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July 24, 2019

Mr. Eric Kallio, P.E.
Project Manager
Ohio Department of Transportation, District 12
5500 Transportation Blvd.
Garfield Heights, OH 44125

RE: CUY-6-14.56 Station (PID 108762)
Veteran Memorial/Detroit-Superior Bridge
West Approach Infilling Feasibility Study

Dear Mr. Kallio:

This letter reports the findings of the Feasibility Study for the in-filling of the rear tunnel and approach spans 1A and 1B of the Veteran Memorial/Detroit-Superior Bridge (CUY-6-14.56, SFN 1800930) over the Cuyahoga River.

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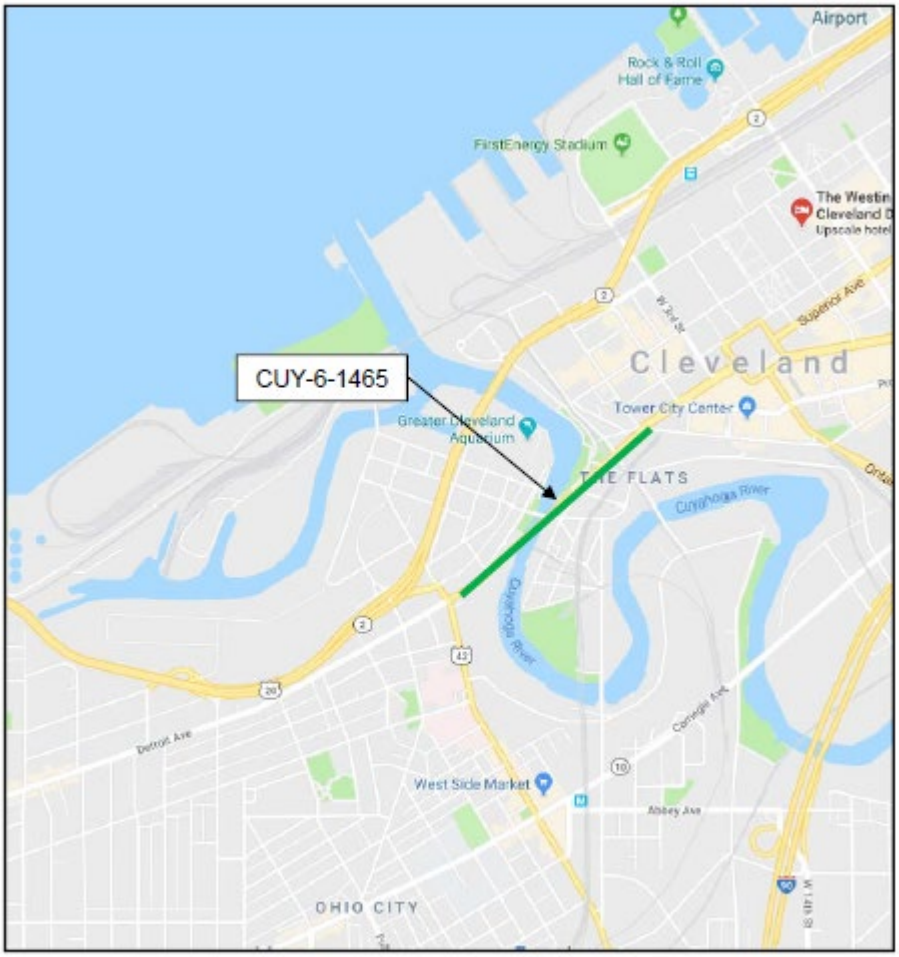
LOCATION MAP



Structure: CUY-6-1456
Veterans Memorial/Detroit-Superior over Cuyahoga River
Cleveland, Ohio

PURPOSE

ODOT requested that Gannett Fleming (GF) evaluate the feasibility of filling the void space of the abandoned subway tunnel and spans 1A and 1B in the west approach with various materials including Expanded Polystyrene (EPS), Low-density cellular concrete (LDCC), and Flowable fill and compare this cost against the current inspection and maintenance/rehabilitation approach. The objective was to reduce the costs associated with the inspection and resulting maintenance of these units.

The West Abutment is located on the Irish Bend slope, which is known for its susceptibility to sliding dating back to filling operations in the 1950's. After completion of the site reconnaissance and during the development of this report it was determined that the slope instabilities affecting The Irish Bend Landslide are also affecting the bridge. Therefore, on June 5, 2019, GF and the district held a scheduled progress meeting to discuss the effect this should have on the project. The meeting was attended by ODOT personnel Kyle Dohlen, Eric Kallio, Christopher Merklin, Alexander Dettloff, and GF personnel Thomas Monaco, Mitch Weber, and Joe Rikk. The meeting reviewed the recorded movement in the tiltmeters installed at Tower B South and Tower B North and the continued movement in the inclinometers located around the bridge. The tiltmeter readings, inclinometer readings, and Geotechnical Letter Report by PSI, Inc. dated November 13, 2013 are included in Appendix A. It was agreed by all participants that filling the bridge without addressing the slope instabilities was not recommended. The scope of this report was changed at that time to be a narrative of the site reconnaissance and the submission of the MS PowerPoint presentation with the utility mapping.

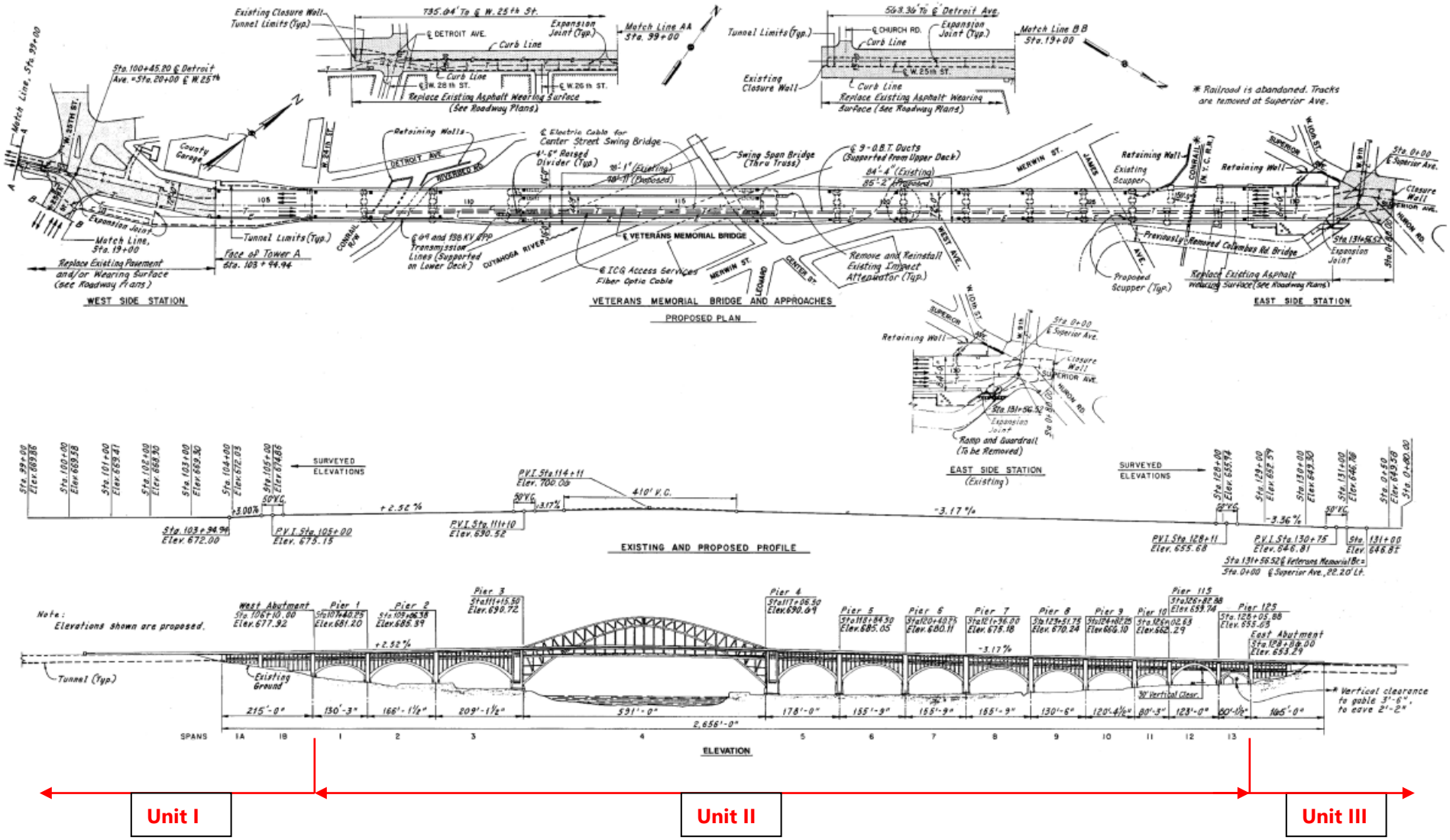
This letter report includes a discussion of the results of the site reconnaissance, the alternatives identified, the infilling material alternatives, the constructibility evaluation, and the preliminary opinion of probable cost. It should be noted that the alternative analyses, constructibility evaluation, the opinion of probable cost, and the recommendations are preliminary because they are dependent on the stabilization of the Irish Bend slope.

GENERAL DESCRIPTION

The Veterans Memorial/Detroit-Superior Bridge consists of three (3) units of varying structure types within each section.

Unit I - West Approach
Unit II - Main Unit Spans
Unit III - East Station

Plan views of the Veterans Memorial/Detroit-Superior Bridge with the units identified follow.


WEST SIDE STATION
VETERANS MEMORIAL BRIDGE AND APPROACHES
PROPOSED PLAN
EAST SIDE STATION
EAST SIDE STATION (Existing)
EXISTING AND PROPOSED PROFILE
ELEVATION
Unit I
Unit II
Unit III

The Veterans Memorial/Detroit-Superior Bridge is approximately 2,880 feet long, including 1,673 feet of subway tunnel that is linked by the lower deck. The bridge was constructed from 1914 to 1917. The upper deck was opened to vehicular traffic in November 1917 and currently carries four lanes of traffic over the Cuyahoga River Valley. The lower deck was designed for four streetcar lines with room for an additional two lines that were active from January 1918 to 1953. On January 18, 1974 the bridge was added to the National Register of Historic Places. On Veterans Day November 11, 1989 the bridge was renamed the Veterans Memorial Bridge.

The bridge has undergone two major rehabilitation projects from 1967 to 1970 and 1995 to 1997. Work included replacing and widening the deck, updating safety features, improving the drainage system, installing new floor system members, and strengthening or replacing deteriorated sections. A third rehabilitation project is schedule for 2019 that will include replacement of the upper deck wearing surface; concrete patching or replacement of the lower superstructure, substructure station, and tunnel components; installation of fiber reinforced polymer wraps over public areas, construction of vandal protection walls and other miscellaneous items.

The Unit I West Approach section consists of the West Station area spanning a total of 565 feet west of the West Abutment and two abandoned subway tunnels: the Detroit Avenue Tunnel (660 feet long) and the West 25th Street Tunnel (480 feet long). There are several utilities that pass through the west station and tunnels. The West Station has been open to the public for tours and festivals since the 1980s. It also includes Spans 1A and 1B. Spans 1A and 1B are transition structures from the underground West Station to the approach and main spans. These two concrete cellular spans total 220 feet long and each has enclosed cellular construction below the lower deck.

Unit II, the Main Unit is comprised Spans 1 through 13. Spans 1 through 13 are the main spans of the bridge with a double deck design. Spans 1 through 3, 5 through 11, and 13 are concrete open spandrel arches. Span 12 is a concrete encased steel half through arch. Span 4 is a 591 foot, three-hinged steel half through arch truss in a Pratt configuration. The upper deck is used for vehicular and pedestrian traffic and the lower deck is used for utilities and maintenance access. Occasional tours and festivals take place on the lower deck.

The Unit III East Station is a concrete cellular span that extends 165 feet past the East Abutment. A three panel long, cellular construction is present under the East Station lower deck immediately behind the East Abutment.

SITE RECONNAISSANCE

On April 24, 2019, GF performed a site reconnaissance consisting of a four-person team that included two structural engineers Eric Dues, PE and Vince Traini, PE; Thomas Monaco, PE, Geotechnical Engineer; and Julia Yeakley, Engineering Geologist. The purpose of the site reconnaissance was to:

1. Preform a cursory condition review of the Unit I. This condition review was to identify maintenance repairs that may be outstanding at the completion of the currently scheduled rehabilitation project (PID 99972).
2. Obtain measurements using hand measuring tools that are not readily available in the plans provided by ODOT to allow for the computation of in-fill quantities.
3. Obtain water sampling results in the submerged Unit I tunnel and stairways to try to identify the source of the water.
4. Identify utilities within Unit I, including owner and general condition.

Figure 1 below, representing Unit I is included as a reference to the various parts of the bridge discussed in this report. The main areas of concern are the tunnel under Detroit Avenue, the tunnel under West 25th Street, the Subway Main Area, and Span 1A and 1B.

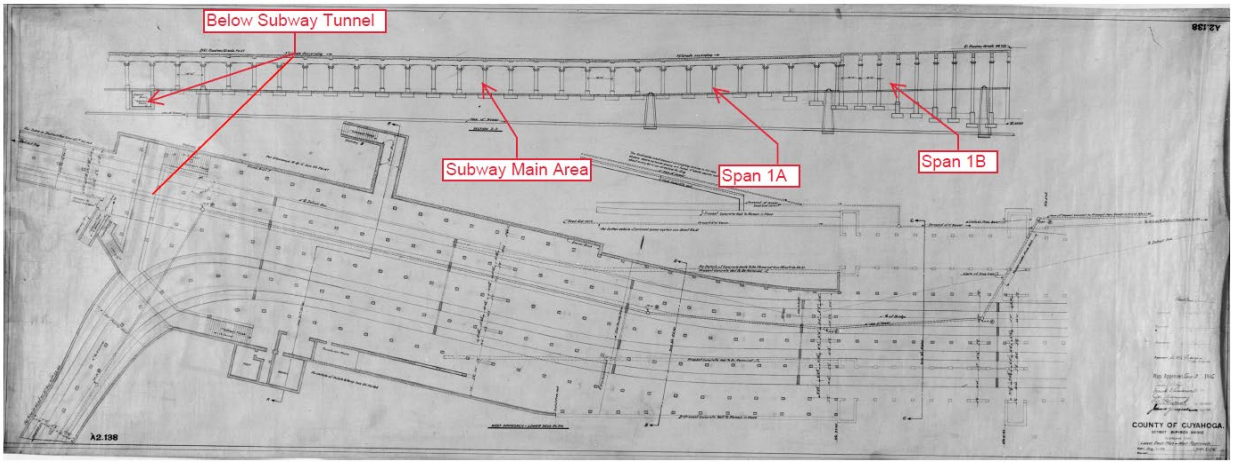


Figure 1: Veteran Memorial/Detroit-Superior Bridge Unit I; Infill Study Area

During the condition review, it was noted that most of the significant deficiencies are addressed in the currently scheduled repairs. The most notable deficiencies that do not appear to be addressed in Project 99972 are the patching of walls (typical spalling with exposed rebar at the base of tunnel walls) and patching of ceilings (some of which have a secondary slab above them). It is GF's opinion that the wall and ceiling patches should be made to slow the degradation in these areas.

The flooded stairwells under the station create a situation where the slabs supporting the station area cannot be inspected without dewatering or diving. It is GF's opinion that the stairwell should be emptied and filled with 70 pcf cellular concrete. This ensures the fill is not buoyant and does not significantly increase the surcharge on the underlying slope. The existing plans and field measurements were used to estimate the volume needed to fill the inaccessible submerged stairwells and interconnecting tunnel. This estimate is summarized and presented in Table 1 below.

Table 1: Flooded Areas Fill Volume Estimate

Flooded Stairwells				
Section	Area of Section ($ft.^2$)	Estimated Height (ft.)	Volume ($ft.^3$)	Volume (yds^3)
Interconnection	1,255.6	8.0	10,045	372
Staircase 1	245.0	8.0	980	36
Staircase 2	283.3	8.0	1,133	42
Staircase 3	255.8	8.0	1,023	38
		Total	**13,181**	**488**

As part of the site reconnaissance, GF obtained water sample results from ODOT, including NEORSD testing of the water in the submerged flooded stairwells. GF could not determine, based on the testing, if the results indicate that the tunnels are filled by groundwater or runoff from the surface; however, GF noted that water infiltrated the tunnel area from the street level, and over time it is assumed that this infiltration would be enough to fill the below subway tunnels and stairwells. The results of the water sample testing can be found in Appendix B.

GF identified approximate locations of ancillary utility equipment and transmission features located on the various levels of Unit I using existing and/or provided mapping within the limits of work. Few damaged pipes were identified during

the utility coordination meeting, but no leaking was observed. The utility lines and pipes that GF was able to identify are shown on the maps in Appendix C.

The Utility Coordination Meeting, held on May 13, 2019, included the following attendees:

Name	Company	E-mail
Alex Cancelliere	Cleveland WPC (Sewer)	Acanelliere@clevelandwpc.com
Kyle Dohlen	ODOT D-12	kyle.dohlen@dot.ohio.gov
Jim Maly	Cleveland Public Power (CPP)	Cmaly@CPP.org
Tom Burke	Cleveland Water	thomas_burke@clevelandwater.com
Bryan Rask	Cleveland Water	Bryan_Rask@clevelandwater.com
Payton Hall	Cleveland Water	Payton_Hall@Clevelandwater.com
Michael Glisic	Cleveland Water	Michael_Glisic@Clevelandwater.com
Barrett Dorsey	Cleveland Water	Barrett_Dorsey@Clevelandwater.com
Romas Pliodzinskas	City of Cleveland Bridges & Docks	RPliodzinskas@city.cleveland.oh.us
Eric Johnston	AT&T Ohio	Eric.Johnston@ATT.com
Gary Saylor	AT&T Ohio	GS8265@ATT.com
Chris Hirzel	CPP Engineering	Chirzel@CPP.org
Michael Ibos	CPP Engineering	Mibos@CPP.org
Doug Lopata	Northeast Ohio Regional Sewer District (NEORSD)	LopataD@neorsd.org
Charles Huse	NEORSD	HuseC@neorsd.org
Rob Storkel	NEORSD	Stoerkelr@neorsd.org

Following is a summary of the information gathered from the utility meeting:

- Cleveland Water stated there are no impacts to their water lines. The water main comes in on Vermont Avenue and goes under the tunnel through an access point from Superior Ave. All Cleveland Water lines run through the waterworks tunnel and underneath the subway tunnel. Two access shafts are present, one each to the north and south of the West Abutment subway tunnel.
- Cleveland Public Power (CPP) identified two "red line" pipe type cables, carrying 69kV and 138kV of electricity, cased within ductile iron and filled with oil at 200 psi to cool the lines. These lines cannot be encapsulated by or be in contact with concrete. There is no access between substations. Access to each line in their entirety is necessary. There are other CPP lines running through the tunnel, but if they are properly sealed, they can be encapsulated. Currently, the access to all splicing chambers for these lines is from the subway tunnel below the bridge

deck and roadway. These chambers would need to be sealed, replaced and reconfigured for access from above. Every splicing chamber would also need a manhole installed above for access from outside. There are a few temporary transformers in the tunnels that either can be moved/removed but should not be buried.

- AT&T owns six clustered fiber-reinforced epoxy-coated flexible lines carrying 12,000 volts. AT&T stated all utility lines can be buried or encapsulated as long as all conduits for holes and joints are sealed to confirm that the casing will not fill in. AT&T would need to replace utility chambers and all manholes with enclosed reinforced concrete manhole chambers.
- City of Cleveland Water Pollution Control owns all manholes in the tunnel and the only utility in the sublevel chambers, a 10-inch pipe running through chamber 6N in Span 1A.
- NEORSD does not have any utilities in the tunnel. However, there are a couple of drainage systems that are a part of the bridge drainage system. These were suggested by NEORSD to remain in operation and fixed to be permanent vertical bypassing structures through the tunnel.

ALTERNATIVES EVALUATION

One of the desired outcomes of this feasibility study was to determine if it was feasible to abandon the subway tunnels and Spans 1A and 1B by filling them and compare the infilling cost to the cost of continued structural maintenance/rehabilitation. The fill would extend under the bridge overhangs adjacent to fill areas and be bulkheaded with MSE wall panels. The infilling would, in essence, bypass the current structural system (deck, piers, etc.) and transfer the dead and live loads to the bottom slab of the tunnel and into the foundation subgrade.

On June 5, 2019, a coordination meeting was held to discuss progress to date and instrumentation data from the slope west slope which indicated that the slope supporting Unit I was moving. Due to the west slope instability, it was mutually decided between ODOT and GF that infilling would add weight to an already unstable slope and therefore infilling would be unacceptable. Through communication with ODOT following the June 5, 2019 meeting, ODOT requested GF to conceptually evaluate the use of a load transfer mechanism (piles, grout inclusions, etc.) to support the infill loads.

In the June 5, 2019 meeting, two potential termini locations were discussed. Location 1 would construct a bulkhead at the east end of Span 1B, also referred to as the west abutment and Location 2 would construct the bulkhead at the west end of Span 1A. See Figure 2 below for these locations. At fill terminus 1 (east end of Span 1B) the approximate dimensions of the bulkhead are 85-feet-wide by 65-feet-tall, including the subway level and the chambers below the subway level. At fill terminus 2 (west end of Span 1A) the approximate dimensions of the bulkhead are 73-feet-wide and 21-feet-tall.

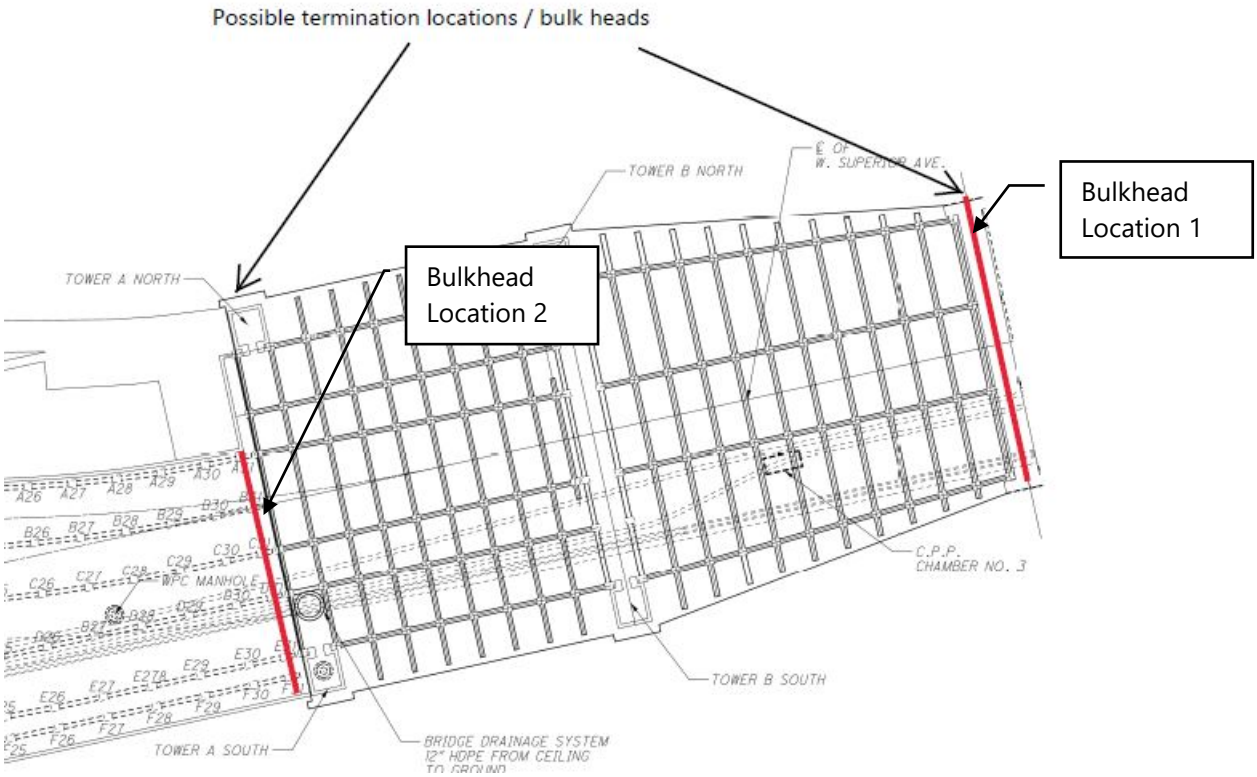


Figure 2: Bulk Head Locations

Since the means and methods of the remediation of the Irish Bend Landslide Stabilization are unknown at this time, the discussion of the load transfer and infilling is very limited and based on the following assumptions:

- Work will be constrained to the immediate area of the bridge;

- The load transfer mechanism will be installed from within the structure with limited overhead space available;
- Assuming the weight of the bridge and traffic on the existing grade will not be changed by the infilling and all infilling load will be transferred to a deep foundation system;
- Access to the bridge will be unchanged by future surrounding development and Irish Bend Stabilization efforts; and
- Global stability evaluation is beyond the scope of this project; however, it should be noted that any deep foundation will likely provide shear resistance to the slope and soil beneath the bridge that could, if fully evaluated, reduce the need to carry 100% of the load of the infill material. This could significantly reduce the number of substructures required to stabilize the load and in turn significantly reduce the cost of underpinning the infilling.

LOAD TRANSFER ALTERNATIVES

GF considered the following load transfer mechanisms:

1. Drilled Shafts or Continuous Flight Augered Piles
2. Driven Piles
3. Grout Inclusions
4. Micropiles

Following is a summary of load transfer mechanisms 1, 2 and 3 and their applicability to this site:

1. **Drilled Shaft or Continuous Flight Augered (CFA) Piles** typically require a large rig since low overhead rigs cannot typically reach the depth required for this project. This would make some locations difficult to access. CFA piles even with enough headroom typically cannot be advanced to such depth. Additionally, drilled shafts can carry very high loads, meaning a smaller number of shafts; however, a much more significant cap to transfer the load to the shafts would be necessary. GF notes that drilled shafts may still be a cost-efficient alternative if they were examined as a landslide stabilization method in addition to a load transfer method. However, this type of in-depth evaluation is beyond the scope of this study.
2. **Driven Piles** require a large rig which could make it difficult to access some locations of the structure. Pile driving requires significant headroom. Driving piles also makes vibrations that could risk the slope stability during construction.

Finally, to fully transfer the load below the slide plane, end bearing piles would be necessary. Driving piles over 150-feet-long would be difficult given the site constraints.

3. **Grout Inclusions** operate through side friction. Given that the slide plane is approximately 70 feet below existing grade it would be impossible not to transfer some of the load above the slide plane. The non-rigid connection between the load and the grout inclusions would limit any benefits the shear strength of the grouted inclusion could make to the stability of the bridge. Grouted inclusions are not installed to the depth required. The rig to install grouted inclusions requires more headroom than is available at this site.
4. **Micropiles** have been successfully installed in similar conditions and geologic settings. Installing the micropiles to a depth of approximately 150 feet is challenging, but achievable.

To consider the costs of installing end bearing micropiles, the following assumptions were made:

- The piles will be installed from the lowest level of the bridge;
- The piles would have a working capacity of 120 tons;
- The piles and load transfer slab have a cost of $10,000 each;
- The shear capacity of the pile is ignored in the slope stabilization;
- The volume of the tunnel and stairwell under the abandoned subway would not have a load transfer mechanism, and
- The number of micropiles required and subsequent spacing is based on the load from the infill material and the area filled (Both are summarized later in this report.).

INFILLING ALTERNATIVES

The original scope proposed the comparison of:

1. Expanded Polystyrene,
2. Low-density Cellular Concrete, and
3. Flowable fill to fill the void area.

Some utilities will likely remain under the bridge. This is especially true for CPP whose lines would be difficult and costly to relocate. To allow the utility companies access to utilities that can remain under the bridge, it is assumed that access points from the road and access tunnels will be constructed where needed. It is also assumed

that the utilities will be moved enough to allow for the forming of tunnels to house the utility lines. However, the volume of the potential utility tunnels is not removed from the volume of fill and the cost of constructing the tunnels is not calculated. This assumption is justified by the observation that the decreased cost of infilling material would likely be offset by the increased cost of forming the tunnels. It is also assumed that access to other utilities could be maintained through access structures along the deck or roadway. The cost of installation of the access portals is insignificant in comparison to the cost of infilling and load transfer piles and, therefore, is not calculated.

Expanded Polystyrene (EPS) is a versatile 'geo-material' generally used to reduce vertical loading of new structures. EPS is manufactured in densities as low as 0.75 to 3.0 pcf. The compressive strength ranges between 5 and 60 psi. While it was originally thought that EPS may have several advantages for this project it is no longer recommended for the following reasons:

- While the light weight could reduce the number of load transfer piles needed, the spacing of the piles would become so wide that load transfer would be difficult and cause the EPS to act more like a beam than a passive fill;
- The cost per cubic yard is 2 to 4 times LDCC and Flowable Fill, respectively; and
- CPP maintains oil cooled lines under the deck, they are likely to remain due to the high cost of relocation and EPS is flammable.

Low-density Cellular Concrete (LDCC) is a flowable fill that has recently been used in a wide variety of project types from mine backfilling to construction of lightweight MSE bridge abutments. LDCC is also locally available, pumpable, and available in a variety of density from mixes that can displace water to mixes that will float. For the purposes of the cost estimate and feasibility study the unit weight is assumed to average 40 pcf. It is likely that actual densities would vary for different locations. For example, the below subway tunnel and stairwells would likely be filled with LDCC with a greater density than water to displace the water in the tunnel, while some fill in the tunnels and Span 1A and 1B could use lighter fill.

Flowable fill is cementitious material that is pumpable and is the least expensive of the fill options examined. It is also the densest, with a density of 140 to 150 pcf. While not

considered in this report, flowable fill can also be mixed on-site. This is the only material under consideration that can be produced on-site.

The summary of the quantities of volume of infilling and number of micropiles is shown in Table 2 below.

Table 2: Summary of Materials

Alternative	Infilling Volume (cy)	Number of Micropile	Average Micropile Spacing C-C in both direction (ft.)
Infilling with Flowable Fill, Bulkhead East of Span 1B	83,682	1407	9
Infilling with Flowable Fill, Bulkhead west of Span 1A	50,099	839	9
Infilling with LDCC, Bulkhead East of Span 1B	83,682	377	17
Infilling with LDCC, Bulkhead west of Span 1A	50,099	225	18

CONSTRUCTABILITY EVALUATION

The constructability evaluation was originally proposed to include an evaluation of the surface drainage, the construction laydown area, the availability of construction materials, and the unintended consequence of the construction. However, with the revised scope, the evaluation has been revised to the following:

Currently several surface drains are conveyed into the open area. The conveyance of this drainage was to be estimated and an outlet solution identified for inclusion into construction feasibility and costs. Given that an in-depth cost estimate is no longer requested, GF did not perform drainage volume estimations. However, Figure 3 demonstrates how surface drainage can be accommodated and conveyed out of the construction area. The drainage layer would consist of porous fill with geotextile at the top. It would include four-inch diameter perforated pipes on 10-foot centers to transfer the drainage water. The layer would be placed on the load transfer slab so that it does not add weight to the bridge. Leaking pipes would be mended so that water would outlet in the drainage layer.

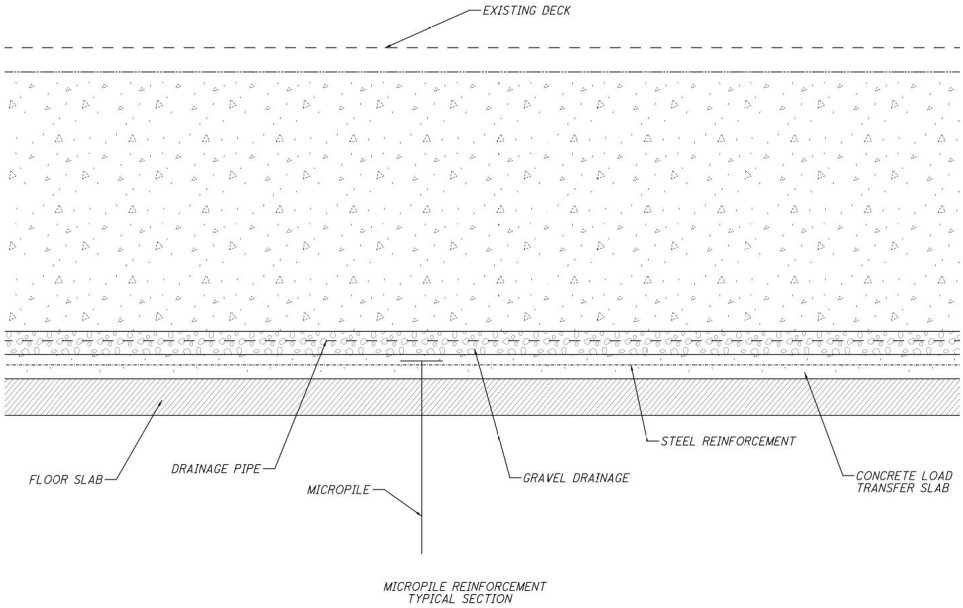


Figure 3: Typical Section of Underpinning

The laydown area will likely be influenced by the structure used to stabilize the Irish Bend slide. Figures 4 and 5 show drone images taken by GF during the site visit of possible laydown areas for pumping stations or micropile material. The areas used for laydown will likely need to be re-evaluated if this project moves forward.

Figure 4: Potential Laydown Area

Availability of infilling construction materials was discussed with Rockside Concrete and Howard Pumping. Based on conversations with both the contractor and supplier, it was determined that by using one local plant, the local supply could deliver approximately 180 cubic yards of LDCC or Flowable Fill to the site an hour. However, it would be advantageous to perform this work at night to avoid traffic delays. A single pump can deliver between 120 and 180 cubic yards an hour, so two pumps were assumed for our cost estimation. In a 10 to 12-hour workday eight hours of pumping is a reasonable assumption this means 1,440 cubic yards could be delivered per day. To allow for curing and form setting it is assumed that the pumping work week will be three days so 4,320 cubic yards could reasonably be installed per week. Given the two possible termination points discussed previously, this would mean 35 to 60 pumping days.

Figure 5: Potential Laydown Area

There are multiple installers of micropiles in the area. Based on our experience and conversations with contractors, GF estimates an installation rate for these long

micropiles to average 5 per day. The pour of the load transfer slab would likely be done in 10 pours, at an approximate rate of one per week. This will not control the micropile installation rate. Given the two different termination points and number of piles required for each alternative, this means there would be 45 to 281 drilling days. The calculations for the number of micropiles for the different alternatives is included in Appendix E.

The primary identified undesirable consequence of infilling is the increased instability of the slope beneath the bridge and possible damage to the bridge itself. If the load from the infilling is transferred to the bedrock, the additional weight will not affect surrounding buildings. The relocation of utilities from under the bridge will create significant resistance from the utility companies, in particular from CPP. This will have to be considered if the project is to move forward, since potential savings to the project may exist from their relocation.

Another consideration that has recently come to our attention that will impact continued maintenance of the tunnel is that future access to the primary entrance may be jeopardized as the Cuyahoga Engineer is selling its property next to the bridge. This may increase the cost or difficulty of maintaining the tunnels.

ENGINEER'S COST & RECOMMENDATION

It should be noted that the costs in this report are based on a conceptual level of detail evaluation and are provided only for a cursory review and for comparative purposes of the alternatives. A global stability analysis will likely find that fewer micropiles are needed due to the shear strength piles add to the moving mass. No contingency was added to any of the costs.

The total opinion of probable cost of the infilling varies depending on A) the termination points of the infilling and B) the fill material used. The cost of providing a drainage layer and pile cap for the micropiles is not included in the cost estimate; however, neither is the total volume of the fill reduction that would result from the inclusion of the pile cap and drainage layer. LDCC is significantly more expensive than flowable fill of $148 vs $83 per cubic yard, respectively. Based on our analysis the weight of the material directly influences the number of micropiles. The number of micropiles is the controlling factor in the cost analysis. Therefore, LDCC with micropiles

was determined to be significantly less expensive than the flowable fill with micropiles. Table 3 compares the alternatives.

No cost was included for creating new access points for utilities where needed. The reason for this exclusion is because it is unknown which utilities would be allowed to stay on ODOT property and which would have to be relocated. It is recognized that effort and cost to install access points from the street level would be minimal when compared to the cost of infilling and load transfer piling. Similarly, the cost for forming tunnels for the utilities would likely be relatively insignificant. MSE walls are envisioned to be placed under the exterior wall overhangs of the filled section of the bridge. An accurate exterior survey would be needed to determine the area of the two alternatives. Since the MSE wall will be backfilled with LDCC or flowable fill this cost is not significant to the volume of infill that it would replace.

The total opinion of probable cost of the patching, stairwell abandonment, and miscellaneous column repairs is currently estimated to be $2.5 million. A lifecycle cost was not completed as part of this task, but it would be prudent to estimate that approximately $2.5 million of repairs would be required approximately every 25 years to maintain the structural condition of the tunnel system going forward. This cost is based upon current and past requirements of structural patching and does not reflect any load rating or structural capacity analysis.

The supporting calculations can be found in Appendix D.

Table 3: Cost Comparison

Alternative	Infilling Cost	Micropile Cost	Repair Cost	Total Cost
Infilling with Flowable Fill, Bulkhead East of Span 1B	$ 6,946,000.00	$ 14,070,000.00	$ 0	$ 21,016,000.00
Infilling with Flowable Fill, Bulkhead west of Span 1A	$ 4,158,000.00	$ 8,390,000.00	$ 0	$ 12,548,000.00
Infilling with LDCC, Bulkhead East of Span 1B	$ 12,385,000.00	$ 3,770,000.00	$ 0	$ 16,155,000.00
Infilling with LDCC, Bulkhead west of Span 1A	$ 7,415,000.00	$ 2,250,000.00	$ 0	$ 9,665,000.00
Periodic Repairs			$ 2,500,000.00	$ 2,500,000.00

Although a final recommendation was not requested, it seems that continued maintenance until it is determined A) if the bridge is to be replaced and B) how the Irish Bend landslide is to be repaired, is the appropriate action.

We appreciate the opportunity of providing our services to you. If you have any questions, please contact me.

Sincerely,

GANNETT FLEMING ENGINEERS AND ARCHITECTS, P.C.

Thomas L. Monaco, P.E.
Project Manager
Geotechnical Group

TLM/tlm
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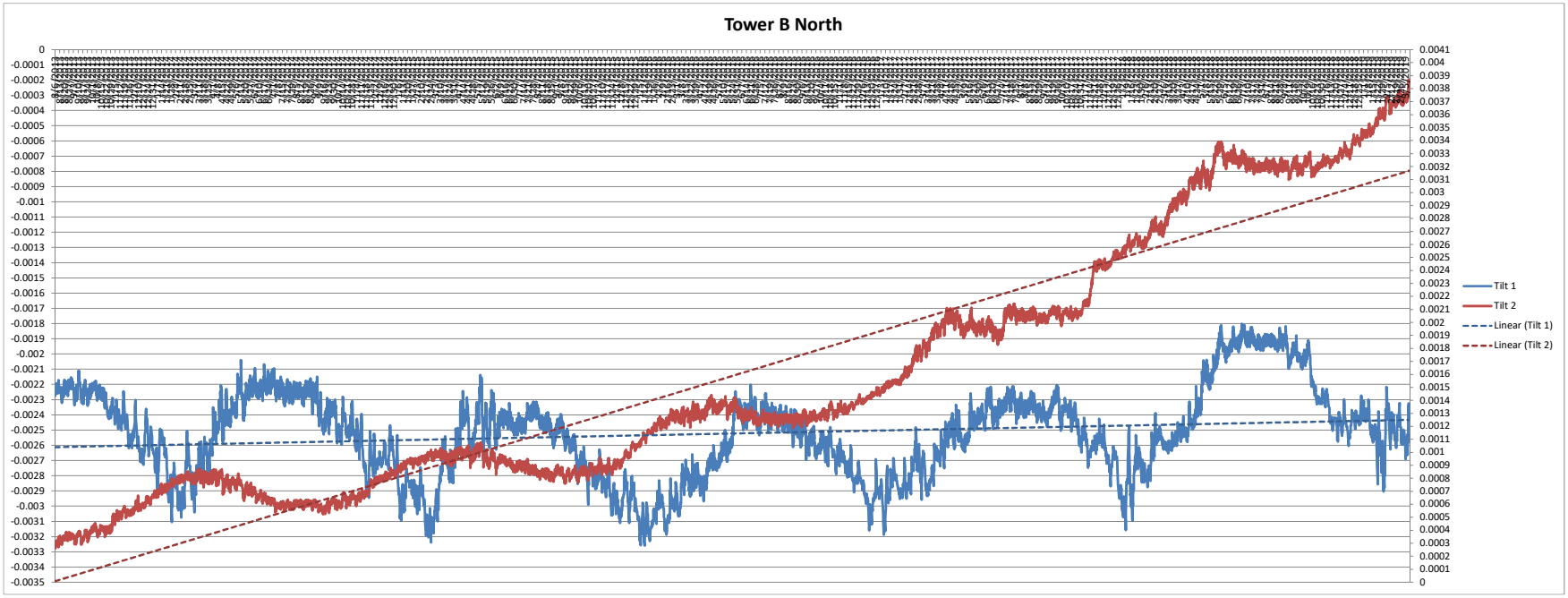
APPENDIX A

TILT METER READINGS, GEOTECHNICAL REPORT AND INCLINOMETER READINGS

APPENDIX A.1

TILT METER READINGS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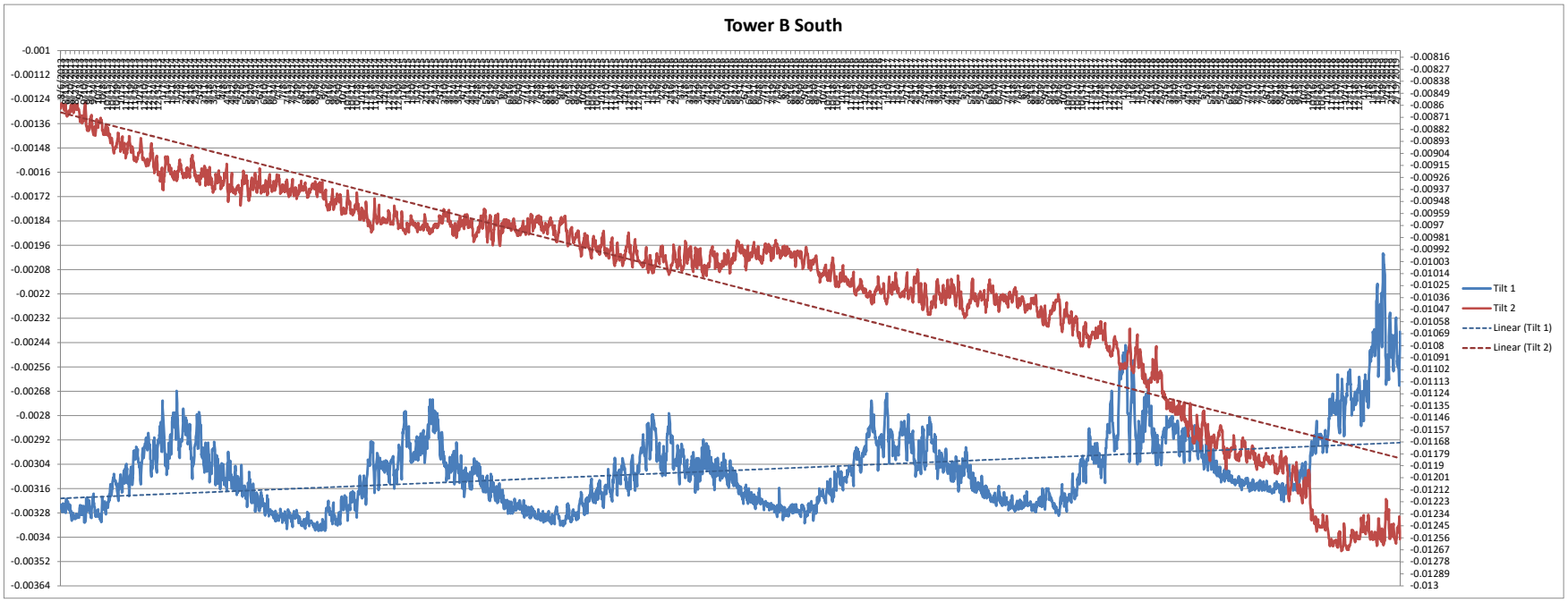
0.0005
0.0004
0.0003
0.0002
0.0001
0
Tilt 1
Tilt 2
Linear (Tilt 1)
Linear (Tilt 2)


Tower B South
-0.001
-0.00112
-0.00124
-0.00136
-0.00148
-0.0016
-0.00172
-0.00184
-0.00196
-0.00208
-0.0022
-0.00232
-0.00244
-0.00256
-0.00268
-0.0028
-0.00292
-0.00304
-0.00316
-0.00328
-0.0034
-0.00352
-0.00364
-0.00816
-0.00827
-0.00838
-0.00849
-0.0086
-0.00871
-0.00882
-0.00893
-0.00904
-0.00915
-0.00926
-0.00937
-0.00948
-0.00959
-0.0097
-0.00981
-0.00992
-0.01003
-0.01014
-0.01025
-0.01036
-0.01047
-0.01058
-0.01069
-0.0108
-0.01091
-0.01102
-0.01113
-0.01124
-0.01135
-0.01146
-0.01157
-0.01168
-0.01179
-0.0119
-0.01201
-0.01212
-0.01223
-0.01234
-0.01245
-0.01256
-0.01267
-0.01278
-0.01289
-0.013
Tilt 1
Tilt 2
Linear (Tilt 1)
Linear (Tilt 2)

APPENDIX A.2

GEOTECHNICAL REPORT

August 30, 2013 (Revised: November 13, 2013)

Mr. Chris Merklin, P.E.
Office of Geotechnical Engineering
Ohio Department of Transportation
1600 West Broad Street
Columbus, Ohio 43223

Re: District 12 GES Pavements and Structure Investigation and
Geotechnical Service Agreement
Inclinometer Casing and Tilt Logger Installation
CUY-6-14.56 (Detroit-Superior Bridge)
PID No.: 77040, Task Order No.: 16921-12-b-6
Cuyahoga County, Ohio
PSI Project No.: 0142-787

Dear Mr. Merklin:

In compliance with your instructions, we have completed Geotechnical Instrumentation, including Inclinometer Casing and Tilt Logger Installation at CUY-6-14.56 (Detroit-Superior Bridge), in the City of Cleveland, Cuyahoga County, Ohio. PSI's services for this project were performed in accordance with PSI Proposal No. 0142-96898 dated May 30, 2013. Authorization to perform this exploration and analysis was in the form of emailed authorization letter to PSI acknowledged by Mr. Chris Merklin of Ohio Department of Transportation on June 7, 2013.

Project information has been provided by Mr. Jason Wise, P.E., Geotechnical Engineer at the Ohio Department of Transportation-District 12. Included, we have received an Instrumentation Location Plan.

Our scope of services includes eight (8) Inclinometer Casings and two (2) Biaxial Tilt Logger installations along CUY-6 (Detroit-Superior Bridge) between W. 25th Street and Riverbed Street, in the City of Cleveland, Cuyahoga County, Ohio. The results of this exploration together with test results are to be found hereunder, three (3) copies of which are being transmitted.

The subsurface conditions at the site were explored with a total of eight (8) test borings to depths of about 138.5 to 198.5 feet below the existing surface grades at the approximate locations shown on the Boring Location Plan presented in the Appendix of this report. The number and location of the test borings were selected by the representatives of Ohio Department of Transportation District 12 and field located by the representatives of PSI prior to the field drilling operations.

Field and laboratory testing was completed in general accordance with the Ohio Department of Transportation Specifications for Subsurface Investigations,

Classification of Soil. Descriptions of the soils encountered in the test borings are provided on the Boring Logs included in the Appendix. Groundwater conditions, standard penetration resistances, and other pertinent information are also included. The remaining soil samples will be retained at our office for 60 days from the date of this report and then discarded.

The following table shows the composition and approximate thicknesses of the existing surface materials encountered at the test boring locations:

Bore #	Topsoil	Asphalt	Gravel
B-001-0-13	--	3 ½”	9”
B-001-1-13	4”	--	--
B-002-0-13	--	3 ½”	9”
B-002-1-13	--	--	--
B-003-0-13	--	3 ½”	9”
B-003-1-13	6”	--	--
B-004-0-13	--	5 ½”	--
B-004-1-13	12”	--	--

The surface of the site and surface materials, at the test boring locations was underlain with miscellaneous fill soils and extended to depths of about 6.5 to 32 feet below the existing grades. The fill soils consisted of gravel and rock fragments (A-1-b, A-2-4), sand (A-3a), sandy silt (A-4a), and, silt and clay (A-6a), with varying degrees of red bricks, foundry sand, concrete, slag, and organics. The fill soils exhibited moisture contents ranging from about 8 to 45 percent. However, the depth and engineering characteristics of the fill materials, such as composition, strength and compressibility, are considered to be variable.

The fill materials at all the test boring locations were underlain by natural soils and extended to depths of about 127 to 187.5 feet below the existing surface grades. The natural soils consisted of gravel and rock fragments (A-1-a and A-1-b), sand (A-3 and A-3a), sandy silt (A-4a), silt (A-4b), silt & clay (A-6a), and clay (A-7-6). The natural soils exhibited a moisture content ranging from about 4 to 35 percent. The natural soils exhibited a very soft to hard consistency for cohesive soil and very loose to dense relative density for granular soils, based on the Standard Penetration tests.

The area’s bottommost formation consists of gray, slightly to moderately weathered, fine grained, slightly to moderately strong, thin to medium bedding, shale rock formation. The rock formation was encountered at all the test boring locations from depths of about 127 to 187.5 feet below the existing grades. The rock information is noted in the following table:

Boring Number	Boring Depths	Ground Elev.	Rock Depths	Rock Elev.	Rock Core	Rock UC test
B-001-0-13	198.5’	658.0’	187.5’	470.5’	10’	--
B-001-1-13	178.2’	635.8’	168.7’	467.1’	9.5’	6,143 PSI @ 170 feet
B-002-0-13	198.8’	657.4’	187.5’	469.9’	10’	--
B-002-1-13	138.5’	595.4’	127.0’	468.4’	10’	2,041 PSI @ 131 feet
B-003-0-13	198.0’	655.0’	188.0’	467.0’	10’	--
B-003-1-13	158.5’	599.7’	147.0’	452.7’	10’	3,212 PSI @ 156 feet
B-004-0-13	173.6’	605.0’	162.0’	443.0’	10’	1,614 PSI @ 173 feet
B-004-1-13	169.2’	606.0’	159.0’	447.0’	10’	1,786 PSI @ 167 feet

The subsurface description is of a generalized nature provided to highlight the major strata encountered. The boring logs included in the Appendix should be reviewed for specific information at the individual boring locations. The stratifications shown on the boring logs represent the conditions only at the actual test positions. Variations may occur and should be expected between the boring locations. The stratifications represent the approximate boundary between the subsurface materials, and the transition may be gradual or not clearly defined.

PSI has completed the installation of eight (8) Inclinometers and two (2) Biaxial Tilt Loggers. The test locations were selected and staked in the field by the representatives of ODOT District-12 prior to the field drilling operations. The completion of the instrument installation area is described below:

Inclinometer					
Boring Number	**Boring Depths**	**Total Casing Installed Depths**	**Type of Cover**	**Casing Above Ground**	**Remark**
B-001-0-13	198.5’	197.5	Flush	-0.5’	--
B-001-1-13	178.2’	180.0	Stick Up	2.5’	--
B-002-0-13	198.8’	184.0	Flush	-0.5’	--
B-002-1-13	138.5’	136.0	Stick Up	2.5’	--
B-003-0-13	198.0’	198.0	Flush	-0.5’	--
B-003-1-13	158.5’	165.5	Stick Up	2.5’	--
B-004-0-13	173.6’	163.0	Flush	-0.5’	--
B-004-1-13	169.2’	175.5	Stick Up	1.5’	--
Biaxial Tilt loggers					
Tower B North					--
Tower B South					--

As always, should you have any questions regarding this transmittal, please do not hesitate to contact the undersigned at 216-447-1335.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Surya Thapa, P.E.
Department Manager

A. Veeramani, P.E.
District Manager

APPENDIX:

Boring Location Plan
Boring Logs
Rock Core Photo Logs
GPS Coordinates and Elevation of Casings
General Notes


B-004-0-13
B-004-1-13
Tower B North
B-003-0-13
B-002-0-13
B-003-1-13
B-001-0-13
Tower B South
I-001-0-12
I-002-0-12
B-001-1-13
B-002-1-13

PROJECT: CUY-6-14.56	DRILLING FIRM / OPERATOR: PSI / T. SUCHAN	DRILL RIG: CME 55 ATV	STATION / OFFSET:	EXPLORATION ID B-001-0-13	
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: DETROIT-SUPERIOR BRIDGE		
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 7/10/13	ELEVATION: 658.0 (MSL) EOB: 198.5 ft.	PAGE 1 OF 4	
START: 8/5/13 END: 8/5/13	SAMPLING METHOD: SPT / NQ	ENERGY RATIO (%): 81.4	COORD: 666028.444 N, 2185925.904 E		

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
3 1/2" ASPHALT 9" SAND AND GRAVEL LOOSE, BLACK, **GRAVEL AND STONE FRAGMENTS WITH SAND**, FOUNDRY SAND WITH SLAG AND CONCRETE, TRACE TO LITTLE SILT/CLAY, MOIST (FILL)	658.0 657.0	2.5	1 2 2	5	39	SS-1	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		5.0																
		7.5	2 3 2	7	39	SS-2	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
		10.0																
	644.5	12.5																
STIFF, GRAY, **SILT**, TRACE CLAY, TRACE GRAVEL, SOME SAND, MOIST		15.0	4 6 8	19	100	SS-3	-	0	0	34	63	3	NP	NP	NP	17	A-4b (6)	
	639.4	17.5																
LOOSE TO MEDIUM DENSE, BROWN, **FINE SAND**, TRACE TO LITTLE SILT/CLAY, TRACE GRAVEL, WET		20.0	3 4 4	11	100	SS-4	-	0	0	90	- 10 -		NP	NP	NP	28	A-3 (0)	
	634.5	22.5																
MEDIUM STIFF TO VERY STIFF, GRAY, **SILT**, TRACE TO LITTLE CLAY, TRACE SAND AND GRAVEL, MOIST		25.0	4 3 3	8	94	SS-5	-	0	0	0	83	17	26	22	4	22	A-4b (8)	
		27.5																
		30.0	3 5 8	18	89	SS-6	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		32.5																
		35.0	4 5 7	16	100	SS-7	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		37.5																
		40.0	4 6 7	18	100	SS-8	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		42.5																
		45.0	5 7 10	23	100	SS-9	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		47.5																
			12	46	100	SS-10	-	-	-	-	-	-	-	-	-	19	A-4b (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 8/5/13	END: 8/5/13	PG 2 OF 4	B-001-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
	608.0		15 19															
	606.0	52.5																
STIFF, GRAY, **SILT AND CLAY**, LITTLE TO SOME SILT, TRACE SAND AND GRAVEL, MOIST		55.0	5 6 6	16	100	SS-11	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		57.5																
	598.0	60.0	4 5 6	15	100	SS-12	-	0	0	0	71	29	34	23	11	23	A-6a (8)	
STIFF TO VERY STIFF, GRAY, **SILT**, LITTLE CLAY, TRACE SAND AND GRAVEL, MOIST		62.5																
		65.0	4 6 7	18	100	SS-13	-	0	0	0	79	21	30	23	7	22	A-4b (8)	
		67.5																
		70.0	6 8 11	26	94	SS-14	-	-	-	-	-	-	-	-	-	20	A-4b (V)	
		72.5																
	583.0	75.0	3 4 6	14	100	SS-15	-	-	-	-	-	-	-	-	-	28	A-4b (V)	
VERY SOFT TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND AND GRAVEL, MOIST		77.5																
** UNCONFINED COMPRESSION = 3,418 @ 78.5' - 80.5'		80.0			100	ST-16	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		82.5																
		85.0	3 4 5	12	89	SS-17	-	0	0	1	39	60	38	23	15	28	A-6a (10)	
		87.5																
		90.0	3 4 3	9	89	SS-18	-	-	-	-	-	-	-	-	-	28	A-6a (V)	
		92.5																
** VERY SOFT SOIL @ 93.5' - 105.0'		95.0	0 0 0	0	44	SS-19	-	0	1	4	46	49	33	21	12	27	A-6a (9)	
		97.5																
		100.0	0 0 0	0	33	SS-20	-	-	-	-	-	-	-	-	-	34	A-6a (V)	
		102.5																

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 8/5/13	END: 8/5/13	PG 3 OF 4	B-001-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
VERY SOFT TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE SAND AND GRAVEL, MOIST *(continued)*	554.5	105.0	0 0 0	0	50	SS-21	-	-	-	-	-	-	-	-	-	28	A-6a (V)	
		107.5																
		110.0	4 5 7	16	78	SS-22	-	0	0	0	66	34	32	21	11	23	A-6a (8)	
		112.5																
		115.0	4 6 8	19	100	SS-23	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		117.5																
	538.0	120.0	7 10 13	31	89	SS-24	-	-	-	-	-	-	-	-	-	21	A-6a (V)	
VERY STIFF, GRAY, **SILT**, WITH CLAY, TRACE SAND AND GRAVEL, MOIST		122.5																
		125.0	6 10 14	33	78	SS-25	-	0	0	0	57	43	30	21	9	22	A-4b (8)	
		127.5																
	528.0	130.0	7 11 15	35	83	SS-26	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE SAND AND GRAVEL, MOIST		132.5																
		135.0	6 9 12	28	72	SS-27	-	0	0	0	11	89	37	22	15	26	A-6a (10)	
		137.5																
		140.0	7 10 15	34	67	SS-28	-	-	-	-	-	-	-	-	-	18	A-6a (V)	
		142.5																
** GRAVEL INCREASES @ 144.5' TO 147.0'		145.0	0 12 7	26	89	SS-29	-	-	-	-	-	-	-	-	-	18	A-6a (V)	
		147.5																
		150.0	5 9 14	31	100	SS-30	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
** COBBLES @ 152.5'		152.5																
		155.0	12 20 27	64	89	SS-31	-	-	-	-	-	-	-	-	-	18	A-6a (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 8/5/13	END: 8/5/13	PG 4 OF 4	B-001-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE SAND AND GRAVEL, MOIST *(continued)*	500.9	157.5																
		160.0	9 11 15	35	89	SS-32	-	-	-	-	-	-	-	-	-	25	A-6a (V)	
		162.5																
		165.0	14 16 24	54	0	SS-33	-	-	-	-	-	-	-	-	-	-	A-6a (V)	
		167.5																
		170.0	11 18 23	56	67	SS-34	-	-	-	-	-	-	-	-	-	12	A-6a (V)	
		172.5																
		175.0	12 19 27	62	78	SS-35	-	-	-	-	-	-	-	-	-	11	A-6a (V)	
		177.5																
		180.0	15 22 33	75	78	SS-36	-	-	-	-	-	-	-	-	-	13	A-6a (V)	
		182.5																
		185.0	14 26 41	91	44	SS-37	-	5	7	7	37	44	32	20	12	14	A-6a (9)	
	470.5	187.5																
SHALE, GRAY, HIGHLY WEATHERED, VERY WEAK.		190.0																
		192.5	42		100	NQ-38											CORE	
		195.0																
	459.5	197.5																
		EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: CUY-6-14.56	DRILLING FIRM / OPERATOR: PSI / T. SUCHAN	DRILL RIG: CME 55 ATV	STATION / OFFSET:	EXPLORATION ID B-001-1-13
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: DETROIT-SUPERIOR BRIDGE	
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 7/10/13	ELEVATION: 635.8 (MSL) EOB: 178.2 ft.	PAGE 1 OF 4
START: 8/12/13 END: 8/12/13	SAMPLING METHOD: SPT / NQ	ENERGY RATIO (%): 81.4	COORD: 665949.799 N, 2186031.495 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 635.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
4" TOPSOIL	635.5																	
LOOSE TO MEDIUM DENSE, BROWN AND GRAY, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT AND CLAY, TRACE GRAVEL, SOME RED BRICK, SOME BROKEN CONCRETE, MOIST (FILL)		2.5	5 12 11	31	100	SS-1	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
	626.8	5.0																
LOOSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS**, SOME SAND, TRACE SILT AND CLAY, MOIST TO WET		7.5	8 4 3	9	78	SS-2	-	-	-	-	-	-	-	-	-	11	A-3a (V)	
		10.0					-	-	-	-	-	-	-	-	-	5	A-1-a (V)	
		12.5	1 2 1	4	67	SS-3	-	73	18	6	-	3 -	NP	NP	NP	4	A-1-a (0)	
		15.0																
		17.5	1 2 2	5	56	SS-4	-	-	-	-	-	-	-	-	-	35	A-1-a (V)	
		20.0																
	611.8	22.5 W																
MEDIUM STIFF TO STIFF, GRAY, **SILT**, LITTLE TO SOME CLAY, TRACE SAND AND GRAVEL, WET		25.0	1 3 6	12	100	SS-5	-	-	-	-	-	-	-	-	-	17	A-1-a (V)	
		27.5					-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		30.0	3 5 6	15	100	SS-6	-	0	1	1	78	20	29	23	6	20	A-4b (8)	
		32.5																
		35.0	3 4 5	12	100	SS-7	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		37.5																
		40.0	2 3 5	11	100	SS-8	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		42.5																
		45.0	3 4 5	12	100	SS-9	-	0	0	0	69	31	32	24	8	24	A-4b (8)	
		47.5																
			2	14	100	SS-10	-	-	-	-	-	-	-	-	-	24	A-4b (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 8/12/13	END: 8/12/13	PG 2 OF 4	B-001-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
MEDIUM STIFF TO STIFF, GRAY, **SILT**, LITTLE TO SOME CLAY, TRACE SAND AND GRAVEL, WET *(continued)*	585.8	52.5	5 5															
		55.0	3 4 6	14	100	SS-11	-	-	-	-	-	-	-	-	-	24	A-4b (V)	
		57.5																
		60.0	3 3 3	8	100	SS-12	-	-	-	-	-	-	-	-	-	29	A-4b (V)	
		62.5																
		65.0	4 6 8	19	100	SS-13	-	-	-	-	-	-	-	-	-	25	A-4b (V)	
		67.5																
	565.8	70.0	4 6 7	18	100	SS-14	-	0	0	0	62	38	30	22	8	24	A-4b (8)	
SOFT TO VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE TO SOME SILT, TRACE SAND AND GRAVEL, MOIST		72.5																
		75.0	2 4 4	11	100	SS-15	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		77.5																
		80.0	0 0 2	3	100	SS-16	-	6	2	5	37	50	35	22	13	25	A-6a (9)	
		82.5																
		85.0	0 4 6	14	100	SS-17	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		87.5																
		90.0	3 5 6	15	67	SS-18	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
		92.5																
		95.0	4 6 8	19	83	SS-19	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
		97.5																
		100.0			0	ST-20	-	-	-	-	-	-	-	-	-	-	A-6a (V)	
		102.5																

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
SOFT TO VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE TO SOME SILT, TRACE SAND AND GRAVEL, MOIST *(continued)*	532.3	105.0	7 9 12	28	56	SS-21	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		107.5																
		110.0	6 9 12	28	100	SS-22	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		112.5																
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE GRAVEL, MOIST	522.3	115.0	5 8 13	28	100	SS-23	-	7	6	9	39	39	27	19	8	17	A-4a (8)	
		117.5																
		120.0	6 10 15	34	67	SS-24	-	-	-	-	-	-	-	-	-	16	A-4a (V)	
		122.5																
		125.0	7 12 17	39	67	SS-25	-	-	-	-	-	-	-	-	-	16	A-4a (V)	
		127.5																
		130.0	4 10 16	35	100	SS-26	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
		132.5																
		135.0	12 22 23	61	100	SS-27	-	1	10	3	38	48	30	20	10	20	A-4a (8)	
		137.5																
		140.0	5 11 11	30	100	SS-28	-	-	-	-	-	-	-	-	-	23	A-4a (V)	
		142.5																
		145.0	16 23 31	73	100	SS-29	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
		147.5																
		150.0			-	SS-30	-	9	12	15	40	24	23	16	7	12	A-4a (6)	
		152.5																
		155.0	8 15 22	50	100	SS-31	-	-	-	-	-	-	-	-	-	15	A-4a (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 8/12/13	END: 8/12/13	PG 4 OF 4	B-001-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
VERY STIFF TO HARD, GRAY, **SANDY SILT**, LITTLE TO SOME CLAY, TRACE GRAVEL, MOIST *(continued)*	478.7	157.5																
	475.8	160.0	16 23 29	71	78	SS-32	-	-	-	-	-	-	-	-	-	15	A-4a (V)	
HARD, GRAY, **SANDY SILT**, LITTLE CLAY, TRACE GRAVEL, MOIST (TILL)		162.5																
		165.0	16 25 35	81	100	SS-33	-	-	-	-	-	-	-	-	-	15	A-4a (V)	
	467.1	167.5																
SHALE, GRAY, VERY WEAK, MOIST.			50/2"	-	100	SS-34	-	-	-	-	-	-	-	-	-	-	Rock (V)	
** UNCONFINED COMPRESSION = 6,143 @ 170.0'		170.0																
		172.5	86		100	NQ-35											CORE	
	457.6	175.0																
		177.5 EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: CUY-6-14.56	DRILLING FIRM / OPERATOR: PSI / T. SUCHAN	DRILL RIG: CME 55 ATV	STATION / OFFSET:	EXPLORATION ID B-002-0-13	
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: DETROIT-SUPERIOR BRIDGE		
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 7/10/13	ELEVATION: 657.4 (MSL) EOB: 198.8 ft.	PAGE 1 OF 4	
START: 7/23/13 END: 7/23/13	SAMPLING METHOD: SPT / NQ	ENERGY RATIO (%): 81.4	COORD: 666086.277 N, 2185989.688 E		

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
3 1/2" ASPHALT	657.1																	
9" SAND AND GRAVEL BASE	656.4																	
VERY LOOSE TO LOOSE, BLACK, **COARSE AND FINE SAND**, TRACE TO LITTLE SILT/CLAY, BRICK, FILL MATERIAL, TRACE GRAVEL, MOIST (FILL) (FOUNDRY SAND)		2.5																
		5.0	1 1 1	3	67	SS-1	-	-	-	-	-	-	-	-	-	13	A-3a (V)	
		7.5																
		10.0	4 3 3	8	61	SS-2	-	-	-	-	-	-	-	-	-	14	A-3a (V)	
	646.4																	
LOOSE, BROWN, **SANDY SILT**, TRACE TO LITTLE CLAY, TRACE GRAVEL, ROOTING, WOOD FRAGMENTS, ORGANICS, MOIST (FILL)		12.5																
	642.4	15.0	4 4 5	12	39	SS-3	-	0	5	46	49	-	NP	NP	NP	15	A-4a (3)	
VERY LOOSE TO LOOSE, BROWN, **GRAVEL AND STONE FRAGMENTS WITH SAND**, TRACE SILT/CLAY, MOIST TO WET		17.5																
		20.0	1 1 1	3	83	SS-4	-	2	48	44	6	-	NP	NP	NP	5	A-1-b (0)	
		22.5																
		25.0	5 5 5	14	72	SS-5	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
		27.5																
** WET BELOW 28.5'		30.0	3 5 6	15	67	SS-6	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		32.5																
	623.4	35.0	4 5 5	14	100	SS-7	-	0	0	9	71	20	24	23	1	18	A-4b (8)	
STIFF TO HARD, GRAY, **SILT**, TRACE CLAY, TRACE SAND AND GRAVEL, MOIST		37.5																
		40.0	4 6 8	19	94	SS-8	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		42.5																
		45.0	8 16 15	42	100	SS-9	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		47.5																
			6	18	100	SS-10	-	-	-	-	-	-	-	-	-	21	A-4b (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/23/13	END: 7/23/13	PG 2 OF 4	B-002-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
STIFF TO HARD, GRAY, **SILT**, TRACE CLAY, TRACE SAND AND GRAVEL, MOIST *(continued)*	607.4	52.5	6 7															
		55.0	5 7 6	18	94	SS-11	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		57.5																
** UNCONFINED COMPRESSION = 4,343 PSI @ 58.5' - 60.5'		60.0			100	ST-12	-	-	-	-	-	-	-	-	-	28	A-4b (V)	
		62.5																
		65.0	4 6 8	19	94	SS-13	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
	588.4	67.5																
STIFF TO VERY STIFF, GRAY, **SANDY SILT**, TRACE GRAVEL, WITH CLAY, MOIST		70.0	9 11 12	31	94	SS-14	-	-	-	-	-	-	-	-	-	19	A-4a (V)	
		72.5																
		75.0	4 4 6	14	94	SS-15	-	-	-	-	-	-	-	-	-	25	A-4a (V)	
	577.4	77.5																
STIFF, GRAY, **SILT AND CLAY**, MOIST		80.0	4 6 9	20	100	SS-16	-	0	1	1	49	49	32	22	10	23	A-4a (8)	
	572.4	82.5																
STIFF TO VERY STIFF, GRAY, **SILT**, WITH CLAY, TRACE SAND AND GRAVEL, MOIST		85.0	3 5 6	15	100	SS-17	-	0	0	0	50	50	37	23	14	27	A-6a (10)	
		87.5																
		90.0	4 4 5	12	100	SS-18	-	0	1	0	54	45	29	22	7	27	A-4b (8)	
		92.5																
		95.0	3 5 6	15	100	SS-19	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		97.5																
		100.0	0 1 5	8	100	SS-20	-	-	-	-	-	-	-	-	-	29	A-4b (V)	
		102.5																

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/23/13	END: 7/23/13	PG 3 OF 4	B-002-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
STIFF TO VERY STIFF, GRAY, **SILT**, WITH CLAY, TRACE SAND AND GRAVEL, MOIST *(continued)*	553.9	105.0	0 4 6	14	100	SS-21	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		107.5																
		110.0	0 5 6	15	100	SS-22	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		112.5																
		115.0	2 7 9	22	100	SS-23	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		117.5																
		120.0	6 10 12	30	100	SS-24	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
		122.5																
		125.0	7 10 12	30	100	SS-25	-	0	0	1	61	38	30	22	8	22	A-4b (8)	
		127.5																
		130.0	6 9 11	27	89	SS-26	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		132.5																
		135.0	7 11 14	34	100	SS-27	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		137.5																
VERY STIFF, GRAY, **SANDY SILT**, WITH CLAY, TRACE GRAVEL, MOIST	518.9	140.0	6 10 14	33	78	SS-28	-	7	9	11	41	32	26	19	7	15	A-4a (8)	
		142.5																
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE GRAVEL, LITTLE SAND, MOIST	513.9	145.0	6 10 16	35	100	SS-29	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
		147.5																
		150.0	7 12 17	39	100	SS-30	-	2	6	9	41	42	30	19	11	17	A-6a (V)	
		152.5																
		155.0	10 18 24	57	100	SS-31	-	-	-	-	-	-	-	-	-	17	A-6a (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/23/13	END: 7/23/13	PG 4 OF 4	B-002-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
VERY STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE GRAVEL, LITTLE SAND, MOIST *(continued)*	500.3	157.5																
		160.0	7 11 14	34	100	SS-32	-	-	-	-	-	-	34	22	12	22	A-6a (V)	
** SILT @ 163.5' - 165.0'		162.5																
		165.0	6 6 9	20	100	SS-33	-	-	-	-	-	-	-	-	-	27	A-4b (V)	
		167.5																
		170.0	14 19 27	62	100	SS-34	-	-	-	-	-	-	-	-	-	11	A-6a (V)	
		172.5																
		175.0	16 32 49	110	28	SS-35	-	-	-	-	-	-	-	-	-	10	A-6a (V)	
		177.5																
		180.0	13 21 30	69	100	SS-36	-	-	-	-	-	-	-	-	-	14	A-6a (V)	
		182.5																
HARD, OLIVE, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, MOIST (TILL)	473.9	185.0	19 35 37	98	67	SS-37	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
	469.9	187.5																
SHALE, GRAY, VERY WEAK, FINE GRAINED, THIN BEDDED.		190.0	100/4"	-	100	SS-38	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		192.5																
		195.0	0		100	NQ-39											CORE	
	458.6	197.5																
		EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: CUY-6-14.56	DRILLING FIRM / OPERATOR: PSI / T. SUCHAN	DRILL RIG: CME 55 ATV	STATION / OFFSET:
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: DETROIT-SUPERIOR BRIDGE
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 7/10/13	ELEVATION: 594.4 (MSL) EOB: 138.5 ft.
START: 7/13/13 END: 7/13/13	SAMPLING METHOD: SPT / NQ	ENERGY RATIO (%): 81.4	COORD: 665886.392 N, 2186246.280 E

EXPLORATION ID: B-002-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
VERY LOOSE, BROWN/BLACK, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT**, WITH CINDERS, ORGANICS, LITTLE CLAY, MOIST (FILL)	594.4	2.5	1 1 2	4	100	SS-1	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	
		5.0	4 2 1	4	100	SS-2	-	-	-	-	-	-	-	-	-	8	A-2-4 (V)	
		7.5	1 1 1	3	100	SS-3	-	-	-	-	-	-	-	-	-	16	A-2-4 (V)	
	583.9	10.0	2 1 2	4	100	SS-4	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	
VERY LOOSE, BROWN, **FINE SAND**, LITTLE SILT, TRACE CLAY, LITTLE GRAVEL, MOIST	581.4	12.5	2 1 2	4	100	SS-5	-	10	26	62	-	2 -	NP	NP	NP	12	A-3 (0)	
LOOSE TO MEDIUM DENSE, BROWN TO GRAY, **SILT**, WITH CLAY, TRACE SAND, TRACE GRAVEL, WET	W	15.0	1 2 2	5	100	SS-6	-	-	-	-	-	-	-	-	-	24	A-4b (V)	
** GRAY @ 16.5'		17.5	2 4 6	14	100	SS-7	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		20.0	6 9 9	24	100	SS-8	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		22.5																
		25.0	3 4 5	12	100	SS-9	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
		27.5																
		30.0	2 3 3	8	100	SS-10	-	0	0	2	57	41	28	18	10	22	A-4b (8)	
		32.5																
		35.0	3 3 5	11	100	SS-11	-	-	-	-	-	-	-	-	-	27	A-4b (V)	
	557.4	37.5																
STIFF, GRAY, **CLAY**, WITH SILT, TRACE SAND, TRACE GRAVEL, WET		40.0	1 2 4	8	100	SS-12	-	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
		42.5																
		45.0	0 4 4	11	100	SS-13	-	0	1	2	49	48	46	23	23	24	A-7-6 (14)	
		47.5																
** UNCONFINED COMPRESSION = 3,260 PSF @ 48.0' - 50.0'					-	ST-14	-	-	-	-	-	-	-	-	-	22	A-7-6 (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/13/13	END: 7/13/13	PG 2 OF 3	B-002-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
STIFF, GRAY, **CLAY**, WITH SILT, TRACE SAND, TRACE GRAVEL, WET *(continued)*	544.4	52.5																
	539.4	55.0	3 4 6	14	100	SS-15	-	-	-	-	-	-	-	-	-	9	A-7-6 (V)	
STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, WET		57.5																
		60.0	2 4 6	14	100	SS-16	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		62.5																
		65.0	4 7 10	23	100	SS-17	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		67.5																
		70.0	4 6 8	19	100	SS-18	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
		72.5																
		75.0	4 6 8	19	100	SS-19	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
		77.5																
		80.0	4 7 10	23	100	SS-20	-	0	12	9	40	39	35	21	14	16	A-6a (10)	
		82.5																
		85.0	5 9 12	28	100	SS-21	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
		87.5																
		90.0	6 9 14	31	100	SS-22	-	-	-	-	-	-	-	-	-	17	A-6a (V)	
		92.5																
	497.4	95.0	7 11 16	37	100	SS-23	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
DENSE, GRAY, **SANDY SILT**, LITTLE SILT, TRACE CLAY, WET		97.5																
	493.4	100.0	14 14 20	46	100	SS-24	-	0	0	58	36	6	NP	NP	NP	16	A-4a (1)	
DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS**, TRACE GRAVEL, TRACE CLAY, MOIST		102.5																

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/13/13	END: 7/13/13	PG 3 OF 3	B-002-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
DENSE, GRAY, **GRAVEL AND/OR STONE FRAGMENTS**, TRACE GRAVEL, TRACE CLAY, MOIST *(continued)*	490.9	105.0	18 38 34	98	100	SS-25	-	73	16	7	- 4	-	NP	NP	NP	7	A-1-a (0)	
	486.4	107.5																
VERY HARD, GRAY, **SANDY SILT**, LITTLE TO SOME ROCK FRAGMENTS, LITTLE CLAY, WET		110.0	16 25 34	80	100	SS-26	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
		112.5																
		115.0	14 19 30	66	100	SS-27	-	7	13	15	34	31	24	17	7	12	A-4a (6)	
		117.5																
		120.0	10 17 23	54	100	SS-28	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
		122.5																
		125.0	8 16 19	47	100	SS-29	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
	467.4	127.5																
SHALE, GRAY, STRONG, FINE GRAINED, THIN TO THICK BEDDED.		130.0																
** UNCONFINED COMPRESSION = 2,041 PSI @ 131.0'		132.5	83		100	NQ-30											CORE	
		135.0																
	455.9	137.5																
		EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/13/13 09:04 - C:\DOCUMENTS AND SETTINGS\ALL USERS\DOCUMENTS\PSI GINT\ODOT LOGS\FROM JANET 102413\0142-7E

PROJECT: CUY-6-14.56	DRILLING FIRM / OPERATOR: PSI / T. SUCHAN	DRILL RIG: CME 55 ATV	STATION / OFFSET:	EXPLORATION ID B-003-0-13
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: DETROIT-SUPERIOR BRIDGE	
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 7/10/13	ELEVATION: 655.0 (MSL) EOB: 198.0 ft.	PAGE 1 OF 4
START: 8/12/13 END: 8/12/13	SAMPLING METHOD: SPT / NQ	ENERGY RATIO (%): 81.4	COORD: 666142.484 N, 2186047.131 E	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
3" ASPHALT 9" SAND AND GRAVEL SOFT, BROWN AND BLACK, **SANDY SILT**, TRACE TO LITTLE CLAY, TRACE GRAVEL, ORGANICS, MOIST (FILL)	655.0 654.0	2.5	1 2 2	5	67	SS-1	-	-	-	-	-	-	-	-	-	21	A-4a (V)	
		5.0																
		7.5	2 2 2	5	44	SS-2	-	-	-	-	-	-	-	-	-	14	A-4a (V)	
LOOSE, BLACK, **COARSE AND FINE SAND**, TRACE SILT AND CLAY, TRACE GRAVEL, ORGANICS, MOIST (FILL)	645.0	10.0																
		12.5	2 3 7	14	100	SS-3	-	-	-	-	-	-	-	-	-	14	A-3a (V)	
VERY LOOSE TO LOOSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, LITTLE SILT AND CLAY, MOIST	636.5	15.0																
		17.5	2 2 3	7	78	SS-4	-	3	47	29	-	21 -	NP	NP	NP	10	A-1-b (0)	
SOFT TO VERY STIFF, BROWN, **SILT**, TRACE TO LITTLE CLAY, TRACE TO LITTLE SAND AND GRAVEL, MOIST TO WET ** GRAVEL LAYER @ 28.5' - 29.0'	631.0 W	20.0																
		22.5	1 1 1	3	100	SS-5	-	-	-	-	-	-	-	-	-	27	A-1-b (V)	
		25.0					-	0	0	27	54	19	24	21	3	30	A-4b (8)	
		27.5	2 1 2	4	72	SS-6	-	-	-	-	-	-	-	-	-	27	A-4b (V)	
		30.0																
		32.5	8 10 12	30	100	SS-7	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		35.0																
		37.5	3 5 7	16	100	SS-8	-	-	-	-	-	-	-	-	-	17	A-4b (V)	
		40.0																
		42.5	6 5 5	14	83	SS-9	-	-	-	-	-	-	-	-	-	25	A-4b (V)	
		45.0																
		47.5	2	14	100	SS-10	-	0	0	1	88	11	24	24	NP	21	A-4b (8)	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
SOFT TO VERY STIFF, BROWN, **SILT**, TRACE TO LITTLE CLAY, TRACE TO LITTLE SAND AND GRAVEL, MOIST TO WET *(continued)*	605.0	52.5	4 6															
	600.0	55.0	3 4 5	12	100	SS-11	-	0	1	0	72	27	31	24	7	23	A-4b (8)	
MEDIUM STIFF TO STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST		57.5																
		60.0	2 4 6	14	100	SS-12	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		62.5																
		65.0	3 5 7	16	100	SS-13	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
		67.5																
		70.0	4 6 7	18	83	SS-14	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		72.5																
		75.0	2 3 5	11	100	SS-15	-	-	-	-	-	-	-	-	-	26	A-6a (V)	
		77.5																
		80.0	3 4 8	16	100	SS-16	-	-	-	-	-	-	-	-	-	26	A-6a (V)	
		82.5																
		85.0	3 4 6	14	100	SS-17	-	0	0	1	40	59	34	21	13	26	A-6a (9)	
		87.5																
		90.0	3 4 6	14	100	SS-18	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		92.5																
		95.0	3 4 5	12	100	SS-19	-	-	-	-	-	-	-	-	-	29	A-6a (V)	
		97.5																
		100.0	0 1 5	8	100	SS-20	-	-	-	-	-	-	-	-	-	28	A-6a (V)	
		102.5																

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
MEDIUM STIFF TO STIFF, GRAY, **SILT AND CLAY**, TRACE SAND, TRACE GRAVEL, MOIST *(continued)*	551.4	105.0	0 6 6	16	100	SS-21	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		107.5																
** UNCONFINED COMPRESSION = 2,951 @ 108.0' - 110.0'	545.0	110.0			92	ST-22	-	-	-	-	-	-	-	-	-	21	A-6a (V)	
VERY STIFF, GRAY, **SILT**, TRACE SAND, TRACE GRAVEL, WITH CLAY, MOIST		112.5																
		115.0	5 8 11	26	78	SS-23	-	0	0	1	66	33	31	21	10	22	A-4b (8)	
	537.0	117.5																
VERY STIFF TO HARD, GRAY, **CLAY**, LITTLE TO SOME SILT, TRACE SAND, TRACE GRAVEL, MOIST		120.0	4 6 9	20	83	SS-24	-	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
		122.5																
		125.0	5 8 11	26	83	SS-25	-	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
		127.5																
		130.0	5 8 12	27	83	SS-26	-	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
		132.5																
		135.0	4 7 10	23	100	SS-27	-	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
		137.5																
		140.0	6 10 13	31	89	SS-28	-	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
		142.5																
		145.0	7 11 13	33	0	SS-29	-	-	-	-	-	-	-	-	-	-	A-7-6 (V)	
		147.5																
		150.0	7 13 18	42	94	SS-30	-	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
		152.5																
	500.0	155.0	11 15 18	45	100	SS-31	-	0	1	0	30	69	42	24	18	25	A-7-6 (12)	
HARD, GRAY, **SANDY SILT**, LITTLE GRAVEL, TRACE TO LITTLE CLAY, MOIST																		

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 8/12/13	END: 8/12/13	PG 4 OF 4	B-003-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
HARD, GRAY, **SANDY SILT**, LITTLE GRAVEL, TRACE TO LITTLE CLAY, MOIST *(continued)*	497.9	157.5																
		160.0	8 12 17	39	72	SS-32	-	-	-	-	-	-	-	-	-	17	A-4a (V)	
		162.5																
		165.0	18 30 32	84	50	SS-33	-	-	-	-	-	-	-	-	-	13	A-4a (V)	
		167.5																
		170.0	14 23 30	72	72	SS-34	-	11	16	16	38	19	22	17	5	10	A-4a (4)	
		172.5																
		175.0	14 24 31	75	78	SS-35	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
		177.5																
	475.0	180.0	16 29 36	88	61	SS-36	-	-	-	-	-	-	-	-	-	7	A-4a (V)	
HARD, GRAY, **SANDY SILT**, (TILL), DAMP		182.5																
		185.0	22 42 50	125	-	SS-37	-	-	-	-	-	-	-	-	-	-	A-4a (V)	
	467.0	187.5																
SHALE, GRAY, HIGHLY WEATHERED.		190.0																
		192.5	0		32	NX-38											CORE	
		195.0																
	457.0	197.5																
		EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/13/13 09:04 - C:\DOCUMENTS AND SETTINGS\ALL USERS\DOCUMENTS\PSI GINT\ODOT LOGS\FROM JANET 102413\0142-7E

PROJECT: CUY-6-14.56	DRILLING FIRM / OPERATOR: PSI / T. SUCHAN	DRILL RIG: CME 55 ATV	STATION / OFFSET:	EXPLORATION ID B-003-1-13
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: DETROIT-SUPERIOR BRIDGE	
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 7/10/13	ELEVATION: 599.7 (MSL) EOB: 158.5 ft.	PAGE 1 OF 4
START: 7/18/13 END: 7/18/13	SAMPLING METHOD: SPT / NQ	ENERGY RATIO (%): 81.4	COORD: 666168.638 N, 2186264.665 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 599.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
6" TOPSOIL	599.2																	
MEDIUM DENSE, BLACK, **COARSE AND FINE SAND**, WITH SILT, TRACE CLAY, TRACE GRAVEL, SOME CINDERS SOME RED BRICKS, LITTLE ORGANICS, MOIST (FILL)	593.2	2.5																
		5.0	13 13 13	35	100	SS-1	-	-	-	-	-	-	-	-	-	16	A-3a (V)	
		7.5																
LOOSE, GRAY, **SILT**, LITTLE CLAY, TRACE GRAVEL, TRACE SAND, WET		10.0	3 3 4	9	100	SS-2	-	-	-	-	-	-	-	-	-	24	A-4b (V)	
** INTERBEDDING OF FINE SAND		12.5																
		15.0	2 2 3	7	100	SS-3	-	0	1	1	78	20	NP	NP	NP	27	A-4b (8)	
		17.5																
		20.0	2 2 2	5	100	SS-4	-	-	-	-	-	-	-	-	-	25	A-4b (V)	
		22.5																
		25.0	3 3 5	11	100	SS-5	-	-	-	-	-	-	-	-	-	21	A-4b (V)	
	572.7	27.5																
MEDIUM STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, WET		30.0	3 5 5	14	100	SS-6	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		32.5																
		35.0	3 5 5	14	100	SS-7	-	0	1	0	50	49	32	20	12	21	A-6a (9)	
		37.5																
** UNCONFINED COMPRESSION = 3,313 PSF @ 38.5' - 40.5'		40.0			88	ST-8	-	-	-	-	-	-	-	-	-	20	A-6a (V)	
		42.5																
		45.0	3 3 4	9	100	SS-9	-	-	-	-	-	-	-	-	-	31	A-6a (V)	
		47.5																
			1	7	100	SS-10	-	-	-	-	-	-	-	-	-	30	A-6a (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/18/13	END: 7/18/13	PG 2 OF 4	B-003-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
MEDIUM STIFF TO VERY STIFF, GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, WET *(continued)*	549.7	52.5	2 3															
		55.0	1 4 5	12	100	SS-11	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		57.5																
		60.0	3 6 9	20	100	SS-12	-	0	3	3	39	55	33	22	11	21	A-6a (8)	
		62.5																
		65.0	3 6 9	20	100	SS-13	-	-	-	-	-	-	-	-	-	20	A-6a (V)	
		67.5																
		70.0	3 7 9	22	100	SS-14	-	-	-	-	-	-	-	-	-	20	A-6a (V)	
		72.5																
		75.0	4 7 11	24	100	SS-15	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		77.5																
		80.0	5 9 13	30	100	SS-16	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
	516.7	82.5																
VERY STIFF TO HARD, GRAY, **SANDY SILT**, WITH CLAY, TRACE GRAVEL, WET		85.0	7 12 15	37	100	SS-17	-	5	6	10	40	39	27	19	8	16	A-4a (8)	
		87.5																
		90.0	6 11 15	35	100	SS-18	-	-	-	-	-	-	-	-	-	16	A-4a (V)	
		92.5																
		95.0	8 14 20	46	100	SS-19	-	-	-	-	-	-	-	-	-	54	A-4a (V)	
	501.7	97.5																
HARD, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, WET		100.0	10 20 30	68	100	SS-20	-	-	-	-	-	-	-	-	-	18	A-6a (V)	
		102.5																

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/18/13	END: 7/18/13	PG 3 OF 4	B-003-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
HARD, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, WET *(continued)*	496.2	105.0	9 20 25	61	100	SS-21	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		107.5																
		110.0	19 30 35	88	100	SS-22	-	-	-	-	-	-	-	-	-	10	A-6a (V)	
		112.5																
		115.0	19 26 36	84	100	SS-23	-	-	-	-	-	-	-	-	-	9	A-6a (V)	
		117.5																
		120.0	12 21 27	65	100	SS-24	-	7	9	12	33	39	30	18	12	14	A-6a (8)	
		122.5																
	474.7	125.0	12 20 28	65	100	SS-25	-	-	-	-	-	-	-	-	-	9	A-6a (V)	
HARD, GRAY, **SANDY SILT**, SOME TO WITH CLAY, TRACE GRAVEL, WET		127.5																
		130.0	11 19 24	58	100	SS-26	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
** LAYER OF SILT AND CLAY (TILL)		132.5																
		135.0	12 30 39	94	100	SS-27	-	-	-	-	-	-	-	-	-	14	A-4a (V)	
		137.5																
		140.0	24 28 55	113	67	SS-28	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
		142.5																
	452.7	145.0	42 56	-	33	SS-29	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
SHALE, GRAY, SLIGHTLY TO MODERATELY WEATHERED, WEAK TO SLIGHTLY STRONG, FINE GRAINED, MEDIUM TO THICK BEDDED.		147.5																
		150.0																
		152.5	90		100	NQ-30											CORE	
		155.0																
** UNCONFINED COMPRESSION = 3,212 PSI @ 156.0'																		

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/18/13	END: 7/18/13	PG 4 OF 4	B-003-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
	442.6																	
	441.2	157.5 EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: CUY-6-14.56	DRILLING FIRM / OPERATOR: PSI / J. WATTS	DRILL RIG: D-50	STATION / OFFSET:	EXPLORATION ID B-004-0-13
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / S.T.	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: DETROIT-SUPERIOR BRIDGE	
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 7/10/13	ELEVATION: 605.0 (MSL) EOB: 173.6 ft.	PAGE 1 OF 4
START: 6/27/13 END: 6/28/13	SAMPLING METHOD: SPT / NQ	ENERGY RATIO (%): 77.98	COORD: 666364.951 N, 2186300.732 E	

MATERIAL DESCRIPTION AND NOTES	ELEV. 605.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
5.5" ASPHALT	604.6																	
VERY LOOSE TO MEDIUM DENSE, BROWN, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, LITTLE SILT, TRACE CLAY, LITTLE RED BRICK, LITTLE ORGANICS, WET (FILL)		2.5	19 9 8	22	100	SS-1	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
		5.0	2 2 1	4	100	SS-2	-	31	23	31	- 15 -		NP	NP	NP	10	A-1-b (0)	
	597.0	7.5	1 0 1	1	28	SS-3	-	-	-	-	-	-	-	-	-	9	A-1-b (V)	
STIFF, BROWN/GRAY, **SANDY SILT**, LITTLE CLAY, LITTLE GRAVEL, LITTLE ORGANICS, SOME WOOD FRAGMENTS, WET (FILL) ** WOOD FRAGMENTS @ 8.5' TO 10.0'		10.0	1 1 11	16	56	SS-4	-	-	-	-	-	-	-	-	-	45	A-4a (V)	
	592.0	W 12.5	2 3 3	8	67	SS-5	-	-	-	-	-	-	-	-	-	26	A-4a (V)	
LOOSE, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, MOIST		15.0	2 3 5	10	78	SS-6	-	-	-	-	-	-	-	-	-	20	A-4b (V)	
		17.5	3 4 5	12	100	SS-7	-	0	1	4	75	20	NP	NP	NP	20	A-4b (8)	
		20.0	2 3 3	8	100	SS-8	-	-	-	-	-	-	-	-	-	27	A-4b (V)	
		22.5 ▼																
		25.0	2 3 5	10	100	SS-9	-	-	-	-	-	-	-	-	-	20	A-4b (V)	
		27.5																
		30.0	2 2 4	8	100	SS-10	-	-	-	-	-	-	-	-	-	27	A-4b (V)	
	570.0	32.5																
MEDIUM STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST TO WET		35.0	3 5 7	16	100	SS-11	-	-	-	-	-	-	-	-	-	24	A-4b (V)	
		37.5																
		40.0	3 5 6	14	100	SS-12	-	-	-	-	-	-	-	-	-	25	A-6a (V)	
		42.5																
		45.0	2 3 4	9	100	SS-13	-	0	0	0	47	53	34	20	14	29	A-6a (10)	
		47.5																
			5	13	100	SS-14	-	-	-	-	-	-	-	-	-	20	A-6a (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 6/27/13	END: 6/28/13	PG 2 OF 4	B-004-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 555.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
MEDIUM STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST TO WET *(continued)*		52.5	6 4															
		55.0	3 2 4	8	100	SS-15	-	-	-	-	-	-	-	-	-	28	A-6a (V)	
		57.5																
		60.0	5 6 8	18	100	SS-16	-	-	-	-	-	-	-	-	-	25	A-6a (V)	
		62.5																
		65.0	5 7 9	21	100	SS-17	-	0	1	2	44	53	35	21	14	22	A-6a (10)	
		67.5																
		70.0	7 10 12	29	28	SS-18	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
		72.5																
		75.0	7 9 11	26	100	SS-19	-	-	-	-	-	-	-	-	-	21	A-6a (V)	
		77.5																
		80.0	6 8 10	23	100	SS-20	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		82.5																
		85.0	7 10 13	30	100	SS-21	-	-	-	-	-	-	-	-	-	24	A-6a (V)	
		87.5																
		90.0	8 15 20	45	100	SS-22	-	-	-	-	-	-	-	-	-	15	A-6a (V)	
		92.5																
		95.0	8 12 15	35	100	SS-23	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
		97.5																
		100.0	4 9 13	29	100	SS-24	-	-	-	-	-	-	-	-	-	18	A-6a (V)	
		102.5																

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 6/27/13	END: 6/28/13	PG 3 OF 4	B-004-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
MEDIUM STIFF TO HARD, GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST TO WET *(continued)*	501.5	105.0	4 9 14	30	100	SS-25	-	2	1	2	34	61	35	22	13	21	A-6a (9)	
	498.0	107.5																
VERY STIFF TO HARD, GRAY, **SILT**, LITTLE CLAY, LAYER OF FINE SAND, TRACE GRAVEL, MOIST		110.0	8 13 14	35	100	SS-26	-	-	-	-	-	-	-	-	-	22	A-4b (V)	
	490.0	112.5																
HARD, GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST		115.0	16 16 19	45	83	SS-27	-	-	-	-	-	-	-	-	-	23	A-4b (V)	
		117.5																
		120.0	11 20 25	58	100	SS-28	-	-	-	-	-	-	-	-	-	10	A-6a (V)	
		122.5																
		125.0	12 17 26	56	100	SS-29	-	-	-	-	-	-	-	-	-	13	A-6a (V)	
		127.5																
		130.0	8 14 23	48	100	SS-30	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
		132.5																
		135.0	22 32 37	90	100	SS-31	-	-	-	-	-	-	-	-	-	10	A-6a (V)	
		137.5																
		140.0	15 25 39	83	100	SS-32	-	8	2	3	25	62	37	22	15	15	A-6a (10)	
		142.5																
		145.0	23 27 40	87	100	SS-33	-	-	-	-	-	-	-	-	-	13	A-6a (V)	
		147.5																
	455.0	150.0	21 30 32	81	94	SS-34	-	-	-	-	-	-	-	-	-	17	A-6a (V)	
HARD, GRAY, **SANDY SILT**, LITTLE ROCK FRAGMENTS, LITTLE CLAY, MOIST		152.5																
		155.0	26 38 50	114	100	SS-35	-	-	-	-	-	-	-	-	-	13	A-4a (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 6/27/13	END: 6/28/13	PG 4 OF 4	B-004-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
HARD, GRAY, **SANDY SILT**, LITTLE ROCK FRAGMENTS, LITTLE CLAY, MOIST *(continued)*	447.9	157.5																
		160.0	28 35 59	122	100	SS-36	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
	443.0	162.5																
SHALE, GRAY, SLIGHTLY WEATHERED, STRONG, FINE GRAINED, MEDIUM TO THICK BEDDED.			50/1"	-	100	SS-37	-	-	-	-	-	-	-	-	-	11	Rock (V)	
		165.0																
		167.5	95		95	NQ-38											CORE	
		170.0																
** UNCONFINED COMPRESSION = 1,614 PSI @ 173.0'	431.4	172.5 EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

PROJECT: CUY-6-14.56	DRILLING FIRM / OPERATOR: PSI / T. SUCHAN	DRILL RIG: CME 55 ATV	STATION / OFFSET:	EXPLORATION ID B-004-1-13	
TYPE: BRIDGE REPLACEMENT	SAMPLING FIRM / LOGGER: PSI / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: DETROIT-SUPERIOR BRIDGE		
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 7/10/13	ELEVATION: 606.0 (MSL) EOB: 169.2 ft.	PAGE 1 OF 4	
START: 7/9/13 END: 7/9/13	SAMPLING METHOD: SPT / NQ	ENERGY RATIO (%): 81.4	COORD: 666282.939 N, 2186374.016 E		

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
12" TOPSOIL	606.0																	
LOOSE TO MEDIUM DENSE, GRAY, **SILT AND CLAY**, LITTLE SAND, TRACE GRAVEL, LITTLE RED BRICKS, LITTLE CINDERS, TRACE ORGANICS, MOIST (FILL)	605.0	2.5	2 3 3	8	78	SS-1	-	-	-	-	-	-	-	-	-	16	A-6a (V)	
		5.0	2 4 2	8	44	SS-2	-	7	7	9	46	31	32	21	11	17	A-6a (8)	
		7.5	4 5 3	11	67	SS-3	-	-	-	-	-	-	-	-	-	18	A-6a (V)	
		10.0	3 3 7	14	67	SS-4	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
VERY LOOSE TO MEDIUM DENSE, BROWN/GRAY, **GRAVEL AND/OR STONE FRAGMENTS WITH SAND**, TRACE CLAY, TRACE SILT, SOME CONCRETE FRAGMENTS, LITTLE RED BRICKS, MOIST (FILL)	595.5	12.5	5 5 7	16	56	SS-5	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	
		15.0	12 26 5	42	56	SS-6	-	-	-	-	-	-	-	-	-	20	A-1-b (V)	
		17.5																
		20.0	5 4 7	15	33	SS-7	-	47	13	17	-	23 -	NP	NP	NP	10	A-1-b (0)	
		22.5																
		25.0	1 1 1	3	25	SS-8	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	
		27.5																
	574.0	30.0	18 7 3	14	33	SS-9	-	-	-	-	-	-	-	-	-	19	A-1-b (V)	
VERY STIFF, GRAY, **SILT**, SOME TO WITH CLAY, TRACE GRAVEL, TRACE SAND, MOIST TO WET		32.5																
		35.0	6 9 10	26	100	SS-10	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
		37.5																
** UNCONFINED COMPRESSION = 1,904 PSF @ 38.5' - 40.5'		40.0			65	ST-11	-	-	-	-	-	-	-	-	-	19	A-4b (V)	
		42.5																
		45.0	5 7 6	18	100	SS-12	-	0	0	0	69	31	29	22	7	22	A-4b (8)	
		47.5																
			3	19	100	SS-13	-	-	-	-	-	-	-	-	-	25	A-4b (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/9/13	END: 7/9/13	PG 2 OF 4	B-004-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
VERY STIFF, GRAY, **SILT**, SOME TO WITH CLAY, TRACE GRAVEL, TRACE SAND, MOIST TO WET *(continued)*	556.0	52.5	6 8															
	552.5																	
SOFT TO VERY STIFF, GRAY, **CLAY**, TRACE TO LITTLE SILT, TRACE SAND, TRACE GRAVEL, MOIST TO WET		55.0	4 4 5	12	100	SS-14	-	-	-	-	-	-	-	-	-	31	A-7-6 (V)	
		57.5																
		60.0	0 0 3	4	100	SS-15	-	-	-	-	-	-	-	-	-	30	A-7-6 (V)	
		62.5																
		65.0	0 0 3	4	100	SS-16	-	-	-	-	-	-	-	-	-	29	A-7-6 (V)	
		67.5																
		70.0	0 0 5	7	100	SS-17	-	-	-	-	-	-	-	-	-	27	A-7-6 (V)	
		72.5																
** UNCONFINED COMPRESSION = 2,620 PSF @ 73.5' - 75.0'		75.0			92	ST-18	-	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
		77.5																
		80.0	6 10 13	31	100	SS-19	-	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
		82.5																
		85.0	6 9 11	27	100	SS-20	-	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
		87.5																
		90.0	4 8 11	26	100	SS-21	-	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
		92.5																
		95.0	8 13 18	42	100	SS-22	-	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
	507.5	97.5																
DENSE, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, WET		100.0	11 16 21	50	100	SS-23	-	-	-	-	-	-	-	-	-	16	A-4b (V)	
		102.5																

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/9/13	END: 7/9/13	PG 3 OF 4	B-004-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
DENSE, GRAY, **SILT**, LITTLE CLAY, TRACE SAND, TRACE GRAVEL, WET *(continued)*	502.5	105.0	4 7 11	24	100	SS-24	-	-	-	-	-	-	-	-	-	18	A-4b (V)	
** BOULDER @ 108.0' TO 109.5'		107.5																
		110.0	50/1"	-	100	SS-25	-	-	-	-	-	-	-	-	-	-	A-4b (V)	
		112.5																
** SAND LAYER @ 114.5' TO 116.0'	490.0	115.0	14 17 20	50	100	SS-26	-	0	2	0	81	17	NP	NP	NP	22	A-4b (8)	
HARD, GRAY, **SILT AND CLAY**, TRACE TO LITTLE SAND, LITTLE ROCK FRAGMENTS, MOIST TO WET		117.5																
		120.0	14 25 31	76	100	SS-27	-	-	-	-	-	-	-	-	-	11	A-6a (V)	
		122.5																
		125.0	15 23 26	66	100	SS-28	-	-	-	-	-	-	-	-	-	14	A-6a (V)	
		127.5																
		130.0	12 18 25	58	100	SS-29	-	-	-	-	-	-	-	-	-	17	A-6a (V)	
		132.5																
		135.0	8 13 17	41	67	SS-30	-	-	-	-	-	-	-	-	-	23	A-6a (V)	
		137.5																
		140.0	10 13 20	45	89	SS-31	-	4	2	4	35	55	35	21	14	19	A-6a (10)	
		142.5																
		145.0	11 14 22	49	100	SS-32	-	-	-	-	-	-	-	-	-	22	A-6a (V)	
		147.5																
		150.0	14 27 29	76	28	SS-33	-	-	-	-	-	-	-	-	-	13	A-6a (V)	
		152.5																
** SOME ROCK FRAGMENTS AFTER 153.0'		155.0	21 37 59	130	100	SS-34	-	-	-	-	-	-	-	-	-	11	A-6a (V)	

PID:	BR ID:	PROJECT: CUY-6-14.56	STATION / OFFSET:	START: 7/9/13	END: 7/9/13	PG 4 OF 4	B-004-1-13

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
	448.9	157.5																
	447.0		31 50/2"	-	113	SS-35	-	-	-	-	-	-	-	-	-	13	A-6a (V)	
SHALE, GRAY, MODERATELY STRONG, FINE GRAINED, MEDIUM BEDDED.		160.0																
		162.5																
		165.0	67		67	NQ-36											CORE	
** UNCONFINED COMPRESSION = 1,786 PSI @ 167.0'		167.5																
	436.8	EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NOT RECORDED

Rock Core Photo # B-001-0-13

Rock Core Photo # B-001-1-13

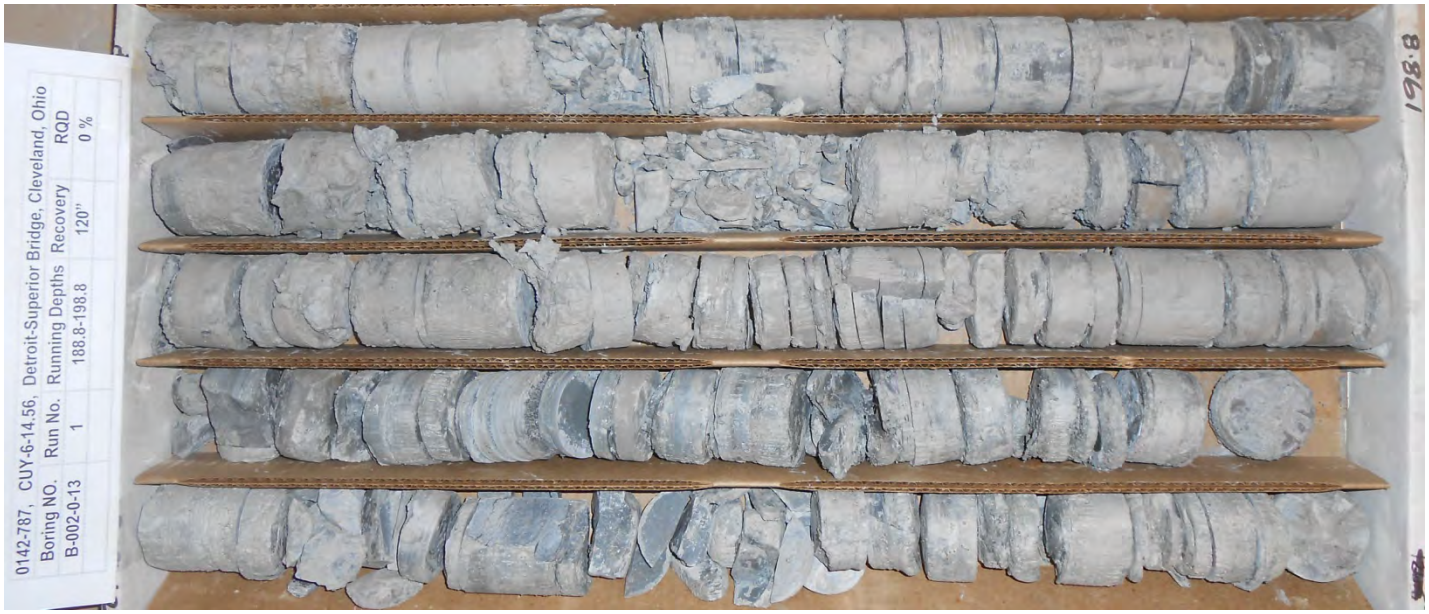
psi Information To Build On
Engineering • Consulting • Testing

CUY-6-14.56 , Inclinometer Installation
PID No.: 77040
Detroit-Superior Bridge
Cleveland, Ohio

Date: 8/06/2013
Drawn By: AA
Scale: NA

Rock Core Photo

PSI Project No.: 0142-787



Rock Core Photo # B-002-0-13

Rock Core Photo # B-002-1-13

Information To Build On
Engineering • Consulting • Testing

CUY-6-14.56 , Inclinometer Installation
PID No.: 77040
Detroit-Superior Bridge
Cleveland, Ohio

Date: 7/09/2013
Drawn By: AA
Scale: NA

Rock Core Photo

PSI Project No.: 0142-787

Rock Core Photo # B-003-0-13

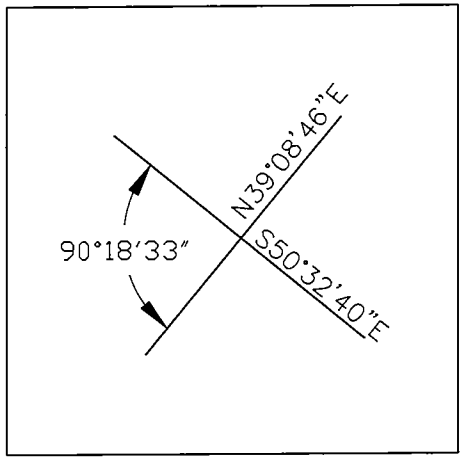
Rock Core Photo # B-003-1-13

psi Information To Build On Engineering • Consulting • Testing	CUY-6-14.56 , Inclinometer Installation PID No.: 77040 Detroit-Superior Bridge Cleveland, Ohio	Date: 7/09/2013 Drawn By: AA Scale: NA	Rock Core Photo PSI Project No.: 0142-787

Rock Core Photo # B-004-0-13

Rock Core Photo # B-004-1-13

psi Information To Build On Engineering • Consulting • Testing	CUY-6-14.56 , Inclinometer Installation PID No.: 77040 Detroit-Superior Bridge Cleveland, Ohio	Date: 7/09/2013 Drawn By: AA Scale: NA	Rock Core Photo PSI Project No.: 0142-787



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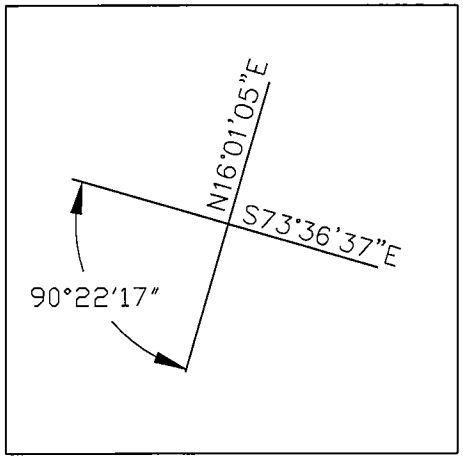
E 2185925.904
EL 658.12



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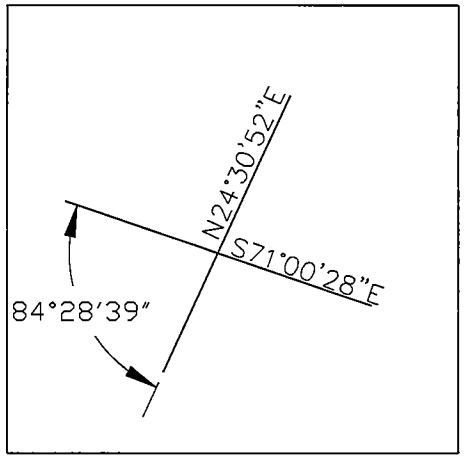

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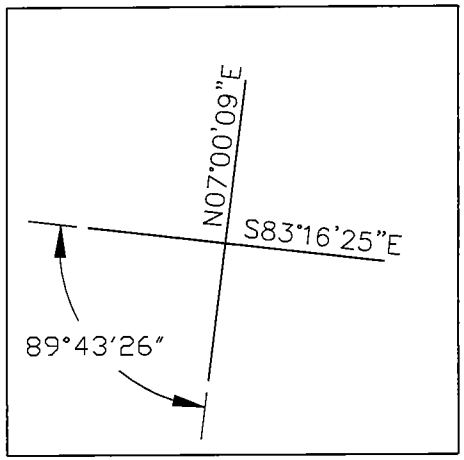

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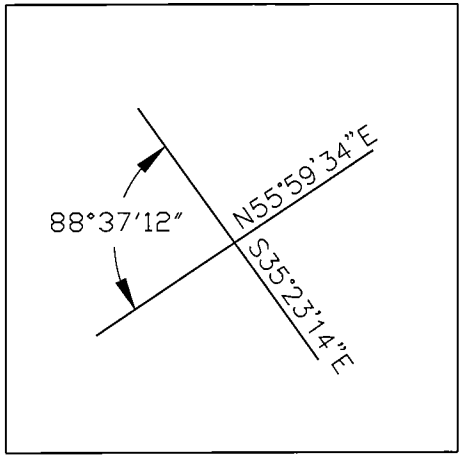

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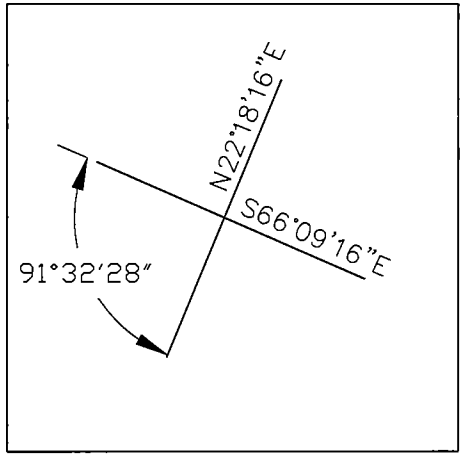

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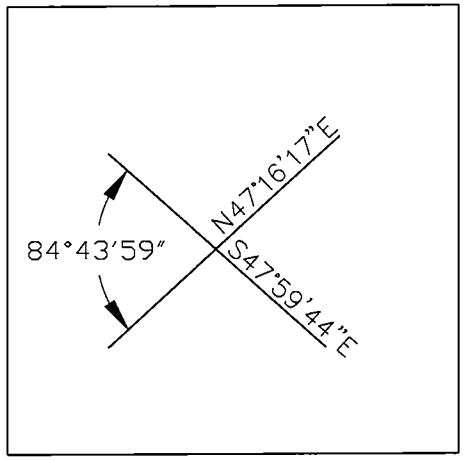

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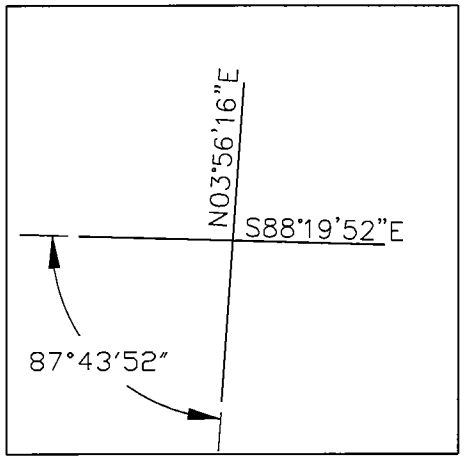

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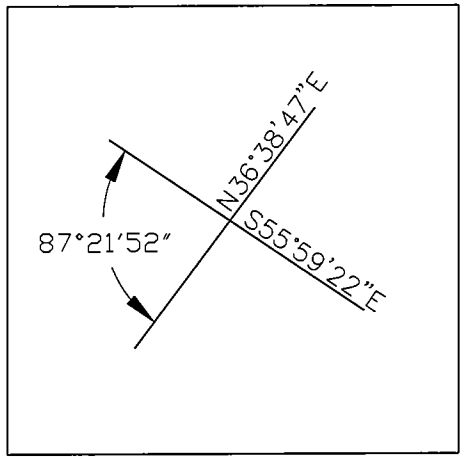

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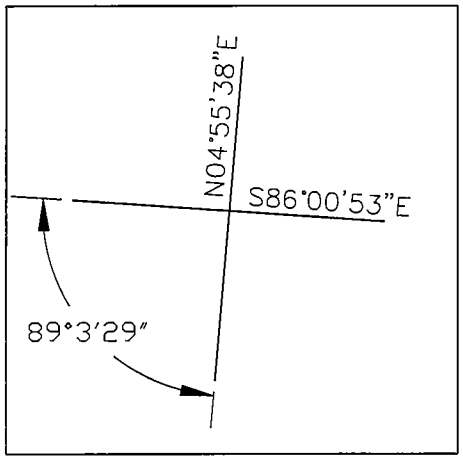

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E 2186142.032
EL 609.29

APPENDIX A.1 - ODOT Quick Reference for Visual Description of Soils

1) STRENGTH OF SOIL:

Non-Cohesive (granular) Soils - Compactness	
Description	**Blows Per Ft.**
Very Loose	≤ 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

2) COLOR:

If a color is a uniform color throughout, the term is single, modified by an adjective such as light or dark. If the predominate color is shaded by a secondary color, the secondary color procedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled"

3) PRIMARY COMPONENT

Use **DESCRIPTION** from ODOT Soil Classification Chart on Back

Cohesive (fine grained) Soils - Consistency

Description	Qu (TSF)	Blows Per Ft.	Hand Manipulation
Very Soft	<0.25	<2	Easily penetrates 2" by fist
Soft	0.25-0.5	2 - 4	Easily penetrates 2" by thumb
Medium Stiff	0.5-1.0	5 - 8	Penetrates by thumb with moderate effort
Stiff	1.0-2.0	9 - 15	Readily indents by thumb, but not penetrate
Very Stiff	2.0-4.0	16 - 30	Readily indents by thumbnail
Hard	>4.0	>30	Indent with difficulty by thumbnail

4) COMPONENT MODIFIERS:

Description	Percentage By Weight
Trace	0% - 10%
Little	10% - 20%
Some	20% - 35%
"And"	35% -50%

5) Soil Organic Content

Description	% by Weight
Slightly Organic	2% - 4%
Moderately Organic	4% - 10%
Highly Organic	> 10%

6) Relative Visual Moisture

Description	Criteria	
	Cohesive Soil	**Non-cohesive Soils**
Dry	Powdery; Cannot be rolled; Water content well below the plastic limit	No moisture present
Damp	Leaves very little moisture when pressed between fingers; Crumbles at or before rolled to $^1/_8$"; Water content below plastic limit	Internal moisture, but no to little surface moisture
Moist	Leaves small amounts of moisture when pressed between fingers; Rolled to $^1/_8$" or smaller before crumbling; Water content above plastic limit to -3% of the liquid limit	Free water on surface, moist (shiny) appearance
Wet	Very mushy; Rolled multiple times to $^1/_8$" or smaller before crumbles; Near or above the liquid limit	Voids filled with free water, can be poured from split spoon.

CLASSIFICATION OF SOILS

Ohio Department of Transportation

(The classification of a soil is found by proceeding from top to bottom of the chart. The first classification that the test data fits is the correct classification.)

SYMBOL	DESCRIPTION	Classifcation AASHTO	Classifcation OHIO	LL_O/LL x 100*	% Pass #40	% Pass #200	Liquid Limit (LL)	Plastic Index (PI)	Group Index Max.	REMARKS
	Gravel and/or Stone Fragments	A-1-a			30 Max.	15 Max.		6 Max.	0	Min. of 50% cambined gravel, cobble and boulder sizes
	Gravel and/ar Stone Fragments with Sand	A-1-b			50 Max.	25 Max.		6 Max.	0	
F.S.	Fine Sand	A-3			51 Min.	10 Max.	NON-PLASTIC		0	
	Coarse and Fine Sand	--	A-3a			35 Max.		6 Max.	0	Min. of 50% cambined coorse and fine sand sizes
	Gravel and/or Stone Fragments with Sand and Silt	A-2-4				35 Max.	40 Max.	10 Max.	0	
		A-2-5					41 Min.			
	Gravel and/or Stone Fragments with Sand, Silt and Clay	A-2-6				35 Max.	40 Max.	11 Min.	4	
		A-2-7					41 Min.			
	Sandy Silt	A-4	A-4a	76 Min.		36 Min.	40 Max.	10 Max.	8	Less than 50% silt sizes
	Silt	A-4	A-4b	76 Min.		50 Min.	40 Max.	10 Max.	8	50% or more silt sizes
	Elastic Silt and Clay	A-5		76 Min.		36 Min.	41 Min.	10 Max.	12	
	Silt and Clay	A-6	A-6a	76 Min.		36 Min.	40 Max.	11 - 15	10	
	Silty Clay	A-6	A-6b	76 Min.		36 Min.	40 Max.	16 Min.	16	
	Elastic Clay	A-7-5		76 Min.		36 Min.	41 Min.	$\geq$LL-30	20	
	Clay	A-7-6		76 Min.		36 Min.	41 Min.	>LL-30	20	
	Organic Silt	A-8	A-8a	75 Max.		36 Min.				W/o organics would classify as A-4a or A-4b
	Organic Clay	A-8	A-8b	75 Max.		36 Min.				W/o organics would classify as A-5, A-6a, A-6b, A-7-5 or A-7-6

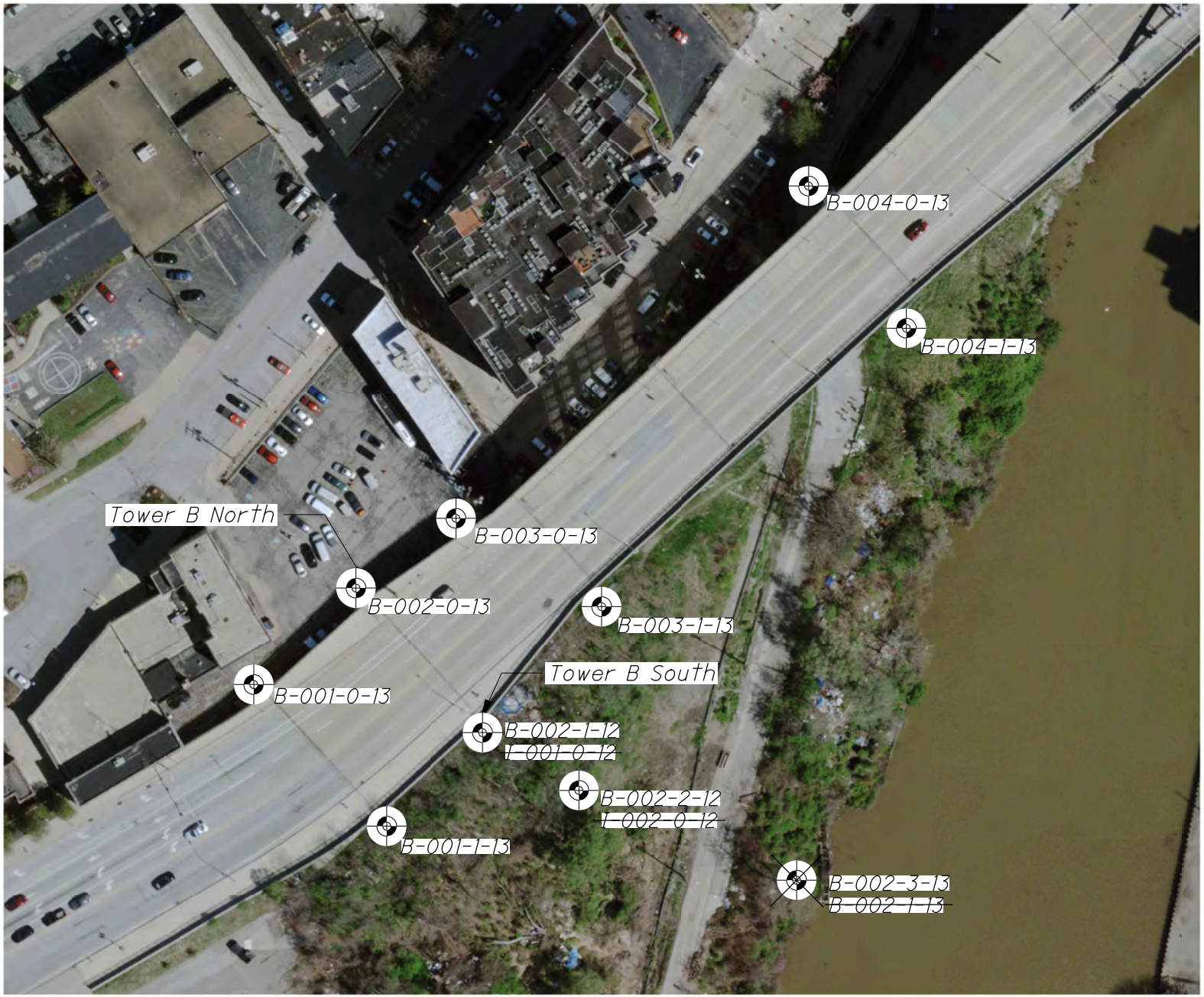
MATERIAL CLASSIFIED BY VISUAL INSPECTION

- Sod and Topsoil
- Pavement or Base
- Uncontrolled Fill (Describe)
- Bouldery Zone
- Peat, S-Sedimentary W-Woody F-Fibrous L-Loamy & etc

* Only perform the oven-dried liquid limit test and this calculation if organic material is present in the sample.

APPENDIX A.3

INCLINOMETER READINGS



NOTE:
Borings B-001-0-12, B-002-0-12 and B-002-1-13, numbering revised with installation of borings in 2013.

B-002-1-13/B-002-3-13 was abandoned on 6/7/2018.

50
0 100
HORIZONTAL SCALE IN FEET

CUY-6-14.56

DETROIT SUPERIOR BRIDGE INCLINOMETER INSTALLATIONS
BORING LOCATION PLAN

CALCULATED KJD
CHECKED

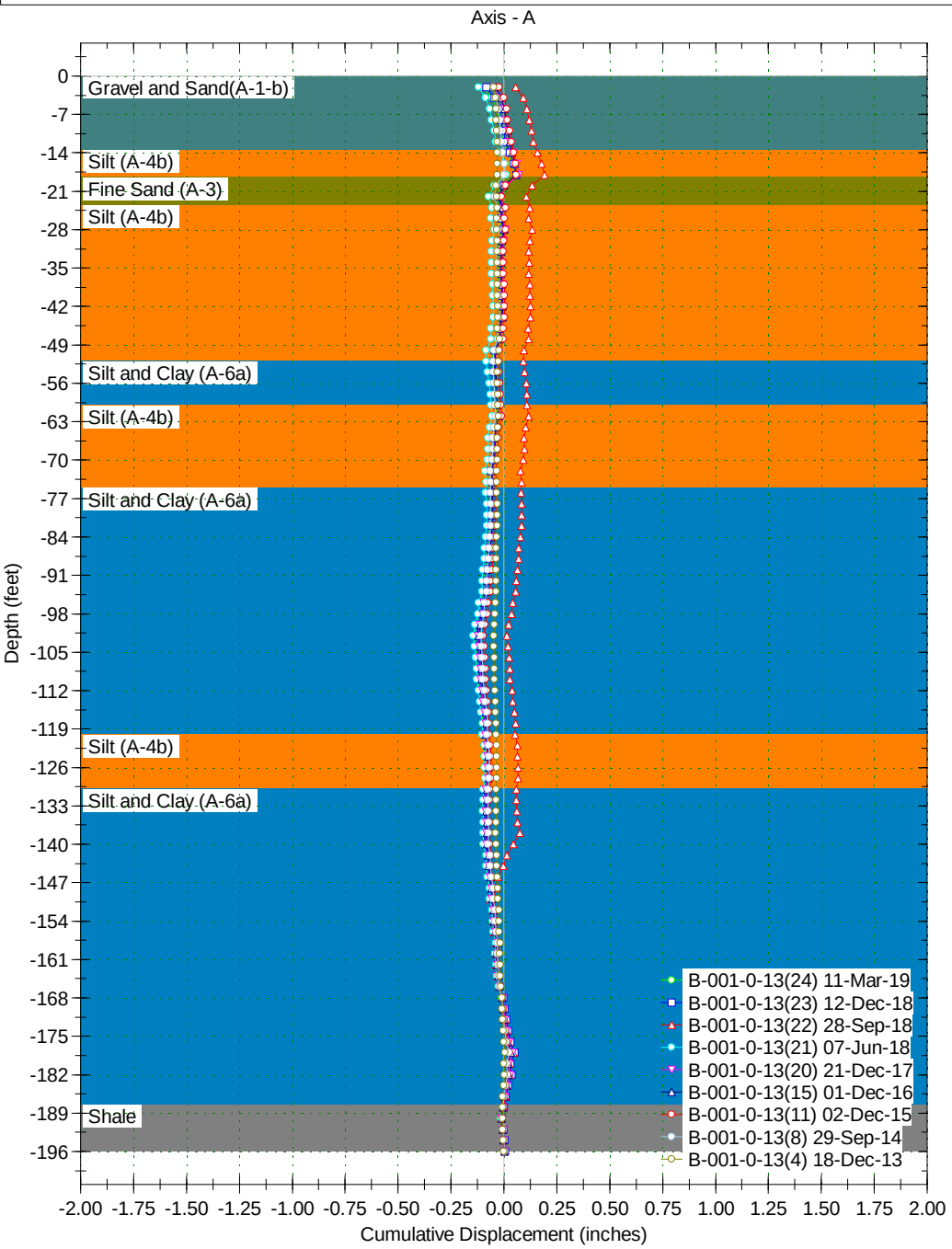
RST Instruments Ltd.

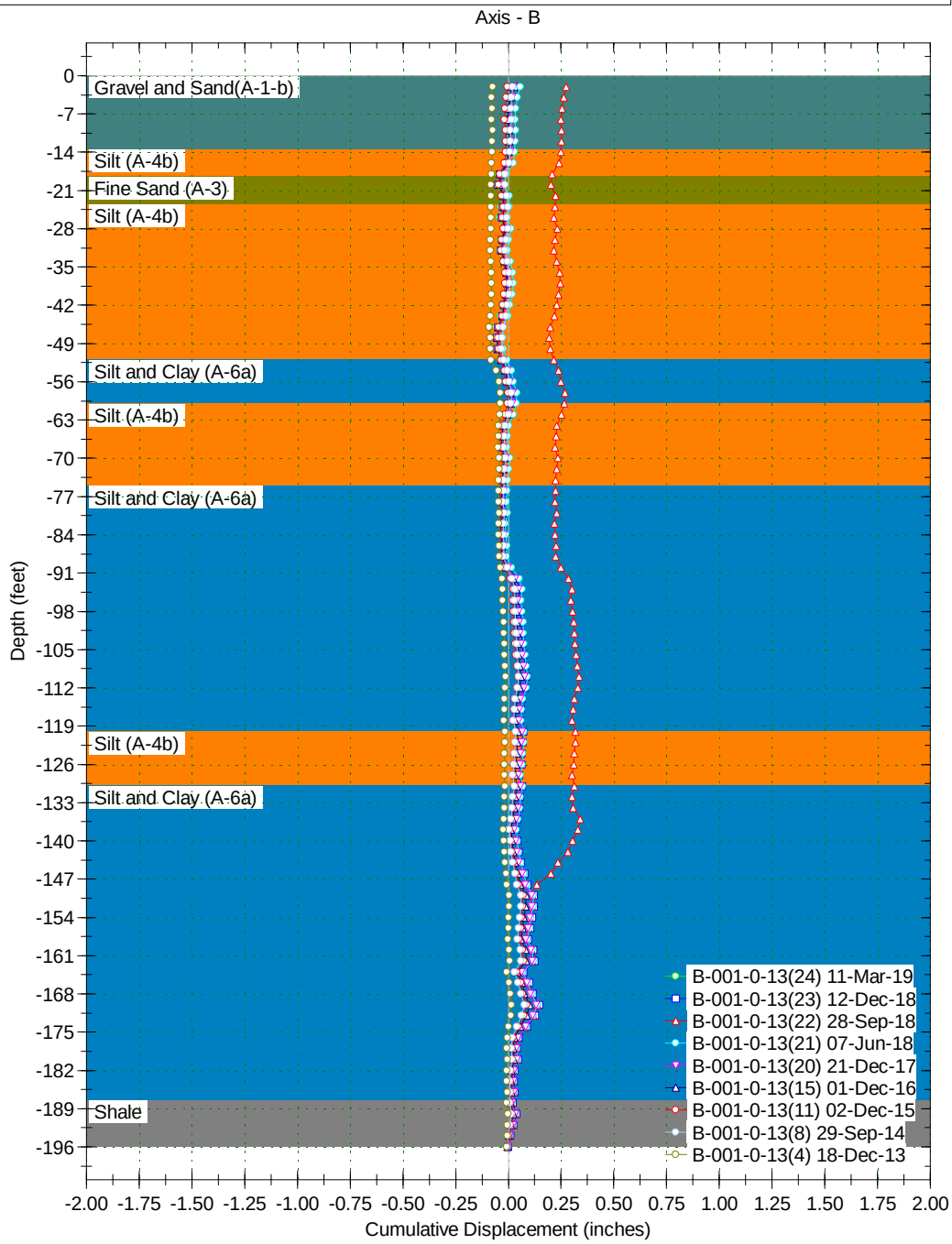
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-001-0-13
Project : Detroit Superior Bridge
Location :
Northing : 666028.444
Easting : 2185925.904
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 196.0 feet
A+ Groove Azimuth :
Base Reading : 2013 Oct 21 15:19
Applied Azimuth : 0.0 degrees





RST Instruments Ltd.

INCREMENTAL DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-001-0-13
Project : Detroit Superior Bridge
Location :
Northing : 666028.444
Easting : 2185925.904
Collar :

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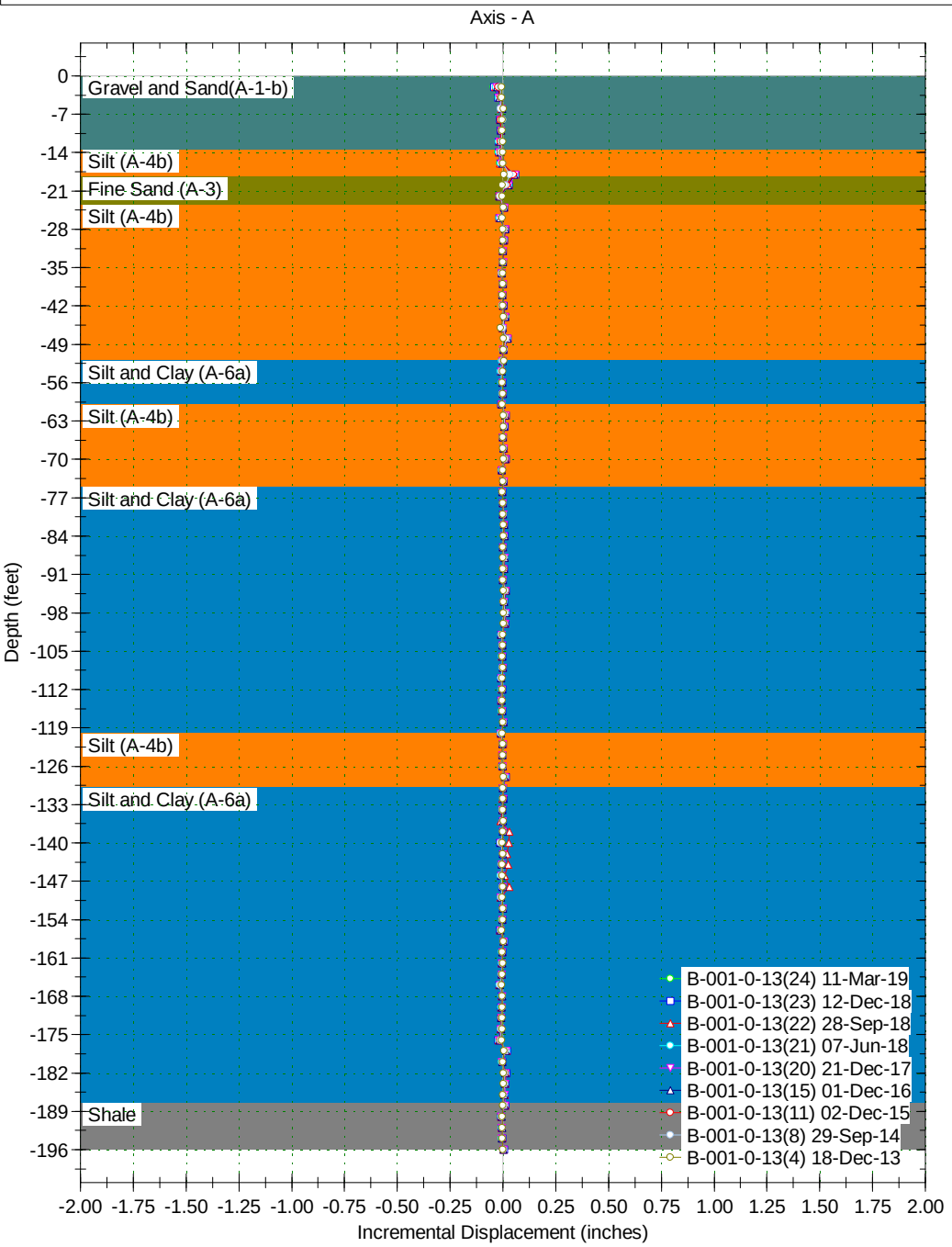
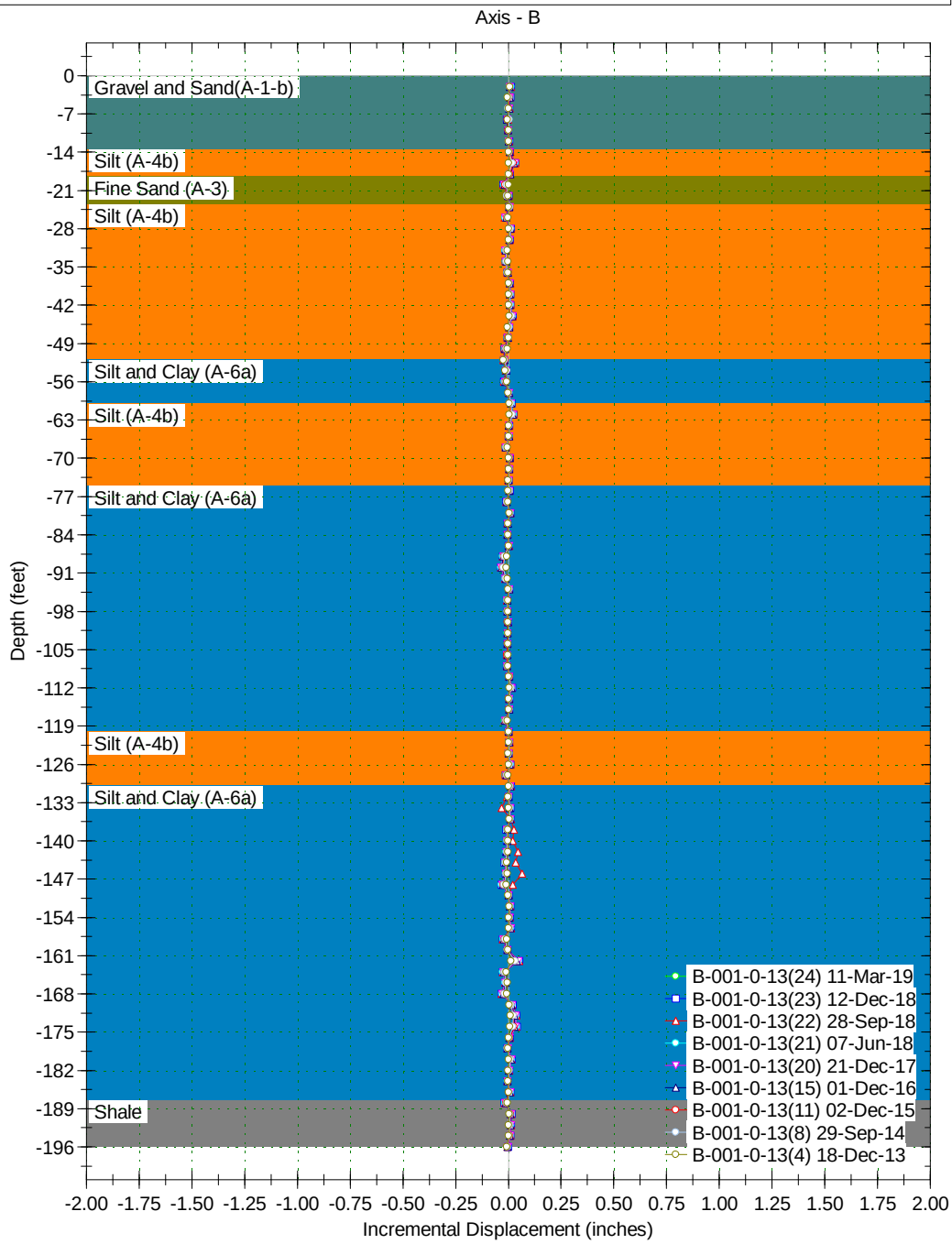




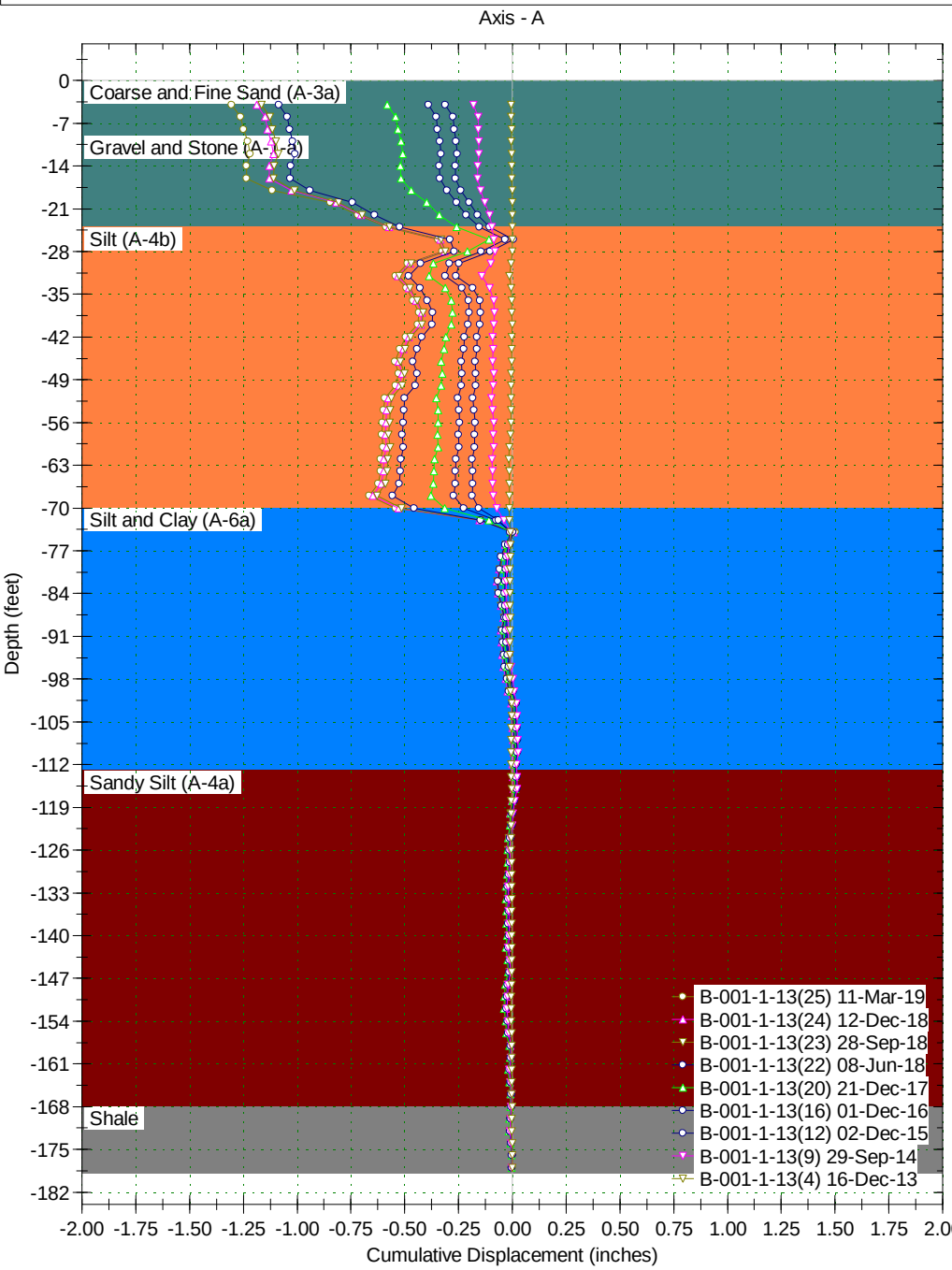
RST Instruments Ltd.

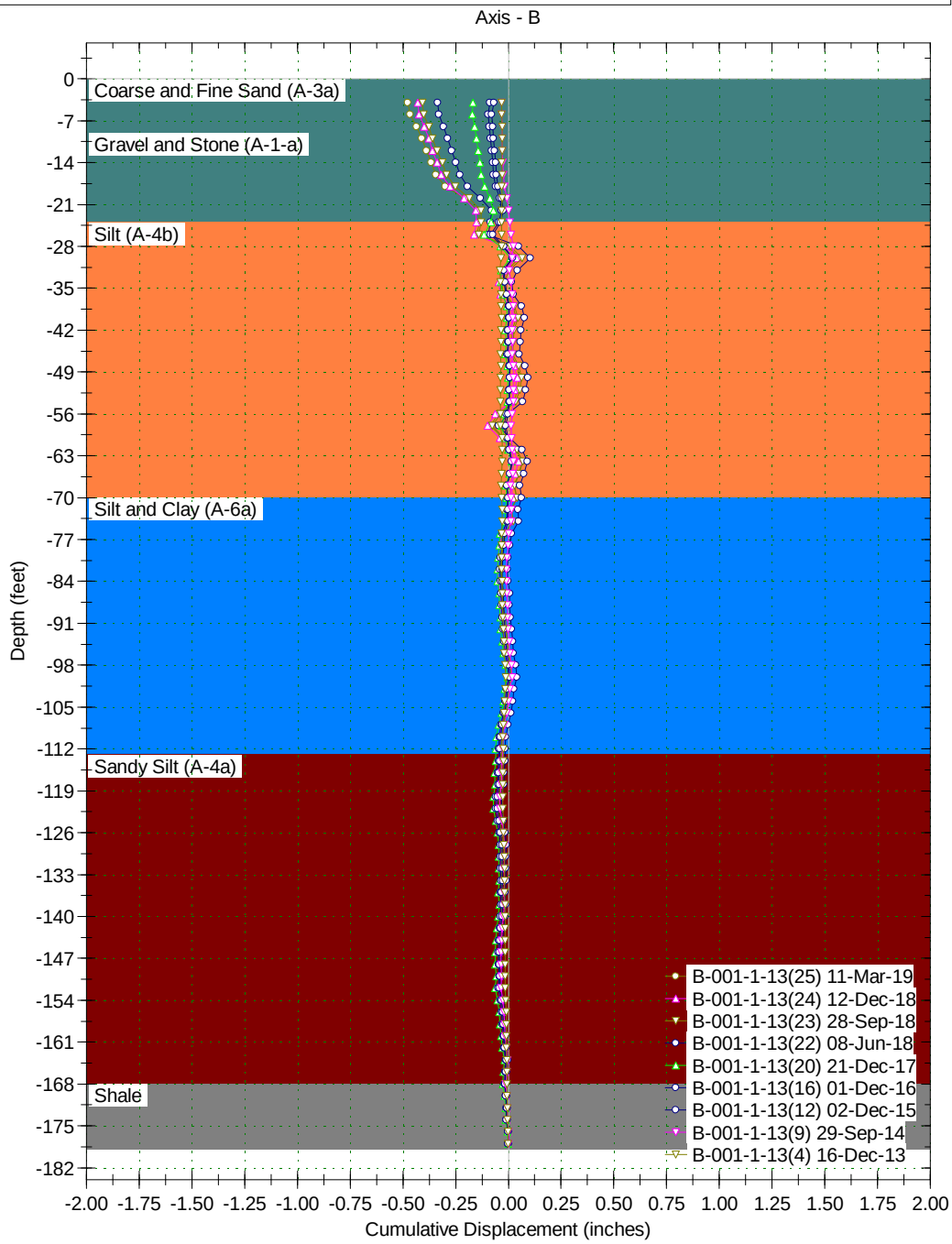
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-001-1-13
Project : Detroit Superior Bridge
Location :
Northing : 665949.799
Easting : 2186031.495
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 178.0 feet
A+ Groove Azimuth :
Base Reading : 2013 Oct 21 13:15
Applied Azimuth : 0.0 degrees





RST Instruments Ltd.

INCREMENTAL DISPLACEMENT

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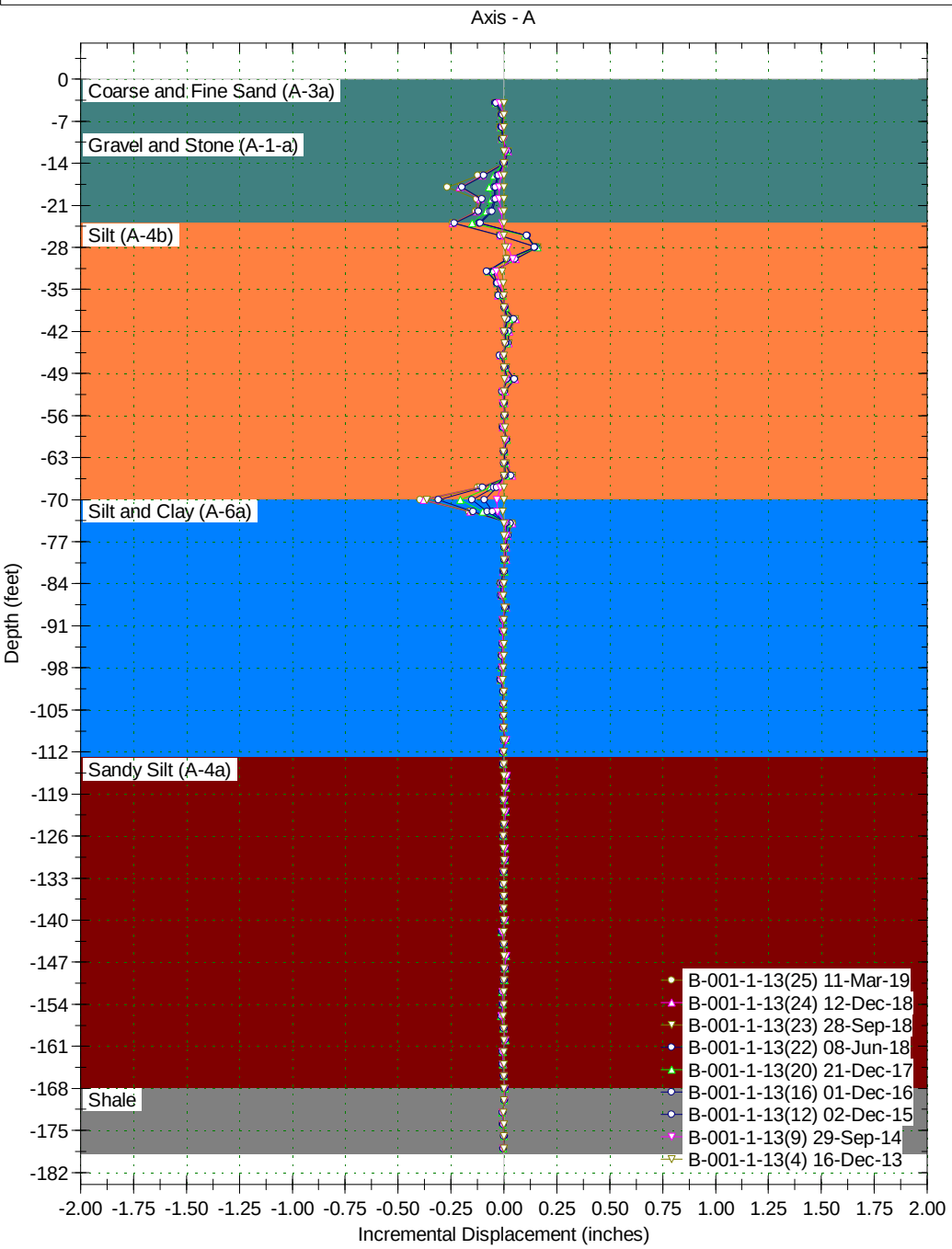
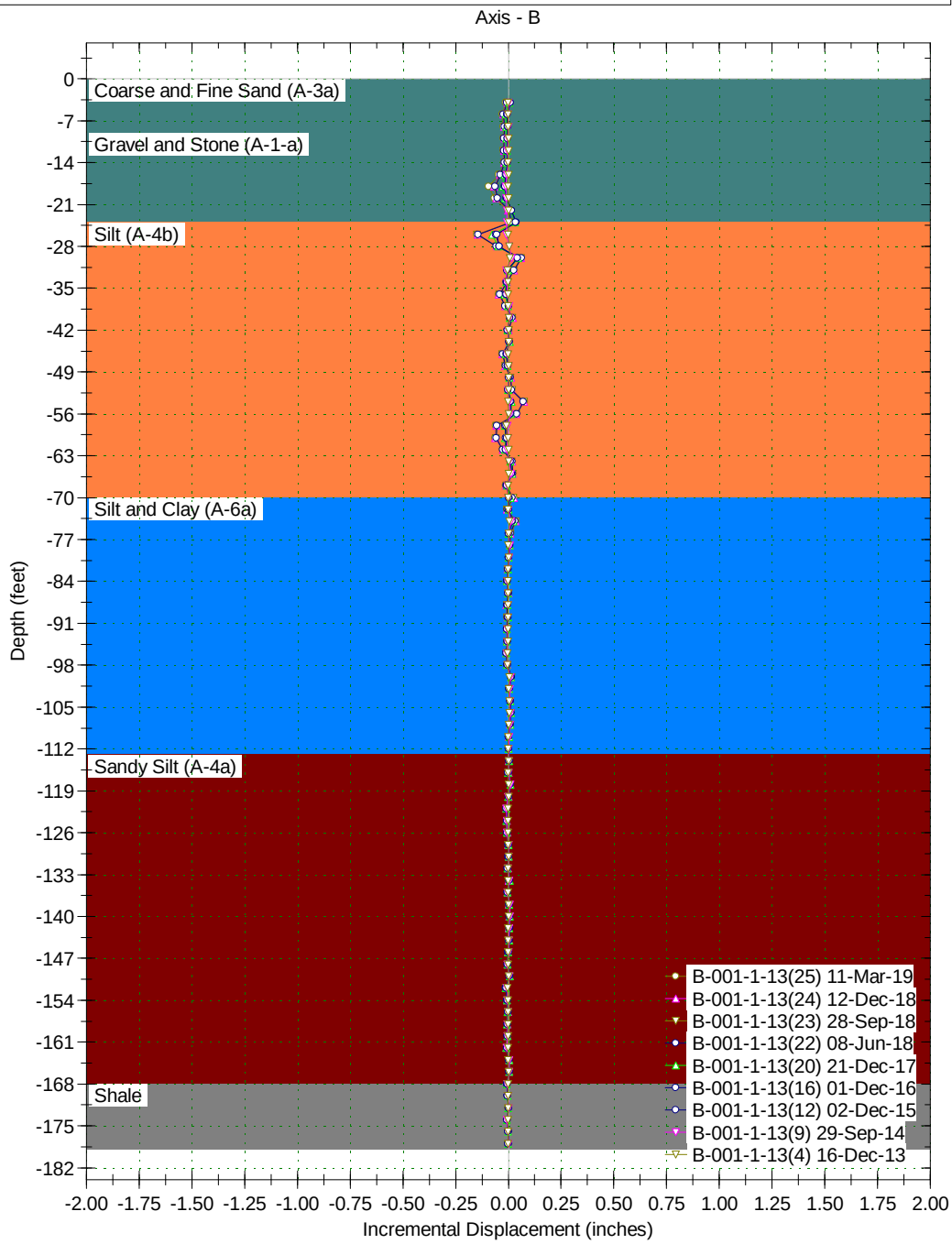
Applied Azimuth : 0.0 degrees





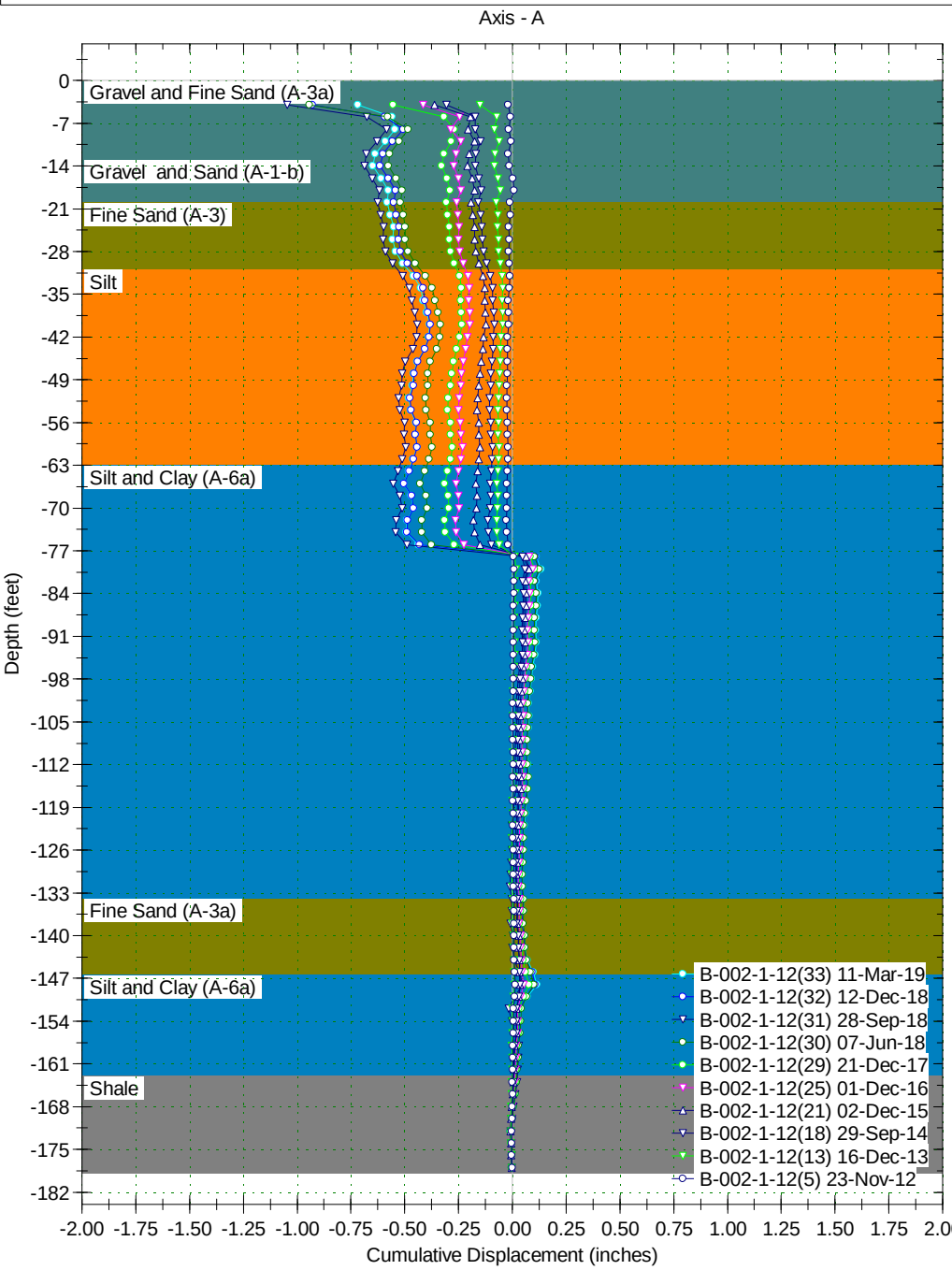
RST Instruments Ltd.

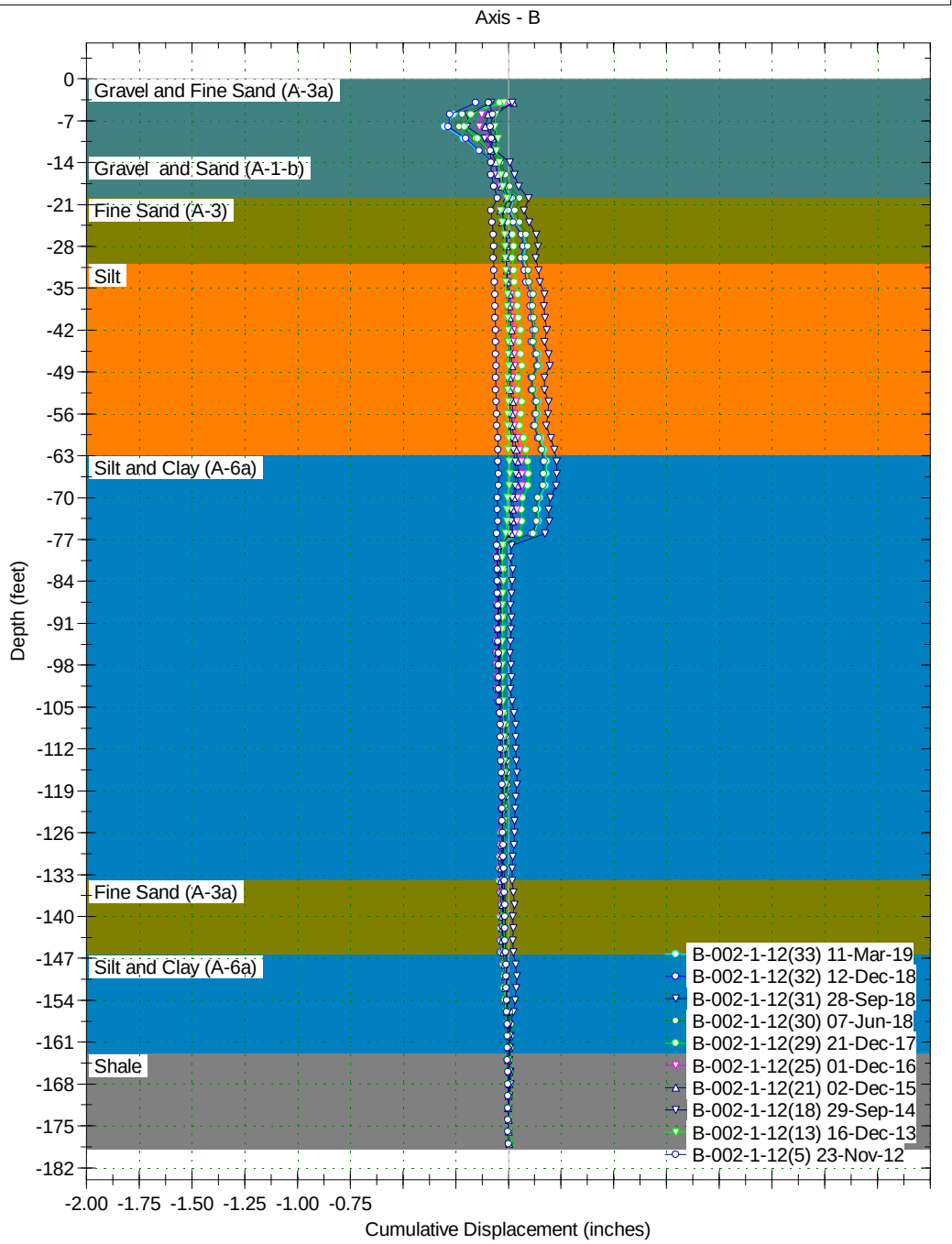
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-002-1-12
Project : Detroit Superior Bridge
Location :
Northing : 665999.036
Easting : 2186079.163
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 178.0 feet
A+ Groove Azimuth :
Base Reading : 2012 Jun 25 10:24
Applied Azimuth : 0.0 degrees





RST Instruments Ltd.

INCREMENTAL DISPLACEMENT

Inclinalysis v. 2.43.1

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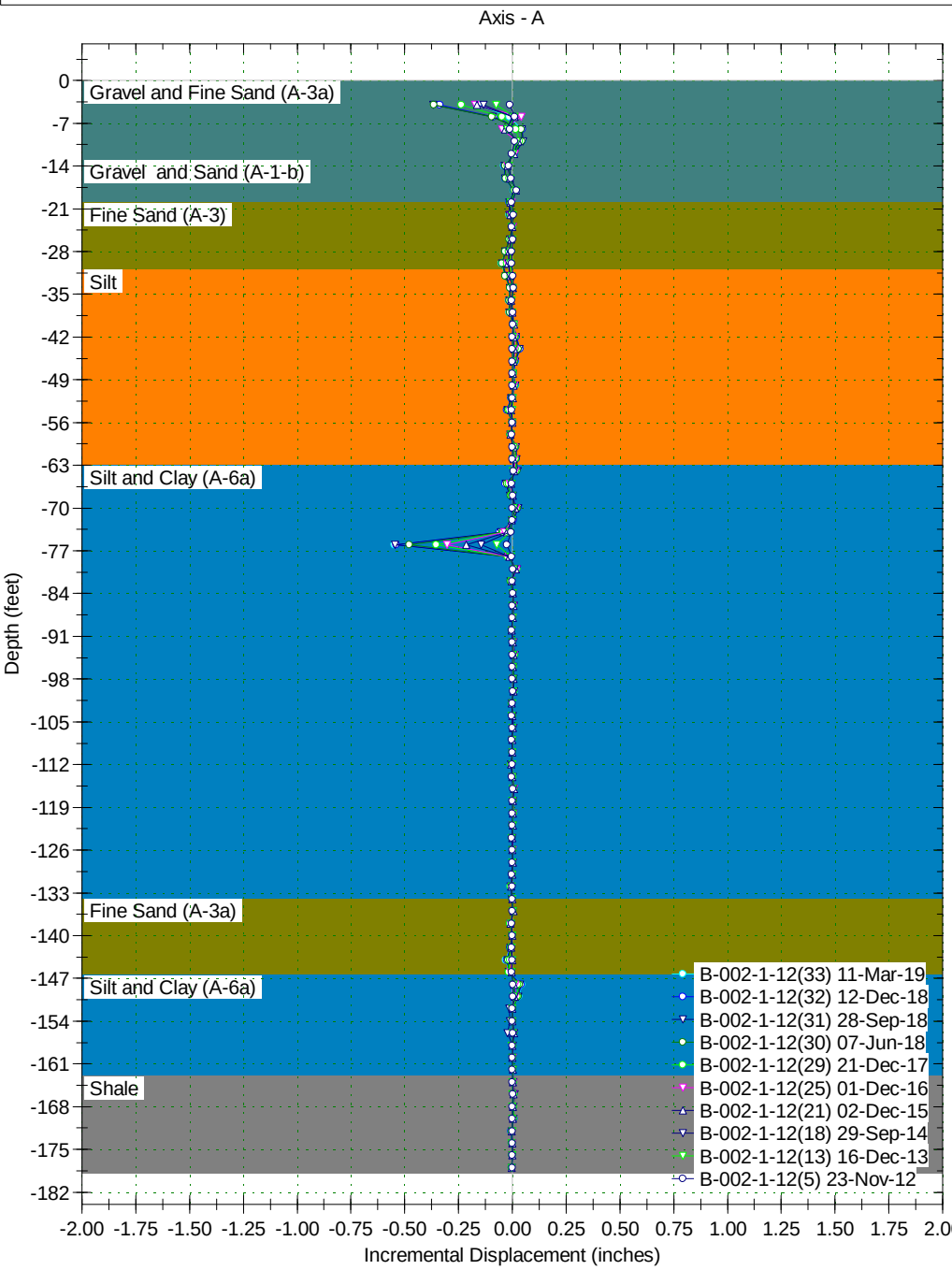
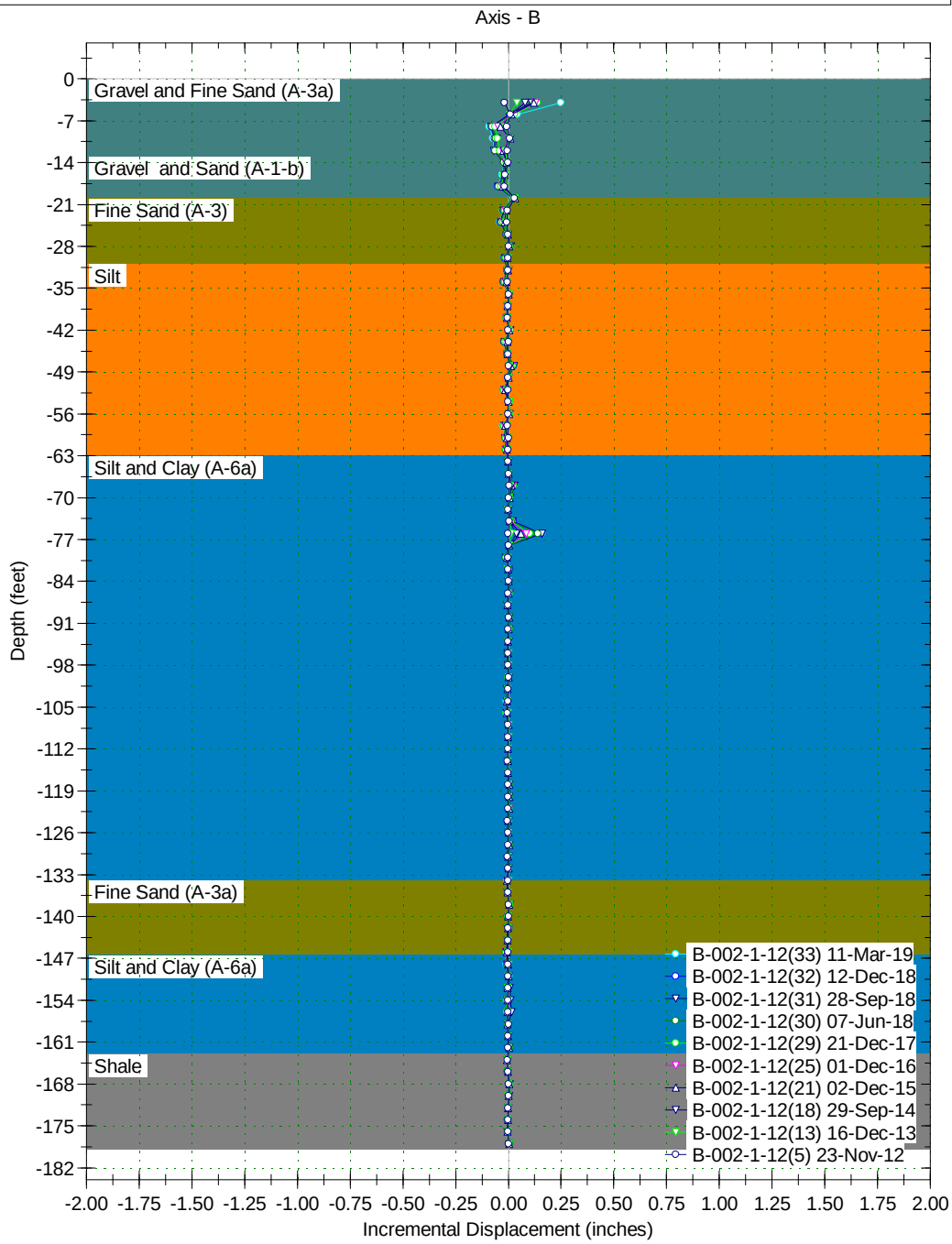




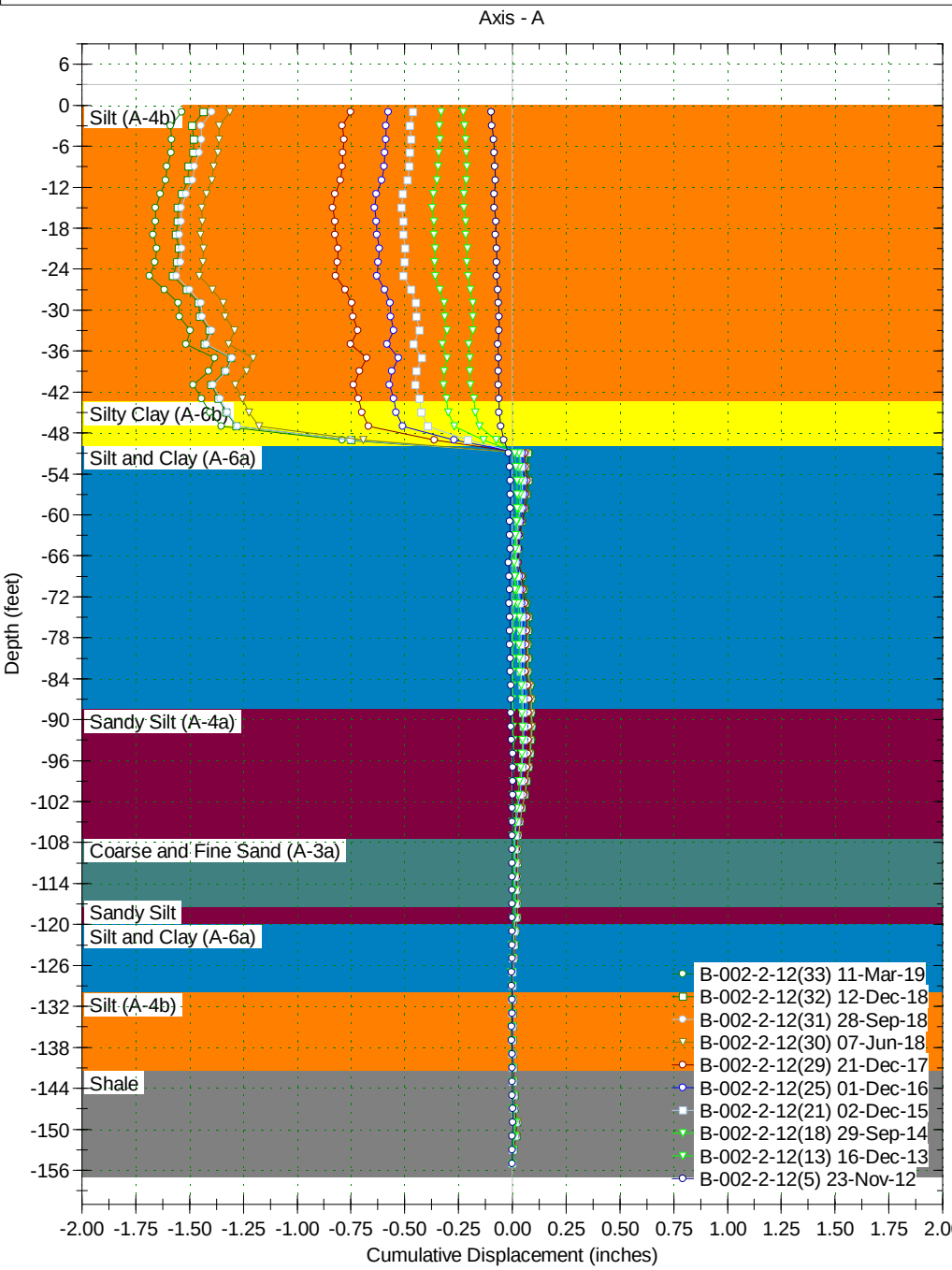
RST Instruments Ltd.

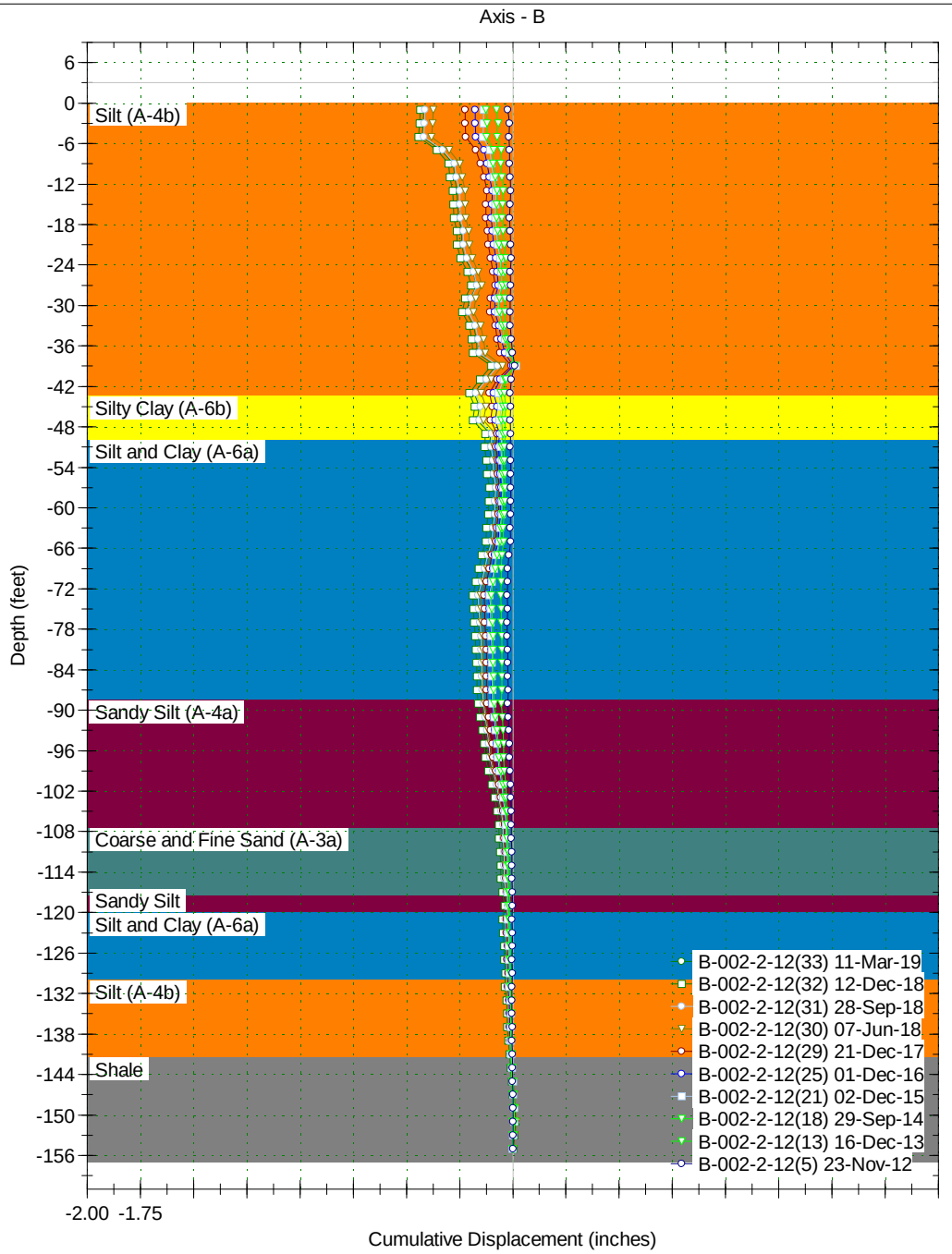
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-002-2-12
Project : Detroit Superior Bridge
Location :
Northing : 665959.660
Easting : 2186142.032
Collar :

Spiral Correction : N/A
Collar Elevation : 3.0 feet
Borehole Total Depth : 158.0 feet
A+ Groove Azimuth :
Base Reading : 2012 Jun 25 10:59
Applied Azimuth : 0.0 degrees





RST Instruments Ltd.

INCREMENTAL DISPLACEMENT

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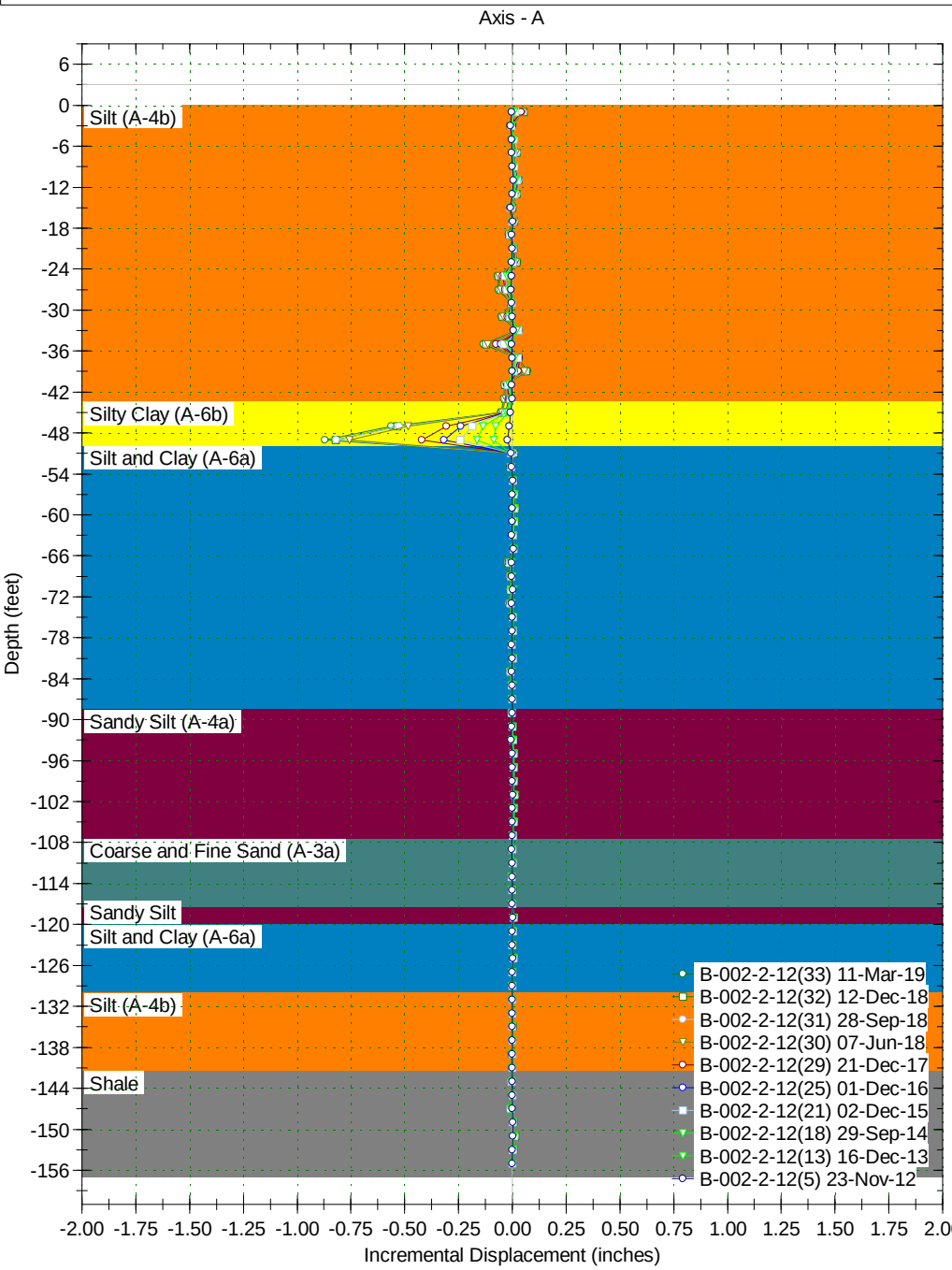
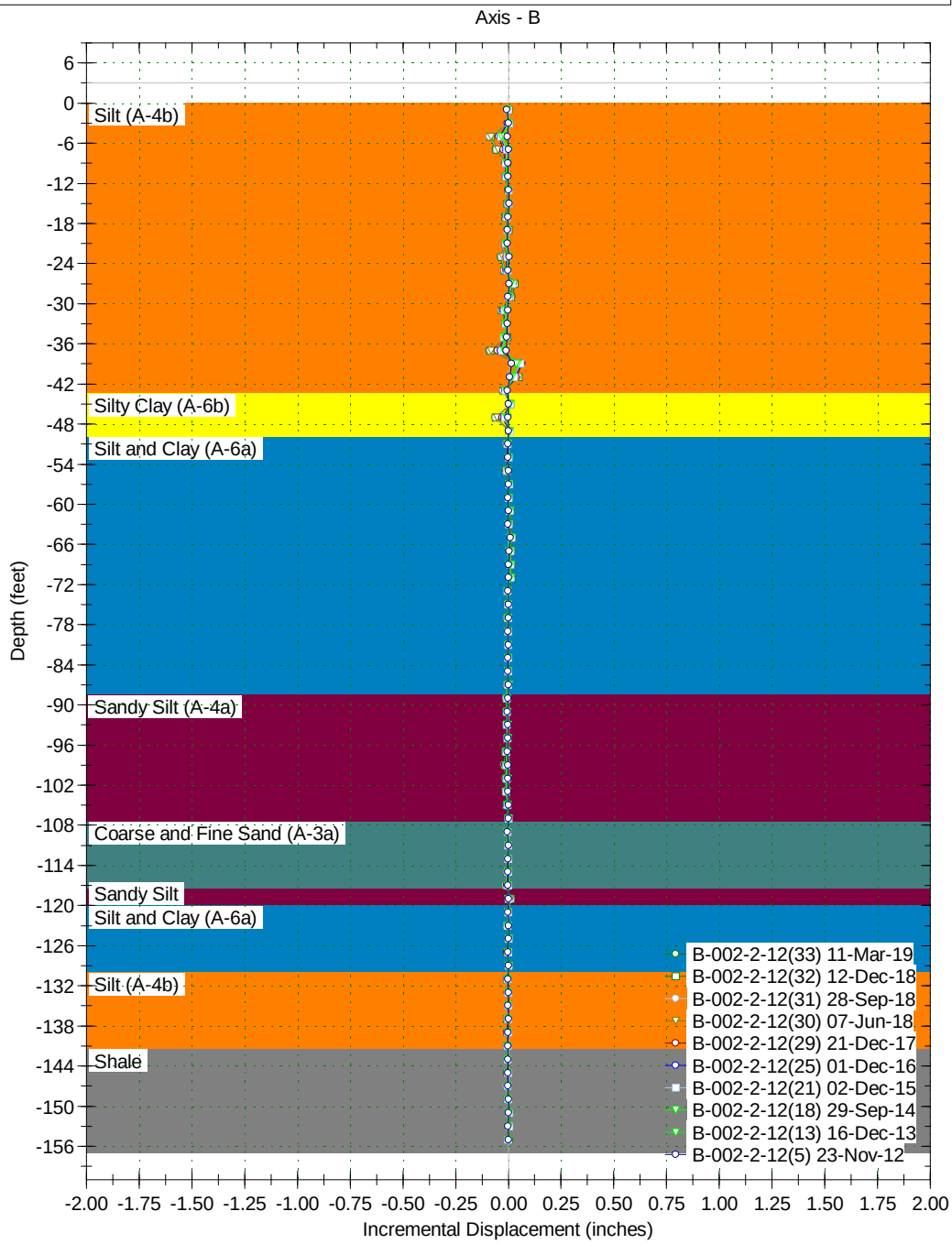




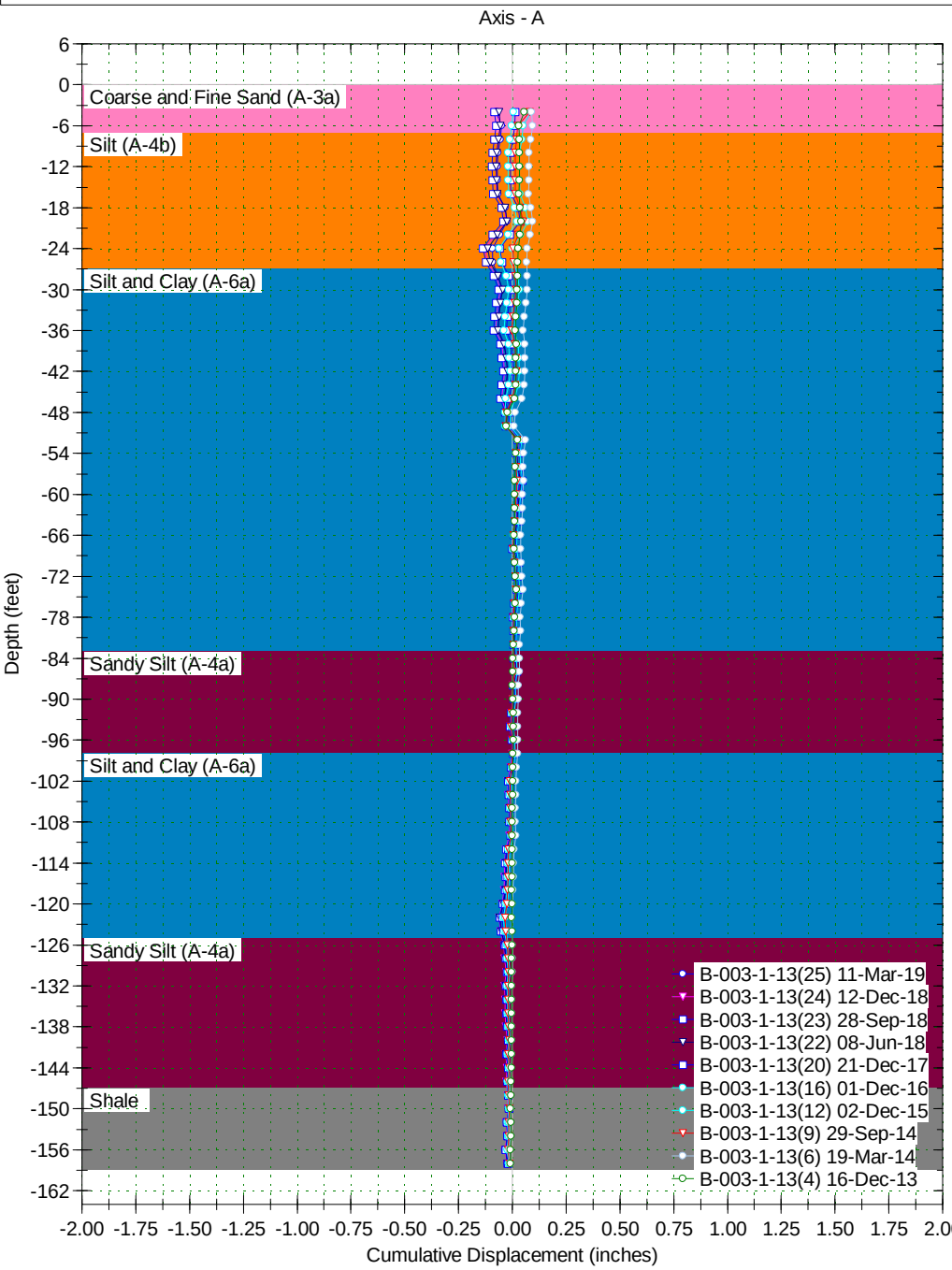
RST Instruments Ltd.

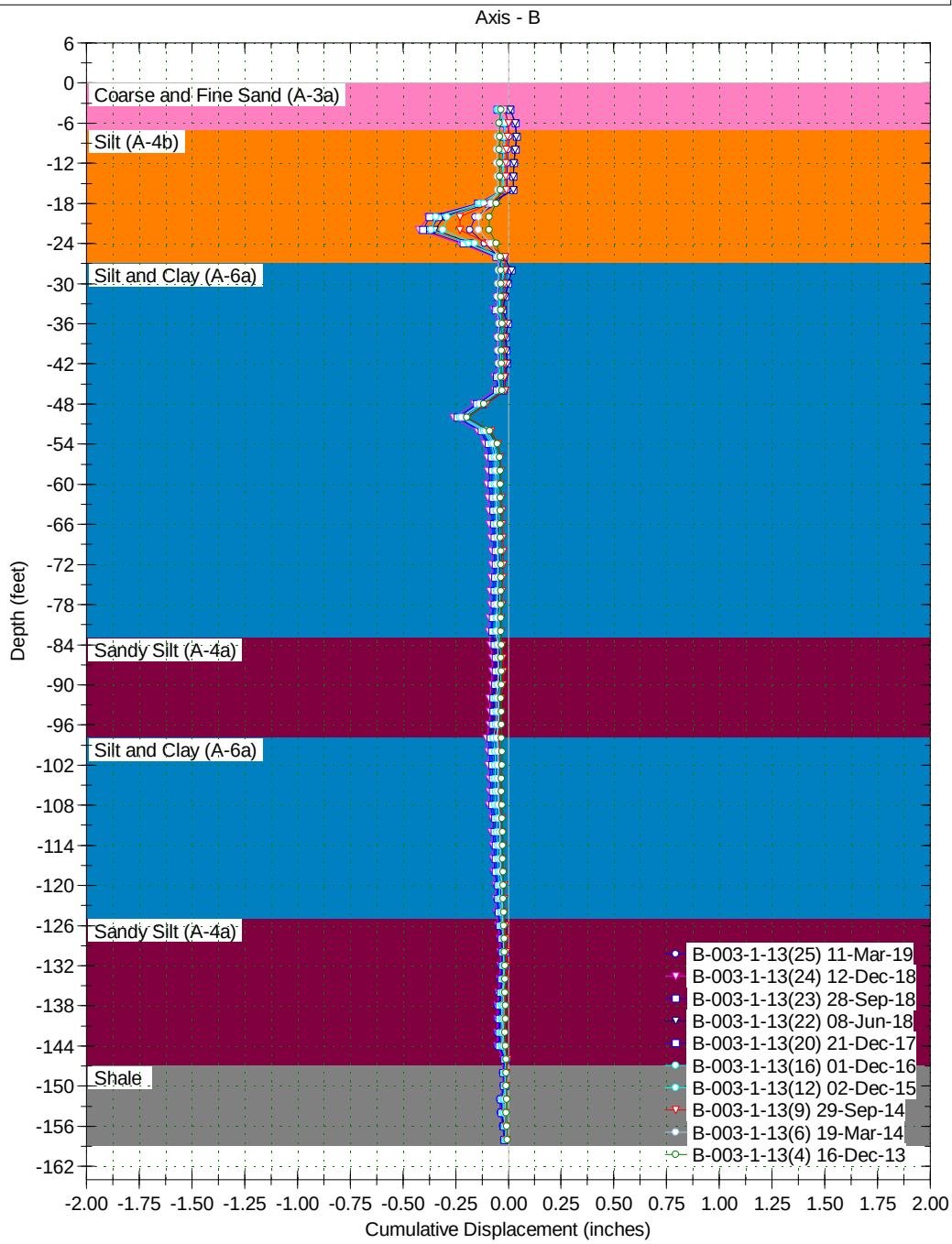
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-003-1-13
Project : Detroit Superior Bridge
Location :
Northing : 666168.638
Easting : 2186264.665
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 158.0 feet
A+ Groove Azimuth :
Base Reading : 2013 Oct 15 15:21
Applied Azimuth : 0.0 degrees





RST Instruments Ltd.

INCREMENTAL DISPLACEMENT

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Project : Detroit Superior Bridge
Location :
Northing : 666168.638
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A+ Groove Azimuth :
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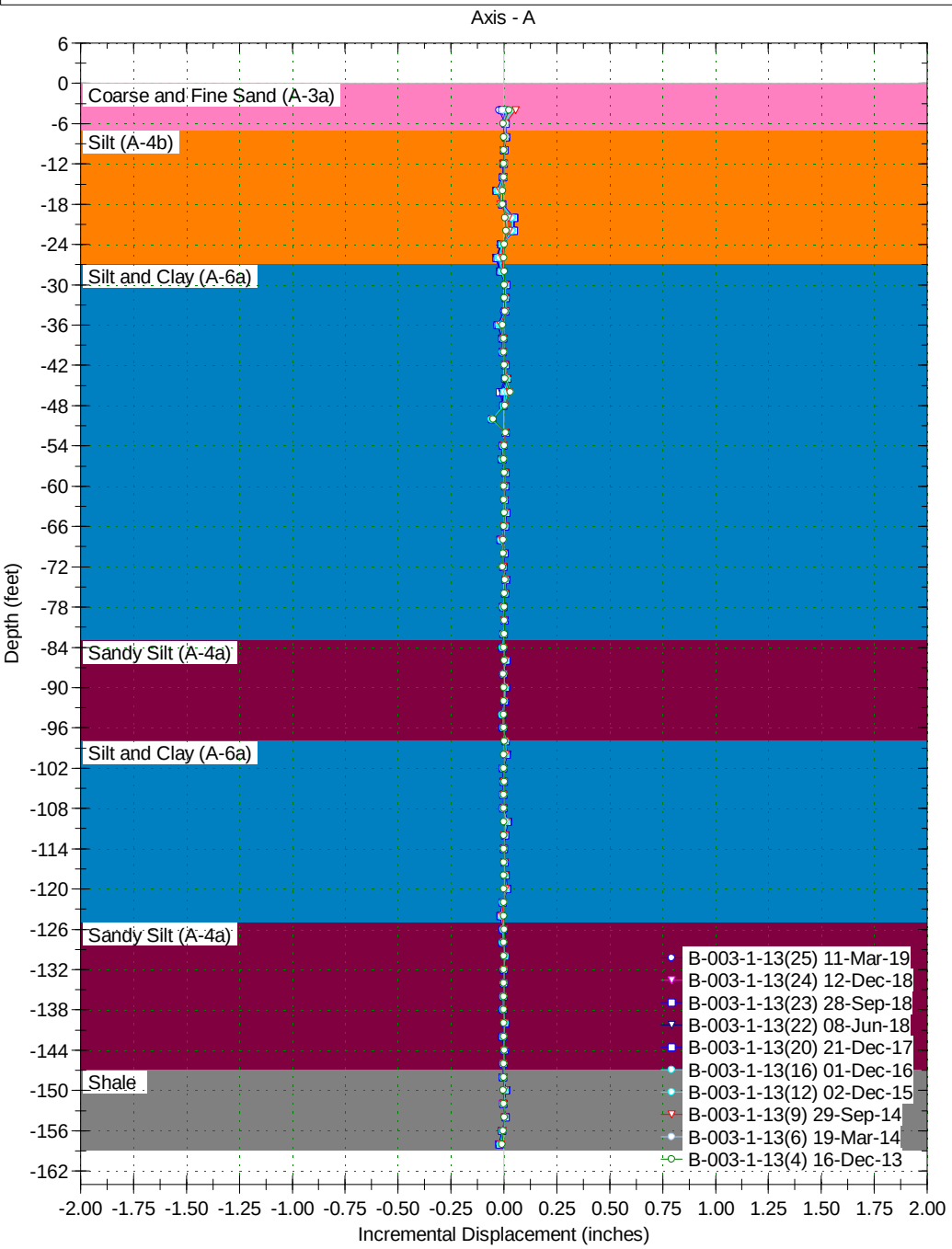
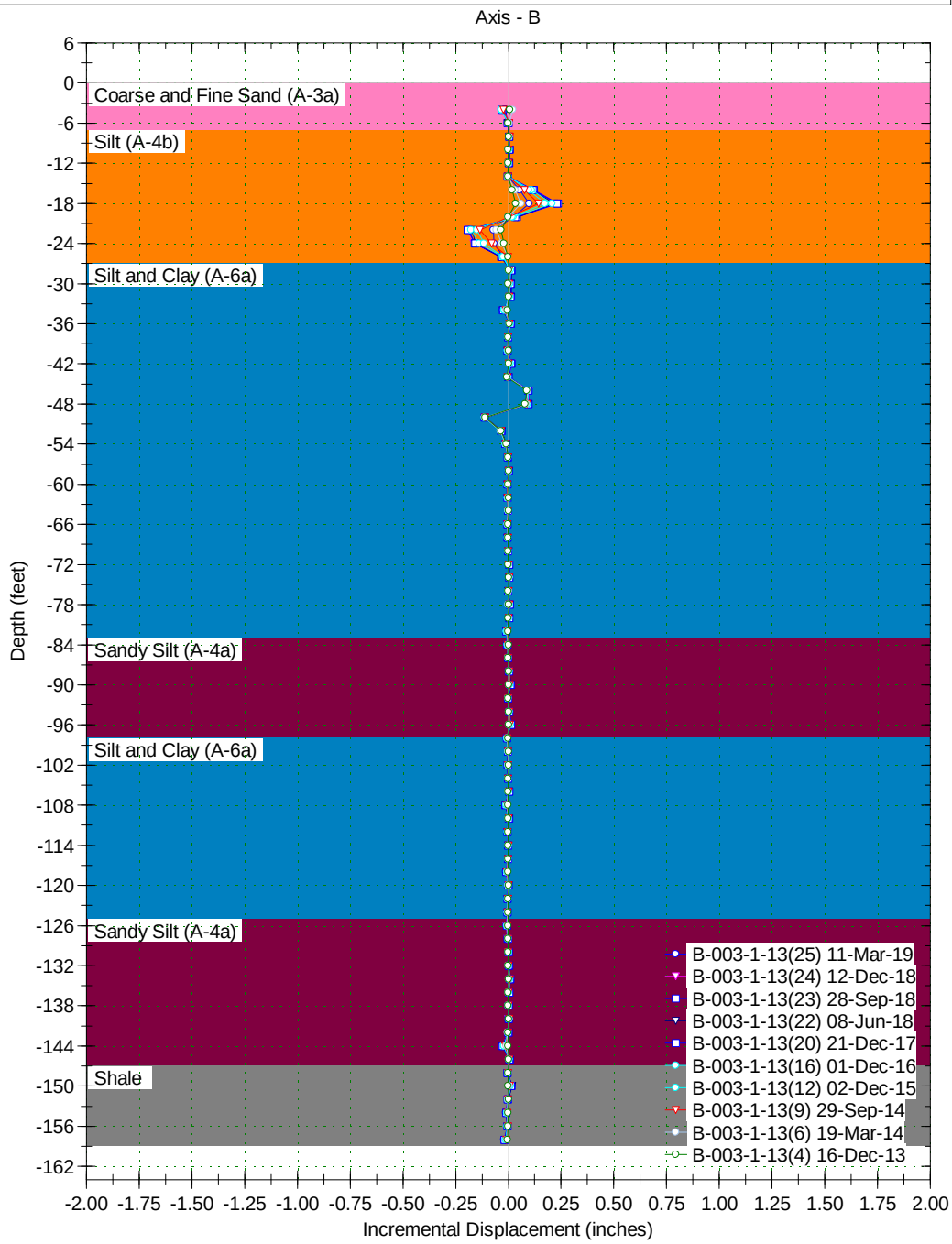
Applied Azimuth : 0.0 degrees





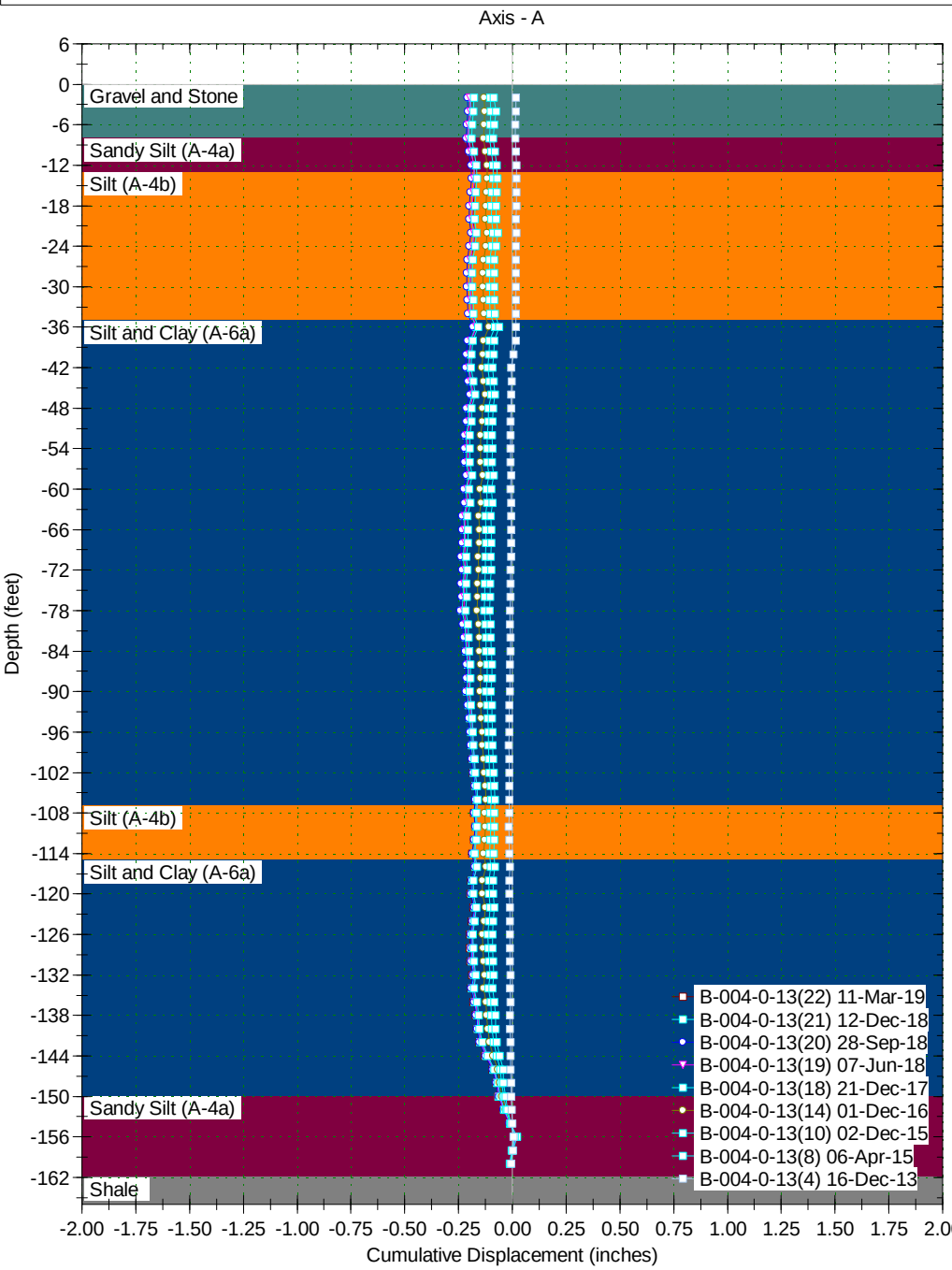
RST Instruments Ltd.

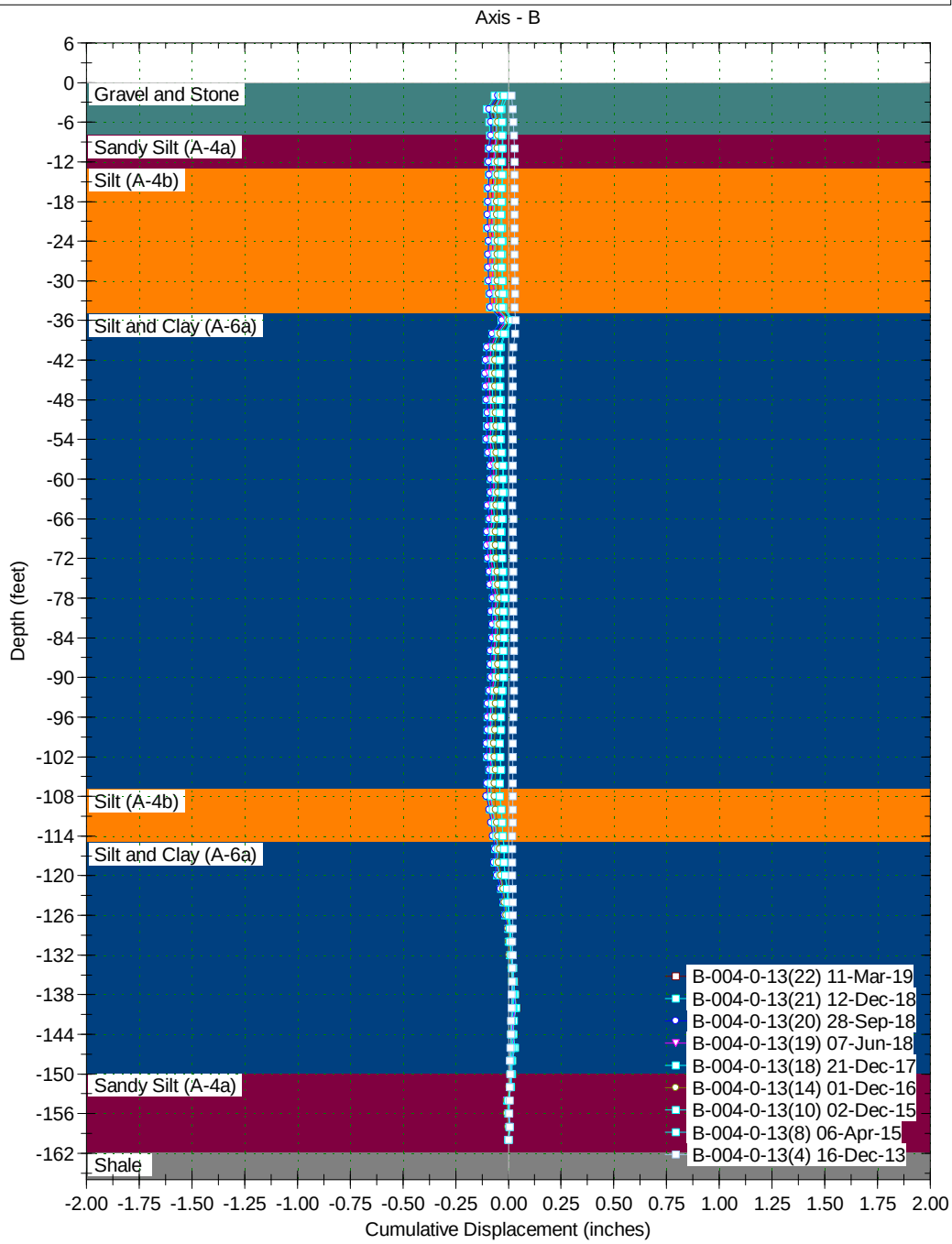
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-004-0-13
Project : Detroit Superior Bridge
Location :
Northing : 666364.951
Easting : 2186300.732
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 160.0 feet
A+ Groove Azimuth :
Base Reading : 2013 Oct 15 16:29
Applied Azimuth : 0.0 degrees





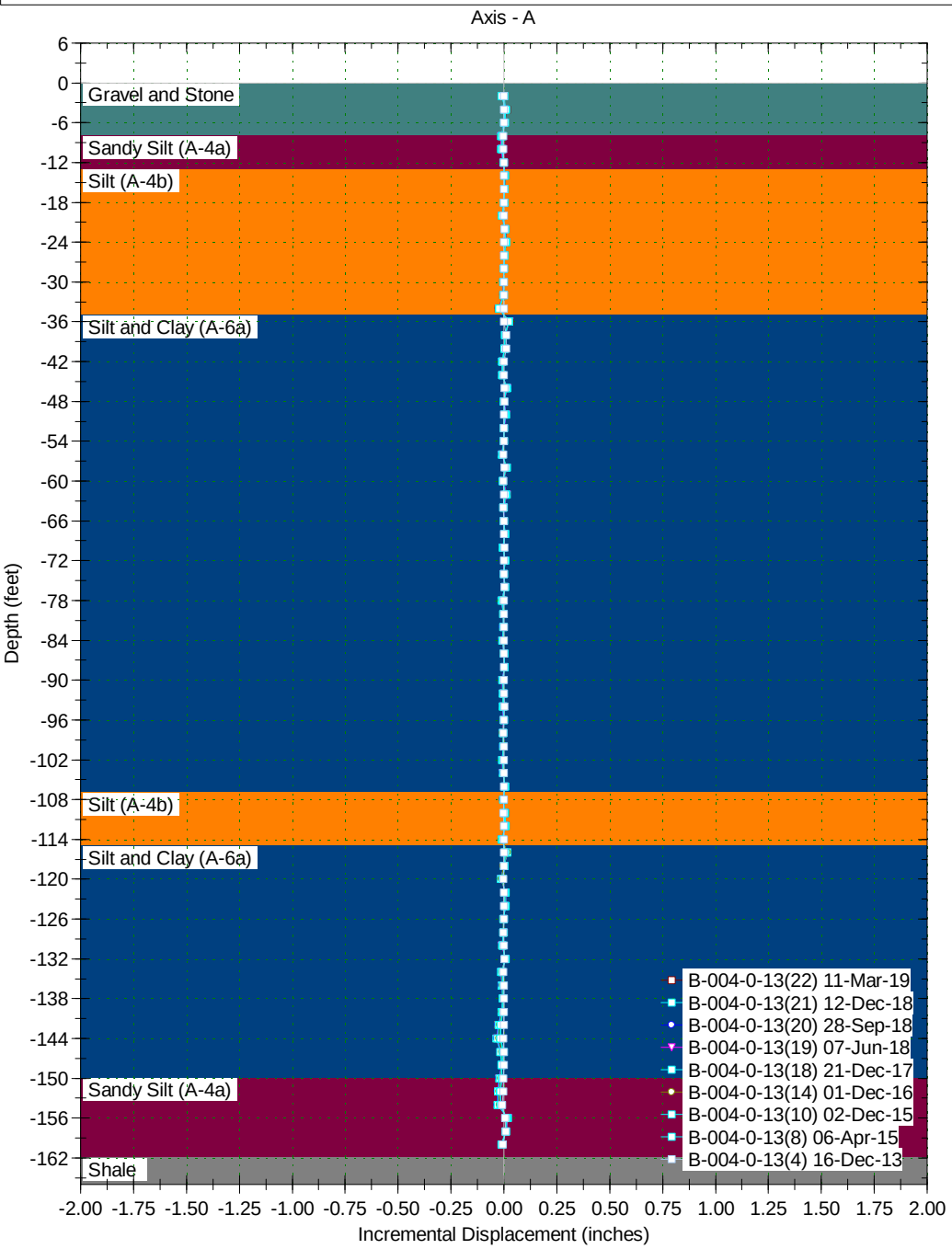
RST Instruments Ltd.

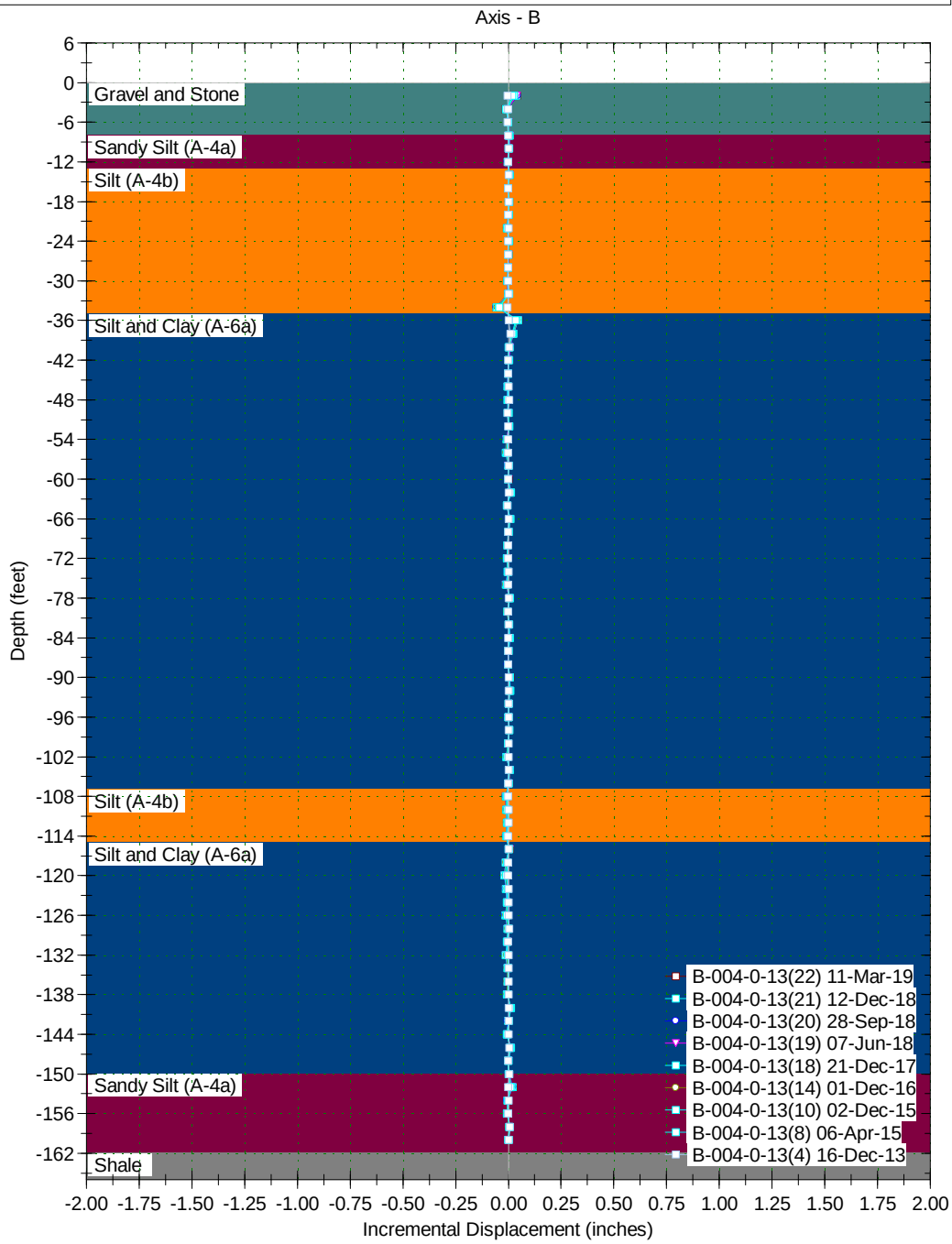
INCREMENTAL DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-004-0-13
Project : Detroit Superior Bridge
Location :
Northing : 666364.951
Easting : 2186300.732
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 160.0 feet
A+ Groove Azimuth :
Base Reading : 2013 Oct 15 16:29
Applied Azimuth : 0.0 degrees





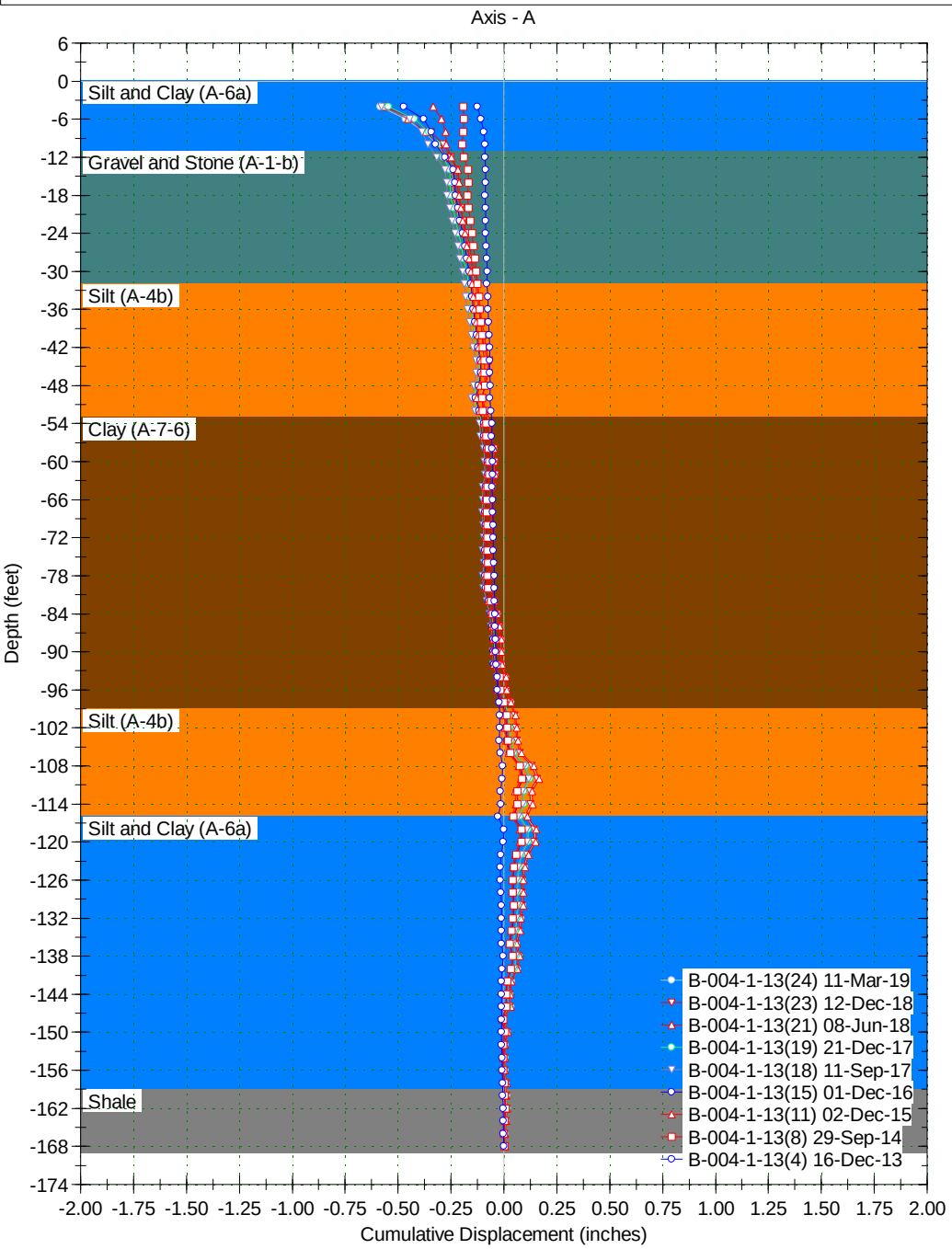
RST Instruments Ltd.

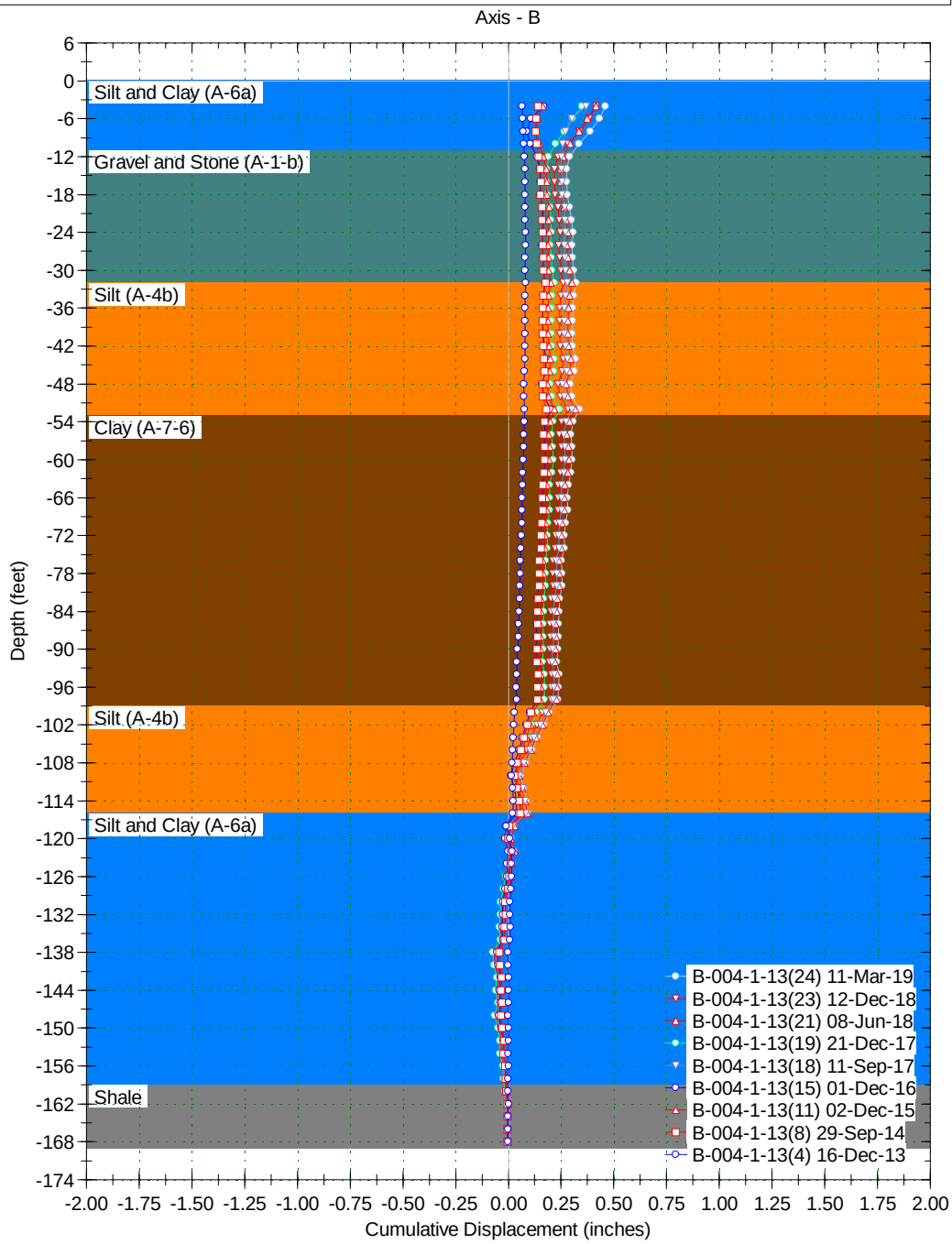
CUMULATIVE DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-004-1-13
Project : Detroit Superior Bridge
Location :
Northing : 666282.939
Easting : 2186374.016
Collar :

Spiral Correction : N/A
Collar Elevation : 0.0 feet
Borehole Total Depth : 168.0 feet
A+ Groove Azimuth :
Base Reading : 2013 Oct 15 15:53
Applied Azimuth : 0.0 degrees





RST Instruments Ltd.

INCREMENTAL DISPLACEMENT

Inclinalysis v. 2.43.1

Borehole : B-004-1-13
Project : Detroit Superior Bridge
Location :
Northing : 666282.939
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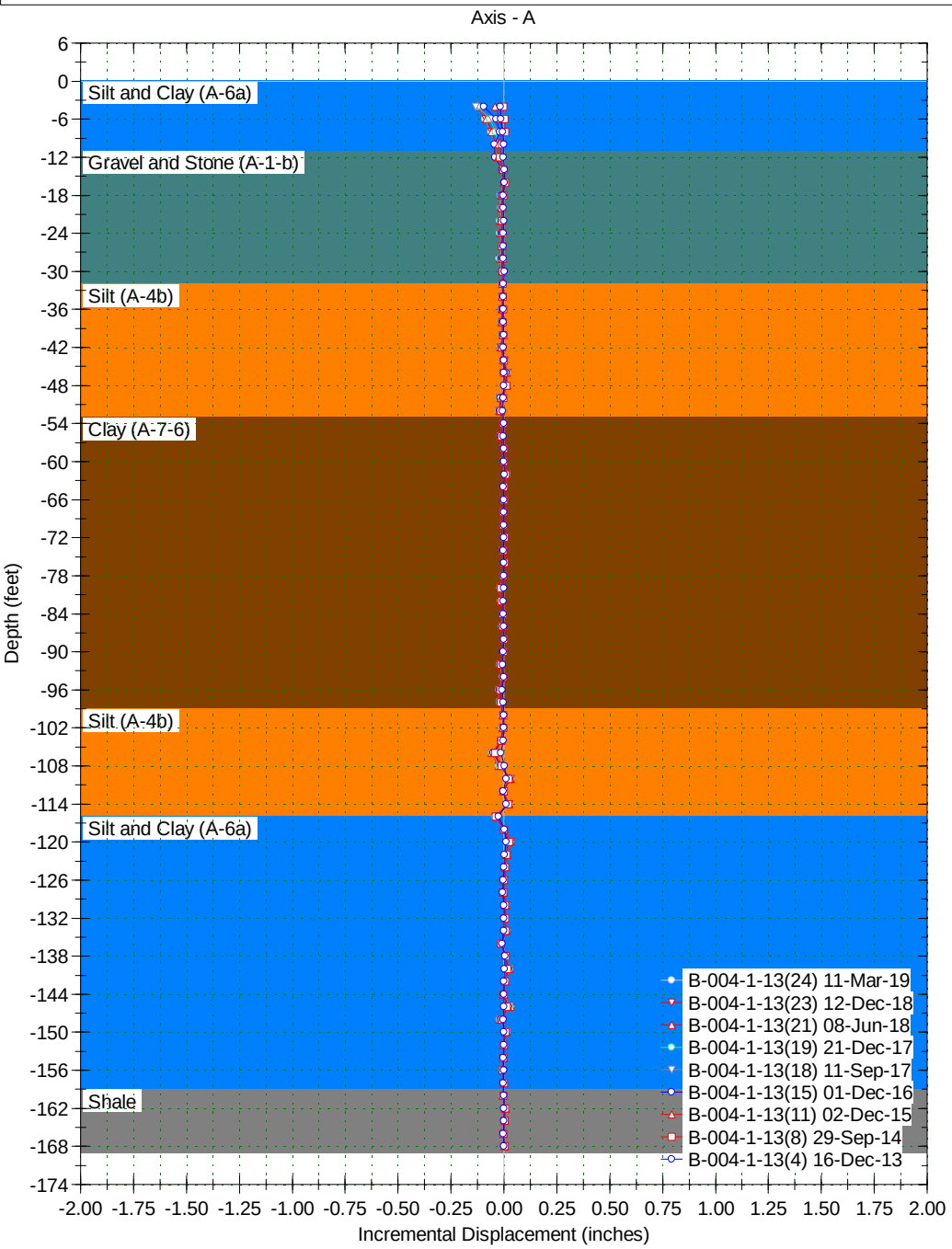
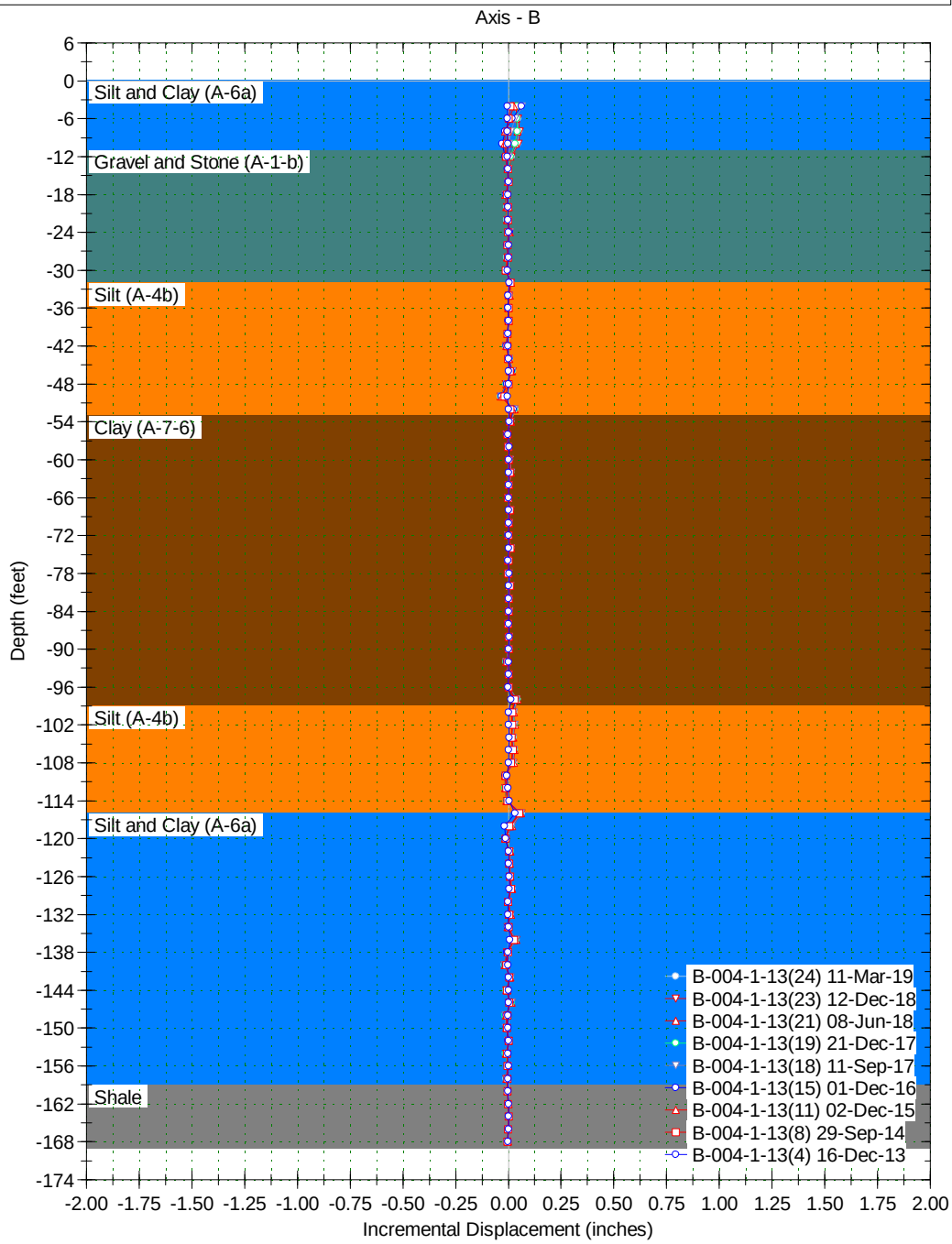
Applied Azimuth : 0.0 degrees





APPENDIX B

WATER SAMPLING

TEST RESULTS

Northeast Ohio Regional Sewer District
Protecting Your Health and Environment

TO:	Doug Lopata Manager of Design	DATE:	June 4, 2015
FROM:	Seth Hothem Supervisor of Environmental Assessment	RE:	Sampling at West Side Station and WR-17a

On May 27, 2015, Water Quality and Industrial Surveillance personnel collected samples from two stairways located in the former West Side Station (Figure 1). Samples were also collected from the first manhole downstream of the building, regulator WR-17a (no longer active), and a catch basin adjacent to WR-17a (Figure 2). The purpose of the sampling was to determine the origin of the water within the subway station and, if possible, a flow path once it exited the building.

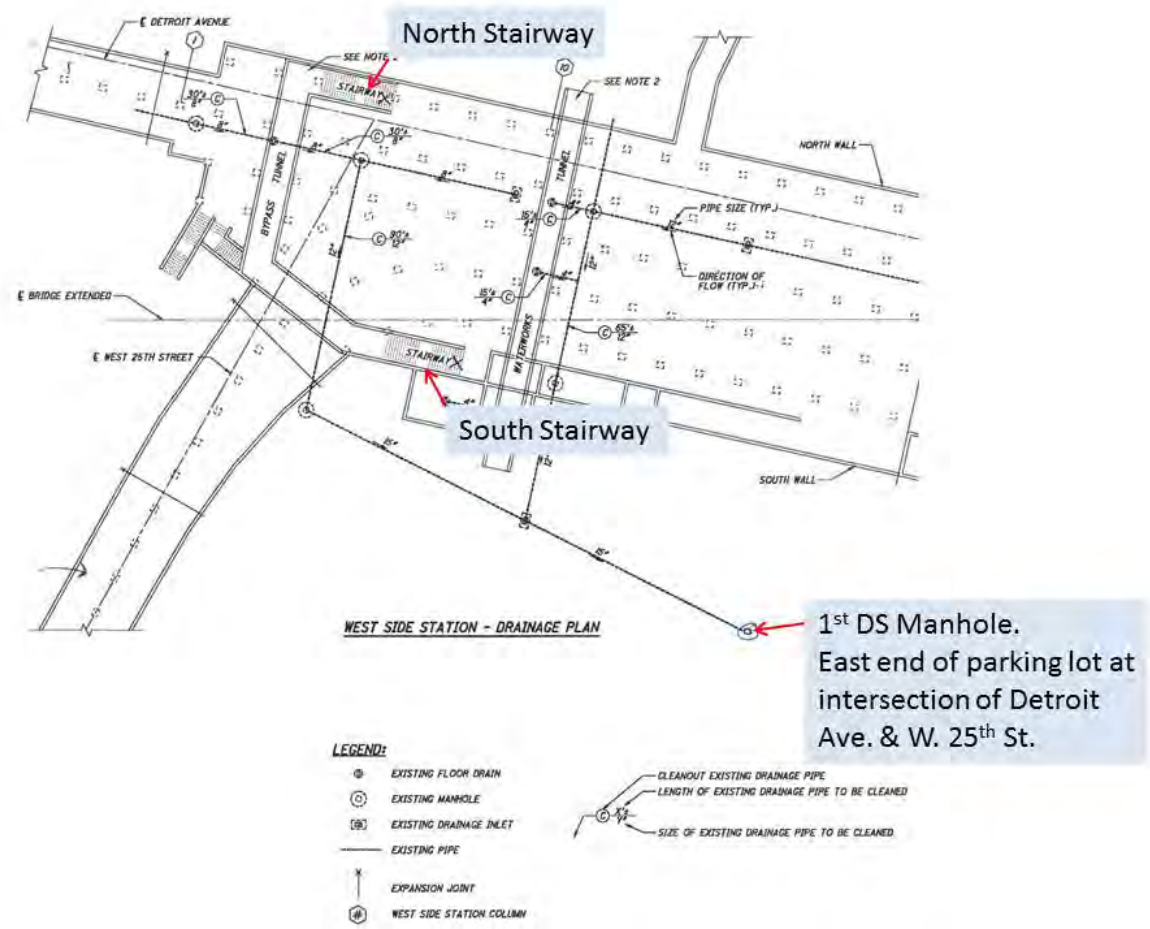


Figure 1. Sampling locations within West Side Station

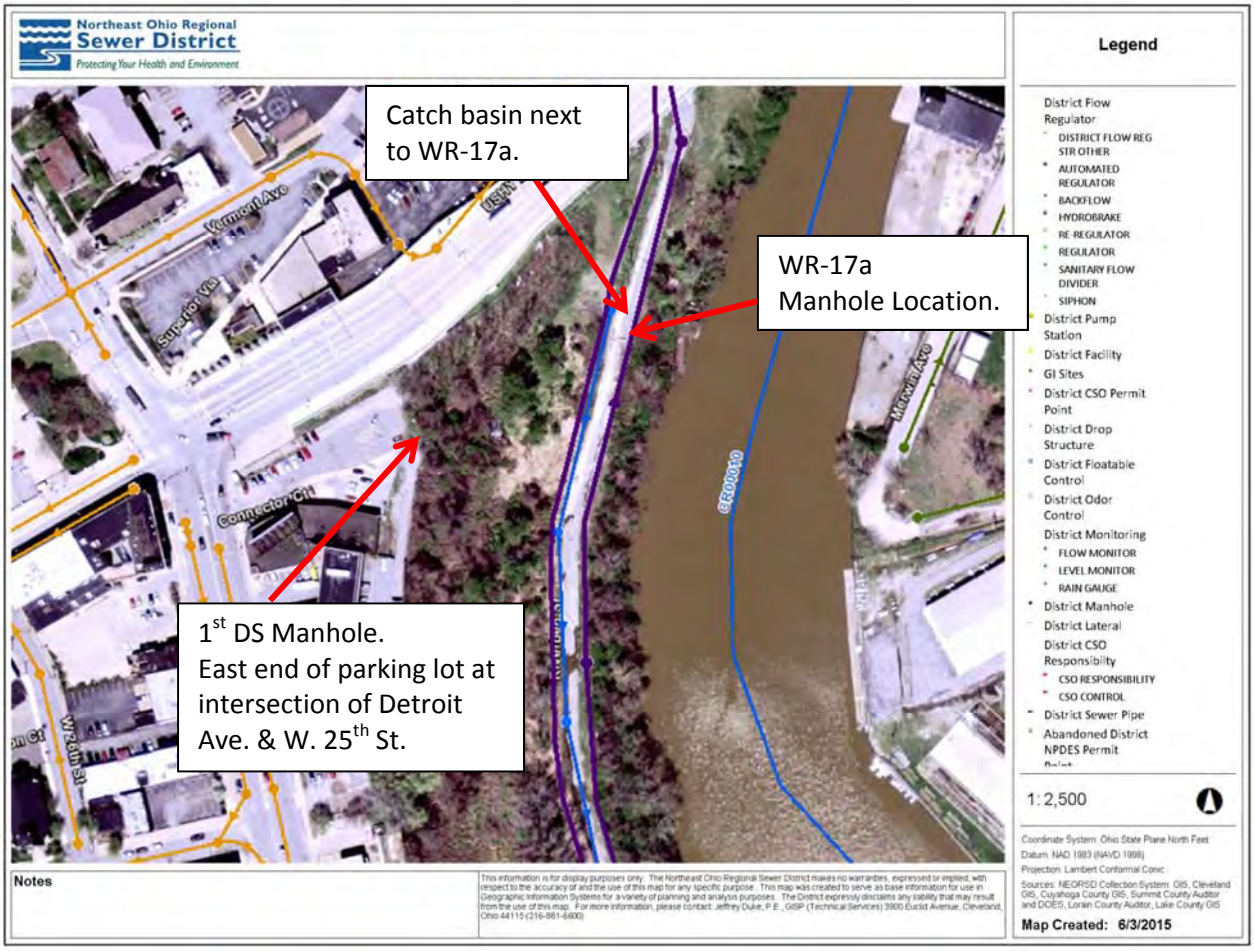


Figure 2. Sampling locations downstream of West Side Station

The collected samples were analyzed for *E. coli*, total chlorine residual, fluoride and some metals (Table 1). The levels of the first three parameters in the samples collected from the station and the first downstream manhole were relatively low. The results from the metals data were inconclusive as to the origin of the water. Although lead, copper, and zinc were relatively high in the stairways, this may have been due to the pipes that were submerged under the water there. Based on the other parameters that were measured, however, the most likely source of the water at those locations is groundwater.

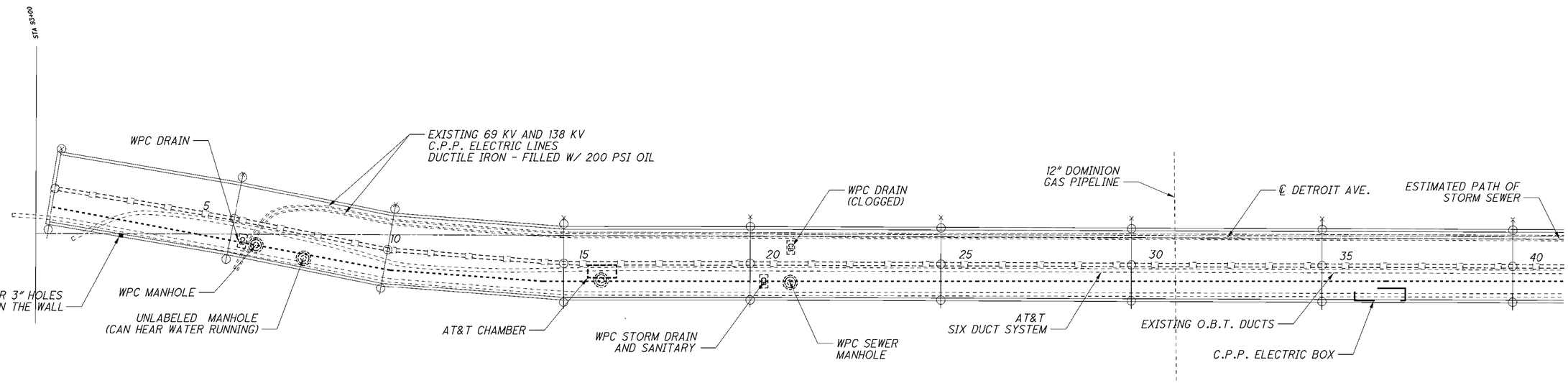
The *E. coli* densities in the samples collected at WR-17a and the adjacent catch basin were elevated, indicating that at least some of the flow present there was sanitary sewage. Because of this, it could not be determined if any of the flow from the station was flowing to WR-17a. Further investigation is needed to determine connectivity within that area.

Table 1. Sample Results						
Parameter	**Units**	**North Stairway**	**South Stairway**	**1st DS Manhole**	**WR-17a**	**Catch Basin next to WR-17a**
E. coli	MPN/100mL*	6	262	8	11,450	17,980
Total Chlorine Residual	mg/L	0.136	0.141	0.23	0.289	0.287
Fluoride	mg/L	0.18	0.11	0.11	0.1	0.08
Aluminum	ug/L	87.14	582.2	374.6	24.71	20.74
Arsenic	ug/L	<0.64	j1.238	j1.795	<0.64	<0.64
Calcium	ug/L	155,600	219,200	23,530	159,000	158,600
Hardness	mg/L CaCO3	494	656	66	504	502
Copper	ug/L	10.65	22.2	8.242	4.197	4.21
Iron	ug/L	510.8	725.9	455.4	442.9	428.6
Magnesium	ug/L	25,640	26,550	1745	25,920	25,850
Manganese	ug/L	15.14	42.87	12.41	80	85.61
Sodium	ug/L	402,000	394,000	34,680	449,400	452,600
Lead	ug/L	82.28	383.8	9.998	1.325	1.101
Zinc	ug/L	172.8	670.7	23.4	34.7	31.78

cc: Wilson Rivera

Appendix C

UTILITY MAPPING SHEETS



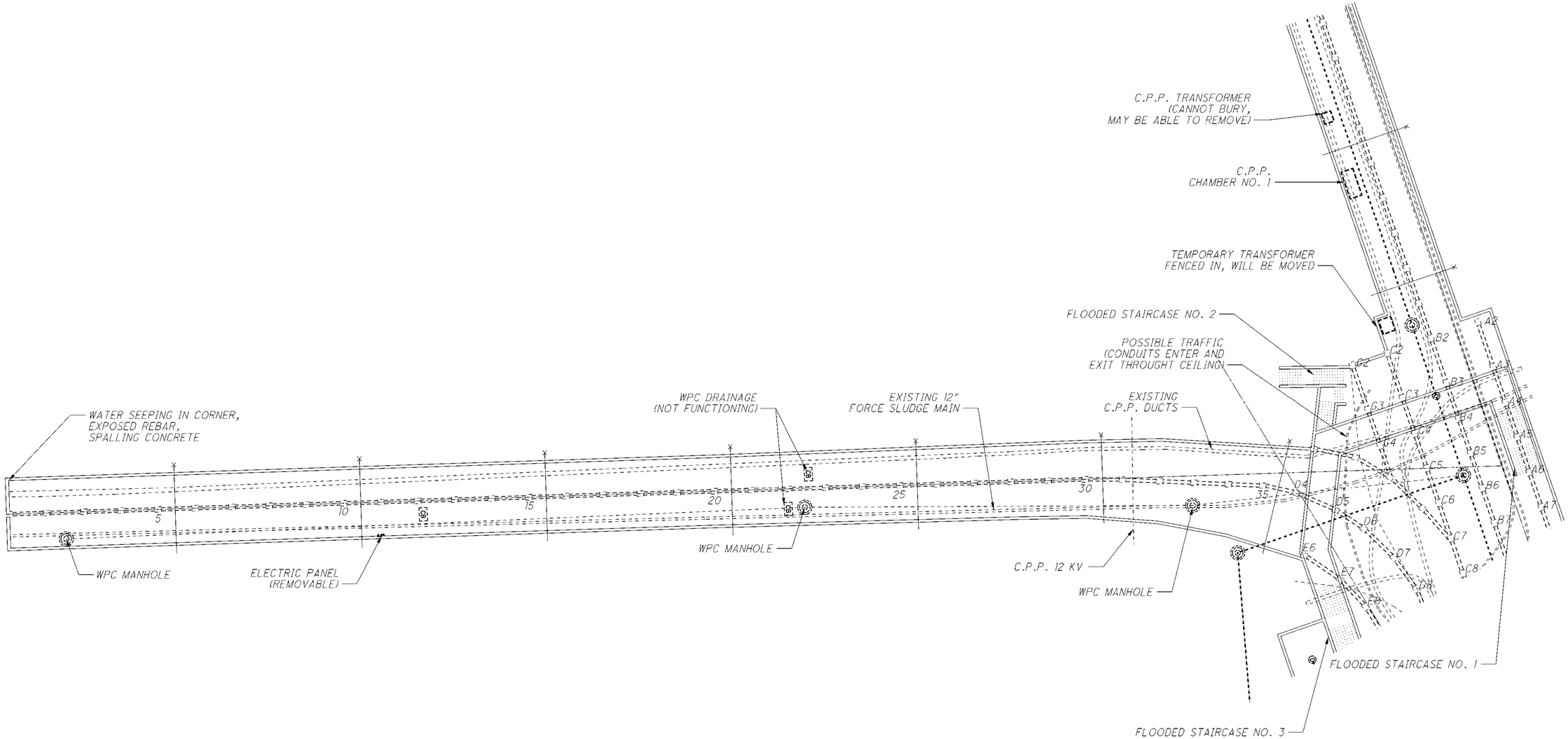
HORIZONTAL SCALE IN FEET
0 10 20 40

DRAWN JAY
CHECKED TLM

DETROIT AVENUE TUNNEL
UTILITY MAP

CUY-6-14.56

1/4



HORIZONTAL SCALE IN FEET

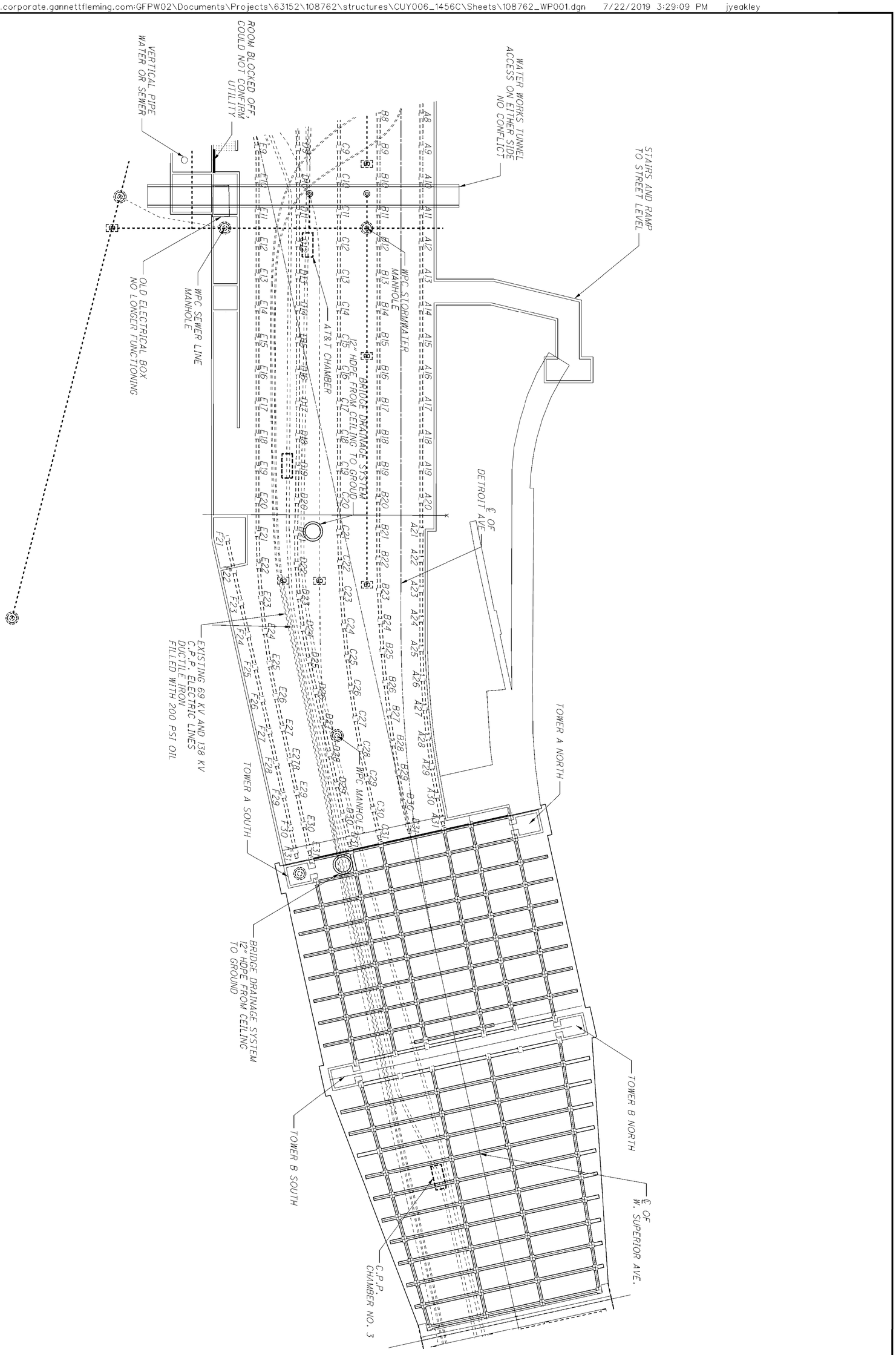
DRAWN JAY

CHECKED TLM

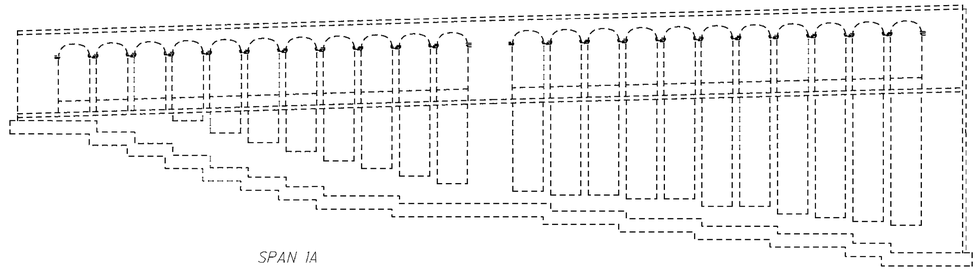
WEST 25th TUNNEL UTILITY MAP

CUY-6-14.56

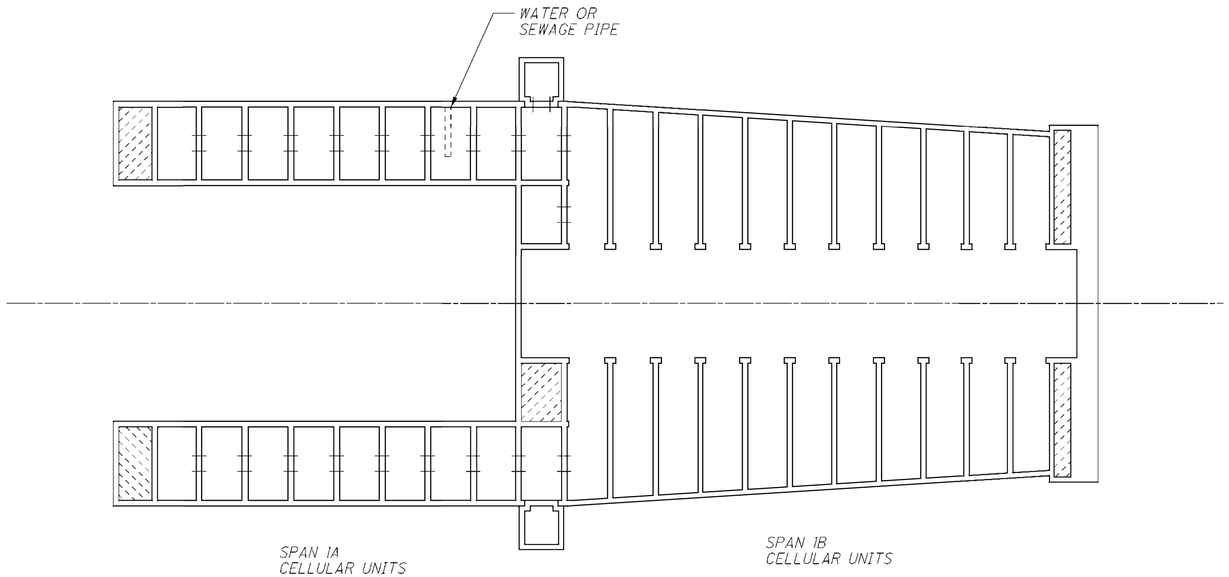
2/4



3/4	CUY-6-14.56	WEST ABUTMENT MAIN TUNNEL UTILITY MAP	DRAWN JAY / CHECKED TLM	0 10 20 40 HORIZONTAL SCALE IN FEET



LOWER CHAMBERS PROFILE
NOT TO SCALE



LOWER CHAMBERS PLAN
NOT TO SCALE

0 10 20 40
HORIZONTAL
SCALE IN FEET

DRAWN JAY
CHECKED TLM

SPAN 1A & 1B LOWER CHAMBERS UTILITY MAP

CUY-6-14.56

4/4

APPENDIX D

QUANTITY CALCULATIONS

Quantity Calculation

Detroit-Superior Bridge

CUY-6-14.56

OBJECTIVE:

The purpose of these calculations is to estimate the infilling volume for Detroit-Superior Bridge West Approach.

INPUT PARAMETERS:

1. Dimensions were determined using ODOT supplied drawings in Microstation.

ASSUMPTIONS:

1. Arches and columns were, conservatively, ignored and not accounted for in calculating the volume.
2. Height of the below chambers were, conservatively, assumed to be 35.0 feet tall.
3. Stairwells and interconnected areas were assumed to be 8.0 feet tall.
4. Overhangs and tunnels were assumed to be 20.0 feet tall.
5. The proposed tunnel to surround the C.P.P. 69 kv and 128 kv lines was also ignored.

RESULTS SUMMARY:

Using the existing plan sets provided by ODOT, the total quantity of infilling material is estimated to be 83,681 cubic yards.

If Span 1A and 1B are not filled, the total quantity of infilling material is reduced to 50,099 cubic yards.

Quantity Calculation

Detroit-Superior Bridge

CUY-6-14.56

Below SPAN 1A			
	Area (ft^2)	Height (ft.)	Volume (ft^3)
0S	148	2	315
1S	152	6	863
2S	150	8	1270
3S	152	11	1716
4S	150	14	2102
5S	150	16	2446
6S	152	19	2833
7S	149	21	3128
0N	148	2	315
1N	152	6	863
2N	146	8	1236
3N	152	11	1716
4N	150	14	2102
5N	150	16	2446
6N	152	19	2833
7N	149	21	3128
Total	2402		29312

Below SPAN 1B			
	Area (ft^2)	Height (ft.)	Volume (ft^3)
0S	152	35	5328
0N	152	35	5328
0C	121	35	4221
OPEN	8856	35	309961
TOWERS	66	35	2308
TOTAL	9347		327146

Above			
SPAN	Area (ft^2)	Height (ft.)	Volume (ft^3)
SPAN A & B	18560	21	389762

Flooded Stairwells				
Section	**ft^2**	**Est. Height (ft.)**	**Volume (ft^3)**	**Volume (yds^3)**
Interconnection	1255.6	8.0	10045	372
Staircase 1	245.0	8.0	980	36
Staircase 2	283.3	8.0	1133	42
Staircase 3	255.8	8.0	1023	38
		Total	**13181**	**488**

Section	Volume (ft^3)	Volume (yds^3)
Span 1A, 1B Chambers	356,458	13,202
Span 1A, 1B Above	389,762	14,436
Tunnel under Detroit Ave	342,456	12,684
Tunnel under W. 25th Street	266,353	9,865
Main Area	730,670	27,062
Overhangs (Span 1A & 1B)	160,513	5,945
Flooded Stairwells	13,181	488
Total Filling Volume	**2,259,393**	**83,681**

Quantity Calculation without SPAN 1A & 1B

Detroit-Superior Bridge

CUY-6-14.56

Flooded Stairwells				
Section	**ft^2**	**Est. Height (ft.)**	**Volume (ft^3)**	**Volume (yds^3)**
Interconnection	1255.6	8.0	10045	372
Staircase 1	245.0	8.0	980	36
Staircase 2	283.3	8.0	1133	42
Staircase 3	255.8	8.0	1023	38
		Total	**13181**	**488**

Section	**Volume (ft^3)**	**Volume (yds^3)**
Tunnel under Detroit Ave	342,456	12,684
Tunnel under W. 25th Street	266,353	9,865
Main Area	730,670	27,062
Flooded Stairwells	13,181	488
Total Filling Volume	**1,352,660**	**50,099**

APPENDIX E

COST ESTIMATE

Cost Estimate

Detroit-Superior Bridge

CUY-6-14.56

Project Number 63152.12-8

OBJECTIVE:

The purpose of the cost estimate is to quanitfy and compare each method of infilling and determine the amount and total cost of micropiles.

INPUT PARAMETERS:

1. Cost is based on previously calculated volumes for infilling quantities.

ASSUMPTIONS:

1. 240,000 pounds is the working load per micropile
2. Average Density of flowable fill is 150 pounds per cubic foot.
3. Average Density of low density cellular concrete is 40 pounds per cubic foot.
4. Overhangs were assumed to be 20.0 feet tall and are only included in SPAN 1A & 1B, the overhangs in the other areas are small and will be covered by the contingency.
5. The volume of the stairwells and interconnecting tunnel will not be underpinned due to access restrictions.

RESULTS SUMMARY:

Using the previously calculated quantities for the volume of infilling, the total cost for the flowable fill and micropiles would be $21,016,000.^{00}$ or $12,548,000.^{00}$ without Span 1A and Span 1B.

Using the previously calculated quantities for the volume of infilling, the total cost for the low density cellular concrete and micropiles would be $16,155,000.^{00}$ or $9,665,000.^{00}$ without Span 1A and Span 1B.

By: JAY 7/19
Chcked: TLM 7/19

Total Cost Estimate Calculation
Detroit-Superior Bridge
CUY-6-14.56

Section	Est. Height (ft.)	Area (ft^2)	Volume (ft^3)	Flowable Fill (lbs/ft^3)	Weight (lbs)	Assumed Capacity per Micropile (lbs)	No. of Micropiles	Cost / Micropile ($)	Cost ($)
Span 1A, 1B Chambers	Varies	11,749	356,458	150	53,468,693	240,000	223	10,000	$ 2,230,000.00
Span 1A, 1B Above	21	18,560	389,762	150	58,464,315	240,000	244	10,000	$ 2,440,000.00
Tunnel under Detroit Ave	20	17,123	342,456	150	51,368,445	240,000	215	10,000	$ 2,150,000.00
Tunnel under W. 25th Street	20	13,318	266,353	150	39,952,925	240,000	167	10,000	$ 1,670,000.00
Main Area	20	36,533	730,670	150	109,600,435	240,000	457	10,000	$ 4,570,000.00
Overhangs	20	8026	160,513	150	24,077,023	240,000	101	10,000	$ 1,010,000.00
Flooded Stairwells	8	2,040	13181	150	1,977,180	240,000	0	10,000	$ -
Total		107,348	2,259,393		338,909,017		1,407		$ 14,070,000.00

Typical C-C Spacing of Micropile 9 ft

Total volume (ft^3)	2,259,393
Total Volume (yd^3)	83,682
Flowable Fill cost per ft^3	$83.00
Total cost of flowable fill	$ 6,946,000.00

Total cost of Material and Micropiles **$21,016,000.00**

By: JAY 7/19
Chcked: TLM 7/19

Cost Estimate Calculation without SPAN 1A & 1B
Detroit-Superior Bridge
CUY-6-14.56

Section	Est. Height (ft.)	Area (ft^2)	Volume (ft^3)	Flowable Fill (lbs/ft^3)	Weight (lbs)	Assumed Capacity per Micropile (lbs)	No. of Micropiles	Cost / Micropile ($)	Cost ($)
Tunnel under Detroit Ave	20	17,123	342,456	150	51,368,445	240,000	215	10,000	$ 2,150,000.00
Tunnel under W. 25th Street	20	13,318	266,353	150	39,952,925	240,000	167	10,000	$ 1,670,000.00
Main Area	20	36,533	730,670	150	109,600,435	240,000	457	10,000	$ 4,570,000.00
Flooded Stairwells	8	2,040	13181	150	1,977,180	240,000	0	10,000	$ -
Total		69,014	1,352,660		202,898,985		839		$ 8,390,000.00

Typical C-C Spacing of Micropile 9 ft

Total volume (ft^3)	1,352,660
Total Volume (yd^3)	50,099
Flowable Fill cost per ft^3	$83.00
Total cost of flowable fill	$ 4,158,000.00

Total cost of Material and Micropiles **$ 12,548,000.00**

By: JAY 7/19
Chcked: TLM 7/19

Cost Estimate Calculation
Detroit-Superior Bridge
CUY-6-14.56

Section	Est. Height (ft.)	Area (ft^2)	Volume (ft^3)	Low Density Cellular Concrete (lbs/ft^3)	Weight (lbs)	Assumed Capacity per Micropile (lbs)	No. of Micropiles	Cost / Micropile ($)	Cost ($)
Span 1A, 1B Chambers	Varies	11,749	356,458	40	14,258,318	240,000	60	10,000	$ 600,000.00
Span 1A, 1B Above	21	18,560	389,762	40	15,590,484	240,000	65	10,000	$ 650,000.00
Tunnel under Detroit Ave	20	17,123	342,456	40	13,698,252	240,000	58	10,000	$ 580,000.00
Tunnel under W. 25th Street	20	13,318	266,353	40	10,654,113	240,000	45	10,000	$ 450,000.00
Main Area	20	36,533	730,670	40	29,226,783	240,000	122	10,000	$ 1,220,000.00
Overhangs	20	8026	160,513	40	6,420,540	240,000	27	10,000	$ 270,000.00
Flooded Stairwells	8	2,040	13181	70	922,684	240,000	0	10,000	$ -
Total		107,348	2,259,393		90,771,174		377		$ 3,770,000.00

Typical C-C Spacing of Micropile 17 ft

Total volume (ft^3)	2,259,393
Total Volume (yd^3)	83,682
Low Desity Concrete cost per ft^3	$148.00
Total cost of LDCC	$ 12,385,000.00

Total cost of Material and Micropiles **$16,155,000.00**

By: JAY 7/19
Chcked: TLM 7/19

Cost Estimate Calculation
Detroit-Superior Bridge
CUY-6-14.56

Section	Est. Height (ft.)	Area (ft^2)	Volume (ft^3)	Low Density Cellular Concrete (lbs/ft^3)	Weight (lbs)	Assumed Capacity per Micropile (lbs)	No. of Micropiles	Cost / Micropile ($)	Cost ($)
Tunnel under Detroit Ave	20	17,123	342,456	40	13,698,252	240,000	58	10,000	$ 580,000.00
Tunnel under W. 25th Street	20	13,318	266,353	40	10,654,113	240,000	45	10,000	$ 450,000.00
Main Area	20	36,533	730,670	40	29,226,783	240,000	122	10,000	$ 1,220,000.00
Flooded Stairwells	8	2,040	13181	70	922,684	240,000	0	10,000	$ -
Total		69,014	1,352,660		54,501,832		225		$ 2,250,000.00

Typical C-C Spacing of Micropile 18 ft

Total volume (ft^3)		1,352,660
Total Volume (yd^3)		50,099
Low Desity Concrete cost per ft^3		$148.00
Total cost of LDCC	$	7,415,000.00

Total cost of Material and Micropiles **$ 9,665,000.00**

Summary of Cost Estimates Rounded up to the nearest $1K		
Infilling Material	**With Span 1A & 1B**	**Without Span 1A & 1B**
Flowable Fill	$ 21,016,000.00	$ 12,548,000.00
Low Density Cellular Concr	$ 16,155,000.00	$ 9,665,000.00

By: JAY 7/19

Chcked: TLM 7/19

Calc: VDT, 7/18/2019 *Check: EFD, 7/20/2019* *GF: 063152.TO12*

Approximate Quantities and Costs for Detroit Superior Bridge Repair

Assumes all current PID 99972 Repairs are made

Detroit Tunnel

			ceiling % major spalls (exp rebar) =	5%		
Length =	700		walls = 1' tall minor spalls, full length=	1		
Width =	25		floor = (couldn't see due to debris)	N/A		
# of columns	48		Additional columns needing repair =	5		
major spall cost =	$ 105,000.00	(Ceiling)	Typical Cost =	$ 120.00	per SF	
minor spall cost =	$ 140,000.00	(Walls)	Typical Cost =	$ 100.00	per SF	
Crack repair cost =			Typical Cost =	$ 100.00	per LF	
Column fix cost =	$ 40,000.00		Typical Cost =	$ 8,000.00	per column	
Total Cost =	$ 285,000.00					

W 25 st Tunnel

			ceiling % major spalls (exp rebar) =	25%		
Length =	500		walls = 1' tall minor spalls, full length=	1		
Width =	26		floor = (couldn't see due to debris)	N/A		
# of columns	35		columns needing repair =	3		
major spall cost =	$ 390,000.00	(Ceiling)				
minor spall cost =	$ 100,000.00	(Walls)				
Column fix cost =	$ 24,000.00					
Total Cost =	$ 515,000.00					

West Station

Plan Area =	38200		ceiling % major spalls (exp rebar) =	20%		
# of Columns =	162		columns needing repair =	7		
flooded walk area =	2000					
major spall cost =	$ 916,800.00	(Ceiling)				
Column fix cost =	$ 56,000.00					
Dewater cost =	$ 20,000.00	(Ped Walkway)				
Walkway Fill =	$ 100,000.00	(Ped Walkway)				
Total Cost =	$ 1,095,000.00					

Spans 1A and 1B

plan area =	24300		Ceiling (includes ovhg minor spalls) =	5%		
# of columns =	106		Column Rehab (most in current rehab)=	5%		
minor spall cost =	$ 121,500.00	(Walls)				
Column fix cost =	$ 48,000.00					
Total Cost =	$ 170,000.00					

Deep chamber

avg wall height =	34.5		walls (minor deficiencies) =	5%		
avg wall length =	35.5		several significant cracks (North wall) LF=	100		
# of walls =	34		includes exterior wall portioned into ~35' pieces	No Distress Noted		
plan area =	15600		moderate spalling, major repairs =	0.1		
major spall cost =	$ 187,200.00	(Ceiling)				
minor spall cost =	$ 208,207.50	(Walls)				
Crack repair cost =	$ 10,000.00					
Total Cost =	$ 410,000.00					

Opinion of Total Rehab Cost= $ 2,500,000.00 *(2019 Costs, not inflated)*