17 17 16	NC	--
Very dense	-60	22 23 26	NC	--
520.0				

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse grained, moist, very dense, (A-3)				
	-65	21 27 28	NC	--
With coarse gravel *Low recovery.*	-70	27 30 18	NC	--
Low recovery.	-75	28 27 23	NC	--
	-80	20 21 23	NC	--

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

SCI Engineering, Inc.
650 Pierce Boulevard
O'Fallon, Illinois 62269

SOIL BORING LOG

Date 7/29,30-8/2,3/2021

ROUTE I-74 **DESCRIPTION** PTB 197 Item 27 I-74 over Griffin Street **LOGGED BY** SCI

SECTION (92-12HB-4)BR-1 **LOCATION** Danville, Illinois
Lat 40.114359 **Long** -87.60165

COUNTY Vermilion **DRILLING METHOD** HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 092-0017 (WB) 092-0016 (EB)
Station

BORING NO. B-2
Station 2034+76
Offset 2 ft RT
Ground Surface Elev. 580.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter None. ft
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse grained, moist, very dense, (A-3) *(continued)*				
498.0				
SAND: Gray, fine to coarse, trace fine gravel, moist, very dense, (A-1)				
		18 24 28	NC	--
	-85			
		20 21 25	NC	--
	-90			
488.0				
SAND: Gray, fine to coarse grained, moist, dense, (A-3)				
		13 11 18	NC	--
	-95			
Dark gray, very dense		22 42 35	NC	--
	-100			
SAND: Gray, fine to coarse grained, moist, dense, (A-3) *(continued)*				
Trace silt deposit		16 26 33	NC	--
	-105			
Gray, dense		18 18 27	NC	--
	-110			
		18 18 27	NC	--
	-115			
463.0				
SILTY LOAM: Gray, moist, very stiff, (A-4)				
		6 10 18	NC	23
Dark gray, with shale fragments 460.0	-120			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

SCI Engineering, Inc.
650 Pierce Boulevard
O'Fallon, Illinois 62269

SOIL BORING LOG

Date 7/29,30-8/2,3/2021

ROUTE I-74 **DESCRIPTION** PTB 197 Item 27 I-74 over Griffin Street **LOGGED BY** SCI

SECTION (92-12HB-4)BR-1 **LOCATION** Danville, Illinois
Lat 40.114359 **Long** -87.60165

COUNTY Vermilion **DRILLING METHOD** HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 092-0017 (WB) 092-0016 (EB)
Station

BORING NO. B-2
Station 2034+76
Offset 2 ft RT
Ground Surface Elev. 580.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter None. ft
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SILTY LOAM: Gray, with shale fragments, moist, very stiff, (A-4) *(continued)*				
Low recovery.		50/3"	NC	--
No recovery. 456.7		100/4"	NC	--
Tricone refusal at 123.3 feet. Borehole grouted upon completion.	-125			
	-130			
	-135			
	-140			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted BBS, form 137 (Rev. 8-99)

Appendix E

Seismic Site Class Determination

Illinois Department of Transportation

SEISMIC SITE CLASS DETERMINATION

PROJECT TITLE=====I-74 over Griffin St.

Substructure 1

Base of Substruct. Elev. (or ground surf for bents	570.71	ft.
Pile or Shaft Dia.	14	inches
Boring Number	B-1	
Top of Boring Elev.	580	ft.
Approximate Fixity Elev.	563.71	ft.

Individual Site Class Definition:

N (bar): 28 (Blows/ft.) Soil Site Class D <----Controls
N_{ch} (bar): 37 (Blows/ft.) Soil Site Class D
s_u (bar): 1.23 (ksf) Soil Site Class D

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	576.0	4.00	9	0.50	B
	573.5	2.50	15	0.70	
	571.0	2.50	40	4.50	
	569.5	1.50	17	4.50	B
	567.0	2.50	36		B
	564.5	2.50	17	4.00	B
1.7	562.0	2.50	18	4.50	B
3.7	560.0	2.00	12	1.20	B
6.7	557.0	3.00	29	4.00	
9.2	554.5	2.50	30	3.50	B
11.7	552.0	2.50	12	2.70	B
15.7	548.0	4.00	27	4.50	B
18.2	545.5	2.50	8	0.50	
20.7	543.0	2.50	8	0.50	B
25.7	538.0	5.00	30		
30.7	533.0	5.00	49		
35.7	528.0	5.00	29		B
40.7	523.0	5.00	31		B
45.7	518.0	5.00	37		
50.7	513.0	5.00	31		
53.7	510.0	3.00	38		B
57.7	506.0	4.00	37		
61.7	502.0	4.00	35		
65.7	498.0	4.00	35		B
70.7	493.0	5.00	28		
75.7	488.0	5.00	22		
80.7	483.0	5.00	60		
85.7	478.0	5.00	50		B
90.7	473.0	5.00	55	4.00	B
95.7	468.0	5.00	44		B
100.7	463.0	5.00	21	0.60	B
103.2	460.5	2.50	32		B
104.7	459.0	1.50	32		B
107.5	456.2	2.80	60		B

Substructure 2

Base of Substruct. Elev. (or ground surf for bents	570.41	ft.
Pile or Shaft Dia.	14	inches
Boring Number	B-2	
Top of Boring Elev.	580	ft.
Approximate Fixity Elev.	563.41	ft.

Individual Site Class Definition:

N (bar): 32 (Blows/ft.) Soil Site Class D <----Controls
N_{ch} (bar): 38 (Blows/ft.) Soil Site Class D
s_u (bar): 0.69 (ksf) Soil Site Class E

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	577.0	3.00	21		
	574.5	2.50	27		
	572.0	2.50	22		
	569.5	2.50	19		B
	566.0	3.50	27	4.50	B
0.4	563.0	3.00	25		
3.4	560.0	3.00	35		B
6.4	557.0	3.00	27		B
8.4	555.0	2.00	10	0.50	B
11.4	552.0	3.00	9	0.50	B
15.4	548.0	4.00	35	4.50	B
17.9	545.5	2.50	20	0.50	B
19.4	544.0	1.50	20	0.50	B
23.4	540.0	4.00	10		B
28.4	535.0	5.00	60		
33.4	530.0	5.00	30		
36.4	527.0	3.00	34		B
39.9	523.5	3.50	33		
43.4	520.0	3.50	49		B
48.4	515.0	5.00	55		
53.4	510.0	5.00	48		
58.4	505.0	5.00	50		
63.4	500.0	5.00	44		
65.4	498.0	2.00	44		B
70.4	493.0	5.00	52		
75.4	488.0	5.00	46		B
80.4	483.0	5.00	29		
85.4	478.0	5.00	77		
90.4	473.0	5.00	59		
95.4	468.0	5.00	45		
100.4	463.0	5.00	45		B
103.4	460.0	3.00	28		
106.7	456.7	3.30	28		B

Substructure 3

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

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 2

N (bar): 30 (Blows/ft.) Soil Site Class D <----Controls
N_{ch} (bar): 38 (Blows/ft.) Soil Site Class D
s_u (bar): 1.07 (ksf) Soil Site Class D

Appendix F

ISGS Coal Mine Maps

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Institute of Natural Resource Sustainability
William W. Shilts, Executive Director

ILLINOIS STATE GEOLOGICAL SURVEY
E. Donald McKay III, Interim Director

For more information contact:

Institute of Natural Resource Sustainablity
Illinois State Geological Survey
615 East Peabody Drive
Champaign, Illinois 61820-6964
(217) 333-4747
http://www.isgs.illinois.edu

Danville Coal Thickness
VERMILION
County

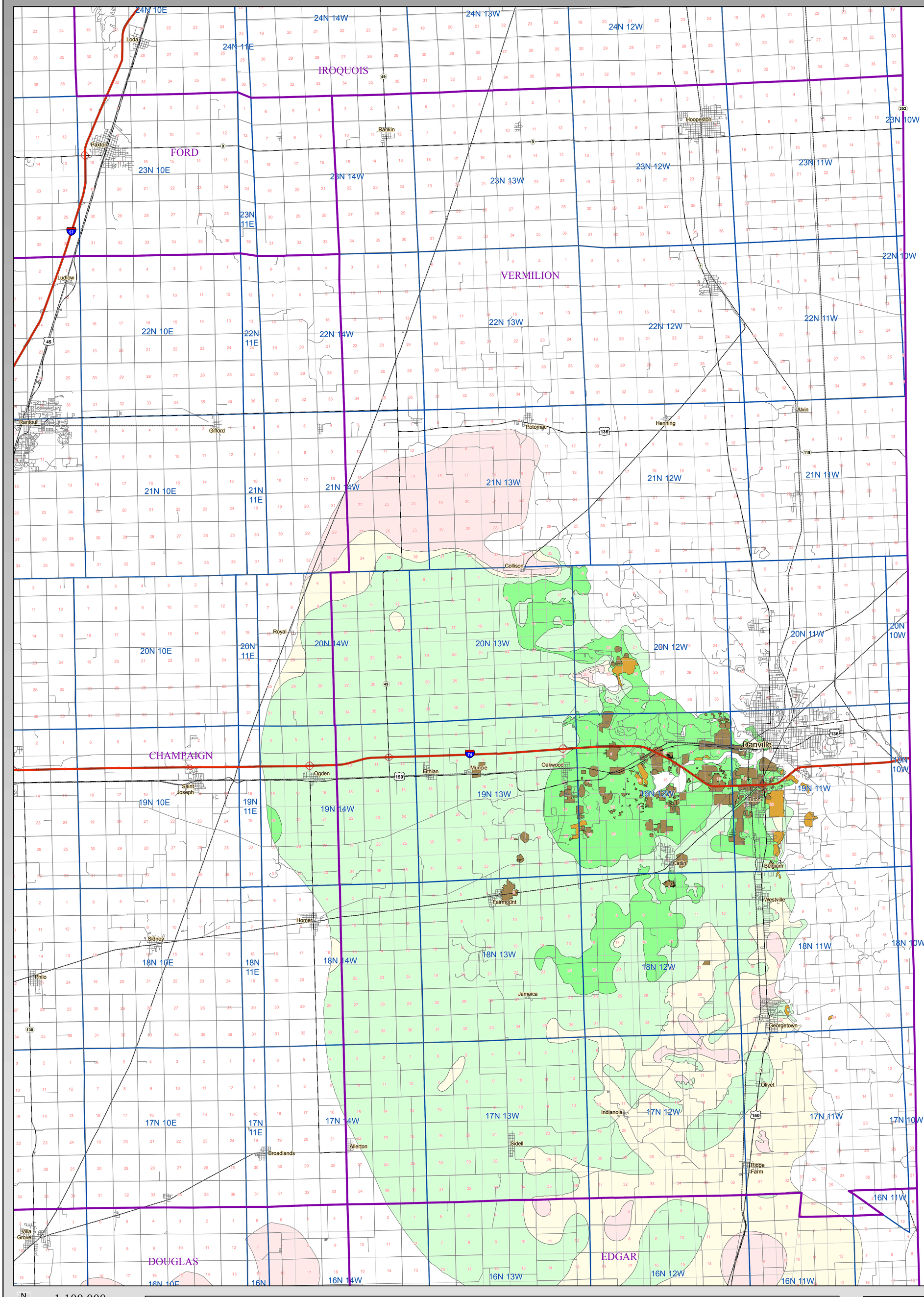
County Coal Map Series

Andrew Louchios, Scott Elrick,
Chris Korose, David Morse

Map construction: October 28, 2009

This product is under review and may not meet the standards of the Illinois State Geological Survey.

County coal maps and select quadrangle maps available as downloadable PDF files at:
http://www.isgs.illinois.edu/maps-data-pub/coal-maps/county-index.shtml



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Miles

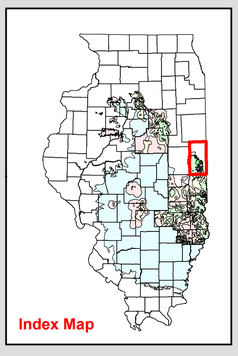

Fig. 1

The Danville Coal underlies about two thirds of Illinois as well as portions of western Indiana and western Kentucky. The coal crops out along the margins of the Illinois Basin and reaches a maximum depth in Illinois of about 1,200 feet. (See Fig 1. and Fig 2.) The Danville Coal is in the Shelburn formation which is part of the Desmoninesian Series. The Danville Coal has been mined in Livingston, McLean, La Salle, and Marshall Counties in addition to Vermilion County. In most of the remainder of the state it is a thin coal, generally a few inches to less than 3 feet thick. The Danville Coal is generally overlain by the Farmington Shale Member of the Shelburn Formation, but in places the immediate roof is 1-2 feet of black fissile shale. It is underlain by a relatively thick underclay. At the type locality in Vermillion county, the Danville Coal is 6 feet thick and occurs 20 feet above the Herrin Coal. (Hopkins, 1968 - B95). (See Fig 4.)

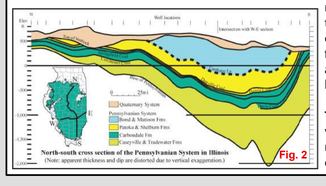

Fig. 2

The original resource of Danville Coal in the State of Illinois totals 19.6 billion tons, of which 0.2 billion have been mined. Approximately 23% of the original Danville Coal resources, 4.5 billion tons, are considered available for mining. (See Fig 3.) Available means that the surface land-use and geologic conditions related to mining of the deposit (e.g. thickness, depth, in-place tonnage, stability of bedrock overburden) are comparable to other coals currently being mined in the state. Of these resources, 4 billion tons occur in coal 42 to 66 inches thick and 0.4 billion tons occur in thicknesses greater than 66 inches.

	Original	Mined	Remaining	Available
	19.6	0.2	19.4	4.5
	3.6	0	3.6	0.9
	88.5	9.4	79.0	51.0
	65.1	2.2	63.0	27.0
	19.0	0.5	18.5	1.0
	6.0	0.1	5.9	0.3
	9.6	0.1	9.5	4.7
	9.7	0	9.7	6.7
	(All numbers in Billions of Tons)			
	221.1	12.5	208.6	96.1

Fig. 3

The Danville Coal has been mined in Illinois for over 100 years, but only about 1% of the original resource has been depleted. The most extensive area of mining was in east-central Illinois near the city of Danville where the coal has been mined by both surface and underground methods. Except for mines in east-central Illinois, most large surface mines recover the Danville Coal only as part of their operation to remove overburden to mine the underlying Herrin Coal. In many cases, the Danville seam has been considered to be too thin or too poor in quality to justify recovery and was simply discarded in the spoil pile with other rock overburden. (Modified from ISGS Pub. IM 124, Korose, et al)

Fig. 4 Pennsylvanian Stratigraphic Column

References:

- *Handbook of Illinois Stratigraphy, 1975, Illinois State Geological Survey Bulletin 95, 261p.*
- *Christopher P. Korose, Colin G. Treworgy, Russell J. Jacobson, and Scott D. Elrick, 2002, Availability of the Danville, Jamestown, Dekoven, Davis, and Seelyville Coals for mining in Selected Areas of Illinois: Illinois State Geological Survey Illinois Minerals 124, 44 p.*

Coal Thickness

- Surface Mine
- Underground Mine
- Insufficient data
- <28 inches
- 28 to 42 inches
- 42 to 66 inches
- >66 inches
- Channel
- Split Coal

Map Explanation

The maps and digital files of this study were compiled from data from a variety of public and private sources and have varying degrees of completeness and accuracy. They present interpretations of the geology of the area and are based on available data. However, these interpretations are based on data that may vary with respect to accuracy of geographic location, type, quantity, and reliability, as they were supplied to the Illinois State Geological Survey. Consequently, the accuracy of the interpreted features shown in these files is subject to the limitations of the data and varies from place to place.

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Disclaimer

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ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Institute of Natural Resource Sustainability
William W. Shilts, Executive Director

ILLINOIS STATE GEOLOGICAL SURVEY
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615 East Peabody Drive
Champaign, Illinois 61820-6964
(217) 333-4747
http://www.isgs.illinois.edu

Danville Coal Depth
VERMILION
County

County Coal Map Series

Andrew Louchios, Scott Elrick,
Chris Korose, David Morse

Map construction: October 26, 2009

This product is under review and may not meet the standards of the Illinois State Geological Survey.

County coal maps and select quadrangle maps available as downloadable PDF files at:
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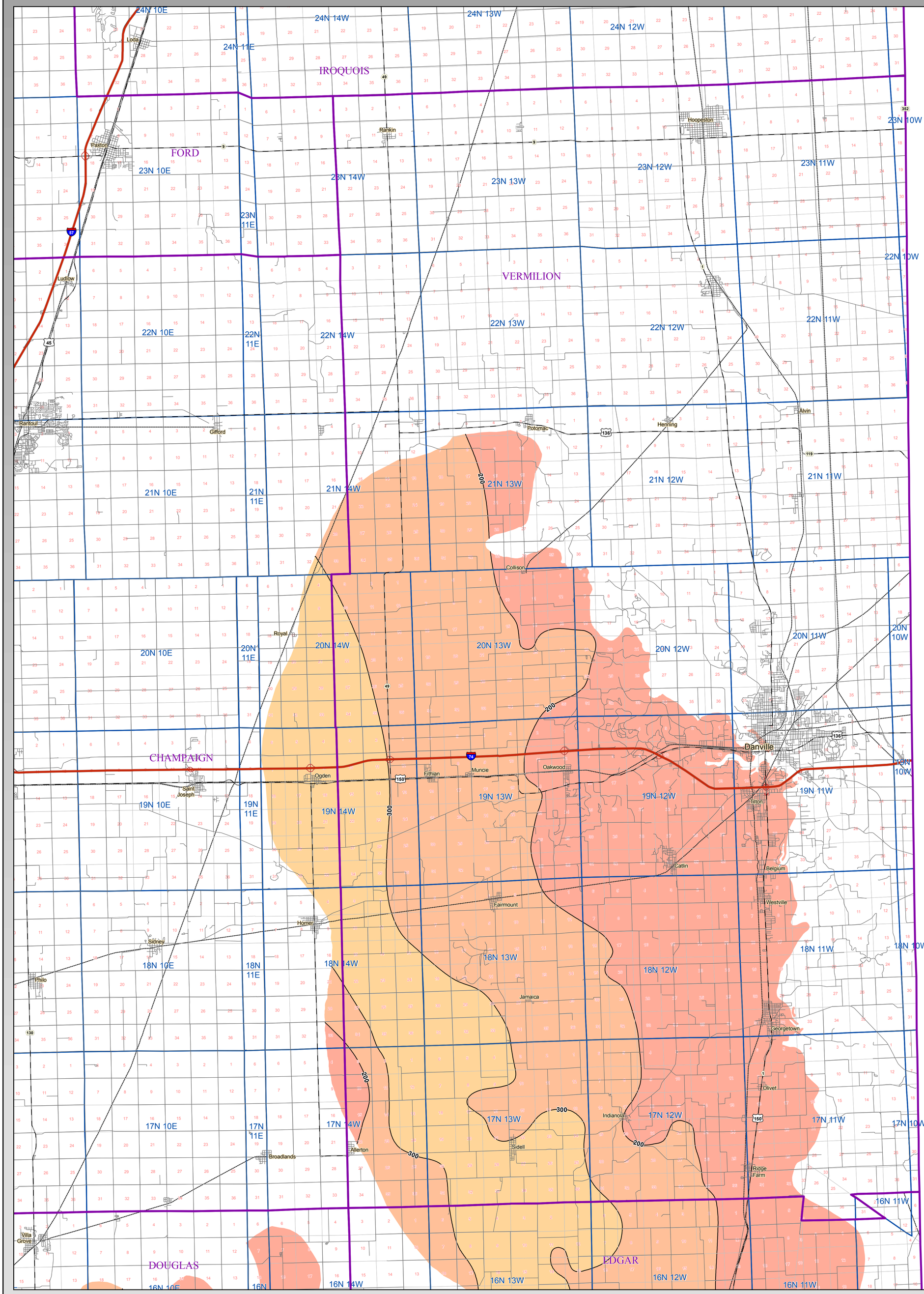

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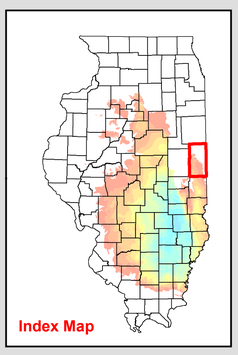
Miles



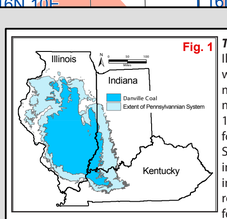


Fig. 1

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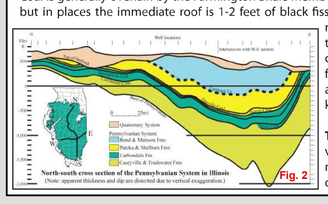

Fig. 2

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	Original	Mined	Remaining	Available
Danville	19.6	0.2	19.4	4.5
Jamestown	3.6	0	3.6	0.9
Herrin	88.5	9.4	79.0	51.0
Springfield	65.1	2.2	63.0	27.0
Colchester	19.0	0.5	18.5	1.0
Dekoven	6.0	0.1	5.9	0.3
Davis	9.6	0.1	9.5	4.7
Seelyville	9.7	0	9.7	6.7
	221.1	12.5	208.6	96.1

(All numbers in Billions of Tons)

Fig. 3

The Danville Coal has been mined in Illinois for over 100 years, but only about 1% of the original resource has been depleted. The most extensive area of mining was in east-central Illinois near the city of Danville where the coal has been mined by both surface and underground methods. Except for mines in east-central Illinois, most large surface mines recover the Danville Coal only as part of their operation to remove overburden to mine the underlying Herrin Coal. In many cases, the Danville seam has been considered to be too thin or too poor in quality to justify recovery and was simply discarded in the spoil pile with other rock overburden. (Modified from ISGS Pub. IM 124, Korose, et al)

Fig. 4

References:

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- *Christopher P. Korose, Colin G. Treworgy, Russell J. Jacobson, and Scott D. Elrick, 2002, Availability of the Danville, Jamestown, Dekoven, Davis, and Seelyville Coals for mining in Selected Areas of Illinois: Illinois State Geological Survey Illinois Minerals 124, 44 p.*

Coal Depth

- < 200 ft
- 200 to 300 ft
- 300 to 400 ft
- 400 to 500 ft
- 500 to 600 ft
- 600 to 700 ft
- 700 to 800 ft
- 800 to 900 ft
- 900 to 1000 ft
- 1000 to 1100 ft
- 1100 to 1200 ft
- 1200 to 1300 ft
- 1300 to 1400 ft
- 1400 to 1500 ft
- 1500 to 1600 ft

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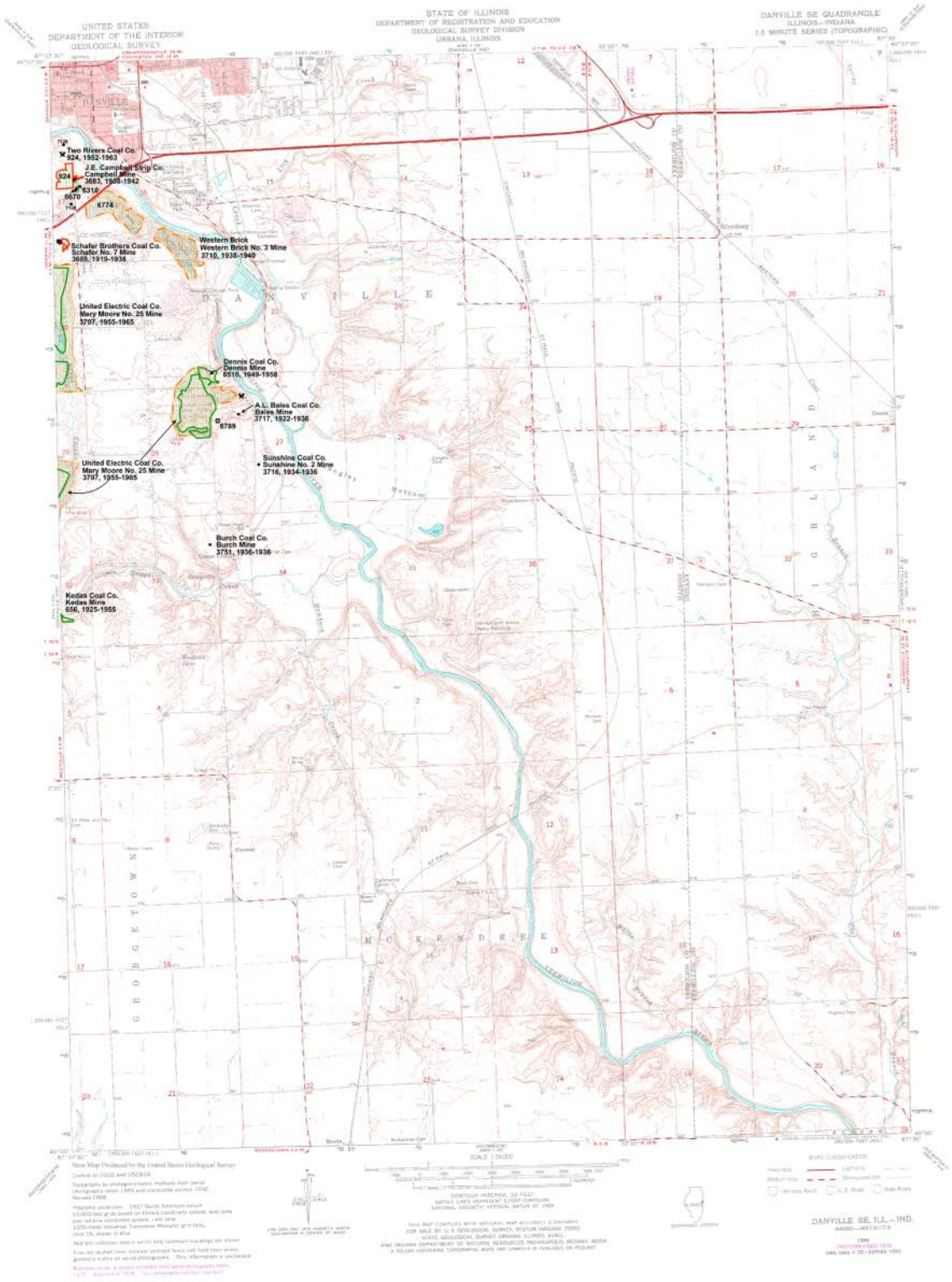


Coal Mines in Illinois
Danville Southeast Quadrangle
Vermilion County, Illinois
Danville Coal

This map accompanies the Coal Mines Directory for the Danville Southeast Quadrangle and map of mines in the Herrin Coal, Danville Southeast Quadrangle. Consult the directory for a complete explanation of the information shown on this map.

Mining Method

- Room & Pillar (RP)
- Room & Pillar Basic (RPB)
- Modified Room & Pillar (MRP)
- Room & Pillar Panel (RPP)
- Blind Room & Pillar (BRP)
- Checkerboard Room & Pillar (CRP)
- High Extraction Retreat (HER)
- Longwall (LW)
- Underground, Method Unknown
- Strip Mine
- Auger Mine
- General Area of Mining

Source of Mine Outline

- Final Mine Map
- Not Final Mine Map
- Undated Mine Map
- Incomplete Mine Map
- Secondary Source Map

Tipple, Shaft, Slope, Drift Locations

- Strip Mine Tipple - Active
- Strip Mine Tipple - Abandoned
- Mine Shaft - Active
- Mine Shaft - Abandoned
- Mine Slope - Active
- Mine Slope - Abandoned
- Mine Drift - Active
- Mine Drift - Abandoned
- Air Shaft
- Uncertain Location
- Uncertain Type of Opening

Mine Annotation
(space permiting)
Company
Mine Name
ISGS Index No., Years of Operation

Location

DISCLAIMER

These data were compiled and digitized from the best source maps available. Locations of some features may be offset by 500 feet of more due to errors in the original source maps, the compilation process, digitizing or a combination of these factors. Documentation of the source materials used is contained in the directory that accompanies this map. It is the user's responsibility to read this documentation and understand the limitations of the data. Though efforts have been made to compile these data accurately, the Illinois State Geological Survey does not guarantee the validity or the accuracy of these data.

The image of the U.S.G.S. Danville Southeast Quadrangle used as a basemap was projected from the original UTM to Lambert Conformal Conic.

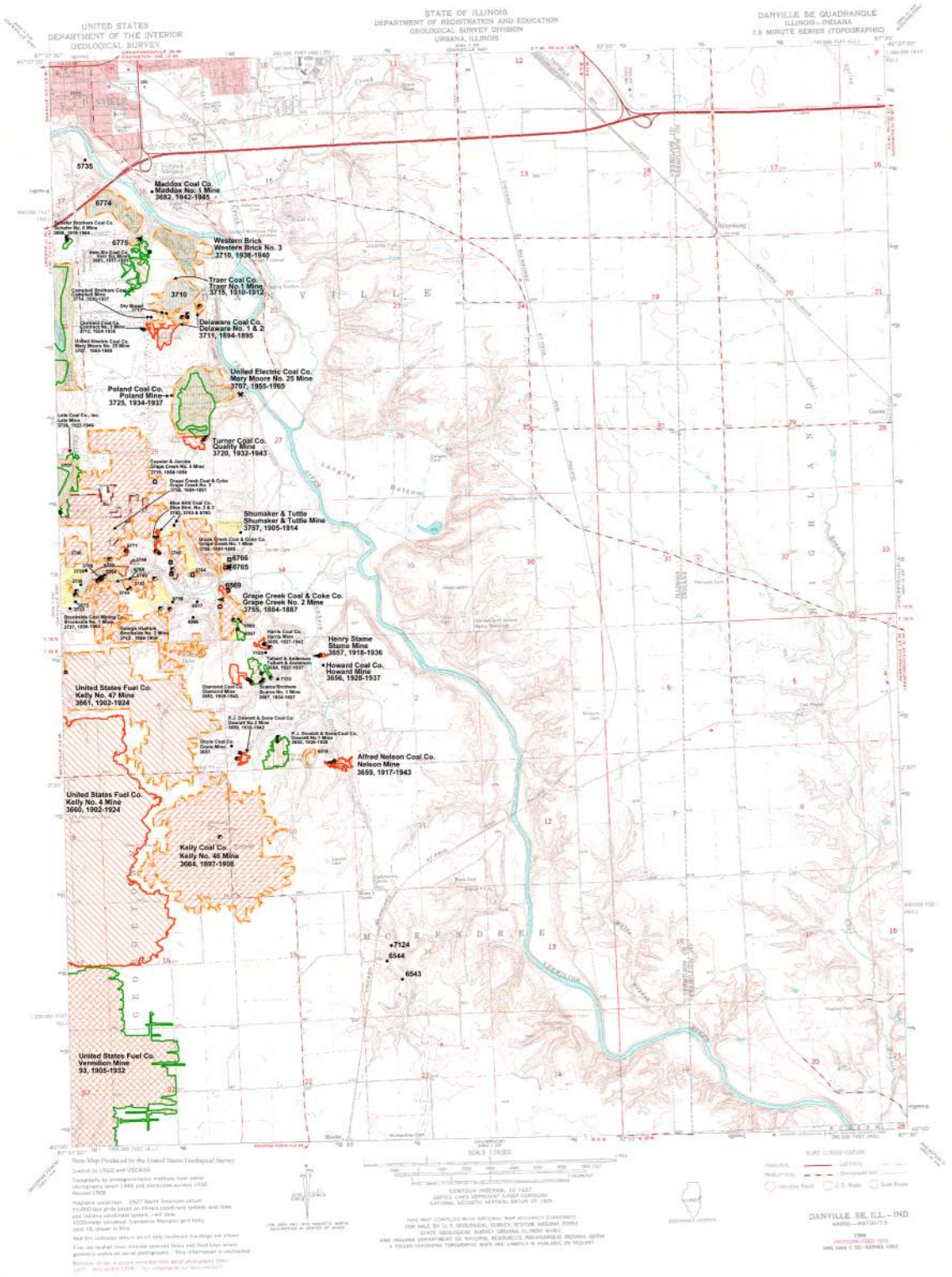
ILLINOIS DEPARTMENT OF NATURAL RESOURCES

ISGS Illinois State Geological Survey Coal Section

Illinois State Geological Survey
615 E. Peabody Dr.
Champaign, IL 61820

Mine Outlines Compiled by
Alan R. Myers, John J. LeGolvan &
Melisa L. Borino

September 30, 2002
Revised October 5, 2007



Coal Mines in Illinois
Danville Southeast Quadrangle
Vermilion County, Illinois
Herrin Coal

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Mining Method

- Room & Pillar (RP)
- Room & Pillar Basic (RPB)
- Modified Room & Pillar (MRP)
- Room & Pillar Panel (RPP)
- Blind Room & Pillar (BRP)
- Checkerboard Room & Pillar (CRP)
- High Extraction Retreat (HER)
- Longwall (LW)
- Underground, Method Unknown
- Strip Mine
- Auger Mine
- General Area of Mining

Source of Mine Outline

- Final Mine Map
- Not Final Mine Map
- Undated Mine Map
- Incomplete Mine Map
- Secondary Source Map

Tipple, Shaft, Slope, Drift Locations

- Strip Mine Tipple - Active
- Strip Mine Tipple - Abandoned
- Mine Shaft - Active
- Mine Shaft - Abandoned
- Mine Slope - Active
- Mine Slope - Abandoned
- Mine Drift - Active
- Mine Drift - Abandoned
- Air Shaft
- Uncertain Location
- Uncertain Type of Opening

Mine Annotation

(space permiting)
Company
Mine Name
ISGS Index No., Years of Operation

Location

DISCLAIMER

These data were compiled and digitized from the best source maps available. Locations of some features may be offset by 500 feet of more due to errors in the original source maps, the compilation process, digitizing or a combination of these factors. Documentation of the source materials used is contained in the directory that accompanies this map. It is the user's responsibility to read this documentation and understand the limitations of the data. Though efforts have been made to compile these data accurately, the Illinois State Geological Survey does not guarantee the validity or the accuracy of these data.

The image of the U.S.G.S. Danville Southeast Quadrangle used as a basemap was projected from the original UTM to Lambert Conformal Conic.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

ISGS Illinois State Geological Survey Coal Section

Illinois State Geological Survey
615 E. Peabody Dr.
Champaign, IL 61820

Mine Outlines Compiled by
Alan R. Myers, John J. LeGolvan &
Melisa L. Borino

September 30, 2002
Revised October 5, 2007

Appendix G

Integral Abutment Feasibility Analysis

In Situ

Illinois Department of Transportation

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

Modified 10/30/17

GENERAL DATA

STRUCTURE NUMBER==========
STRUCTURE TYPE ==========: SIMPLE-SPAN
STRUCTURE SKEW==========: 0 DEGREES
SUPER. DATA IN REFERENCE TO SUB. DATA ==== ABUT 1

TOTAL STRUCTURE LENGTH========== 152.67 FT

SUPERSTRUCTURE DATA (END OR MAIN SPAN)		
BEAM TYPE ==========	CONCRETE BEAM	
CONCRETE BEAM ==========	IL72-2438	
BEAM F'C ==========	8.5	KSI
BEAM SPACING PERP. TO CL ==========	7.17	FT
SLAB THICKNESS ==========	8.00	IN
SLAB F'C ==========	4.00	KSI

SUPERSTRUCTURE DATA (ADJACENT SPAN)		
		KSI
BEAM SPACING PERP. TO CL ==========		FT

ABUTMENT #1 DATA		
ABUTMENT NAME ==========	West	
ABUTMENT REFERENCE BORING ==========	B-1	
BOTTOM OF ABUTMENT ELEVATION ==========	570.71	FT
ESTIMATED NUMBER OF PILES AT ABUT. =======	6	
PILE SPACING PERP. TO CL ==========	7.17	FT

ABUTMENT #2 DATA		
ABUTMENT NAME ==========	East	
ABUTMENT REFERENCE BORING==========	B-2	
BOTTOM OF ABUTMENT ELEVATION==========	570.41	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	6	
PILE SPACING PERP. TO CL ==========	7.17	FT

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #1

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
569.68	1.03	4.5		
567.18	2.50		36	3.4
564.68	2.50	4.0		
562.18	2.50	4.5		
560.71	1.47	1.2		

10.00 FT = TOTAL DEPTH ENTERED

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #2

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
568.17	2.24	4.5		
566.17	2.00	4.5		
563.17	3.00		25	3.1
560.41	2.76		35	3.4

10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1======: 3.61 TSF

PILE STIFFNESS MODIFIER FOR ABUTMENT #1
= 1/(1.45-[0.3*3.61])========== 2.73

WEIGHTED AVERAGE Qu FOR ABUTMENT #2======: 3.77 TSF

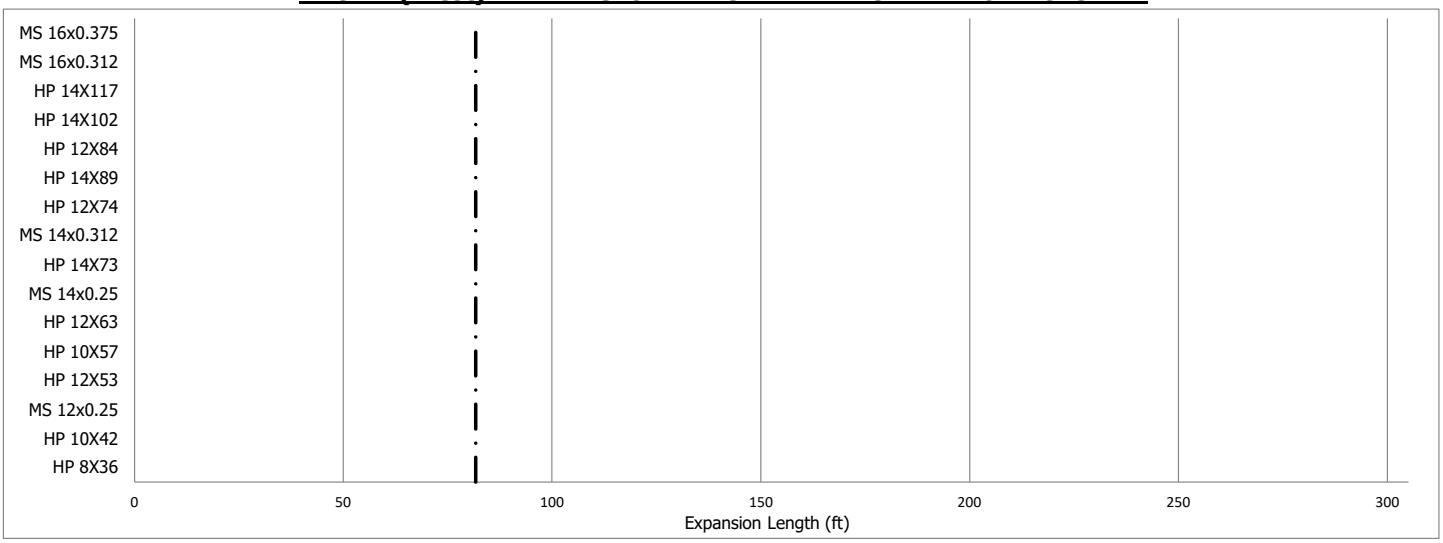
PILE STIFFNESS MODIFIER FOR ABUTMENT #2
= 1/(1.45-[0.3*3.77])========== 3.14

WEIGHTED AVG. Qu > 3.0 TSF WITH TRIB. LENGTH > 20%, INTEGRAL ABUTMENT STRUCTURE NOT ALLOWED

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [2.73*6*0+3.14*6*152.67]/[2.73*6+3.14*6]========== ~~81.67~~ FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [3.14*6*0+2.73*6*152.67]/[3.14*6+2.73*6]========== ~~71.00~~ FT

ABUT 1 (West) - EXPANSION LENGTH LIMIT CHART - 0 DEG. SKEW



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

Bentonite

Illinois Department of Transportation

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

Modified 10/30/17

GENERAL DATA

STRUCTURE NUMBER==========
STRUCTURE TYPE ==========: SIMPLE-SPAN
STRUCTURE SKEW==========: 0 DEGREES
SUPER. DATA IN REFERENCE TO SUB. DATA ==== ABUT 1

TOTAL STRUCTURE LENGTH========== 152.67 FT

SUPERSTRUCTURE DATA (END OR MAIN SPAN)		
BEAM TYPE ==========:	CONCRETE BEAM	
CONCRETE BEAM ==========	IL72-2438	
BEAM F'C ==========	8.5	KSI
BEAM SPACING PERP. TO CL ==========:	7.17	FT
SLAB THICKNESS ==========:	8.00	IN
SLAB F'C ==========	4.00	KSI

SUPERSTRUCTURE DATA (ADJACENT SPAN)		
		KSI
BEAM SPACING PERP. TO CL ==========		FT

ABUTMENT #1 DATA		
ABUTMENT NAME ==========:	West	
ABUTMENT REFERENCE BORING ==========	B-1	
BOTTOM OF ABUTMENT ELEVATION ==========	570.71	FT
ESTIMATED NUMBER OF PILES AT ABUT. =======	6	
PILE SPACING PERP. TO CL ==========:	7.17	FT

ABUTMENT #2 DATA		
ABUTMENT NAME ==========:	East	
ABUTMENT REFERENCE BORING==========	B-2	
BOTTOM OF ABUTMENT ELEVATION==========	570.41	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	6	
PILE SPACING PERP. TO CL ==========:	7.17	FT

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #1

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
568.21	2.50	1.5		
565.71	2.50	1.5		
563.21	2.50	1.5		
560.71	2.50	1.5		

10.00 FT = TOTAL DEPTH ENTERED

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #2

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
567.91	2.50	1.5		
565.41	2.50	1.5		
562.91	2.50	1.5		
560.41	2.50	1.50		

10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1======: 1.50 TSF

PILE STIFFNESS MODIFIER FOR ABUTMENT #1
= 1/(1.45-[0.3*1.5])==========: 1.00

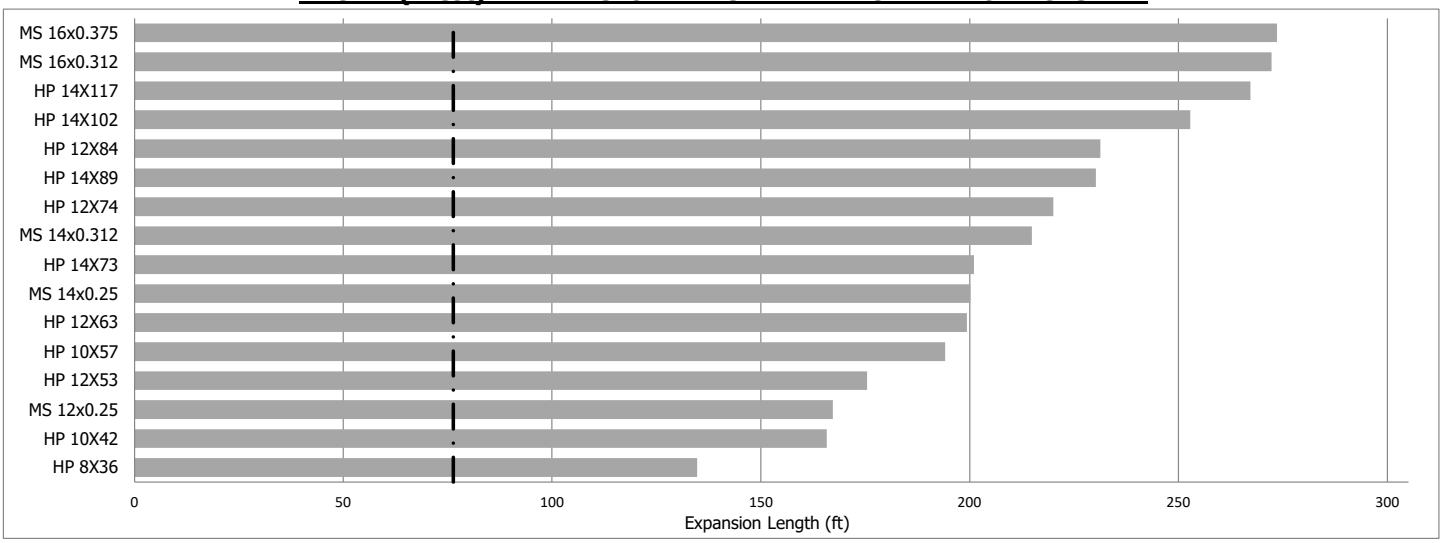
WEIGHTED AVERAGE Qu FOR ABUTMENT #2======: 1.50 TSF

PILE STIFFNESS MODIFIER FOR ABUTMENT #2
= 1/(1.45-[0.3*1.5])==========: 1.00

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [1*6*0+1*6*152.67]/[1*6+1*6]========== 76.34 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [1*6*0+1*6*152.67]/[1*6+1*6]========== 76.34 FT

ABUT 1 (West) - EXPANSION LENGTH LIMIT CHART - 0 DEG. SKEW



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

Appendix H

Driven Pile Analysis

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== W Abutment
REFERENCE BORING ========== B-01
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 572.71 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 570.71 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 ========== 2500 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 466.96 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 175.11 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.312" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 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
570 KIPS	**547** KIPS	**301** KIPS	**42** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
569.50	1.21		17	Hard Till	4.2		***81.2***				81	0	0	45	3
567.00	2.50		36	Medium Sand	35.0	77.0	***100.1***				100	0	0	55	6
564.50	2.50		17	Hard Till	8.6	60.9	***138.2***				138	0	0	76	8
562.00	2.50		18	Hard Till	9.1	90.4	***70.9***				71	0	0	39	11
560.00	2.00	1.20			9.4	14.1	***212.6***				213	0	0	117	13
557.00	3.00		29	Hard Till	17.6	146.4	***235.2***				235	0	0	129	16
554.50	2.50		30	Hard Till	15.1	151.4	***130.5***				131	0	0	72	18
552.00	2.50	2.70			20.4	31.7	***255.5***				255	0	0	141	21
550.00	2.00		27	Hard Till	10.9	136.3	***266.4***				266	0	0	147	23
548.00	2.00		27	Hard Till	10.9	136.3	***146.9***				147	0	0	81	25
545.50	2.50	0.50			5.6	5.9	***152.5***				152	0	0	84	27
543.00	2.50	0.50			5.6	5.9	***354.1***				354	0	0	195	30
542.00	1.00		30	Medium Sand	10.6	201.9	***364.7***				365	0	0	201	31
541.00	1.00		30	Medium Sand	10.6	201.9	***375.3***				375	0	0	206	32
540.00	1.00		30	Medium Sand	10.6	201.9	***385.9***				386	0	0	212	33
539.00	1.00		30	Medium Sand	10.6	201.9	***396.5***				396	0	0	218	34
538.00	1.00		30	Medium Sand	10.6	201.9	***534.9***				535	0	0	294	35
533.00	5.00		49	Medium Sand	121.3	329.7	***521.7***				522	0	0	287	40
530.50	2.50		29	Medium Sand	25.3	195.2	***547.0***				547	0	0	301	42
528.00	2.50		29	Medium Sand	25.3	195.2	***585.7***				~~586~~	~~0~~	~~0~~	~~322~~	~~45~~
523.00	5.00		31	Fine Sand	49.8	208.6	***675.9***				~~676~~	~~0~~	~~0~~	~~372~~	~~50~~
518.00	5.00		37	Medium Sand	73.3	249.0	***708.8***				~~709~~	~~0~~	~~0~~	~~390~~	~~55~~
513.00	5.00		31	Medium Sand	55.5	208.6	***811.5***				~~811~~	~~0~~	~~0~~	~~446~~	~~60~~
510.00	3.00		38	Medium Sand	46.0	255.7	***850.7***				~~851~~	~~0~~	~~0~~	~~468~~	~~63~~
506.00	4.00		37	Fine Sand	51.4	249.0	***888.7***				~~889~~	~~0~~	~~0~~	~~489~~	~~67~~
502.00	4.00		35	Fine Sand	47.1	235.5	***935.8***				~~936~~	~~0~~	~~0~~	~~515~~	~~71~~
498.00	4.00		35	Fine Sand	47.1	235.5	***935.8***				~~936~~	~~0~~	~~0~~	~~515~~	~~75~~
493.00	5.00		28	Medium Sand	48.2	188.4	***943.7***				~~944~~	~~0~~	~~0~~	~~519~~	~~80~~
488.00	5.00		22	Medium Sand	37.1	148.0	***1236.5***				~~1237~~	~~0~~	~~0~~	~~680~~	~~85~~
483.00	5.00		60	Medium Sand	176.8	403.8	***1346.0***				~~1346~~	~~0~~	~~0~~	~~740~~	~~90~~
478.00	5.00		50	Medium Sand	126.1	336.5	***1413.3***				~~1413~~	~~0~~	~~0~~	~~777~~	~~95~~
473.00	5.00		55	Hard Till	68.6	277.6	***1500.3***				~~1500~~	~~0~~	~~0~~	~~825~~	~~100~~
468.00	5.00		44	Fine Sand	85.8	296.1	***1297.1***				~~1297~~	~~0~~	~~0~~	~~713~~	~~105~~
463.00	5.00	0.60			13.2	7.0	***1464.8***				~~1465~~	~~0~~	~~0~~	~~806~~	~~110~~
460.50	2.50		32	Very Fine Silty Sand	23.4	161.5	***1488.1***				~~1488~~	~~0~~	~~0~~	~~818~~	~~112~~
459.00	1.50		32	Very Fine Silty Sand	14.0	161.5	***1677.1***				~~1677~~	~~0~~	~~0~~	~~922~~	~~114~~
458.00	1.00			Shale	230.7	336.5	***1907.8***				~~1908~~	~~0~~	~~0~~	~~1049~~	~~114.7~~
457.00	1.00			Shale		336.5									

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== W Abutment
REFERENCE BORING ========== B-01
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 572.71 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 570.71 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 ========== 2500 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 466.96 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 175.11 KIPS

PILE TYPE AND SIZE ========== Metal Shell 16"Φ w/.312" walls
Pile Perimeter========== 4.189 FT.
Pile End Bearing Area========== 1.396 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
654 KIPS	**486** KIPS	**267** KIPS	**34** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
569.50	1.21		17	Hard Till	4.7		***105.4***				105	0	0	58	3
567.00	2.50		36	Medium Sand	40.0	100.6	***124.3***				124	0	0	68	6
564.50	2.50		17	Hard Till	9.8	79.5	***172.7***				173	0	0	95	8
562.00	2.50		18	Hard Till	10.4	118.1	***83.3***				83	0	0	46	11
560.00	2.00	1.20			10.7	18.4	***266.9***				267	0	0	147	13
557.00	3.00		29	Hard Till	20.1	191.2	***293.5***				294	0	0	161	16
554.50	2.50		30	Hard Till	17.2	197.8	***154.3***				154	0	0	85	18
552.00	2.50	2.70			23.3	41.4	***314.2***				314	0	0	173	21
550.00	2.00		27	Hard Till	12.5	178.0	***326.7***				327	0	0	180	23
548.00	2.00		27	Hard Till	12.5	178.0	***168.8***				169	0	0	93	25
545.50	2.50	0.50			6.4	7.7	***175.2***				175	0	0	96	27
543.00	2.50	0.50			6.4	7.7	***437.6***				438	0	0	241	30
542.00	1.00		30	Medium Sand	12.1	263.7	***449.7***				450	0	0	247	31
541.00	1.00		30	Medium Sand	12.1	263.7	***461.9***				462	0	0	254	32
540.00	1.00		30	Medium Sand	12.1	263.7	***474.0***				474	0	0	261	33
539.00	1.00		30	Medium Sand	12.1	263.7	***486.1***				486	0	0	267	34
538.00	1.00		30	Medium Sand	12.1	263.7	***665.2***				~~665~~	~~0~~	~~0~~	~~366~~	~~35~~
533.00	5.00		49	Medium Sand	138.7	430.7	***628.1***				628	0	0	345	40
530.50	2.50		29	Medium Sand	28.9	254.9	***657.0***				~~657~~	~~0~~	~~0~~	~~361~~	~~42~~
528.00	2.50		29	Medium Sand	28.9	254.9	***703.5***				~~703~~	~~0~~	~~0~~	~~387~~	~~45~~
523.00	5.00		31	Fine Sand	56.9	272.5	***813.1***				~~813~~	~~0~~	~~0~~	~~447~~	~~50~~
518.00	5.00		37	Medium Sand	83.8	325.2	***844.1***				~~844~~	~~0~~	~~0~~	~~464~~	~~55~~
513.00	5.00		31	Medium Sand	63.5	272.5	***969.1***				~~969~~	~~0~~	~~0~~	~~533~~	~~60~~
510.00	3.00		38	Medium Sand	52.6	334.0	***1012.9***				~~1013~~	~~0~~	~~0~~	~~557~~	~~63~~
506.00	4.00		37	Fine Sand	58.8	325.2	***1054.1***				~~1054~~	~~0~~	~~0~~	~~580~~	~~67~~
502.00	4.00		35	Fine Sand	53.9	307.6	***1108.0***				~~1108~~	~~0~~	~~0~~	~~609~~	~~71~~
498.00	4.00		35	Fine Sand	53.9	307.6	***1100.3***				~~1100~~	~~0~~	~~0~~	~~605~~	~~75~~
493.00	5.00		28	Medium Sand	55.1	246.1	***1102.7***				~~1103~~	~~0~~	~~0~~	~~606~~	~~80~~
488.00	5.00		22	Medium Sand	42.4	193.4	***1479.1***				~~1479~~	~~0~~	~~0~~	~~814~~	~~85~~
483.00	5.00		60	Medium Sand	202.0	527.4	***1593.3***				~~1593~~	~~0~~	~~0~~	~~876~~	~~90~~
478.00	5.00		50	Medium Sand	144.1	439.5	***1660.5***				~~1660~~	~~0~~	~~0~~	~~913~~	~~95~~
473.00	5.00		55	Hard Till	78.4	362.6	***1763.0***				~~1763~~	~~0~~	~~0~~	~~970~~	~~100~~
468.00	5.00		44	Fine Sand	98.1	386.7	***1483.6***				~~1484~~	~~0~~	~~0~~	~~816~~	~~105~~
463.00	5.00	0.60			15.1	9.2	***1700.4***				~~1700~~	~~0~~	~~0~~	~~935~~	~~110~~
460.50	2.50		32	Very Fine Silty Sand	26.7	210.9	***1727.1***				~~1727~~	~~0~~	~~0~~	~~950~~	~~112~~
459.00	1.50		32	Very Fine Silty Sand	16.0	210.9	***1971.6***				~~1972~~	~~0~~	~~0~~	~~1084~~	~~114~~
458.00	1.00			Shale	263.7	439.5	***2235.3***				~~2235~~	~~0~~	~~0~~	~~1229~~	~~114.7~~
457.00	1.00			Shale		439.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== W Abutment
REFERENCE BORING ========== B-01
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 572.71 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 570.71 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 ========== 2500 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 466.96 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 175.11 KIPS

PILE TYPE AND SIZE ========== Metal Shell 16"Φ w/.375" walls
Plugged Pile Perimeter========== 4.189 FT.
Plugged Pile End Bearing Area========== 1.396 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
782 KIPS	**703** KIPS	**387** KIPS	**45** 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 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.)
569.50	1.21		17	Hard Till	4.7		***105.4***				105	0	0	58	3
567.00	2.50		36	Medium Sand	40.0	100.6	***124.3***				124	0	0	68	6
564.50	2.50		17	Hard Till	9.8	79.5	***172.7***				173	0	0	95	8
562.00	2.50		18	Hard Till	10.4	118.1	***83.3***				83	0	0	46	11
560.00	2.00	1.20			10.7	18.4	***266.9***				267	0	0	147	13
557.00	3.00		29	Hard Till	20.1	191.2	***293.5***				294	0	0	161	16
554.50	2.50		30	Hard Till	17.2	197.8	***154.3***				154	0	0	85	18
552.00	2.50	2.70			23.3	41.4	***314.2***				314	0	0	173	21
550.00	2.00		27	Hard Till	12.5	178.0	***326.7***				327	0	0	180	23
548.00	2.00		27	Hard Till	12.5	178.0	***168.8***				169	0	0	93	25
545.50	2.50	0.50			6.4	7.7	***175.2***				175	0	0	96	27
543.00	2.50	0.50			6.4	7.7	***437.6***				438	0	0	241	30
542.00	1.00		30	Medium Sand	12.1	263.7	***449.7***				450	0	0	247	31
541.00	1.00		30	Medium Sand	12.1	263.7	***461.9***				462	0	0	254	32
540.00	1.00		30	Medium Sand	12.1	263.7	***474.0***				474	0	0	261	33
539.00	1.00		30	Medium Sand	12.1	263.7	***486.1***				486	0	0	267	34
538.00	1.00		30	Medium Sand	12.1	263.7	***665.2***				665	0	0	366	35
533.00	5.00		49	Medium Sand	138.7	430.7	***628.1***				628	0	0	345	40
530.50	2.50		29	Medium Sand	28.9	254.9	***657.0***				657	0	0	361	42
528.00	2.50		29	Medium Sand	28.9	254.9	***703.5***				703	0	0	387	45
523.00	5.00		31	Fine Sand	56.9	272.5	***813.1***				~~813~~	~~0~~	~~0~~	~~447~~	~~50~~
518.00	5.00		37	Medium Sand	83.8	325.2	***844.1***				~~844~~	~~0~~	~~0~~	~~464~~	~~55~~
513.00	5.00		31	Medium Sand	63.5	272.5	***969.1***				~~969~~	~~0~~	~~0~~	~~533~~	~~60~~
510.00	3.00		38	Medium Sand	52.6	334.0	***1012.9***				~~1013~~	~~0~~	~~0~~	~~557~~	~~63~~
506.00	4.00		37	Fine Sand	58.8	325.2	***1054.1***				~~1054~~	~~0~~	~~0~~	~~580~~	~~67~~
502.00	4.00		35	Fine Sand	53.9	307.6	***1108.0***				~~1108~~	~~0~~	~~0~~	~~609~~	~~71~~
498.00	4.00		35	Fine Sand	53.9	307.6	***1100.3***				~~1100~~	~~0~~	~~0~~	~~605~~	~~75~~
493.00	5.00		28	Medium Sand	55.1	246.1	***1102.7***				~~1103~~	~~0~~	~~0~~	~~606~~	~~80~~
488.00	5.00		22	Medium Sand	42.4	193.4	***1479.1***				~~1479~~	~~0~~	~~0~~	~~814~~	~~85~~
483.00	5.00		60	Medium Sand	202.0	527.4	***1593.3***				~~1593~~	~~0~~	~~0~~	~~876~~	~~90~~
478.00	5.00		50	Medium Sand	144.1	439.5	***1660.5***				~~1660~~	~~0~~	~~0~~	~~913~~	~~95~~
473.00	5.00		55	Hard Till	78.4	362.6	***1763.0***				~~1763~~	~~0~~	~~0~~	~~970~~	~~100~~
468.00	5.00		44	Fine Sand	98.1	386.7	***1483.6***				~~1484~~	~~0~~	~~0~~	~~816~~	~~105~~
463.00	5.00	0.60			15.1	9.2	***1700.4***				~~1700~~	~~0~~	~~0~~	~~935~~	~~110~~
460.50	2.50		32	Very Fine Silty Sand	26.7	210.9	***1727.1***				~~1727~~	~~0~~	~~0~~	~~950~~	~~112~~
459.00	1.50		32	Very Fine Silty Sand	16.0	210.9	***1971.6***				~~1972~~	~~0~~	~~0~~	~~1084~~	~~114~~
458.00	1.00			Shale	263.7	439.5	***2235.3***				~~2235~~	~~0~~	~~0~~	~~1229~~	~~114.7~~
457.00	1.00			Shale		439.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== E Abutment
REFERENCE BORING ========== B-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 572.41 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 570.41 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 ========== 2500 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 466.96 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 175.11 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.312" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 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
570 KIPS	**566** KIPS	**311** KIPS	**42** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
569.50	0.91		19	Very Fine Silty Sand	5.0		***73.7***				74	0	0	41	3
566.00	3.50		27	Hard Till	19.1	68.7	***130.9***				131	0	0	72	6
563.00	3.00		25	Very Fine Silty Sand	21.6	106.9	***222.3***				222	0	0	122	9
560.00	3.00		35	Very Fine Silty Sand	31.2	176.6	***213.2***				213	0	0	117	12
557.00	3.00		27	Very Fine Silty Sand	23.4	136.3	***106.1***				106	0	0	58	15
555.00	2.00	0.50			4.5	5.9	***110.6***				111	0	0	61	17
552.00	3.00	0.50			6.7	5.9	***288.1***				288	0	0	158	20
550.00	2.00		35	Hard Till	14.3	176.6	***302.4***				302	0	0	166	22
548.00	2.00		35	Hard Till	14.3	176.6	***146.0***				146	0	0	80	24
545.50	2.50	0.50			5.6	5.9	***151.6***				152	0	0	83	27
544.00	1.50	0.50			3.4	5.9	***216.3***				216	0	0	119	28
543.00	1.00		10	Medium Sand	3.4	67.3	***219.7***				220	0	0	121	29
542.00	1.00		10	Medium Sand	3.4	67.3	***223.1***				223	0	0	123	30
541.00	1.00		10	Medium Sand	3.4	67.3	***226.5***				226	0	0	125	31
540.00	1.00		10	Medium Sand	3.4	67.3	***492.3***				492	0	0	271	32
535.00	5.00		49	Medium Sand	121.3	329.7	***485.8***				486	0	0	267	37
530.00	5.00		30	Medium Sand	53.0	201.9	***565.7***				566	0	0	311	42
527.00	3.00		34	Medium Sand	38.3	228.8	***597.3***				~~597~~	~~0~~	~~0~~	~~329~~	~~45~~
523.50	3.50		33	Medium Sand	42.7	222.1	***747.6***				~~748~~	~~0~~	~~0~~	~~411~~	~~49~~
520.00	3.50		49	Medium Sand	84.9	329.7	***873.0***				~~873~~	~~0~~	~~0~~	~~480~~	~~52~~
515.00	5.00		55	Medium Sand	151.1	370.1	***977.0***				~~977~~	~~0~~	~~0~~	~~537~~	~~57~~
510.00	5.00		48	Medium Sand	116.7	323.0	***1107.1***				~~1107~~	~~0~~	~~0~~	~~609~~	~~62~~
505.00	5.00		50	Medium Sand	126.1	336.5	***1192.9***				~~1193~~	~~0~~	~~0~~	~~656~~	~~67~~
500.00	5.00		44	Medium Sand	99.3	296.1	***1292.1***				~~1292~~	~~0~~	~~0~~	~~711~~	~~72~~
498.00	2.00		44	Medium Sand	39.7	296.1	***1385.7***				~~1386~~	~~0~~	~~0~~	~~762~~	~~74~~
493.00	5.00		52	Medium Sand	136.0	349.9	***1481.3***				~~1481~~	~~0~~	~~0~~	~~815~~	~~79~~
488.00	5.00		46	Medium Sand	107.8	309.6	***1474.6***				~~1475~~	~~0~~	~~0~~	~~811~~	~~84~~
483.00	5.00		29	Medium Sand	50.6	195.2	***1848.2***				~~1848~~	~~0~~	~~0~~	~~1017~~	~~89~~
478.00	5.00		77	Medium Sand	264.1	518.2	***1991.2***				~~1991~~	~~0~~	~~0~~	~~1095~~	~~94~~
473.00	5.00		59	Medium Sand	171.7	397.0	***2068.6***				~~2069~~	~~0~~	~~0~~	~~1138~~	~~99~~
468.00	5.00		45	Medium Sand	103.5	302.8	***2172.1***				~~2172~~	~~0~~	~~0~~	~~1195~~	~~104~~
463.00	5.00		45	Medium Sand	103.5	302.8	***2114.0***				~~2114~~	~~0~~	~~0~~	~~1163~~	~~109~~
460.00	3.00		28	Very Fine Silty Sand	24.2	141.3	***2138.2***				~~2138~~	~~0~~	~~0~~	~~1176~~	~~112~~
458.00	2.00		28	Very Fine Silty Sand	16.2	141.3	***2349.5***				~~2350~~	~~0~~	~~0~~	~~1292~~	~~114~~
457.00	1.00			Shale	230.7	336.5	***2580.3***				~~2580~~	~~0~~	~~0~~	~~1419~~	~~115.4~~
456.00	1.00			Shale		336.5									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== E Abutment
REFERENCE BORING ========== B-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 572.41 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 570.41 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 ========== 2500 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 466.96 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 175.11 KIPS

PILE TYPE AND SIZE ========== Metal Shell 16"Φ w/.312" walls
Pile Perimeter========== 4.189 FT.
Pile End Bearing Area========== 1.396 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
654 KIPS	**588** KIPS	**323** KIPS	**37** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
569.50	0.91		19	Very Fine Silty Sand	5.7		***95.4***				95	0	0	52	3
566.00	3.50		27	Hard Till	21.8	89.7	***167.1***				167	0	0	92	6
563.00	3.00		25	Very Fine Silty Sand	24.7	139.6	***282.9***				283	0	0	156	9
560.00	3.00		35	Very Fine Silty Sand	35.6	230.7	***265.9***				266	0	0	146	12
557.00	3.00		27	Very Fine Silty Sand	26.7	178.0	***122.2***				122	0	0	67	15
555.00	2.00	0.50			5.1	7.7	***127.3***				127	0	0	70	17
552.00	3.00	0.50			7.7	7.7	***358.1***				358	0	0	197	20
550.00	2.00		35	Hard Till	16.4	230.7	***374.5***				374	0	0	206	22
548.00	2.00		35	Hard Till	16.4	230.7	***167.8***				168	0	0	92	24
545.50	2.50	0.50			6.4	7.7	***174.2***				174	0	0	96	27
544.00	1.50	0.50			3.8	7.7	***258.2***				258	0	0	142	28
543.00	1.00		10	Medium Sand	3.9	87.9	***262.1***				262	0	0	144	29
542.00	1.00		10	Medium Sand	3.9	87.9	***265.9***				266	0	0	146	30
541.00	1.00		10	Medium Sand	3.9	87.9	***269.8***				270	0	0	148	31
540.00	1.00		10	Medium Sand	3.9	87.9	***616.4***				616	0	0	339	32
535.00	5.00		49	Medium Sand	138.7	430.7	***588.1***				588	0	0	323	37
530.00	5.00		30	Medium Sand	60.6	263.7	***683.8***				~~684~~	~~0~~	~~0~~	~~376~~	~~42~~
527.00	3.00		34	Medium Sand	43.8	298.8	***718.9***				~~719~~	~~0~~	~~0~~	~~395~~	~~45~~
523.50	3.50		33	Medium Sand	48.8	290.1	***908.3***				~~908~~	~~0~~	~~0~~	~~500~~	~~49~~
520.00	3.50		49	Medium Sand	97.1	430.7	***1058.1***				~~1058~~	~~0~~	~~0~~	~~582~~	~~52~~
515.00	5.00		55	Medium Sand	172.7	483.4	***1169.3***				~~1169~~	~~0~~	~~0~~	~~643~~	~~57~~
510.00	5.00		48	Medium Sand	133.4	421.9	***1320.2***				~~1320~~	~~0~~	~~0~~	~~726~~	~~62~~
505.00	5.00		50	Medium Sand	144.1	439.5	***1411.6***				~~1412~~	~~0~~	~~0~~	~~776~~	~~67~~
500.00	5.00		44	Medium Sand	113.5	386.7	***1525.1***				~~1525~~	~~0~~	~~0~~	~~839~~	~~72~~
498.00	2.00		44	Medium Sand	45.4	386.7	***1640.8***				~~1641~~	~~0~~	~~0~~	~~902~~	~~74~~
493.00	5.00		52	Medium Sand	155.4	457.1	***1743.5***				~~1743~~	~~0~~	~~0~~	~~959~~	~~79~~
488.00	5.00		46	Medium Sand	123.1	404.3	***1717.2***				~~1717~~	~~0~~	~~0~~	~~944~~	~~84~~
483.00	5.00		29	Medium Sand	57.8	254.9	***2196.9***				~~2197~~	~~0~~	~~0~~	~~1208~~	~~89~~
478.00	5.00		77	Medium Sand	301.8	676.8	***2340.4***				~~2340~~	~~0~~	~~0~~	~~1287~~	~~94~~
473.00	5.00		59	Medium Sand	196.2	518.6	***2413.6***				~~2414~~	~~0~~	~~0~~	~~1327~~	~~99~~
468.00	5.00		45	Medium Sand	118.2	395.5	***2531.8***				~~2532~~	~~0~~	~~0~~	~~1392~~	~~104~~
463.00	5.00		45	Medium Sand	118.2	395.5	***2439.1***				~~2439~~	~~0~~	~~0~~	~~1342~~	~~109~~
460.00	3.00		28	Very Fine Silty Sand	27.7	184.6	***2466.8***				~~2467~~	~~0~~	~~0~~	~~1357~~	~~112~~
458.00	2.00		28	Very Fine Silty Sand	18.5	184.6	***2740.1***				~~2740~~	~~0~~	~~0~~	~~1507~~	~~114~~
457.00	1.00			Shale	263.7	439.5	***3003.8***				~~3004~~	~~0~~	~~0~~	~~1652~~	~~115.4~~
456.00	1.00			Shale		439.5									

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== E Abutment
REFERENCE BORING ========== B-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 572.41 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 570.41 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 ========== 2500 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 466.96 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 175.11 KIPS

PILE TYPE AND SIZE ========== Metal Shell 16"Φ w/.375" walls
Plugged Pile Perimeter========== 4.189 FT.
Plugged Pile End Bearing Area========== 1.396 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
782 KIPS	**719** KIPS	**395** KIPS	**45** 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 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.)
569.50	0.91		19	Very Fine Silty Sand	5.7		***95.4***				95	0	0	52	3
566.00	3.50		27	Hard Till	21.8	89.7	***167.1***				167	0	0	92	6
563.00	3.00		25	Very Fine Silty Sand	24.7	139.6	***282.9***				283	0	0	156	9
560.00	3.00		35	Very Fine Silty Sand	35.6	230.7	***265.9***				266	0	0	146	12
557.00	3.00		27	Very Fine Silty Sand	26.7	178.0	***122.2***				122	0	0	67	15
555.00	2.00	0.50			5.1	7.7	***127.3***				127	0	0	70	17
552.00	3.00	0.50			7.7	7.7	***358.1***				358	0	0	197	20
550.00	2.00		35	Hard Till	16.4	230.7	***374.5***				374	0	0	206	22
548.00	2.00		35	Hard Till	16.4	230.7	***167.8***				168	0	0	92	24
545.50	2.50	0.50			6.4	7.7	***174.2***				174	0	0	96	27
544.00	1.50	0.50			3.8	7.7	***258.2***				258	0	0	142	28
543.00	1.00		10	Medium Sand	3.9	87.9	***262.1***				262	0	0	144	29
542.00	1.00		10	Medium Sand	3.9	87.9	***265.9***				266	0	0	146	30
541.00	1.00		10	Medium Sand	3.9	87.9	***269.8***				270	0	0	148	31
540.00	1.00		10	Medium Sand	3.9	87.9	***616.4***				616	0	0	339	32
535.00	5.00		49	Medium Sand	138.7	430.7	***588.1***				588	0	0	323	37
530.00	5.00		30	Medium Sand	60.6	263.7	***683.8***				684	0	0	376	42
527.00	3.00		34	Medium Sand	43.8	298.8	***718.9***				719	0	0	395	45
523.50	3.50		33	Medium Sand	48.8	290.1	***908.3***				~~908~~	~~0~~	~~0~~	~~500~~	~~49~~
520.00	3.50		49	Medium Sand	97.1	430.7	***1058.1***				~~1058~~	~~0~~	~~0~~	~~582~~	~~52~~
515.00	5.00		55	Medium Sand	172.7	483.4	***1169.3***				~~1169~~	~~0~~	~~0~~	~~643~~	~~57~~
510.00	5.00		48	Medium Sand	133.4	421.9	***1320.2***				~~1320~~	~~0~~	~~0~~	~~726~~	~~62~~
505.00	5.00		50	Medium Sand	144.1	439.5	***1411.6***				~~1412~~	~~0~~	~~0~~	~~776~~	~~67~~
500.00	5.00		44	Medium Sand	113.5	386.7	***1525.1***				~~1525~~	~~0~~	~~0~~	~~839~~	~~72~~
498.00	2.00		44	Medium Sand	45.4	386.7	***1640.8***				~~1641~~	~~0~~	~~0~~	~~902~~	~~74~~
493.00	5.00		52	Medium Sand	155.4	457.1	***1743.5***				~~1743~~	~~0~~	~~0~~	~~959~~	~~79~~
488.00	5.00		46	Medium Sand	123.1	404.3	***1717.2***				~~1717~~	~~0~~	~~0~~	~~944~~	~~84~~
483.00	5.00		29	Medium Sand	57.8	254.9	***2196.9***				~~2197~~	~~0~~	~~0~~	~~1208~~	~~89~~
478.00	5.00		77	Medium Sand	301.8	676.8	***2340.4***				~~2340~~	~~0~~	~~0~~	~~1287~~	~~94~~
473.00	5.00		59	Medium Sand	196.2	518.6	***2413.6***				~~2414~~	~~0~~	~~0~~	~~1327~~	~~99~~
468.00	5.00		45	Medium Sand	118.2	395.5	***2531.8***				~~2532~~	~~0~~	~~0~~	~~1392~~	~~104~~
463.00	5.00		45	Medium Sand	118.2	395.5	***2439.1***				~~2439~~	~~0~~	~~0~~	~~1342~~	~~109~~
460.00	3.00		28	Very Fine Silty Sand	27.7	184.6	***2466.8***				~~2467~~	~~0~~	~~0~~	~~1357~~	~~112~~
458.00	2.00		28	Very Fine Silty Sand	18.5	184.6	***2740.1***				~~2740~~	~~0~~	~~0~~	~~1507~~	~~114~~
457.00	1.00			Shale	263.7	439.5	***3003.8***				~~3004~~	~~0~~	~~0~~	~~1652~~	~~115.4~~
456.00	1.00			Shale		439.5									