Prepared for:
City of Springfield
300 South Seventh Street
Springfield, Illinois 62701

Structure Designer:
Hanson Professional Services Inc.
1525 South Sixth Street
Springfield, Illinois 62703
(217) 788-2450

Prepared By:
Hanson Professional Services Inc.
1525 South Sixth Street
Springfield, Illinois 62703
(217) 788-2450
rchantome@hanson-inc.com

Structure Geotechnical Report

5th St. (FAP 666 ALT.)
Section (109)VB, (110) VB-5
Sangamon County
Job No. ---
Contract No. 72K43
PTB No. N/A
UPRR & NSRR Over 5th Street
Structure Nos. 084-9960 and 084-9961

December 2017
Revised August 2018

Table of Contents

Tables

1. Project Description

This report provides geotechnical data and recommendations for the proposed Union Pacific Railroad (UPRR) and Norfolk Southern Railroad (NSRR) Bridges at the 5th Street Underpass, which is part of the Springfield Rail Improvements Project. The project includes the relocation of the existing UP tracks from the 3rd Street corridor to the 10th Street corridor and the relocation of the existing NS tracks within the 10th Street corridor. The project includes modifications to four existing grade separations and nine new grade separations. The bridges and retaining walls covered by this structure geotechnical report will replace the existing 5th Street NSRR underpass.

2. Location

The proposed underpass is located in the central portion of Sangamon County, within the Southeast Quarter of Section 4, Township 15 North, Range 5 West. The structures are located at Sta. 47855+08.40 along the UPRR Main 1 alignment and Sta. 52503+80.65 along the NSRR Main 1 alignment. Structure Number 084-9960 carries the UPRR over 5th Street at Sta. 1000+21.64, while Structure Number 084-9961 carries the NSRR over 5th Street at Sta. 999+39.76.

3. Existing Structure

The existing structure has a single, 84.5 ft long by 9 ft deep through girder span supported by massive, closed abutments. The bridge is founded on spread footings bearing at approximately Elev. 577.2 on hard, brown silt. According to the design plans, the silt layer has an allowable bearing pressure of 8.0 ksf.

4. Proposed Structures

The general structure configuration was determined from an informal type study as discussed later in this report. The proposed structures will be single-span bridges with stub abutments. The superstructures will be steel plate ballast pans on W36 floor beams between 150-inch web through-plate girders. Abutments will be supported by deep foundations independent of the retaining walls. 5th Street will be maintained at existing grade. The low point of the underpass is located under the existing NSRR track. The proposed crossing will include one additional track to the north and two additional tracks to the south. Retaining walls will extend from Sta. 998+05.31 to Sta. 1001+70.52.

The structures will be supported on drilled shaft foundations. Based on information provided by the structure designer, vertical service loads of approximately 4,200 kips per abutment will be applied to the foundations.

Both proposed bridges will be constructed with the existing rail line active through the construction zone and 5th Street will remain open to traffic. The substructures for the new bridges will be constructed in a top-down sequence. The NSRR Bridge will be built first south of the existing structures along with the south portion of the East and West Retaining Walls. Rail traffic then will be diverted onto the newly constructed NSRR Bridge to allow construction of the proposed UPRR Bridge abutments. The remaining retaining walls can then be constructed after the existing structure is removed.

5. Site Investigation

The project site is located in a residential area with single-family houses surrounding the underpass. At the existing railroad crossing, 5th Street is lowered below the existing railroad. Existing grade along the street ranges from approximately Elev. 584.5 to Elev. 600.0 with the lowest point under the railroad and the highest point south

of the crossing. The existing roadway backslope has a maximum height of approximately 15ft. The slope is generally 1V:3H but steepens to 1V: 2H next to the existing structure.

Logs of borings drilled for the existing bridge's design were available in Hanson's files. Four borings, designated B-1 through B-4 were drilled in May 1958 by Raymond Concrete Pile Company. These boring were terminated on shale at a maximum depth of 28.2 feet. The logs include SPT N-values and unconfined strengths of samples, but no natural moisture content data. The borings were drilled before the excavation of the existing underpass and include samples of soils that have been removed.

One new test boring designated B-147 was completed in September 2013 at the location of the proposed structure using a drill rig operated by Professional Services Industries, Inc. The boring was advanced using hollow stem augers to bedrock. Bedrock samples were collected using NQ-sized core samples. Standard Penetration Test (SPT) samples were generally collected at 2.5 ft. intervals. All SPT samples were collected using an automatic hammer. The boring was advanced to 36.0 ft. below grade.

Boring locations are shown on the Boring Location Plan included in the Appendix. The boring logs and rock core photos are also included in the Appendix.

6. Laboratory Investigation

Soil samples from the new boring were tested in Hanson's soils laboratory. The laboratory analysis consisted of moisture content determinations, unconfined strength tests of SPT samples, and unconfined strength tests of rock core samples. The results of the tests are indicated on the subsurface data profile. Data from the rock core tests are included in the appendix.

7. Subsurface Profile

Subsurface data profiles for the proposed bridge and retaining walls are presented in the Appendix for use by the structure designer. The data profiles includes the borings that were drilled near the proposed structures. The general subsurface profile consists of deposits of fill material, loess, glacial till, and shale bedrock.

A layer of fill was encountered in all borings. The fill material was heterogeneous and included sandy silt with cinders, coal, and concrete fragments. The SPT N-values for the fill sample collected were 6 to 18 blows per foot penetration. Unconfined strengths were not measured for the fill.

Loessial deposits were encountered only in the 1958 borings. This stratum has been completely removed at the existing roadway level where the recent boring was drilled. The silty clay to silt was encountered at approximately Elev. 597.4 or about 4 ft. below the 1958 ground surface. The N-value for the loess was 4 to 17 blows per foot penetration. The measured unconfined strength ranged from 0.5 to 2.7 tsf with an average of approximately 0.9 tsf.

A weathered glacial till layer was encountered in all borings. This sandy, silty clay layer was encountered at approximately Elev. 585.4 or about 16 ft. below the 1958 ground surface. The N-value was 4 to 7 blows per foot. Measured unconfined strength ranged from 0.4 to 2.7 tsf with an average of approximately 1.0 tsf.

Bedrock was encountered in all borings at approximately Elev. 578.4, or about 6 ft. below the current street grade. The uppermost 5 ft. was a shale with various degrees of weathering. A competent, but weak shale layer was encountered from Elev. 573.4 to Elev. 556.0. Unconfined strengths from cores taken in this layer were 9.5 to 15.2 tsf. A 6.9 ft. thick coal layer was located beneath the weak shale.

Groundwater was not encountered during drilling of boring B-147. This boring was drilled during an unusually dry period. Groundwater was encountered approximately 7 ft below the ground surface in the 1958 borings.

Maps of documented coal mines published by the Illinois Geological Survey show the proposed structures have not been directly undermined but are very near to a mined area. The boundary of the Peabody Coal Company Peabody Mine No. 53 (PCCP 53) is shown approximately 200 ft. northeast of the proposed structures. The PCCP 53 was a room and pillar panel mine that was active between 1887 and 1944. Between 40 and 70 percent of the coal seam is removed in this type of mine. The Springfield coal seam was mined with an average thickness of 5.8 ft. The depth of the mine is 250 ft. Considering the accuracy of the mine boundaries and the zone of influence of a potential mine subsidence event, there is at least a small chance of mine subsidence at this site.

8. Geotechnical Evaluations

Several retaining wall and bridge configurations were considered for the proposed grade separation. An underpass requires the use of closed abutments or retaining walls along both sides of the street due to the existing ROW and maximized bridge span lengths. Non-gravity cantilever walls are the best choice for the conditions at this site, because they can be constructed within the confined space of the proposed bridge spans and are the least disruptive to rail and roadway traffic and the surrounding homes.

ROW and/or permanent easements for tiebacks are not available. A substantial cantilevered structural member is required to support the temporary grade differences of up to 20 ft. Consequently, sheet pile and driven soldier pile walls are not feasible for the tallest sections of the wall. Drilled soldier pile walls with either wide-flange structural sections or reinforcement bars are feasible.

Drilled shafts are appropriate for support of the bridge abutments due to the use of drilled foundations for the retaining walls. Spread footings bearing on the relatively shallow bedrock would be feasible, but very costly due the substantial temporary shoring required to excavate near an active rail line.

Slope stability analyses were not necessary, because the 1V:3H slopes beyond the proposed structures will match the existing condition. The retaining wall soldier piles will be socketed into relatively shallow bedrock, preventing a compound slope stability failure. If the retaining walls are designed to satisfy AASHTO external stability and sliding requirements, they will also meet AASHTO and IDOT global stability requirements.

Up to 15 ft. of fill will be placed behind the proposed retaining walls south of the existing structure. This fill is located in areas that were excavated for the existing underpass, so the existing subgrade is overconsolidated. Settlement due to the new fill is expected to be less than 0.5 inches.

9. Design Recommendations

The proposed bridge substructures should be supported on drilled shaft foundations with the tips founded in the weak shale. In order to provide a consistent bearing surface on unweathered rock, the estimated tip elevations should be at least 2.0 ft below the top of weak shale elevations listed in Table 9.1. The shafts should be proportioned to resist the axial loads using the tip resistance and skin resistance of the weak shale given in Table 9.2. Any side resistance contributed by the overlying, much softer layers above should be ignored. Tip resistance within the weak shale decreases with depth due to the presence of the coal layer below. For maximum tip resistance, the drilled shafts should be founded a minimum of two socket diameters above the coal layer. Considering that lateral resistance may control design, reduced tip resistance values are provided in the table for deeper rock sockets.

Table 9.1 Top of Strata Elevations for Foundation Design

Location	Existing Fill	Loess	Glacial Till	Weathered Shale	Weak Shale	Coal
Abutments and Walls	*	597.4	585.4	578.4	573.4	556.0

* Existing ground surface or assumed bottom of excavation for existing structure.

Table 9.2 Drilled Shaft or Drilled Soldier Pile Axial Load Design Parameters

Stratum		Nominal Side Resistance (ksf)	Resistance Factor φ_{stat}	Nominal Tip Resistance (ksf)	Resistance Factor φ_{stat}
Fill		-	-	-	-
Loess		-	-	-	-
Glacial Till		-	-	-	-
Weathered Shale		2.2	0.45	40	0.40
Weak Shale	2.0D above coal	7.9	0.50[1]	80	0.50[1]
	1.5D above coal			62	0.50[1]
	1.0D above coal			44	0.50[1]
	0.5D above coal			31	0.50[1]
Coal		-	-	-	-

[1] Use FS=2.5 for AREMA allowable stress design

The structure designer should evaluate lateral resistance of the drilled shafts based on both soil and structure properties. Soil parameters for generating P-y curves with the LPILE computer program are given in Table 9.3. Parameters not provided in the table should use the default values assigned by the LPILE program. Factored axial and factored lateral loads should be used for structural design of the soldier piles. The P-multipliers in AASHTO Table 10.7.2.4-1 should be used in the analyses

Soldier pile walls retaining level ground should be designed for an active earth pressure of 40 pcf if drainage is provided along the face of the wall. For soldier piles retaining slopes, the earth pressure should be calculated using a 32° friction angle and a 120 pcf unit weight. Surcharges due to the weight of soil behind the abutments and railroad live loads should also be applied as applicable. Drilled soldier piles for the underpass retaining walls will not have significant vertical load and may be supported in either rock or soil as required by the wall heights. Table 9.1 provides design strata elevations for the various soil layers found along the walls. The structure designer should evaluate lateral resistance based on both soil and structure properties. Soil parameters for generating P-y curves with the LPILE computer program are given in Table 9.3. Factored axial and factored lateral loads should be used for structural design of the soldier piles. The P-multipliers in AASHTO Table 10.7.2.4-1 should be used in the analyses.

Table 9.2 provides geotechnical design parameters for axial resistance of drilled soldier piles. When soldier piles are tipped in the weak shale, only the side and tip resistance of that layer should be included in the axial strength. If soldier piles are tipped above the weak shale, the side resistance should be neglected in the upper 5 ft. and bottom 2D of the shaft, but all layers may be included in the axial strength.

Table 9.3 LPILE Parameters

Stratum	LPILE Soil Type	Soil Parameters				
Proposed Fill	sand	φ=32°	γ'=125 pcf	k=90 pci		
Existing Fill	sand	φ=28°	γ'=58 pcf	k=20 pci		
Loess	stiff clay w/o water	c=900 psf	γ'=58 pcf			
Glacial Till	stiff clay w/o water	c=1,000 psf	γ'=66 pcf			
Weathered Shale	stiff clay w/o water	c=4,500 psf	γ'=72 pcf			
Weak Shale	weak rock	q_u=167 psi	γ'=81 pcf	E_i=1,000 ksi	RQD=37	$k_{rm}=5x10^{-4}$

* Existing ground surface or assumed bottom of excavation for existing structure.

Soldier pile retaining walls should be detailed to include geocomposite wall drain and an underdrain collector as shown in Figures 3.11.3.2.1-2 and 3.11.3.2.1-3 of the IDOT Bridge Manual. Any fill placed behind soldier piles should be porous granular embankment placed in thin lifts and lightly compacted with hand-held or walk-behind compactors.

The project is located in a region of low seismic activity, which is caused primarily by earthquakes in the New Madrid Fault Zone, 225 miles south of the site. The subsurface profile to a depth of 100 ft below the assumed point of drilled shaft fixity consists of weak shale bedrock. This profile is indicative of Soil Type C. Seismic design parameters obtained from the 2017 AREMA Seismic Design for Railway Structures Specifications are listed in Table 9.4. The soils found at the site are not liquefaction-susceptible for the design earthquakes.

Table 9.4 Seismic Design Parameters

Ground Motion Level	PGA	F_{pga}	S_s	F_a	S_1	F_v
Level 1 (100 year)	0.010	1.2	0.025	1.2	0.005	1.7
Level 2 (475 year)	0.040	1.2	0.090	1.2	0.035	1.7
Level 3 (2475 year)	0.10	1.2	0.22	1.2	0.10	1.7

10. Construction Considerations

The "top of rock" as shown on the plans should be the top of the weathered shale as defined in this report. This elevation should be used to estimate quantities for drilled shaft and drilled soldier pile rock excavation. The weathered shale is expected to require additional drilling effort as compared to the soil layers above.

It is anticipated that the drilled shafts and soldier pile shaft excavations will be constructed using either the dry method or temporary casing method. Shafts that extend into the highly weathered shale stratum should be detailed with the 6-inch size reduction as described in Section 3.10.2.4 of the Bridge Manual. This allows the contractor to seat an over-sized casing into the bedrock to remediate water-bearing or sloughing soils that are sometimes encountered. At this site, the problem soils are most likely to be encountered immediately above the bedrock and in areas that have been backfilled during previous construction.

Drilled shafts supporting the bridges should be installed with access ducts for crosshole sonic logging in accordance with railroad requirements. Guide Bridge Special Provision #91, Crosshole Sonic Logging Testing of Drilled Shafts (April 20, 2016) should be included with the contract documents.

Temporary shoring will be required to remove conflicting portions of the existing bridge abutments while maintaining rail traffic. Cantilever sheet piling is not feasible due to the substantial railroad surcharge loads. It is

anticipated that the NSRR will require that any temporary soil retention system supporting active tracks be fully designed and included in the contract plans. The temporary soil retention system for this structure is expected to utilize some of the drilled shafts for the proposed abutments as a temporary tangent pile retaining wall. At these locations, secant lagging shafts should be installed to prevent the loss of soil between the drilled shafts. In locations where secant lagging is used, horizontal drains that penetrate the secant lagging should be installed at not more than 12 ft. horizontal and 6 ft. vertical spacing over the full height of the secant lagging. The horizontal drains should have not less than 2.5 ft. of 3 in. diameter slotted PVC well casing extending behind the secant lagging and should be plumbed to drain to a suitable outlet.

References

American Railway Engineering and Maintenance-of-Way Association (2017). *AREMA Design Specifications.*

American Association of State Highway and Transportation Officials (2014-2016). *ASHTO LRFD Bridge Design Specifications, Seventh Edition with Interim Revisions.*

Chenoweth, C.A., Bargh, M.H., & Treworgy, C.G. (2009). *Directory of Coal Mines in Illinois, 7.5-Minute Quadrangle Series, Springfield East & West Quadrangles, Sangamon County.* Champaign, Illinois: Illinois State Geological Survey

Illinois Department of Transportation (2012). *Bridge Manual*.

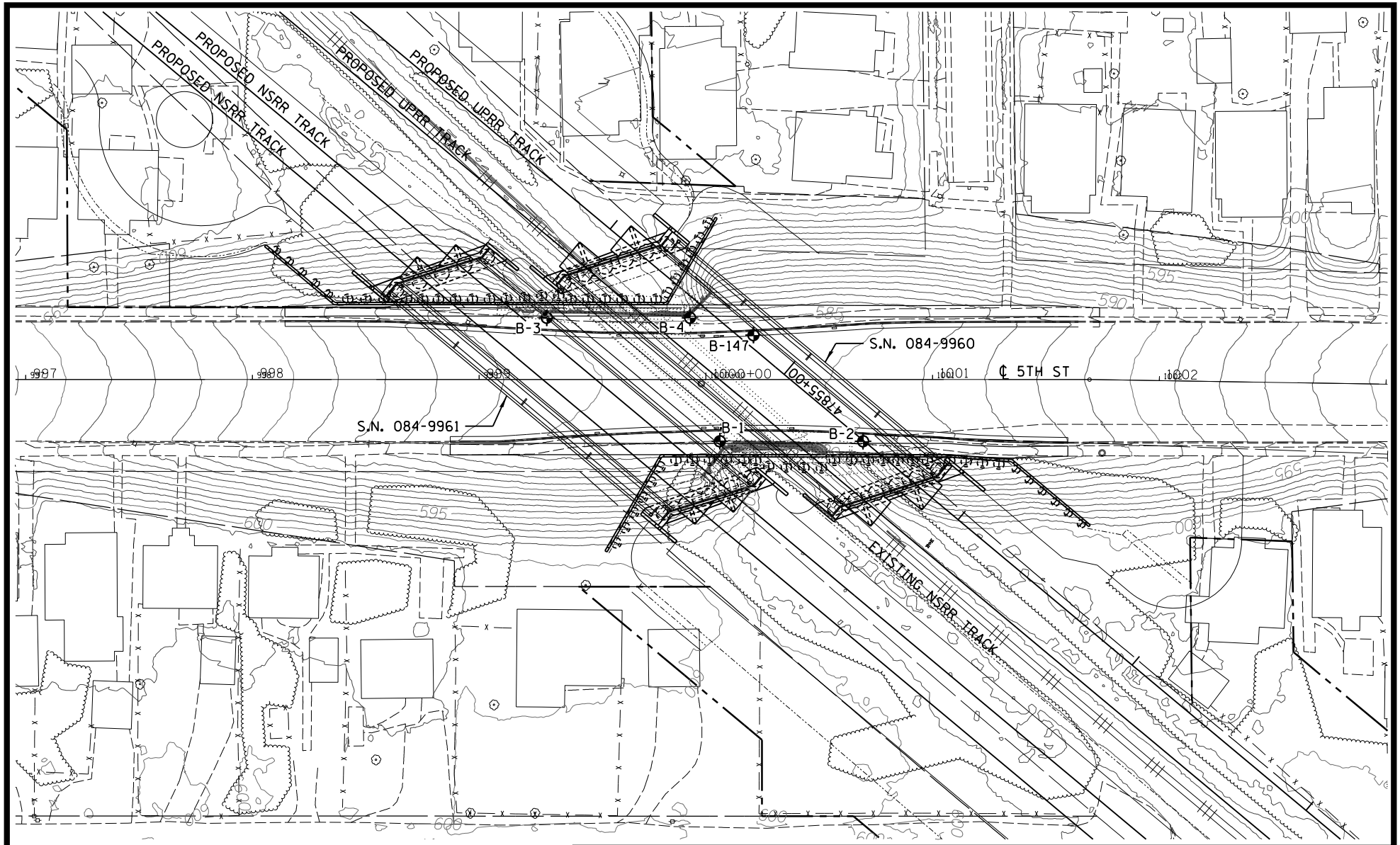
Illinois Department of Transportation (2015). *Geotechnical Manual*.

Illinois Department of Transportation (2016). *Standard Specifications for Road and Bridge Construction*.

Appendix

Boring Location Plan
Subsurface Data Profile
Boring Logs
Rock Core Photographs

c:\pwise_work\do_not_delete\d0200846\084-9960-9961-SGR.dgn 12/19/2017 maddau00223



LEGEND

B-147 BORING LOCATION

60 0 60 120

HANSON

BORING LOCATION PLAN

UPRR & NSRR OVER 5TH STREET
S.N. 084-9960 & 084-9961
SPRINGFIELD, ILLINOIS

09L0179B 12/19/17

B-4
Sta. 999+93, 27' LT
5/6/58

	N	Qu	w%	
601.4				CINDER, COAL, & misc. FILL.
	7			
597.4				Brown silty CLAY.
	14	2.67		
594.4 ▽				
593.9 Oh	9	0.53		Brown & gray SILT, tr. clay.
	9	0.85		
589.9				Brown SILT, tr. clay.
	7	0.53		
	6	0.32		
585.4				Gray silty CLAY.
	4	0.53		
582.4				No Description.
	7	1.60		
579.4				Brown SILT.
	39	8.54		
576.4				Gray decomposed SHALE.
	100/7"	10.15		
573.5	100/5"			Bottom of Hole = 27.9 feet

B-147
Sta. 100+21, 20' LT
9/10/13

	N	Qu	w%	
584.4				
583.55				ASPHALT.
583.35				AGGREGATE.
	6		5	Brown fine sandy SILT, some concrete fragments - FILL.
580.85				
	4	0.41B	22	Gray fine sandy silty CLAY, trace coarse sand and small gravel.
578.35				
	32	4.50P	14	
575.85				Brown and gray SHALE. (HIGHLY WEATHERED SHALE)
	80	4.50P	12	
	50/5"	4.50P	10	Gray SHALE.
569.35	50/4"		8	
	Rec. = 38%			
	RQD = 38%			Gray clayey SHALE, micaceous.
	Rec. = 96%			
	RQD = 46%			
	15.2			
	Rec. = 93% RQD = 82%			
	9.5			
	Rec. = 71% RQD = 28%			
	Rec. = 93%			
	RQD = 0%			
556.05	Rec. = 100%			
	RQD = 0%			COAL.
	Rec. = 90% RQD = 67%			
549.15				
548.35	2.5			Gray clayey SHALE, micaceous.
				Bottom of Hole = 36.0 feet

B-2
Sta. 1000+69, 27' RT
5/6/58

	N	Qu	w%	
601.4				
600.4				Black CLAY FILL.
	14			CINDER, COAL, & misc. FILL.
597.9				Brown & gray silty CLAY.
	17	1.60		
594.4 ▽				
593.9 Oh	11			Brown & gray SILT, tr. clay. Became soft at 592.9.
	3	0.53		
589.9				Brown SILT, tr. clay.
	5	0.85		
587.9				Brown & gray silty CLAY.
	4	0.53		
585.4				Gray silty CLAY.
	4	1.06		
	5	1.06		
579.4				Brown SILT, tr. clay.
	34	10.15		
575.4	100/10"	8.54		Gray decomposed SHALE.
573.2	100/6"	8.54		Bottom of Hole = 28.2 feet

LEGEND

N	Standard Penetration Test N (blows/ft)
Qu	Unconfined Strength (tsf)
w%	Natural Moisture Content (%)
DD ▽ 558.10	Water Surface Elevation Encountered in Boring DD = during drilling Oh = at completion 24h = 24 hours after completion

DESIGNED	RGC	6/29/16
DRAWN	EJM	6/29/16
REVIEWED	RGC	6/29/16

pw:\\spi-svr306.hanson.dom:Hanson Projects\Documents\09Jobs\09L01798\CAD\Geo\Sheet\084-9960-9961-SGR

HANSON

USER NAME = madau00223	DESIGNED - EJM	REVISED -
	CHECKED - RGC	REVISED -
PLOT SCALE = NONE	DRAWN - EJM	REVISED -
PLOT DATE = 12/19/2017	CHECKED - RGC	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SUBSURFACE DATA PROFILE
STRUCTURE NO. 084-9960
SHEET NO. 1 OF 1 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
666	(109) VB,(110) VB-5	SANGAMON	-	-
		CONTRACT NO. 72K43		
	ILLINOIS	FED. AID PROJECT		

B-3
Sta. 999+30, 27' LT
5/6/58

	N	Qu	w%	
600.8				CINDER, COAL, & misc. FILL.
	18			
596.8				
	16	1.60		Brown silty CLAY.
593.8 ▽				
593.3 Oh	6	0.53		Brown & gray SILT, tr. clay.
	6	1.06		
589.8				Brown SILT, tr. clay.
	5	1.60		
	4	1.06		
584.8				Gray silty CLAY, tr. small gravel.
	4	0.85		
	4	1.06		
578.8				
	97	6.10		Brown SILT.
	100/7"	6.94		
574.8				
573.3	100/6"			Gray decomposed SHALE.
				Bottom of Hole = 27.5 feet

B-147
Sta. 100+21, 20' LT
9/10/13

	N	Qu	w%	
584.4				
583.55				ASPHALT.
583.35				AGGREGATE.
	6		5	Brown fine sandy SILT, some concrete fragments - FILL.
580.85				
	4	0.41B	22	Gray fine sandy silty CLAY, trace coarse sand and small gravel.
578.35				
	32	4.50P	14	
575.85				Brown and gray SHALE. (HIGHLY WEATHERED SHALE)
	80	4.50P	12	
	50/5"	4.50P	10	Gray SHALE.
	50/4"		8	
569.35				
	Rec. = 38%			
	RQD = 38%			Gray clayey SHALE, micaceous.
	Rec. = 96%			
	RQD = 46%			
	15.2			
	Rec. = 93% RQD = 82%			
	9.5			
	Rec. = 71% RQD = 28%			
	Rec. = 93%			
	RQD = 0%			
556.05				
	Rec. = 100%			
	RQD = 0%			COAL.
	Rec. = 90% RQD = 67%			
549.15				
	2.5			Gray clayey SHALE, micaceous.
548.35				Bottom of Hole = 36.0 feet

B-1
Sta. 1000+06, 27' RT
5/6/58

	N	Qu	w%	
601.8				CINDER, COAL, & misc. FILL.
	7			
598.8				Black silty CLAY.
	10	2.67		
595.8				Brown & gray SILT, tr. clay.
594.3 ▽ Oh	10	1.60		
	10	2.12		
590.3				
	7	0.53		Brown SILT, tr. clay.
	5	0.85		
585.8				Gray silty CLAY, tr. small gravel.
	5	2.67		
	5	1.60		
	6	1.39		
577.5				
	100	11.20		Brown SILT.
575.3				
573.8	100/7"			Gray decomposed SHALE.
				Bottom of Hole = 28.0 feet

LEGEND

N	Standard Penetration Test N (blows/ft)
Qu	Unconfined Strength (tsf)
w%	Natural Moisture Content (%)
DD ▽ 558.10	Water Surface Elevation Encountered in Boring DD = during drilling Oh = at completion 24h = 24 hours after completion

DESIGNED	RGC	6/29/16
DRAWN	EJM	6/29/16
REVIEWED	RGC	6/29/16

pw:\\spi-svr306.hanson.dom:Hanson Projects\Documents\09Jobs\09L01798\CAD\Geo\Sheet\084-9960-9961-SGR

HANSON

USER NAME = madau00223	DESIGNED - EJM	REVISED -
	CHECKED - RGC	REVISED -
PLOT SCALE = NONE	DRAWN - EJM	REVISED -
PLOT DATE = 6/29/16	CHECKED - RGC	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SUBSURFACE DATA PROFILE
STRUCTURE NO. 084-9961
SHEET NO. 1 OF 1 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
666	(109) VB,(110) VB-5	SANGAMON	-	-
		CONTRACT NO. 72K43		
	ILLINOIS	FED. AID PROJECT		

B-3
Sta. 999+30, 27' LT
5/6/58

	N	Qu	w%	
600.8				CINDER, COAL, & misc. FILL.
	18			
596.8				
	16	1.60		Brown silty CLAY.
593.8				
593.3 Oh	6	0.53		Brown & gray SILT, tr. clay.
	6	1.06		
589.8				Brown SILT, tr. clay.
	5	1.60		
	4	1.06		
584.8				Gray silty CLAY, tr. small gravel.
	4	0.85		
	4	1.06		
578.8				
	97	6.10		Brown SILT.
	100/7"	6.94		
574.8				
573.3	100/6"			Gray decomposed SHALE.
				Bottom of Hole = 27.5 feet

B-4
Sta. 999+93, 27' LT
5/6/58

	N	Qu	w%	
601.4				CINDER, COAL, & misc. FILL.
	7			
597.4				
	14	2.67		Brown silty CLAY.
594.4				
593.9 Oh	9	0.53		Brown & gray SILT, tr. clay.
	9	0.85		
589.9				Brown SILT, tr. clay.
	7	0.53		
	6	0.32		
585.4				Gray silty CLAY.
	4	0.53		
582.4				
	7	1.60		No Description.
579.4				
	39	8.54		Brown SILT.
576.4				
	100/7"	10.15		Gray decomposed SHALE.
573.5	100/5"			
				Bottom of Hole = 27.9 feet

B-147
Sta. 100+21, 20' LT
9/10/13

	N	Qu	w%	
584.4				
583.55				ASPHALT.
583.35	6		5	AGGREGATE.
580.85				Brown fine sandy SILT, some concrete fragments - FILL.
	4	0.41B	22	
578.35				Gray fine sandy silty CLAY, trace coarse sand and small gravel.
	32	4.50P	14	
575.85				Brown and gray SHALE. (HIGHLY WEATHERED SHALE)
	80	4.50P	12	
	50/5"	4.50P	10	Gray SHALE.
569.35	50/4"		8	
	Rec. = 38% RQD = 38% Rec. = 96% RQD = 46% 15.2 Rec. = 93% RQD = 82% 9.5 Rec. = 71% RQD = 28% Rec. = 93% RQD = 0%			Gray clayey SHALE, micaceous.
556.05	Rec. = 100% RQD = 0%			COAL.
	Rec. = 90% RQD = 67%			
549.15				
548.35	2.5			Gray clayey SHALE, micaceous.
				Bottom of Hole = 36.0 feet

WEST WALL

B-2
Sta. 1000+69, 27' RT
5/6/58

	N	Qu	w%	
601.4				
600.4				Black CLAY FILL.
	14			CINDER, COAL, & misc. FILL.
597.9				
	17	1.60		Brown & gray silty CLAY.
594.4				
593.9 Oh	11			Brown & gray SILT, tr. clay. Became soft at 592.9.
	3	0.53		
589.9				
	5	0.85		Brown SILT, tr. clay.
587.9				
	4	0.53		Brown & gray silty CLAY.
585.4				
	4	1.06		Gray silty CLAY.
	5	1.06		
579.4				
	34	10.15		Brown SILT, tr. clay.
575.4	100/10"	8.54		
573.2	100/6"	8.54		Gray decomposed SHALE.
				Bottom of Hole = 28.2 feet

B-1
Sta. 1000+06, 27' RT
5/6/58

	N	Qu	w%	
601.8				CINDER, COAL, & misc. FILL.
	7			
598.8				Black silty CLAY.
	10	2.67		
595.8				
594.3 Oh	10	1.60		Brown & gray SILT, tr. clay.
	10	2.12		
590.3				
	7	0.53		Brown SILT, tr. clay.
	5	0.85		
585.8				Gray silty CLAY, tr. small gravel.
	5	2.67		
	5	1.60		
	6	1.39		
577.5				
	100	11.20		Brown SILT.
575.3	100/7"			Gray decomposed SHALE.
573.8				Bottom of Hole = 28.0 feet

EAST WALL

LEGEND

N	Standard Penetration Test N (blows/ft)
Qu	Unconfined Strength (tsf)
w%	Natural Moisture Content (%)
DD ▽ 558.10	Water Surface Elevation Encountered in Boring DD = during drilling Oh = at completion 24h = 24 hours after completion

DESIGNED	RGC	6/29/16
DRAWN	EJM	6/29/16
REVIEWED	RGC	6/29/16

pw:\\spi-svr306.hanson.dom:Hanson Projects\Documents\09Jobs\09L01798\CAD\Geo\Sheet\084-9960-9961-SGR

HANSON

USER NAME = madau00223	DESIGNED - EJM	REVISED -	
	CHECKED - RGC	REVISED -	
PLOT SCALE = NONE	DRAWN - EJM	REVISED -	
PLOT DATE = 6/29/16	CHECKED - RGC	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SUBSURFACE DATA PROFILE
5TH ST. RETAINING WALLS
SHEET NO. 1 OF 1 SHEETS

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
666	(109) VB,(110) VB-5	SANGAMON	-	-
		CONTRACT NO. 72K43		
	ILLINOIS FED. AID PROJECT			

HANSON SOIL BORING LOG

Date 9/10/13

ROUTE _____ **DESCRIPTION** Springfield Rail Improvements Project **LOGGED BY** ARP

SECTION _____ **LOCATION** SE ¼ of SEC. 4, TWP. 15N, RNG. 5W, 3rd P.M.

COUNTY Sangamon **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Auto

STRUCT. NO. _____
Station _____
BORING NO. B-147
Station 1000+21
Offset 20' LT
Ground Surface Elev. 584.4 ft

Surface Water Elev. _____
Stream Bed Elev. _____

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
ASPHALT. 583.55				
AGGREGATE. 583.35				
Brown fine sandy SILT, some concrete fragments - FILL.	5 4 2		5	
2				
580.85				
Gray fine sandy silty CLAY, trace coarse sand and small gravel.	2 2 2	0.41B	22	
4				
578.35				
Brown and gray SHALE, (HIGHLY WEATHERED SHALE)	7 11 21	4.50P	14	
6				
575.85				
Gray SHALE.	17 30 50	4.50P	12	
8				
10				
	31 50/5"	4.50P	10	
12				
	32 50/4"		8	
14				
569.35				
see Rock Core log.				

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

HANSON

ROCK CORE LOG

Date 9/10/13

ROUTE _____ **DESCRIPTION** Springfield Rail Improvements Project **LOGGED BY** ARP

SECTION _____ **LOCATION** SE ¼ of SEC. 4, TWP. 15N, RNG. 5W, 3rd P.M.

COUNTY Sangamon **CORING METHOD** NQ Core

STRUCT. NO. _____
Station _____

BORING NO. B-147
Station 1000+21
Offset 20' LT
Ground Surface Elev. 584.35

CORING BARREL TYPE & SIZE NQ
Core Diameter 1.874 in
Top of Rock Elev. 569.35 ft
Begin Core Elev. 569.35 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray clayey SHALE, micaceous.	569.35	16	Run 1	38	38		
		18	Run 2	96	46		
		20	Run 3	93	82		15.2
		22	Run 4	71	28		
		24					
		26	Run 5	93	0		9.5
		28					
COAL.	556.05	30	Run 6	100	0		
		32	Run 7	90	67		
		34					
Gray clayey SHALE, micaceous.	549.15	36					2.5
End of Boring	548.35						

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

F-348-C-50 PADS - 1-56

TEST BORING REPORT
RAYMOND
CONCRETE PILE COMPANY
GOW DIVISION
140 CEDAR STREET - NEW YORK 6, N. Y.

File #124

To ALFRED BENESCH & ASSOCIATES Date MAY 6 19 58

Address 10 SOUTH WABASH AVENUE CHICAGO, ILLINOIS

We have completed the following borings for you at SITE OF THE WABASH RAILROAD SUBWAY AT SOUTH FIFTH STREET SPRINGFIELD, ILLINOIS

with results shown below. In accordance with your instructions, we have sent labelled samples of the strata encountered

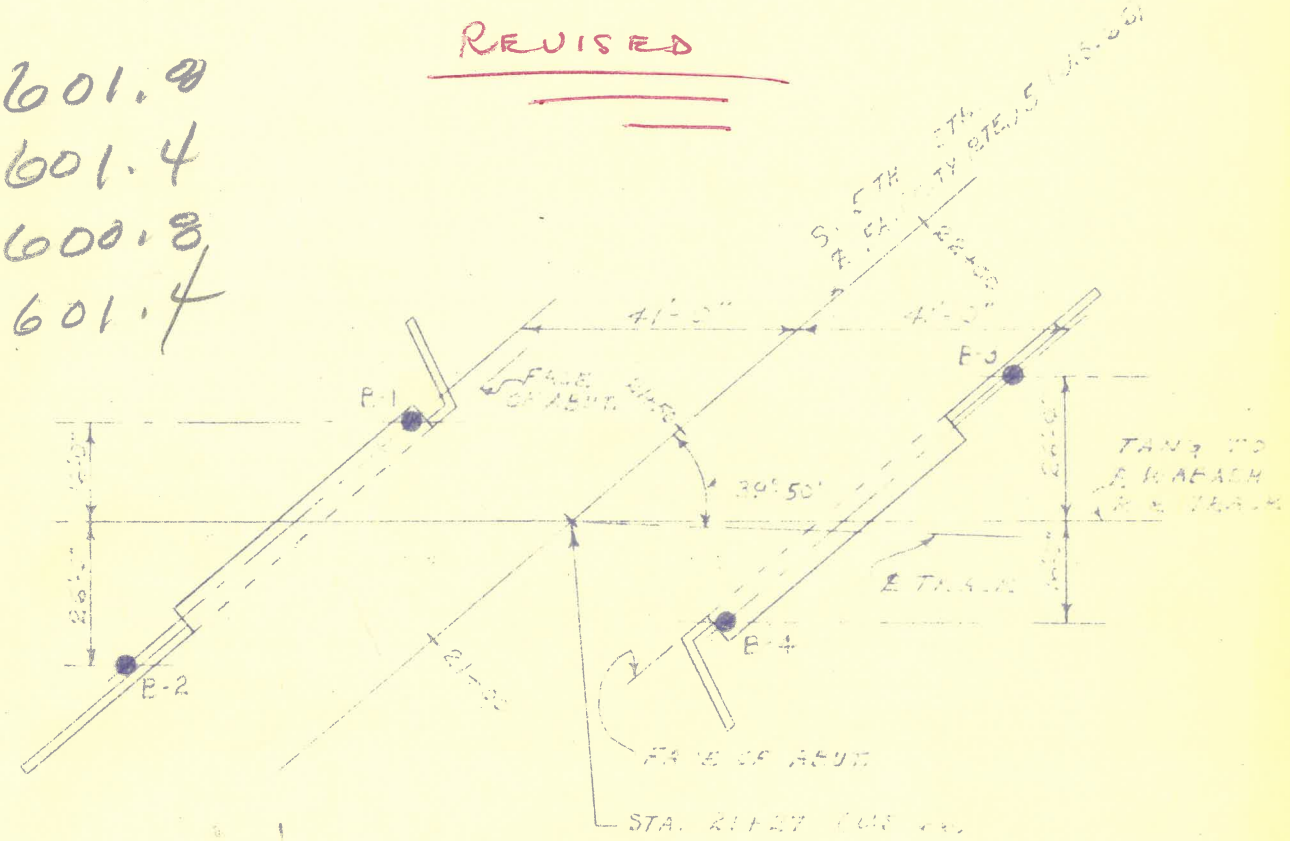
To _____ Address _____

Via _____ under date of _____ Raymond Concrete Pile Co.

LOCATION PLAN SCALE 1" = 30'

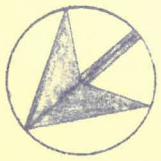
REVISED

#1 - 601.8
2 - 601.4
3 - 600.8
4 - 601.4



BM.
4 5TH AVE & ℄ EXIST RR CROSSING -
TOP PLANKS. 603.4

Compass Points



This boring report prepared in the ST. LOUIS OFFICE of the Raymond Concrete Pile Company

By H.A.GA

Job No. B 227 3994

Sheet 1 of 5

F-344-B-100 PADS-10-56

TEST BORING REPORT
RAYMOND
CONCRETE PILE COMPANY
GOW DIVISION

To ALFRED BENESCH & ASSOCIATES - CHICAGO, ILLINOIS Date MAY 6, 1958

Location of Borings WABASH RAILROAD SUBWAY AT SOUTH EIGTH STREET SPRINGFIELD, ILLINOIS

All borings are plotted to scale of 1" = 8 ft. using DATUM AS NOTED ON PLAN as a fixed datum.

Boring No. 1 STA. 21+19 LEFT 28'

Boring No. _____

Boring No. _____

	GROUND SURFACE	N VALUE	QU (T/FT²)	
385	ELEV. 583.4			0'0"
	CINDER COAL & MISC. FILL	7		3'0"
380	BLACK SILTY CLAY	10	2.67	6'0"
	BROWN & GRAY SILT	10	1.60	
375	TRACE CLAY	10	2.12	11'6"
	BROWN SILT TRACE CLAY	7	0.53	
370		5	0.85	16'0"
	GRAY SILTY CLAY	5	2.67	
365	TRACE SMALL GRAVEL	5	1.60	
		6	1.39	
360				24'4"
	BROWN SILT	100	11.20	26'6"
355	GRAY DECOMP. SHALE	100/7	X	28'0"

BORING STOPPED BY CLIENT

USED 14'0" OF 2 1/2" CASING

BORING BAILED TO 25'0"

WATER LEVEL APPROX. 7" TO 8' (RECENT HEAVY RAINS)

X - UNSUITABLE FOR TESTING

4/24/58

Classifications are made from visual inspection.

Water Levels (WL). Figure indicates time of reading (hours) after completion of boring. Water levels indicated are those observed when borings were made, or as noted. Porosity of the soil stratas, variations of rainfall, site topography, etc., may cause changes in these levels.

Figures in right hand column indicate number of blows required to drive 2" O. D. sampling pipe one foot, using a 140 lb. weight falling 30 inches.

Total Footage 28'0"

Foreman A J HOUSE

Classifications by AH & GA

Job No. B 227350L

Sheet 2 of 5

F-344-S-100 PADS-10-56

TEST BORING REPORT
RAYMOND
CONCRETE PILE COMPANY
GOW DIVISION

To ALFRED BENESCH & ASSOCIATES - CHICAGO, ILLINOIS Date MAY 6, 1958

Location of Borings WABASH RAILROAD SUBWAY AT SOUTH FIFTH STREET SPRINGFIELD, ILLINOIS

All borings are plotted to scale of 1" = 8 ft. using DATUM AS NOTED ON PLAN as a fixed datum.

Boring No. 2 | Boring No. | Boring No.

STA. 20+61 LEFT 28'

	GROUND SURFACE	N VALUE	QU (T/FT²)	
385	ELEV. 583.0			0'0"
	BLACK CLAY FILL			1'0"
380	CINDER COAL & MISC. FILL	14		3'6"
	BROWN & GRAY SILTY CLAY	17	1.50	7'0"
375	BROWN & GRAY SILT TRACE CLAY	11 3	X 0.53	← BECAME SOFT AT 8'6" 11'5"
370	BROWN SILT TRACE CLAY	5	0.85	13'6"
	BROWN & GRAY SILTY CLAY	4	0.53	15'0"
365	GRAY SILTY CLAY	4 5	1.06 1.06	22'0"
360	BROWN SILT TRACE CLAY	34 100/10	10.15 8.54	26'0"
355	GRAY DECOMP. SHALE	100/6	8.54	28'2"
	BORING STOPPED BY CLIENT			
350	USED 14'0" OF 2 1/2" CASING			

BORING BAILED TO 25'0"

WATER LEVEL APPROX. 7' TO 8' (RECENT HEAVY RAINS)

X = INDICATES UNSUITABLE FOR TESTING

4/22/58

Classifications are made from visual inspection.

Water Levels (WL). Figure indicates time of reading (hours) after completion of boring. Water levels indicated are those observed when borings were made, or as noted. Porosity of the soil stratas, variations of rainfall, site topography, etc., may cause changes in these levels.

Figures in right hand column indicate number of blows required to drive 2" O. D. sampling pipe one foot, using a 140 lb. weight falling 30 inches.

Total Footage 28'2"

Foreman A. J. HOUSE

Classifications by AH & GA

Job No. B 22735SL

Sheet 3 of 5

344-S-100 PADS-10-56

TEST BORING REPORT
RAYMOND
CONCRETE PILE COMPANY
GOW DIVISION

To ALFRED BENESCH & ASSOCIATES CHICAGO, ILLINOIS Date MAY 6, 1958

Location of Borings WABASH RAILROAD SUBWAY AT SOUTH FIFTH STREET SPRINGFIELD, ILLINOIS

All borings are plotted to scale of 1" = 8 ft. using DATUM AS NOTED ON PLAN as a fixed datum.

Boring No. 3 Boring No. Boring No.

STA. 21+95 RIGHT 28'

	GROUND SURFACE	N VALUE	QU (T/FT²)	
385	ELEV. 582.4			0'0"
380	CINDER COAL & MISC. FILL	18		4'0"
	BROWN SILTY CLAY	16	1.50	7'0"
375	BROWN & GRAY SILT TRACE CLAY	6	0.53	
		6	1.06	11'0"
370	BROWN SILT TRACE CLAY	5	1.60	
		4	1.05	15'0"
365	GRAY SILTY CLAY TRACE SMALL GRAVEL	4	0.85	
		4	1.06	22'0"
360	BROWN SILT	97	6.30	
		100/7	6.94	26'0"
355	GRAY DECOMP. SHALE	100/8	X	27'6"

BORING STOPPED BY CLIENT

USED 14'0" OF 2 1/2" CASING

BORING BAILED TO 24'0"

X - UNSUITABLE FOR TESTING

WATER LEVEL APPROX. 7' TO 8' (RECENT HEAVY RAINS)

4/23/58

Classifications are made from visual inspection.

Water Levels (WL). Figure indicates time of reading (hours) after completion of boring. Water levels indicated are those observed when borings were made, or as noted. Porosity of the soil stratas, variations of rainfall, site topography, etc., may cause changes in these levels.

Figures in right hand column indicate number of blows required to drive 2" O. D. sampling pipe one foot, using a 140 lb. weight falling 30 inches.

Total Footage 27'6"

Foreman A J HOUSE

Classifications by AH & GA

Job No. B 227355L

Sheet 4 of 5

F-344-S—100 PADS—10-56

TEST BORING REPORT
RAYMOND
CONCRETE PILE COMPANY
GOW DIVISION

To ALFRED BENESCH & ASSOCIATES CHICAGO, ILLINOIS Date MAY 6, 1958

Location of Borings WABASH RAILROAD SUBWAY AT SOUTH FIFTH STREET SPRINGFIELD, ILLINOIS

All borings are plotted to scale of 1" = 8 ft. using DATUM AS NOTED ON PLAN as a fixed datum.

Boring No. 4 Boring No. Boring No.

STA. 21+36 RIGHT 26'

	GROUND SURFACE	N VALUE	QU (T/FT²)	
385	ELEV. 583.0			0'0"
	CINDER COAL & MISC. FILL	7		4'0"
380	BROWN SILTY CLAY	14	2.67	7'0"
375	BROWN & GRAY SILT TRACE CLAY	9	0.53	
		9	0.85	11'6"
370	BROWN SILT TRACE CLAY	7	0.53	
		6	0.32	16'0"
365	GRAY SILTY CLAY	4	0.53	19'0"
	SEE NOTE A	7	1.60	22'0"
360	BROWN SILT	39	8.54	25'0"
	GRAY DECOMPOSED SHALE	100/7 100/5	10.15 X	27'11"

BORING STOPPED BY CLIENT

USED 14'0" OF 2 1/2" CASING

BORING BAILED TO 25'0"

WATER LEVEL APPROX. 7" TO 8' (RECENT HEAVY RAINS)

X - UNSUITABLE FOR TESTING

4/22/58

Classifications are made from visual inspection.

Water Levels (WL). Figure indicates time of reading (hours) after completion of boring. Water levels indicated are those observed when borings were made, or as noted. Porosity of the soil stratas, variations of rainfall, site topography, etc., may cause changes in these levels.

Figures in right hand column indicate number of blows required to drive 2" O. D. sampling pipe one foot, using a 140 lb. weight falling 30 inches.

Total Footage 27'11"

Foreman A J HOUSE

Classifications by AH & GA

Job No. B 227355L

Sheet 5 of 5

Boring B-147 15.0 - 27.0 ft			
Run	Depth (ft)	REC (%)	RQD (%)
1	15.0 - 17.0	38	38
2	17.0 - 19.0	96	46
3	19.0 - 21.5	93	82
4	21.5 - 24.5	71	28
5	24.5 - 27.0	93	0

Boring B-147 27.0 - 36.0 ft			
Run	Depth (ft)	REC (%)	RQD (%)
5	27.0 - 28.0	93	0
6	28.0 - 31.0	100	0
7	31.0 - 36.0	90	67

ROCK CORE COMPRESSIVE STRENGTH TESTING
Data and Photograph Sheet

PROJECT DESCRIPTION:	Springfield Rail Improvement
PROJECT LOCATION:	Springfield IL
PROJECT NUMBER:	09L0179B

HANSON

Input By: *RIN* Date: *09/18/13*
Checked By: *JDM* Date: *09/18/13*
Balance #: *G09745*
Caliper #: *7142658*

ROCK CORE TESTING DATA

Boring Name	Sample Number	Run Number	Depth Range (ft)	Elevation Range (ft)	Moisture Content (%)	Unit Weight (pcf)	Unconfined Compressive Strength (psi)	(tsf)
B-147	1	3	20.2 - 20.5	564.2 - 563.9	N/A	142.7	**211.1**	**15.2**
B-147	2	5	26.0 - 26.3	558.4 - 558.1	N/A	143.9	**132.3**	**9.5**
B-147	3	7	35.5 - 35.8	548.9 - 548.6	N/A	146.4	**34.8**	**2.5**

ROCK CORE TESTING PHOTOGRAPHS

B-147 - 1

B-147 - 2

B-147 - 3