

**FOUNDATION INVESTIGATION AND DESIGN REPORT
STATIC PILE LOAD TESTING
PIC RIVER BRIDGE REHABILITATION
HIGHWAY 17, MARATHON, ONTARIO
ASSIGNMENT NO. 6013-E-0012**

G.W.P. No. 6137-13-00 Site No. 48E-025

Geocres Number: 42D-32

Report to

**Ministry of Transportation Ontario
Northwestern Region**

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December 11, 2013
File: 15-64-29

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation involving static pile load tests, piezocone testing and vane shear strength testing at the Pic River Bridge site on Highway 17 about 8 km east of Marathon.

The existing Pic River Bridge carries Highway 17 over the Pic River valley on a three-span steel truss structure with a total length of 178.3 m. The valley is underlain by a thick deposit of soft to stiff varved clay, which overlies a deep silt deposit exhibiting artesian groundwater pressures. The bridge piers and abutments are supported on steel H-piles (12 BP 53 / HP 310 x 79) driven into the clay deposit, locally into the underlying silt stratum at the west abutment.

During bridge construction in 1959, static pile load tests were conducted on several test piles to confirm that the design capacity derived by static analysis was achieved. The load test results indicated that the design capacity of the piles was not achieved, and that driving piles to greater depths in attempts to increase the capacity actually resulted in a capacity decrease.

To avoid the need for significant changes to the bridge design, electro-osmotic treatment was applied to the foundation clay at the west pier, east pier and east abutment in an effort to increase the pile capacity and reduce the potential for foundation settlement. Subsequent pile load tests on treated foundations indicated a gain in pile capacity through treatment, and this gain was sustained during additional load tests conducted in subsequent years, including the latest test in 1992.

The purpose of the current work program was to carry out another set of static pile load tests on selected piles at the east and west piers, confirm whether the gain in pile capacity has been maintained, conduct piezocone and vane testing adjacent to the test piles to assess the current

condition of the foundation clay, evaluate the current geotechnical resistance of the pile foundations, and provide foundation recommendations for rehabilitation (deck replacement) of the existing bridge.

This work was authorized by MTO Northwest Region under Assignment No. 6013-E-0012.

In the preparation of this report, reference has been made to the following selected reference reports from Geocres and published papers:

1. Soil Conditions and Engineering Study, Proposed Big Pic River Bridge, Highway 17, Marathon, Ontario. Report submitted on Sept. 19, 1958 by Geocon Ltd. to Department of Highways, Ontario. Geocres No. 42D-7.
2. Pile Driving, Pile Loading and Piezometric Observations, Proposed Big Pic River Bridge, Highway 17, Marathon, Ontario. Report submitted on March 3, 1959 by Geocon Ltd to Department of Highways, Ontario. Geocres No. 42D-11.
3. MTO Pile Load and Extraction Tests, 1954-1992, Foundation Design Section, Report EM-48 Rev. 1993.
4. Paper entitled "First Application of Electro-Osmosis to Improve Friction Pile Capacity – Three Decades Later" by Victor Milligan, Golder Associates. Paper published in the 13th International Conference on Soil Mechanics and Foundation Engineering held in New Delhi, 1994.

2 SITE DESCRIPTION

The Pic River Bridge is located on Highway 17 approximately 8 km east of Marathon, Ontario. At present, the highway crosses the Pic River on a three-span through steel truss structure supported on two piers and two abutments. The span lengths are 48 m, 82.3 m and 48 m. The total length of the bridge is 178.3 m and the width is approximately 11.7 m. A snowmobile trail bridge exists to the north of the existing bridge.

The river channel at the bridge is approximately 67 m wide and 7.5 m deep. The river flows to the south and is relatively fast-flowing at this location. Rock fill erosion protection is visible above the river level in the lower parts of the approach embankments and valley slopes.

Photographs in Appendix A show the existing bridge structure and general nature of the site.

The river valley is underlain by an approximate 18 m thick deposit of soft to stiff varved clay, grading to stratified silt and then to silty fine sand at 70 to 80 m depth. The depth to bedrock is greater than 80 m and has not been determined. Artesian water pressure was encountered in the silt stratum.

3 INVESTIGATION PROCEDURES

3.1 Previous Investigation

A foundation investigation was carried out in April 2011 to determine the subsurface conditions along a proposed detour bridge alignment situated approximately 15 m to the south of the existing bridge. The fieldwork consisted of three boreholes drilled to depths of 26.5 to 46.3 m (Elev. 148.8 to 161.3) near the west pier, east pier and west abutment (designated Boreholes 11-01, 11-02 and 11-03, respectively). The Record of Borehole sheets, laboratory test results, and Borehole Locations and Soil Strata Drawing prepared for the initial detour alignment are presented in Appendix B.

In addition to the boreholes, piezocone penetration testing (CPTu) was carried out along the detour alignment, adjacent to each foundation unit. The locations of the piezocone tests are shown on the Borehole Locations and Soil Strata Drawing in Appendix B. The CPT plots provided by the piezocone contractor, ConeTec, are included in Appendix B.

The proposed detour was subsequently shifted away from this initial alignment.

3.2 Static Pile Load Tests

As part of the original foundation evaluation in 1959, a number of piles at each pier were isolated from the load bearing pile group by boxing out access portals in the pile cap to permit load testing during and after completion of electro-osmotic treatment of the foundations. A reaction beam was cast into the pile cap above each test pile to enable application of static loads on the piles. Subsequent to electro-osmotic treatment, static load testing of selected piles was carried out by MTO in 1961, 1968, 1971 and 1992 to confirm that the load capacity was sustained. The results of the load tests are available in MTO files and summarized in a paper published by V. Milligan (Reference No. 4).

The present scope of work involved static pile load tests conducted on three of the isolated piles, selected in consultation with MTO's Foundation Office:

- East Pier: Pile Nos. G-5 and E-16
- West Pier: Pile No E-2

The locations of the test piles within the pier pile groups are shown on Drawing 15-64-29-1 in Appendix C.

The static load test procedure was developed in discussion with MTO's Foundations Office and the procedure is attached in Appendix C. As indicated in the procedure, the piles were to be loaded to a maximum load of 800 kN and settlement of each pile was to be recorded at prescribed intervals under each load increment.

Geo-Foundations Contractors Inc. provided the pile load test set up, two 1,000 kN jacks, dial gauges and associated equipment. Thurber Engineering Ltd. recorded all load-settlement readings. The load test set-ups are shown in Geo-Foundations' Drawings G-13-24-SK1 and SK2 in Appendix C. Geo-Foundations provided the calibration charts for the jacks.

Photographs of the load test set-up are also presented in Appendix C. Four dial gauges were used for settlement measurement, one at each corner of the steel plate attached to the head of the pile. In addition, a fifth dial gauge was used to measure the deflection of the reaction beam. Further, a digital gauge was used to independently measure the settlements near one of the dial gauges.

3.3 Piezocone and Field Vane Testing

In addition to the pile load testing program, piezocone penetration testing and field vane testing were conducted within selected access portals in the pile cap. This testing was carried out to evaluate the current condition of the clay within the pile group and assess whether electro-osmosis had affected the clay between the piles in the group.

The piezocone penetration testing (CPT) was conducted at two locations within the east pier (CPT 13-F10-01 and 02 in pile access portal F10) and one location within the west pier (CPT 13-E16-03 in pile access portal E16). The locations are shown on Drawing 15-64-29-1 in Appendix C. The piezocones were pushed to a depth of 11.8 m.

One of the CPT tests at the east pier was pushed as close as possible to the pile (0.23 m from centre of the pile) while the second CPT test was pushed 0.56 m away from the pile in an effort to compare soil properties within and outside the zone of electro-osmotic treatment. At the west pier, the piezocone was pushed 0.3 m north of the test pile. Pore pressure dissipation tests were conducted at selected depths within the foundation clay.

Field vane testing employing the MTO N-vane was conducted at pile access portals F10 in the east pier and E16 in the west pier. The field vanes were conducted at approximately 0.75 m intervals within the foundation clay, to a maximum depth of 12 m.

4 RESULTS OF INVESTIGATION

4.1 Description of Subsurface Conditions

The subsurface conditions encountered in the boreholes previously drilled along the preliminary detour alignment generally consisted of 1.2 to 2.3 m of rock fill, overlying a 2.0 to 3.8 m thick deposit of loose sand/silt at the pier locations, underlain by varved silty clay. The clay deposit transitions to compact silt with clay bands below depths of approximately 17.6 to 27.0 m (Elev. 168.1 to 169.3 m). Details of the encountered soil stratigraphy are

presented on the Record of Borehole sheets and “Borehole Locations and Soil Strata” drawing in Appendix B.

In general, the silty clay deposit is soft to stiff, some 12.9 to 24.5 m thick, and contains 5 to 10 mm thick bands (varves) of silt. The undrained shear strength of the clay, measured by in situ vane testing, typically ranged from about 16 to 40 kPa in the upper 4.5 m of this deposit, and increased to 32 to 76 kPa below this level. Other properties of the clay were as follows:

- Moisture content: 30 to 60%
- Silt content: 28 to 34%; Clay content: 66 to 72%
- Silt content in silt interlayers: 58 to 72%; Clay content in silt interlayers: 28 to 42%
- Liquid Limit: 45 to 55; Plastic Limit: 22 to 24
- Intermediate to high plasticity (CI-CH).

The boundary between the silty clay and underlying silt deposit is transitional, with thinner clay and thicker silt bands occurring with increasing depth. The silt is loose to dense, typically compact, with moisture contents of 20 to 40%. The silt gradation includes 83 to 96% silt-size particles and 4 to 17% clay. The boreholes were terminated in the silt at depths of 26.5 to 46.3 m (Elev. 148.8 to 161.3 m).

The results of the piezocone penetration tests were generally consistent with the stratigraphy encountered in the boreholes. Locally at the west pier, the piezocone results identified an approximate 2 m thick layer of sand within the silty clay, between approximate depths of 7 to 9 m.

The water levels measured in the open boreholes upon completion and in the standpipe piezometers installed in the boreholes were as follows:

Table 4.1 – Measured Groundwater Levels

Borehole	Date	Measured Groundwater Level		Comment
		Depth (m)	Elevation	
11-01	May 1, 2011	-0.9*	188.7	In piezometer
	July 2, 2013	1.1	186.7	In piezometer
11-02	April 7, 2011	-0.8*	187.7	Upon completion
	July 2, 2013	1.6	185.3	In piezometer
11-03	May 1, 2011	0.0	195.1	In piezometer
	July 2, 2013	-0.7*	195.8	In piezometer

*denotes artesian condition

The source of the artesian water pressure is the silt deposit underlying the clay layer. A similar artesian condition was noted in the silt layer during the original 1958 investigation. V. Milligan in his paper reports a maximum artesian head of 6 m above existing ground at a depth of 80 m. At this depth and below, SPT blow counts were essentially zero due to piping in the borehole.

4.2 Results of Static Pile Load Tests

The results of the static pile load tests on Piles G-5 and E-16 at the east pier and Pile E-2 at the west pier are plotted on the load-settlement curves presented in Appendix D. The recorded settlement data used to prepare the plots are included in Appendix D.

Review of the pile load test data indicates the following:

1. The interpreted ultimate capacity of Piles G-5 and E-16 from the east pier ranges between about 550 and 600 kPa.
2. The load/deformation behaviour of the test piles at the east pier is essentially elastic below a load of 600 kN and the pile settlements are less than 5 mm. The settlement increased more rapidly with each load increment over 600 kN, reaching a maximum of 19 to 20 mm (indicating pile failure) at applied loads of approximately 690 and 750 kN before the load test was discontinued.
3. The load test for Pile E-2 at the west pier indicated that the pile did not reach failure at a loading of 900 kN and the pile settlement at this loading was in the order of 8 mm.
4. Each pile was unloaded and reloaded at one point during the load tests, and the resulting load-settlement behaviour remained essentially elastic.

4.3 Results of Piezocone and Field Vane Tests

The results of the piezocone penetration tests conducted at two locations within the east pier (CPT 13-F10-01 and 02) and one location within the west pier (CPT 13-E16-03) are presented in Appendix E. Plots showing the corrected tip resistance (q_t), sleeve friction (f_s), friction ratio (R_f), pore pressure (u), and soil behaviour type (SBT) interpreted from the test results are shown. The results of pore pressure dissipation tests conducted at selected depths are also provided in the appendix. The locations of the tests are shown on Drawing 15-64-29-1 in Appendix C.

The stratigraphy inferred from the piezocone tests typically consists of layered silts and sands to depths of about 5.6 to 6.8 m, underlain by silty clay to clayey silt with silt interbeds, extending to the exploration depth of 11.8 m.

The results of the field vane tests and interpreted subsurface stratigraphy are plotted on the Record of Borehole sheets (Boreholes 13-01 and 13-02) provided in Appendix E. The undrained shear strengths measured in the clay ranged from about 46 to 80 kPa at the east pier and from 58 to 80 kPa at the west pier.

5 MISCELLANEOUS

The static pile load tests were conducted by Geo-Foundations Contractors Inc. of Acton, Ontario. Thurber Engineering Ltd. supervised the load tests and recorded the load and settlement readings.

CPT testing was conducted by ConeTec Investigations Limited of Richmond Hill, Ontario. The drill rig used to push the cones and conduct vane testing was supplied by TBT Engineering of Thunder Bay, Ontario.

Mr. Mark Farrant, P. Eng. and Mr. Shahir Opiani of Thurber Engineering supervised the pile load tests, piezocone investigations and vane testing on a full-time basis. The field program was conducted under the direction of Mr. Jason Lee, P.Eng. of Thurber Engineering and Dr. P.K. Chatterji, P.Eng. of Thurber Engineering, a Designated Principal Contact for MTO Foundations Projects.

Interpretation of the data and preparation of the report were carried out by Mr. Jason Lee, P.Eng. The report was reviewed by Mr. Murray Anderson, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

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PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

6 GENERAL

This report presents interpretation of the geotechnical data (static pile load tests, CPT and vane tests) presented in the factual report and presents geotechnical recommendations regarding the available geotechnical resistance and predicted settlement behaviour of the existing pile foundations supporting the Pic River Bridge.

The discussions and recommendations presented in this report are based on the factual data obtained at the east and west piers during the course of the current investigation, subsurface information obtained during a previous investigation along a preliminary detour alignment, and information presented in the documents referenced in the Foundation Investigation Report.

6.1 Existing Bridge Foundations

The existing bridge is a three-span through steel truss structure supported on two piers and two abutments. The end spans are 48.0 m in length and the centre span is 82.3 m long. The piers and abutments are each supported on a pile group system consisting of 12BP53 (HP 310 x 79) friction piles. Details of the foundation units are summarized in Table 6.1.

The piles were designed as friction piles driven into the thick deposit of soft to stiff varved clay underlying the site, locally into the underlying silt deposit at the west abutment. Electro-osmotic treatment was applied to the foundation clay at the west pier, east pier and east abutment, and a design pile capacity of 135 kN/pile was employed.

Table 6.1 – Existing Foundation Details

Foundation Unit	Number of Load-Bearing Piles	Driven Pile Length (m)	Pile Cap Dimensions (m x m)	Centre to Centre Pile Spacing (m)
East Abutment	33	17.1	3.5 x 13.6	1.2
East Pier	95	17.1	7.3 x 20.3	1.2 (locally 1.0 to 1.8)
West Pier	95	17.1	7.3 x 20.3	1.2 (locally 1.0 to 1.8)
West Abutment	22	33.5	2.3 x 13.6	1.1 to 1.2

The foundation treatment and design pile capacity were selected on the basis of pile load tests carried out during construction:

- Initially, load tests were conducted on piles of varying lengths driven into the untreated clay and underlying silt. The ultimate load capacities achieved by the load tests are summarized in Table 6.2.

Table 6.2 – Results of Previous Load Tests on Untreated Piles

Foundation Unit	Pile Length (m)	Days after Installation	Ultimate Load (kN)	Remarks
East Abutment	33.5	40	265	
East Pier	16.5	7	355	
	20.7	8	310	
	33.5	41	220	
West Pier	33.5	37	355	
	42.1	6	355	
	50.6	5	135-180	
West Abutment	33.5	8	620	Maximum applied load
	33.5	54	755	

- As indicated in the table, the ultimate capacities at the east abutment, east pier and west pier ranged from about 135 to 355 kN, and did not achieve the required capacity of 350 kN derived by static analysis and specified by the original foundation design. In addition, the pile capacities typically decreased as a result of artesian pressures as the piles were driven deeper into the silt. The piles at the west abutment were judged to have sufficient capacity.
- In response to the load test results, electro-osmotic treatment of the foundation soils was carried out in an effort to increase the pile capacity at the east abutment, east pier and west pier, reduce the potential for foundation settlement, and avoid the need for redesign of the foundation system. A pile length of 16.5 m was selected to prevent penetration into the underlying silt deposit. The piles at the west abutment did not warrant electro-osmotic treatment.

- During electro-osmotic treatment, static pile load testing was carried out on a selected pile (Pile E-16) at the east pier. The load test results indicated an increase in ultimate pile capacity from about 300 kN for the untreated pile to over 600 kN for the treated pile. Subsequent load testing on another pile (Pile G-5) at the treated east pier indicated an ultimate capacity in the order of 500 to 600 kN. Testing of a pile (Pile E-2) at the west pier after foundation treatment indicated that the pile did not fail under the maximum applied load of 800 kN.
- Following these load tests, a design pile capacity of 135 kN per pile was adopted for design, even after improvement of the foundation soils by electro-osmotic treatment. The design capacity was likely selected based on application of a safety factor to the measured post-treatment capacity and considerations for limiting settlement of the entire pile group.

Subsequent to bridge construction, static pile load tests have been carried out by MTO on Pile G-5 at the east pier and Pile E-2 at the west pier at various times, most recently in 1992. These tests have indicated that the piles sustained the post-treatment capacity over a period of 33 years between 1959 and 1992.

6.2 Proposed Bridge Rehabilitation

Rehabilitation of the bridge, including replacement of the bridge deck, is now planned. MTO's Bridge Office has indicated that the rehabilitated bridge with a new, heavier deck will require geotechnical resistances of up to 350 kN/pile at factored ULS and 250 kN/pile at SLS to support the new loads including transient loads. The SLS loading represents an 85% increase in pile load.

In light of this requirement, MTO retained Thurber to carry out static pile load tests on three piles at the piers to confirm that the ultimate capacities are being maintained, assess the current pile capacity, and evaluate the load-displacement behaviour of the test piles. A program of piezocone and vane shear testing was also undertaken to further evaluate the condition of the foundation clay subjected to electro-osmotic treatment, the existing foundation loading, and any aging effects during the 50 years since construction.

On the basis of the findings, analyses were carried out to evaluate the geotechnical resistance of each group of existing piles and assess the load-settlement behaviour of the foundations at each pier and abutment. Settlement estimates for selected foundation loads are provided to enable the structural designers to select loading levels that limit total settlements and differential settlements between adjacent foundation units to tolerable levels for the structure.

7 ASSESSMENT OF STATIC PILE LOAD TESTS ON SINGLE PILES

The factual results of the static pile load tests carried out on Pile G-5 and Pile E-16 at the east pier and Pile E-2 at the west pier were presented in Section 4.2 and the load-settlement plots are provided in Appendix D. The ultimate capacity of Piles G-5 and E-16 from the east pier ranged from about 550 to 600 kPa. Pile E-2 at the west pier did not reach failure at a loading of 900 kN.

The ultimate capacities of the piles tested during the current program are consistent with the capacities determined during the historical load tests on the same piles. As noted above, the ultimate capacities previously determined for the treated piles at the east pier (Piles E-16 and G-5) were in the order of 500 to 600 kN, and the pile at the west pier (Pile E-2) did not fail under the maximum load of 800 kN applied during the historical tests.

Figures showing the load-settlement curves from the current load tests plotted against the load-settlement curves previously presented in the Milligan paper (Reference 4) are provided in Appendix F. The results indicate that the ultimate pile capacities of all three piles have been maintained, and actually appear to have increased for Piles G-5 and E-2.

Based on the results of the pile load tests, an ultimate capacity of 600 kN per pile may be assumed for a single pile within the east and west pier pile groups. The factored geotechnical resistance at ULS per pile is therefore in the order of 360 kN ($600 \text{ kN} \times \text{resistance factor of } 0.6$). Based on the load-settlement curve, the immediate settlement of a single pile subjected to the maximum design load of 250 kN at SLS will be in the order of 1 to 2 mm.

The load test results indicate that single piles at the piers can accommodate the maximum design loads of 350 kN at factored ULS and 250 kN at SLS. It should be noted, however, that these conclusions are drawn from load tests on single piles whereas the foundation elements consist of pile groups comprising 22 to 95 piles. The settlement behaviour of a pile group is different from the settlement behaviour of a single pile, and evaluation of the potential settlement of the entire pile group must be considered. Assessment of the pile group behaviour is provided in Section 9.

It is further noted that static pile load tests were carried out at the piers only, and similar testing was not conducted at the abutments. Previous data indicates that the pile capacity at the west abutment exceeds that at the piers, and that conditions at the east abutment are similar to those at the east pier. The current testing program however does not provide confirmation of this assessment.

8 PIEZOCONE AND VANE SHEAR TESTS

The results of the current piezocone testing and vane shear strength tests conducted in the treated foundation soils within the pile group are provided in Appendix E. A brief description of the factual data was presented in Section 4.3.

The undrained shear strength and preconsolidation pressure profiles with depth, derived from the factual data, are presented in Appendix F. Similar profiles derived from the data previously obtained

in the untreated soils along the preliminary detour alignment (Appendix B) are also presented for comparison. The following observations are made from these figures:

1. At the east pier, the undrained shear strength of the treated clay is in the order of 50 kPa between approximate Elevation 181 to 179, and increases to about 70 kPa between Elevation 179 and 176. In the untreated clay, the undrained shear strength varies from about 20 to 30 kPa between Elevation 181 and 179, and from 30 to 50 kPa between Elevation 179 and 176.
2. At the west pier, the undrained shear strength of the treated clay varies from about 50 to 70 kPa between approximate Elevation 182 and 187. At this same level in the untreated clay, the undrained shear strength varies from about 25 to 50 kPa.
3. The above results indicate that the electro-osmotic treatment and extended period of loading from the existing bridge foundations have resulted in an increase in shear strength of the foundation clay under the pile caps.
4. The preconsolidation pressure profiles derived from the piezocone tests indicate little change in preconsolidation pressure due to the electro-osmotic treatment. At the east pier, the preconsolidation pressure of both the treated and untreated clay deposit increases from 150 to 300 kPa with depth. At the west pier, the preconsolidation pressure increases from about 200 to 300 kPa within the zone investigated during the current piezocone testing.
5. No difference in the shear strength and preconsolidation pressure profiles is evident between the piezocone pushed adjacent to the pile (CPT13-F10-01) and the piezocone pushed presumably outside the zone of electro-osmotic treatment (CPT13-F10-02) at the east pier. This appears to indicate that the entire block of clay within the pile group has experienced an increase in strength from the electro-osmotic treatment and extended period of pile loading.

9 GEOTECHNICAL RESISTANCE AND SETTLEMENT OF PILE GROUPS

The geotechnical resistance and settlement characteristics of a single pile were evaluated from the results of the static pile load tests as discussed in Section 7. The resistance and settlement of the entire pile group must also be considered when assessing the capability of the existing foundation system to carry the new deck loads. Comments regarding assessment of the pile group are presented below.

9.1 Geotechnical Resistance of Pile Groups at ULS

The geotechnical resistance of the pile group in clay will equal the lesser of the sum of the resistance of the individual piles or the resistance of the pile group acting as a block with dimensions of the entire group. Assessment of the pile group resistance for block-failure mode has indicated that the block-failure mode will not govern design.

In light of this assessment and noting that the typical centre to centre pile spacing of 1.2 m is nearly four times the pile width, the factored ULS resistance of the pile group may be computed as the sum of the factored geotechnical resistance of individual piles at ULS. Assuming a factored geotechnical resistance of 360 kN/pile at ULS as indicated by the load tests, the factored resistance at ULS of each foundation element will be as follows:

Table 9.1 – Factored Geotechnical Resistance of Pile Groups

Foundation Unit	Number of Piles	Factored Geotechnical Resistance at ULS (kN)
East Abutment	33	11,880
East Pier	95	34,200
West Pier	95	34,200
West Abutment	22	7,920

The resistance values presented in Table 9.1 reflect the ultimate capacity of the pile groups and do not consider the serviceability (settlement) of the structure under these loads. It is anticipated that the design of the rehabilitation works will be governed by the SLS condition (elastic, consolidation and creep-type settlements) of the pile groups as discussed in the next section.

With regard to the lateral resistance of the existing piles, the maximum lateral resistance per pile should be assumed to be 120 kN at factored ULS and 35 kN at SLS.

9.2 Settlement of Pile Groups at SLS

Estimates of the settlement to be anticipated under various foundation loads are required by the bridge designer to select pile loads and modify the bridge rehabilitation design as required to limit both total settlement and differential settlements between adjacent foundation elements to tolerable levels.

In order to estimate the settlement of the existing pile foundations under the increased loads applied by bridge rehabilitation, interpretation of the pile load tests, CPT and vane shear test data was carried out. This data, along with the results of oedometer tests conducted on untreated clay foundation soils during the original bridge investigation, were used to estimate the settlement of the pile groups.

The total anticipated settlement of the bridge foundations will include both immediate (elastic) settlement of the pile groups as the load is applied as well as post-construction consolidation and creep-type settlement in the clay. The approach used to compute these settlements were as follows:

1. The immediate settlement of a single pile experiencing undrained deformation under an applied load was estimated using the approximate analytical solution proposed by Randolph and Wroth (1978). This method assumes a uniform shear stress distribution along the pile shaft and considers the load sustained by the pile shaft and pile base separately. The elastic parameters used in the solution were calibrated using the initial linear elastic portion of the load-settlement curves produced during the current pile load tests.

Immediate settlement of the pile group was estimated based on the settlement of a single pile and application of the interaction factor method described by Poulos and Davis (1980) combined with diffraction factors developed by Mylonakis and Gazetas (1998).

2. Consolidation settlement of the pile group due to dissipation of excess pore pressures in the foundation soils was estimated using the equivalent raft method suggested by Tomlinson (1986). Compressibility parameters of the clay deposit were assessed from the original foundation investigation (Reference 1). In-situ stress states of the clay deposit and elastic properties of the underlying silt deposit were derived based on correlations with the CPTu tests conducted near the pile groups.
3. Long-term creep settlements were estimated for selected loads and periods of 25, 50 and 75 years using the experiment-based approach suggested by Edil and Mochtar (1988) in conjunction with the ultimate load capacity of single piles assessed from the pile load tests. Creep coefficients used in the calculation were calibrated using the observed settlement response reported during the first 30 years after bridge construction (Reference 4).

The immediate settlements and the long-term settlements estimated at time intervals of 25, 50 and 75 years following bridge rehabilitation are presented in Tables 9.2 to 9.5 for applied bridge loads of 175, 200, 225 and 250 kN per pile.

Table 9.2 – Estimated Settlement of Pile Group at West Abutment

Applied Load (kN)		Estimated Settlement (mm)			
		Immediate	Post-Construction		
Per Pile	Total Group		25 Years	50 Years	75 Years
175	3,850	1	10	15	19
200	4,400	2	14	19	24
225	4,950	3	17	23	28
250	5,500	4	21	28	34

Table 9.3 – Estimated Settlement of Pile Group at West Pier

Applied Load (kN)		Estimated Settlement (mm)			
		Immediate	Post-Construction		
Per Pile	Total Group		25 Years	50 Years	75 Years
175	16,625	2	15	20	25
200	19,000	3	20	25	30
225	21,375	4	30	35	40
250	23,750	5	35	40	45

Table 9.4 – Estimated Settlement of Pile Group at East Pier

Applied Load (kN)		Estimated Settlement (mm)			
		Immediate	Post-Construction		
Per Pile	Total Group		25 Years	50 Years	75 Years
175	16,625	3	20	25	30
200	19,000	5	30	35	40
225	21,375	7	40	45	50
250	23,750	10	50	60	70

Table 9.5 – Estimated Settlement of Pile Group at East Abutment

Applied Load (kN)		Estimated Settlement (mm)			
		Immediate	Post-Construction		
Per Pile	Total Group		25 Years	50 Years	75 Years
175	5,775	2	16	23	28
200	6,600	3	22	30	37
225	7,425	4	28	38	45
250	8,250	6	35	46	55

The settlement estimates provided in the tables allow the bridge designer to select pile loads and modify the bridge rehabilitation design as required to limit both total settlement and differential settlements between adjacent foundation elements to tolerable levels.

Based on discussions with the MTO Bridge Office on Oct 25, 2013, it is understood that the maximum design pile loads of 350 kN at factored ULS and 250 kN at SLS include transient loading. The load requirement excluding transient loads will be less.

In view of the high predicted settlements, particularly at the east pier where the estimated total settlement is in the order of 80 mm under the 250 kN/pile loading, use of a high SLS resistance is not recommended. Considering the significant increase in bridge loads and the potential for increased settlement, it is recommended that the load increase on the existing piles be kept as low as practical, in the order of 175 to 200 kN/pile.

10 MONITORING DURING BRIDGE REHABILITATION

The foundations of the existing bridge should be monitored during and subsequent to rehabilitation of the bridge. This should include settlement monitoring of the abutment and pier pile caps and pore pressure monitoring of the foundation clay adjacent to the pile caps.

Geotechnical instruments including vibrating wire piezometers and settlement monitoring points are being installed at and near the existing bridge structure for monitoring of the existing structure during driving of the detour bridge piles. These instruments should be preserved so that they may be used for monitoring during rehabilitation of the existing bridge.

11 CONCLUSIONS

The existing Pic River Bridge is supported on pile groups consisting of steel H-piles driven into soft to stiff silty clay. During initial construction, electro-osmotic treatment was applied to the foundation soils at the east abutment, east pier and west pier to improve the pile capacity and settlement characteristics of the foundations.

Rehabilitation of the existing bridge is now planned and will include replacement of the bridge deck, resulting in a significant increase in the foundation loads. Confirmation was required that the existing piles subjected to electro-osmotic treatment have maintained the increase in pile capacity realized by treatment. Assessment of the geotechnical resistance and settlement response of the pile groups subjected to an increased loading was also required.

To provide the necessary information for rehabilitation design, a foundation investigation program consisting of static pile load tests, piezocone testing and vane shear strength testing has been carried out. Data from the foundation investigation for the original bridge, previous pile load test results, and subsurface information from an investigation carried out along a preliminary detour route has also been reviewed. Based on the results of the current investigation program and the review of existing data, the following conclusions have been drawn:

- The capacity improvements realized by electro-osmotic treatment have been maintained since original construction in 1959.
- The piezocone and vane shear strength testing indicates that the strength of the clay within the entire block of the pile group has been improved.
- Increasing the loads applied to the existing foundation system is considered feasible.
- A geotechnical resistance of 360 kN/pile at factored ULS may be employed for design. The ULS resistance of the pile group may be taken as the sum of the resistance of the individual piles.
- Based on the results of the pile load tests and computation of block settlement, estimates of settlement under various applied loads have been presented to enable the bridge designer to

select pile loads and modify the bridge rehabilitation design as required to limit both total settlement and differential settlements between adjacent foundation elements to tolerable levels.

- Considering the significant increase in bridge loads and the potential for increased settlement, it is recommended that the load increase on the existing piles be kept as low as practical, in the order of 175 to 200 kN/pile.
- Field monitoring is recommended to confirm that settlements remain within tolerable levels.

12 CLOSURE

Engineering analysis and preparation of this report were carried out by Mr. Keli Shi, P.Eng., Mr. Jason Lee, P.Eng. and Mr. Murray Anderson, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

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Appendix A

Site Photographs



Photograph A1 – Looking East from West Bank of Pic River



Photograph A2 - East Pier and Abutment



Photograph A3 – Looking West from East Bank of Pic River



Photograph A4 – West Pier

Appendix B

Data from Previous Foundation Investigation along Preliminary Detour Alignment

Includes:

Record of Borehole Sheets

Results of Laboratory Testing

Piezocene Test Results

Borehole Locations and Soil Strata Drawing

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer



4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ($W_L < 30\%$).
		CI	Inorganic clays of medium plasticity, silty clays. ($30\% < W_L < 50\%$).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

METRIC

SOIL PROFILE			SAMPLES	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	"N" VALUES
187.8 0.0	ORGANICS, with roots and rootlets (50mm) ROCK FILL	[Cross-hatched pattern]		
186.6 1.2	SAND, trace gravel Loose Brown Wet (FILL)	[Vertical stripes pattern]	1	SS 6
186.0 1.8	SILT, some sand Loose Brown Wet	[Horizontal stripes pattern]	2	SS 11
183.7 4.1	SAND, fine grained Loose Brown Wet	[Dotted pattern]	3	SS 4
182.2 5.6	Silty CLAY Soft to Firm Grey Wet	[Diagonal stripes pattern]	4	SS 0
			5	SS 1
			6	SS 2
	Varved, with 5mm thick bands of silt, some clay	[Alternating horizontal stripes pattern]		

DYNAMIC CONE PENETRATION RESISTANCE PLOT

20 40 60 80 100

SHEAR STRENGTH kPa

- O UNCONFINED + FIELD VANE
- QUICK TRIAXIAL x LAB VANE

20 40 60 80 100

PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT

w_P w_L

WATER CONTENT (%)

20 40 60

UNIT WEIGHT γ

kN/m³

REMARKS &
GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

+³, ×³: Numbers refer to Sensitivity

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No BH11-1

3 OF 3

METRIC

W.P. 6048-10-00 LOCATION PIC River Detour N 5 396 761.8 E 357 474.2 ORIGINATED BY SLL
 HWY 17 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY AN
 DATUM Geodetic DATE 2011.04.05 - 2011.04.06 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								20 40 60 80 100							
	Continued From Previous Page							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
			10	SS	13		167								
			11	SS	21		166								0 0 68 32 0 0 83 17
			12	SS	26		165								
			13	SS	22		163								
			14	SS	23		162								0 0 84 16
161.3 26.5	END OF BOREHOLE AT 26.5m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2011.05.01 -0.9* 188.7 2013.07.02 1.1 186.7 * Above ground surface														

ONTMT4S 5122.GPJ 2012TEMPLATE(MTO).GDT 11/14/13

METRIC

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa	W P W W L	WATER CONTENT (%)		
186.9 0.0 0.1	ORGANICS, with roots and rootlets: (100mm) ROCK FILL	[Pattern]										
185.7 1.2	SAND, some silt, trace organics Loose Brown Moist	[Pattern]	1	SS	4							
			2	SS	2							
183.7 3.2	Silty CLAY, with silt bands less than 5mm thick Soft to Firm Grey Wet	[Pattern]	3	SS	1							
			4	SS	0							
			5	SS	0							
			1	TW								



+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No BH11-2

2 OF 4

METRIC

W.P. 6048-10-00 LOCATION PIC River Detour N 5 396 755.6 E 357 558.0 ORIGINATED BY SLL
 HWY 17 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY AN
 DATUM Geodetic DATE 2011.04.06 - 2011.04.07 CHECKED BY LRB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _P	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			kN/m ³	GR SA SI CL
								20 40 60 80 100	○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE											
	Continued From Previous Page							20 40 60 80 100												
169.3 17.6	Silty CLAY , with 5mm to 10mm thick silt bands Soft to Firm Grey Wet		6	SS	2		176													
			2	TW																
			7	SS	4															
			3	TW			173													
												</								

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+³, ×³: Numbers refer to
Sensitivity 20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BH11-2

3 OF 4

METRIC

W.P. 6048-10-00 LOCATION PIC River Detour N 5 396 755.6 E 357 558.0 ORIGINATED BY SLL
 HWY 17 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY AN
 DATUM Geodetic DATE 2011.04.06 - 2011.04.07 CHECKED BY LRB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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+³, ×³: Numbers refer to
Sensitivity 20
15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BH11-2

4 OF 4

METRIC

W.P. 6048-10-00 LOCATION PIC River Detour N 5 396 755.6 E 357 558.0 ORIGINATED BY SLL
 HWY 17 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY AN
 DATUM Geodetic DATE 2011.04.06 - 2011.04.07 CHECKED BY LRB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	W P	W	W L	WATER CONTENT (%)		
	Continued From Previous Page		17	SS	22									
			18	SS	34									
			19	SS	16									
149.7														
37.2	END OF BOREHOLE AT 37.2m. WATER LEVEL AT 0.8m ABOVE GROUND SURFACE UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2013.07.02 1.6 185.3													

ONTMT4S 5122.GPJ 2012TEMPLATE(MTO).GDT 11/14/13

RECORD OF BOREHOLE No BH11-3

1 OF 5

METRIC

W.P. 6048-10-00 LOCATION PIC River Detour N 5 396 764.5 E 357 420.2 ORIGINATED BY SLL
 HWY 17 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY AN
 DATUM Geodetic DATE 2011.04.02 - 2011.04.04 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
195.1								20	40	60	80	100		
0.0	ROCK FILL (50mm size), trace to some sand Compact Brown Moist													
192.8			1	SS	21									
2.3	ORGANICS , with roots and rootlets													
192.6	Black													
2.5	Moist													
	Silty CLAY Soft to Firm Grey Moist to Wet		2	SS	2									
	Varved, with 5mm thick bands of silt, some clay		3	SS	3									
			4	SS	0									
			5	SS	9									
			1	TW										

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

METRIC

SOIL PROFILE				SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT		NATURAL MOISTURE CONTENT		LIQUID LIMIT		UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV	DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W _P	W			W _L	WATER CONTENT (%)				
Continued From Previous Page								SHEAR STRENGTH kPa		UNCONFINED		FIELD VANE		QUICK TRIAXIAL		LAB VANE		kN/m ³		GR SA SI CL			
<p>SILT, some clay, dilatant, varved, with 5mm to 10mm thick bands of silty clay Compact Grey Wet</p> <p>With 25mm to 50mm thick bands of silty clay</p> <p>With seams of silty clay</p>								165												0 0 71 29 0 0 89 11			
								164															
								163															
								162															
								161															
								160															
								159															
								158														0 0 75 25 0 0 96 4	
								157															
								156															
								17		SS		28											
								18		SS		28											
								19		SS		16											
								20		SS		17											

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No BH11-3

5 OF 5

METRIC

W.P. 6048-10-00 LOCATION PIC River Detour N 5 396 764.5 E 357 420.2 ORIGINATED BY SLL
 HWY 17 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY AN
 DATUM Geodetic DATE 2011.04.02 - 2011.04.04 CHECKED BY TJH

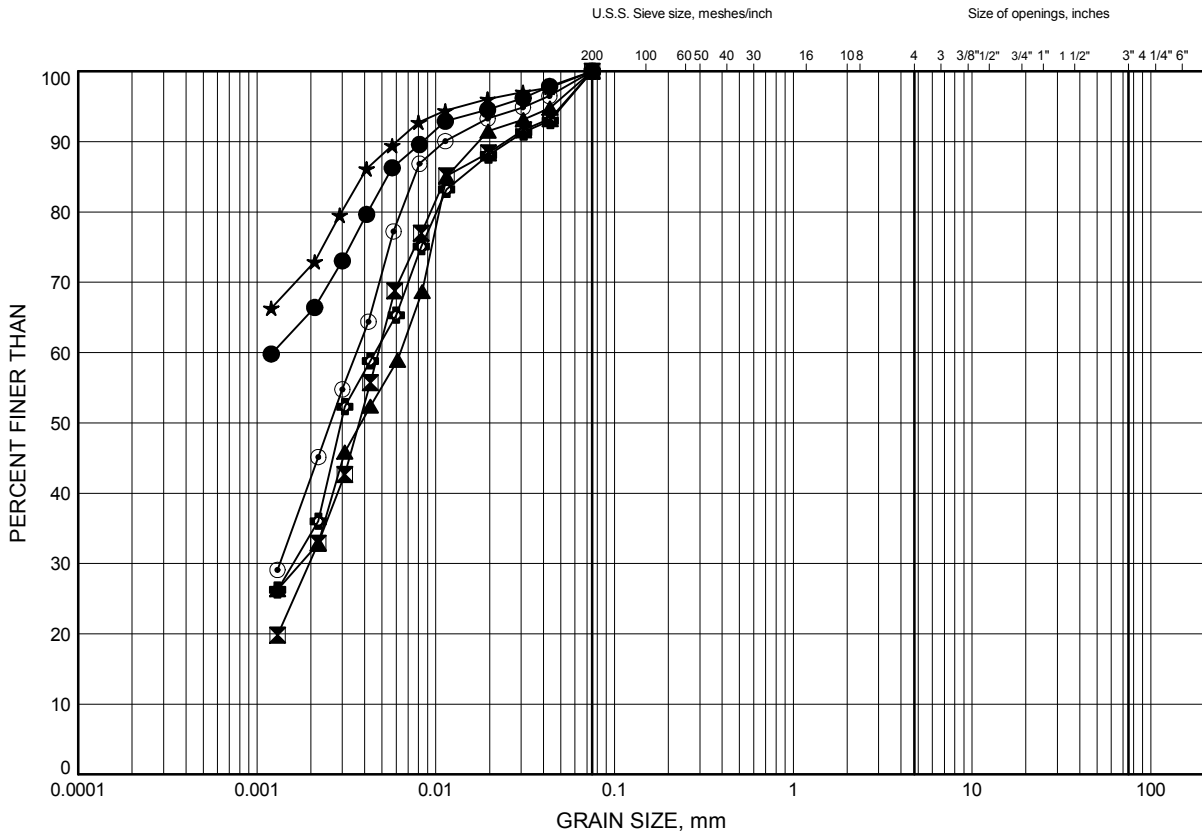
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
Continued From Previous Page																
148.8	SILT, some clay, with clay seams, varved Compact Grey Wet		21	SS	20		155									
							154									
							153									
							152									
							151									
							150									
							149									
46.3	END OF BOREHOLE AT 46.3m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2011.05.01 0.0 195.1 2013.07.02 -0.7* 195.8 * Above ground surface															

Pic River Bridge Rehab

GRAIN SIZE DISTRIBUTION

FIGURE B1

Silty CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH11-1	7.92	179.88
⊠	BH11-1	18.59	169.21
▲	BH11-1	21.64	166.16
★	BH11-2	5.64	181.26
⊙	BH11-2	16.31	170.59
⊕	BH11-2	20.88	166.02

Date November 2013
W.P. 6048-10-00



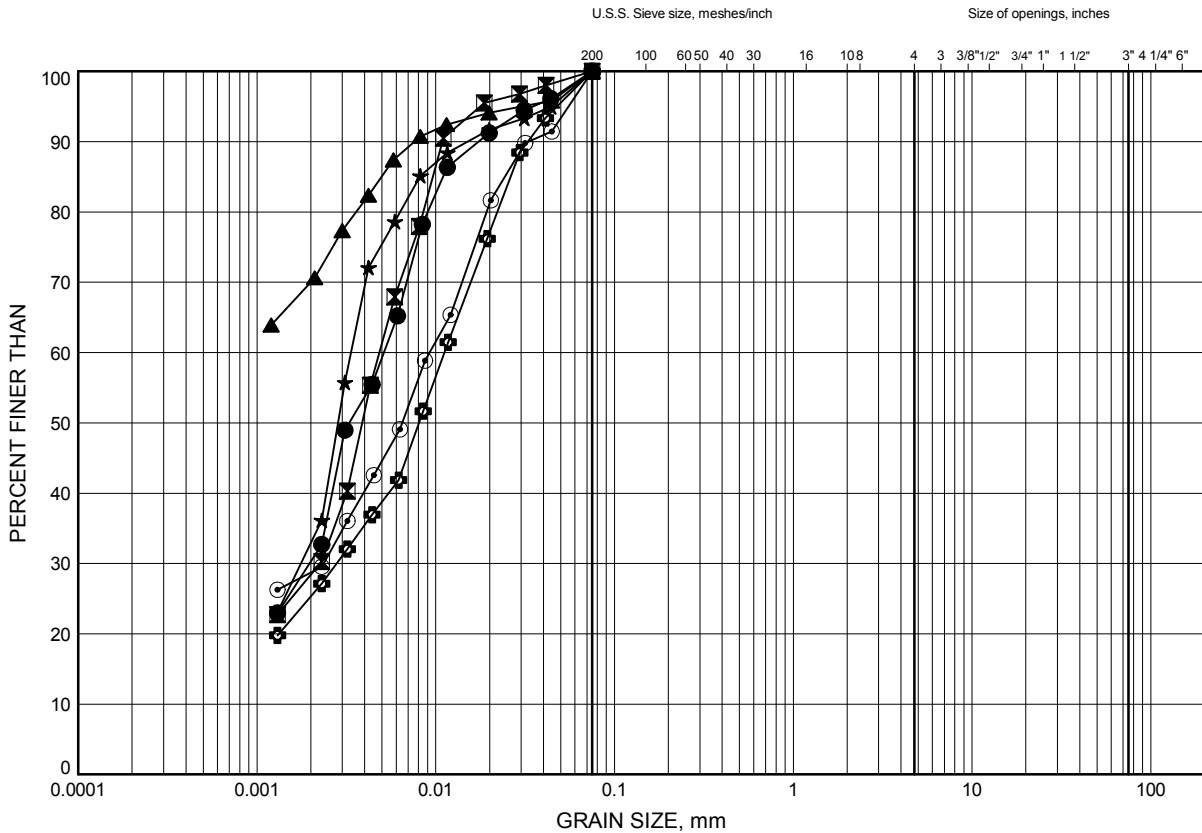
Prep'd AN
Chkd. MRA

Pic River Bridge Rehab

GRAIN SIZE DISTRIBUTION

FIGURE B2

Silty CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH11-3	6.40	188.70
⊠	BH11-3	6.43	188.67
▲	BH11-3	17.07	178.03
★	BH11-3	24.69	170.41
⊙	BH11-3	30.78	164.32
⊕	BH11-3	36.88	158.22

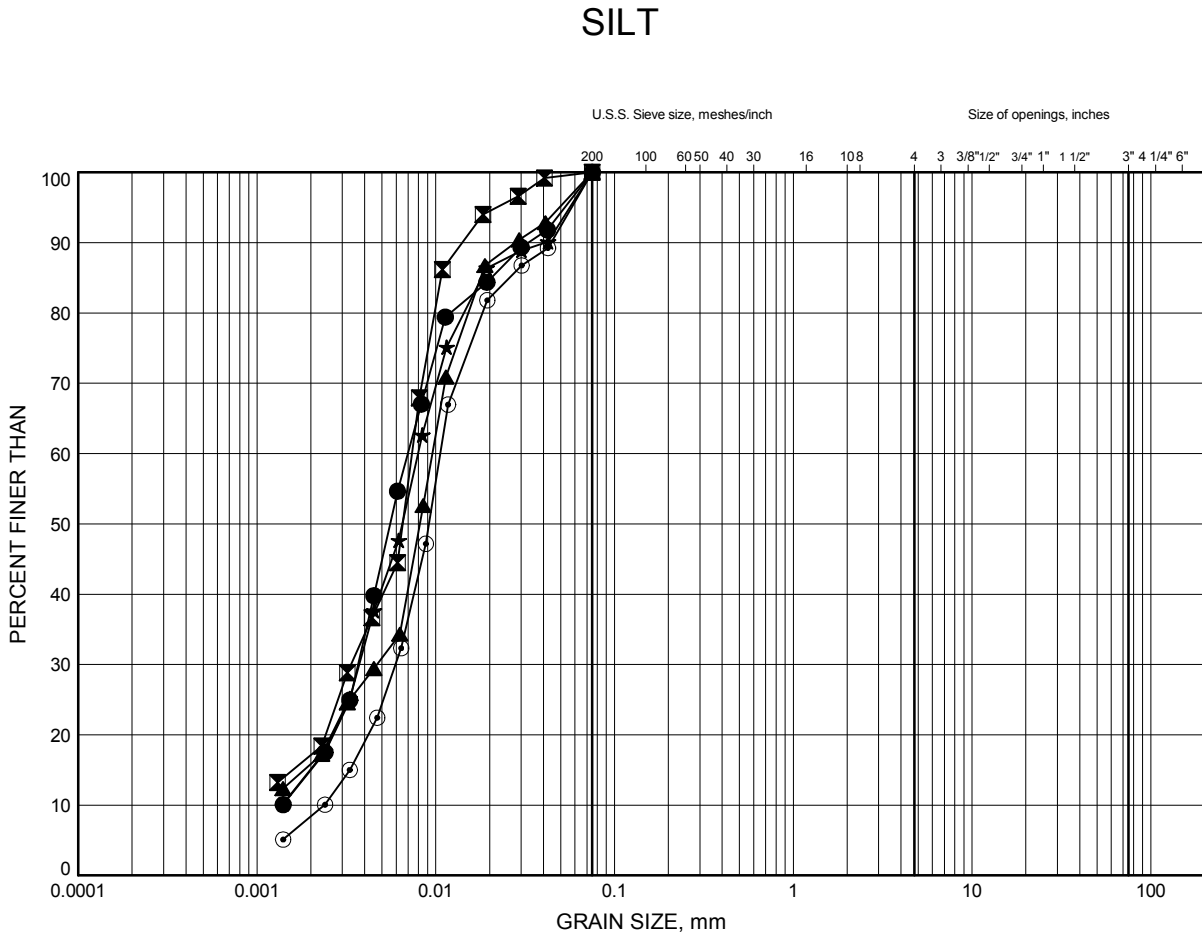
Date November 2013
W.P. 6048-10-00



Prep'd AN
Chkd. MRA

Pic River Bridge Rehab
GRAIN SIZE DISTRIBUTION

FIGURE B3



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH11-1	18.62	169.18
⊠	BH11-1	21.67	166.13
▲	BH11-1	26.21	161.59
★	BH11-2	20.91	165.99
⊙	BH11-2	23.93	162.97

Date November 2013
W.P. 6048-10-00

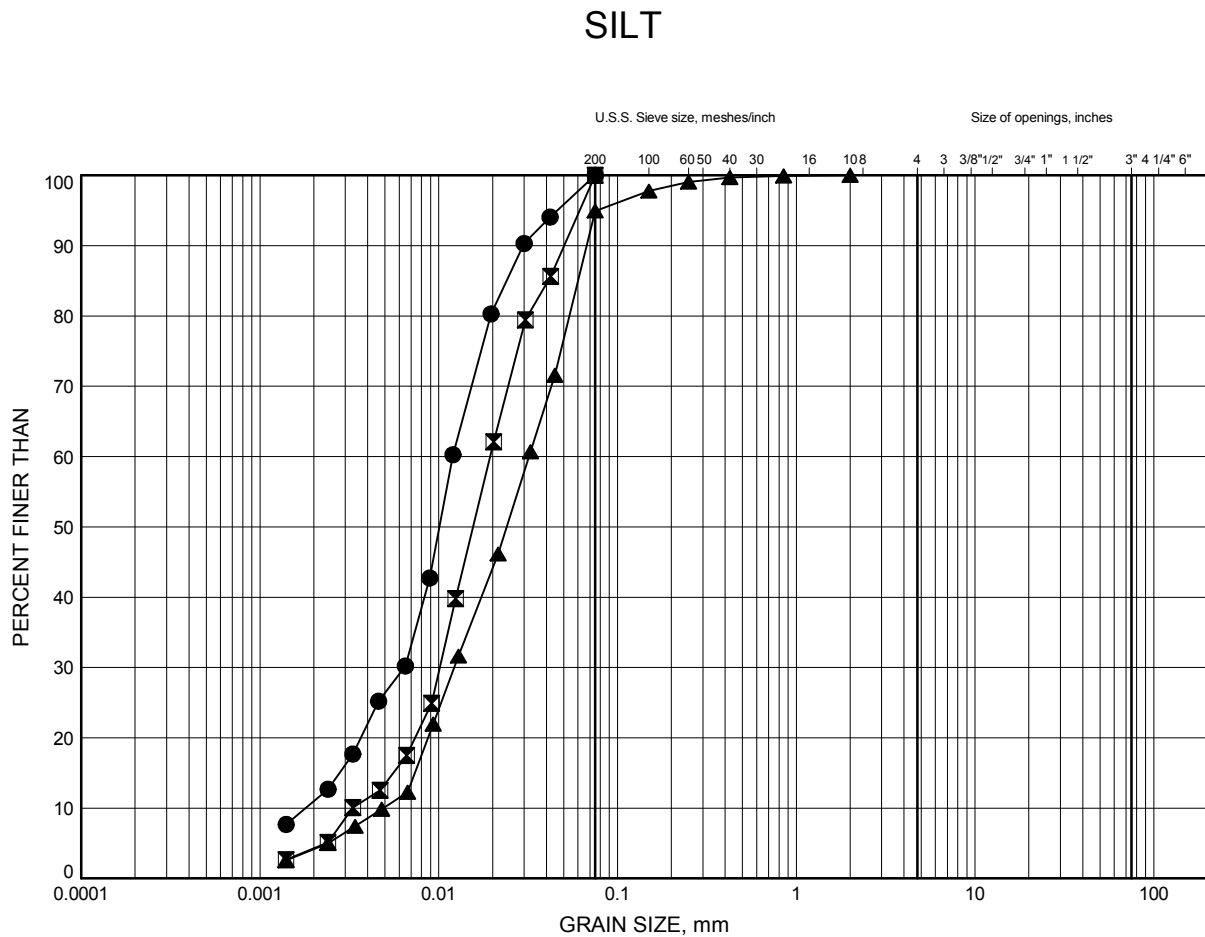


Prep'd AN
Chkd. MRA

Pic River Bridge Rehab

GRAIN SIZE DISTRIBUTION

FIGURE B4



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH11-3	30.82	164.28
⊠	BH11-3	36.91	158.19
▲	BH11-3	46.02	149.08

Date November 2013
W.P. 6048-10-00

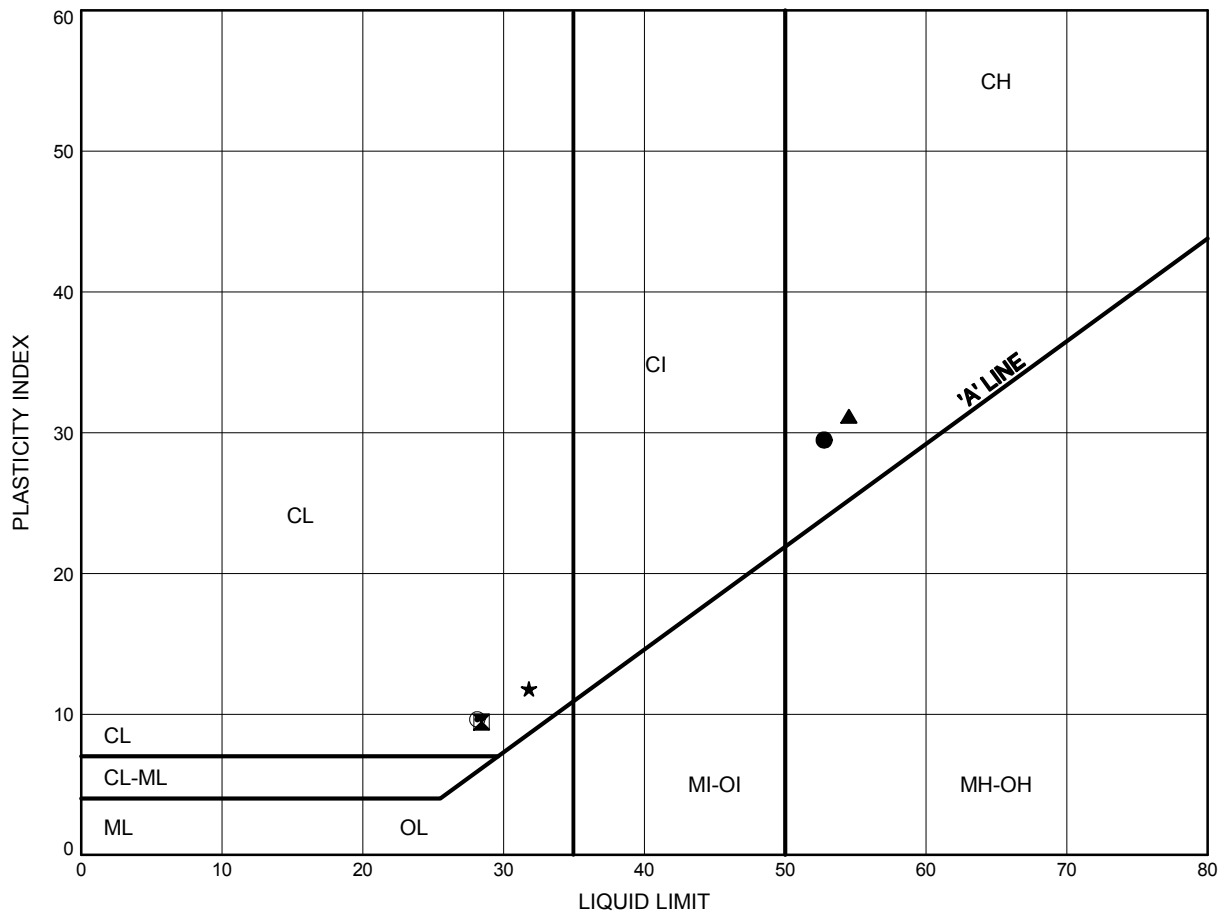


Prep'd AN
Chkd. MRA

Pic River Bridge Rehab
ATTERBERG LIMITS TEST RESULTS

FIGURE B5

Silty CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH11-1	7.92	179.88
⊗	BH11-1	18.59	169.21
▲	BH11-2	5.64	181.26
★	BH11-2	16.31	170.59
⊙	BH11-2	20.88	166.02

Date November 2013
W.P. 6048-10-00

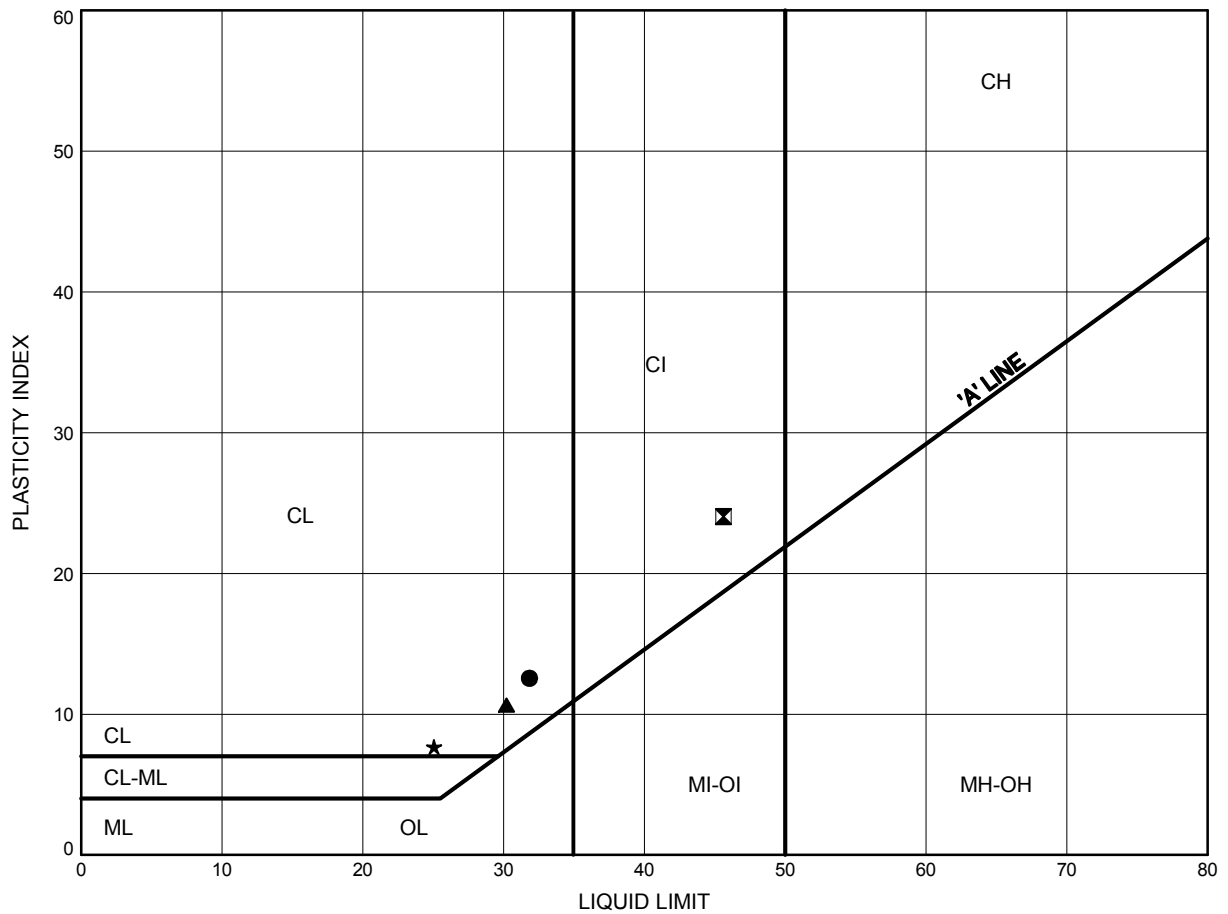


Prep'd AN
Chkd. MRA

Pic River Bridge Rehab
ATTERBERG LIMITS TEST RESULTS

FIGURE B6

Silty CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH11-3	6.40	188.70
⊠	BH11-3	17.07	178.03
▲	BH11-3	24.69	170.41
★	BH11-3	36.88	158.22

Date November 2013
 W.P. 6048-10-00



Prep'd AN
 Chkd. MRA

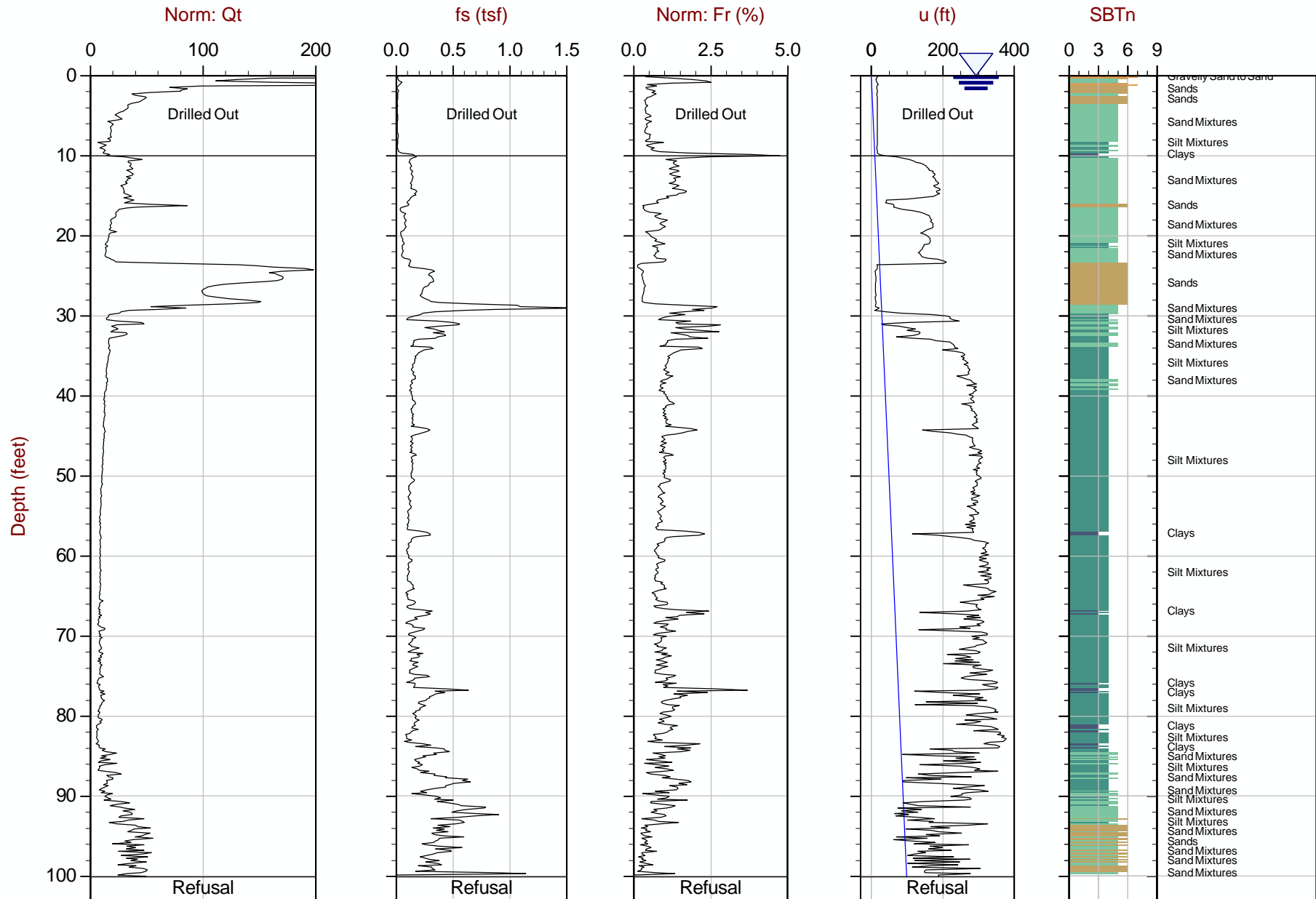




Thurber Engineering

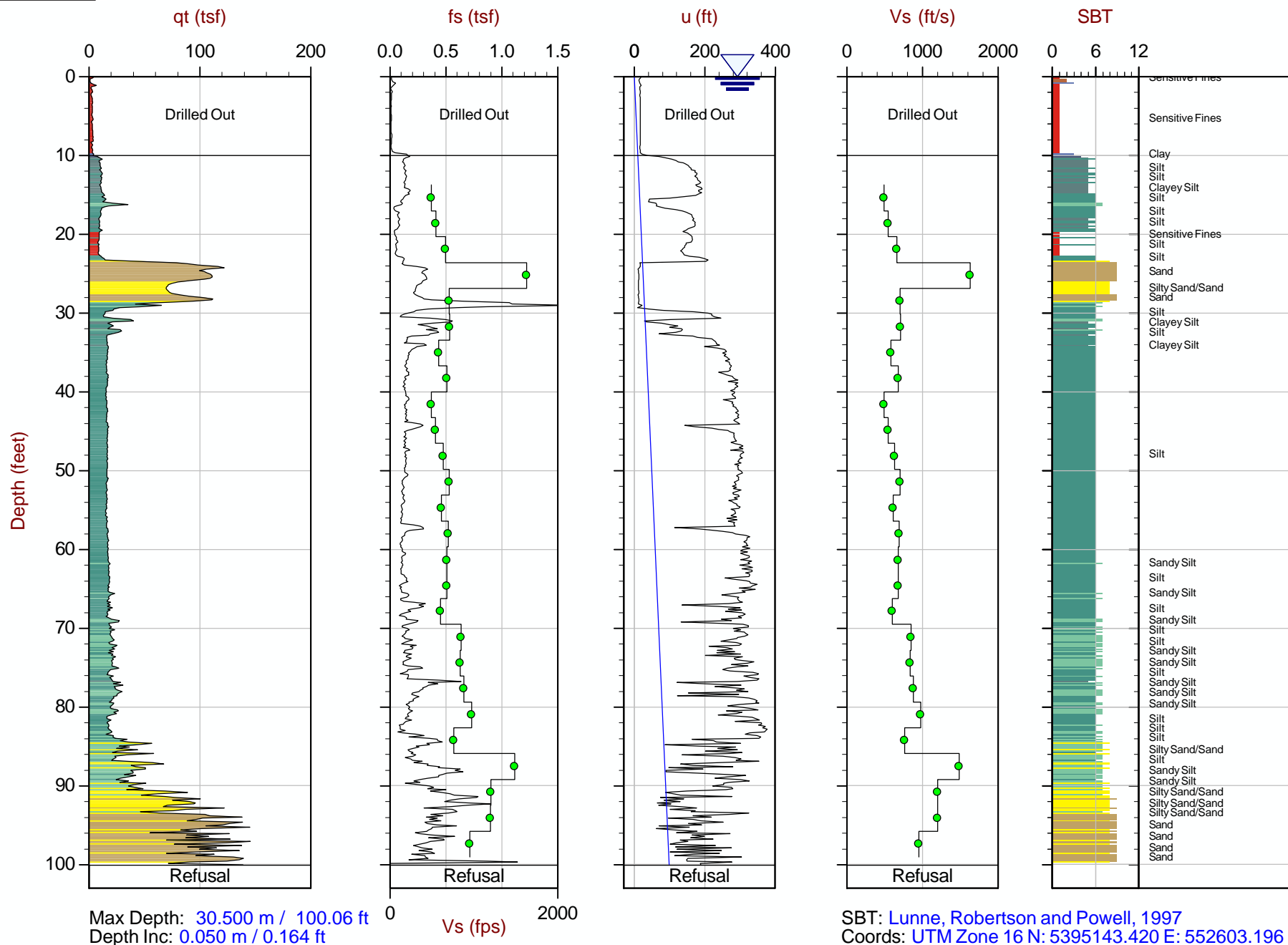
Job No: 11-724
Date: 04:01:11 08:20
Site: Pic River Bridge

Sounding: CPTU11-1
Cone: 301:T1500F15U500



Max Depth: 30.500 m / 100.06 ft File: 724CP01.COR
Depth Inc: 0.050 m / 0.164 ft

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 16 N: 5395143.420 E: 552603.196



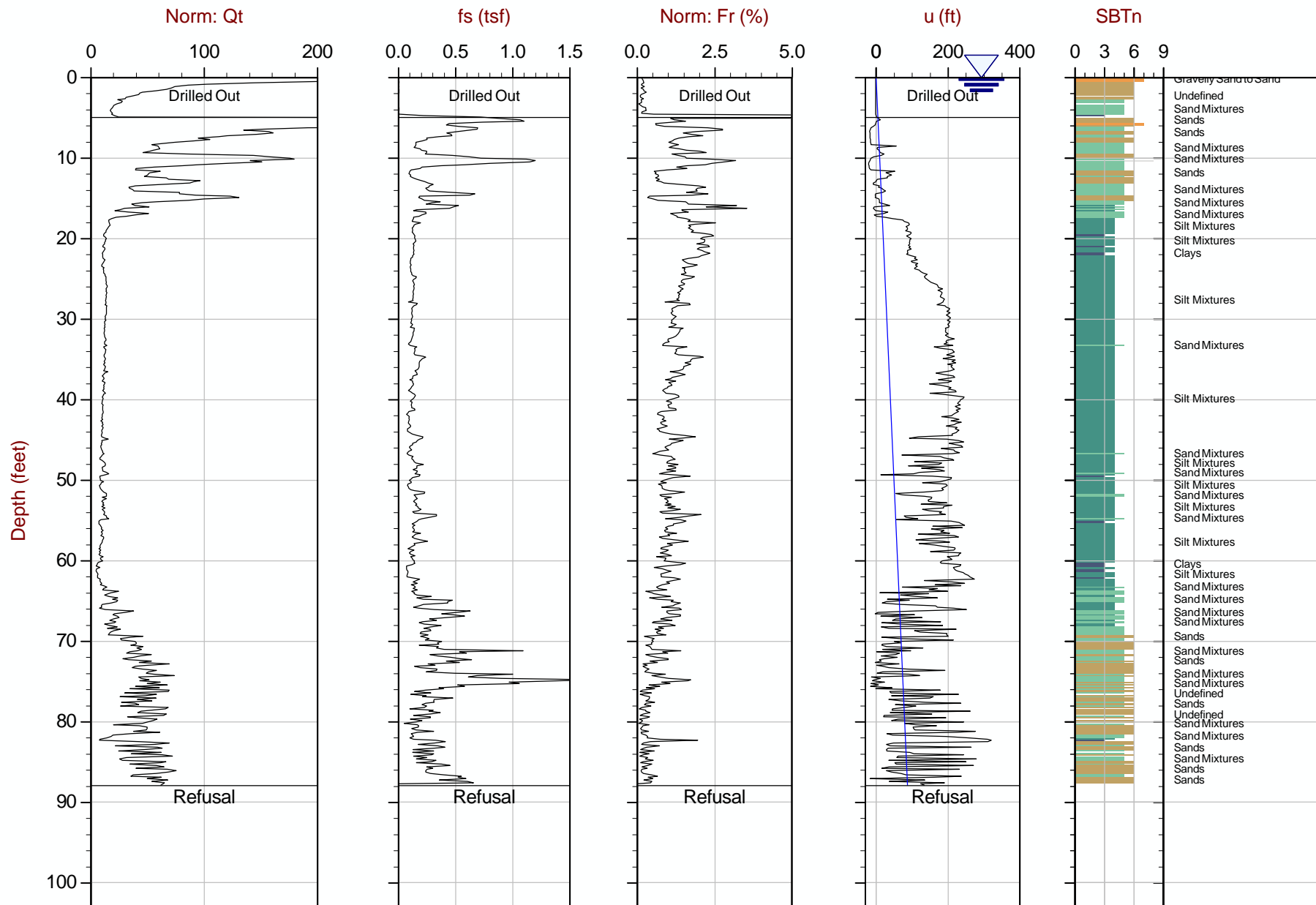




Thurber Engineering

Job No: 11-724
Date: 04:02:11 08:16
Site: Pic River Bridge

Sounding: CPTU11-2
Cone: 301:T1500F15U500



Max Depth: 26.800 m / 87.93 ft
Depth Inc: 0.050 m / 0.164 ft
File: 724CP02.COR

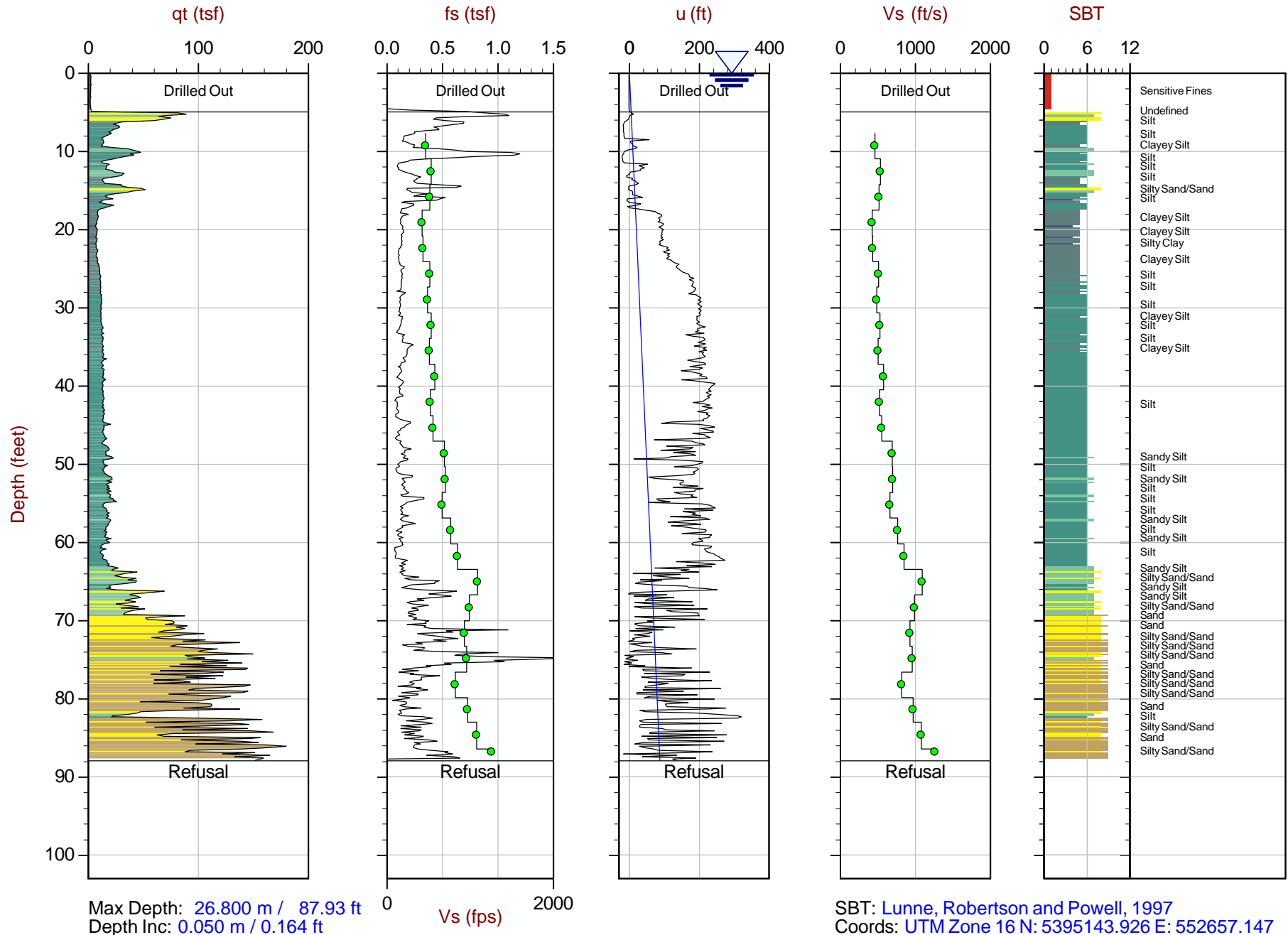
SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 16 N: 5395143.926 E: 552657.147



Thurber Engineering

Job No: 11-724
Date: 04:02:11 08:16
Site: Pic River Bridge

Sounding: CPTU11-2
Cone: 301:T1500F15U500



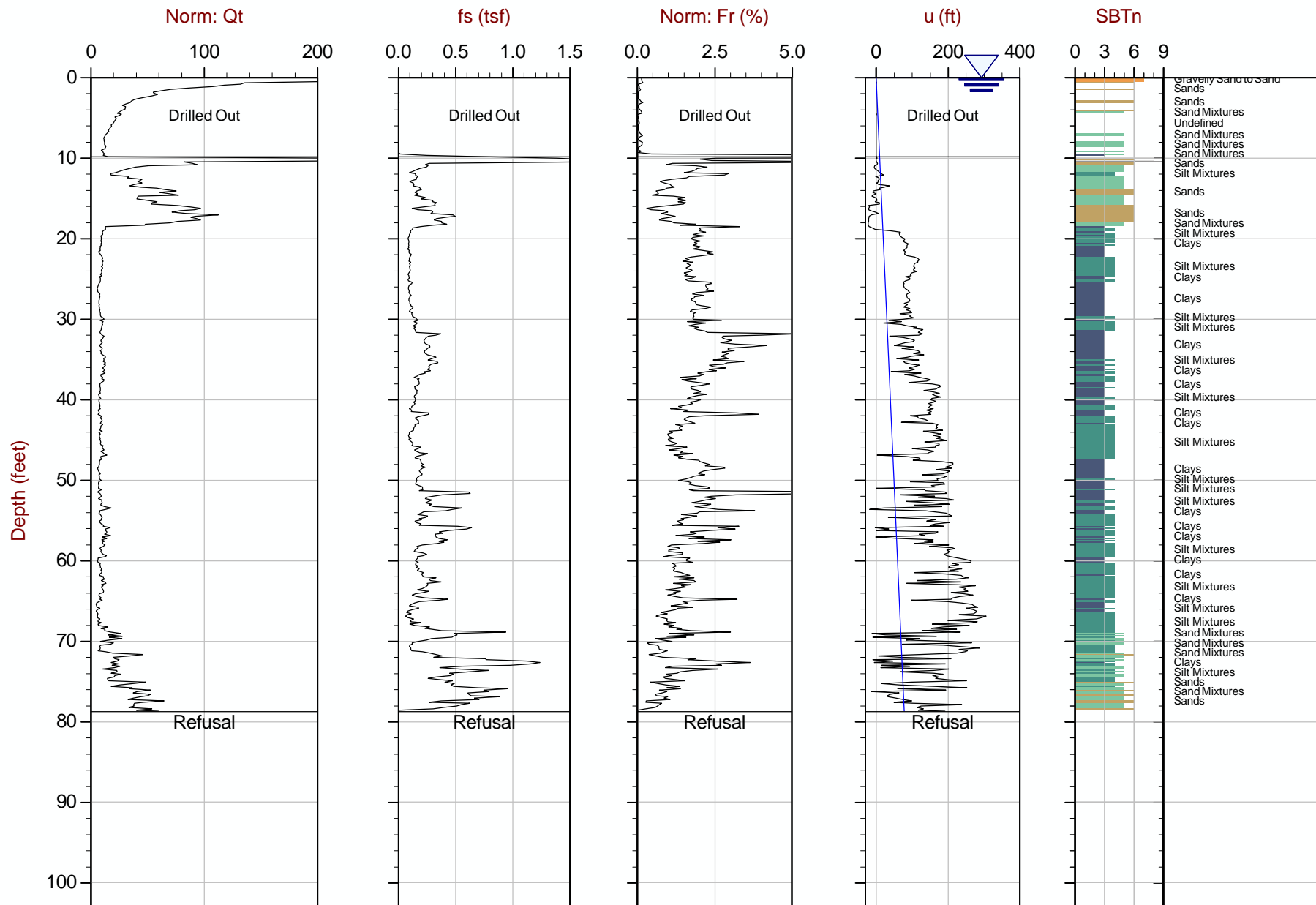




Thurber Engineering

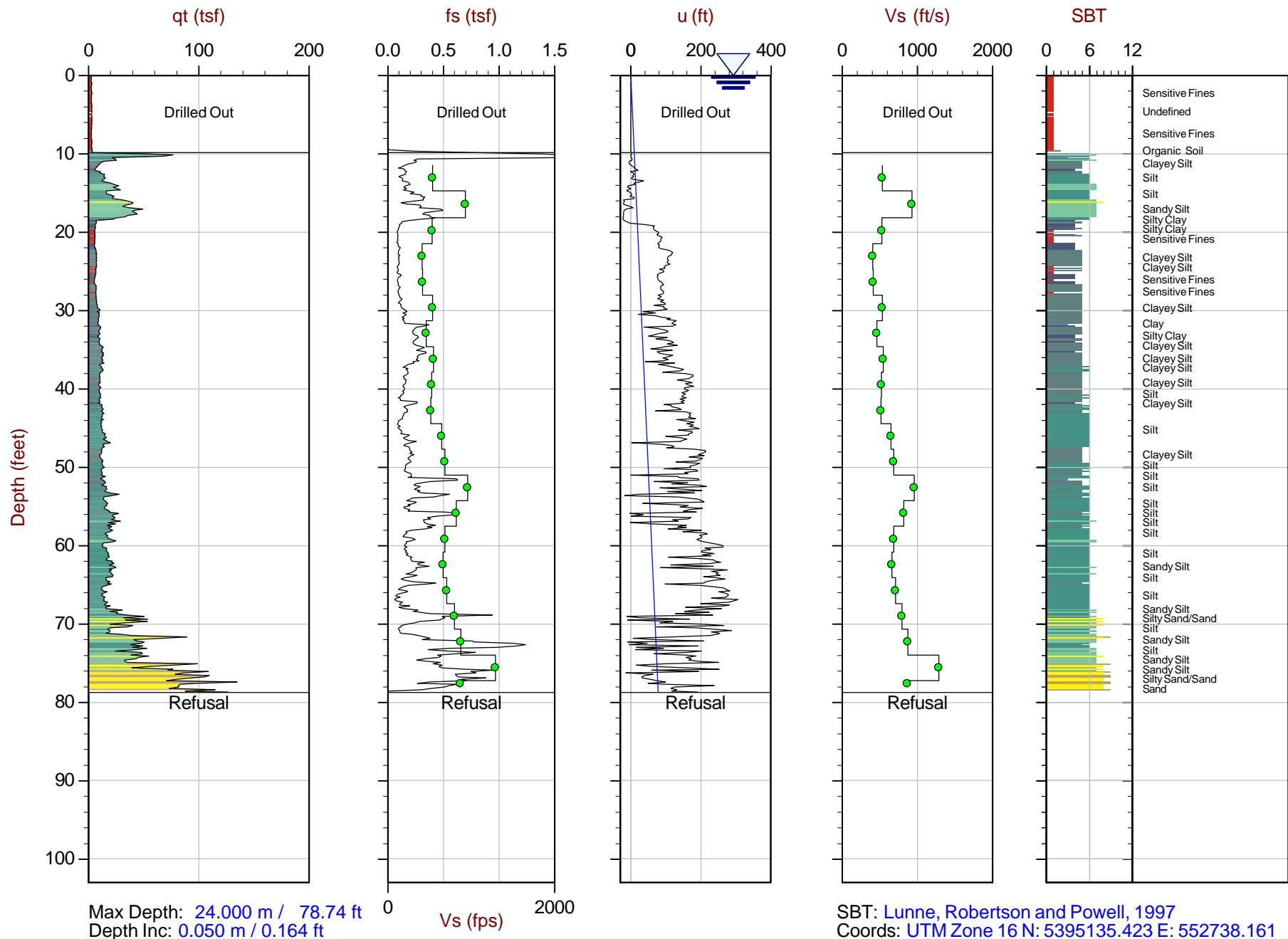
Job No: 11-724
Date: 03:31:11 08:53
Site: Pic River Bridge

Sounding: CPTU11-3
Cone: 301:T1500F15U500



Max Depth: 24.000 m / 78.74 ft
Depth Inc: 0.050 m / 0.164 ft
File: 724CP03.COR

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 16 N: 5395135.423 E: 552738.161



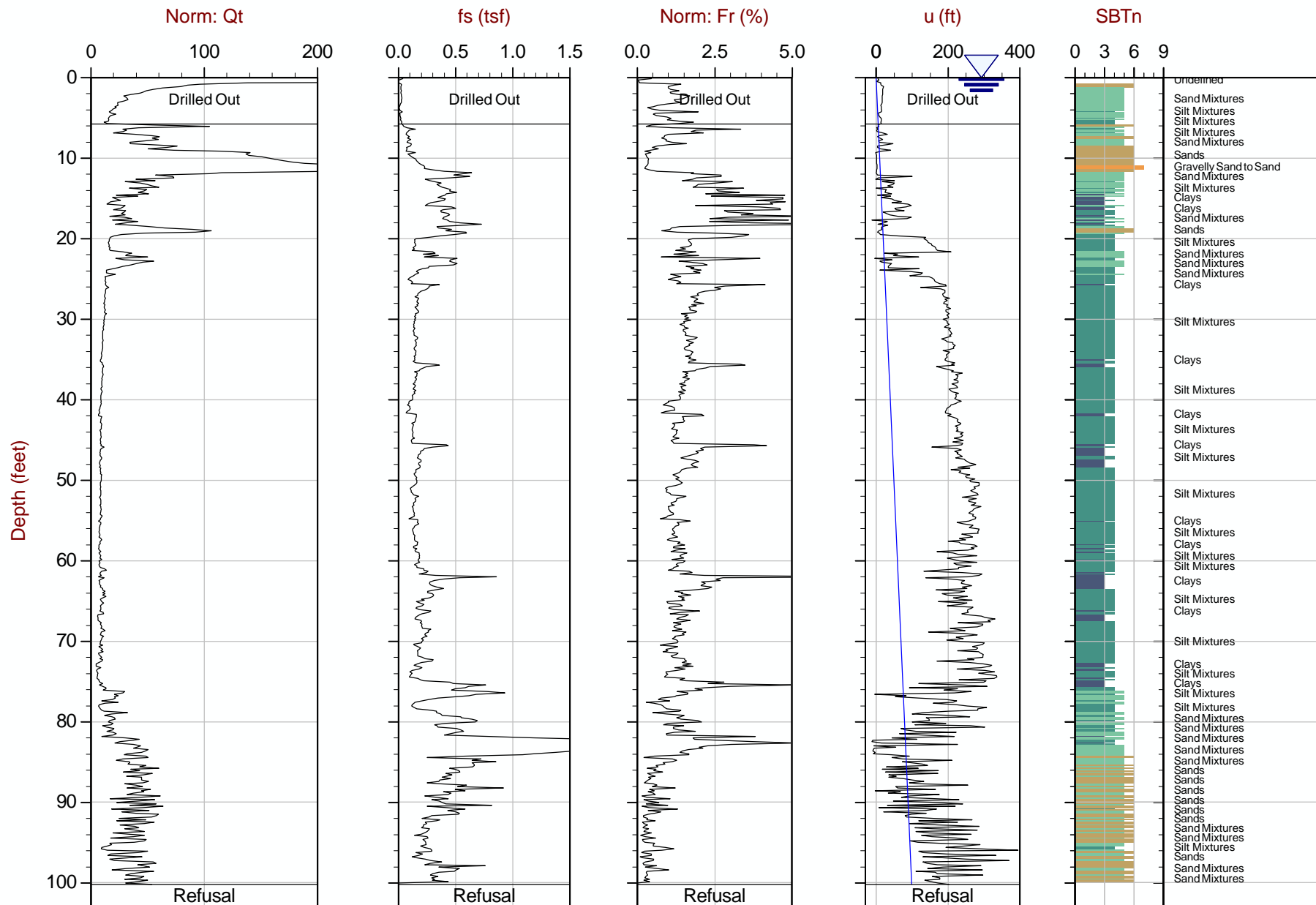




Thurber Engineering

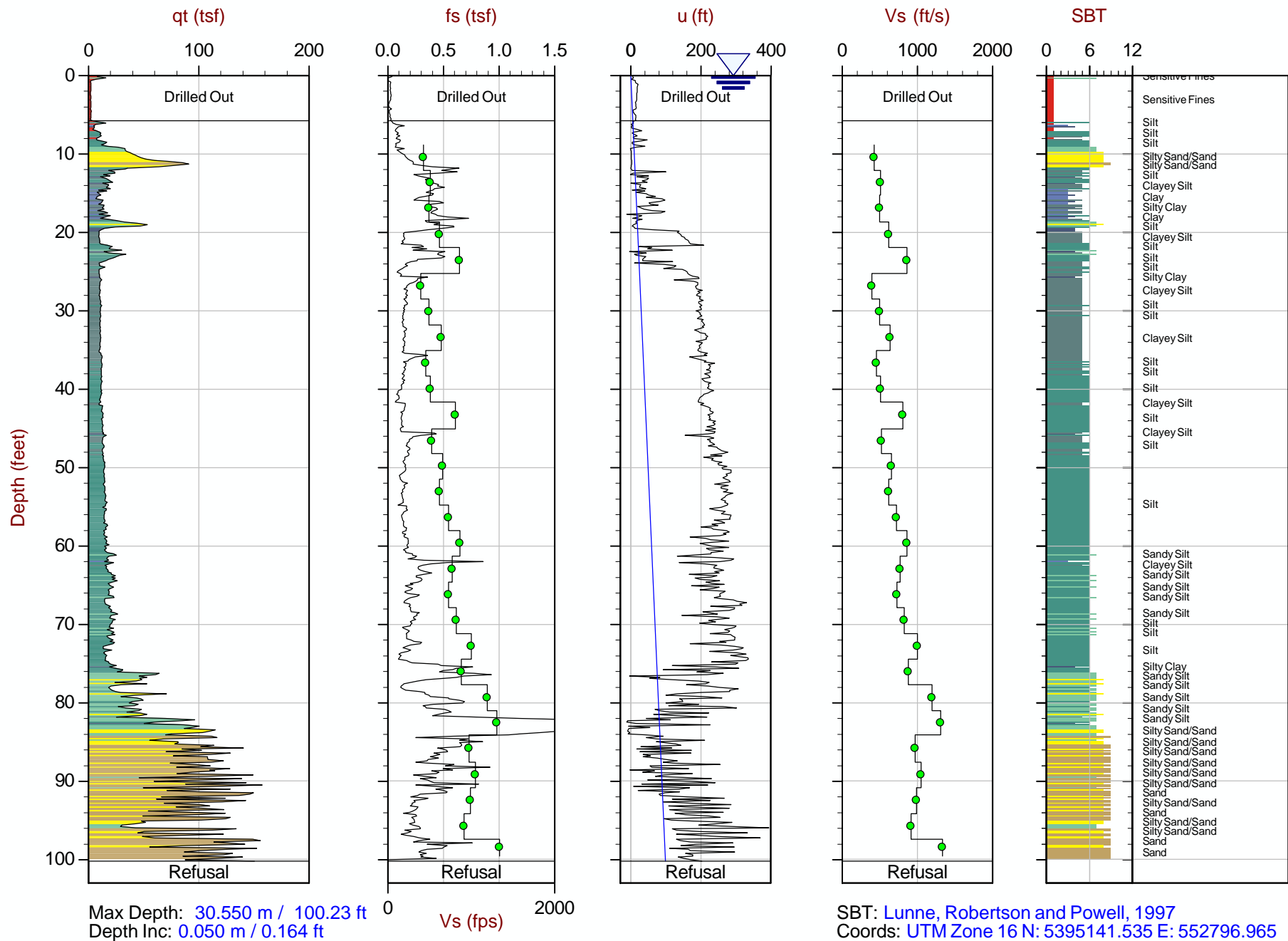
Job No: 11-724
Date: 03:30:11 11:49
Site: Pic River Bridge

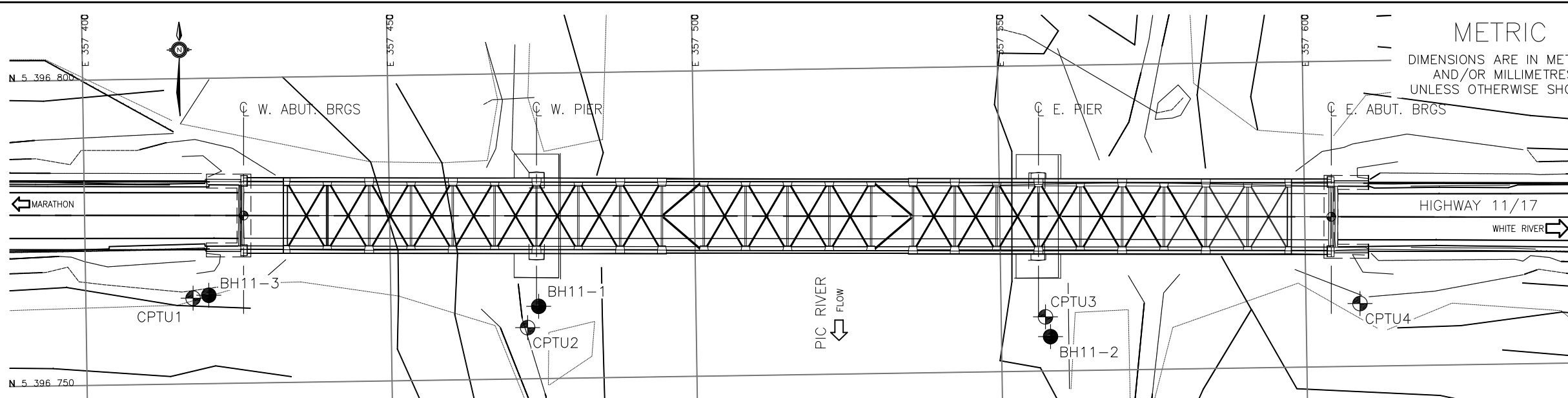
Sounding: CPTU11-4
Cone: 301:T1500F15U500



Max Depth: 30.550 m / 100.23 ft File: 724CP04.COR
Depth Inc: 0.050 m / 0.164 ft

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 16 N: 5395141.535 E: 552796.965





CONT No 2013-6017
WP No 6048-13-00

PIC RIVER BRIDGE
REHABILITATION
BOREHOLE LOCATIONS AND SOIL STRATA I



SHEET
11



Ministry of Transportation
NorthWestern Region
Structural Section



Hatch Mott
MacDonald



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

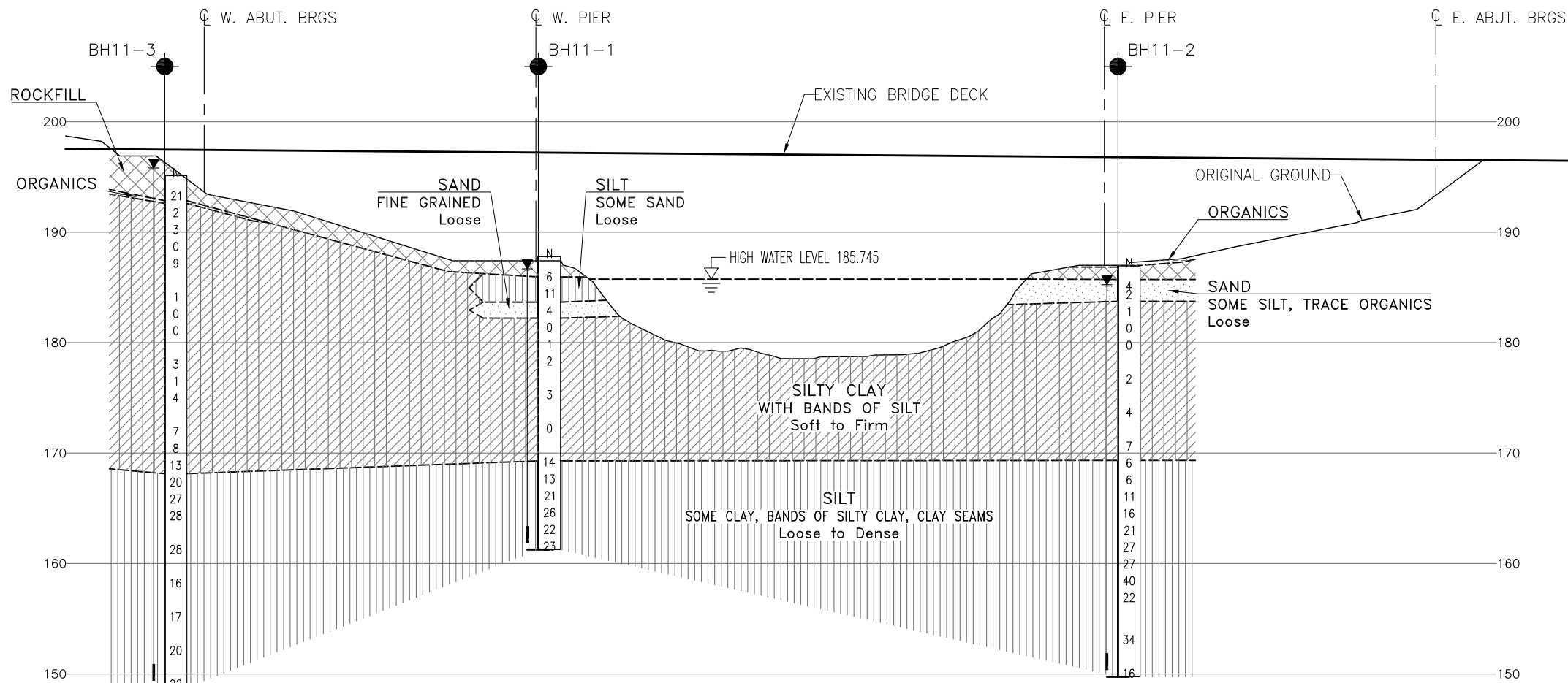
	Borehole
	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60' Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
BH11-1	187.8	5 396 761.8	357 474.2
BH11-2	186.9	5 396 755.6	357 558.0
BH11-3	195.1	5 396 764.5	357 420.2
CPTU1	195.1	5 396 764.0	357 417.6
CPTU2	187.8	5 396 758.4	357 472.4
CPTU3	186.9	5 396 758.9	357 557.3
CPTU4	191.7	5 396 760.3	357 608.9

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRIS No.



DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

DATE	BY	DESCRIPTION
DESIGN	MRA	CHK PKC [CODE CAN/CSA S6-06] [LOAD CL-625-ONT] [DATE NOV. 2013]
DRAWN	MFA	CHK MRA [SITE 48E-025] [STRUCT DWG 2]

Appendix C

Static Pile Load Test Procedures

Includes:

Pile Location Plan

Load Test Procedures

Drawings and Photographs of Load Test Set-up

PILE TESTING UNDER STATIC AXIAL COMPRESSIVE LOAD

3 load tests will be carried out at the following pile locations:

- West Pier – Pile E2
- East Pier – Piles G5 & E16.

A Pile location sketch is attached.

PROCEDURES

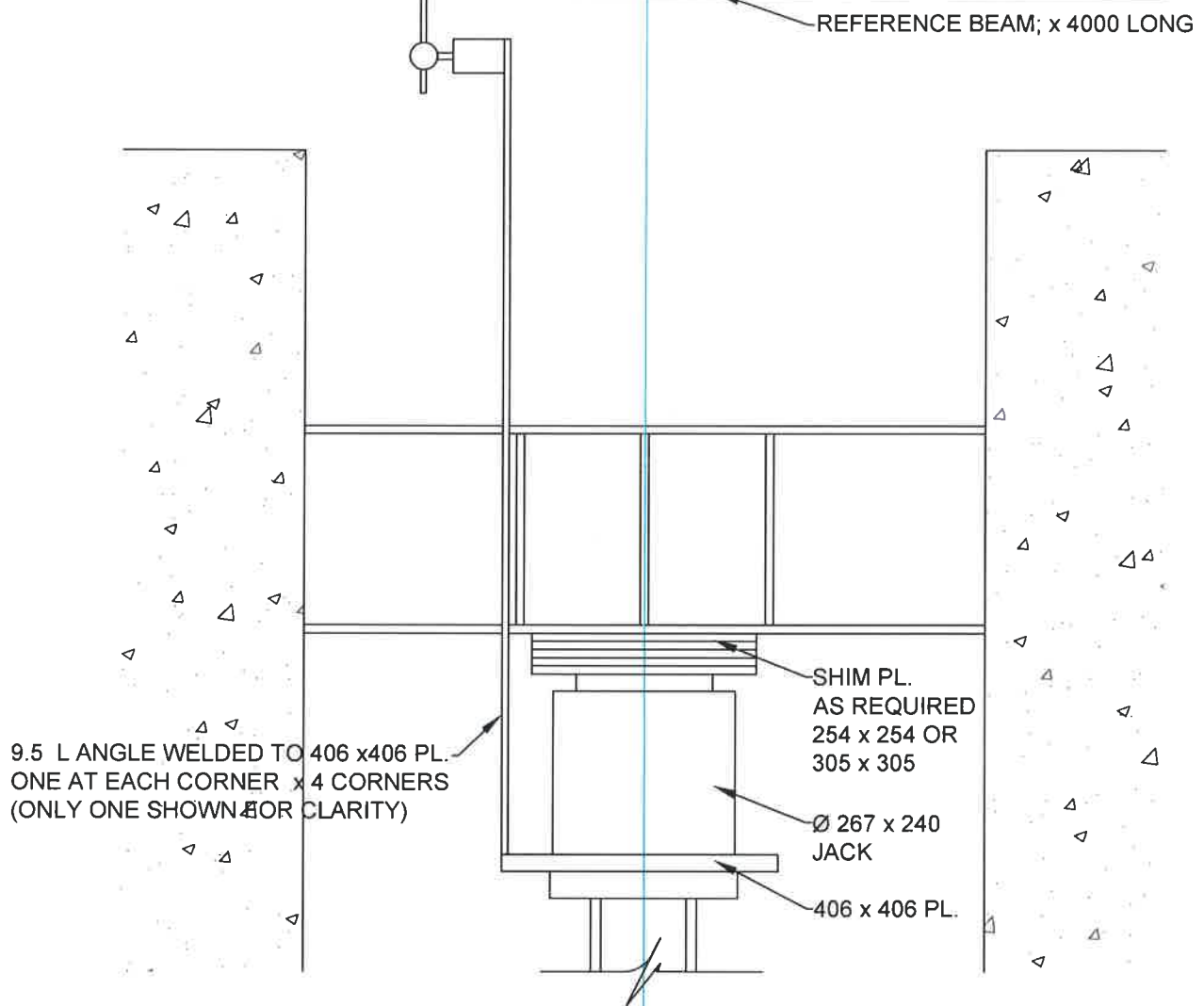
1. ASTM Standard D1143-07 applies to pile compression testing.
 - a. A jack with a load capacity of 1000kN will be provided by the Testing Contractor
 - b. 4 dial gauges will be provided for each load test setup
2. Conduct test with load increment up to a maximum load of 800 kN or until failure occurs as identified below in kN:
45, 90, 135, 180, 240, 300, 375, 450, 525, 600, 800
3. Convert loads to equivalent jack pressures using test jack calibration curve.
4. Conduct specified pile load test, measuring an accuracy of 0.01 mm with respect to an independent fixed reference system.

AXIAL COMPRESSION TEST

1. The test shall be conducted by incrementally loading and unloading until the pile fails, with measurement recorded at intervals directed by the Engineer in the Field.
 - a. Loading; as specified in the procedures above.
 - b. Unloading; Maximum 25% reduction at peak ... to 0.
2. Apply load as per identified load increments tabulated above, maintaining the load until the rate of settlement for that constant load is ≤ 0.25 mm/hr (0.01"/hr). However, maximum time period is 2 hours.
3. Obtain reading for each incremental loading at times outlined on Record sheets:
ie. 5 min., 10 min., 15 min., 30 min., 1 hr., 2 hr.
If the settlement rate is ≤ 0.25 mm/hr (0.01"/hr) at a minimum of 30 min., proceed to next load increment
4. The maximum load is 800 kN. If this force is achieved, obtain readings at the following time intervals.
ie. 5 min., 10 min., 15 min., 30 min., 1 hr., 2 hr., ... every hour thereafter.

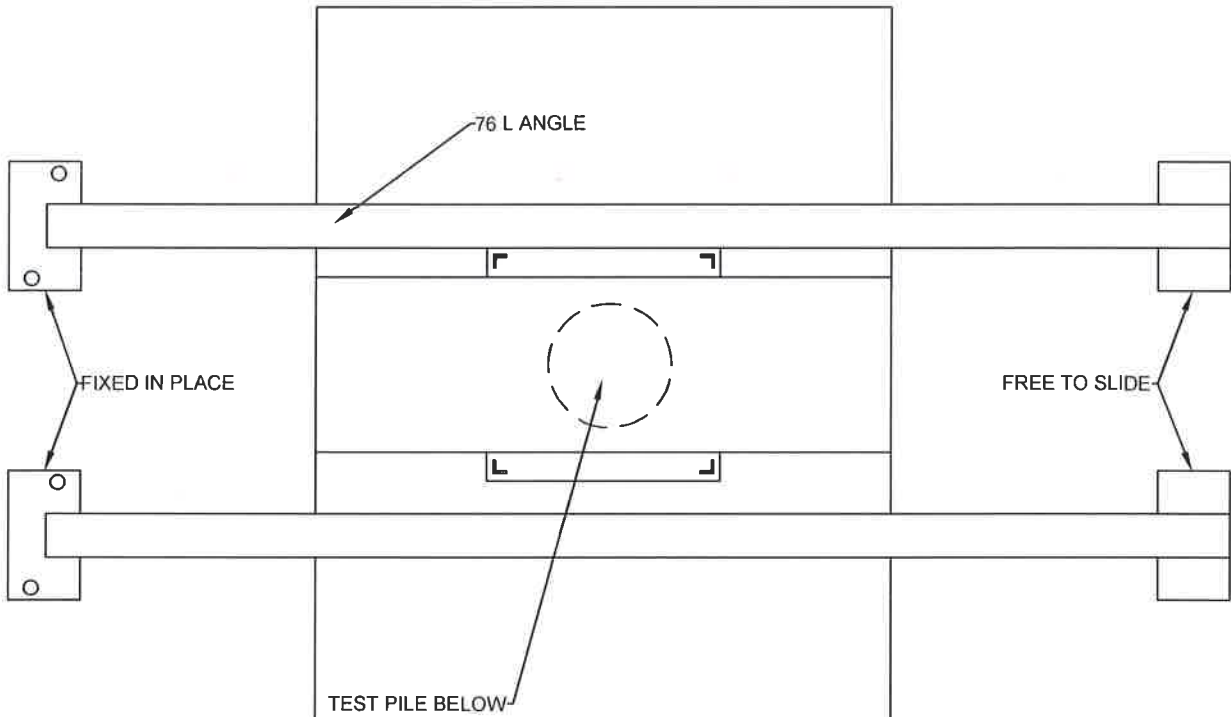
The minimum load application time is 12 hrs.; maximum 24 hours. The minimum is defined by the settlement rate ≤ 0.25 mm/hr (0.01"/hr) at 1 hour intervals

5. If failure occurs prior to 800 kN, monitor load-settlement until total settlement for the particular load is 50 mm (15% deflection of pile diameter or diagonal dimension).
6. Unloading with 25% reduction from the peak value and maintain pressure a minimum of 30 min. and maximum 1 hr. with total time less than 4 hours.




SECTION

1	ISSUED FOR COORINDATION	09/25/2013
No.	DESCRIPTION	DATE
519-853-3216		
 302 MAIN STREET NORTH ACTON, ONTARIO L7J 1W9 GEO-FOUNDATIONS CONTRACTORS INC.		
TITLE: THURBER ENGINEERING LTD. PIC RIVER BRIDGE PILE LOAD TESTING SEPT./OCT. 2013		
SCALE:		DWG NO:
N.T.S		G-13-24-SK1



PLAN

1	ISSUED FOR COORDINATION	09/25/2013
No.	DESCRIPTION	DATE
519-853-3216		
 302 MAIN STREET NORTH ACTON, ONTARIO L7J 1W9 GEO-FOUNDATIONS CONTRACTORS INC.		
TITLE: THURBER ENGINEERING LTD. PIC RIVER BRIDGE PILE LOAD TESTING SEPT./OCT. 2013		
SCALE: N.T.S		DWG NO: G-13-24-SK2



Photograph C1 – Pile Cap Cut-out and Reaction Beam at Pier G-5



Photograph C2 – Pile Load Test Set-up at Pile E-16, East Pier



Photograph C3 – Pile Load Test Set-up at Pile E-2, West Pier



Photograph C4 – Shelter Set-up for Pile Load Test at Pier E-2



Photograph C6 – Drill Rig Set-up for Piezocone Penetration Testing, Pile E-16



Photograph C7 – Piezocone Testing at Pile E-16

Appendix D

Results of Static Pile Load Tests

Includes:

Load-Settlement Plots

Recorded Settlement Data



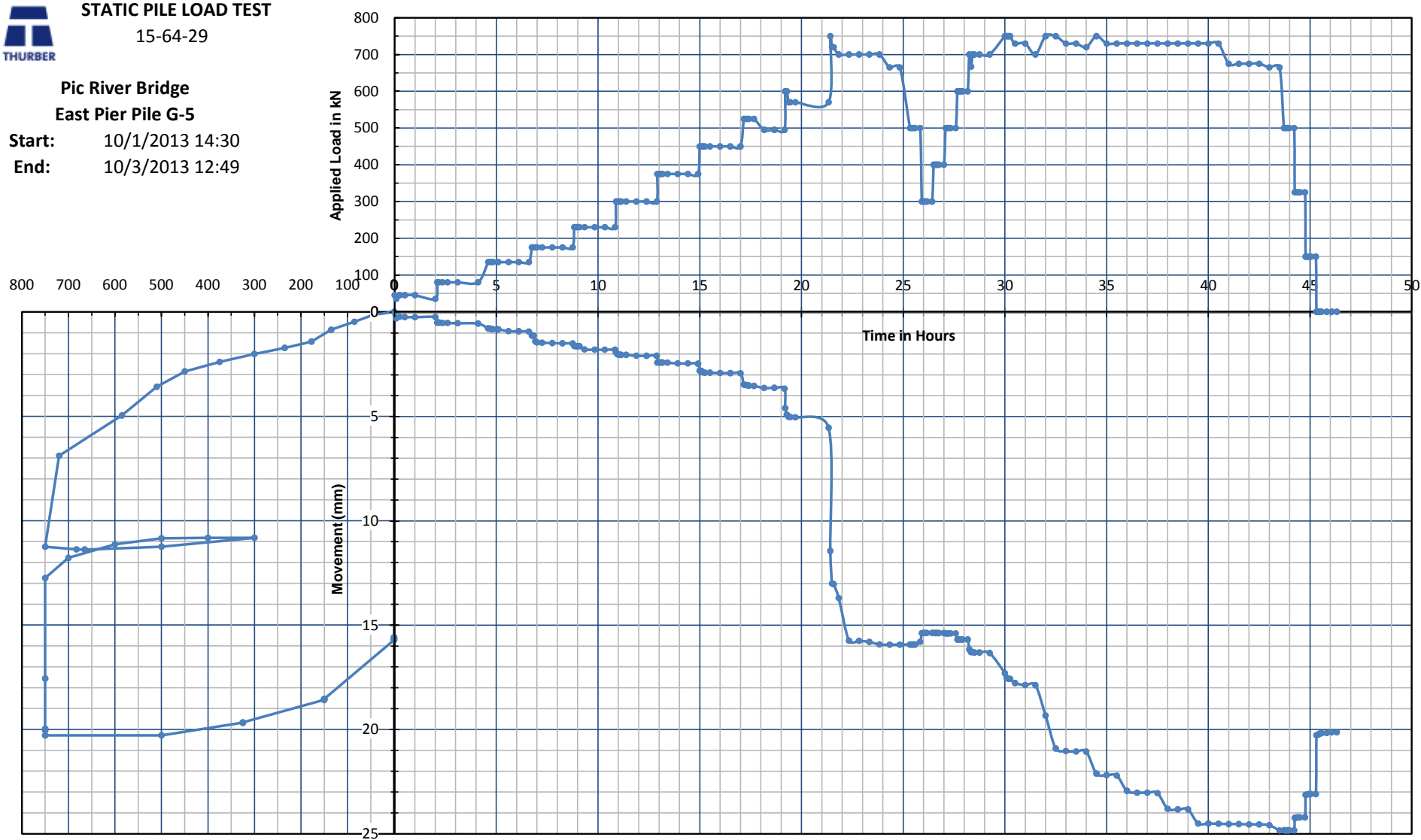
STATIC PILE LOAD TEST

15-64-29

Pic River Bridge
East Pier Pile G-5

Start: 10/1/2013 14:30

End: 10/3/2013 12:49



Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:East Pier

Start:10/1/2013 14:30

End:10/3/2013 12:49

Pile:G-5

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
												Gauge 5			Gauge 6	
	kN	psi	kN	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	Avg G1 to G4 (mm)	(mm)	Δ (mm)
Zero	45	250	45	11.61		2.9		8.64		0.74		5.31			0.824	
2:35	45	250	35	11.81	0.2	2.95	0.05	9.53	0.89	0.74	0	5.31	0	0.29	0.762	-0.06
2:45	45	250	45	11.73	-0.08	2.9	-0.05	9.42	-0.11	0.69	-0.05	5.31	0	-0.07	0.758	0.00
3:00	45	250	45	11.73	0	2.92	0.02	9.45	0.03	0.71	0.02	5.31	0	0.02	0.754	0.00
3:30	45	250	45	11.76	0.03	2.92	0	9.45	0	0.69	-0.02	5.33	0.02	0.00	0.75	0.00
4:30	45	250	35	11.73	-0.03	2.9	-0.02	9.45	0	0.71	0.02	5.38	0.05	-0.01	0.756	0.01
4:36	90	550	80	12.12	0.39	3.05	0.15	9.91	0.46	0.81	0.1	5.41	0.03	0.28	0.756	0.00
4:41	90	550	80	12.12	0	3.05	0	9.88	-0.03	0.81	0	5.41	0	-0.01	0.75	-0.01
4:51	90	550	80	12.17	0.05	3.05	0	9.91	0.03	0.81	0	5.41	0	0.02	0.766	0.02
5:06	90	550	80	12.17	0	3.05	0	9.91	0	0.81	0	5.41	0	0.00	0.766	0.00
5:36	90	550	80	12.19	0.02	3.05	0	9.91	0	0.84	0.03	5.51	0.1	0.01	0.758	-0.01
6:36	90	550	80	12.19	0	3.07	0.02	9.93	0.02	0.86	0.02	6.12	0.61	0.01	0.766	0.01
7:06	135	800	135	12.45	0.26	3.28	0.21	10.24	0.31	1.01	0.15	10.92	4.8	0.23	0.91	0.14
7:11	135	800	135	12.45	0	3.28	0	10.24	0	1.04	0.03	11	0.08	0.01	0.872	-0.04
7:16	135	800	135	12.47	0.02	3.3	0.02	10.29	0.05	1.07	0.03	11.07	0.07	0.03	0.872	0.00
7:21	135	800	135	12.47	0	3.3	0	10.29	0	1.07	0	11.2	0.13	0.00	0.872	0.00
7:36	135	800	135	12.5	0.03	3.3	0	10.29	0	1.07	0	11.33	0.13	0.01	0.872	0.00
8:06	135	800	135	12.6	0.1	3.35	0.05	10.44	0.15	1.12	0.05	11.43	0.1	0.09	0.922	0.05
8:36	135	800	135	12.6	0	3.35	0	10.44	0	1.14	0.02	11.46	0.03	0.00	0.922	0.00
9:06	135	800	135	12.65	0.05	3.35	0	10.46	0.02	1.14	0	11.48	0.02	0.02	0.914	-0.01
9:15	180	1050	175	12.9	0.25	3.5	0.15	10.72	0.26	1.24	0.1	11.53	0.05	0.19	1.03	0.12
9:20	180	1050	175	12.9	0	3.5	0	10.72	0	1.24	0	11.53	0	0.00	1.048	0.02
9:25	180	1050	175	13.99	1.09	3.5	0	10.74	0.02	1.24	0	11.53	0	0.28	1.046	0.00
9:30	180	1050	175	14.05	0.06	3.53	0.03	10.79	0.05	1.27	0.03	11.53	0	0.04	1.046	0.00
9:45	180	1050	175	14.07	0.02	3.53	0	10.82	0.03	1.3	0.03	11.53	0	0.02	1.054	0.01
10:15	180	1050	175	14.09	0.02	3.56	0.03	10.84	0.02	1.3	0	11.56	0.03	0.02	1.068	0.01
10:45	180	1050	175	14.09	0	3.56	0	10.87	0.03	1.32	0.02	11.56	0	0.01	1.076	0.01
11:15	180	1050	175	14.09	0	3.56	0	10.87	0	1.35	0.03	11.56	0	0.01	1.078	0.00
11:20	240	1400	230	14.173	0.083	3.73	0.17	10.9	0.03	1.55	0.2	11.61	0.05	0.12	1.286	0.21
11:25	240	1400	230	14.199	0.026	3.73	0	10.92	0.02	1.55	0	11.61	0	0.01	1.308	0.02
11:30	240	1400	230	14.199	0	3.73	0	10.92	0	1.55	0	11.61	0	0.00	1.308	0.00
11:35	240	1400	230	14.199	0	3.73	0	10.92	0	1.55	0	11.61	0	0.00	1.308	0.00
11:50	240	1400	230	14.199	0	3.78	0.05	11.43	0.51	1.6	0.05	11.61	0	0.15	1.308	0.00
12:20	240	1400	230	14.224	0.025	3.78	0	11.43	0	1.63	0.03	11.98	0.37	0.01	1.308	0.00
12:50	240	1400	230	14.224	0	3.78	0	11.43	0	1.63	0	12.07	0.09	0.00	1.342	0.03
1:20	240	1400	230	14.224	0	3.78	0	11.43	0	1.63	0	12.09	0.02	0.00	1.342	0.00
1:23	300	1800	300	14.249	0.025	3.96	0.18	11.71	0.28	1.88	0.25	12.14	0.05	0.18	1.59	0.25
1:28	300	1800	300	14.3	0.051	3.98	0.02	11.79	0.08	1.91	0.03	12.91	0.77	0.05	1.622	0.03
1:33	300	1800	300	14.326	0.026	3.98	0	11.79	0	1.91	0	12.91	0	0.01	1.622	0.00

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:East Pier

Start:10/1/2013 14:30

End:10/3/2013 12:49

Pile:G-5

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
												Gauge 5			Gauge 6	
	kN	psi	kN	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	Avg G1 to G4 (mm)	(mm)	Δ (mm)
1:38	300	1800	300	14.351	0.025	3.98	0	11.81	0.02	1.91	0	12.21	-0.7	0.01	1.622	0.00
1:53	300	1800	300	14.351	0	3.98	0	11.81	0	1.91	0	12.21	0	0.00	1.642	0.02
2:23	300	1800	300	14.402	0.051	4.01	0.03	11.88	0.07	1.93	0.02	12.24	0.03	0.04	1.656	0.01
2:53	300	1800	300	14.402	0	4.01	0	11.86	-0.02	1.96	0.03	12.24	0	0.00	1.662	0.01
3:23	300	1800	300	14.402	0	4.01	0	11.86	0	1.96	0	12.27	0.03	0.00	1.67	0.01
3:25	375	2300	375	14.351	-0.051	4.34	0.33	12.47	0.61	2.39	0.43	12.32	0.05	0.33	2.08	0.41
3:30	375	2300	375	14.351	0	4.34	0	12.47	0	2.33	-0.06	12.32	0	-0.02	2.082	0.00
3:35	375	2300	375	14.351	0	4.34	0	12.47	0	2.36	0.03	12.32	0	0.01	2.086	0.00
3:40	375	2300	375	14.351	0	4.34	0	12.47	0	2.36	0	12.32	0	0.00	2.086	0.00
3:55	375	2300	375	14.376	0.025	4.34	0	12.47	0	2.36	0	12.32	0	0.01	2.081	0.00
4:25	375	2300	375	14.326	-0.05	4.39	0.05	12.57	0.1	2.41	0.05	12.36	0.04	0.04	2.174	0.09
4:55	375	2300	375	14.326	0	4.39	0	12.57	0	2.41	0	12.39	0.03	0.00	2.174	0.00
5:25	375	2300	375	14.326	0	4.39	0	12.6	0.03	2.44	0.03	12.42	0.03	0.01	2.178	0.00
5:30	450	2700	450	14.58	0.254	4.67	0.28	13.06	0.46	2.79	0.35	12.5	0.08	0.34	3	0.34
5:35	450	2700	450	14.58	0	4.67	0	13.08	0.02	2.82	0.03	12.5	0	0.01	2.518	0.00
5:40	450	2650	450	14.63	0.05	4.75	0.08	13.18	0.1	2.84	0.02	12.57	0.07	0.06	2.6	0.08
5:45	450	2700	450	14.656	0.026	4.77	0.02	13.2	0.02	2.84	0	12.57	0	0.02	2.6	0.00
6:00	450	2700	450	14.656	0	4.77	0	13.2	0	2.84	0	12.57	0	0.00	2.628	0.03
6:30	450	2700	450	14.656	0	4.77	0	13.23	0.03	2.87	0.03	12.75	0.18	0.02	2.656	0.03
7:00	450	2700	450	14.656	0	4.77	0	13.23	0	2.9	0.03	12.82	0.07	0.01	2.656	0.00
7:30	450	2700	450	14.681	0.025	4.775	0.005	13.233	0.003	2.896	-0.004	12.852	0.032	0.01	2.656	0.00
7:40	525	3150	525	15.24	0.559	5.232	0.457	13.894	0.661	3.378	0.482	12.979	0.127	0.54	3.186	0.53
7:45	525	3150	525	15.265	0.025	5.258	0.026	13.919	0.025	3.404	0.026	12.979	0	0.03	3.192	0.01
7:50	525	3150	525	15.265	0	5.258	0	13.945	0.026	3.404	0	12.979	0	0.01	3.21	0.02
7:55	525	3150	525	15.291	0.026	5.283	0.025	13.945	0	3.429	0.025	13.03	0.051	0.02	3.228	0.02
8:10	525	3150	525	15.291	0	5.283	0	13.97	0.025	3.454	0.025	13.132	0.102	0.01	3.266	0.04
8:40	525	3150	495	15.443	0.152	5.359	0.076	14.072	0.102	3.531	0.077	13.513	0.381	0.10	3.284	0.02
9:10	525	3150	495	15.494	0.051	5.182	-0.177	14.122	0.05	3.581	0.05	-	-	-0.01	3.224	-0.06
9:40	525	3150	495	15.57	0.076	5.207	0.025	14.122	0	3.632	0.051	-	-	0.04	3.28	0.06
9:42	600	3650	600	16.485	0.915	6.02	0.813	15.24	1.118	4.521	0.889	-	-	0.93	4.21	0.93
9:47	600	3650	600	16.789	0.304	6.299	0.279	15.596	0.356	4.826	0.305	-	-	0.31	4.528	0.32
9:52	600	3650	570	16.942	0.153	6.375	0.076	15.697	0.101	4.902	0.076	-	-	0.10	4.606	0.08
9:57	600	3650	570	16.942	0	6.375	0	15.723	0.026	4.928	0.026	-	-	0.01	4.63	0.02
10:12	600	3650	570	16.942	0	6.401	0.026	15.748	0.025	4.928	0	-	-	0.01	4.632	0.00
10:42	600	3650	570	16.942	0	6.426	0.025	15.748	0	4.978	0.05	-	-	0.02	4.718	0.09
11:12	600	4900	570	17.45	0.508	6.833	0.407	16.281	0.533	5.385	0.407	-	-	0.46	5.128	0.41
11:42	600	4900	570	17.45	0	6.883	0.05	16.281	0	5.41	0.025	-	-	0.02	5.172	0.04
11:50	800	4900	750	21.971	4.521	10.998	4.115	21.184	4.903	9.779	4.369	-	-	4.48	9.584	4.41
11:55	800	4900	750	23.419	1.448	12.395	1.397	22.657	1.473	11.176	1.397	-	-	1.43	10.964	1.38

Pile Load Test - Settlement Record

Job Number: 15-64-29
Location: Pic River Bridge
Location: East Pier

Start: 10/1/2013 14:30
End: 10/3/2013 12:49
Pile: G-5

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi	kN	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	Avg G1 to G4 (mm)	(mm)	Δ (mm)
12:00	800	4900	720	24.994	1.575	13.919	1.524	24.308	1.651	12.7	1.524	-	-	1.57	12.508	1.54
12:05	800	4900	720	24.994	0	13.97	0.051	24.333	0.025	12.725	0.025	-	-	0.03	12.546	0.04
12:20	800	4900	700	25.679	0.685	14.605	0.635	24.994	0.661	13.411	0.686	-	-	0.67	13.162	0.62
12:50	800	4900	700	27.711	2.032	16.561	1.956	27.153	2.159	15.418	2.007	-	-	2.04	15.034	1.87
1:20	800	4900	700	27.737	0.026	16.586	0.025	27.153	0	15.418	0	-	-	0.01	15.036	0.00
1:50	800	4900	700	27.788	0.051	16.637	0.051	27.203	0.05	15.467	0.049	23.393	-	0.05	15.044	0.01
2:20	665	4050	700	27.788	0	16.637	0	27.703	0.5	15.467	0	23.393	0	0.13	15.046	0.00
2:50	665	4050	665	27.788	0	16.637	0	27.703	0	15.494	0.027	23.393	0	0.01	15.048	0.00
3:20	665	4050	665	27.788	0	16.637	0	27.703	0	15.494	0	23.393	0	0.00	15.048	0.00
3:50	500	3000	500	27.788	0	16.637	0	27.703	0	15.469	-0.025	23.393	0	-0.01	15.044	0.00
3:55	500	3000	500	27.788	0	16.637	0	27.703	0	15.469	0	23.393	0	0.00	15.044	0.00
4:00	500	3000	500	27.788	0	16.637	0	27.703	0	15.469	0	23.393	0	0.00	15.044	0.00
4:05	500	3000	500	27.788	0	16.637	0	27.703	0	15.469	0	23.393	0	0.00	15.044	0.00
4:20	500	3000	500	27.788	0	16.637	0	27.178	-0.525	15.469	0	23.393	0	-0.13	15.044	0.00
4:25	300	1800	300	27.457	-0.331	16.205	-0.432	26.721	-0.457	15.037	-0.432	23.317	-0.076	-0.41	14.934	-0.11
4:30	300	1800	300	27.457	0	16.18	-0.025	26.695	-0.026	15.037	0	23.317	0	-0.01	14.934	0.00
4:35	300	1800	300	27.457	0	16.18	0	26.695	0	15.037	0	23.317	0	0.00	14.934	0.00
4:40	300	1800	300	27.457	0	16.18	0	26.695	0	15.037	0	23.317	0	0.00	14.934	0.00
4:55	300	1800	300	27.457	0	16.18	0	26.695	0	15.037	0	23.317	0	0.00	14.916	-0.02
5:00	400	2400	400	27.457	0	16.18	0	26.695	0	15.037	0	23.317	0	0.00	14.916	0.00
5:05	400	2400	400	27.457	0	16.18	0	26.721	0.026	15.037	0	23.317	0	0.01	14.916	0.00
5:10	400	2400	400	27.457	0	16.18	0	26.721	0	15.037	0	23.317	0	0.00	14.916	0.00
5:15	400	2400	400	27.457	0	16.18	0	26.721	0	15.037	0	23.317	0	0.00	14.916	0.00
5:30	400	2400	400	27.457	0	16.18	0	26.721	0	15.037	0	23.317	0	0.00	14.916	0.00
5:35	500	3000	500	27.457	0	16.18	0	26.772	0.051	15.062	0.025	23.317	0	0.02	14.916	0.00
5:40	500	3000	500	27.457	0	16.205	0.025	26.772	0	15.062	0	23.317	0	0.01	13.958	0.00
5:45	500	3000	500	27.457	0	16.205	0	26.772	0	15.037	-0.025	23.317	0	-0.01	13.938	-0.02
5:50	500	3000	500	27.457	0	16.205	0	26.772	0	15.037	0	23.317	0	0.00	13.938	0.00
6:05	500	3000	500	27.457	0	16.205	0	26.772	0	15.037	0	23.317	0	0.00	13.936	0.00
6:10	600	3650	600	27.686	0.229	16.535	0.33	27.051	0.279	15.367	0.33	23.368	0.051	0.29	14.292	0.36
6:15	600	3650	600	27.686	0	16.535	0	27.051	0	15.367	0	23.368	0	0.00	14.292	0.00
6:20	600	3650	600	27.686	0	16.535	0	27.051	0	15.367	0	23.368	0	0.00	14.292	0.00
6:25	600	3650	600	27.686	0	16.535	0	27.051	0	15.367	0	23.368	0	0.00	14.292	0.00
6:40	600	3650	600	27.686	0	16.535	0	27.051	0	15.367	0	23.368	0	0.00	14.292	0.00
6:45	700	4300	700	28.118	0.432	16.993	0.458	27.559	0.508	15.85	0.483	23.444	0.076	0.47	14.728	0.44
6:50	700	4300	667	28.27	0.152	17.094	0.101	27.686	0.127	15.977	0.127	23.444	0	0.13	14.82	0.09
6:55	700	4300	700	28.27	0	17.12	0.026	27.686	0	15.977	0	23.444	0	0.01	14.824	0.00
7:00	700	4300	700	28.296	0.026	17.12	0	27.71	0.024	16.002	0.025	23.444	0	0.02	14.85	0.03
7:15	700	4300	700	28.296	0	17.12	0	27.71	0	16.002	0	23.444	0	0.00	14.86	0.01

Pile Load Test - Settlement Record

Job Number: 15-64-29
Location: Pic River Bridge
Location: East Pier

Start: 10/1/2013 14:30
End: 10/3/2013 12:49
Pile: G-5

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi	kN	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	Avg G1 to G4 (mm)	(mm)	Δ (mm)
7:45	700	4300	700	28.321	0.025	17.145	0.025	27.737	0.027	16.027	0.025	23.444	0	0.03	14.878	0.02
8:30	750	4600	750	29.235	0.914	18.11	0.965	28.753	1.016	16.993	0.966	23.469	0.025	0.97	15.854	0.98
8:35	750	4600	750	29.413	0.178	18.339	0.229	28.981	0.228	17.247	0.254	23.469	0	0.22	16.09	0.24
8:40	750	4600	750	29.489	0.076	18.39	0.051	29.032	0.051	17.247	0	23.469	0	0.04	16.11	0.02
8:45	750	4600	750	29.515	0.026	18.39	0	29.032	0	17.247	0	23.469	0	0.01	16.118	0.01
9:00	750	4600	730	29.692	0.177	18.593	0.203	29.235	0.203	17.475	0.228	23.469	0	0.20	16.398	0.28
9:30	750	4600	730	29.82	0.128	18.669	0.076	29.337	0.102	17.551	0.076	23.469	0	0.10	16.41	0.01
10:00	750	4600	700	29.82	0	18.669	0	29.362	0.025	17.557	0.006	23.469	0	0.01	16.418	0.01
10:30	750	4600	750	31.267	1.447	20.091	1.422	30.861	1.499	18.999	1.442	23.469	0	1.45	17.888	1.47
11:00	750	4600	750	32.868	1.601	21.641	1.55	32.41	1.549	20.624	1.625	23.469	0	1.58	19.512	1.62
11:30	750	4600	730	32.995	0.127	21.742	0.101	32.537	0.127	20.751	0.127	23.469	0	0.12	19.63	0.12
12:00	750	4600	730	33.02	0.025	21.768	0.026	32.563	0.026	20.777	0.026	23.469	0	0.03	19.646	0.02
12:30	750	4600	720	33.02	0	21.793	0.025	32.563	0	20.777	0	23.469	0	0.01	19.662	0.02
1:00	750	4600	750	34.061	1.041	22.86	1.067	33.63	1.067	21.793	1.016	23.469	0	1.05	20.178	0.52
1:30	750	4600	730	34.138	0.077	22.911	0.051	33.731	0.101	21.869	0.076	23.469	0	0.08	20.792	0.61
2:00	750	4600	730	34.163	0.025	22.911	0	33.757	0.026	21.895	0.026	23.469	0	0.02	20.806	0.01
2:30	750	4600	730	34.874	0.711	23.622	0.711	34.519	0.762	22.657	0.762	23.469	0	0.74	21.564	0.76
3:00	750	4600	730	34.95	0.076	23.698	0.076	34.62	0.101	22.733	0.076	23.469	0	0.08	21.656	0.09
3:30	750	4600	730	34.95	0	23.698	0	34.62	0	22.733	0	23.469	0	0.00	21.658	0.00
4:00	750	4600	730	34.976	0.026	23.724	0.026	34.646	0.026	22.758	0.025	23.469	0	0.03	21.682	0.02
4:30	750	4600	730	35.738	0.762	24.434	0.71	35.408	0.762	23.52	0.762	23.469	0	0.75	22.45	0.77
5:00	750	4600	730	35.763	0.025	24.486	0.052	35.433	0.025	23.546	0.026	23.469	0	0.03	22.48	0.03
5:30	750	4600	730	35.763	0	24.486	0	35.433	0	23.546	0	23.469	0	0.00	22.484	0.00
6:00	750	4600	730	36.449	0.686	25.146	0.66	36.119	0.686	24.206	0.66	23.469	0	0.67	23.152	0.67
6:30	750	4600	730	36.449	0	25.146	0	36.119	0	24.206	0	23.469	0	0.00	23.158	0.01
7:00	750	4600	730	36.449	0	25.146	0	36.144	0.025	24.232	0.026	23.469	0	0.01	23.168	0.01
7:30	750	4600	675	36.449	0	25.197	0.051	36.144	0	24.232	0	23.47	0.001	0.01	23.174	0.01
8:00	750	4600	675	36.449	0	25.197	0	36.144	0	24.232	0	23.47	0	0.00	23.182	0.01
8:30	750	4600	675	36.449	0	25.222	0.025	36.144	0	24.282	0.05	23.47	0	0.02	23.24	0.06
9:00	750	4600	675	36.449	0	25.222	0	36.144	0	24.282	0	23.444	-0.026	0.00	23.24	0.00
9:30	750	4600	665	36.525	0.076	25.248	0.026	36.195	0.051	24.282	0	23.444	0	0.04	23.262	0.02
10:00	750	4600	665	36.525	0	25.248	0	36.195	0	25.282	1	23.444	0	0.25	23.262	0.00
10:13	500	3000	500	36.525	0	25.248	0	36.17	-0.025	25.282	0	23.444	0	-0.01	23.262	0.00
10:18	500	3000	500	36.525	0	25.248	0	36.17	0	25.282	0	23.444	0	0.00	23.262	0.00
10:23	500	3000	500	36.525	0	25.248	0	36.17	0	25.282	0	23.444	0	0.00	23.262	0.00
10:28	500	3000	500	36.525	0	25.248	0	36.17	0	25.282	0	23.444	0	0.00	23.262	0.00
10:43	500	3000	500	36.525	0	25.248	0	36.17	0	25.282	0	23.444	0	0.00	23.262	0.00
10:45	325	2000	325	36.271	-0.254	24.887	-0.361	35.789	-0.381	23.876	-1.406	23.393	-0.051	-0.60	22.976	-0.29
10:50	325	2000	325	36.271	0	24.887	0	35.763	-0.026	23.876	0	23.393	0	-0.01	22.976	0.00

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:East Pier

Start:10/1/2013 14:30

End:10/3/2013 12:49

Pile:G-5

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi	kN	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	Avg G1 to G4 (mm)	(mm)	Δ (mm)
10:55	325	2000	325	36.271	0	24.841	-0.046	35.763	0	23.876	0	23.368	-0.025	-0.01	22.97	-0.01
11:00	325	2000	325	36.271	0	24.841	0	35.763	0	23.876	0	23.368	0	0.00	22.968	0.00
11:15	325	2000	325	36.271	0	24.841	0	35.763	0	23.876	0	23.368	0	0.00	22.968	0.00
11:17	150	1000	150	35.357	-0.914	23.749	-1.092	34.62	-1.143	22.708	-1.168	23.216	-0.152	-1.08	21.888	-1.08
11:22	150	1000	150	35.331	-0.026	23.724	-0.025	34.595	-0.025	22.682	-0.026	23.216	0	-0.03	21.836	-0.05
11:27	150	1000	150	35.306	-0.025	23.698	-0.026	34.595	0	22.682	0	23.216	0	-0.01	21.836	0.00
11:32	150	1000	150	35.306	0	23.698	0	34.569	-0.026	22.682	0	23.216	0	-0.01	21.832	0.00
11:47	150	1000	150	35.306	0	23.698	0	34.569	0	22.682	0	23.216	0	0.00	21.832	0.00
11:49	0	0	0	32.537	-2.769	21.692	-2.006	30.734	-3.835	20.015	-2.667	22.911	-0.305	-2.82	19.744	-2.09
11:54	0	0	0	32.512	-0.025	21.717	0.025	30.632	-0.102	20.015	0	22.911	0	-0.03	19.74	0.00
11:59	0	0	0	32.461	-0.051	21.666	-0.051	30.556	-0.076	19.99	-0.025	22.911	0	-0.05	19.7	-0.04
12:04	0	0	0	32.436	-0.025	21.666	0	30.531	-0.025	19.964	-0.026	22.911	0	-0.02	19.654	-0.05
12:19	0	0	0	32.436	0	21.641	-0.025	30.531	0	19.964	0	22.911	0	-0.01	19.63	-0.02
12:34	0	0	0	32.385	-0.051	21.641	0	30.455	-0.076	19.914	-0.05	22.911	0	-0.04	19.596	-0.03
12:49	0	0	0	32.385	0	21.641	0	30.455	0	19.914	0	22.911	0	0.00	19.596	0.00



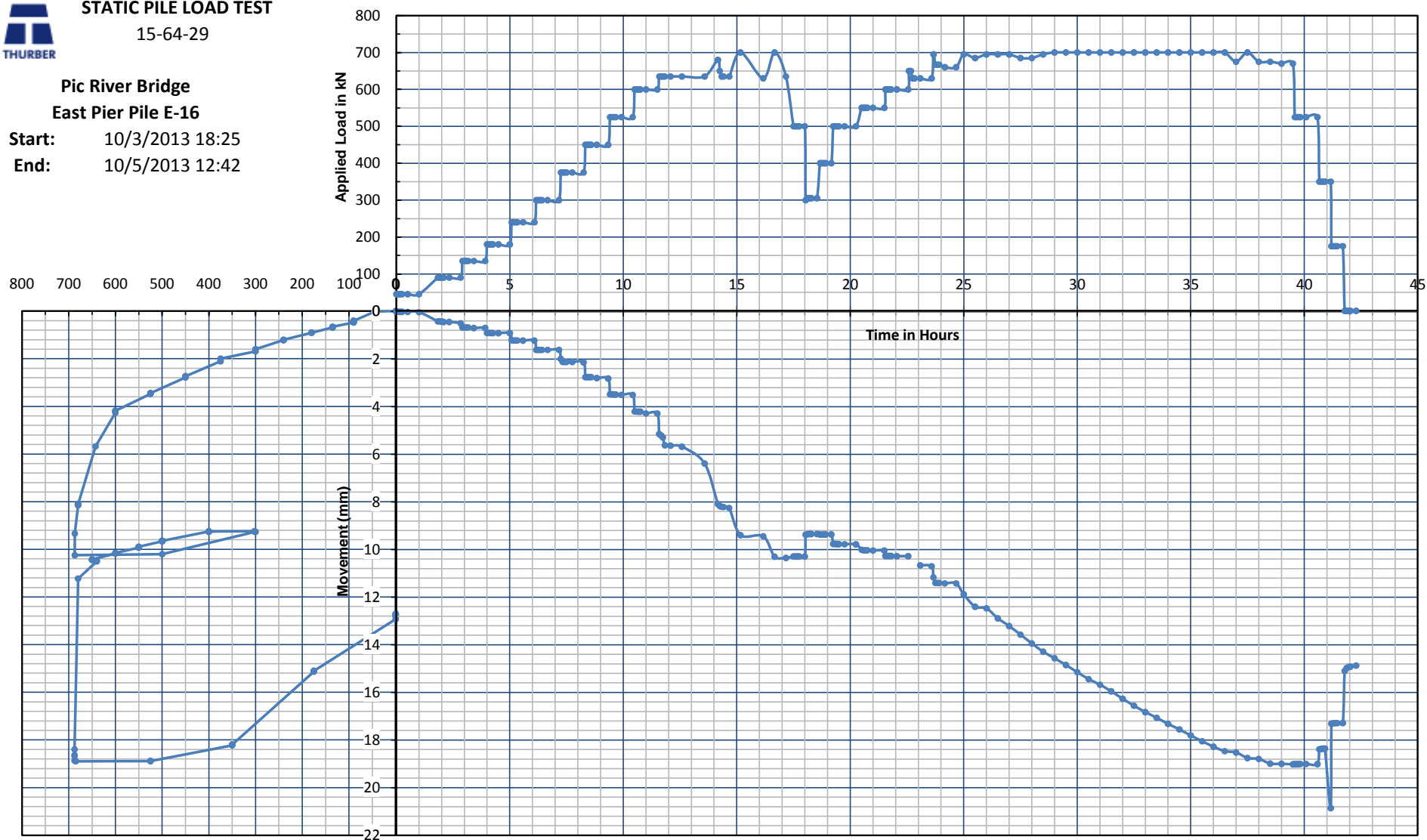
STATIC PILE LOAD TEST

15-64-29

Pic River Bridge
East Pier Pile E-16

Start: 10/3/2013 18:25

End: 10/5/2013 12:42



Pile Load Test - Settlement Record

Job Number:

15-64-29

Location:

Pic River Bridge

Location:

East Pier

Start:

10/3/2013 18:25

End:

10/5/2013 12:42

Pile:

E-16

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations Avg G1 to G4 (mm)	Digital	
	kN	psi		(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)		(mm)	Δ (mm)
6:25	45	300	45	10.871		2.642		2.54		3.454		38.887			1.452	
6:30	45	300	45	10.871		2.642	0	2.591	0.051	3.454	0	38.887	0	0.01	1.47	0.02
6:35	45	300	45	10.871	0	2.642	0	2.616	0.025	3.454	0	38.887	0	0.01	1.47	0.00
6:40	45	300	45	10.871	0	2.642	0	2.616	0	3.454	0	38.887	0	0.00	1.47	0.00
6:55	45	300	45	10.871	0	2.642	0	2.616	0	3.479	0.025	38.887	0	0.01	1.482	0.01
7:25	45	300	45	10.871	0	2.642	0	2.642	0.026	3.479	0	38.887	0	0.01	1.484	0.00
8:15	90	600	90	11.405	0.534	2.769	0.127	3.226	0.584	3.785	0.306	38.887	0	0.39	1.826	0.34
8:20	90	600	90	11.405	0	2.769	0	3.226	0	3.785	0	38.887	0	0.00	1.826	0.00
8:25	90	600	90	11.43	0.025	2.769	0	3.226	0	3.785	0	38.887	0	0.01	1.826	0.00
8:30	90	600	90	11.481	0.051	2.769	0	3.226	0	3.81	0.025	38.887	0	0.02	1.826	0.00
8:45	90	600	90	11.481	0	2.769	0	3.226	0	3.81	0	38.887	0	0.00	1.83	0.00
9:15	90	600	90	11.481	0	2.769	0	3.226	0	4.039	0.229	38.887	0	0.06	1.848	0.02
9:20	135	900	135	11.481	0	2.946	0.177	3.733	0.507	4.039	0	38.887	0	0.17	2.07	0.22
9:25	135	900	135	11.481	0	2.946	0	3.733	0	4.039	0	38.887	0	0.00	2.07	0.00
9:30	135	900	135	11.481	0	2.946	0	3.733	0	4.039	0	38.887	0	0.00	2.086	0.02
9:35	135	900	135	11.481	0	2.946	0	3.733	0	4.039	0	38.887	0	0.00	2.092	0.01
9:50	135	900	135	11.481	0	2.997	0.051	3.733	0	4.089	0.05	38.887	0	0.03	2.11	0.02
10:20	135	900	135	11.481	0	2.997	0	3.733	0	4.089	0	38.887	0	0.00	2.118	0.01
10:25	180	1200	180	11.481	0	3.2	0.203	4.14	0.407	4.318	0.229	38.887	0	0.21	2.352	0.23
10:30	180	1200	180	11.481	0	3.2	0	4.14	0	4.318	0	38.887	0	0.00	2.352	0.00
10:35	180	1200	180	11.481	0	3.2	0	4.14	0	4.318	0	38.887	0	0.00	2.352	0.00
10:40	180	1200	180	11.481	0	3.2	0	4.14	0	4.343	0.025	38.887	0	0.01	2.356	0.00
10:55	180	1200	180	11.481	0	3.2	0	4.14	0	4.343	0	38.887	0	0.00	2.356	0.00
11:25	180	1200	180	11.481	0	3.2	0	4.14	0	4.343	0	38.887	0	0.00	2.356	0.00
11:30	240	1550	240	11.684	0.203	3.407	0.207	4.623	0.483	4.6482	0.3052	38.887	0	0.30	2.646	0.29
11:35	240	1550	240	11.684	0	3.429	0.022	4.623	0	4.6482	0	38.887	0	0.01	2.646	0.00
11:40	240	1550	240	11.684	0	3.429	0	4.623	0	4.6482	0	38.887	0	0.00	2.646	0.00
11:45	240	1550	240	11.684	0	3.429	0	4.623	0	4.6482	0	38.887	0	0.00	2.646	0.00
12:00	240	1550	240	11.735	0.051	3.429	0	4.597	-0.026	4.6482	0	38.887	0	0.01	2.646	0.00
12:30	240	1550	240	11.735	0	3.429	0	4.597	0	4.6482	0	38.887	0	0.00	2.648	0.00
12:35	300	1900	300	12.293	0.558	3.708	0.279	5.055	0.458	4.928	0.2798	38.887	0	0.39	2.97	0.32
12:40	300	1900	300	12.293	0	3.708	0	5.055	0	4.928	0	38.887	0	0.00	2.97	0.00
12:45	300	1900	300	12.293	0	3.708	0	5.055	0	4.928	0	38.887	0	0.00	2.97	0.00
12:50	300	1900	300	12.293	0	3.708	0	5.055	0	4.928	0	38.887	0	0.00	2.97	0.00
1:05	300	1900	300	12.293	0	3.708	0	5.055	0	4.928	0	38.887	0	0.00	3.438	0.47
1:35	300	1900	300	12.293	0	3.708	0	5.055	0	4.928	0	38.887	0	0.00	3.438	0.00
1:40	375	2400	375	12.522	0.229	4.166	0.458	5.435	0.38	5.385	0.457	38.887	0	0.38	3.438	0.00
1:45	375	2400	375	13.005	0.483	4.166	0	5.435	0	5.385	0	38.887	0	0.12	3.44	0.00
1:50	375	2400	375	13.005	0	4.166	0	5.435	0	5.385	0	38.887	0	0.00	3.44	0.00

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:East Pier

Start:10/3/2013 18:25

End:10/5/2013 12:42

Pile:E-16

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi		(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)		(mm)	Δ (mm)
1:55	375	2400	375	13.005	0	4.166	0	5.435	0	5.385	0	38.887	0	0.00	3.44	0.00
2:10	375	2400	375	13.005	0	4.166	0	5.435	0	5.385	0	38.887	0	0.00	3.44	0.00
2:40	375	2400	375	13.081	0.076	4.166	0	5.435	0	5.385	0	38.887	0	0.02	3.44	0.00
2:45	450	2900	450	13.301	0.22	4.775	0.609	6.452	1.017	6.02	0.635	38.913	0.026	0.62	4.08	0.64
2:50	450	2900	450	13.301	0	4.775	0	6.452	0	6.02	0	38.913	0	0.00	4.088	0.01
2:55	450	2900	450	13.301	0	4.775	0	6.452	0	6.02	0	38.913	0	0.00	4.088	0.00
3:00	450	2900	450	13.301	0	4.775	0	6.452	0	6.02	0	38.913	0	0.00	4.088	0.00
3:15	450	2900	450	13.3861	0.0851	4.8	0.025	6.477	0.025	6.045	0.025	38.913	0	0.04	4.088	0.00
3:45	450	2900	450	13.437	0.0509	4.801	0.001	6.502	0.025	6.045	0	38.913	0	0.02	4.096	0.01
3:50	525	3350	525	14.072	0.635	5.385	0.584	7.214	0.712	6.756	0.711	38.963	0.05	0.66	4.748	0.65
3:55	525	3350	525	14.072	0	5.385	0	7.214	0	6.756	0	38.963	0	0.00	4.818	0.07
4:00	525	3350	525	14.097	0.025	5.385	0	7.239	0.025	6.756	0	38.963	0	0.01	4.818	0.00
4:05	525	3350	525	14.097	0	5.385	0	7.239	0	6.756	0	38.989	0.026	0.00	4.818	0.00
4:20	525	3350	525	14.097	0	5.436	0.051	7.239	0	6.756	0	39.014	0.025	0.01	4.818	0.00
4:50	525	3350	525	14.097	0	5.436	0	7.239	0	6.756	0	39.014	0	0.00	4.818	0.00
4:55	600	3800	600	14.631	0.534	6.172	0.736	8.001	0.762	7.518	0.762	39.014	0	0.70	5.552	0.73
5:00	600	3800	600	14.631	0	6.172	0	8.001	0	7.518	0	39.014	0	0.00	5.582	0.03
5:05	600	3800	600	14.631	0	6.172	0	8.026	0.025	7.518	0	39.014	0	0.01	5.582	0.00
5:10	600	3800	600	14.631	0	6.172	0	8.026	0	7.518	0	39.014	0	0.00	5.582	0.00
5:25	600	3800	600	14.681	0.05	6.274	0.102	8.077	0.051	7.62	0.102	39.1414	0.1274	0.08	5.656	0.07
5:55	600	3800	600	14.681	0	6.274	0	8.077	0	7.62	0	39.1414	0	0.00	5.663	0.01
6:00	650	4120	635	15.443	0.762	7.163	0.889	8.966	0.889	8.534	0.914	39.1414	0	0.86	6.587	0.92
6:05	650	4120	635	15.494	0.051	7.214	0.051	9.0424	0.0764	8.616	0.082	39.1414	0	0.07	7.04	0.45
6:10	650	4120	635	15.57	0.076	7.315	0.101	9.119	0.0766	8.689	0.073	39.1414	0	0.08	7.04	0.00
6:15	650	4120	635	15.875	0.305	7.671	0.356	9.449	0.33	8.992	0.303	39.1414	0	0.32	7.058	0.02
6:30	650	4120	635	15.875	0	7.6962	0.0252	9.474	0.025	9.017	0.025	39.1414	0	0.02	7.06	0.00
7:00	650	4120	635	15.952	0.077	7.722	0.0258	9.5	0.026	9.068	0.051	39.1414	0	0.04	7.122	0.06
8:00	650	4120	635	16.688	0.736	8.382	0.66	10.185	0.685	9.804	0.736	39.167	0.0256	0.70	7.85	0.73
8:35	700	4400	680	20.091	3.403	9.5	1.118	11.227	1.042	11.049	1.245	39.192	0.025	1.70	8.996	1.15
8:40	700	4400	650	20.142	0.051	9.601	0.101	11.278	0.051	11.176	0.127	39.192	0	0.08	9.128	0.13
8:45	700	4400	635	20.193	0.051	9.627	0.026	11.303	0.025	11.201	0.025	39.192	0	0.03	9.132	0.00
8:50	700	4400	635	20.193	0	9.652	0.025	11.328	0.025	11.201	0	39.192	0	0.01	9.148	0.02
9:05	700	4400	635	20.269	0.076	9.703	0.051	11.328	0	11.227	0.026	39.192	0	0.04	9.17	0.02
9:35	700	4400	700	21.438	1.169	10.82	1.117	12.471	1.143	12.37	1.143	39.218	0.026	1.14	10.308	1.14
10:35	700	4400	630	21.488	0.05	10.871	0.051	12.497	0.026	12.421	0.051	39.218	0	0.04	10.354	0.05
11:05	700	4400	700	22.276	0.788	11.735	0.864	13.386	0.889	13.31	0.889	39.218	0	0.86	11.242	0.89
11:35	700	4400	635	22.327	0.051	11.786	0.051	13.437	0.051	13.36	0.05	39.218	0	0.05	11.286	0.04
11:55	500	3200	500	22.352	0.025	11.709	-0.077	13.259	-0.178	13.36	0	39.218	0	-0.06	11.308	0.02
12:00	500	3200	500	22.352	0	11.709	0	13.259	0	13.36	0	39.218	0	0.00	11.3	-0.01

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:East Pier

Start:10/3/2013 18:25

End:10/5/2013 12:42

Pile:E-16

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi		(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)		(mm)	Δ (mm)
12:05	500	3200	500	22.352	0	11.709	0	13.259	0	13.36	0	39.218	0	0.00	11.3	0.00
12:10	500	3200	500	22.352	0	11.709	0	13.259	0	13.36	0	39.218	0	0.00	11.3	0.00
12:25	500	3200	500	22.352	0	11.709	0	13.259	0	13.36	0	39.218	0	0.00	11.3	0.00
12:27	300	1900	300	21.844	-0.508	10.77	-0.939	12.04	-1.219	12.344	-1.016	39.141	-0.077	-0.92	10.286	-1.01
12:32	300	1900	305	21.844	0	10.719	-0.051	12.04	0	12.344	0	39.141	0	-0.01	10.284	0.00
12:37	300	1900	305	21.819	-0.025	10.719	0	12.04	0	12.319	-0.025	39.141	0	-0.01	10.268	-0.02
12:42	300	1900	305	21.819	0	10.719	0	12.04	0	12.319	0	39.141	0	0.00	10.268	0.00
12:57	300	1900	305	21.819	0	10.719	0	12.04	0	12.319	0	39.141	0	0.00	10.266	0.00
1:05	400	2600	400	21.819	0	10.744	0.025	12.09	0.05	12.319	0	39.141	0	0.02	10.256	-0.01
1:10	400	2600	400	21.844	0.025	10.744	0	12.09	0	12.319	0	39.141	0	0.01	10.256	0.00
1:15	400	2600	400	21.819	-0.025	10.744	0	12.09	0	12.319	0	39.141	0	-0.01	10.256	0.00
1:20	400	2600	400	21.819	0	10.744	0	12.09	0	12.319	0	39.141	0	0.00	10.256	0.00
1:35	400	2600	400	21.819	0	10.744	0	12.09	0	12.319	0	39.141	0	0.00	10.25	-0.01
1:40	500	3200	500	22.174	0.355	11.125	0.381	12.573	0.483	12.7	0.381	39.141	0	0.40	10.594	0.34
1:45	500	3200	500	22.174	0	11.125	0	12.573	0	12.7	0	39.141	0	0.00	10.604	0.01
1:50	500	3200	500	22.2	0.026	11.125	0	12.573	0	12.7	0	39.141	0	0.01	10.612	0.01
1:55	500	3200	500	22.2	0	11.125	0	12.573	0	12.7	0	39.141	0	0.00	10.612	0.00
2:10	500	3200	500	22.2	0	11.151	0.026	12.573	0	12.7	0	39.141	0	0.01	10.612	0.00
2:40	500	3200	500	22.2	0	11.151	0	12.573	0	12.725	0.025	39.141	0	0.01	10.626	0.01
2:55	550	3500	550	22.377	0.177	11.379	0.228	12.852	0.279	12.954	0.229	39.141	0	0.23	10.866	0.24
3:00	550	3500	550	22.403	0.026	11.379	0	12.878	0.026	12.979	0.025	39.141	0	0.02	10.878	0.01
3:05	550	3500	550	22.403	0	11.379	0	12.878	0	12.979	0	39.141	0	0.00	10.882	0.00
3:10	550	3500	550	22.403	0	11.379	0	12.878	0	12.979	0	39.141	0	0.00	10.886	0.00
3:25	550	3500	550	22.403	0	11.405	0.026	12.878	0	13.005	0.026	39.141	0	0.01	10.898	0.01
3:55	550	3500	550	22.403	0	11.405	0	12.878	0	13.005	0	39.141	0	0.00	10.9	0.00
3:58	600	3800	600	22.606	0.203	11.633	0.228	13.132	0.254	13.233	0.228	39.167	0.026	0.23	11.126	0.23
4:03	600	3800	600	22.606	0	11.633	0	13.132	0	13.233	0	39.167	0	0.00	11.126	0.00
4:08	600	3800	600	22.606	0	11.633	0	13.132	0	13.233	0	39.167	0	0.00	11.142	0.02
4:13	600	3800	600	22.606	0	11.633	0	13.132	0	13.233	0	39.167	0	0.00	11.148	0.01
4:28	600	3800	600	22.606	0	11.633	0	13.132	0	13.259	0.026	39.167	0	0.01	11.15	0.00
4:58	600	3800	600	22.606	0	11.633	0	13.132	0	13.259	0	39.167	0	0.00	11.198	0.05
5:00	650	4100	650	-	-	11.963	0.33	13.513	0.381	13.513	0.254	39.192	0.025	0.32	11.484	0.29
5:05	650	4100	650	-	-	11.963	0	13.564	0.051	13.538	0.025	39.192	0	0.03	11.502	0.02
5:10	650	4100	630	-	-	12.014	0.051	13.564	0	13.589	0.051	39.192	0	0.03	11.546	0.04
5:15	650	4100	630	-	-	12.014	0	13.564	0	13.589	0	39.218	0.026	0.00	11.548	0.00
5:30	650	4100	630	23.012	-	12.014	0	13.564	0	13.589	0	39.218	0	0.00	11.558	0.01
6:00	650	4100	630	23.102	0.09	12.04	0.026	13.589	0.025	13.589	0	39.218	0	0.04	11.562	0.00
6:05	700	4400	695	23.571	0.469	12.7	0.66	14.326	0.737	13.589	0	39.243	0.025	0.47	12.26	0.70
6:10	700	4400	667	23.647	0.076	12.776	0.076	14.376	0.05	14.326	0.737	39.243	0	0.23	12.308	0.05

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:East Pier

Start:10/3/2013 18:25

End:10/5/2013 12:42

Pile:E-16

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi	kN	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	Avg G1 to G4 (mm)	(mm)	Δ (mm)
6:15	700	4400	667	23.647	0	12.776	0	14.376	0	14.326	0	39.243	0	0.00	12.308	0.00
6:20	700	4400	667	23.647	0	12.776	0	14.376	0	14.326	0	39.243	0	0.00	12.308	0.00
6:35	700	4400	660	23.673	0.026	12.802	0.026	14.402	0.026	14.326	0	39.243	0	0.02	12.316	0.01
7:05	700	4400	660	23.673	0	12.802	0	14.402	0	14.326	0	39.243	0	0.00	12.316	0.00
7:25	700	4400	695	24.105	0.432	13.284	0.482	14.884	0.482	14.783	0.457	39.243	0	0.46	12.782	0.47
7:55	700	4400	685	24.562	0.457	13.818	0.534	15.443	0.559	15.2901	0.5071	39.243	0	0.51	13.312	0.53
8:25	700	4400	695	24.663	0.101	13.894	0.076	15.494	0.051	15.342	0.0519	39.243	0	0.07	13.37	0.06
8:55	700	4400	695	25.07	0.407	14.3	0.406	15.926	0.432	15.773	0.431	39.243	0	0.42	13.802	0.43
9:25	700	4400	695	25.324	0.254	14.707	0.407	16.18	0.254	16.154	0.381	39.243	0	0.32	14.19	0.39
9:55	700	4400	685	25.679	0.355	15.088	0.381	16.485	0.305	16.561	0.407	39.243	0	0.36	14.64	0.45
10:25	700	4400	685	25.984	0.305	15.494	0.406	16.866	0.381	16.942	0.381	39.243	0	0.37	15.018	0.38
10:55	700	4400	695	26.314	0.33	15.875	0.381	17.17	0.304	17.323	0.381	39.243	0	0.35	15.392	0.37
11:25	700	4400	700	26.594	0.28	16.18	0.305	17.399	0.229	17.602	0.279	39.243	0	0.27	15.676	0.28
11:55	700	4400	700	26.873	0.279	16.485	0.305	17.678	0.279	17.882	0.28	39.243	0	0.29	15.976	0.30
12:25	700	4400	700	27.153	0.28	16.815	0.33	17.958	0.28	18.186	0.304	39.243	0	0.30	16.29	0.31
12:55	700	4400	700	27.432	0.279	17.094	0.279	18.237	0.279	18.517	0.331	39.243	0	0.29	16.598	0.31
1:25	700	4400	700	27.686	0.254	17.274	0.18	18.517	0.28	18.745	0.228	39.243	0	0.24	16.852	0.25
1:55	700	4400	700	27.94	0.254	17.628	0.354	18.745	0.228	19.025	0.28	39.243	0	0.28	17.126	0.27
2:25	700	4400	700	28.245	0.305	17.983	0.355	19.025	0.28	19.329	0.304	39.243	0	0.31	17.442	0.32
2:55	700	4400	700	28.55	0.305	18.263	0.28	19.304	0.279	19.634	0.305	39.243	0	0.29	17.746	0.30
3:25	700	4400	700	28.804	0.254	18.542	0.279	19.558	0.254	19.914	0.28	39.243	0	0.27	18.026	0.28
3:55	700	4400	700	29.058	0.254	18.771	0.229	19.812	0.254	20.142	0.228	39.243	0	0.24	18.288	0.26
4:25	700	4400	700	29.312	0.254	19.025	0.254	20.041	0.229	20.422	0.28	39.243	0	0.25	18.528	0.24
4:55	700	4400	700	29.54	0.228	19.279	0.254	20.244	0.203	20.676	0.254	39.243	0	0.23	18.76	0.23
5:25	700	4400	700	29.769	0.229	19.533	0.254	20.498	0.254	20.955	0.279	39.243	0	0.25	19.006	0.25
5:55	700	4400	700	30.023	0.254	19.787	0.254	20.752	0.254	21.158	0.203	39.218	-0.025	0.24	19.258	0.25
6:25	700	4400	700	30.277	0.254	20.015	0.228	20.955	0.203	21.387	0.229	39.218	0	0.23	19.494	0.24
6:55	700	4400	700	30.505	0.228	20.193	0.178	21.158	0.203	21.539	0.152	39.218	0	0.19	19.684	0.19
7:25	700	4400	675	30.531	0.026	20.269	0.076	21.209	0.051	21.59	0.051	39.218	0	0.05	19.76	0.08
7:55	700	4400	700	30.759	0.228	20.498	0.229	21.412	0.203	21.869	0.279	39.192	-0.026	0.23	19.992	0.23
8:25	700	4400	675	30.81	0.051	20.549	0.051	21.438	0.026	21.895	0.026	39.192	0	0.04	20.024	0.03
8:55	700	4400	675	30.988	0.178	20.752	0.203	21.641	0.203	22.098	0.203	39.192	0	0.20	20.222	0.20
9:25	700	4400	670	30.998	0.01	20.777	0.025	21.641	0	22.098	0	39.192	0	0.01	20.24	0.02
9:55	700	4400	670	31.013	0.015	20.777	0	21.666	0.025	22.149	0.051	39.192	0	0.02	20.258	0.02
10:00	525	3350	525	31.013	0	20.726	-0.051	21.666	0	22.149	0	39.192	0	-0.01	20.264	0.01
10:05	525	3350	525	31.013	0	20.726	0	21.666	0	22.149	0	39.192	0	0.00	20.264	0.00
10:10	525	3350	525	31.013	0	20.726	0	21.666	0	22.149	0	39.192	0	0.00	20.264	0.00
10:15	525	3350	525	31.013	0	20.701	-0.025	21.666	0	22.149	0	39.192	0	-0.01	20.264	0.00
10:30	525	3350	525	31.013	0	20.701	0	21.666	0	22.149	0	39.192	0	0.00	20.264	0.00

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:East Pier

Start:10/3/2013 18:25

End:10/5/2013 12:42

Pile:E-16

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi		(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)		(mm)	Δ (mm)
11:00	525	3350	525	31.013	0	20.726	0.025	21.666	0	22.149	0	39.192	0	0.01	20.264	0.00
11:05	350	2250	350	30.734	-0.279	19.888	-0.838	21.057	-0.609	21.387	-0.762	39.141	-0.051	-0.62	19.422	-0.84
11:10	350	2250	350	30.709	-0.025	19.863	-0.025	21.031	-0.026	21.387	0	39.141	0	-0.02	19.41	-0.01
11:15	350	2250	350	30.709	0	19.863	0	21.006	-0.025	21.387	0	39.141	0	-0.01	19.41	0.00
11:20	350	2250	350	30.709	0	19.837	-0.026	21.006	0	21.387	0	39.141	0	-0.01	19.4	-0.01
11:35	350	2250	350	30.709	0	19.837	0	21.006	0	31.387	10	39.141	0	2.50	19.396	0.00
11:37	175	1200	175	29.87	-0.839	18.796	-1.041	19.812	-1.194	20.295	-11.092	39.014	-0.127	-3.54	18.252	-1.14
11:42	175	1200	175	29.845	-0.025	18.745	-0.051	19.812	0	20.269	-0.026	39.014	0	-0.03	18.246	-0.01
11:47	175	1200	175	29.845	0	18.745	0	19.812	0	20.269	0	39.014	0	0.00	18.234	-0.01
11:52	175	1200	175	29.845	0	18.745	0	19.812	0	20.269	0	39.014	0	0.00	18.234	0.00
12:07	175	1200	175	29.845	0	18.72	-0.025	19.812	0	20.269	0	39.014	0	-0.01	18.22	-0.01
12:12	0	0	0	28.397	-1.448	16.967	-1.753	16.891	-2.921	17.653	-2.616	38.887	-0.127	-2.18	16.107	-2.11
12:17	0	0	0	28.27	-0.127	16.815	-0.152	16.84	-0.051	17.501	-0.152	38.887	0	-0.12	15.968	-0.14
12:22	0	0	0	28.245	-0.025	16.764	-0.051	16.84	0	17.399	-0.102	38.887	0	-0.04	15.924	-0.04
12:27	0	0	0	28.245	0	16.739	-0.025	16.84	0	17.374	-0.025	38.887	0	-0.01	15.9	-0.02
12:42	0	0	0	28.194	-0.051	16.688	-0.051	16.84	0	17.297	-0.077	38.887	0	-0.04	15.834	-0.07



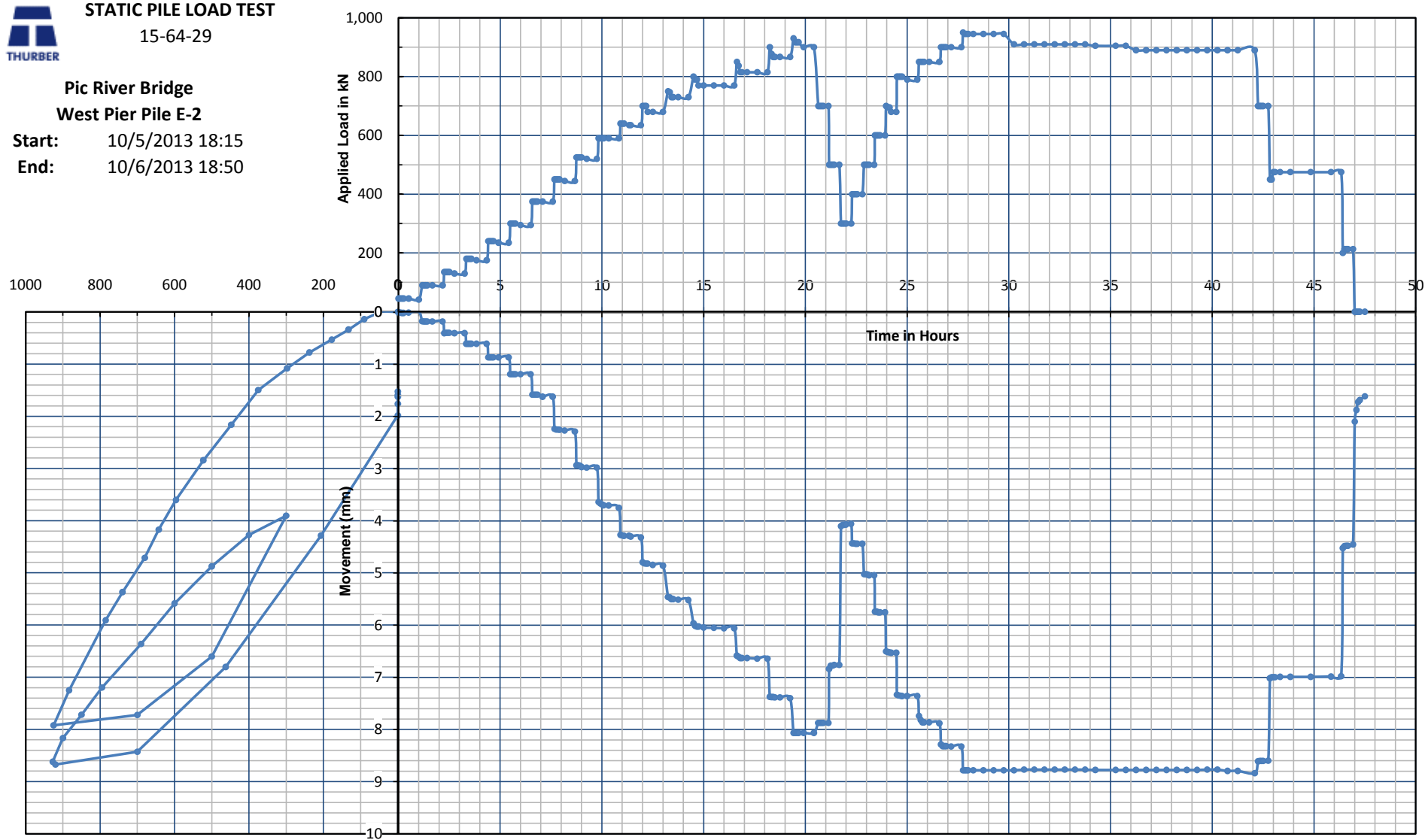
STATIC PILE LOAD TEST

15-64-29

Pic River Bridge
West Pier Pile E-2

Start: 10/5/2013 18:15

End: 10/6/2013 18:50



Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:West Pier

Start:10/5/2013 18:15

End:10/7/2013 17:45

Pile:E-2

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi		(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)		(mm)	Δ (mm)
6:15	45	300	45	0.127		1.067		0.864		1.6		15.494			-0.002	
6:20	45	300	45	0.127		1.067	0	0.889	0.025	1.6	0	15.494	0	0.01	-0.002	0.00
6:25	45	300	45	0.127	0	1.092	0.025	0.889	0	1.6	0	15.494	0	0.01	-0.002	0.00
6:30	45	300	45	0.127	0	1.092	0	0.889	0	1.6	0	15.494	0	0.00	-0.002	0.00
6:45	45	300	45	0.102	-0.025	1.092	0	0.889	0	1.6	0	15.494	0	-0.01	-0.024	-0.02
7:15	45	300	41.25	0.102	0	1.092	0	0.889	0	1.549	-0.051	15.494	0	-0.01	-0.024	0.00
7:25	90	600	90	0.102	0	1.346	0.254	1.0414	0.1524	1.854	0.305	15.545	0.051	0.18	-0.02	0.00
7:30	90	600	90	0.102	0	1.372	0.026	1.0414	0	1.854	0	15.545	0	0.01	-0.02	0.00
7:35	90	600	90	0.102	0	1.372	0	1.0414	0	1.854	0	15.545	0	0.00	-0.02	0.00
7:40	90	600	90	0.102	0	1.372	0	1.0414	0	1.854	0	15.545	0	0.00	-0.02	0.00
7:55	90	600	90	0.102	0	1.372	0	1.0414	0	1.854	0	15.545	0	0.00	-0.02	0.00
8:25	90	600	90	0.102	0	1.372	0	1.0414	0	1.854	0	15.545	0	0.00	-0.02	0.00
8:30	135	900	135	0.102	0	1.676	0.304	1.295	0.2536	2.184	0.33	15.621	0.076	0.22	0.09	0.11
8:35	135	900	135	0.0762	-0.0258	1.676	0	1.295	0	2.184	0	15.621	0	-0.01	0.09	0.00
8:40	135	900	135	0.0762	0	1.676	0	1.295	0	2.184	0	15.621	0	0.00	0.09	0.00
8:45	135	900	135	0.0762	0	1.676	0	1.295	0	2.184	0	15.621	0	0.00	0.09	0.00
9:00	135	900	130	0.0762	0	1.702	0.026	1.295	0	2.184	0	15.621	0	0.01	0.092	0.00
9:30	135	900	130	0.0762	0	1.702	0	1.295	0	2.184	0	15.646	0.025	0.00	0.092	0.00
9:35	180	1200	180	0.102	0.0258	2.007	0.305	1.524	0.229	2.438	0.254	15.697	0.051	0.20	0.238	0.15
9:40	180	1200	180	0.102	0	2.007	0	1.524	0	2.438	0	15.697	0	0.00	0.238	0.00
9:45	180	1200	180	0.102	0	2.007	0	1.524	0	2.438	0	15.697	0	0.00	0.238	0.00
9:50	180	1200	180	0.102	0	2.007	0	1.524	0	2.438	0	15.697	0	0.00	0.238	0.00
10:05	180	1200	175	0.102	0	2.007	0	1.524	0	2.438	0	15.697	0	0.00	0.238	0.00
10:35	180	1200	175	0.102	0	2.007	0	1.524	0	2.438	0	15.697	0	0.00	0.238	0.00
10:40	240	1550	240	0.203	0.101	2.388	0.381	1.778	0.254	2.743	0.305	15.799	0.102	0.26	0.428	0.19
10:45	240	1550	240	0.203	0	2.388	0	1.778	0	2.743	0	15.799	0	0.00	0.428	0.00
10:50	240	1550	240	0.203	0	2.388	0	1.778	0	2.743	0	15.799	0	0.00	0.428	0.00
10:55	240	1550	240	0.203	0	2.388	0	1.778	0	2.743	0	15.799	0	0.00	0.428	0.00
11:10	240	1550	235	0.203	0	2.388	0	1.778	0	2.743	0	15.799	0	0.00	0.428	0.00
11:40	240	1550	235	0.203	0	2.388	0	1.778	0	2.743	0	15.799	0	0.00	0.428	0.00
11:45	300	1900	300	0.457	0.254	2.769	0.381	2.108	0.33	3.073	0.33	15.875	0.076	0.32	0.656	0.23
11:50	300	1900	300	0.457	0	2.769	0	2.108	0	3.073	0	15.875	0	0.00	0.656	0.00
11:55	300	1900	300	0.457	0	2.769	0	2.108	0	3.073	0	15.875	0	0.00	0.656	0.00
12:00	300	1900	300	0.457	0	2.769	0	2.108	0	3.073	0	15.875	0	0.00	0.656	0.00
12:15	300	1900	295	0.457	0	2.769	0	2.108	0	3.073	0	15.875	0	0.00	0.656	0.00
12:45	300	1900	295	0.457	0	2.769	0	2.108	0	3.073	0	15.875	0	0.00	0.656	0.00
12:50	375	2400	375	0.686	0.229	3.226	0.457	2.565	0.457	3.5005	0.4275	16.002	0.127	0.39	1.01	0.35
12:55	375	2400	375	0.686	0	3.226	0	2.565	0	3.5005	0	16.002	0	0.00	1.01	0.00
1:00	375	2400	375	0.686	0	3.226	0	2.565	0	3.5005	0	16.002	0	0.00	1.016	0.01

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:West Pier

Start:10/5/2013 18:15

End:10/7/2013 17:45

Pile:E-2

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital		
	kN	psi		(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)		Avg G1 to G4 (mm)	Gauge 6	
																(mm)	Δ (mm)
1:05	375	2400	375	0.686	0	3.226	0	2.565	0	3.5005	0	16.002	0	0.00	1.016	0.00	
1:20	375	2400	375	0.787	0.101	3.277	0.051	2.565	0	3.5005	0	16.002	0	0.04	1.016	0.00	
1:50	375	2400	375	0.787	0	3.277	0	2.565	0	3.5005	0	16.002	0	0.00	1.016	0.00	
1:55	450	2900	450	1.194	0.407	3.962	0.685	3.278	0.713	4.166	0.6655	16.129	0.127	0.62	1.64	0.62	
2:00	450	2900	450	1.219	0.025	3.962	0	3.302	0.024	4.166	0	16.129	0	0.01	1.64	0.00	
2:05	450	2900	450	1.219	0	3.962	0	3.302	0	4.166	0	16.129	0	0.00	1.656	0.02	
2:10	450	2900	450	1.219	0	3.962	0	3.302	0	4.191	0.025	16.129	0	0.01	1.656	0.00	
2:25	450	2900	445	1.245	0.026	3.988	0.026	3.302	0	4.191	0	16.129	0	0.01	1.658	0.00	
2:55	450	2900	445	1.321	0.076	3.988	0	3.302	0	4.191	0	16.129	0	0.02	1.66	0.00	
3:00	525	3350	525	1.727	0.406	4.724	0.736	4.013	0.711	4.928	0.737	16.282	0.153	0.65	2.274	0.61	
3:05	525	3350	525	1.727	0	4.724	0	4.013	0	4.928	0	16.282	0	0.00	2.28	0.01	
3:10	525	3350	525	1.753	0.026	4.724	0	4.013	0	4.928	0	16.282	0	0.01	2.282	0.00	
3:15	525	3350	525	1.78	0.027	4.75	0.026	4.039	0.026	4.953	0.025	16.282	0	0.03	2.288	0.01	
3:30	525	3350	520	1.803	0.023	4.775	0.025	4.039	0	4.953	0	16.282	0	0.01	2.29	0.00	
4:00	525	3350	520	1.803	0	4.775	0	4.039	0	4.953	0	16.282	0	0.00	2.298	0.01	
4:05	600	3800	3800	2.311	0.508	5.512	0.737	4.801	0.762	5.588	0.635	16.408	0.126	0.66	2.976	0.68	
4:10	600	3800	3800	2.337	0.026	5.537	0.025	4.801	0	5.639	0.051	16.408	0	0.03	2.988	0.01	
4:15	600	3800	3800	2.337	0	5.563	0.026	4.83	0.029	5.664	0.025	16.408	0	0.02	2.988	0.00	
4:20	600	3800	3750	2.337	0	5.588	0.025	4.83	0	5.699	0.035	16.408	0	0.02	2.992	0.00	
4:35	600	3800	3750	2.388	0.051	5.563	-0.025	4.83	0	5.699	0	16.408	0	0.01	2.998	0.01	
5:05	600	3800	3750	2.565	0.177	5.563	0	4.83	0	5.699	0	16.408	0	0.04	3.008	0.01	
5:10	650	4120	4120	2.946	0.381	6.121	0.558	5.41	0.58	6.248	0.549	16.534	0.126	0.52	3.542	0.53	
5:15	650	4120	4120	2.972	0.026	6.147	0.026	5.41	0	6.248	0	16.534	0	0.01	3.558	0.02	
5:20	650	4120	4120	2.997	0.025	6.147	0	5.41	0	6.248	0	16.534	0	0.01	3.58	0.02	
5:35	650	4120	635	2.997	0	6.147	0	5.41	0	6.248	0	16.534	0	0.00	3.582	0.00	
5:40	650	4120	635	2.997	0	6.172	0.025	5.41	0	6.274	0.026	16.534	0	0.01	3.582	0.00	
6:10	650	4120	635	3.023	0.026	6.172	0	5.436	0.026	6.299	0.025	16.534	0	0.02	3.588	0.01	
6:15	700	4430	700	3.378	0.355	6.68	0.508	5.97	0.534	6.807	0.508	16.662	0.128	0.48	4.078	0.49	
6:20	700	4430	700	3.405	0.027	6.706	0.026	5.994	0.024	6.807	0	16.662	0	0.02	4.098	0.02	
6:25	700	4430	700	3.429	0.024	6.706	0	5.994	0	6.807	0	16.662	0	0.01	4.098	0.00	
6:30	700	4430	680	3.429	0	6.706	0	5.994	0	6.807	0	16.662	0	0.00	4.098	0.00	
6:45	700	4430	680	3.429	0	6.731	0.025	6.02	0.026	6.858	0.051	16.662	0	0.03	4.122	0.02	
7:15	700	4430	680	3.48	0.051	6.756	0.025	6.02	0	6.833	-0.025	16.662	0	0.01	4.123	0.00	
7:30	750	4750	750	3.937	0.457	7.391	0.635	6.706	0.686	7.468	0.635	16.866	0.204	0.60	4.726	0.60	
7:35	750	4750	747	3.962	0.025	7.391	0	6.706	0	7.468	0	16.891	0.025	0.01	4.734	0.01	
7:40	750	4750	730	4.013	0.051	7.417	0.026	6.731	0.025	7.493	0.025	16.891	0	0.03	4.752	0.02	
7:45	750	4750	730	4.013	0	7.417	0	6.731	0	7.493	0	16.891	0	0.00	4.752	0.00	
8:00	750	4750	730	4.039	0.026	7.442	0.025	6.731	0	7.493	0	16.891	0	0.01	4.758	0.01	
8:30	750	4750	730	4.064	0.025	7.442	0	6.731	0	7.493	0	16.891	0	0.01	4.776	0.02	

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:West Pier

Start:10/5/2013 18:15

End:10/7/2013 17:45

Pile:E-2

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi	kN	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	Avg G1 to G4 (mm)	(mm)	Δ (mm)
8:45	800	5000	800	4.42	0.356	7.95	0.508	7.137	0.406	8.001	0.508	17.145	0.254	0.44	5.249	0.47
8:50	800	5000	790	4.445	0.025	7.976	0.026	7.264	0.127	8.026	0.025	17.145	0	0.05	5.264	0.02
8:55	800	5000	790	4.47	0.025	7.976	0	7.29	0.026	8.026	0	17.145	0	0.01	5.264	0.00
9:00	800	5000	770	4.47	0	7.976	0	7.29	0	8.026	0	17.17	0.025	0.00	5.282	0.02
9:15	800	5000	770	4.496	0.026	8.001	0.025	7.29	0	8.052	0.026	17.17	0	0.02	5.288	0.01
9:45	800	5000	770	4.496	0	8.001	0	7.315	0.025	8.052	0	17.17	0	0.01	5.31	0.02
10:15	800	5000	770	4.496	0	8.026	0.025	7.315	0	8.052	0	17.17	0	0.01	5.31	0.00
10:45	800	5000	770	4.496	0	8.026	0	7.315	0	8.052	0	17.17	0	0.00	5.31	0.00
10:53	850	5300	850	4.902	0.406	8.585	0.559	7.925	0.61	8.585	0.533	17.882	0.712	0.53	5.844	0.53
10:58	850	5300	837	4.928	0.026	8.611	0.026	7.925	0	8.611	0.026	17.882	0	0.02	5.852	0.01
11:03	850	5300	815	4.978	0.05	8.611	0	7.95	0.025	8.636	0.025	17.907	0.025	0.02	5.868	0.02
11:08	850	5300	815	4.978	0	8.611	0	7.95	0	8.636	0	17.907	0	0.00	5.868	0.00
11:23	850	5300	815	4.978	0	8.611	0	7.95	0	8.636	0	17.907	0	0.00	5.876	0.01
11:53	850	5300	815	5.004	0.026	8.636	0.025	7.95	0	8.636	0	17.907	0	0.01	5.88	0.00
12:23	850	5300	815	5.004	0	8.636	0	7.95	0	8.636	0	17.907	0	0.00	5.88	0.00
12:30	900	5600	900	5.664	0.66	9.347	0.711	8.738	0.788	9.398	0.762	19.558	1.651	0.73	6.608	0.73
12:35	900	5600	877	5.69	0.026	9.347	0	8.738	0	9.398	0	19.558	0	0.01	6.608	0.00
12:40	900	5600	867	5.69	0	9.347	0	8.738	0	9.398	0	19.583	0.025	0.00	6.614	0.01
12:45	900	5600	867	5.715	0.025	9.347	0	8.738	0	9.398	0	19.583	0	0.01	6.614	0.00
1:00	900	5600	867	5.715	0	9.347	0	8.738	0	9.398	0	19.583	0	0.00	6.616	0.00
1:30	900	5600	867	5.715	0	9.373	0.026	8.763	0.025	9.398	0	19.583	0	0.01	6.662	0.05
1:40	950	5900	930	6.223	0.508	10.058	0.685	9.525	0.762	10.109	0.711	21.717	2.134	0.67	7.35	0.69
1:45	950	5900	917	6.223	0	10.058	0	9.525	0	10.109	0	21.717	0	0.00	7.35	0.00
1:50	950	5900	917	6.223	0	10.058	0	9.525	0	10.109	0	21.717	0	0.00	7.350	0.00
1:55	950	5900	917	6.223	0	10.058	0	9.525	0	10.109	0	21.717	0	0.00	7.35	0.00
2:10	950	5900	900	6.223	0	10.058	0	9.525	0	10.109	0	21.742	0.025	0.00	7.35	0.00
2:40	950	5900	900	6.223	0	10.058	0	9.525	0	10.109	0	21.742	0	0.00	7.35	0.00
2:53	700	4400	700	6.198	-0.025	9.804	-0.254	9.322	-0.203	9.83	-0.279	21.742	0	-0.19	7.128	-0.22
2:58	700	4400	700	6.198	0	9.804	0	9.322	0	9.83	0	21.742	0	0.00	7.122	-0.01
3:03	700	4400	700	6.198	0	9.804	0	9.322	0	9.83	0	21.742	0	0.00	7.122	0.00
3:08	700	4400	700	6.198	0	9.804	0	9.322	0	9.83	0	21.742	0	0.00	7.122	0.00
3:23	700	4400	700	6.198	0	9.804	0	9.322	0	9.83	0	21.742	0	0.00	7.122	0.00
3:25	500	3200	500	5.563	-0.635	8.661	-1.143	8.128	-1.194	8.661	-1.169	21.463	-0.279	-1.17	5.984	-1.14
3:30	500	3200	500	5.309	-0.254	8.661	0	8.128	0	8.661	0	21.463	0	0.00	5.978	-0.01
3:35	500	3200	500	5.309	0	8.661	0	8.128	0	8.661	0	21.463	0	0.00	5.96	-0.02
3:40	500	3200	500	5.309	0	8.636	-0.025	8.128	0	8.636	-0.025	21.463	0	-0.02	5.96	0.00
3:55	500	3200	500	5.309	0	8.636	0	8.128	0	8.636	0	21.463	0	0.00	5.96	0.00
4:00	300	1900	300	3.023	-2.286	5.893	-2.743	5.283	-2.845	5.867	-2.769	20.777	-0.686	-2.66	3.318	-2.64
4:05	300	1900	300	2.997	-0.026	5.867	-0.026	5.258	-0.025	5.842	-0.025	20.777	0	-0.03	3.316	0.00

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:West Pier

Start:10/5/2013 18:15

End:10/7/2013 17:45

Pile:E-2

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi	kN	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	Avg G1 to G4 (mm)	(mm)	Δ (mm)
4:10	300	1900	300	2.997	0	5.867	0	5.258	0	5.842	0	20.777	0	0.00	3.316	0.00
4:15	300	1900	300	2.972	-0.025	5.867	0	5.258	0	5.842	0	20.777	0	-0.01	3.306	-0.01
4:30	300	1900	300	2.972	0	5.867	0	5.232	-0.026	5.817	-0.025	20.803	0.026	-0.01	3.288	-0.02
4:33	400	2600	400	3.2	0.228	6.274	0.407	5.664	0.432	6.248	0.431	20.93	0.127	0.37	3.608	0.32
4:38	400	2600	400	3.2	0	6.274	0	5.664	0	6.248	0	20.93	0	0.00	3.608	0.00
4:43	400	2600	400	3.2	0	6.274	0	5.664	0	6.274	0.026	20.93	0	0.01	3.608	0.00
4:48	400	2600	400	3.2	0	6.274	0	5.664	0	6.274	0	20.93	0	0.00	3.608	0.00
5:03	400	2600	400	3.2	0	6.274	0	5.664	0	6.274	0	20.93	0	0.00	3.608	0.00
5:08	500	3200	500	3.658	0.458	6.909	0.635	6.299	0.635	6.883	0.609	21.107	0.177	0.58	4.202	0.59
5:13	500	3200	500	3.658	0	6.909	0	6.299	0	6.883	0	21.107	0	0.00	4.206	0.00
5:18	500	3200	500	3.683	0.025	6.909	0	6.299	0	6.883	0	21.107	0	0.01	4.206	0.00
5:23	500	3200	500	3.683	0	6.934	0.025	6.299	0	6.909	0.026	21.107	0	0.01	4.206	0.00
5:38	500	3200	500	3.683	0	6.934	0	6.299	0	6.909	0	21.107	0	0.00	4.206	0.00
5:40	600	3800	600	4.242	0.559	7.671	0.737	7.061	0.762	7.645	0.736	21.285	0.178	0.70	4.912	0.71
5:45	600	3800	600	4.242	0	7.671	0	7.061	0	7.645	0	21.285	0	0.00	4.914	0.00
5:50	600	3800	600	4.267	0.025	7.696	0.025	7.061	0	7.645	0	21.285	0	0.01	4.916	0.00
5:55	600	3800	600	4.267	0	7.696	0	7.061	0	7.645	0	21.285	0	0.00	4.916	0.00
6:10	600	3800	600	4.267	0	7.696	0	7.061	0	7.645	0	21.285	0	0.00	4.918	0.00
6:13	700	4400	700	4.877	0.61	8.484	0.788	7.874	0.813	8.433	0.788	21.488	0.203	0.75	5.684	0.77
6:18	700	4400	695	4.902	0.025	8.484	0	7.874	0	8.458	0.025	21.488	0	0.01	5.692	0.01
6:23	700	4400	695	4.902	0	8.509	0.025	7.874	0	8.458	0	21.846	0.358	0.01	5.694	0.00
6:28	700	4400	680	4.902	0	8.509	0	7.874	0	8.484	0.026	21.846	0	0.01	5.698	0.00
6:43	700	4400	680	4.902	0	8.509	0	7.874	0	8.484	0	21.846	0	0.00	5.698	0.00
6:45	800	5000	800	5.639	0.737	9.322	0.813	8.738	0.864	9.296	0.812	21.692	-0.154	0.81	6.52	0.82
6:50	800	5000	800	5.664	0.025	9.347	0.025	8.738	0	9.296	0	21.692	0	0.01	6.532	0.01
6:55	800	5000	800	5.69	0.026	9.347	0	8.738	0	9.296	0	21.692	0	0.01	6.534	0.00
7:00	800	5000	800	5.69	0	9.347	0	8.763	0.025	9.296	0	21.692	0	0.01	6.536	0.00
7:15	800	5000	790	5.69	0	9.347	0	8.763	0	9.296	0	21.692	0	0.00	6.54	0.00
7:45	800	5000	790	5.69	0	9.347	0	8.763	0	9.296	0	21.692	0	0.00	6.542	0.00
7:50	850	5300	850	5.994	0.304	9.754	0.407	9.169	0.406	9.703	0.407	21.692	0	0.38	6.996	0.45
7:55	850	5300	850	6.045	0.051	9.855	0.101	9.246	0.077	9.78	0.077	21.793	0.101	0.08	7.058	0.06
8:00	850	5300	850	6.121	0.076	9.881	0.026	9.271	0.025	9.83	0.05	21.793	0	0.04	7.058	0.00
8:05	850	5300	850	6.121	0	9.881	0	9.271	0	9.83	0	21.793	0	0.00	7.062	0.00
8:20	850	5300	850	6.121	0	9.881	0	9.271	0	9.83	0	21.793	0	0.00	7.07	0.01
8:50	850	5300	850	6.147	0.026	9.906	0.025	9.296	0.025	9.83	0	21.793	0	0.02	7.07	0.00
8:55	900	5600	900	6.452	0.305	10.363	0.457	9.728	0.432	10.262	0.432	21.946	0.153	0.41	7.498	0.43
9:00	900	5600	900	6.502	0.05	10.389	0.026	9.754	0.026	10.287	0.025	21.971	0.025	0.03	7.512	0.01
9:05	900	5600	900	6.502	0	10.389	0	9.754	0	10.287	0	21.971	0	0.00	7.522	0.01
9:10	900	5600	900	6.502	0	10.389	0	9.754	0	10.287	0	21.971	0	0.00	7.526	0.00

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:West Pier

Start:10/5/2013 18:15

End:10/7/2013 17:45

Pile:E-2

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi		(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)		(mm)	Δ (mm)
9:25	900	5600	900	6.528	0.026	10.389	0	9.754	0	10.287	0	21.971	0	0.01	7.528	0.00
9:55	900	5600	900	6.528	0	10.389	0	9.754	0	10.287	0	21.971	0	0.00	7.528	0.00
10:00	950	5900	950	6.883	0.355	10.871	0.482	10.287	0.533	10.744	0.457	22.657	0.686	0.46	7.992	0.46
10:05	950	5900	945	6.883	0	10.871	0	10.287	0	10.744	0	22.657	0	0.00	7.992	0.00
10:10	950	5900	945	6.883	0	10.871	0	10.287	0	10.744	0	22.657	0	0.00	7.992	0.00
10:15	950	5900	945	6.883	0	10.871	0	10.287	0	10.744	0	22.682	0.025	0.00	7.992	0.00
10:30	950	5900	945	6.883	0	10.871	0	10.287	0	10.744	0	22.682	0	0.00	7.992	0.00
11:00	950	5900	945	6.883	0	10.871	0	10.287	0	10.744	0	22.682	0	0.00	7.992	0.00
11:30	950	5900	945	6.883	0	10.871	0	10.287	0	10.744	0	22.682	0	0.00	7.992	0.00
12:00	950	5900	945	6.883	0	10.871	0	10.287	0	10.744	0	22.682	0	0.00	7.992	0.00
12:30	950	5900	910	6.883	0	10.871	0	10.287	0	10.744	0	22.682	0	0.00	7.992	0.00
1:00	950	5900	910	6.883	0	10.871	0	10.262	-0.025	10.719	-0.025	22.682	0	-0.01	7.992	0.00
1:30	950	5900	910	6.883	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
2:00	950	5900	910	6.883	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
2:30	950	5900	910	6.883	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
3:00	950	5900	910	6.883	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
3:30	950	5900	910	6.883	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
4:00	950	5900	910	6.883	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
4:30	950	5900	905	6.909	0.026	10.871	0	10.262	0	10.719	0	22.682	0	0.01	7.992	0.00
5:30	950	5900	905	6.909	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
6:00	950	5900	905	6.909	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
6:30	950	5900	890	6.909	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
7:00	950	5900	890	6.909	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
7:30	950	5900	890	6.909	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
8:00	950	5900	890	6.909	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
8:30	950	5900	890	6.909	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
9:00	950	5900	890	6.909	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
9:30	950	5900	890	6.909	0	10.871	0	10.262	0	10.719	0	22.682	0	0.00	7.992	0.00
10:00	950	5900	890	6.909	0	10.871	0	10.262	0	10.693	-0.026	22.682	0	-0.01	7.992	0.00
10:30	950	5900	890	6.909	0	10.871	0	10.262	0	10.693	0	22.682	0	0.00	7.992	0.00
11:00	950	5900	890	7.01	0.101	10.871	0	10.262	0	10.693	0	22.682	0	0.03	7.984	-0.01
11:30	950	5900	890	7.01	0	10.871	0	10.262	0	10.693	0	22.682	0	0.00	7.984	0.00
12:20	950	5900	890	7.163	0.153	10.871	0	10.287	0.025	10.693	0	22.708	0.026	0.04	8.008	0.02
12:30	700	4400	700	7.01	-0.153	10.617	-0.254	10.033	-0.254	10.439	-0.254	22.657	-0.051	-0.23	7.776	-0.23
12:35	700	4400	700	7.01	0	10.617	0	10.033	0	10.414	-0.025	22.657	0	-0.01	7.766	-0.01
12:40	700	4400	700	7.01	0	10.617	0	10.033	0	10.414	0	22.657	0	0.00	7.764	0.00
12:45	700	4400	700	7.01	0	10.617	0	10.033	0	10.414	0	22.657	0	0.00	7.764	0.00
1:00	700	4400	700	7.01	0	10.617	0	10.008	-0.025	10.414	0	22.657	0	-0.01	7.756	-0.01
1:05	450	2900	450	5.69	-1.32	8.941	-1.676	8.331	-1.677	8.763	-1.651	22.2	-0.457	-1.58	6.15	-1.61

Pile Load Test - Settlement Record

Job Number:15-64-29

Location:Pic River Bridge

Location:West Pier

Start:10/5/2013 18:15

End:10/7/2013 17:45

Pile:E-2

Time	Load-desired		Load Cell-actual	Gauge 1		Gauge 2		Gauge 3		Gauge 4		Reaction Beam		Deformations	Digital	
	kN	psi	kN	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	(mm)	Δ (mm)	Avg G1 to G4 (mm)	(mm)	Δ (mm)
1:10	450	2900	450	5.664	-0.026	8.915	-0.026	8.306	-0.025	8.763	0	22.2	0	-0.02	6.138	-0.01
1:15	450	2900	475	5.664	0	8.915	0	8.306	0	8.763	0	22.2	0	0.00	6.13	-0.01
1:20	450	2900	475	5.664	0	8.915	0	8.306	0	8.763	0	22.2	0	0.00	6.13	0.00
1:35	450	2900	475	5.639	-0.025	8.915	0	8.306	0	8.763	0	22.2	0	-0.01	6.118	-0.01
2:05	450	2900	475	5.639	0	8.915	0	8.306	0	8.763	0	22.225	0.025	0.00	6.11	-0.01
3:05	450	2900	475	5.639	0	8.915	0	8.306	0	8.763	0	22.225	0	0.00	6.102	-0.01
4:05	450	2900	475	5.639	0	8.915	0	8.306	0	8.738	-0.025	22.2	-0.025	-0.01	6.102	0.00
4:35	450	2900	475	5.613	-0.026	8.915	0	8.306	0	8.738	0	22.2	0	-0.01	6.102	0.00
4:40	200	1300	200	3.531	-2.082	6.35	-2.565	5.715	-2.591	6.147	-2.591	21.59	-0.61	-2.46	3.684	-2.42
4:45	200	1300	213	3.48	-0.051	6.325	-0.025	5.664	-0.051	6.121	-0.026	21.59	0	-0.04	3.662	-0.02
4:50	200	1300	213	3.454	-0.026	6.325	0	5.664	0	6.121	0	21.59	0	-0.01	3.642	-0.02
4:55	200	1300	213	3.454	0	6.325	0	5.664	0	6.121	0	21.59	0	0.00	3.642	0.00
5:10	200	1300	213	3.429	-0.025	6.299	-0.026	5.639	-0.025	6.096	-0.025	21.59	0	-0.03	3.622	-0.02
5:15	0	0	0	2.007	-1.422	3.912	-2.387	2.642	-2.997	3.48	-2.616	21.006	-0.584	-2.36	1.531	-2.09
5:20	0	0	0	1.956	-0.051	3.607	-0.305	2.388	-0.254	3.2	-0.28	20.98	-0.026	-0.22	1.314	-0.22
5:25	0	0	0	1.651	-0.305	3.429	-0.178	2.311	-0.077	3.15	-0.05	20.98	0	-0.15	1.244	-0.07
5:30	0	0	0	1.626	-0.025	3.378	-0.051	2.286	-0.025	3.099	-0.051	20.98	0	-0.04	1.224	-0.02
5:45	0	0	0	1.575	-0.051	3.302	-0.076	2.21	-0.076	3.023	-0.076	20.98	0	-0.07	1.168	-0.06

Appendix E

Piezocone and Vane Shear Test Results



Job No: 13-05022
Client: Thurber Engineering
Project: Pic River Bridge - Marathon, Ontario
Date: 10/8/13 & 10/9/13

TABLE 1 Summary of CPT Soundings							
CPT Sounding	File Name	Date	Cone	Assumed Phreatic Surface (m)	Final Depth (m)	Northing UTM Zone 16	Easting UTM Zone 16
CPT13-F10-01	13-05022_CP01	10/8/2013	323:T1500F15U500	2.750	11.80	5395149	552744
CPT13-F10-02	13-05022_CP02	10/8/2013	323:T1500F15U500	2.750	11.80	5395141	552745
CPT13-E16-03	13-05022_CP03	10/9/2013	323:T1500F15U500	1.908	11.80	5395138	552651
	3				35.40		

Note: The hydrostatic water table is assumed for the interpretation tables and based on pore pressure dissipations.





Thurber Engineering

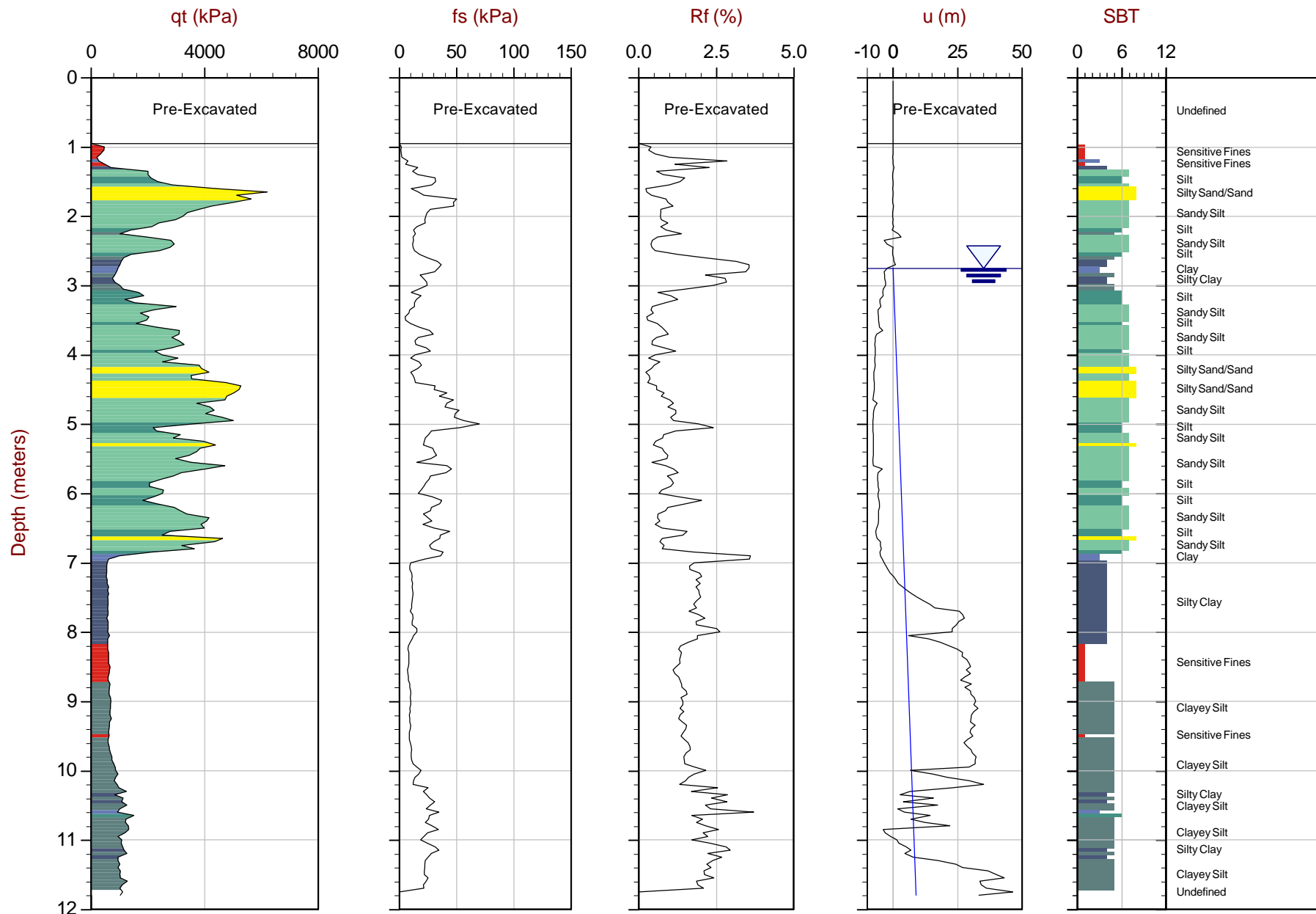
Job No: 13-05022

Date: 10:08:13 16:30

Site: Pic River Bridge, Marathon, ON

Sounding: CPT13-F10-02

Cone: 323:T1500F15U500



Max Depth: 11.800 m / 38.71 ft
Depth Inc: 0.050 m / 0.164 ft

File: 13-05022_CP02.COR

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 15 N: 5395141 E: 552745



Thurber Engineering

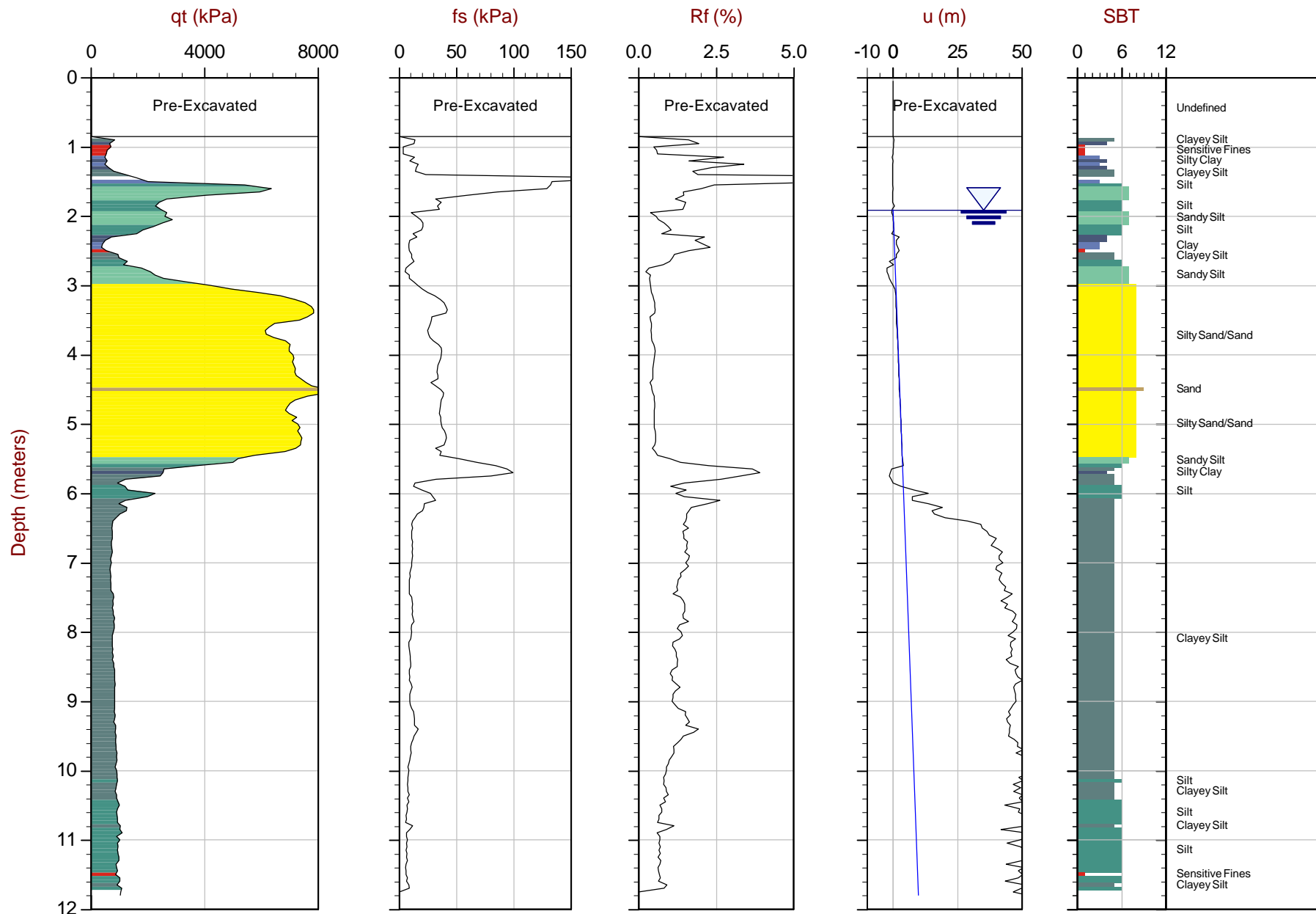
Job No: 13-05022

Date: 10:09:13 08:43

Site: Pic River Bridge, Marathon, ON

Sounding: CPT13-E16-03

Cone: 323:T1500F15U500



Max Depth: 11.800 m / 38.71 ft
Depth Inc: 0.050 m / 0.164 ft

File: 13-05022_CP03.COR

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 15 N: 5395138 E: 552651

Job Number 13-05022
Client Thurber Engineering
Project Pic River Bridge, Marathon, ON
Date Oct 8, 2013 to Oct 9, 2013

TABLE 2 Dissipation Trace Summary

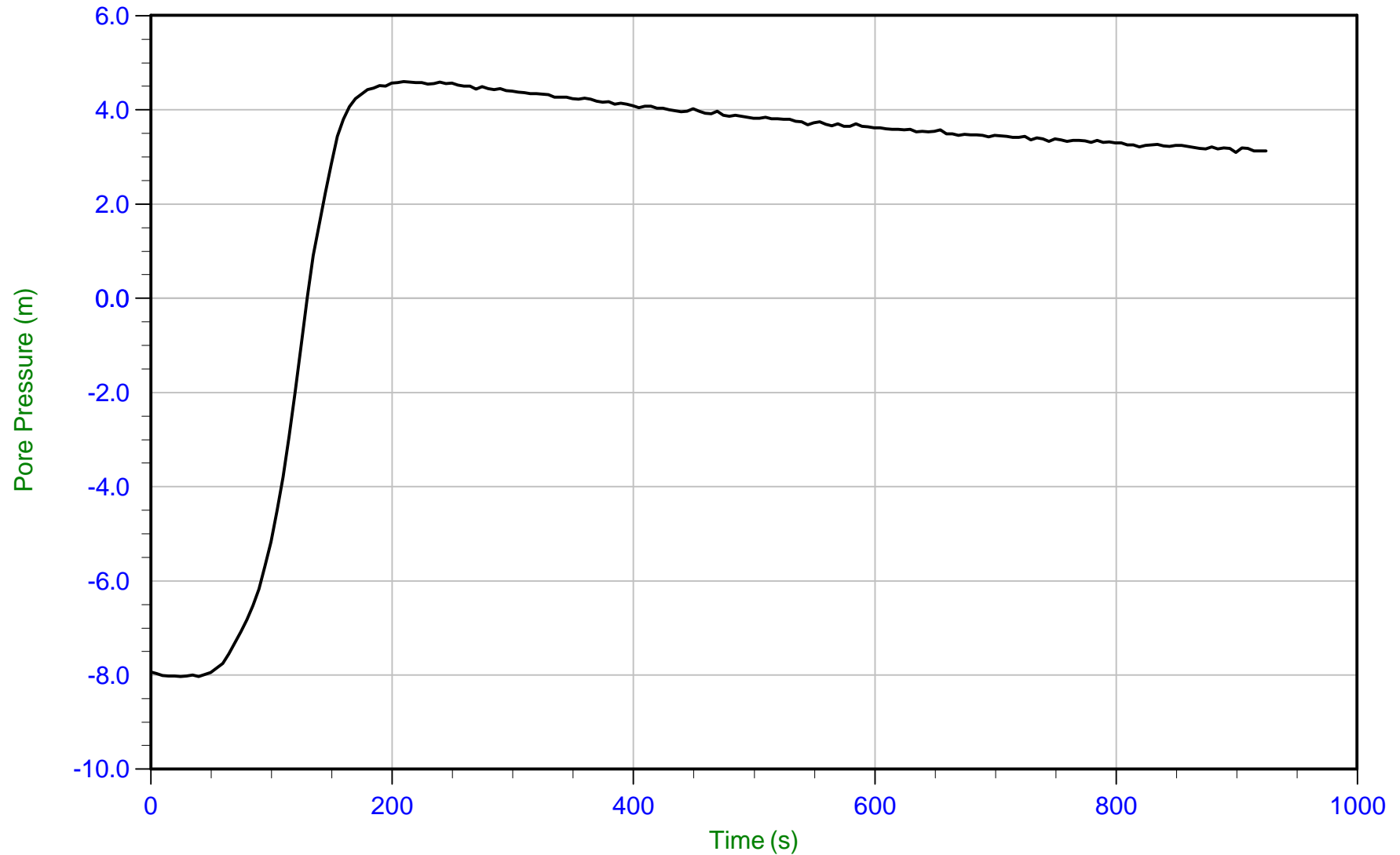
Sounding ID	Duration s	Depth m	Ueq m	Calc. Phrea. Surface m	Est. Phrea. Surface m	T at U50 s	T50 s	Ch cm ² /min
CPT13-F10-01	925.0	5.000	2.25		2.75	694.7	484.7	1.45
CPT13-F10-01	900.0	6.600	3.85	2.75				
CPT13-F10-01	7500.0	8.000	5.25		2.75	6786.6	6701.6	0.10
CPT13-F10-02	6000.0	8.000	5.25		2.75	5058.9	5043.9	0.14
CPT13-E16-03	320.0	3.500	1.59	1.91				



Thurber Engineering

Job No: 13-05022
Date: 10/08/2013 12:49
Site: Pic River Bridg

Sounding: CPT13-F10-01
Cone: 323:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-05022_CP01.PPD
Depth: 5.000 m / 16.404 ft
Duration: 925.0 s

U Min: -8.0 m
U Max: 4.6 m

WT: 2.750 m / 9.022 ft
Ueq: 2.2 m
U(50): 3.42 m

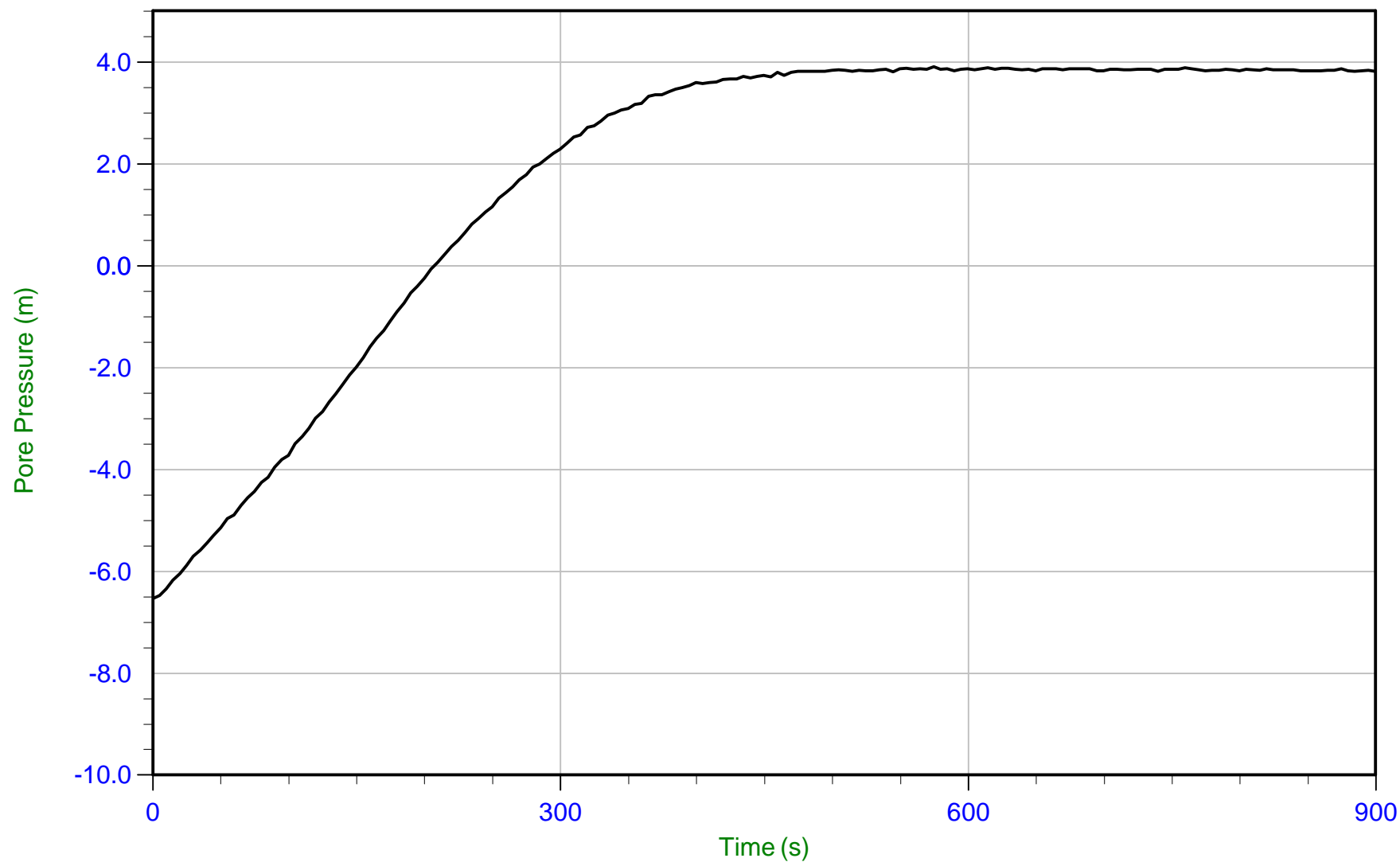
T(50): 484.7 s
Ir: 100
Ch: 1.4 sq cm/min



Thurber Engineering

Job No: 13-05022
Date: 10/08/2013 12:49
Site: Pic River Bridg

Sounding: CPT13-F10-01
Cone: 323:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-05022_CP01.PPD
Depth: 6.600 m / 21.653 ft
Duration: 900.0 s

U Min: -6.5 m
U Max: 3.9 m

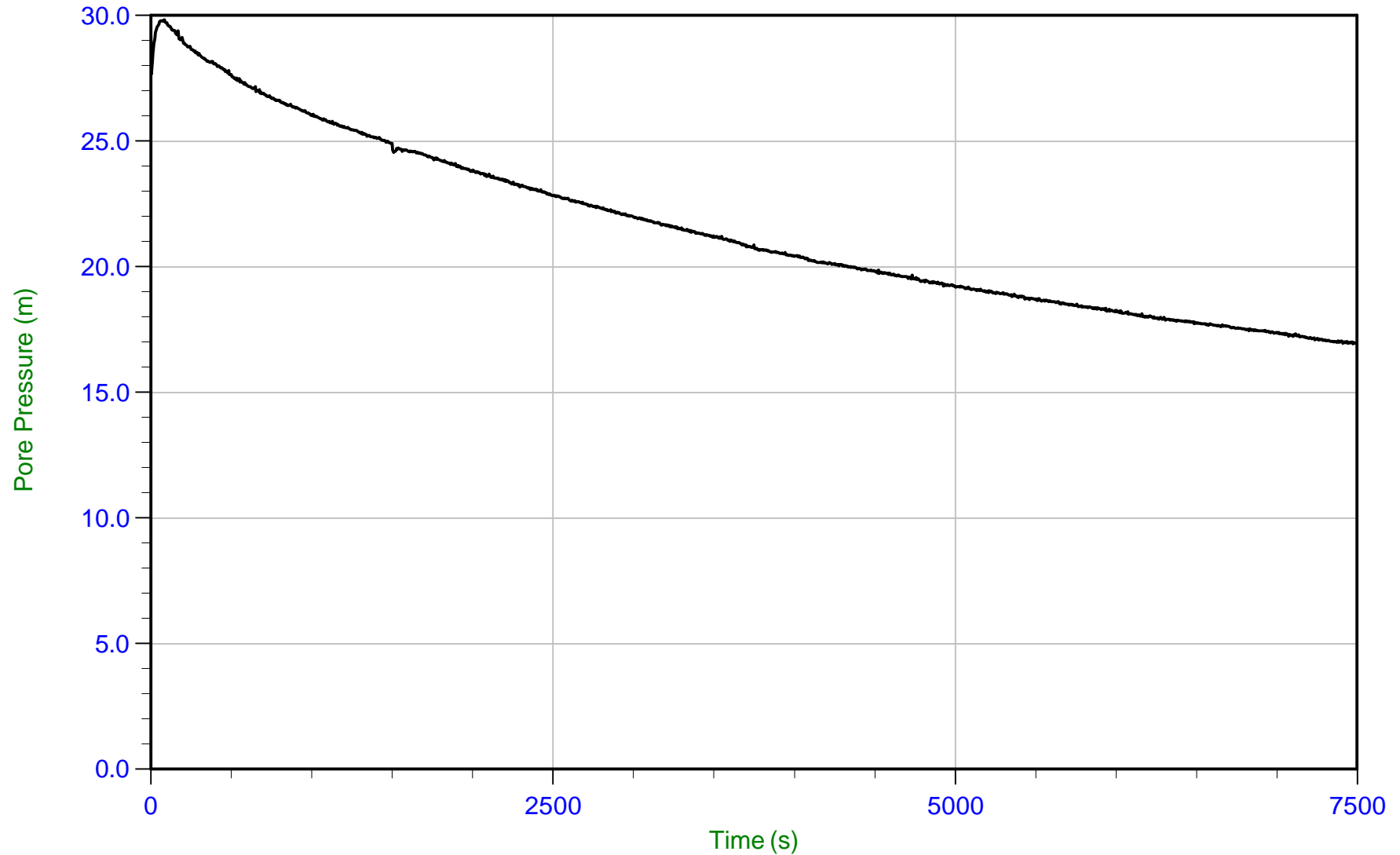
WT: 2.750 m / 9.022 ft
Ueq: 3.9 m



Thurber Engineering

Job No: 13-05022
Date: 10/08/2013 12:49
Site: Pic River Bridg

Sounding: CPT13-F10-01
Cone: 323:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-05022_CP01.PPD
Depth: 8.000 m / 26.246 ft
Duration: 7500.0 s

U Min: 16.9 m
U Max: 29.8 m

WT: 2.750 m / 9.022 ft
Ueq: 5.2 m
U(50): 17.54 m

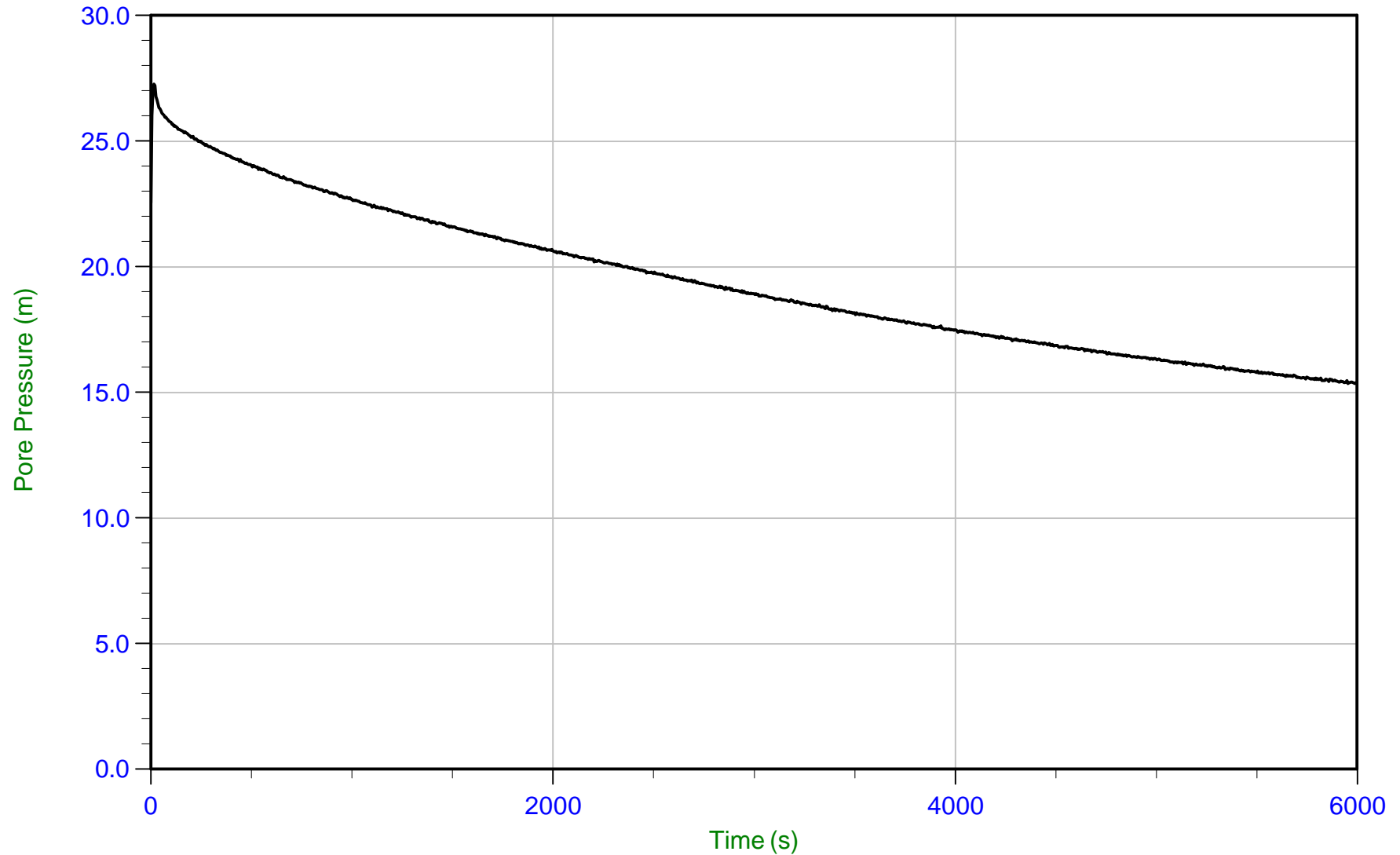
T(50): 6701.6 s
Ir: 100
Ch: 0.1 sq cm/min



Thurber Engineering

Job No: 13-05022
Date: 10/08/2013 16:30
Site: Pic River Bridg

Sounding: CPT13-F10-02
Cone: 323:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-05022_CP02.PPD
Depth: 8.000 m / 26.246 ft
Duration: 6000.0 s

U Min: 15.4 m
U Max: 27.3 m

WT: 2.750 m / 9.022 ft
Ueq: 5.2 m
U(50): 16.26 m

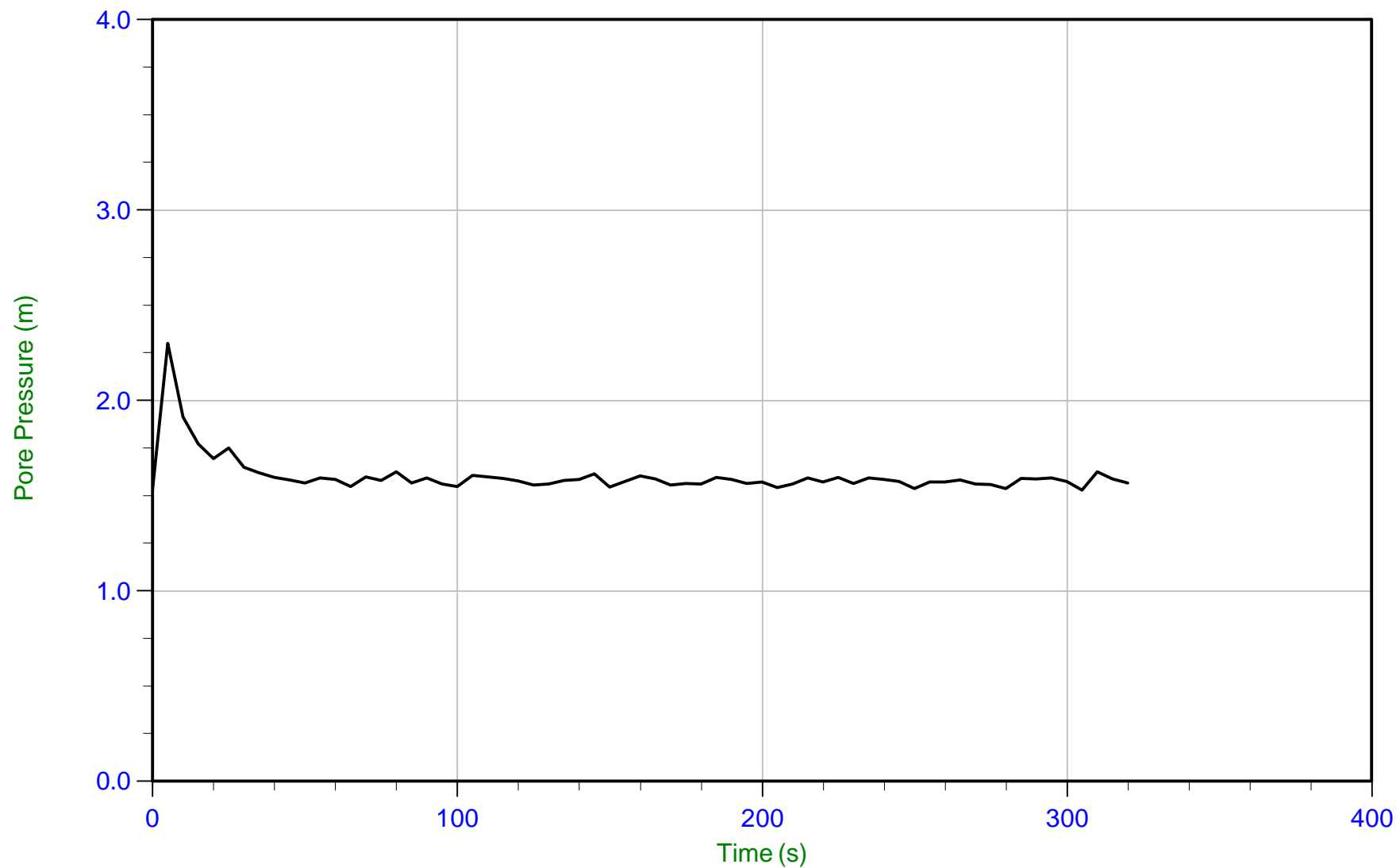
T(50): 5043.9 s
Ir: 100
Ch: 0.1 sq cm/min



Thurber Engineering

Job No: 13-05022
Date: 10/09/2013 08:43
Site: Pic River Bridg

Sounding: CPT13-E16-03
Cone: 323:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-05022_CP03.PPD
Depth: 3.500 m / 11.483 ft
Duration: 320.0 s

U Min: 1.5 m
U Max: 2.3 m

WT: 1.908 m / 6.260 ft
Ueq: 1.6 m

RECORD OF BOREHOLE No 13-01

1 OF 2

METRIC

W.P. _____ LOCATION Pic River Bridge, East Pier, Pile F-10 ORIGINATED BY MEF
 HWY 17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2013.10.10 - 2013.10.10 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
							20	40	60	80	100					
188.0	Open air inside East Pier concrete pile cap (Borehole located at 0.36m south of center of pile F-10 and 0.28m west of east wall)						188									
187.1	SAND and GRAVEL Brown Dry (FILL)						187									
185.9							186									
2.1	SILT , trace clay, trace sand Brown Wet						185									
185.0	Becoming Compact and Grey						184									
			1	SS	16		183									
182.8	Becoming sandy, some sand lenses						182									
5.2			2	SS	11		181									
181.1	Silty CLAY , varved Firm to Stiff Grey Wet						180									
6.9							179									
			3	SS	4											

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 13-01

2 OF 2

METRIC

W.P. _____ LOCATION Pic River Bridge, East Pier, Pile F-10 ORIGINATED BY MEF
 HWY 17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2013.10.10 - 2013.10.10 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page													
	Silty CLAY , varved Stiff Grey Wet						178							
							177							
176.1														
11.9	END OF BOREHOLE AT 11.9m. BOREHOLE GROUTED WITH CEMENT/BENTONITE SLURRY USING TREMIE PIPE METHOD.													

RECORD OF BOREHOLE No 13-02

1 OF 2

METRIC

W.P. _____ LOCATION Pic River Bridge, West Pier, Pile E-16 ORIGINATED BY MEF
 HWY 17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2013.10.09 - 2013.10.09 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)					
188.5								20	40	60	80	100		W _P	W	W _L	
0.0	Open air inside West Pier concrete pile cap (Borehole located at 0.46m south of center of pile E-16 and 0.31m west of east wall)						188										
187.6																	
0.9	SAND and GRAVEL Brown Dry (FILL)						187										
186.4																	
2.1	SILT , trace clay Compact Brown Wet						186										
185.4			1	SS	27												
3.1	SAND , trace gravel Very Loose to Compact Brown Wet						185										
182.4			2	SS	1		184										
							183										
			3	SS	12												
6.1	Silty CLAY , varved Stiff Grey Wet						182										

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 13-02

2 OF 2

METRIC

W.P. _____ LOCATION Pic River Bridge, West Pier, Pile E-16 ORIGINATED BY MEF
 HWY 17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2013.10.09 - 2013.10.09 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
	Continued From Previous Page															
	Silty CLAY , varved Stiff Grey Wet						178									
							177									
176.6																
11.9	END OF BOREHOLE AT 11.9m. BOREHOLE GROUTED WITH CEMENT/BENTONITE SLURRY USING TREMIE PIPE METHOD.															

+³, ×³: Numbers refer to
Sensitivity

20
15
10
5
0
(%) STRAIN AT FAILURE

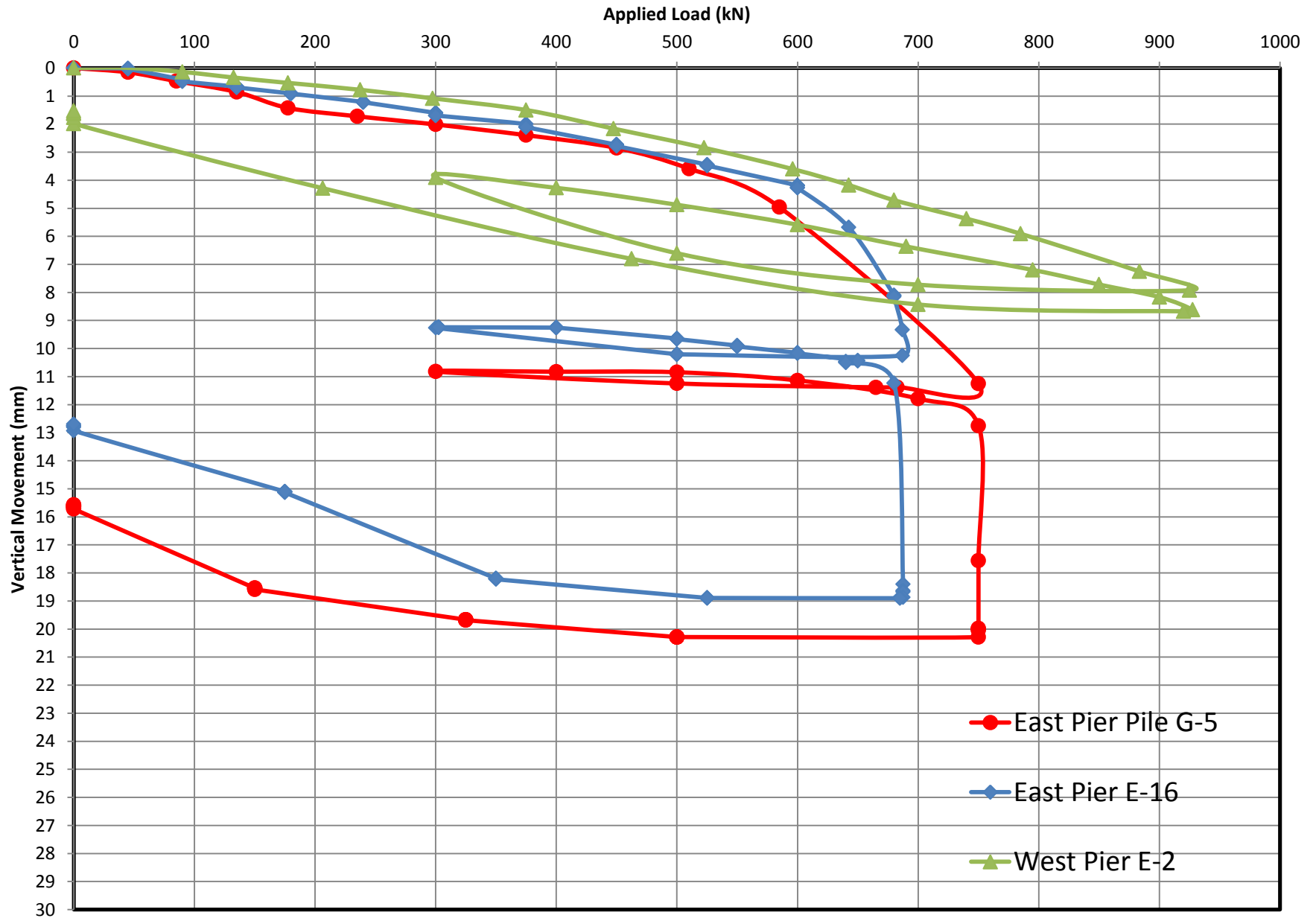
Appendix F

Evaluation Figures

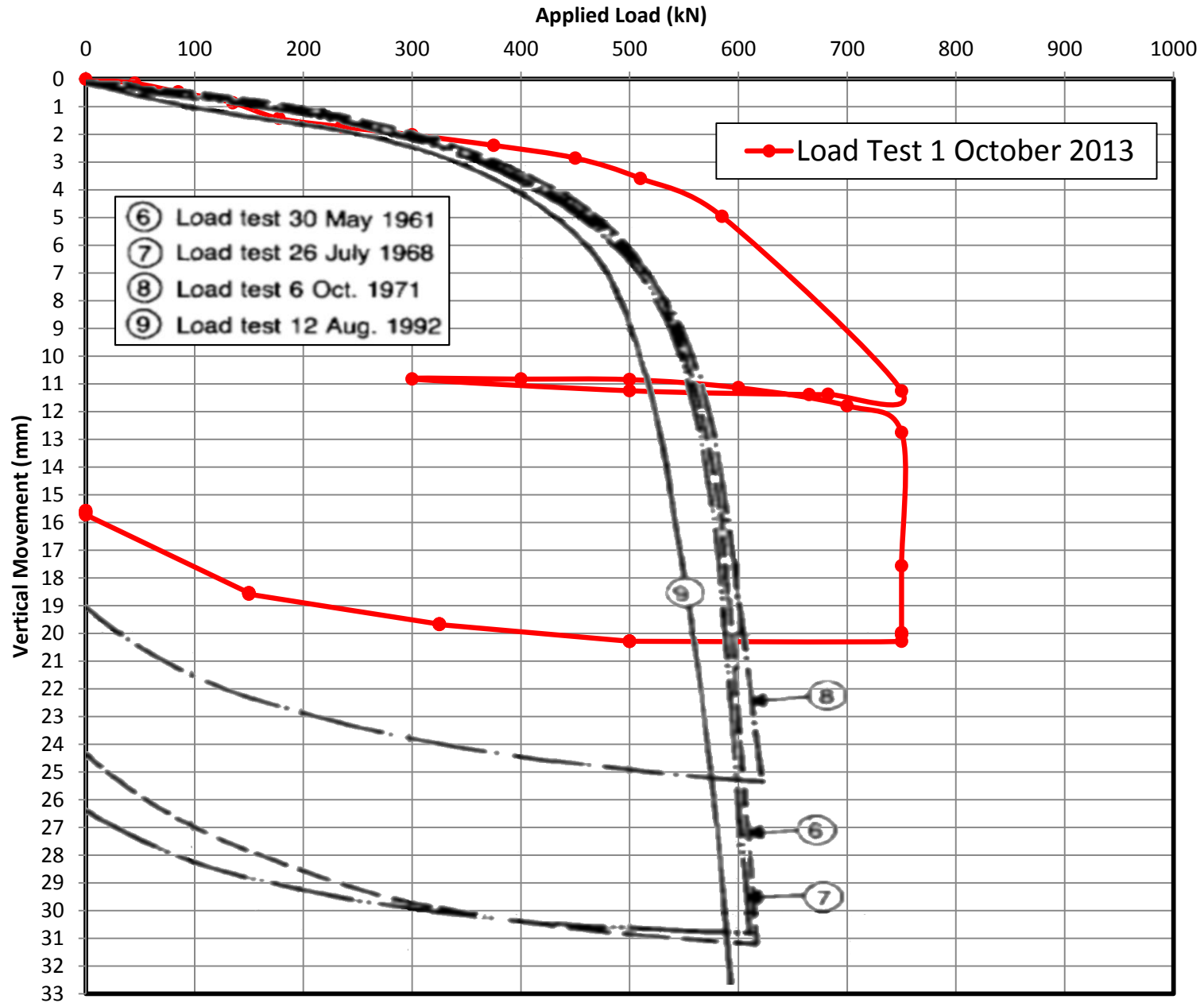
Includes:

Load-Settlement Curves from Current and Previous Load Tests
Undrained Shear Strength and Preconsolidation Pressure Profiles

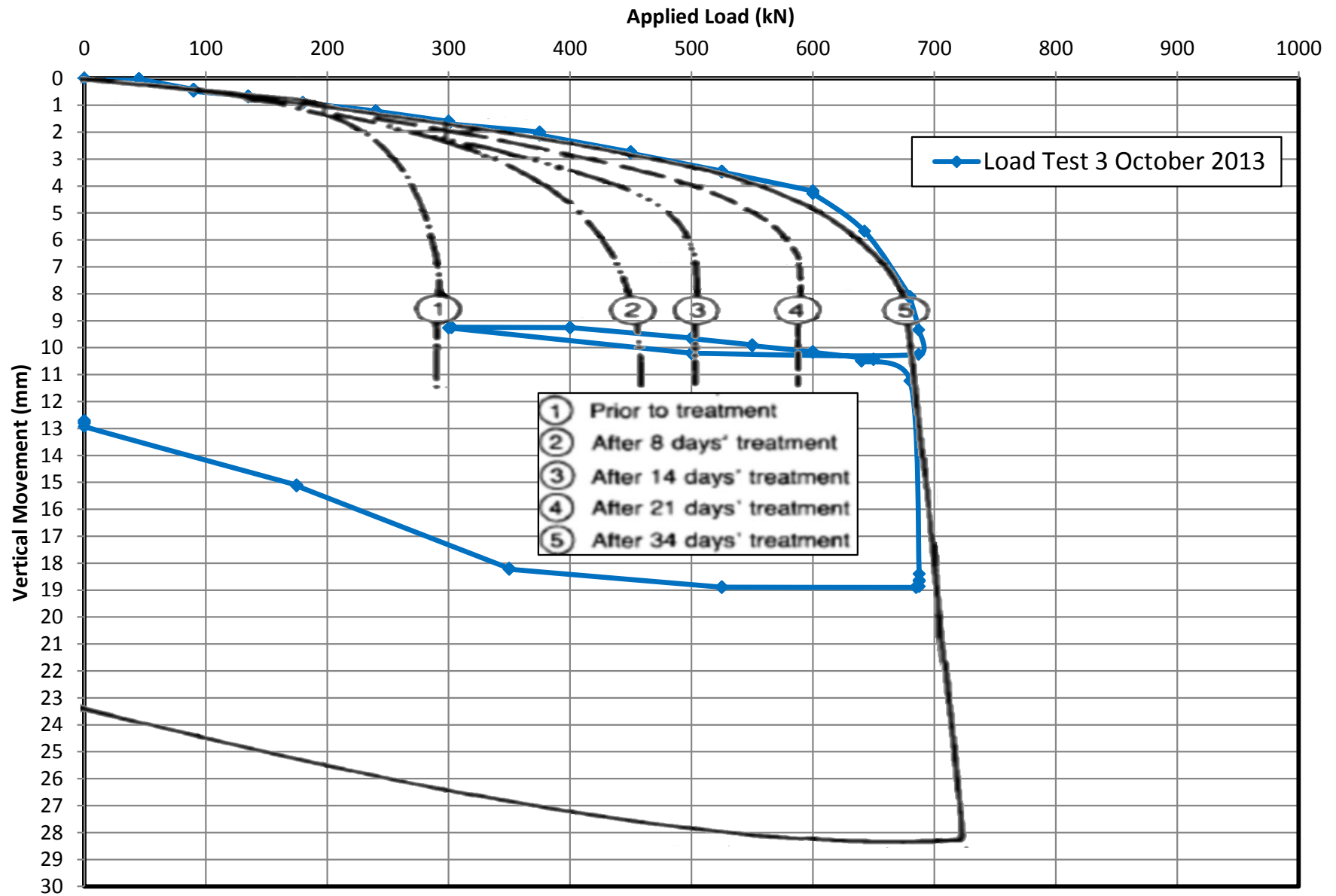
Hwy 17 Pic River Bridge - Pile Load Test Results



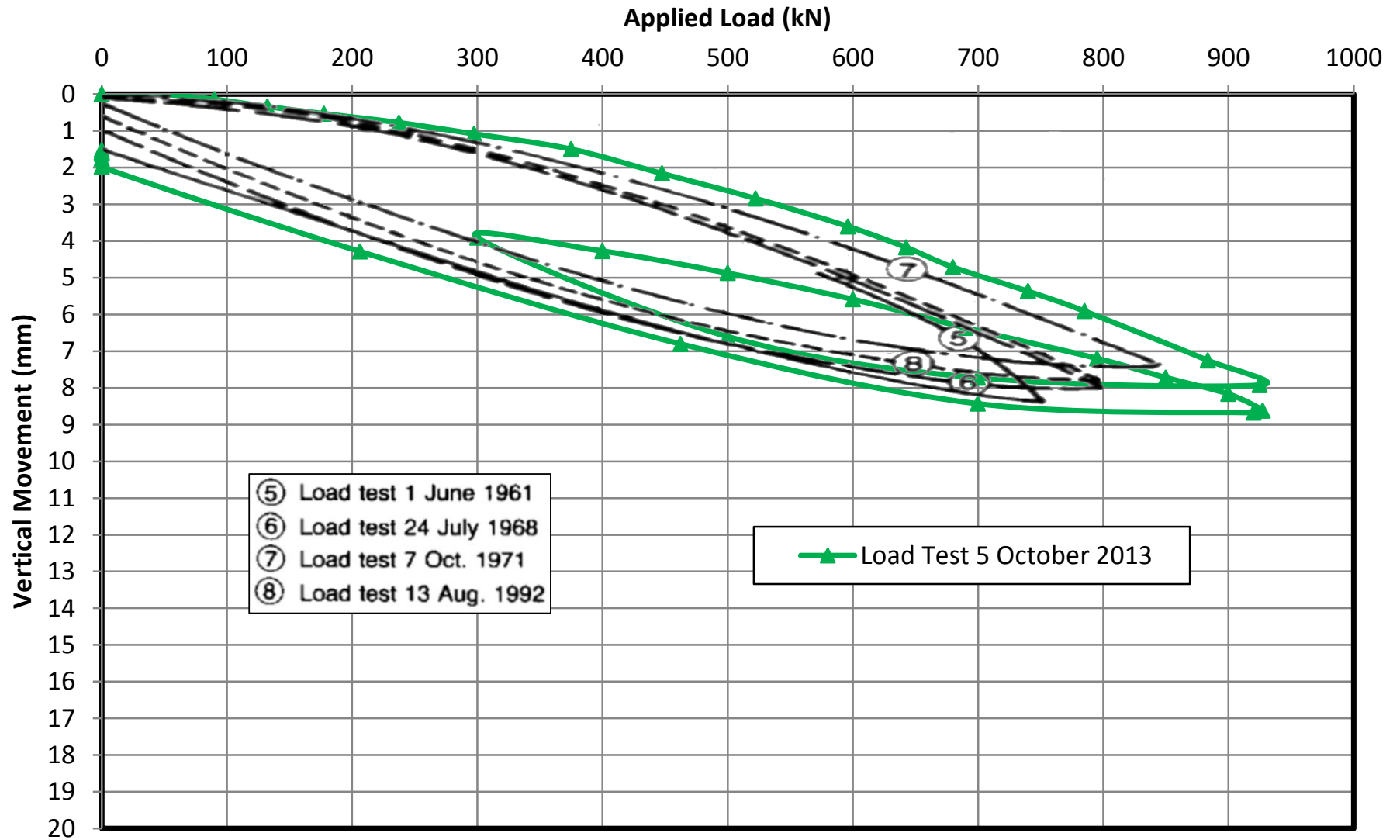
Hwy 17 Pic River Bridge - Pile Load Test Results - East Pier G-5



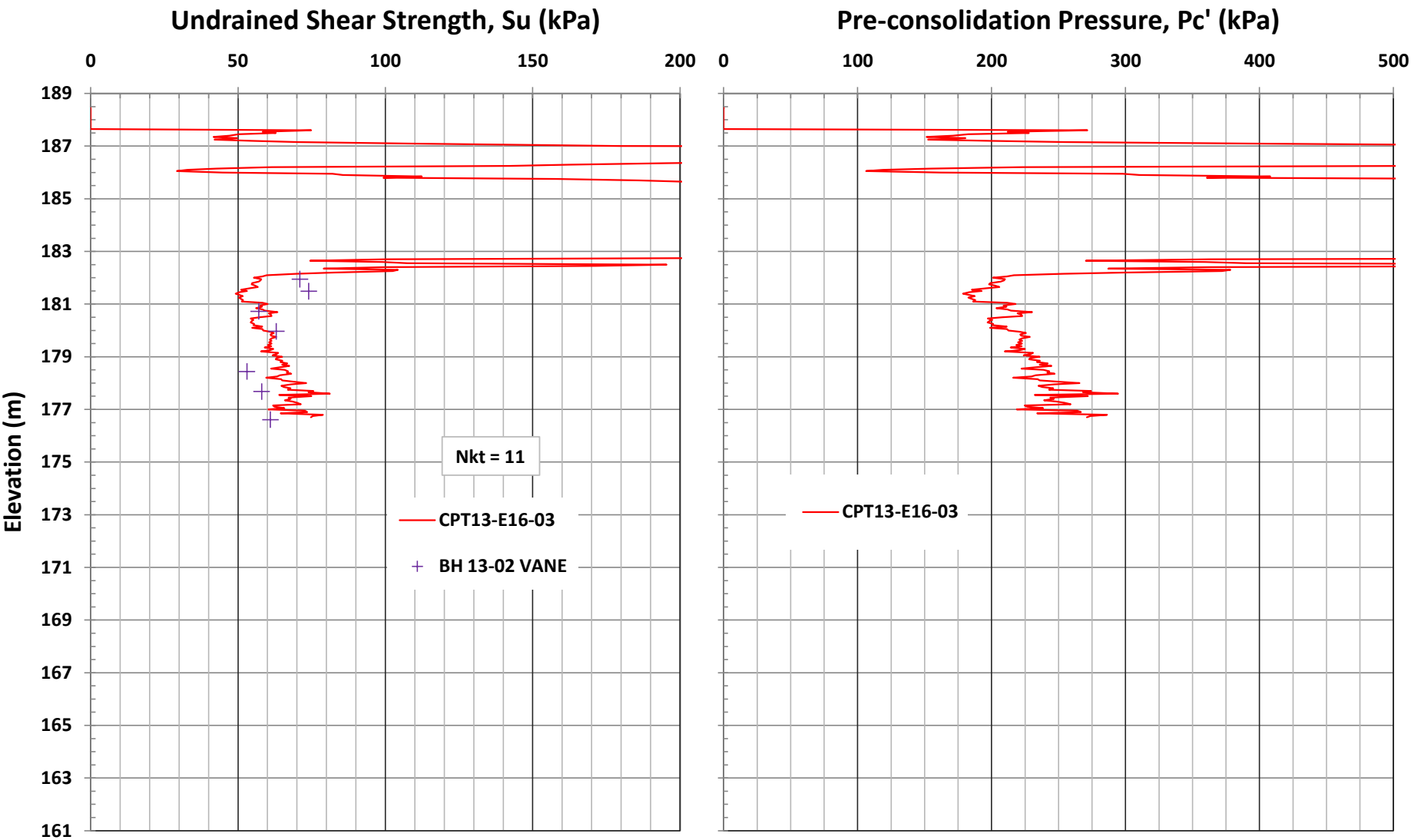
Hwy 17 Pic River Bridge - Pile Load Test Results - East Pier E-16



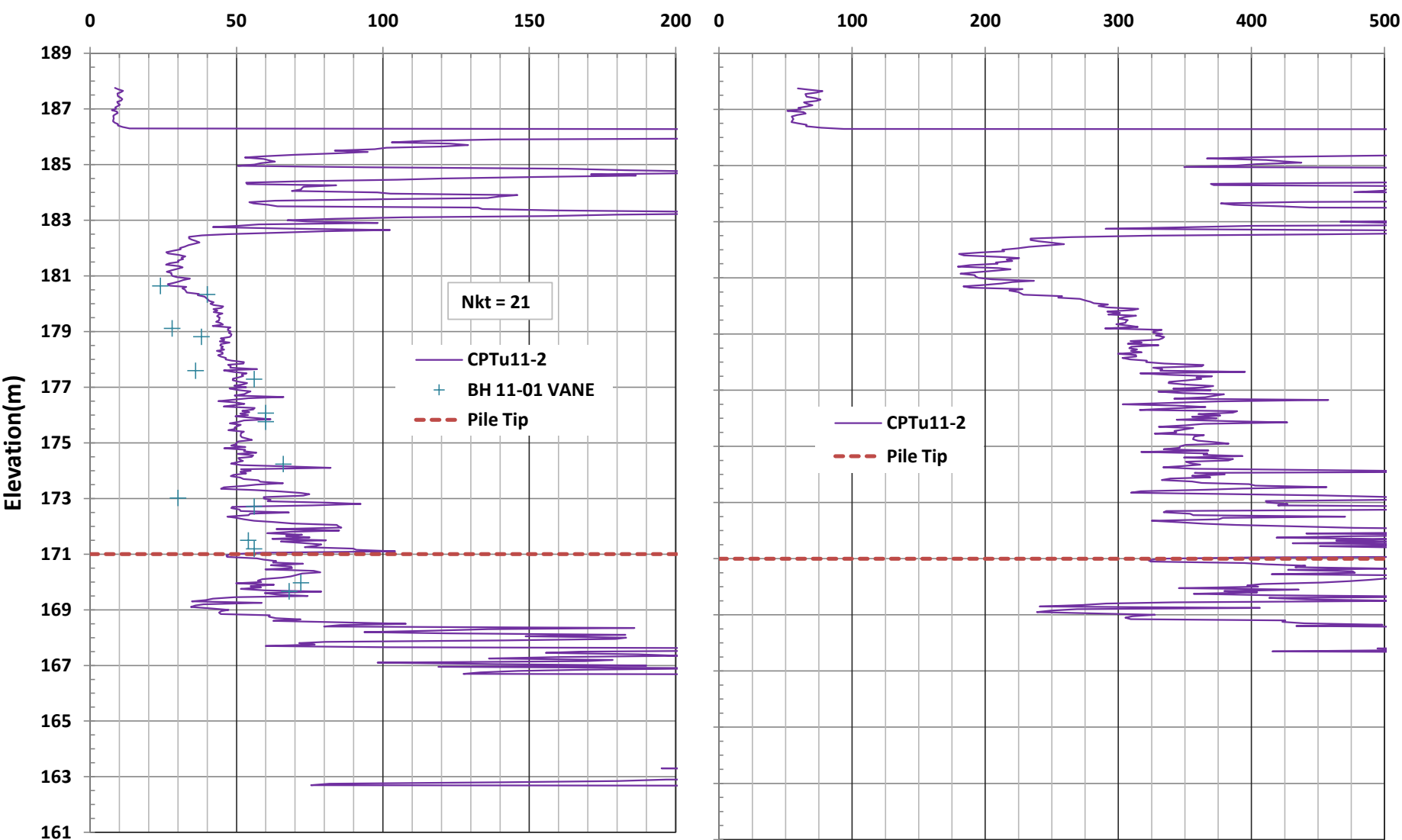
Hwy 17 Pic River Bridge - Pile Load Test Results (West Pier - E2)



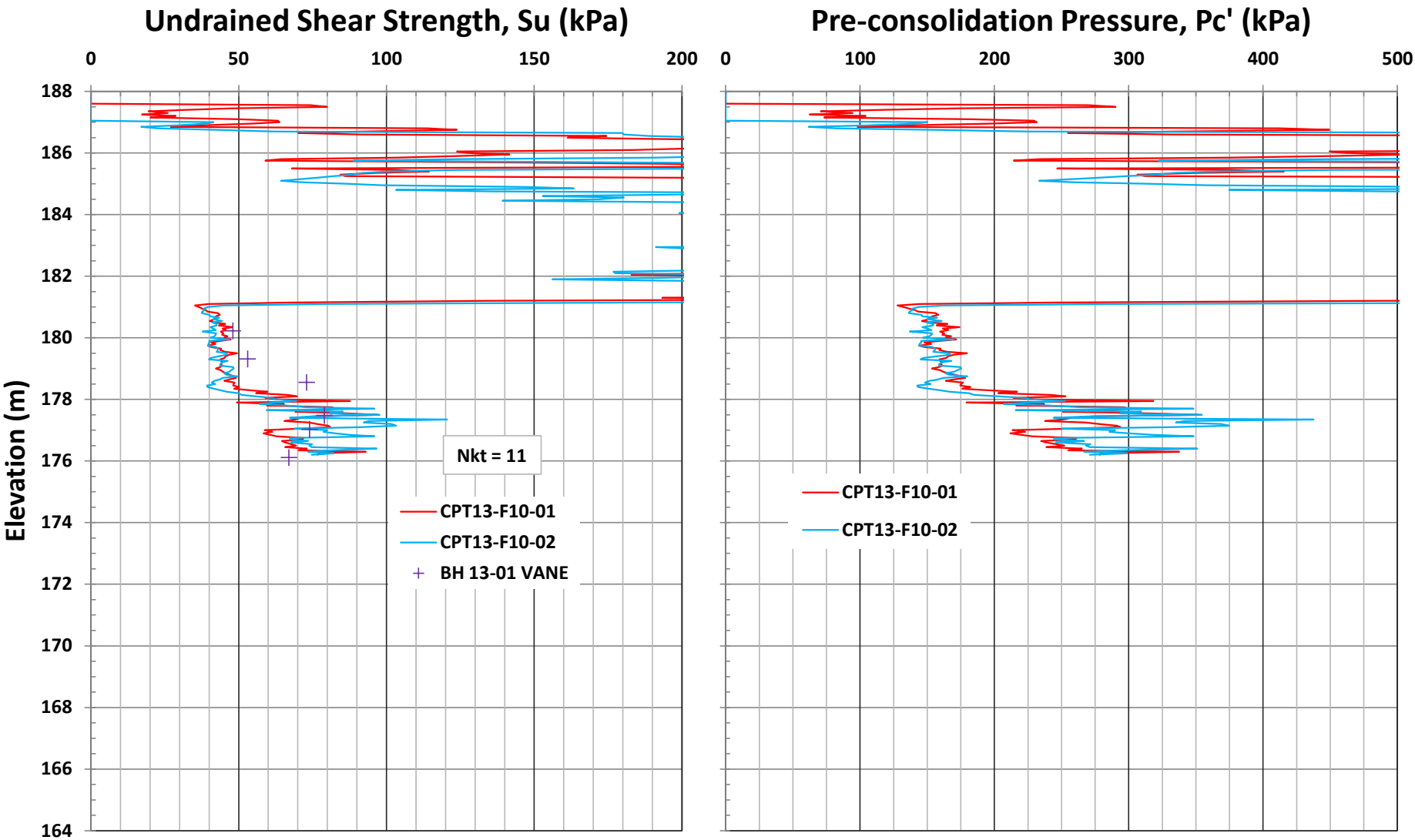
West Pier - Within Pile Group



West Pier - Untreated Native Ground Outside of Pile Group



East Pier - Within Pile Group



East Pier - Untreated Native Ground Outside of Pile Group

