

Report LT-2

Static Load Testing at Highway 400-89

**Highway 400-89 Interchange Reconstruction
Site 30-256
MTO 2018-2024**

Prepared for

**Fermar Paving Limited
1921 Albion Road
Etobicoke, ON M9W 5S8**

Our File No. 1905CS1373

October 31, 2019

Prepared by:



Shawn Ferguson, P.Eng.

Distribution: 1 electronic copy to Fermar Paving Limited
1 electronic copy to Urkkada

Report LT-2

Static Load Testing at Highway 400-89

Highway 400-89 Interchange Reconstruction Site 30-256 MTO 2018-2024

1. Terms of Reference

Urkada has been retained by Fermar Paving Inc. (Fermar) to observe and document the static load tests performed at the Highway 400-89 Interchange. Mr. Charles Ezomo, Fermar, was the contact person and coordinated the activities during the load test.

The purpose of the static load testing was to investigate the axial resistances of a driven steel 310 x 110 H-pile. This report presents the results of the static load test performed from October 28 – 29th, 2019. The static load test was performed in general conformance with the contract documents and ASTM D1143, and as amended by Golder Associates (Golder) acting as the Foundation Engineering Specialist for the owner.

2. Test Pile

One 310x110 H-pile with a cross sectional area of 141.0 cm² was subjected to static load testing. Per Item 103, vibrating wire piezometers were installed around the test pile location.

The test pile was an existing pile, which was previously installed for Load Test #1 and #2. Please refer to our “*Report LT-1, Static Load Testing at Highway 400-89*” for details on the location, installation, and test results.

3. Pile Installation and Static Load Test Set-up

The existing test pile was driven to a further depth of 50.80 m from 36.34 m, in general conformance with the piling subcontractor's submittal. Please refer to our *"Report LT-1, Static Load Testing at Highway 400-89"* for the piling subcontractor's submittal.

The reaction system remained unchanged from Load Test #1 and #2, as described in our *"Report LT-1, Static Load Testing at Highway 400-89"*. The reaction piles consisted of steel 310 x 110 H-piles, three driven to a tip depth of 36.0 m and the fourth to a tip depth of 43.3 m below grade.

The measurement system was the same as used during Load Test #1 and #2, as described in *"Report LT-1, Static Load Testing at Highway 400-89"*. Two linear displacement dial gauges for vertical movement and two linear displacement dial gauges for lateral movement were used the primary instruments used to measure pile movements. A test pile wireline was also installed to provide backup measurements for the vertical movement. A sketch showing the location and numbering of the monitoring points and reaction piles is provided in Appendix 1.

The pile installation logging was performed by Golder and Bare Engineering. The blow count recordings have been transcribed from Golder on-site notes and are included in Appendix 2. Based on the installation log, the test pile was driven to a penetration resistance of 32 blows for 250 mm of movement at end of drive. Additional information provided by Bare Engineering is also included in Appendix 2.

The results of the PDA testing from the end of drive, performed by Urkkada are included in Appendix 2.

4. Soils Information

Based on the boring logs provided in the contract documents, the soil profile at the test location is as follows:

1. Elev. 227.4 m to 226.7 m: Fill
2. Elev. 226.7 m to 209.6 m: Silty – Sandy Silt
3. Elev. 209.6 m to 208.9 m: Silty Clay
4. Elev. 208.9 m to 206.5 m: Silt and Sand
5. Elev. 206.5 m to 195.5 m: Clayey Silt – Silty Clay
6. Elev. 195.5 m to 189.0 m: Silt and Sandy Silt
7. Elev. 189.0 m to 182.9 m: Clayey Silt
8. Elev. 182.9 m: Clayey Silt Till

Copies of the logs from the two closest borings, 89UP-03 and 89UP-05, as taken from “*Foundation Investigation Report, Hill Embankment, Highway 400-89 Interchange Reconstruction, Town of Innisfil, Simcoe County*” prepared by Golder dated September 2018, are included in Appendix 3.

5. Calibration Records

The load cell used during the static loading test was calibrated on August 12, 2019 by RocTest. A copy of the calibration record is included in Appendix 4.

Powell’s test pile submission package contained a calibration record for the hydraulic jack / digital pressure gauge performed by Canadian BBR Inc. dated August 28, 2019. A copy of this calibration record is included in Appendix 4.

During the test, the load cell was the primary instrument used to determine the load applied to the pile.

6. Static Load Test Results

The complete field readings for the static load tests are provided in Appendix 5. The enclosed tables provide the following information:

- ☐ Date and time of each reading
- ☐ Load cell reading
- ☐ Pressure gauge reading
- ☐ Readings from two vertical dial gauges mounted to the test pile
- ☐ Average vertical movement of the pile head based on the two dial gauges
- ☐ Readings from two lateral dial gauges mounted to the test pile
- ☐ Test pile wire line reading
- ☐ Test pile movement based on wire line
- ☐ Survey readings from the four reaction piles

The Load Test #3 procedure was provided in INC-207 and by Golder staff on-site October 28, 2019. The procedure was to increase loads in 300 kN intervals to a maximum of 2000 kN following ASTM Procedure B, with a maximum movement limit of 10% + 30 mm (61 mm).

At the 1800 kN load interval of Test #3, it became apparent that the pile was not capable of holding the 1800 kN without exceeding the movement limit of 61 mm prior to reaching hold phase of the test. Per Golder’s instruction, the test was modified to a maximum loading of 1700 kN and begin a 12 hr hold period.

The load movement data for Test #3 is presented in Figure placed in Appendix 6. The results are plotted as the applied load based on the load cell and the vertical movement based on the displacement dial gauges. The Davisson Offset based on the as-built pile dimensions (310x110 H-pile) are also plotted on Figure 1. A summary of Load – Movement data used to produce Figure 1 is provided in Table, also placed in Appendix 6.

7. Static Load Test Photos

A selection of photos detailing the setup of the load test is provided in Appendix 7.

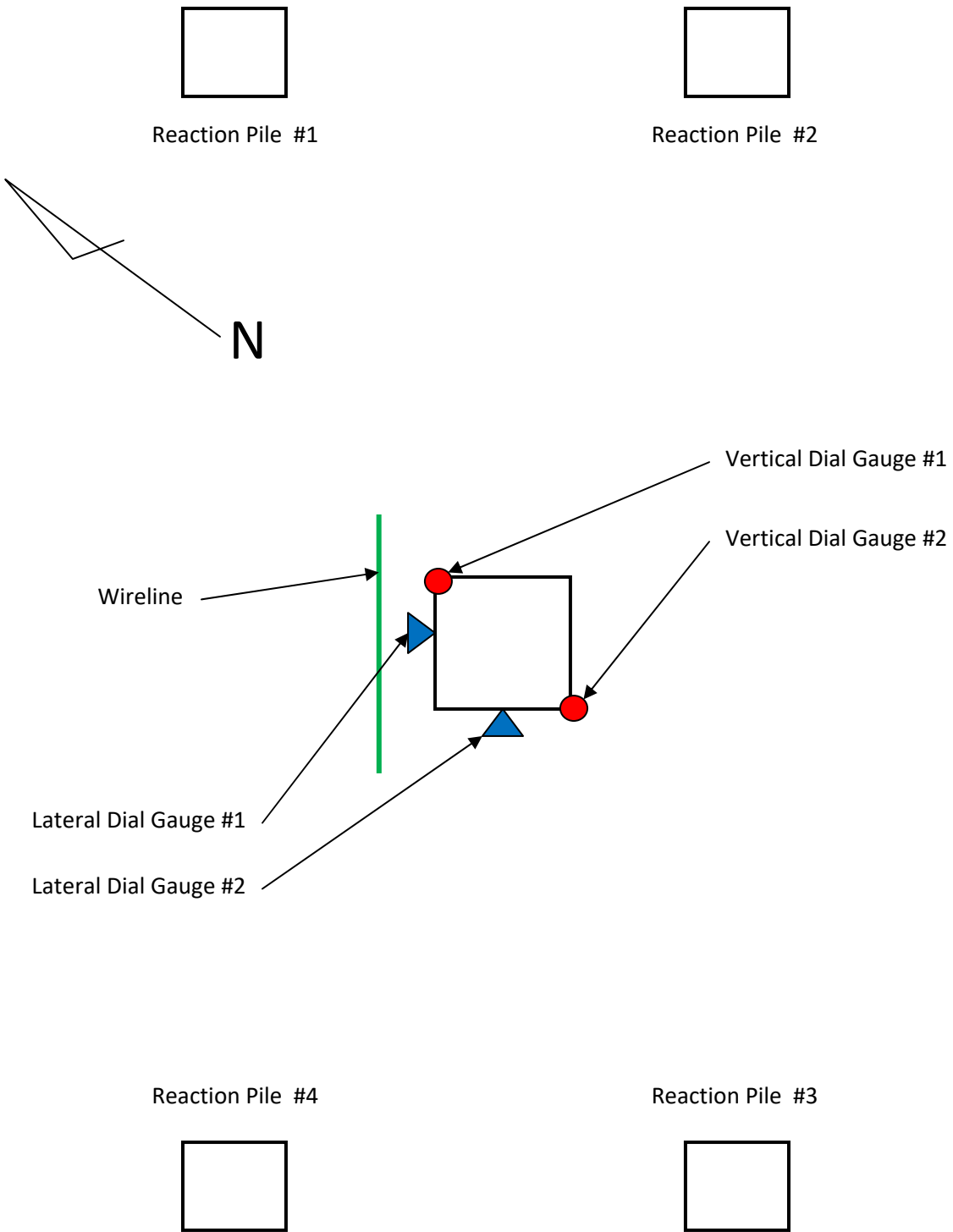
8. Conclusion

Based on the results of the static load test, the following comments can be made:

1. Using the Davisson Offset Load Limit criterion, the ultimate capacity of the pile is typically defined as the point where the load-movement curve crosses the Offset Load Limit Line (unless a specific movement criterion is specified, which has not been provided for this project). Based on the load-movement curves provided in Appendix 6, the ultimate capacity of the test pile using the Davisson Offset Load Limit Method was found to be 1630 kN during Load Test #3.
2. Plunging failure was not observed during Load Test #3.

Appendix 1

Monitoring Point Layout Sketch



General Test Pile Layout
Not to Scale

Appendix 2

Pile Installation Log and PDA Test Report

Job No: 1905CS1373

Pile Driving Record - Transcribed from Golder Associates

Project:	MTO 2018-2024	Pile No:	Test Pile	Driving Shoe:	
Client:	Not Applicable	Type of Pile:	310x110	Inclination:	
		Pile Size:		Straightness:	
Structure:	N/A	Length:			
Hammer:	B-32	Site Conditions	Date	AM	PM
Crane:	Soilmec SC-90				
Ground Elev:					
Cut Off Elev:					

Penetration (m)	Blows	Penetration (m)	Blows	Penetration (m)	Blows	Penetration (m)	Blows	Comments	
30.25		40.25	12	50.25	25	60.25		Pile Head Inclination at End of Drive: N/S: E/W:	
30.50		40.50	12	50.50	29	60.50			
30.75		40.75	12	50.75	32	60.75			
31.00		41.00	12	51.00	*12	61.00			
31.25		41.25	11	51.25		61.25			
31.50		41.50	12	51.50		61.50			
31.75		41.75	11	51.75		61.75			
32.00		42.00	12	52.00		62.00			
32.25		42.25	11	52.25		62.25			
32.50		42.50	12	52.50		62.50			
32.75		42.75	11	52.75		62.75			
33.00		43.00	12	53.00		63.00			
33.25		43.25	12	53.25		63.25			
33.50		43.50	11	53.50		63.50			
33.75		43.75	12	53.75		63.75			
34.00		44.00	12	54.00		64.00			
34.25		44.25	13	54.25		64.25			
34.50		44.50	16	54.50		64.50			
34.75		44.75	16	54.75		64.75			
35.00		45.00	16	55.00		65.00			
35.25		45.25	14	55.25		65.25			
35.50		45.50	19	55.50		65.50			
35.75		45.75	20	55.75		65.75			
36.00		46.00	17	56.00		66.00			
36.25		46.25	15	56.25		66.25		Date / Time	Work Performed
36.50		46.50	15	56.50		66.50			
36.75	17	46.75	14	56.75		66.75			
37.00	17	47.00	13	57.00		67.00			
37.25	14	47.25	19	57.25		67.25			
37.50	16	47.50	28	57.50		67.50			
37.75	12	47.75	26	57.75		67.75			
38.00	16	48.00	26	58.00		68.00		Splice Information	
38.25	13	48.25	22	58.25		68.25		Location of Splice:	
38.50	13	48.50	24	58.50		68.50		Date welded:	
38.75	12	48.75	23	58.75		68.75		Date welded:	
39.00	12	49.00	26	59.00		69.00		Number of Welder (s):	
39.25	13	49.25	26	59.25		69.25			
39.50	13	49.50	26	59.50		69.50		Heat Number	
39.75	13	49.75	27	59.75		69.75		Bottom:	
40.00	12	50.00	29	60.00		70.00		Top:	

Inspector:

Bare Eng. Ltd.

64 Shadow Lake Rd. # 43 - P.O. Box 1, Cobocook - Ontario K0M 1K0 - Canada
Phone 705-454-2730 - Fax 705-454-0367 - Email bareengr@sympatico.ca

Date: September 16, 2019, to Oct.11, 2019
Contractor: (Fermar) Powell Foundations
Contract: 2018-2024
Location: Hwy. 400 & Hwy. 89 Interchange

Test Pile Record Summary

Hammer: Sc -90 Soiltec B32 Diesel

Location: McDonald Parking Lot

Pile Driven Date:	Pile No.	Pile Projection (m)	Design Tip Elevation (m)	Grade Elevation (m)	Total Pile length with Splice record (m)	Total Pile Length in Ground (m)	Actual Tip Elevation	Value n	Value S	Value c	Bpm	Type: Vertical & Batter	Initial-Tap Date & Re-tap Time:	Hiley Resistance 2300 (kN)	PDA Design Resistance 2300 (kN)	Remarks:
Sept.16, 2019 Sept.17, 2019 Sept.19, 2019	P -1NE	9.28	192.500	228.51	15.28 - + 0.28 + +15.28 - 0.28+ 15.28 = 45.28	36	192.510				38	v				
Sept.16, 2019 Sept.17, 2019 Sept.18, 2019 Sept.19, 2019	P -2 SE	9.28	192.500	228.470	15.28 - 0.28 + +15.28 - 0.28+ 15.28 = 45.28	36	192.470				40	v				
Sept.16, 2019 Sept.17, 2019 Sept.18, 2019	P -3 SW	1.86	192.500	228.43	15.29 - 0.28 + +15.28 - 0.28+ 15.23 = 45.28	43.42	185.010				6 blows/ 200mm	v				
Sept.16, 2019 Sept.17, 2019 Sept.19, 2019	P - 4 NW	9.28	192.500	228.390	15.33 - 0.28 + +15.28 - 0.28+ 15.28 = 45.28	36	192.390				42	v				
Sept.16, 2019 Sept.18, 2019 Sept.19, 2019 Oct.11, 2019	TS	9.28	192.500	228.47	15.28 - + 15.30 - 0.58+ 15.28 - 8.28 + 15.3 = 52.3	36	177.720	0.550	Sept.19, 2019 21, 25.7, 23.7 Sept.23, 2019 16.3 Oct.11, 2019 8.9, 9.4	Sept.19, 2019 5, 3.75, 4 Sept.23, 2019 4.28 Oct.11, 2019 7.9, 9.2	Sept.19, 2019 42, 42, 42 Sept.23, 2019 38 Oct.11, 2019 40, 40	v	Sept.19, 2019 Time: 4:20pm, 4:35pm, 4:38pm Sept.23, 2019 Time: 9:18am Oct.11, 2019 Time: 12:15pm, 1:55pm	Sept.19, 2019 1661 1466 1559 Sept.23, 2019 1958 Re-Tap Oct.11, 1891 1871	Resistance 1042 Bpm 41 Stress 203 Mpa	Note: Pile was spliced to total length of 67.6 m, and after cut off without driving

Report 2

Dynamic Testing and Analysis of Piles

Highway 400 and 89 Interchange
MTO 2018-2024

Prepared for

Fermar Paving Limited
1921 Albion Road
Rexdale, ON M9W 5S8

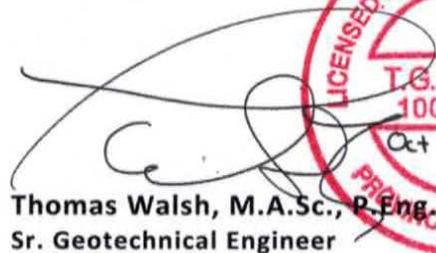
Our File No. 1905CS1373

October 16, 2019

Prepared by:



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Project Engineer



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Sr. Geotechnical Engineer

Distribution: 1 electronic copy to Fermar
1 electronic copy to Urkkada

Report 2

Dynamic Testing and Analysis of Piles

Highway 400 and 89 Interchange MTO 2018-2024

1. Terms of Reference

Urkada has been retained by Fermar Paving Limited (Fermar) to perform Pile Driving Analyzer (PDA) testing and analysis on the Highway 400 and 89 Interchange project.

The purpose of the dynamic testing was to assess the capacity of the test pile. This report presents the results of dynamic pile testing on one (1) pile during driving on October 11, 2019. The dynamic testing was performed in accordance with ASTM D4945 and the contract specifications.

2. Piles

The pile subjected to PDA testing is a 310x110 H-Pile.

3. Hammer Used

The pile was driven and tested using a Bermingham B-32 single acting diesel hammer. Powell Foundations Inc. was the piling subcontractor.

4. Subsurface Conditions

The test pile is located at the northwest corner of the project. A copy of the closest available boring logs, 89UP-3, is attached in Appendix I.

5. Results

5.1 General

Details of the test pile, hammer information, dates of testing, depths, etc. are summarized in Table 1 placed after the text portion of the report.

Dynamic test data, such as Case Method Estimates of mobilized static resistance, transferred energy, maximum compressive stresses, computed compressive stress at pile toe, corresponding penetration resistance values, CAPWAP results, and other information, are presented in Table 2.

The dynamic records from the pile are compiled in Pile Driving Analyzer (PDA) diagrams presented in Appendix II. The PDA diagrams presented in Figures II-1 and II-2 show the following values versus blows in sequence (Figure II-1) and versus pile penetration (Figure II-2):

- Maximum Transferred Energy (EMX, kJ)
- Maximum Compressive Force (FMX, kN)
- CMES Capacity (RMX, kN)
- Maximum Average Compressive Stress (CSX, MPa)
- Computed Compressive Stress at the Pile Toe (CSB, MPa)
- Penetration Resistance (PRES, blows/0.25)

Figure II-2 is based on the pile blow counts provided by Powell. The depth for each blow is calculated based on the PRES values.

One CAPWAP analysis is performed as indicated in Table 1. Detailed CAPWAP results are enclosed in Appendix III. The CAPWAP results include two pages of graphs. The first shows the measured wave traces, and the results of the analysis shown as force match, simulated static loading tests for pile head and pile toe, and the distribution of shaft resistance and pile forces. The second shows diagrams of the distribution of “extrema” along the pile, that is, the following values:

- Maximum Force and Maximum Transferred Energy
- Maximum Compressive Stress and Maximum Tension Stress
- Maximum Velocity and Maximum Displacement

5.2 Pile Capacity

As indicated in Table 2, the CAPWAP computed mobilized resistances of the tested pile are as follows:

Pile ID	Testing Condition	CAPWAP Mobilized Resistance (kN)	Shaft Resistance (kN)	Toe Resistance (kN)
Test Pile	End of Third Drive	1,500	975	525

5.3 Hammer Transferred Energy

The maximum transferred energy for the blow subjected to CAPWAP analysis was 42.8 kJ.

5.4 Maximum Compressive Stress During Testing

The maximum compressive stress for the blow subjected to CAPWAP analysis was 219 MPa.

5.5 Pile Structural Integrity

No structural damage was observed during testing.

Dynamic Testing and Analysis of Piles
MTO 2010-2024 - Highway 400 and 89 Interchange

TABLE 1 PILE DATA SUMMARY

Pile No.	Date of of Testing	Testing Condition	Hammer Model and Type	Pile Type	Pile Size	Pile Cross Section Area at Sensors (cm ²)	Total Length (m)	Length below Gages (m)	Embed. Depth during Dynamic Testing (m)	CAPWAP Analysis Performed
Test Pile	September 19, 2019	ID	Berminghammer B-32	H-Pile	310x110	26.1	115.0	37.0	34.00 - 36.00	Yes
	September 23, 2019	RSTR							36.00 - 36.34	Yes
	October 11, 2019	D2						50.3	44.25 - 47.50	No
	October 11, 2019	D3						51.3	47.50 - 50.75	Yes

ID: Initial Drive
RSTR: Restrike

Dynamic Testing and Analysis of Piles
MTO 2010-2024 - Highway 400 and 89 Interchange

TABLE 2 : PDA DATA TABLE and CAPWAP RESULTS

Pile (No.)	Record (No.)	Testing Condition	Equivalent PRES (bl/0.25m)	Pile Driving Analyzer Data							CAPWAP RESULTS						
				EMX	Max. Force	CSX	CSB	RMX J = 0.8	RMX J = 1.0	RMX J = 1.2	Mobilized Static Resistance			Smith Damping Factor		Quake	
				(kJ)	(kN)	(MPa)	(MPa)	(kN)	(kN)	(kN)	Total (kN)	Shaft (kN)	Toe (kN)	Shaft (s/m)	Toe (s/m)	Shaft (mm)	Toe (mm)
Test Pile	93	EOD	11	36.6	2,887	203	49	986	940	894	850	650	200	0.2	0.8	2.5	15.0
	23	BOR	17	35.8	2,904	211	34	1,286	1,160	1,057	1,150	875	275	0.3	0.2	2.5	10.7
	110	EOD3	32	42.8	3,078	219	140	1,554	1,496	1,476	1,500	975	525	0.1	0.6	3.0	7.0

PRES: Penetration Resistance
 EOID: End of Initial Drive
 BOR: Beginning of Restrike
 EMX: Maximum Transferred Energy at Sensors
 CSX: Maximum Average Compressive Stress
 CSB: Computed Compressive Stress at Pile Toe
 RMX: Maximum Case-Golbe Capacity
 RA2 : Auto Capacity Friction Piles

APPENDIX I

Boring 89UP-03

PROJECT <u>1668512</u>		RECORD OF BOREHOLE No 89UP-03		SHEET 1 OF 4		METRIC	
G.W.P. <u>2438-13-00</u>		LOCATION <u>N 4895628.3; E 292375.2 MTM NAD 83 ZONE 10 (LAT. 44.200549; LONG. -79.655451)</u>		ORIGINATED BY <u>DF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>D50 Track Mount, NW Casing and Wash Boring with Drilling Mud</u>		COMPILED BY <u>DH</u>			
DATUM <u>Geodetic</u>		DATE <u>July 17 to 21, 2017</u>		CHECKED BY <u>SMM/TZ</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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 (%)		
227.4	GROUND SURFACE																
0.0	TOPSOIL																
0.2	Gravelly sand, some silt (FILL)		1	SS	6												
226.7	Loose Brown Moist																
0.7	SILT, trace to some sand to SILT and SAND, trace to some clay Loose to very dense Grey Wet		2	SS	6												
			3	SS	16												
			4	SS	22												
			5	SS	17												
			6	SS	22												
			7	SS	13												
			8A	SS	23												
			8B	SS	23												
			9	SS	17												
			10	SS	10												
			11A	SS	33												
			11B	SS	33												
			12	SS	16												
			13	SS	17												

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PROJECT <u>1668512</u>		RECORD OF BOREHOLE No 89UP-03		SHEET 2 OF 4		METRIC	
G.W.P. <u>2438-13-00</u>		LOCATION <u>N 4895628.3; E 292375.2 MTM NAD 83 ZONE 10 (LAT. 44.200549; LONG. -79.655451)</u>		ORIGINATED BY <u>DF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>D50 Track Mount, NW Casing and Wash Boring with Drilling Mud</u>		COMPILED BY <u>DH</u>			
DATUM <u>Geodetic</u>		DATE <u>July 17 to 21, 2017</u>		CHECKED BY <u>SMM/TZ</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						WATER CONTENT (%)			GR	SA	SI	CL
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × REMOULDED	20	40	60		80	100	w _p	w	w _L		
	--- CONTINUED FROM PREVIOUS PAGE ---																			
	SILT, trace to some sand to SILT and SAND, trace to some clay Loose to very dense Grey Wet		14	SS	37															
			15	SS	80															
209.6																				
17.8	SILTY CLAY, trace sand Grey Moist		16A	SS	44															
208.9			16B	SS	44															
18.5	SILT and SAND Dense to very dense Grey Wet		17	SS	59															
206.5																				
20.9	Varved CLAYEY SILT to SILTY CLAY with silt and clay laminae Stiff to very stiff Grey Moist - Sand inclusions from 20.9 m to 22.4 m		18	SS	11															
			19	SS	8															
			20	TO	PH															
			21	SS	3															
			22	TO	PH															
			23	SS	4															

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PROJECT 1668512		RECORD OF BOREHOLE No 89UP-03		SHEET 3 OF 4		METRIC	
G.W.P. 2438-13-00		LOCATION N 4895628.3; E 292375.2 MTM NAD 83 ZONE 10 (LAT. 44.200549; LONG. -79.655451)		ORIGINATED BY DF			
DIST Central HWY 400		BOREHOLE TYPE D50 Track Mount, NW Casing and Wash Boring with Drilling Mud		COMPILED BY DH			
DATUM Geodetic		DATE July 17 to 21, 2017		CHECKED BY SMM/TZ			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			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 (%)		
								○ UNCONFINED + FIELD VANE											w _p w w _L		
								● QUICK TRIAXIAL × REMOULDED													
		--- CONTINUED FROM PREVIOUS PAGE ---					20 40 60 80 100														
		Varved CLAYEY SILT to SILTY CLAY with silt and clay laminae Stiff to very stiff Grey Moist																			
195.5			24	SS	9																
31.9		SILT, some sand, trace clay Compact to very dense Grey Wet - Clayey silt inclusions encountered between depths of about 32.0 m and 32.6 m	25	SS	27																
			26	SS	86																
192.0																					
35.4		Sandy SILT, trace clay Very dense Grey Wet																			
			27A	SS	100																
			27B																		
189.0																					
38.4		CLAYEY SILT, some sand Very stiff Grey Moist																			
			28	SS	17																
										</											

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+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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PROJECT		1668512		RECORD OF BOREHOLE No 89UP-03				SHEET 4 OF 4		METRIC										
G.W.P.		2438-13-00		LOCATION		N 4895628.3; E 292375.2 MTM NAD 83 ZONE 10 (LAT. 44.200549; LONG. -79.655451)		ORIGINATED BY		DF										
DIST		Central HWY 400		BOREHOLE TYPE		D50 Track Mount, NW Casing and Wash Boring with Drilling Mud		COMPILED BY		DH										
DATUM		Geodetic		DATE		July 17 to 21, 2017		CHECKED BY		SMM/TZ										
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 (%)		
	--- CONTINUED FROM PREVIOUS PAGE ---							20	40	60	80	100								
181.4	CLAYEY SILT (TILL) Grey Moist		30A	SS	101															
46.0	SILT and SAND, trace gravel, trace clay (TILL) Very dense Grey Wet		30B																	
178.2			31	SS	100/0.10															
49.2	END OF BOREHOLE																			
NOTES: 1. Water level measurements in the casing at the beginning of each work shift: Date Depth (m) Elev. (m) 18/07/17 0.7 226.7 19/07/17 1.6 225.8 20/07/17 0.0 227.4 21/07/17 3.3 224.1 2. A borehole was advanced to a depth of about 4.0 m immediately next to borehole 89UP-03 in order to install a standpipe piezometer. 3. Water level measurements in standpipe piezometer: Date Depth (m) Elev. (m) 03/08/17 1.0 226.4 10/08/17 1.0 226.4 15/08/17 1.2 226.2 19/09/17 1.3 226.1 05/03/18 0.7 226.7 16/05/18 0.5 226.9																				

APPENDIX II

PDA Plots

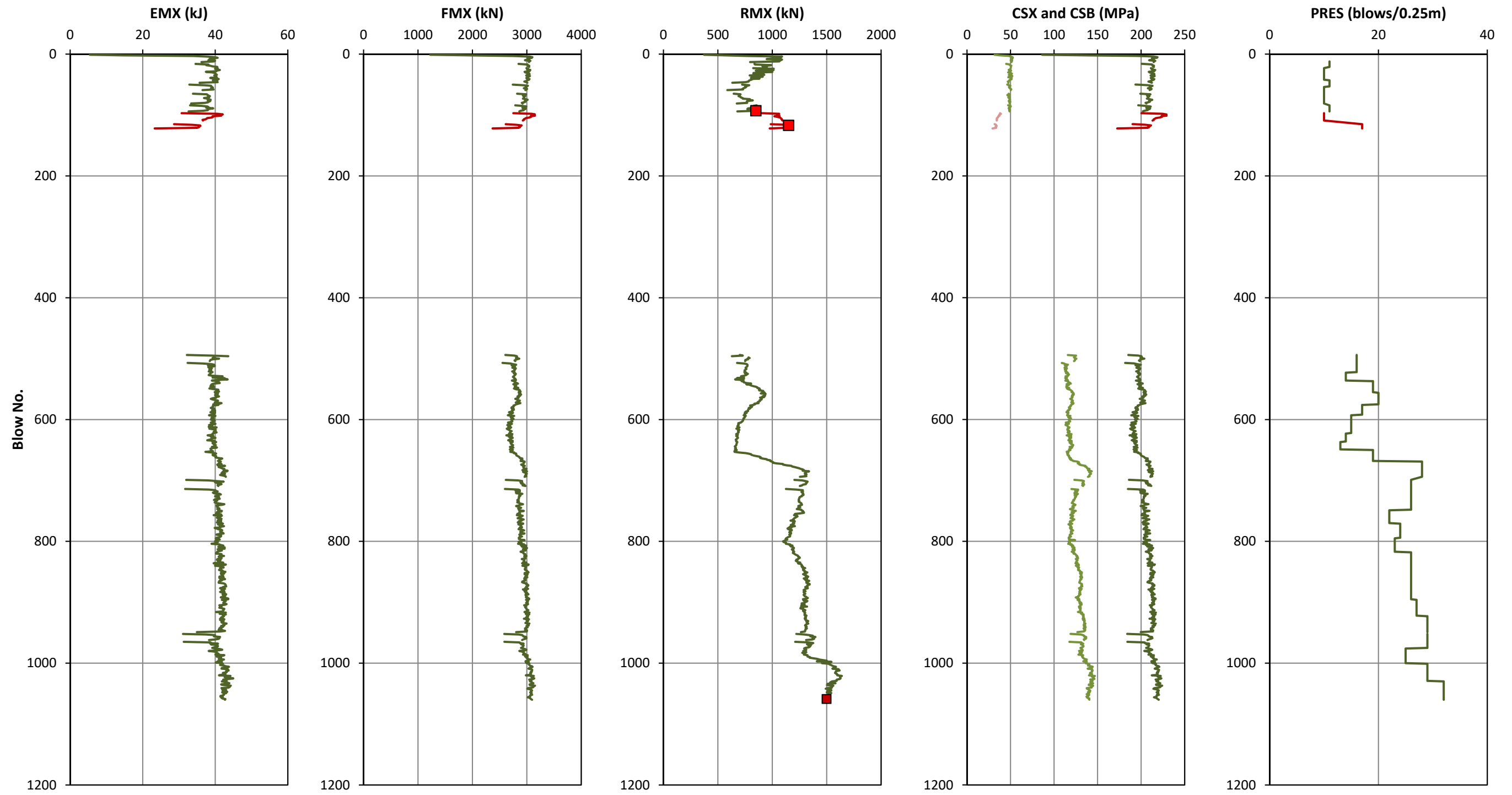


Figure II-1: PDA Diagram of Test Pile
(Quantities vs Blows in Sequence)

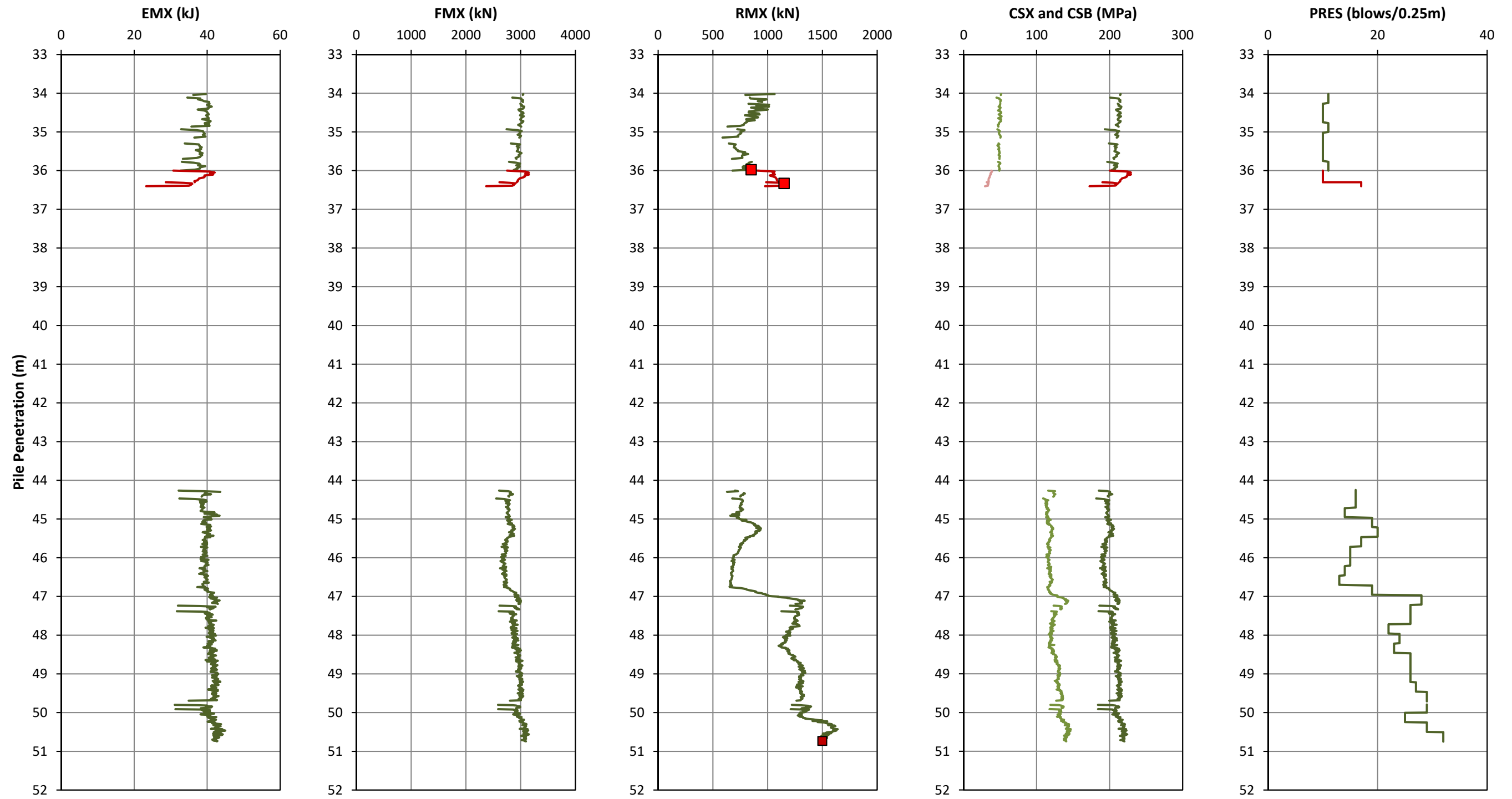
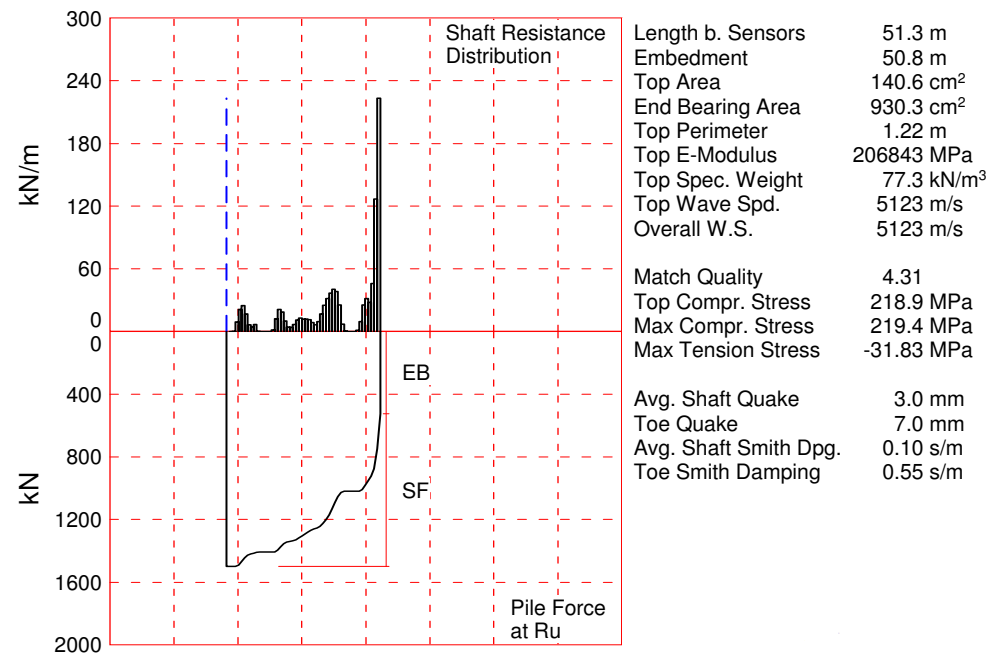
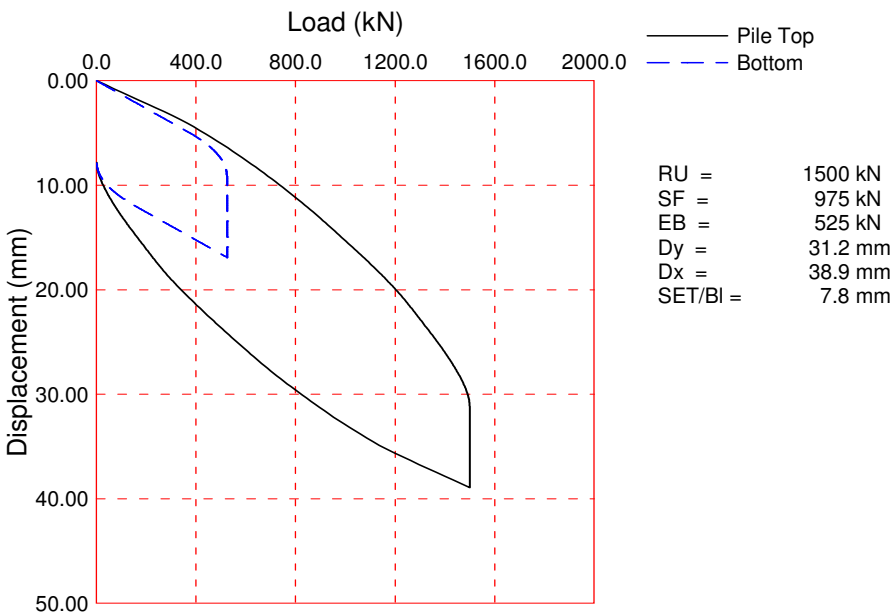
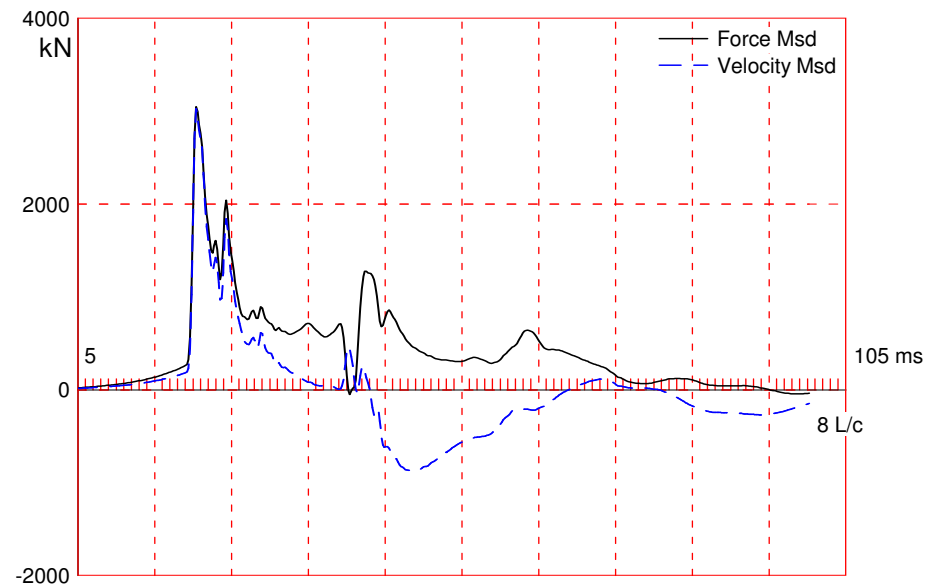
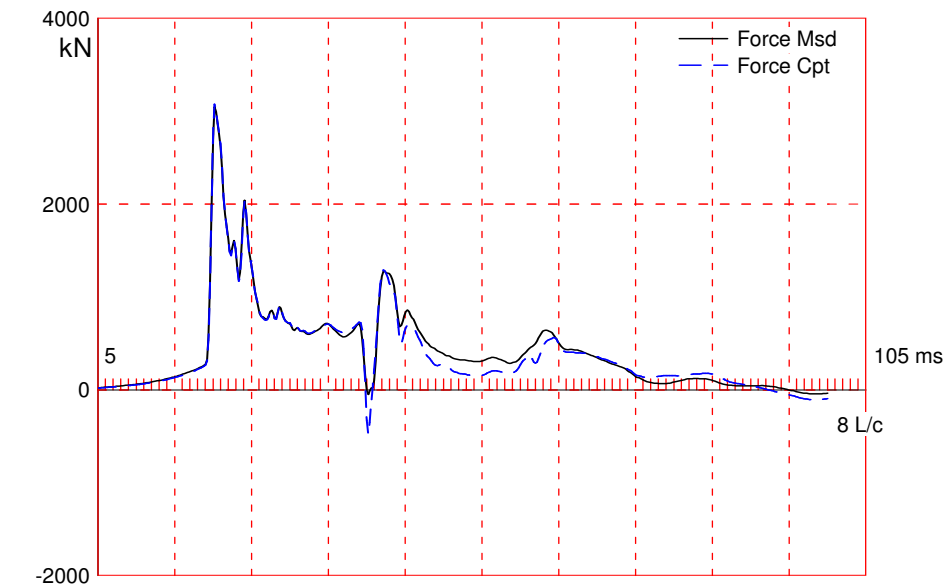


Figure II-2: PDA Diagram of Test Pile
(Quantities vs Pile Penetration)

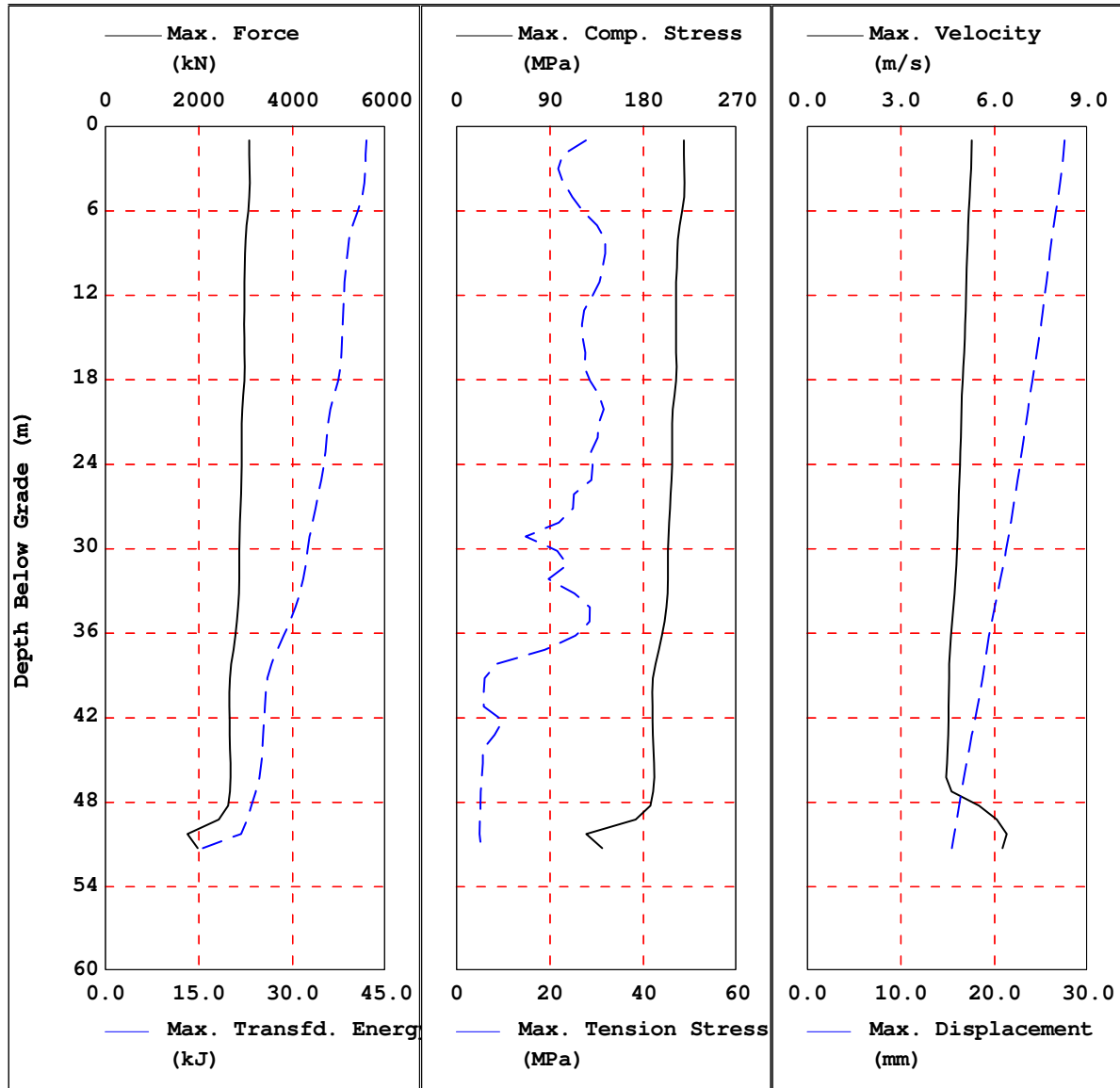
APPENDIX III

CAPWAP Analysis Results



File: Test Pile (EOD3)
Blow: 110
Urkkada Technology Ltd.

Test: 11-Oct-2019 13:30
CAPWAP (R) 2014-3
OP: MF



Analysis: 16-Oct-2019

File: Test Pile (EOD3)
 Blow: 110
 Urkkada Technology Ltd.

Test: 11-Oct-2019 13:30
 CAPWAP (R) 2014-3
 OP: MF

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1500.4; along Shaft 975.1; at Toe 525.3 kN

Soil Sgmt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
4	5.0	4.5	21.2	1469.3	31.1	21.10	17.29	0.10
5	6.0	5.5	25.0	1444.3	56.1	24.88	20.39	0.10
6	7.0	6.5	17.1	1427.2	73.2	17.02	13.95	0.10
7	8.0	7.5	6.7	1420.5	79.9	6.67	5.47	0.10
8	9.0	8.5	4.6	1415.9	84.5	4.58	3.75	0.10
9	10.0	9.5	6.9	1409.0	91.4	6.87	5.63	0.10
10	11.1	10.6	0.5	1408.5	91.9	0.50	0.41	0.10
11	12.1	11.6	0.0	1408.5	91.9	0.00	0.00	0.00
12	13.1	12.6	0.0	1408.5	91.9	0.00	0.00	0.00
13	14.1	13.6	0.0	1408.5	91.9	0.00	0.00	0.00
14	15.1	14.6	0.0	1408.5	91.9	0.00	0.00	0.00
15	16.1	15.6	1.5	1407.0	93.4	1.49	1.22	0.10
16	17.1	16.6	12.4	1394.6	105.8	12.34	10.11	0.10
17	18.1	17.6	21.2	1373.4	127.0	21.10	17.29	0.10
18	19.1	18.6	18.8	1354.6	145.8	18.71	15.33	0.10
19	20.1	19.6	10.1	1344.5	155.9	10.05	8.24	0.10
20	21.1	20.6	4.4	1340.1	160.3	4.38	3.59	0.10
21	22.1	21.6	4.2	1335.9	164.5	4.18	3.43	0.10
22	23.1	22.6	6.9	1329.0	171.4	6.87	5.63	0.10
23	24.1	23.6	11.3	1317.7	182.7	11.24	9.22	0.10
24	25.1	24.6	13.1	1304.6	195.8	13.04	10.69	0.10
25	26.1	25.6	12.2	1292.4	208.0	12.14	9.95	0.10
26	27.1	26.6	12.0	1280.4	220.0	11.94	9.79	0.10
27	28.1	27.6	11.6	1268.8	231.6	11.54	9.46	0.10
28	29.1	28.6	8.8	1260.0	240.4	8.76	7.18	0.10
29	30.1	29.6	6.7	1253.3	247.1	6.67	5.47	0.10
30	31.2	30.7	9.8	1243.5	256.9	9.75	7.99	0.10
31	32.2	31.7	16.9	1226.6	273.8	16.82	13.78	0.10
32	33.2	32.7	25.2	1201.4	299.0	25.08	20.55	0.10
33	34.2	33.7	31.7	1169.7	330.7	31.55	25.86	0.10
34	35.2	34.7	37.1	1132.6	367.8	36.92	30.26	0.10
35	36.2	35.7	40.8	1091.8	408.6	40.60	33.28	0.10
36	37.2	36.7	38.5	1053.3	447.1	38.31	31.40	0.10
37	38.2	37.7	25.7	1027.6	472.8	25.57	20.96	0.10
38	39.2	38.7	7.1	1020.5	479.9	7.07	5.79	0.10
39	40.2	39.7	0.7	1019.8	480.6	0.70	0.57	0.10
40	41.2	40.7	0.0	1019.8	480.6	0.00	0.00	0.00
41	42.2	41.7	0.0	1019.8	480.6	0.00	0.00	0.00
42	43.2	42.7	0.0	1019.8	480.6	0.00	0.00	0.00
43	44.2	43.7	1.4	1018.4	482.0	1.39	1.14	0.10
44	45.2	44.7	9.6	1008.8	491.6	9.55	7.83	0.10

File: Test Pile (EOD3)
 Blow: 110
 Urkkada Technology Ltd.

Test: 11-Oct-2019 13:30
 CAPWAP (R) 2014-3
 OP: MF

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1500.4; along Shaft 975.1; at Toe 525.3 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
45	46.2	45.7	25.5	983.3	517.1	25.38	20.80	0.10
46	47.2	46.7	31.7	951.6	548.8	31.55	25.86	0.10
47	48.2	47.7	28.1	923.5	576.9	27.96	22.92	0.10
48	49.2	48.7	46.1	877.4	623.0	45.88	37.60	0.10
49	50.2	49.7	127.6	749.8	750.6	126.98	104.08	0.10
50	51.3	50.8	224.5	525.3	975.1	223.40	183.12	0.10
Avg. Shaft			19.5			19.21	15.75	0.10
Toe			525.3				5646.87	0.55

Soil Model Parameters/Extensions

	Shaft	Toe
Quake (mm)	3.0	7.0
Case Damping Factor	0.17	0.51
Damping Type	Viscous	Sm+Visc
Reloading Level (% of Ru)	100	100
Unloading Level (% of Ru)	0	

max. Top Comp. Stress = 218.9 MPa (T= 20.6 ms, max= 1.002 x Top)
 max. Comp. Stress = 219.4 MPa (Z= 4.0 m, T= 21.2 ms)
 max. Tens. Stress = -31.83 MPa (Z= 8.0 m, T= 38.8 ms)
 max. Energy (EMX) = 41.8 kJ; max. Measured Top Displ. (DMX)= 27.5 mm

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3077.7	-389.7	218.9	-27.71	41.8	5.28	27.5
2	2.0	3077.7	-320.7	218.9	-22.81	41.7	5.27	27.4
5	5.0	3078.8	-349.3	219.0	-24.84	41.1	5.20	26.8
8	8.0	2996.1	-447.5	213.1	-31.83	39.1	5.14	26.1
11	11.1	2970.8	-430.2	211.3	-30.60	38.3	5.10	25.6
14	14.1	2969.1	-377.8	211.2	-26.87	38.0	5.06	25.0
17	17.1	2979.7	-384.8	211.9	-27.37	37.7	5.00	24.3
20	20.1	2927.2	-443.0	208.2	-31.51	36.1	4.94	23.6
23	23.1	2918.0	-404.6	207.5	-28.78	35.3	4.91	22.9
26	26.1	2898.1	-353.2	206.1	-25.12	34.1	4.86	22.2

File: Test Pile (EOD3)
 Blow: 110
 Urkkada Technology Ltd.

Test: 11-Oct-2019 13:30
 CAPWAP (R) 2014-3
 OP: MF

EXTREMA TABLE

Pile Sgmt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
29	29.1	2867.5	-208.3	203.9	-14.81	32.7	4.82	21.5
32	32.2	2862.0	-277.3	203.6	-19.72	31.7	4.75	20.6
35	35.2	2813.7	-400.9	200.1	-28.51	29.6	4.64	19.7
38	38.2	2693.0	-120.9	191.5	-8.60	26.6	4.55	19.0
41	41.2	2651.7	-83.0	188.6	-5.90	25.6	4.53	18.2
44	44.2	2664.2	-80.9	189.5	-5.76	25.2	4.50	17.3
47	47.2	2659.9	-74.1	189.2	-5.27	24.1	4.62	16.5
48	48.2	2622.8	-72.8	186.5	-5.18	23.4	5.51	16.2
49	49.2	2423.6	-71.8	172.4	-5.11	22.7	6.07	16.0
50	50.2	1757.7	-69.9	125.0	-4.97	21.7	6.39	15.7
51	51.3	1970.7	-74.2	140.2	-5.28	15.6	6.26	15.4
Absolute	4.0			219.4			(T =	21.2 ms)
	8.0				-31.83		(T =	38.8 ms)

CASE METHOD

J =	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8
RP	2839	2183	1526	870	213					
RX	2839	2235	1943	1678	1554	1496	1476	1465	1464	1464
RU	2839	2183	1526	870	213					

RAU = 1464 (kN); RA2 = 1688 (kN)

Current CAPWAP Ru = 1500 (kN); Corresponding J(RP) = 0.41; J(RX) = 0.98

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS	KEB
m/s	ms	kN	kN	kN	mm	mm	mm	kJ	kN	kN/mm
5.36	20.40	3044	3078	3078	27.5	7.8	7.8	42.8	2421	75

Appendix 3

Borehole Logs

PROJECT <u>1668512</u>		RECORD OF BOREHOLE No 89UP-03		SHEET 1 OF 4		METRIC	
G.W.P. <u>2438-13-00</u>		LOCATION <u>N 4895628.3; E 292375.2 MTM NAD 83 ZONE 10 (LAT. 44.200549; LONG. -79.655451)</u>		ORIGINATED BY <u>DF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>D50 Track Mount, NW Casing and Wash Boring with Drilling Mud</u>		COMPILED BY <u>DH</u>			
DATUM <u>Geodetic</u>		DATE <u>July 17 to 21, 2017</u>		CHECKED BY <u>SMM/TZ</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						WATER CONTENT (%)			GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	20	40	60	80		100	w _p	w	w _L			
227.4	GROUND SURFACE																			
0.0	TOPSOIL																			
0.2	Gravelly sand, some silt (FILL)		1	SS	6															
226.7	Loose Brown Moist																			
0.7	SILT, trace to some sand to SILT and SAND, trace to some clay Loose to very dense Grey Wet		2	SS	6															
			3	SS	16															
			4	SS	22															
			5	SS	17															
			6	SS	22															
			7	SS	13															
			8A	SS	23															
			8B																	
			9	SS	17															
			10	SS	10															
			11A	SS	33															
			11B																	
			12	SS	16															
			13	SS	17															

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+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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PROJECT <u>1668512</u>		RECORD OF BOREHOLE No 89UP-03		SHEET 2 OF 4		METRIC	
G.W.P. <u>2438-13-00</u>		LOCATION <u>N 4895628.3; E 292375.2 MTM NAD 83 ZONE 10 (LAT. 44.200549; LONG. -79.655451)</u>		ORIGINATED BY <u>DF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>D50 Track Mount, NW Casing and Wash Boring with Drilling Mud</u>		COMPILED BY <u>DH</u>			
DATUM <u>Geodetic</u>		DATE <u>July 17 to 21, 2017</u>		CHECKED BY <u>SMM/TZ</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						WATER CONTENT (%)			GR	SA	SI	CL
								20 40 60 80 100	W _p	W	W _L									
--- CONTINUED FROM PREVIOUS PAGE ---																				
	SILT, trace to some sand to SILT and SAND, trace to some clay Loose to very dense Grey Wet		14	SS	37															
			15	SS	80															
209.6																				
17.8	SILTY CLAY, trace sand Grey Moist																			
208.9			16A																	
18.5	SILT and SAND Dense to very dense Grey Wet		16B	SS	44															
			17	SS	59															
206.5																				
20.9	Varved CLAYEY SILT to SILTY CLAY with silt and clay laminae Stiff to very stiff Grey Moist - Sand inclusions from 20.9 m to 22.4 m		18	SS	11															
			19	SS	8															
			20	TO	PH															
			21	SS	3															
			22	TO	PH															
			23	SS	4															

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+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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PROJECT		1668512		RECORD OF BOREHOLE No 89UP-03				SHEET 4 OF 4		METRIC									
G.W.P.		2438-13-00		LOCATION		N 4895628.3; E 292375.2 MTM NAD 83 ZONE 10 (LAT. 44.200549; LONG. -79.655451)				ORIGINATED BY		DF							
DIST		Central HWY 400		BOREHOLE TYPE		D50 Track Mount, NW Casing and Wash Boring with Drilling Mud				COMPILED BY		DH							
DATUM		Geodetic		DATE		July 17 to 21, 2017				CHECKED BY		SMM/TZ							
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 (%)	
	--- CONTINUED FROM PREVIOUS PAGE ---							20	40	60	80	100							
181.4	CLAYEY SILT (TILL) Grey Moist		30A	SS	101		182												
46.0	SILT and SAND, trace gravel, trace clay (TILL) Very dense Grey Wet		30B																
178.2			31	SS	100/0.10		179												
49.2	END OF BOREHOLE																		
NOTES: 1. Water level measurements in the casing at the beginning of each work shift: Date Depth (m) Elev. (m) 18/07/17 0.7 226.7 19/07/17 1.6 225.8 20/07/17 0.0 227.4 21/07/17 3.3 224.1 2. A borehole was advanced to a depth of about 4.0 m immediately next to borehole 89UP-03 in order to install a standpipe piezometer. 3. Water level measurements in standpipe piezometer: Date Depth (m) Elev. (m) 03/08/17 1.0 226.4 10/08/17 1.0 226.4 15/08/17 1.2 226.2 19/09/17 1.3 226.1 05/03/18 0.7 226.7 16/05/18 0.5 226.9																			



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+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

PROJECT <u>1668512</u>		RECORD OF BOREHOLE No 89UP-05		SHEET 2 OF 4		METRIC	
G.W.P. <u>2438-13-00</u>		LOCATION <u>N 4895649.6; E 292418.6 MTM NAD 83 ZONE 10 (LAT. 44.200750; LONG. -79.654912)</u>		ORIGINATED BY <u>DF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>D50 Track Mount, NW Casing and Wash Boring with Drilling Mud</u>		COMPILED BY <u>DM</u>			
DATUM <u>Geodetic</u>		DATE <u>June 26 to 29 and July 3, 2017</u>		CHECKED BY <u>SMM/TZ</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								20 40 60 80 100	○ UNCONFINED	+ FIELD VANE	○ UNCONFINED	+ FIELD VANE			○ UNCONFINED	+ FIELD VANE	
--- CONTINUED FROM PREVIOUS PAGE ---																	
	SILT to Sandy SILT, trace clay with clayey silt pockets Compact to very dense Grey Wet		12	SS	27		214									0 10 87 3	
							213										
							212										
							211										
							210										
							209										
							208										
							207										
							206										
206.8																	
22.4	Varved CLAYEY SILT, with silt and clay laminae Stiff to very stiff Grey Wet		17	SS	10		206								0 0 62 38		
							205										
204.1																	
25.1	Varved SILTY CLAY, with silt and clay laminae Stiff to very stiff Grey Wet						204										
							203										
							202										
							201										
							200										
							19	SS	1								

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+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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PROJECT <u>1668512</u>		RECORD OF BOREHOLE No 89UP-05		SHEET 3 OF 4		METRIC	
G.W.P. <u>2438-13-00</u>		LOCATION <u>N 4895649.6; E 292418.6 MTM NAD 83 ZONE 10 (LAT. 44.200750; LONG. -79.654912)</u>		ORIGINATED BY <u>DF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>D50 Track Mount, NW Casing and Wash Boring with Drilling Mud</u>		COMPILED BY <u>DM</u>			
DATUM <u>Geodetic</u>		DATE <u>June 26 to 29 and July 3, 2017</u>		CHECKED BY <u>SMM/TZ</u>			

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		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED									
	--- CONTINUED FROM PREVIOUS PAGE ---							20	40	60	80	100					
195.0	Varved SILTY CLAY, with silt and clay laminae Stiff to very stiff Grey Wet		20	SS	5												
34.2	SILT, trace to some sand, trace clay Very dense Grey Wet		21	SS	54												
			22	SS	71												
189.3	CLAYEY SILT, trace to some sand Very stiff Grey Wet		23	SS	15												
186.2	Sandy CLAYEY SILT, some gravel (TILL) Hard Grey Wet		24	SS	35												

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTOWHY_400_AND_HWY_89_INTERCHANGE\02_DATA\GINT\HWY_400_AND_HWY_89_INTERCHANGE.GPJ GAL-GTA.GDT 09/12/18

PROJECT 1668512		RECORD OF BOREHOLE No 89UP-05				SHEET 4 OF 4		METRIC																								
G.W.P. 2438-13-00		LOCATION N 4895649.6; E 292418.6 MTM NAD 83 ZONE 10 (LAT. 44.200750; LONG. -79.654912)				ORIGINATED BY DF																										
DIST Central HWY 400		BOREHOLE TYPE D50 Track Mount, NW Casing and Wash Boring with Drilling Mud				COMPILED BY DM																										
DATUM Geodetic		DATE June 26 to 29 and July 3, 2017				CHECKED BY SMM/TZ																										
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 ---							20	40	60	80	100																				
	Sandy CLAYEY SILT, some gravel (TILL) Hard Grey Wet					184																										
	- Inferred cobbles/boulders encountered between depths of about 46.3 m and 46.9 m					183																										
			25	SS	43	182																										
						181																										
						180																										
178.8 50.4	END OF BOREHOLE		26	SS	100/70/10	179																										
NOTE: 1. Water level measurements in the casing at the beginning of each work shift: <table style="width:100%; border-collapse: collapse;"> <tr> <th>Date</th> <th>Depth (m)</th> <th>Elev. (m)</th> </tr> <tr> <td>27/06/17</td> <td>1.1</td> <td>228.1</td> </tr> <tr> <td>28/06/17</td> <td>4.3</td> <td>224.9</td> </tr> <tr> <td>29/06/17</td> <td>1.1</td> <td>228.1</td> </tr> <tr> <td>03/07/17</td> <td>9.0</td> <td>220.2</td> </tr> </table> The water level measurements are not considered to be representative of the groundwater level due to introduction of water/drilling mud during wash boring operations.																		Date	Depth (m)	Elev. (m)	27/06/17	1.1	228.1	28/06/17	4.3	224.9	29/06/17	1.1	228.1	03/07/17	9.0	220.2
Date	Depth (m)	Elev. (m)																														
27/06/17	1.1	228.1																														
28/06/17	4.3	224.9																														
29/06/17	1.1	228.1																														
03/07/17	9.0	220.2																														

GTA-MTO 001 S:\CLIENTS\TOHWY_400_AND_HWY_89_INTERCHANGE\02_DATA\GINT\HWY_400_AND_HWY_89_INTERCHANGE.GPJ GAL-GTA.GDT 09/12/18

Appendix 4

Calibration Records



48 Spencer St. Lebanon, NH 03766 USA

Load Cell Calibration Report

Model Number: 3000-1000-6Calibration Date: November 14, 2017Serial Number: 1700884

This calibration has been verified/validated as of 01/25/2018

Max. Range (lbs): 1000000Calibration Instruction: CI-3000

Initial Cycling Data

Load (lbs):	0	0	1500000	0
Reading:	-322	-324	7309	-327

Cable Length: 40 feetTechnician: 

Calibration

Applied Load in lbs	Readings from GK-501 or GK-502 readout box				Linearity % Max Load	Polynomial Error (%FS)
	Cycle 1	Cycle 2	Average	Change		
0	-327	-327	-327		0.51	0.48
100000	165	162	164	491	0.12	0.10
200000	664	664	664	500	-0.07	-0.08
300000	1175	1172	1174	510	-0.09	-0.09
400000	1695	1687	1691	517	0.05	0.05
500000	2197	2197	2197	506	-0.04	-0.03
600000	2708	2710	2709	512	-0.01	0.00
700000	3228	3220	3224	515	0.09	0.09
800000	3728	3733	3731	507	0.01	0.01
900000	4238	4241	4240	509	-0.02	-0.03
1000000	4751	4751	4751	511	0.00	-0.02
0	-319	-324	-322			

GK-501 or GK-502 Readout

Linear Gage Factor (G): 195.9 lbs/digitRegression Zero (R_0):* -353Polynomial Gage Factors: A: -0.00005872 B: 196.2 C: 68890

$$\text{Polynomial, } L = AR_1^2 + BR_1 + C$$

Full Scale mV/V: 1.270 mV/VCalculate C by setting $L=0$ and R_1 = initial field zero reading in the polynomial equation

* Note: The above calibration uses a linear regression method. The Regression Zero Reading shown is ideal for straight line computation and does not usually agree with the actual no-load reading.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

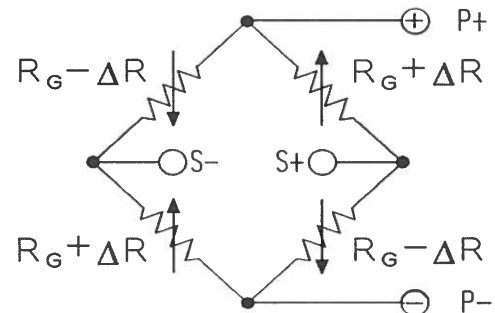
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CALIBRATION DATA SHEET

LOAD CELL

Model: ANCLO-4500
Serial number: 1700884
Capacity: 4500 kN
Max. excitation: 10.00 VDC
Temperature: 21 °C
Cable model: Three twisted pair (six conductor)
Cable length: 11 m



Color code: Red (B): Power P +
 Black (C): Power P -
 Green (D): Signal S +
 White (A): Signal S -

Calibration data:

First pass		Second pass		Average reading		Linear regression	
Load kN	Output mV/V	Load kN	Output mV/V	Load kN	Output mV/V	Load kN	Error (% F.S.)
0.0	-0.079	0.0	-0.079	0.0	-0.079	---	---
450.0	0.065	452.0	0.061	451.0	0.063	444.6	-0.14
900.0	0.213	901.0	0.207	900.5	0.210	902.2	0.04
1353.0	0.361	1352.0	0.350	1352.5	0.356	1355.1	0.06
1802.0	0.508	1799.0	0.491	1800.5	0.500	1803.4	0.06
2250.0	0.652	2252.0	0.635	2251.0	0.644	2251.7	0.01
2700.0	0.797	2706.0	0.779	2703.0	0.788	2701.5	-0.03
3156.0	0.944	3166.0	0.925	3161.0	0.935	3157.5	-0.08
3605.0	1.088	3604.0	1.066	3604.5	1.077	3601.1	-0.07
4049.0	1.229	4053.0	1.216	4051.0	1.223	4054.1	0.07
4495.0	1.372	4504.0	1.360	4499.5	1.366	4500.8	0.03

Load cell sensitivity: 1.4456 mV/V at full scale
Regression zero (L_0): -0.0798 mV/V

Traceability no: TR-12-07
Certificate no: 1700884.xlsx

Calibrated by: Stéphane Fortin *SF*

Date: 2019-08-12



Canadian BBR Inc.
3450 Midland Avenue
Agincourt Ontario

Calibration of Hydraulic Components

28-Aug-19

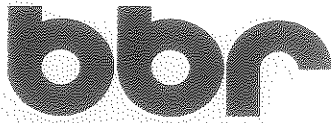
RJ 1000-18-5306

Ram Area (sq. in.) 243.7
Friction Calibration 1.017

Calibrated with Digital pressure gauge
Enerpac Model DGB / 10000 psi
Load cell BBR no.2



Gauge psi	Voltage run 1	Voltage run 2	Voltage run 3	Voltage (avg)	Load kips
1000	1.691	1.703	1.711	1.702	238.23
2000	3.409	3.423	3.422	3.418	478.52
3000	5.136	5.14	5.146	5.141	719.69
4000	6.834	6.855	6.855	6.848	958.72
5000	8.55	8.567	8.566	8.561	1198.54
5800	9.9	9.918	9.91	9.909	1387.31



P.O. Box 37, Agincourt, ON M1S 3B4
3450 Midland Ave., Scarborough, ON M1V 4V4

Tel: (416) 291-1618
Fax: (416) 291-9960

CERTIFIED TEST REPORTS

Reference No. : **256** Date : **09-Aug-19**

Gauge Type : **WIKA 0 - 10,000 PSI**

Machine : **Deadweight Tester Mansfield & Green**


Traceability To : **National Bureau Standards**

Dead Weight Pressure

1000 psi
2000 psi
3000 psi
4000 psi
5000 psi
6000 psi
7000 psi
8000 psi
9000 psi

Gauge Indicated Pressure

1025 psi
2025 psi
3025 psi
4000 psi
5000 psi
6000 psi
7000 psi
8000 psi
9000 psi

Signature : 



P.O. Box 37, Agincourt, ON M1S 3B4
3450 Midland Ave., Scarborough, ON M1V 4V4

Tel: (416) 291-1618
Fax: (416) 291-9960

CERTIFIED TEST REPORTS

Reference No. : 257

Date : 28-Aug-19

Gauge Type : WIKA 0 - 10,000 PSI

Machine : Deadweight Tester Mansfield & Green


Traceability To : National Bureau Standards

Dead Weight Pressure

1000	psi
2000	psi
3000	psi
4000	psi
5000	psi
6000	psi
7000	psi
8000	psi
9000	psi

Gauge Indicated Pressure

975	psi
2000	psi
3000	psi
4000	psi
5000	psi
5975	psi
6975	psi
7950	psi
8950	psi

Signature : 

Appendix 5

Load Test Records



Load Increment 300 kN

PILE NO: Test Pile

Urkkada Job No. 1905CS1373

Project: MTO 2018-2024

Date: Oct 28, 2019

Location: HWY 400 & 89

Start Time: 11:21 AM

Owner: MTO

Pile Size: 310x110

Contractor: Fermar Paving Limited

Pile Type: H-Pile

Inspector: M. El Kotob

Embedment (m): 50.80

[illegible]



Load Increment 600 kN

PILE NO: Test Pile

Urkkada Job No. 1905CS1373

Project: MTO 2018-2024

Date: Oct 28, 2019

Location: HWY 400 & 89

Start Time: 11:47 AM

Owner: MTO

Pile Size: 310x110

Contractor: Fermar Paving Limited

Pile Type: H-Pile

Inspector: M. El Kotob

Embedment (m): 50.80

[illegible]



Load Increment 900 kN

PILE NO: Test Pile

Urkkada Job No. 1905CS1373

Project: MTO 2018-2024

Date: Oct 28, 2019

Location: HWY 400 & 89

Start Time: 12:13 PM

Owner: MTO

Pile Size: 310x110

Contractor: Fermar Paving Limited

Pile Type: H-Pile

Inspector: M. El Kotob

Embedment (m): 50.80

[illegible]



Load Increment 1200 kN

PILE NO: Test Pile

Urkkada Job No. 1905CS1373

Project: MTO 2018-2024

Date: Oct 28, 2019

Location: HWY 400 & 89

Start Time: 01:16 PM

Owner: MTO

Pile Size: 310x110

Contractor: Fermar Paving Limited

Pile Type: H-Pile

Inspector: M. El Kotob

Embedment (m): 50.80

[illegible]



Load Increment 1500 kN

PILE NO: _____ Test Pile

Urkkada Job No. 1905CS1373

Project: MTO 2018-2024

Date: Oct 28, 2019

Location:	HWY 400 & 89
------------------	--------------

Start Time:	02:20 PM
-------------	----------

Owner:	MTO
--------	-----

Pile Size:	310x110
------------	---------

Contractor: Fermar Paving Limited

Pile Type:	H-Pile
-------------------	--------

Inspector: S. Ferguson/M. El Kotob

Embedment (m):	50.80
----------------	-------

[illegible]



Load Increment 1700 kN

Load was increased back to 1700 kN at 12 hr and 16 hr

PILE NO: _____ Test Pile _____

Urkkada Job No. 1905CS1373

Project: MTO 2018-2024

Date: Oct 28/29, 2019

Location: HWY 400 & 89

Start Time: 03:47 PM

Owner: MTO

Pile Size: 310x110

Contractor: Fermar Paving Limited

Pile Type: H-Pile

Inspector: S. Ferguson/ M. Ferguson

Embedment (m): 50.80

Date	Time		Applied Load (kN)	Gauge Reading (psi)	Test Pile									Reaction			
					Vertical Gauge #1 (in)	Vertical Gauge #2 (in)	Gauge #1 Δ (mm)	Gauge #2 Δ (mm)	Average Δ Gauge (mm)	Lateral #1 (in)	Lateral #2 (in)	Wire Line Reading (cm)	Movement from Wire Line (cm)	Pile 1 (cm)	Pile 2 (cm)	Pile 3 (cm)	Pile 4 (cm)
	ZERO		0	0	3.393	3.325	-	-	-	0.365	0.683	82.80	-	45.7	45.8	53.2	53.8
2019-10-28	0 min	15:47	1796	1850	1.961	1.826	36.37	38.07	37.22	0.316	0.781	86.20	-3.40				
	2 min	15:49	1762	1850	1.954	1.821	36.55	38.20	37.38	0.316	0.781	86.20	-3.40				
	5 min	15:52	1746	1850	1.951	1.819	36.63	38.25	37.44	0.316	0.781	86.30	-3.50				
	10 min	15:57	1730	1800	1.949	1.815	36.68	38.35	37.52	0.315	0.780	86.30	-3.50				
	20 min	16:07	1720	1800	1.946	1.810	36.75	38.48	37.62	0.314	0.778	86.30	-3.50				
	40 min	16:27	1708	1800	1.940	1.805	36.91	38.61	37.76	0.314	0.776	86.30	-3.50	45.1	45.1	52.5	53.2
	60 min	16:47	1704	1800	1.936	1.803	37.01	38.66	37.83	0.315	0.777	86.30	-3.50				
	80 min	17:07	1702	1800	1.934	1.800	37.06	38.74	37.90	0.316	0.777	86.30	-3.50				
	100 min	17:27	1701	1800	1.932	1.797	37.11	38.81	37.96	0.315	0.777	86.30	-3.50				
	120 min	17:47	1701	1800	1.930	1.794	37.16	38.89	38.02	0.316	0.778	86.40	-3.60				
	3 hr	18:47	1698	1800	1.925	1.788	37.29	39.04	38.16	0.317	0.777	86.40	-3.60				
	4 hr	19:47	1694	1800	1.922	1.785	37.36	39.12	38.24	0.318	0.777	86.40	-3.60				
	5 hr	20:47	1689	1800	1.921	1.783	37.39	39.17	38.28	0.320	0.777	86.40	-3.60				
	6 hr	21:47	1685	1750	1.919	1.782	37.44	39.19	38.32	0.319	0.777	86.40	-3.60				
	7 hr	22:47	1681	1700	1.918	1.782	37.47	39.19	38.33	0.322	0.777	86.40	-3.60	45.1	45.4	52.7	53.3
	8 hr	23:47	1677	1700	1.918	1.782	37.47	39.19	38.33	0.323	0.777	86.40	-3.60				



Load Increment 1700 kN
 Load was increased back to 1700 kN at 12 hr and 16 hr

PILE NO: Test Pile
 Project: MTO 2018-2024
 Location: HWY 400 & 89
 Owner: MTO
 Contractor: Fermar Paving Limited
 Inspector: S. Ferguson/ M. Ferguson

Urkkada Job No. 1905CS1373
 Date: Oct 28/29, 2019
 Start Time: 03:47 PM
 Pile Size: 310x110
 Pile Type: H-Pile
 Embedment (m): 50.80

29/10/2019	9 hr	00:47	1671	1650	1.918	1.781	37.47	39.22	38.34	0.324	0.777	86.40	-3.60				
	10 hr	01:47	1665	1600	1.918	1.781	37.47	39.22	38.34	0.324	0.778	86.40	-3.60				
	11 hr	02:47	1656	1550	1.919	1.782	37.44	39.19	38.32	0.325	0.778	86.40	-3.60				
	12 hr	03:47	1646	1500	1.920	1.783	37.41	39.17	38.29	0.325	0.777	86.40	-3.60				
	12 hr	03:48	1697	1800	1.908	1.772	37.72	39.45	38.58	0.325	0.776	86.40	-3.60				
	13 hr	04:47	1677	1700	1.906	1.770	37.77	39.50	38.63	0.325	0.776	86.40	-3.60				
	14 hr	05:47	1670	1600	1.906	1.770	37.77	39.50	38.63	0.326	0.776	86.40	-3.60				
	15 hr	06:47	1661	1550	1.906	1.770	37.77	39.50	38.63	0.326	0.776	86.40	-3.60				
	16 hr	07:47	1650	1550	1.907	1.771	37.74	39.47	38.61	0.326	0.777	86.40	-3.60				
	16 hr	07:48	1701	1800	1.896	1.761	38.02	39.73	38.87	0.325	0.775	86.40	-3.60				



Unloading Cycle - 25% Decrements

PILE NO: _____ Test Pile _____
Project: _____ MTO 2018-2024 _____
Location: _____ HWY 400&89 _____
Owner: _____ MTO _____
Contractor: _____ Ferman Paving Limited _____
Inspector: _____ M. El Kotob _____

Urkkada Job No. 1905CS1373
Date: Oct 29, 2019
Start Time: 08:07 AM
Pile Size: 310x110
Pile Type: H-Pile
Embedment (m): 50.80

Date	Time		Applied Load (kN)	Gauge Reading (psi)	Test Pile												
					Vertical Gauge #1 (in)	Vertical Gauge #2 (in)	Gauge #1 Δ (mm)	Gauge #2 Δ (mm)	Average Δ Gauge (mm)	Lateral #1 (in)	Lateral #2 (in)	Wire Line Reading (cm)	Movement from Wire Line (cm)	Reaction Pile 1 (cm)	Reaction Pile 2 (cm)	Reaction Pile 3 (cm)	Reaction Pile 4 (cm)
	ZERO		0	0	3.393	3.325		-	-	0.365	0.683	82.80	-	45.7	45.8	53.2	53.8
2019-10-29		1250 kN															
	0 min	08:07	1251	1000	2.080	1.940	33.35	35.18	34.26	0.359	0.758	86.00	-3.20				
	20 min	08:27	1261	1000	2.081	1.940	33.32	35.18	34.25	0.362	0.757	86.10	-3.30				
	40 min	08:47	1261	1000	2.082	1.940	33.30	35.18	34.24	0.362	0.757	86.10	-3.30				
	60 min	09:07	1259	1000	2.084	1.941	33.25	35.15	34.20	0.359	0.759	86.10	-3.30				
		850 kN															
	0 min	09:09	845	680	2.356	2.217	26.34	28.14	27.24	0.384	0.727	85.30	-2.50				
	20 min	09:29	853	680	2.360	2.219	26.24	28.09	27.17	0.382	0.728	85.30	-2.50				
	40 min	09:49	854	680	2.359	2.218	26.26	28.12	27.19	0.383	0.726	85.30	-2.50				
	60 min	10:09	850	680	2.363	2.219	26.16	28.09	27.13	0.379	0.729	85.30	-2.50				



Unloading Cycle - 25% Decrements

PILE NO: Test Pile

Urkkada Job No. 1905CS1373

Project: MTO 2018-2024

Date: Oct 29, 2019

Location: HWY 400&89

Start Time: 08:07 AM

Owner: MTO

Pile Size: 310x110

Contractor: Fermar Paving Limited

Pile Type: H-Pile

Inspector: M. El Kotob

Embedment (m): 50.80

2019-10-29		425 kN															
	0 min	10:15	430	325	2.645	2.522	19.00	20.40	19.70	0.408	0.709	84.60	-1.80				
	20 min	10:35	447	325	2.644	2.523	19.02	20.37	19.70	0.410	0.706	84.60	-1.80				
	40 min	10:55	451	325	2.642	2.523	19.08	20.37	19.72	0.412	0.705	84.60	-1.80				
	60 min	11:15	456	325	2.641	2.523	19.10	20.37	19.74	0.415	0.704	84.60	-1.80				
		0 kN															
	0 min	11:20	2	0	2.932	2.849	11.71	12.09	11.90	0.452	0.682	84.00	-1.20				
	5 min	11:25	0	0	2.938	2.858	11.56	11.86	11.71	0.453	0.682	83.90	-1.10	45.6	45.7	53.1	53.7
	12 hr	23:25	27	0	2.946	2.861	11.35	11.79	11.57	0.451	0.671	84.00	-1.20	45.6	45.7	53.1	53.7

Appendix 6

Load Movement Curves

Figure 1: Load Movement Curve for from Static Load Test #3

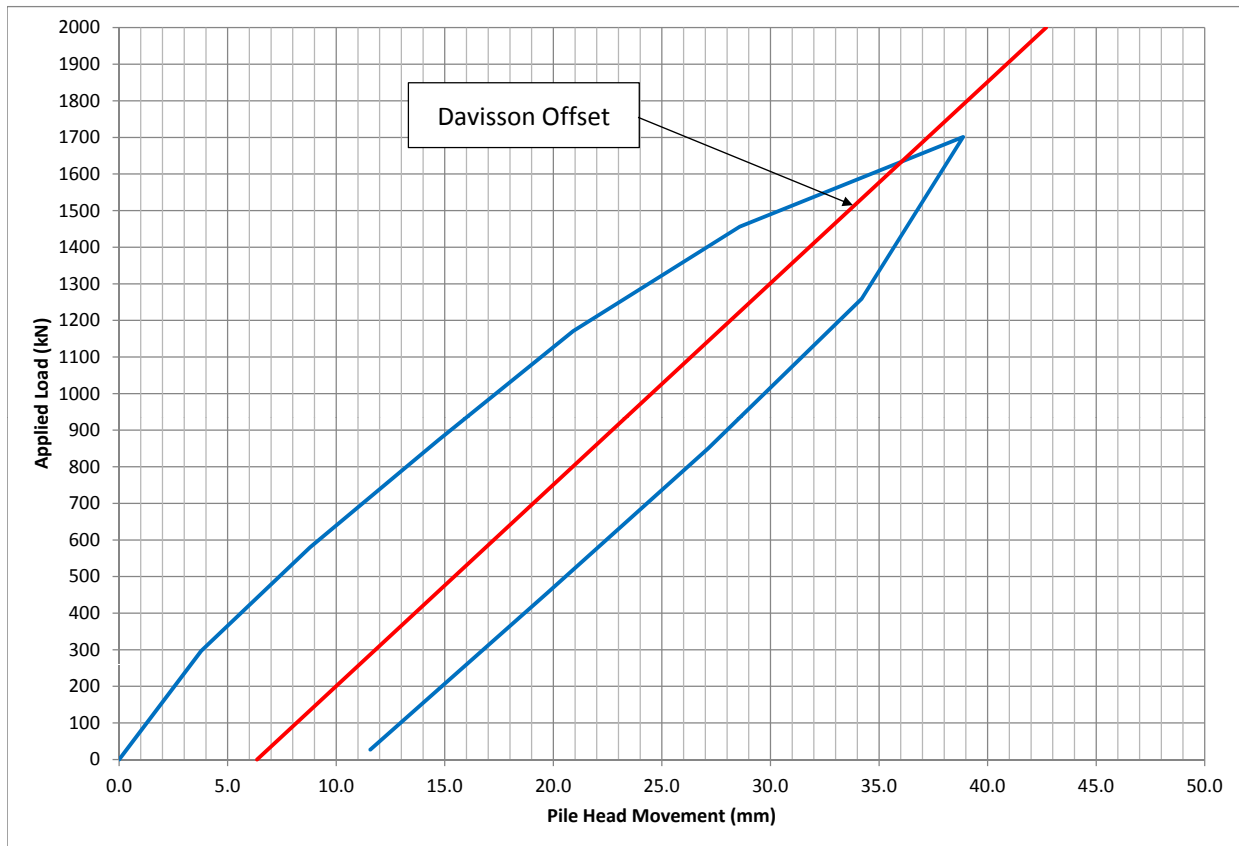


Table 1: Load Movement Summary

Load (kN)	Movement (mm)
0	0.0
297	3.8
580	8.8
873	14.7
1171	20.9
1456	28.6
1701	38.9
1259	34.2
850	27.1
456	19.7
27	11.6

Appendix 7

Site Photographs





