TECHNICAL MEMORANDUM

DATE September 21, 2012 **PROJECT No.** 11-1111-0083

TO Sardar Nabi, P.Eng., Saad Syed, P.Eng. and Roy Pritchard, P.Eng.
URS Canada Inc.

CC Minkyung Kwak, P.Eng. and Dave Dundas, P.Eng. - MTO Foundations Section

FROM Nikol Kochmanová, P.Eng., Lisa Coyne, P.Eng.
and Fin Heffernan, P.Eng.

PRELIMINARY FOUNDATION RECOMMENDATIONS
HIGH MAST LIGHT POLES
HIGHWAY 410 WIDENING FROM SOUTH OF HIGHWAY 401 TO QUEEN STREET
REGIONAL MUNICIPALITY OF PEEL
G.W.P. 2144-07-00

This technical memorandum presents a summary of the interpreted subsurface conditions throughout the project area based on boreholes advanced by Golder and by others as part of previous investigations in the vicinity of the proposed high mast light (HML) poles. The information provided in this memorandum is intended for preliminary use and will be superseded by the Foundation Investigation and Design Report, which will be submitted following completion of some additional site-specific borehole investigation, and which should be used for the detail design of the high mast light poles.

The subsurface information used in the preparation of this memorandum was obtained from Golder's current borehole investigation as well as previous Foundation Investigation Reports prepared by others, available from MTO Pavement and Foundations Section's GEOCRES database, as follows:

- **MTO GEOCRES No. 30M12-110**: "Preliminary Foundation Investigation Report for Proposed Hwy. 410 from South Limits of Hwy. 401 to Hwy. 7, Regional Municipality of Peel, Cities of Mississauga and Brampton, District #6, Toronto, W.P. 103-69-00," by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated July 31, 1975.
- **MTO GEOCRES No. 30M12-122**: "Foundation Investigation and Design Report, W.P. 103-69-08, Hwy. 410 from Steeles Avenue Southerly to Derry Road, Culverts" by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated December 21, 1976.
- **MTO GEOCRES No**. **30M12-148**: "Foundation Investigation Report for Clark Boulevard Underpass, W.P. 21-79-04, Site 24-145-471, Highway 410, Toronto," by Ministry of Transportation and Communications, Engineering Materials Office, Pavement and Foundation Design Section, dated January 8, 1982.
- **MTO GEOCRES No. 30M12-149**: "Foundation Investigation Report for Culvert Station 13+125.659 under Hwy. 410, W.P. 21-79-03, Hwy. 410, Toronto," by Ministry of Transportation and Communications, Engineering Materials Office, Pavement and Foundation Design Section, dated August 25, 1982.

Golder Associates Ltd.
2390 Argentia Road, Mississauga, Ontario, Canada L5N 5Z7
Tel: +1 (905) 567 4444 Fax: +1 (905) 567 6561 www.golder.com

- **MTO GEOCRES No. 30M12-176**: "Geotechnical Investigation, Retaining Walls, Highway 410 (Brampton By-Pass), Site 24, W.P. 21-79-15, Toronto," by Dominion Soil Investigation Inc., dated September, 1982.
- **MTO GEOCRES No. 30M12-187**: "Foundation Investigation Report for Steeles Avenue Underpass, W.P. 21-79-18; Site 24-81-488, Hwy 410, Toronto," by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated October 18, 1984.
- **MTO GEOCRES No. 30M12-193**: "Foundation Investigation Report for Derry Road Underpass, W.P. 103-69-15, Site 24-81-495, Hwy. 410, Toronto," by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated June 18, 1987.
- **MTO GEOCRES No. 30M12-196**: "Foundation Investigation Report for W.P. 54-82-09; High Mast Lighting (Hwy. 401/Hwy. 410 Interchange), Hwy. 401, Toronto," by Ministry of Transportation and Communications, Soil Mechanics Section, Geotechnical Office, dated March 30, 1987.
- **MTO GEOCRES No. 30M12-229**: "Foundation Investigation Report for High Mast Lighting, Hwy 410, Steeles Avenue to Highway 7N, W.P. 697-96-00, Central Region," by Ministry of Transportation, Ontario, dated October 8, 1996.

The previous boreholes used in this memorandum have been renamed to show the MTO GEOCRES reference number followed by the original borehole designation. For example, the boreholes from MTO GEOCRES No. 30M12-110 have been renamed to 110-X, where X is the original borehole number.

The following points are noted regarding determining the locations of the previous boreholes, and assessing the previous boreholes for potential use with respect to the foundation design for the proposed HML pole locations:

- The borehole locations in the previous Foundation Investigation Reports for the Highway 410 corridor are referenced to a number of coordinate or station systems. In general, the boreholes from all the GEOCRES reports were referenced to a global datum, and could be converted to the MTM NAD83 coordinate system. The accuracy of these borehole locations is considered to be consistent with the original survey.
- In general, an existing borehole is located within approximately 50 m to less than 200 m of each of the proposed HML pole locations. For boreholes located at distances greater than 100 m, Golder has reviewed the topography and subsurface conditions for other boreholes in the general area of each proposed HML pole location to confirm that the conditions are relatively consistent in the area and therefore applicable to the proposed HML pole location.
- Where multiple boreholes were located at a proposed HML pole location, the most conservative borehole was selected for use in the HML pole foundation design.
- At several proposed HML pole locations, the closest existing boreholes were drilled from original ground surface prior to the construction of the Highway 410 embankment in these areas, and the existing boreholes do not provide information on the material type and properties of the embankment fill. In addition, the proposed grade along the median will be raised slightly to accommodate the median widening of Highway 410. It has been assumed that the existing Highway 410 embankment was constructed to engineered fill standards and that the new embankment fill will also be constructed to engineered fill standards. However, to be conservative, the geotechnical parameters that are provided in this memorandum where the fill has not been investigated are based on an undrained shear

strength of 50 kPa or an effective angle of friction of 28 degrees. The structural assessment should be completed for both cohesionless and cohesive soil cases, and the more conservative approach adopted.

Based on the compiled borehole locations and information, one borehole considered to be representative of the subsurface conditions and in compliance with the Terms of Reference for the current assignment was chosen for each proposed high mast light pole location. At the following HML pole locations, no suitable boreholes existing within a reasonable distance, and site-specific borehole investigation is presently being coordinated in order to provide recommendations in the Foundation Investigation and Design Report:

- P6 to P9, between approximately Stations 5+614 and 6+111;
- P14 to P21, between approximately Stations 6+551 and 7+571; and
- P37, at approximately Station 11+316.

FOUNDATION ENGINEERING RECOMMENDATIONS

It is understood that based on the value engineering workshop, many of the existing HML pole foundations (are proposed to be reused following construction of the median widening and tall wall barrier; in most instances, the replacement pole will be the same height as the existing. The existing HML foundations consist of single, 1.22 m or 1.37 m diameter caissons that extend to depths of between 6 m and 10.7 m. URS will complete a structural assessment of the existing foundations based on the geotechnical parameters provided in this memorandum to confirm that they satisfy the design requirements for use. For any existing caisson foundations that do not satisfy the new design requirements based on this assessment, a site-specific design for a new caisson foundation should be completed based on the geotechnical parameters provided in this memorandum. In addition, fifteen new HML pole foundations are required, and these should consist of single caisson foundations designed using the geotechnical parameters provided in this memorandum.

Caisson foundations for HML poles should be designed in accordance with the requirements in MTO's *Guidelines for the Design of High Mast Pole Foundations* (May 2004), based on the interpolated stratigraphy and geotechnical design parameters given in Table 1 appended to this memorandum. As noted above, where both undrained shear strength and effective stress parameters are provided for fill material, the structural assessment should be completed for both cohesive and cohesionless soil cases, and the more conservative approach adopted. In the design of the foundations, the passive resistance within the upper 1.2 m below ground surface should be neglected to account for frost action.

Where sufficient resistance is not provided by the overburden soils, the caisson foundations will have to be embedded into the shale bedrock. The depth to "sound" bedrock is provided in Table 1, along with recommended values for f_{horiz} (the factored horizontal bearing capacity of sound rock at Ultimate Limit States, as defined in *Guidelines for the Design of High Mast Pole Foundations*).

CONSTRUCTION CONSIDERATIONS

The water-bearing cohesionless soils at this site should be expected to run or flow into the caisson hole during or after the drilling for the caisson foundations. Therefore, appropriate equipment and procedures will be required to minimize ground loss during drilling and concrete placement. This could include the use of temporary or

permanent caisson liners, and/or the use of drilling mud. It is recommended that a Non-Standard Special Provision (NSSP) be included in the Contract Documents to warn the Contractor of this condition, which will affect the installation of the HML pole foundations at this site. An NSSP is attached to this memorandum.

CLOSURE

This technical memorandum was prepared by Ms. Nikol Kochmanová, P.Eng., and reviewed by Ms. Lisa Coyne, P.Eng., a geotechnical engineer and Principal with Golder. Mr. Fin Heffernan, P.Eng., a Designated MTO Foundations Contact for Golder, conducted an independent review of the technical memorandum.

GOLDER ASSOCIATES LTD.

Nikol Kochmanová, P.Eng.
Geotechnical Engineer

Lisa C. Coyne, P.Eng.
Senior Geotechnical Engineer, Principal

Fintan J. Heffernan, P.Eng.
Designated MTO Foundations Contact

NK/LCC/FJH/jl

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Attachments: Table 1 – Geotechnical Design Parameters for High Mast Light Pole Foundations
Highway 410 Widening, G.W.P. 2144-07-00
NSSP for Caisson Foundations for HML and Sign Support foundations

TABLE 1
GEOTECHNICAL DESIGN PARAMETERS FOR HIGH MAST LIGHT POLE FOUNDATIONS
HIGHWAY 410 WIDENING, G.W.P. 2144-07-00

Pole No.	Station	New Pole or Potential Re-Use of	Borehole No.	Ground Surface Elevation at Reference Borehole	Existing Top of Footing Elevation (m)	Proposed Top of Footing Elevation (m)	Proposed Ground Surface Elevation (m)	Stratum	Depth Below Proposed Ground Surface at HML Pole Location (m)	Elevation (m)	Groundwater Elevation (m)	Design Parameters					
												S_u (kPa)	Φ'	γ (kN/m^3)	γ' (kN/m^3)	K_p	f_{horiz} (kPa)
P1	4+894	Re-use	196-C26	177.4	178.4	178.8	177.8	Fill (Assumed - Existing/New)	0 - 0.4	177.8 - 177.4	177	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till/ Weathered shale bedrock	0.4 - 3.0	177.4 - 174.8		-	34	21	11	3.5	-
								Shale bedrock	Below 3.0	Below 174.8		-	-	23	13	-	600
P2	5+016	Re-use	196-C27	178.2	179.0	179.8	178.7	Fill (Assumed - Existing/New)	0 - 0.5	178.7 - 178.2	177	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till	0.5 - 3.2	178.2 - 175.5		-	34	21	11	3.5	-
								Inferred shale bedrock	Below 3.2	Below 175.5		-	-	23	13	-	600
P3	5+158	Re-use	196-C28	180.0	180.1	180.9	179.8	Very stiff to hard clayey silt till	0 - 8.3	179.8 - 171.5	178	-	34	21	11	3.5	-
								Shale/limestone bedrock	Below 8.3	Below 171.5		-	-	23	13	-	600
P4	5+298	Re-use	196-C29 (~75 m)	179.3	181.2	182.0	180.9	Fill (Assumed - Existing/New)	0 - 1.6	180.9 - 179.3	178	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till	1.6 - 5.0	179.3 - 175.9		-	34	21	11	3.5	-
								Inferred shale bedrock	Below 5.0	Below 175.9		-	-	23	13	-	600
P5	5+450	New	196-C29 (~100 m)	179.3	N/A	183.1	182.1	Fill (Assumed - Existing/New)	0 - 2.8	182.1 - 179.3	178	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till	2.8 - 6.2	179.3 - 175.9		-	34	21	11	3.5	-
								Inferred shale bedrock	Below 6.2	Below 175.9		-	-	23	13	-	600
P6	5+614	Re-use			183.6	184.4	183.3										
P7	5+783	Re-use			184.8	185.7	184.5										
P8	5+952	Re-use			186.2	187.0	185.9										
P9	6+111	Re-use			187.3	188.1	187.0										
P10	10+123	New	110-1 (~200 m)	187.5	N/A	188.4	188.3	Fill (Assumed - Existing/New)	0 - 0.8	188.3 - 187.5	184	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till	0.8 - 17.6	187.5 - 170.7		-	34	21	11	3.5	-
								Shale bedrock	Below 17.6	Below 170.7		-	-	23	13	-	600
P11	10+253	New	110-1 (~150 m)	187.5	N/A	186.2	186.0	Very stiff to hard clayey silt till	0 - 15.3	186.0 - 170.7	184	-	34	21	11	3.5	-
								Shale bedrock	Below 15.3	Below 170.7		-	-	23	13	-	600
P12	6+276	Re-use	110-1	187.5	187.5	188.3	187.2	Very stiff to hard clayey silt till	0 - 16.5	187.2 - 170.7	184	-	34	21	11	3.5	-
								Shale bedrock	Below 16.5	Below 170.7		-	-	23	13	-	600
P13	6+437	Re-use	110-1 (~125 m)	187.5	186.9	187.6	186.6	Very stiff to hard clayey silt till	0 - 15.9	186.6 - 170.7	184	-	34	21	11	3.5	-
								Shale bedrock	Below 15.9	Below 170.7		-	-	23	13	-	600
P14	6+551	Future Pole			N/A	Future Pole											
P15	6+602	Re-use			186.2	187.0	186.0										
P16	6+767	Re-use			185.6	186.5	185.4										
P17	6+929	Re-use			185.1	185.9	184.9										
P18	7+095	Re-use			185.2	186.0	185.0										
P19	7+260	Re-use			185.6	186.4	185.4										
P20	7+423	Re-use			186.0	186.8	185.7										
P21	7+571	Re-use			186.2	187.2	186.2										
P22	7+743	Re-use	110-2	186.5	186.8	188.1	187.0	Fill (Assumed - Existing/New)	0 - 0.5	187.0 - 186.5	184	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till/ Very dense silty sand	0.5 - 14.1	186.5 - 172.9		-	34	21	11	3.5	-
								Shale bedrock	Below 14.1	Below 172.9		-	-	23	13	-	600
P23	7+890	Re-use	193-8 (~75m)	186.6	187.3	188.0	187.0	Fill (Assumed - Existing/New)	0 - 0.4	187.0 - 186.6	185.5	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till	0.4 - 12.7	186.6 - 174.3		-	34	21	11	3.5	-
								Weathered shale bedrock	Below 12.7	Below 174.3		-	34	21	11	3.5	-
P24	8+903	Re-use	110-3 (~75 m)	193.4	194.1	195.6	194.5	Fill (Assumed - Existing/New)	0 - 1.1	194.5 - 193.4	191.5	50	28	19	9	2.8	-
								Hard clayey silt till/ Weathered shale bedrock	1.1 - 6.3	193.4 - 188.2		-	34	21	11	3.5	-
								Shale bedrock	Below 6.3	Below 188.2		-	-	23	13	-	600
P25	9+065	New	110-3 (~100 m)	193.4	N/A	196.7	193.9	Fill (Assumed - Existing/New)	0 - 0.5	193.9 - 193.4	191.5	50	28	19	9	2.8	-
								Hard clayey silt till/ Weathered shale bedrock	0.5 - 5.7	193.4 - 188.2		-	34	21	11	3.5	-
								Shale bedrock	Below 5.7	Below 188.2		-	-	23	13	-	600

TABLE 1
GEOTECHNICAL DESIGN PARAMETERS FOR HIGH MAST LIGHT POLE FOUNDATIONS
HIGHWAY 410 WIDENING, G.W.P. 2144-07-00

Pole No.	Station	New Pole or Potential Re-Use of	Borehole No.	Ground Surface Elevation at Reference Borehole	Existing Top of Footing Elevation (m)	Proposed Top of Footing Elevation (m)	Proposed Ground Surface Elevation (m)	Stratum	Depth Below Proposed Ground Surface at HML Pole Location (m)	Elevation (m)	Groundwater Elevation (m)	Design Parameters					
												S_u (kPa)	Φ'	γ (kN/m^3)	γ' (kN/m^3)	K_p	f_{horiz} (kPa)
P26	9+534	Re-use	EC-1	190.5	192.0	193.7	191.9	Fill (Assumed new plus existing firm to hard clayey silt fill)	0 - 5.9	191.9 - 186.0	186	50	28	19	9	2.8	-
								Loose sand and gravel	5.9 - 7.9	186.0 - 184.0			28	19	9	2.8	-
								Weathered shale bedrock	Below 7.9	Below 184.0		-	-	23	13	-	600
P27	9+860	Re-use	EC-10 (~200m)	191.4	192.6	193.6	192.6	Fill (Assumed - Existing/New)	0 - 1.2	192.6 - 191.4	188	50	28	19	9	2.8	-
								Very stiff to hard clayey silt fill	1.2 - 2.7	191.4 - 189.9		-	32	20	10	3.3	-
								Very stiff to hard clayey silt till/ Weathered shale bedrock	2.7 - 4.4	189.9 - 188.2		-	34	21	11	3.5	-
								Shale bedrock	Below 4.4	Below 188.2		-	-	23	13	-	600
P28	10+010	Re-use	122-3(1)	192.7	193.7	194.0	193.0	Fill (Assumed - Existing/New)	0 - 0.3	193.0 - 192.7	189.5	50	28	19	9	2.8	-
								Hard clayey silt till	0.3 - 9.5	192.7 - 183.5		-	34	21	11	3.5	-
P29	10+179	Re-use	122-4(2) (~100 m)	191.6	194.1	194.6	193.5	Fill (Assumed - Existing/New)	0 - 1.9	193.5 - 191.6	190	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till	1.9 - 11.3	191.6 - 182.2		-	34	21	11	3.5	-
P30	10+345	Re-use	122-4(2) (~75 m)	191.6	194.6	196.0	193.9	Fill (Assumed - Existing/New)	0 - 2.3	193.9 - 191.6	190	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till	2.3 - 11.7	191.6 - 182.2		-	34	21	11	3.5	-
P31	10+512	Re-use	122-5(2) (~200 m)	192.5	195.2	196.6	194.3	Fill (Assumed - Existing/New)	0 - 1.8	194.3 - 192.5	191.5	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till	1.8 - 10.9	192.5 - 183.4		-	34	21	11	3.5	-
P32	10+667	Re-use	122-5(2)	192.5	195.7	197.0	194.7	Fill (Assumed - Existing/New)	0 - 2.2	194.7 - 192.5	191.5	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till	2.2 - 11.3	192.5 - 183.4		-	34	21	11	3.5	-
P33	10+837	New	110-5 (~150 m)	197.3	196.1	197.5	195.3	Hard clayey silt till/ Weathered shale bedrock	0 - 10.3	195.3 - 185.0	195.5	-	34	21	11	3.5	-
								Shale bedrock	Below 10.3	Below 185.0		-	-	23	13	-	600
P34	11+004	Re-use	110-5	197.3	195.9	197.4	195.2	Hard clayey silt till/ Weathered shale bedrock	0 - 10.2	195.2 - 185.0	195.5	-	34	21	11	3.5	-
								Shale bedrock	Below 10.2	Below 185.0		-	-	23	13	-	600
P35	9+861	New	187-3 (~110 m)	197.5	N/A	196.8	196.7	Hard clayey silt till	0 - 8.4	196.7 - 188.3	195.5	-	34	21	11	3.5	-
P36	11+166	Re-use	187-4 (~75 m)	197.5	196.5	197.3	196.0	Hard clayey silt till	0 - 6.4	196.0 - 189.6	195.5	-	34	21	11	3.5	-
P37	11+316	Re-use			198.0	198.6	197.5									1.0	
P38	11+479	Re-use	229-21 (~200)	199.3	199.7	200.4	199.3	Very stiff to hard clayey silt till/ Weathered shale bedrock	0 - 5.5	199.3-193.8	197.5	-	34	21	11	3.5	-
								Shale bedrock	Below 5.5	Below 193.8		-	-	23	13	-	600
P39	11+622	Re-use	229-21	199.3	202.2	202.7	201.6	Fill (Assumed - Existing/New)	0 - 2.3	201.6 - 199.3	197.5	50	28	19	9	2.8	-
								Very stiff to hard clayey silt till/ Weathered shale bedrock	2.3 - 7.8	199.3 - 193.8		-	34	21	11	3.5	-
								Shale bedrock	Below 7.8	Below 193.8		-	-	23	13	-	600
P40	11+791	New	229-16	199.5	N/A	206.7	205.6	Fill (Assumed - Existing/New)	0 - 6.1	205.6 - 199.5	197.5	50	28	19	9	2.8	-
								Hard clayey silt till/ Weathered shale bedrock	6.1 - 8.4	199.5 - 197.2		-	34	21	11	3.5	-
P41	11+971	New	GR-6	207.7	N/A	209.3	208.2	Fill (Assumed new plus existing embankment fill)	0 - 10.4	208.2 - 197.8	199	50	28	19	9	2.8	-
								Shale bedrock	Below 10.4	Below 197.8		-	-	23	13	-	600
P42	12+126	Re-use	GR-6	207.7	211.6	212.2	211.2	Fill (Assumed new plus existing embankment fill)	0 - 13.4	211.2 - 197.8	199	50	28	19	9	2.8	-
								Shale bedrock	Below 13.4	Below 197.8		-	-	23	13	-	600
P43	12+297	Re-use	CN-2 (~175 m)	217.4	214.8	215.5	214.4	Existing Fill	0 - 5.7	214.4 - 208.7	210	50	28	19	9	2.8	-
								Stiff to hard clayey silt till/ Weathered shale bedrock	5.7 - 9.2	208.7 - 205.2		-	34	21	11	3.5	-
								Shale bedrock	Below 9.2	Below 205.2		-	-	23	13	-	600
P44	12+449	New	CN-2	217.4	N/A	218.4	217.4	Fill (Assumed new plus existing embankment fill)	0 - 8.7	217.4 - 208.7	210	50	28	19	9	2.8	-
								Stiff to hard clayey silt till/ Weathered shale bedrock	8.7 - 12.2	208.7 - 205.2		-	34	21	11	3.5	-
								Shale bedrock	Below 12.2	Below 205.2		-	-	23	13	-	600
P45	12+633	New	CN-10	218.5	N/A	221.2	220.1	Fill (Assumed - New)	0 - 1.6	220.1 - 218.5	213.5	50	28	19	9	2.8	-
								Embankment fill	1.6 - 10.3	218.5 - 209.8		50	28	19	9	2.8	-
								Hard clayey silt till	10.3 - 11.3	209.8 - 208.8		-	34	21	11	3.5	-
P46	12+811	Re-use	OR-1	219.9	221.2	221.7	220.6	Fill (Assumed existing/new plus existing embankment fill)	0 - 7.4	220.6 - 213.2	213	50	28	19	9	2.8	-
								Very stiff clayey silt till	7.4 - 8.9	213.2 - 211.7		-	32	21	11	3.3	-

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HIGHWAY 410 WIDENING, G.W.P. 2144-07-00

Pole No.	Station	New Pole or Potential Re-Use of	Borehole No.	Ground Surface Elevation at Reference Borehole	Existing Top of Footing Elevation (m)	Proposed Top of Footing Elevation (m)	Proposed Ground Surface Elevation (m)	Stratum	Depth Below Proposed Ground Surface at HML Pole Location (m)	Elevation (m)	Groundwater Elevation (m)	Design Parameters					
												S_u (kPa)	Φ'	γ (kN/m^3)	γ' (kN/m^3)	K_p	f_{horiz} (kPa)
P47	12+987	Re-use	176-7	213.0	219.8	220.5	219.4	Fill (Assumed - Existing/New)	0 - 6.4	219.4 - 213.0	210.5	50	28	19	9	2.8	-
								Hard silty clay fill/ Hard clayey silt till	6.4 - 11.1	213.0 - 208.3		-	34	21	11	3.5	-
								Shale bedrock	Below 11.1	Below 208.3		-	-	23	13	-	600
P48	13+150	Re-use	149-2	212.8	218.6	219.3	218.1	Fill (Assumed - Existing/New)	0 - 5.3	218.1 - 212.8	211	50	28	19	9	2.8	-
								Stiff to hard clayey silt till	5.3 - 9.3	212.8 - 208.8		-	32	21	11	3.3	-
								Weathered shale bedrock	9.3 - 10.4	208.8 - 207.7		-	34	21	11	3.5	-
P49	13+319	New	229-6	216.9	N/A	218.2	217.2	Fill (Assumed existing/new plus existing stiff silty clay fill)	0 - 3.7	217.2 - 213.5	214	50	28	19	9	2.8	-
								Hard clayey silt till	3.7 - 8.7	213.5 - 208.5		-	34	21	11	3.5	-
P50	13+476	New	148-3	214.5	N/A	216.7	216.5	Fill (Assumed - Existing/New)	0 - 2.0	216.5 - 214.5	214	50	28	19	9	2.8	-
								Hard clayey silt till	2.0 - 10.4	214.5 - 206.1		-	34	21	11	3.5	-
P51	13+618	New	229-11	216.0	N/A	216.8	215.7	Hard clayey silt till	0 - 8.1	215.7 - 207.6	213	-	34	21	11	3.5	-
P52	9+592	New	229-11 (~80 m)	216.0	N/A	216.7	216.5	Fill (Assumed - Existing/New)	0 - 0.5	216.5 - 216.0	213	50	28	19	9	2.8	-
								Hard clayey silt till	0.5 - 8.9	216.0 - 207.6		-	34	21	11	3.5	-

NOTES:

1. Design parameters:
   - s_u = undrained shear strength (kPa);
   - φ' = effective friction angle (degrees);
   - γ = bulk unit weight (kN/m3);
   - γ' = effective unit weight below the groundwater level (kN/m3);
   - K_p = passive earth pressure coefficient; and
   - f_{horiz} = factored lateral geotechnical resistance of sound rock at Ultimate Limit States (kPa).

2. Depths are given at the existing or proposed HML pole locations relative to the estimated proposed ground surface following construction, including any median grade raises or regrading. Although Su, φ' and Kp parameters are given for the full depth of the soil, the passive resistance in the upper 1.2 m should be neglected to account for frost action.

3. Where both undrained shear strength and effective friction angle parameters have been provided for fill materials, the structural assessment should be completed for both cohesive soil and cohesionless soil cases, and the selected design should be based on the more conservative approach.

CAISSON FOUNDATIONS FOR HML AND SIGN SUPPORT FOUNDATIONS - Item No.

Special Provision

Where OPSS 903 is called up by OPSS 915, OPSS 903 is amended by the following. Where conflict occurs, THIS NSSP shall take precedence.

The Contractor shall construct HML and Sign Support foundations in conformance with the design and at locations indicated in the Contract Documents.

The Contractor shall construct the HML and Sign Support foundations against undisturbed bases and sides of excavations. The bases of caisson excavations shall be cleaned of loosened and/or softened materials prior to pouring concrete for the foundation. The construction methods and techniques shall be the responsibility of the Contactor, but consideration could be given to using temporary liners or tremie concreting techniques where conditions warrant.

The Contractor is advised that variable subsurface conditions may be encountered at HML caisson locations and Sign (including conventional overhead and tri-chord types) caisson locations where included in the contract. For bidding purposes, the Contractor shall assume that the overburden has zones of non-cohesive soil and contains cobbles and boulders, and that the groundwater levels are near the surface. The Contractor is advised that non-cohesive soil is susceptible to disturbance under conditions of unbalanced hydrostatic head. As a lower priority than the above-noted instruction, the Contractor shall assume that the subsurface conditions at HML caisson locations and Sign (including conventional overhead and tri-chord types) caisson locations are generally similar to the closest of the boreholes, as illustrated in the Foundation Investigation Report.

Pre-augering/pre-coring for caissons for the HML and Sign Support foundations may extend into the shale bedrock, which is weak to medium strong and which contains stronger interlayers of limestone bedrock. Appropriate construction procedures and equipment will be required to penetrate the bedrock.

Basis of Payment

Payment at the lump sum contract price for this tender item shall be full compensation for all labour, equipment and materials for completion of the work.

END OF SECTION