GEOTECHNICAL REPORT
PROPOSED STRUCTURE REPLACEMENT
ON U.S. ROUTE 20 (GRANT HIGHWAY)
OVER HARMONY CREEK
SECTION NO. 2009-08-I
KANE COUNTY, ILLINOIS, IDOT JOB # 36313

For

Illinois Department of Transportation
Region One – District One

Through
Terra Engineering, Ltd.

SAM Job No.16017GT

December 05, 2016

Prepared by:

S.A.M. Consultants, Inc.
407 Eisenhower Lane South
Lombard, Illinois 60148

GEOTECHNICAL REPORT
PROPOSED STRUCTURE REPLACEMENT
ON U.S. ROUTE 20 (GRANT HIGHWAY)
OVER HARMONY CREEK - FAP 525
STRUCTURE NO. 045-2037 (Existing) / 045-2100 (Proposed)
KANE COUNTY, ILLINOIS, IDOT JOB # P-91-363-013

For
Illinois Department of Transportation
Region One – District One

Through
Terra Engineering, Ltd.

SAM Job No.16017GT, December 05, 2016

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation including laboratory testing, and geotechnical analyses for the proposed replacement of an existing culvert structure on U.S. Route 20, (Grant Highway) over Harmony Creek, in Kane County, Illinois. A *Site Location Map* is presented in the Appendix showing the site of the structure.

These geotechnical services were performed in accordance with our revised cost estimate presented on IDOT CECS Form submitted by SAM on May 12, 2016 which was subsequently approved by Terra Engineering, Inc

2.0 LOCATION & DETAILS OF THE PROJECT

The following information was provided to us by our clients. The existing Structure at the site was originally constructed in 1920's and consists of a single cast-in-place reinforced concrete box culvert with dimensions of 12 feet wide x 4 feet high x 32 feet long. The out to out width of the structure is 32'-0", with a clear roadway width of 26'-0". Based on the Borings B-3 and B-4 made recently through the existing pavement, the roadway pavement was measured to be 12-inch hot mix asphalt (HMA) pavement with a 4-inch layer of granular base at B-3, (on the west bound lane); and 7 inches of hot mix asphalt (HMA) over 7 inches of concrete (PCC) underlain by a 16-inch layer of aggregate at B-4 (on the east bound lane). The structure spans north and south and carries a total of 2 lanes with one in each direction. Adjacent to each lane is a 2 feet wide aggregate shoulder. Harmony Creek flows from northeast to the southwest through the existing culvert. There are aerial electrical lines that run along the west side of U.S. #20. There is also an underground gas main that runs along the north side of U.S. #20.

The existing structure is 12 feet wide x 4 feet high x 32 feet long concrete box culvert. Additionally, there is an existing pipe culvert (that per a "bridge inspection report") is in a satisfactory condition with an invert elevation lower than the existing main culvert. This culvert drains the area before water enters the 12 feet wide x 4 feet high culvert.

The proposed construction is expected to involve replacing the existing culvert with three spans reinforced concrete cast in place culvert, each span 12 feet wide x 7 feet high. The center line of new culvert will be a small distance south of the centerline of the existing 12 feet wide x 4 feet high culvert. The proposed invert elevation of the new culvert is expected to be at **875.10**, an elevation lower than the existing lower pipe culvert allowing the vertical profile to remain unchanged. The proposed length of the culvert will allow for 44 feet clear width and meet current design standards. The new Triple 12 feet x7 feet x46 feet cast in place concrete box culvert is expected to be constructed under staged construction.

Based on the General Plan S-8.19, the roadway embankment at the approaches will be widened from the existing 32 feet width to a final width of 46 feet which will require as much as 7 feet extra width on each side of the embankment, with new fills to be added on the existing embankment's side slopes. The elevation of the top of the roadway is at elevation **883.41**, which will remain the same after the new culvert is constructed. New earth fills of height approximately 8.31 feet is expected to be placed on the sides of the approach embankments.

3.0 SITE CONDITIONS AND GEOLOGICAL SETTING

The project site is located on U.S. Highway #20 (Grant Highway), at its intersection with Getty Road, in Kane County, Illinois, immediately south of the boundary of Kane and McHenry Counties. According to a "Bridge Inspection Report" published in October 2014, the structural elements of the culvert are in poor conditions. The existing roadway pavement is in a fair condition with minor longitudinal and transverse cracks in the pavement. Harmony Creek at the structure location north to the south flows from the north to the south through the existing culvert.

3.1 Site Geological Settings

The surficial cover in Kane County, is made up mostly of Quaternary glycogenic of unratified drift of the Wedron Group. Per Illinois State Geological Survey's "Quaternary Deposits of Illinois" Map (1979), the project lies mostly within the surficial soil deposits of the *Tiskilwa Till Member of the Waldron Formation, (Wt and Wt-a)* These are mostly Silty and Sandy Clay deposits of glacial origin. Hard pan or rock formations were not encountered for the 45 feet depth to which our borings were taken. Bedrock of Silurian age is expected to be overlain by approximately more than 100 feet of overburden in this area. Our subsurface investigation results generally agree with the local geologic contexts. The borings drilled in the project area revealed that below the embankment fills, the native sediments consisted of Sand and Gravel and below elevation 912 (30 feet below the road grade), stiff clays and Sandy Clays were encountered.

4.0 METHODS OF INVESTIGATION

The following section outlines the subsurface and laboratory investigations provided by SAM.

4.1 Field Work

The borings for the subsurface investigation for the U.S. Route #20 (Greg Highway) culvert site across Harmony Creek, B-3 and B-4, were performed by SAM on September 29, 2016. Drill rig and crews from GEOCON companies were used to drill the borings under the direct surveillance and direction of SAM's field engineer who accompanied the drill rig, logged the borings and collected the soil samples. Both borings B-3 and B-4 were made on the road drilled through pavement of the roadway. Boring B-3 was made on the west bound lane, approximately 10 feet east of the centerline of U.S. #20 at the edge of the pavement. Boring B-4 was made on the east bound lane, approximately 8 feet west of the centerline of U.S. #20 near the turn to Getty Road. As drilled, approximate boring locations are shown on the *Boring Logs* and on the *Boring Location Plan* provided in the attachments.

A truck mounted drilling rig equipped with hollow stem augurs, was used to complete the two borings for the proposed culvert replacement across the Unnamed Creek. Drilling was conducted with hollow stem augers to advance and maintain an open borehole. Soil sampling was performed per AASHTO T 206, "*Penetration Test and Split Barrel Sampling of Soils".* All samples collected were sealed in glass jars and transported to SAM's laboratory.

Field boring logs prepared and maintained by SAM's field engineer, included lithological descriptions, and visual-manual soil classifications (as per IDH textural classification system). Results of Rimac unconfined compressive strength testing on cohesive soils, and Standard Penetration Test (SPT) recorded as blows per 6 inches of penetration are provided on the boring logs. Groundwater observations were made during and at completion of drilling operations. The borings were backfilled with soil cuttings and bentonite chips, and the surface was restored as close as possible to its original condition.

4.2 Laboratory Testing

Appropriate soil tests were conducted on samples of soil from borings B-3 and B-4 to determine the strength and other pertinent properties of the soils encountered. These tests included: Moisture Content Determination on All the Samples Collected (ASTM D2116), Visual Classification Tests (D2487), Strength Tests By "Rimac" and Pocket Penetrometer Test in the Field, Dry Unit Weight, Atterberg Limits (ASTM D4318), Particle Size Analyses Including Hydrometer Analysis (ASTM D422), Classification of Soils by the Unified Soil Classification System, (ASTM D2487). The results of all tests performed on the soil samples are provided either on the logs of borings or separate sheets in Appendix of this report. Based on the results of the field drilling and laboratory testing, the sub-surface conditions encountered were analyzed for the appropriate support of the planned culvert project. Details of our analyses and geotechnical recommendations are provided in the following portions of this report.

4.3 Geotechnical Report

This report presents results of our subsurface investigation, laboratory testing and characterization of the site soil and groundwater conditions, geotechnical analyses, and provides recommendations for the design and construction of the new replacement culvert supports and approach slabs. The analysis, recommendations and effects of new earth fill and related grading work are also included in this report.

5.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

Detailed descriptions of the soil conditions encountered during the subsurface investigation are presented in the *Boring Logs* included in the Appendix. Please note that strata contact lines represent approximate boundaries between soil types. The actual transition between soil types in the field may be gradual in horizontal and vertical direction.

5.1 Subsoil Conditions

Boring B-3 was made close to the south, southeast end of the existing culvert on U.S. Route #20 (Grant Highway) over Harmony Creek. This boring indicated a 12-inch hot mix asphalt (HMA) pavement at the surface, underlain by a 4-inch layer of aggregate base.

Below the pavement and the aggregate base in B-3 and down to a depth of 5 feet, (or to elevation 878.4), a fill made with medium stiff to stiff lean clay soils with traces of sand and gravel was encountered. The moisture content of these soils varied between 13% and 24%, Liquid Limit 36%; Plasticity Index 11%; classification CL – Lean Clay. These soils were noted to have Standard Penetration Resistance "N" values of between 6 and 7 blows per foot.

In B-3, between elevations 878.4 and 872.4, a deposit of loose to medium dense Gravelly Sand was encountered. This sand layer was noted to exist with a Standard Penetration Resistance "N" value of 12 to 20 blows per foot, and was classified as SM by the Unified system.

Deposits of stiff to very stiff lean clays with trace of gravel were encountered between elevation 872.4 and 858.4. These soils had the following in place properties; moisture content 9 to 13%; shear strength by "Rimac" of 0.6 to 2.1 tsf; Standard Penetration Resistance "N" values 8 to 12 blows per foot. These soils were classified as CL – Lean Clay by the Unified System.

A layer of very soft / loose silty clay was encountered in B-3 between elevations 858.4 and 853.4 (depths of 25 feet and 30 feet). These soils had the following in place properties; moisture content 12% to 13%, shear strength by "Rimac" of 0.4 tsf; Standard Penetration Resistance "N" values 6 to 8 blows per foot. These soils were classified as CL – ML Silty Clay by the Unified System.

Below elevation 853.4 (depth of 30 feet) and continued down to the bottom of B-3 to elevation 838.4', (depth of 45 feet), gravelly sand deposits were encountered. This sand layer was noted to

exist with a Standard Penetration Resistance "N" value of 10 to 27 blows per foot, and was classified as SM by the Unified system.

Boring B-4 was made close to the north, northwest end of the existing culvert on U.S. Route #20 (Grant Highway) over Harmony Creek. This boring indicated a 7-inch hot mix asphalt (HMA) pavement at the surface, underlain by a 7-inch thick concrete (PCC) pavement, which in turn was underlain by a 16-inch layer of aggregate base fill.

Below the pavement and the aggregate base in B-4 and down to a depth of 7.5 feet, (or to elevation 876.2), a fill made with stiff to very stiff lean clay soils with traces of sand and gravel was encountered. The moisture content of these fill soils varied between 8% and 14%. These soils were noted to have Standard Penetration Resistance "N" values of between 15 and 20 blows per foot.

In B-4, between elevations 876.2 and 871.2 (depths of 7.5 feet and 12.5 feet), a deposit of medium dense sandy gravel and fine to medium grained sand was encountered. This granular soil was noted to exist with a Standard Penetration Resistance "N" value of 16 to 22 blows per foot, and was classified as SP – SM by the Unified system.

Deposits of stiff to very stiff lean clays with trace of sand and gravel were encountered between elevation 871.2 and 862.7, (depths of 12.5 feet to 21 feet). These soils had the following in place properties; moisture content 8 to 13%; shear strength by "Rimac" of 2.1 to 3.9 tsf; Standard Penetration Resistance "N" values 13 to 14 blows per foot. These soils were classified as CL – Lean Clay by the Unified System.

A thin layer of silt was encountered between elevation 862.7 and 861.2 (depths 21 feet to 22.5 feet) in B-4. This silt layer exists in a dense state with Standard Penetration Resistance value "N" of 31 blows per foot and had a moisture content of 20.5%.

A layer of medium stiff to stiff lean clay with traces of Sand and gravel was encountered in B-4 between elevations 861.2 and 853.7 (depths of 22.5 feet and 30 feet). These soils had the following in place properties; moisture content 10 to 12%, shear strength by "Rimac" of 0.7 to 1.7 tsf; Standard Penetration Resistance "N" values 13 to 14 blows per foot. These soils were classified as CL – Lean Clay by the Unified System.

Below elevation 853.7 (depth of 30 feet) and continued down to the bottom of B-4 to elevation 838.7, (depth of 45 feet), sandy gravel and sands were encountered. These granular soils were noted to exist with a Standard Penetration Resistance "N" value of 22 to 32 blows per foot, and were classified as SM to SP by the Unified system

5.2 Groundwater Conditions

In B-3 and B-4, groundwater was encountered at approximately depth of 10 feet (at elevation 873.7) during drilling on September 29, 2016. The groundwater level observations provide an

approximate indication of the groundwater at the time the borings were drilled. Fluctuations in the groundwater level should be anticipated throughout the year depending on regional variations in the climate and other factors not apparent at the time the borings were performed.

6.0 GEOTECHNICAL EVALUATION

6.1 Excavations and Embankment Construction

Excavations will be needed to 869.6 from the existing ground surface, in two stages as per the Project General Plan, for the construction of the new cast-in-place reinforced concrete culvert including the thickening slab / invert slab foundation which is 3 feet typical below the bottom of invert slab. It is highly recommended that the soils should be excavated to the elevation 869.6 and ensure all the wet sandy soils are removed due to the expected ground water level. Backfill material between elevation 869.6 and 872.7 should consist of granular material such as IDOT CA06 shall be placed and compacted in loose lifts of 6 inches to a dry density of 95% of ASTM D-1557. Construction of the thickening slab / foundation for the invert slab can be performed by trenching through the CA-06 granular fill material. Since the base of the excavations are expected to be wet with possible standing groundwater as seen in boring B-1 and B-2 we recommend continuous dewatering should be performed during the soils excavation, placement and compaction of granular materials. Similarly, the backfills on the sides of the new culvert shall also be made with compacted aggregate fill made with CA-6 material. In case, the culvert walls have "weep holes" the outside walls of the culvert should be backfilled with drainage material such as IDOT CA-07 and densified to allow drainage of any collected water. The excavation for the wing walls is recommended to be performed to an elevation of 869.6 and backfill with the granular soils such as IDOT CA06 shall be placed and compacted as stated above. It is important that the foundation soils at elevation 869.6 should be verified by the construction Quality Control to have a minimum allowable bearing pressure of 3000 psf.

The side slopes of any open cut construction excavations shall be constructed safe and in accordance with the OSHA requirements. The soils material for all new fills and the backfill around the new culvert shall be granular materials. The compaction procedures and minimum density requirements shall be in accordance with Illinois Department of Transportation's "Standard Specifications for Road and Bridge Construction", 2016 Edition, Section 205.

6.2 Culvert Foundation Evaluation and Design Considerations

The proposed construction is expected to involve replacing the existing culvert with three span reinforced concrete cast in place culvert, each span 12 feet wide x 7 feet high. The center line of new culvert will be a small distance south of the centerline of the existing 12 feet wide x 4 feet high culvert. The invert elevation of the new culvert is expected to be at **874.10 at B-3 location and 874.0 at B-4 location**, which is lower than the existing lower pipe culvert allowing the vertical profile to remain unchanged. The proposed length of the culvert will allow for 44 feet clear width and meet current design standards. The new Triple 12 feet x7 feet x 46 feet cast in place concrete box culvert is expected to be constructed under staged construction. Temporary

arrangements should be made to divert the flow from the creek during the construction of the new culvert. Open excavations possibly as deep as 12 feet to be made for the construction.

The new triple 12 feet wide x 7 feet high culvert will have head walls on both its east and west sides with wing walls at their both ends. The new roadway at the culvert will be 44 feet wide, while the existing roadway is 28 feet wide with existing head walls are approximately 32 feet apart.

Since the proposed invert elevation at B-3 and B-4 location is in the medium dense fine sand to sandy loam layer, and the thickening slab / foundation for the invert slab is at elevation approximately 869.6, which is in the stiff to very stiff clay layer, all the material to the elevation 869.67 should be excavated and ensure all the wet medium dense sand to sandy loam material is removed. This should be confirmed by the field Geotechnical Engineer / Quality Control. Furthermore, due to the presence of ground water table at an elevation of 873.7 continuous dewatering should be performed during construction and ensure the dry construction condition is maintained. Below the base slab of the culvert, a 36-inch layer of compacted (at 95% ASTM D-1557) aggregate (such as IDOT CA-6) be created (between elevation 872.6 and 869.7). Since the culvert is to be constructed in two stages, for the Stage I construction, the north portion of the culvert shall be constructed independent of the Stage II construction. Subsequently the culvert is recommended to be placed on the above said granular fill material, the required allowable bearing pressure against the vertical loads would be safe. The foundation system for the wing walls will be spread footing with the allowable bearing pressure of 3,000 psf.

The subsoils encountered in the two borings B-3 and B-4, generally indicated stiff to very stiff soils in the settlement zone with the unconfined compressive strength varying between 2.0-tsf to 4.0-tsf and the moisture content varying between 9% and 12%. Based on this information, the soils are over-consolidated and practically incompressible. Therefore, there would be **very minimal to negligible settlement due to the placement of new backfill.**

6.3 Seismic Considerations

The subsoils at the culvert structure at the Harmony Creek site are a combination of granular soils interspersed with cohesive soils. Ground water was observed to exist in the recently made boring B-4 at depth of 10 feet. As per the Geotechnical Manual User (AGMU) Memo section 10.1 (January 2010) provided by IDOT, the liquefaction potential was determined.

For the Seismic Site Class Determination, we have extended the soil column to 50 feet, extrapolating the soil properties at depths beyond the bottom of the borings to those that were encountered at the base of the two borings. The site soils within the top 45 feet have an average normalized undrained shear strength of 1.44 ksf, classifying the site in Seismic Site as Class D (AASHTO, 2008 Method C). The project location belongs to seismic performance zone 1, and the site soil class is D. The seismic spectral acceleration parameters recommended for design in accordance with the *2008 Interim Revisions of the AASHTO LRFD Design Specifications* are summarized in Table 6. 2 below.

Table 6.2: Seismic Design Parameters

Spectral Acceleration Period (sec)	Site Factors	Design Spectrum for Site Class D** (%g)
	F_{pga}=1.6	As = 6.7
0.2	F_a=1.6	S_{DS}=15.2
1.0	F_v=2.4	S_{D1}=8.4

**Site Class D values to be presented on plans

6.4 Scour Considerations

The following stream information was taken from the Bridge Condition Report dated October 18, 2013 prepared by Collins Engineers Inc.

- Elevation of Flood Levels: 882.9 – 10 year; 884.1 – 100 year;
- The bottom elevation of the stream channel is at 871.0
- Proposed Flow Line – 876.90 (upstream) and 874.90 (downstream)

A layer of Riprap is preferred to be provided at the base of the channel. Further the side slopes of the channel near the bridge should also be receiving a layer of Riprap. With this we feel that scour will not be of any consequence. However, to assist the hydraulic designers, we have performed two mechanical analyses, including hydrometer analyses for the soils from the top 10' from the two borings. The results of these are included in the Appendix of this report.

6.5 Mining Activity

Per all available information for Kane/McHenry Counties the subject site does not have any record of any coal mining or other mining activities in the area.

7.0 QUALITY CONTROL DURING CONSTRUCTION

It is recommended that all undercuts, subgrade examinations and proof-rolling etc. shall be observed and documented by the geotechnical engineer during construction. The soils material for the backfill around the new culvert as well as all new embankment fill and the compaction procedures and minimum density requirements shall be in accordance with Illinois Department of Transportation's "Standard Specifications for Road and Bridge Construction", 2016 Edition, Section 205.

8.0 REPORT LIMITATIONS

The information, analyses and recommendations presented in this report are based on the design and construction related information supplied to S. A. M. Consultants Inc., by Terra Engineering Ltd. and their sub-consultants., the results of our field drilling, sampling and testing and the ensuing analyses performed by us. If any of the project information is different from our current

understanding as presented in this report, or if any of the same changes, please inform us so that we can modify our recommendations if necessary.

The analyses and recommendations presented in this report conform to the current standards of the industry for similar projects. Beyond this, no warranty is provided or implied.

The recommendations provided in this report are for the exclusive use of Illinois Department of Transportation and their consultants Terra Engineering for the specific use in the design and construction of the proposed culvert replacement on U.S. Route #2 (Grant Highway) going across Harmony Creek, in Kane County, Illinois.

Submitted by:
S. A. M. Consultants, Inc.

Altaf (Al) Rahman, Ph.D., P.E.
(IL Reg. # 062-054163)
Principal

Hanumanth S. Kulkarni, Ph.D.
Senior Geotechnical Engineer

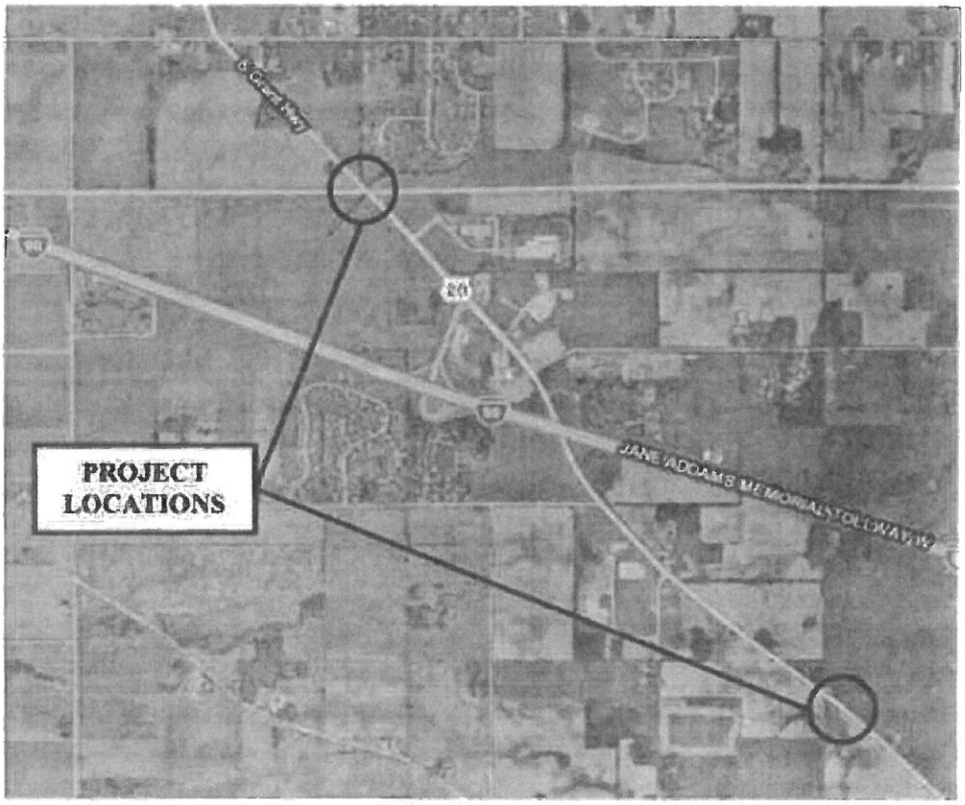
APPENDIX

Project Location Plan


SITE 1
Harmony Rd
Botterman Rd
Sunflower Ln
Seeman Rd
Hillsboro
Hampshire Rd
Getty Rd
Elgilloy Dr
Hawk Dr
Arrowhead Dr
Dietrich Rd
Woodview Pkwy
Woodview Pkwy W
Felsmith Rd
Higgins Rd
311
316
20
90
N
3000 ft
Google earth
© 2016 Google

Illinois Department of Transportation

U.S. ROUTE 20
over Harmony Creek (at Getty Rd)
&
over an unnamed ditch (aka Eakin Creek West) (1.2 mi South of I-90)



P-91-363-13

SN 045-2037 (ex.) / SN 045-2100 (pr.)
SN 045-0252 (ex.) / SN 045-2101 (pr.)

Kane/McHenry Counties, Illinois

IDOT – Division of Highways – District One
January 2016

Project General Plan

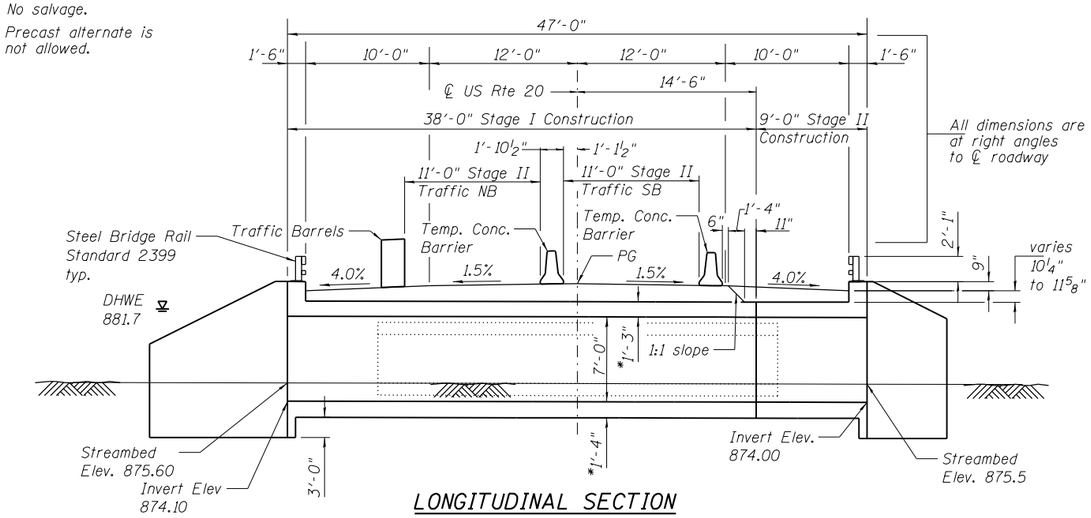
Benchmark B: Bench tie on PP @ NW corner of Getty Road and US 20, Elev. 882.67

Existing Structure No. 045-2037 built in the 1920's as a cast in place 12'Wx4'Hx32'L box culvert.

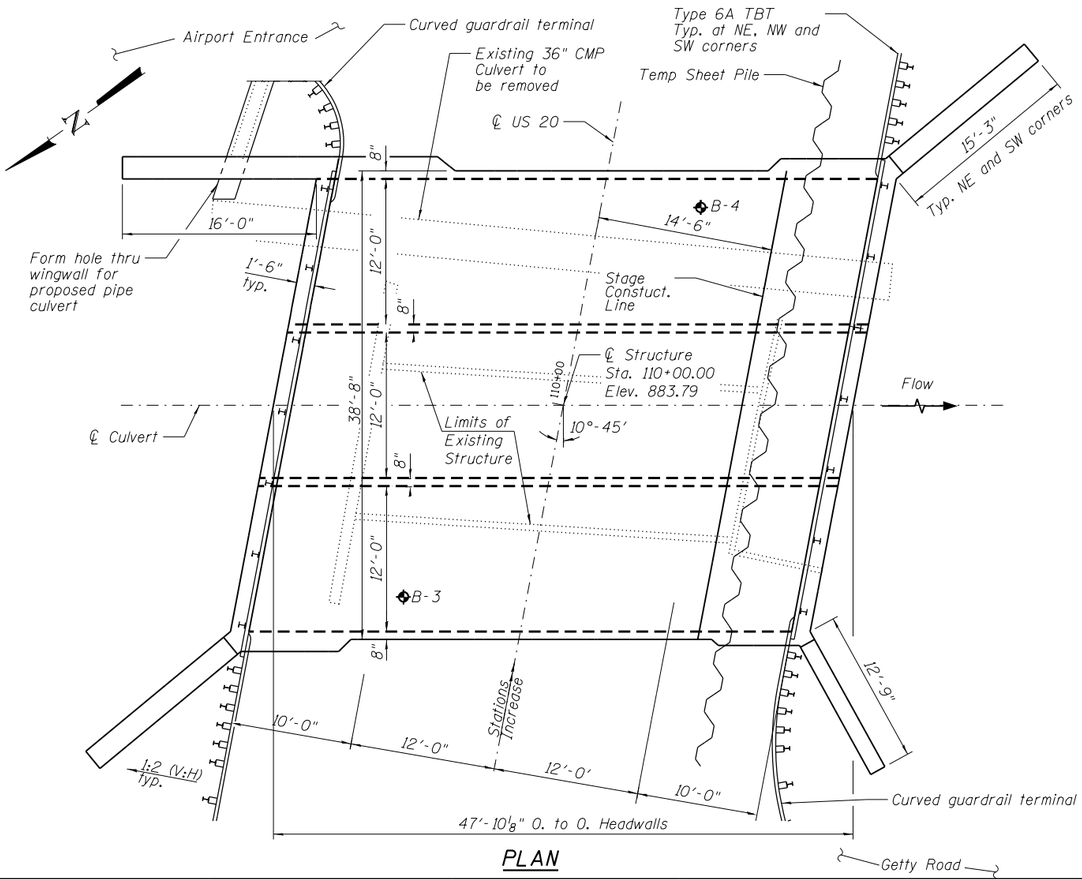
Stage construction with two lanes of Stage I traffic on a runaround to the west.

No salvage.

Precast alternate is not allowed.



LONGITUDINAL SECTION

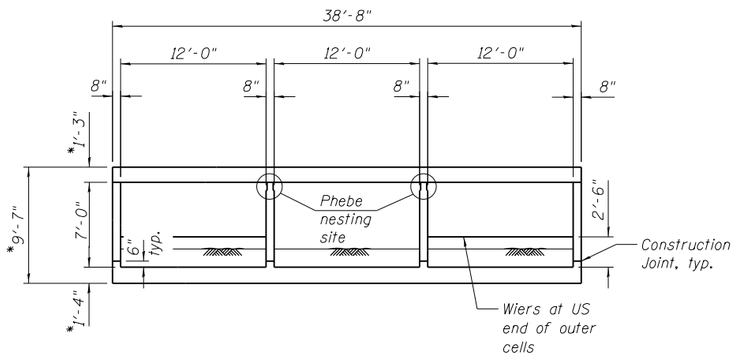


PLAN

WATERWAY INFORMATION

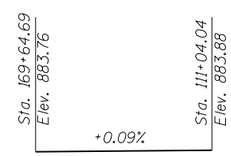
Drainage Area = 3.5 sq. mi. Low Grade Elev. 883.5 @ Sta. 113+00

Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	352	37.2	166.8	880.7	2.2	0.3	882.9	881.0
Design	50	662	48.6	174.0	881.7	2.3	0.3	884.0	882.0
Base	100	787	54.2	174.0	882.2	2.0	0.3	884.1	882.5
Overtopping		1250		174.0	883.3		0.6		883.9
Max. Calc.	500	1005	55.1	174.0	882.7	1.5	0.4	884.2	883.1



SECTION THRU BARREL

* Slab thickness may be refined in final design



PROFILE GRADE

HIGHWAY CLASSIFICATION

Rte. US 20
Functional Class: Other Principal Arterial
ADT: 9700 (2015): (20)
ADTT: 2454 (2015): (20)
DHV:
Design Speed: 45 m.p.h.
Posted Speed: 45 m.p.h.

LOADING HL-93

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

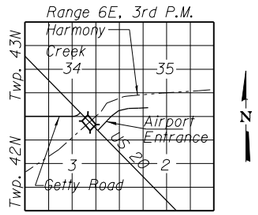
DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications.
7th Edition with 2015 & 2016 Interims

DESIGN STRESSES

FIELD UNITS

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



LOCATION SKETCH

GENERAL PLAN & ELEVATION
US 20 (GRANT HIGHWAY) OVER HARMONY CREEK
F.A. ____ SEC. 2009-08-I
KANE COUNTY
STATION 110+00.00
STRUCTURE NO. 045-2100

T:\Projects\12-154-009 US 20-Harmony and unnamed Crk\Structural\CADD sheets\045210036313.dgn

TERRA ENGINEERING LTD.

Date plotted: 12/1/2016
Time plotted: 1:45:24 PM

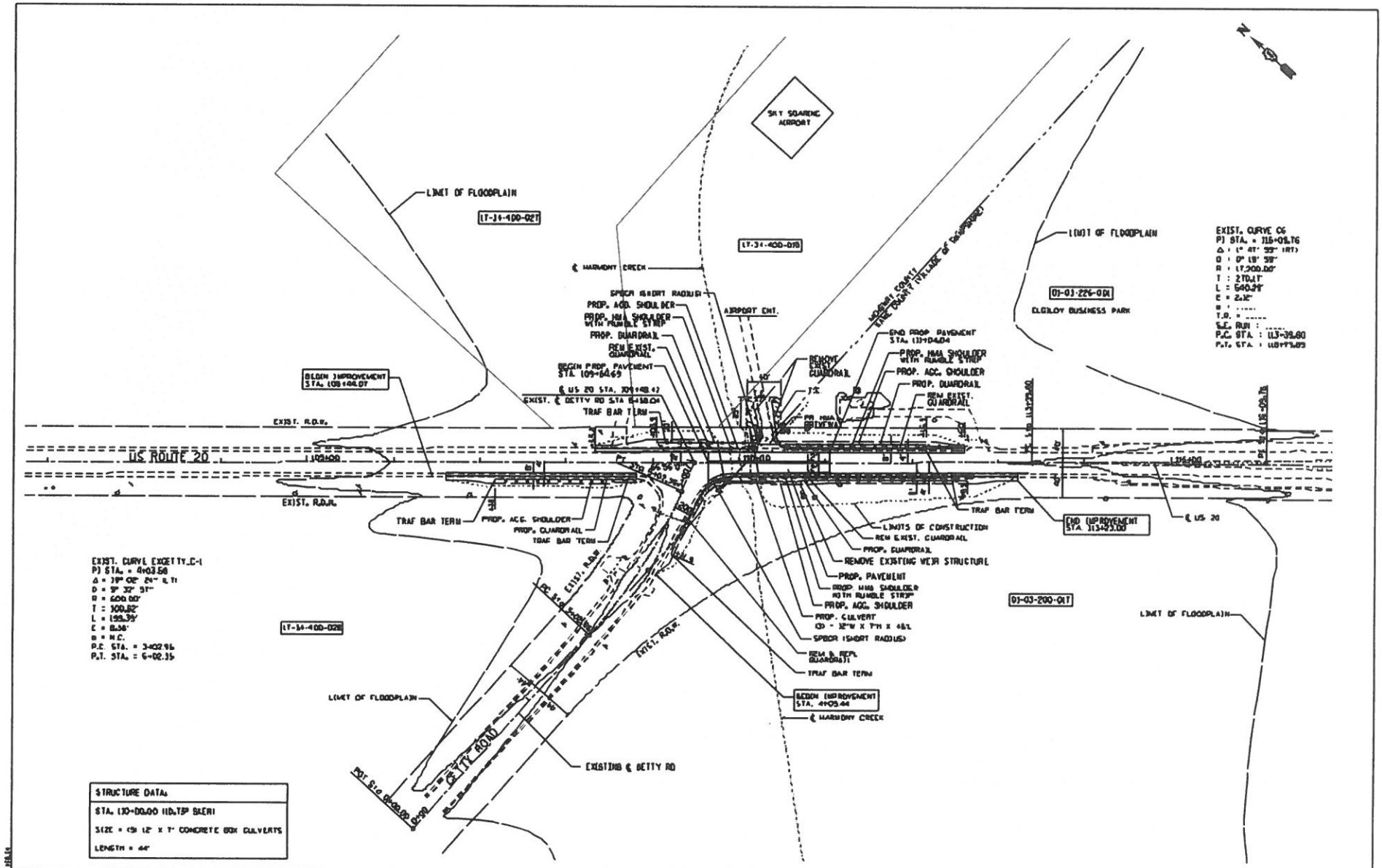
DESIGNED - DDB | CHECKED - ___ | DRAWN - DDB | CHECKED - ___
REVISED - ___ | REVISED - ___ | REVISED - ___ | REVISED - ___

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 1 SHEETS

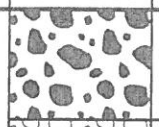
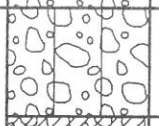
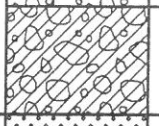
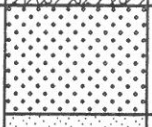
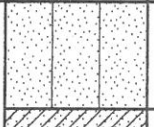
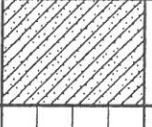
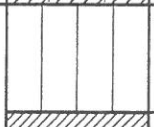
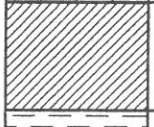
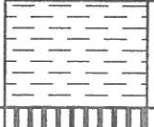
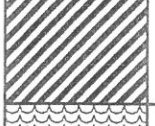
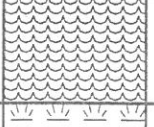
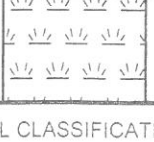
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
____	2009-08-I	KANE	1	1

CONTRACT NO. 36313
ILLINOIS FED. AID PROJECT


SKY SQUARING AIRPORT
LIMIT OF FLOODPLAIN
17-34-400-027
17-34-400-018
17-34-400-028
01-03-226-001
ELGILOY BUSINESS PARK
01-03-200-017
HARMONY CREEK
AIRPORT ENT.
EXIST. R.O.W.
US ROUTE 20
EXISTING E BETTY RD
BETTY ROAD
BEGIN IMPROVEMENT STA. 108+00.00
BEGIN PROP. PAVEMENT STA. 109+54.69
EXIST. E BETTY RD STA 6+58.04
TRAF BAR TERM
PROP. ACC. SHOULDER
PROP. GUARDRAIL
REM EXIST. GUARDRAIL
PROP. HMA SHOULDER WITH RUMBLE STRIP
END PROP. PAVEMENT STA. 113+04.04
REMOVE EXIST. GUARDRAIL
LIMITS OF CONSTRUCTION
REMOVE EXISTING WEIR STRUCTURE
PROP. PAVEMENT
PROP. CULVERT
SPECIAL (SHORT RADIUS)
REM. & REPL. GUARDRAIL
END IMPROVEMENT STA. 113+23.00
BEGIN IMPROVEMENT STA. 4+03.44
EXIST. CURVE EXCETTY_C-1
P) STA. = 4+03.58
Δ = 19° 02' 24" (LT)
D = 9° 32' 57"
R = 600.00'
T = 100.82'
L = 199.39'
E = 8.38'
S = N.C.
P.C. STA. = 3+02.96
P.T. STA. = 5+02.35
EXIST. CURVE CG
P) STA. = 116+08.76
Δ = 1° 41' 22" (RT)
D = 0° 18' 38"
R = 17,200.00'
T = 270.17'
L = 540.39'
E = 2.12'
S = ...
T.O. = ...
S.E. RUN = ...
P.C. STA. = 113+38.60
P.T. STA. = 118+79.00
STRUCTURE DATA:
STA. 110+00.00 (D.T.P. BAER)
SIZE = (5) 12' X 7' CONCRETE BOX CULVERTS
LENGTH = 44'
DESIGNED -
DRAWN -
CHECKED -
DATE -
REVISED -
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
US ROUTE 20 OVER HARMONY CREEK
ATTACHMENT 1 - PROPOSED PLAN
SCALE:
SHEET NO. OF SHEETS
STA.
TO STA.
SECTION
COUNTY
ROADWAY/LANE
CONTRACT NO.

Soil Classification & General Notes

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS: Split Spoon – 1 3/8" I.D., 2" O.D., unless otherwise noted
ST: Thin-Walled Tube – 3" O.D., Unless otherwise noted
PA: Power Auger
HA: Hand Auger
DB: Diamond Bit – 4", N, B
AU: Auger Sample
HS: Hollow Stem Auger
PS: Piston Sample
WS: Wash Sample
FT: Fish Tail Bit
RB: Rock Bit
BS: Bulk Sample
PM: Pressuremeter
DC: Dutch Cone
WB: Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon, except when noted.

WATER LEVEL MEASUREMENT SYMBOLS:

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATIONS:

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles; gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve: they are described as: clays, if they are plastic and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in place density and the fine grained soils on the basis of their consistency. Example: Lean Clay with sand, trace of gravel, stiff (CL); Silty sand, trace of gravel, medium dense (SM).

CONSISTENCY OF FINE GRAINED SOILS:

Unconfined Compressive Strength, Qu, tsf	N-Blows/ft	Consistency
< 0.25	Below 2	Very soft
0.25 - 0.50	2 – 4	Soft
0.50 - 1.0	4 – 8	Medium Stiff
1.0 - 2.0	8 - 15	Stiff
2.0 - 4.0	15 - 30	Very Stiff
4.0 - 8.0	30 – 50	Hard
> 8.0	> 50	Very Hard

RELATIVE DENSITY OF COARSE GRAINED SOILS

N-Blows/ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 - 29	Medium Dense
30 – 49	Dense
50 – 60	Very Dense
80+	Extremely Dense

RELATIVE PROPORTIONS OF SAND & GRAVEL

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component Of Sample	Size Range
Cobbles	12 in. to 3 in. (300 mm to 75 mm)
Gravel	3 in. to #4 sieve (75 mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75 mm to 0.75 mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

S. A. M. Consultants, Inc.

Logs of Borings B-3 and B-4

S.A.M. CONSULTANTS, INC.
DBE/MBE Firm

SOIL BORING LOG

Date 9/29/16

ROUTE U.S. #20 (Grant Highway) / FAP 525 DESCRIPTION S.A.M Job #16017GT LOGGED BY Danish

First Encounter

SECTION 2009-089 LOCATION On U.S. #20 Pavement - 10' East of C/L, SEC. , TWP. , RNG.

COUNTY Kane DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 045-2037(Exist.) 045-2100(Prop.)
Station 110+00.00

BORING NO. B-3
Station 110+18.00
Offset 8.00ft East
Ground Surface Elev. 883.41 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.: 873.4 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Asphalt Pavement - 12" 882.41				
4" Sand & Gravel Base 882.08		10		
FILL - made with Lean Clay with trace Sand & Gravel Dark Brown		4 3	1.0 P	13.1
		3		
		3 3	1.3 P	24.1
878.41	-5			
SANDY LOAM Gray Medium Dense SM		4		
		5 7		13.1
		2		
		8 12		11.3
▼	-10			
872.41				
LEAN CLAY with trace of Coarse Gravel Gray Very Stiff to Stiff CL		4		
		5 5	2.1 S	12.2
		4		
		5 7	2.9 S	9.3
	-15			
		3		
		4 6	1.7 S	10.1
		2		
		3 5	1.3 S	11.6
863.41	-20			

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
LEAN CLAY with trace of Coarse Gravel Gray Stiff to Medium Stiff CL		3		
		4 5	1.0 S	12.0
		3		
		3 5	0.6 B	11.8
858.41	-25			
SILTY CLAY - trace of Sand & Gravel Gray Soft to Medium Stiff CL - ML		3		
		4 4	0.4 B	12.7
		2		
		3 3	0.4 B	12.1
853.41	-30			
SANDY LOAM Gray Medium Dense SM				
		6		
		11 16		5.0
	-35			
		8		
		9 17		7.4
	-40			

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

S.A.M. CONSULTANTS, INC.
DBE/MBE Firm

SOIL BORING LOG

Date 9/29/16

ROUTE U.S. #20 (Grant Highway) / FAP 525 DESCRIPTION S.A.M Job #16017GT LOGGED BY Danish

SECTION 2009-089 LOCATION On U.S. #20 Pavement - 10' East of C/L, SEC. , TWP. , RNG.

COUNTY Kane DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 045-2037(Exist.) 045-2100(Prop.)
Station 110+00.00

BORING NO. B-3
Station 110+18.00
Offset 8.00ft East
Ground Surface Elev. 883.41 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 873.4 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
SANDY LOAM Gray Medium Dense SM *(continued)*				
	3			
	5		14.2	
838.41 -45	5			
End of Boring				
-50				
-55				
-60				

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)

S.A.M. CONSULTANTS, INC.
DBE/MBE Firm

SOIL BORING LOG

Date 9/29/16

ROUTE U.S. #20 (Grant Highway) / FAP 525 DESCRIPTION S.A.M. Job 316017GT LOGGED BY Danish

SECTION 2009-089 LOCATION On U.S. #20 Pavement - 8' West of C/L, SEC. , TWP. , RNG.

COUNTY Kane DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 045-2037 (Exist.) 045-2100(Prop.)
Station
BORING NO. B-4
Station 109+82.00
Offset 10.00ft West
Ground Surface Elev. 883.73 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.: 873.7 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Asphalt - 7" 883.13				
CONCRETE - 7" 882.53		10		
FILL - Sand, Gravel & Crushed Concrete		12		10.2
881.23		7		
FILL - made with Lean Clay with trace of Sand & Gravel Dark Brown		12		
		10		13.7
	-5	5		
		9		
		9		8.2
876.23		11		
SANDY LOAM Gray Medium Dense SM		10		
		9		12.3
873.73 ▼	-10	13		
SAND - Fine to Medium with Silt and gravel- Gray Medium Dense SP-SM		6		
		8		17.5
871.23		8		
LEAN CLAY with Traces of Sand & Gravel Gray Very Stiff CL		4		
		5	3.9	12.0
	-15	8	S	
		4		
		6	2.1	8.0
		8	S	
		4		
		5	2.3	12.7
	-20	9	S	

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
862.73				
SILT Gray Dense ML		8		
		15		20.5
861.23		16		
LEAN CLAY - traces of Sand & Gravel Gray Stiff to Medium Stiff CL		4		
		5	1.7	10.3
	-25	9	S	
		4		
		6	1.2	11.8
		7	S	
		3		
		5	0.7	12.0
853.73	-30	6	S	
SANDY GRAVEL Gray Medium Dense GP		5		
		11		15.2
	-35	18		
		3		
		9		21.3
843.73	-40	13		

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)

S.A.M. CONSULTANTS, INC.
DBE/MBE Firm

SOIL BORING LOG

Date 9/29/16

ROUTE U.S. #20 (Grant Highway) / FAP 525 DESCRIPTION S.A.M. Job 316017GT LOGGED BY Danish

SECTION 2009-089 LOCATION On U.S. #20 Pavement - 8' West of C/L, SEC. , TWP. , RNG.

COUNTY Kane DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 045-2037 (Exist.) 045-2100(Prop.)
Station
BORING NO. B-4
Station 109+82.00
Offset 10.00ft West
Ground Surface Elev. 883.73 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
873.7 ft ▼
Upon Completion ft
After Hrs. ft

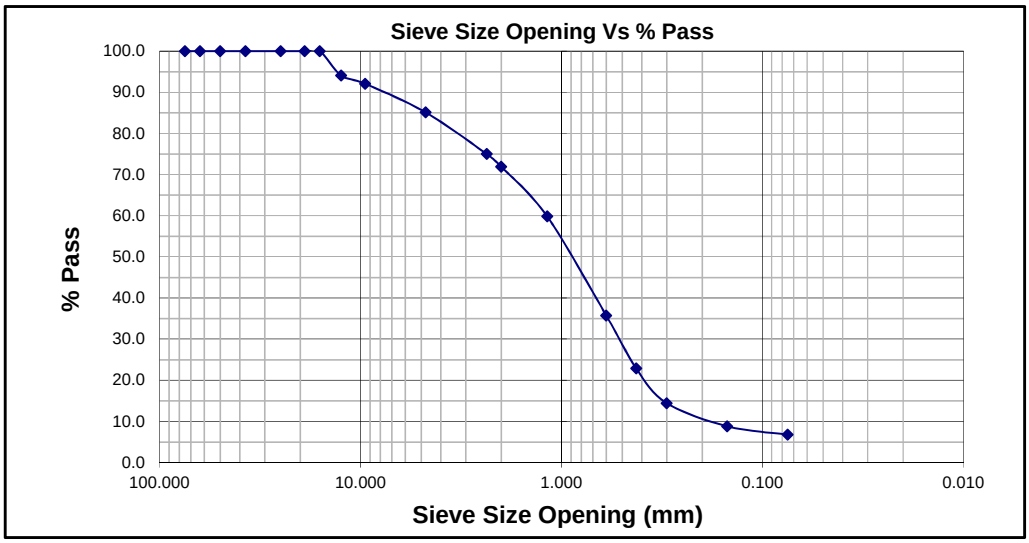
	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
FINE TO MEDIUM DENSE SAND Gray Dense SP		7		
		14 18		23.0
838.73	-45			
End of Boring				
	-50			
	-55			
	-60			

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)

Laboratory Test Reports

Particle Size Analysis for Grannular Materials

Project:	# 16017GT / CULVERT REPLACEMENT ON U.S. ROUTE 20		**Date Tested:**	10/14/2016	**Tested By:** Hanu
Sample ID	B-4 (11.0 - 12.5)		**Sample Location:**	HARMONY CREEK	
Sample Description:	Brown Poorly Graded Sand with Silt and Gravel (SP-SM)			**Date Sample Collected**	9/29/2016



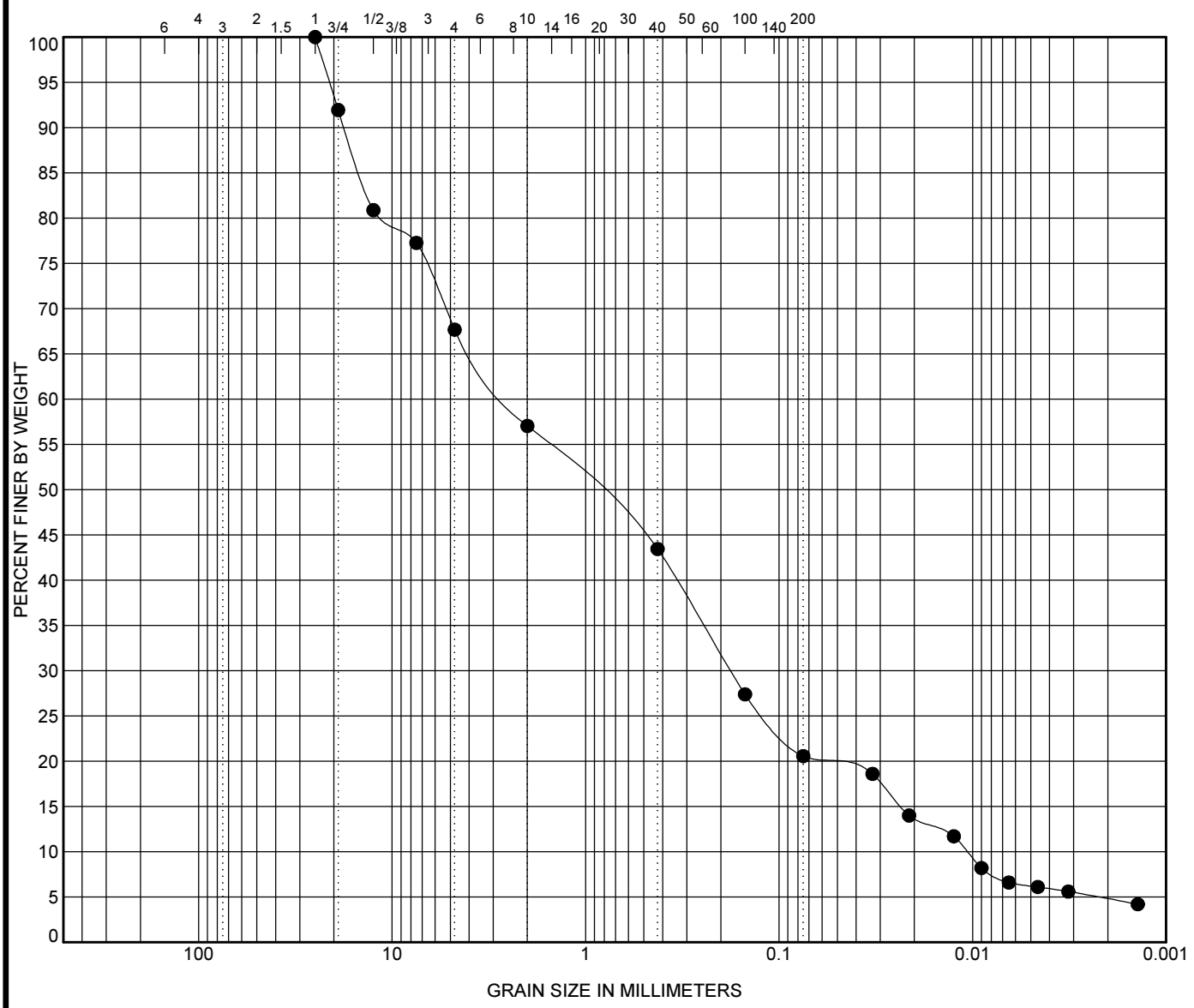
Sieve Size Openings (Inches)	Sieve Size Opening (mm)	Individual weight retained (g)	Cummu. weight retained (g)	Cummu. % Retained	% Passed
3.0 inch	75.000	0	0	0	**100**
2.5 inch	63.000	0.0	0.0	0	**100**
2.0 inch	50.000	0.0	0.0	0	**100**
1.5 inch	37.500	0.0	0.0	0.0	**100.0**
1.0 inch	25.000	0.0	0.0	0.0	**100.0**
3/4 Inch	19.000	0.0	0.0	0.0	**100.0**
5/8 Inch	16.000	0.0	0.0	0.0	**100.0**
1/2 Inch	12.500	23.2	23.2	6.0	**94.0**
3/8 Inch	9.500	7.7	30.9	7.9	**92.1**
# 4	4.750	27.1	58.0	14.9	**85.1**
# 8	2.360	39.4	97.4	25.0	**75.0**
# 10	2.000	12.0	109.3	28.1	**71.9**
#16	1.180	47.0	156.3	40.2	**59.8**
#30	0.600	93.7	250.0	64.2	**35.8**
# 40	0.425	50.2	300.2	77.1	**22.9**
# 50	0.300	32.7	332.9	85.5	**14.5**
# 100	0.150	21.9	354.9	91.2	**8.8**
# 200	0.075	7.7	362.6	93.2	**6.8**
Pan		0.5	363.1		
Total dry weight		**389.2**			
Total wash weight		**363.1**			
Difference {(-) # 200}		**26.1**			
Wash (-) #200		**6.7%**			

% + 3"	**0**
% Gravel	**14.9**
% Sand	**78.3**
% Fines	**6.8**

D85 (mm)	**4.8**
D60 (mm)	**1.2**
D30 (mm)	**0.5**
D10 (mm)	**0.19**
Cc	**1.16**
Cu	**0.22**

Soil Classification	**SP-SM**
Soil Description	**Poorly Graded Sand with Silt and Gravel**
System	**USCS**

S.A.M. CONSULTANTS, Inc.
407 Eisenhower lane South, Lombard, IL 60148.
Ph:(630)-424-1200 Fax:(630) 424-1245



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**B-3(6.0-7.5)**	**0.00**	**SANDY LOAM**				**1.16**	**238.85**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-3(6.0-7.5)**	**0.00**	**25**	**2.545**	**0.178**	**0.011**	**32.3**	**47.1**	**15.8**	**4.8**

Illinois Department of Transportation
Division of Highways
SAM Consuntants, Inc.

GRAIN SIZE DISTRIBUTION

Route:
Section:
County:

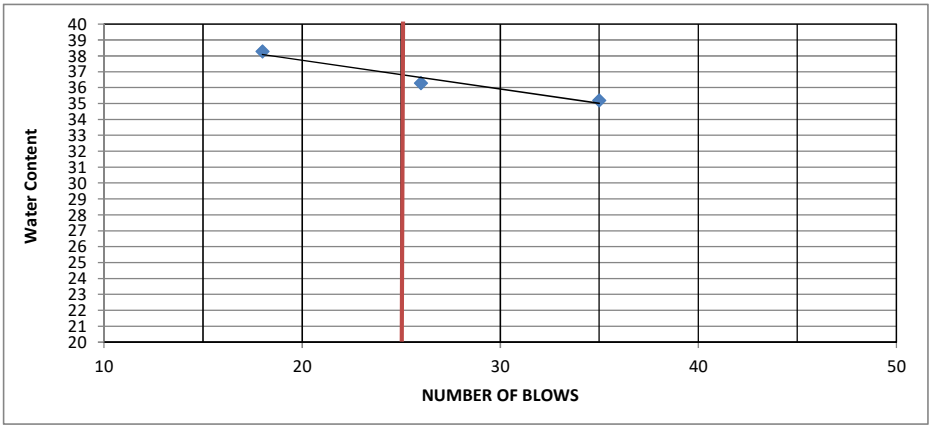
GRAIN SIZE 16017GT-GRADATION2.GPJ IL DOT.GDT 10/27/16

ATTERBERG LIMITS (D4318 - T89 & T90)

Client Name:	Terra Engineering / IDOT	Project No.:	P-91-363-13
Project Name:	PROPOSED CULVERT REPLACEMENT ON U.S. ROUTE 20 (GRANT HIGHWAY) OVER HARMONY CREEK, fap-525	SAM Project No.:	16017GT
Location:		Sampled on:	9/29/2016
Sample Description:	**Black Silty Clay (CL)**	Tested on:	10/14/2016
Source / Placement:			
Location:	B-3 (3.5-5.0)		
Elevation:			
QC Sample No:	**B-3 (3.5-5.0)**		

LIQUID LIMIT:

No. of blows	35	26	18		
Wt. of Sample + Tare (wet)	33.54	34.31	37.31		
Wt. of Sample + Tare (dry)	29.81	30.37	32.31		
Wt. of Water	3.73	3.94	5.00		
Tare weight	19.21	19.51	19.25		
Weight of Dry Soil	10.6	10.86	13.06		
Water Content	35.19	36.28	38.28		



PLASTIC LIMIT: Hand Rolled

Wt. of Sample + Tare (wet)	26.87	26.99			
Wt. of Sample + Tare (dry)	25.37	25.45			
Wt. of Water	1.50	1.54			
Tare weight	19.40	19.36			
Weight of Dry Soil	5.97	6.09			
Water Content	25.13	25.29			

TEST RESULTS

Material Description	LL	PL	PI
Black Silty Clay (CL)	36	25	11

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Seismic Site Class Determination

SEISMIC SITE CLASS DETERMINATION

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified on 12/10/10

PROJECT TITLE=====U.S. HWY #20 (Grant Highway) over Harmony Creek

Substructure 1

Base of Substruct. Elev. (or ground surf for bents)	873.5	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-3	
Top of Boring Elev.	883.5	ft.
Approximate Fixity Elev.	850	ft.

Individual Site Class Definition:

N (bar): 11 (Blows/ft.) Soil Site Class E
N_{ch} (bar): 15 (Blows/ft.) Soil Site Class D <----Controls
s_u (bar): 1.11 (ksf) Soil Site Class D

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
2.5	881.0	2.50	7	1.00	
5.0	878.5	2.50	6	1.30	B
7.5	876.0	2.50	12		B
10.0	873.5	2.50	20		
12.5	871.0	2.50	12	2.90	B
17.5	868.5	5.00	10	1.70	
22.5	863.5	5.00	9	1.30	B
27.5	858.5	5.00	9	1.00	
32.5	852.5	5.00	8	0.40	B
37.5	847.5	5.00	27		
42.5	842.5	5.00	10		
45.0	838.5	2.50	10		

Substructure 2

Base of Substruct. Elev. (or ground surf for bents)	873.5	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-4	
Top of Boring Elev.	884	ft.
Approximate Fixity Elev.	854	ft.

Individual Site Class Definition:

N (bar): 19 (Blows/ft.) Soil Site Class D
N_{ch} (bar): 23 (Blows/ft.) Soil Site Class D <----Controls
s_u (bar): 1.88 (ksf) Soil Site Class D

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
2.5	881.5	2.50	19		
5.0	879.0	2.50	15		B
7.5	876.5	2.50	20		B
10.0	874.0	2.50	22		
15.0	869.0	5.00	13	3.90	
20.0	864.0	5.00	14	2.30	B
25.0	859.0	5.00	29	1.70	B
30.0	854.0	5.00	11	1.00	B
35.0	849.0	5.00	29		B
40.0	844.0	5.00	22		B
45.0	839.0	5.00	32		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): 15 (Blows/ft.) Soil Site Class D
N_{ch} (bar): 20 (Blows/ft.) Soil Site Class D <----Controls
s_u (bar): 1.44 (ksf) Soil Site Class D