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April 10, 2015 DST Reference No.: GS-TB-020477

J.P Perron, P. Eng.
Ministry of Transportation NER
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Re: Agreement # 5013-E-0033, Assignment # 6, GWP 5475-05-00, Geocres No. 41H-151
CPR OH Bridge, Highway 529, Harrison Township, Station 11+231

DST Consulting Engineers Inc. (DST) has been retained by the Ministry of Transportation (MTO), Geotechnical Section, Northeastern Region to conduct a geotechnical investigation for the CPR OH Bridge on Highway 529 approximately 1.3 km north of the Highway's South junction with Highway 69. This work was carried out under Agreement No.: 5013-E-0033, Assignment # 6.

Site work was carried on February 24, 25,and 26, 2015 and included the advancement of two geotechnical boreholes at the bridge approaches. To advance the boreholes a CME 750 truck-mounted drill rig was utilized. Borehole 1 was advanced at Station 11+243 (2.0 m West of the West expansion joint), 2.1 m right of centreline in the Westbound lane North of the centreline. Borehole 2 was advanced at Station 11+218 (2.0 m East of the East expansion joint) and, 2.2 m left of centreline in the Eastbound lane South of the centreline. The boreholes were advanced through fill materials and coring of the cobbles and bedrock was required. Borehole 1 was terminated in cobbles at a depth of 9.5 m below surface and Borehole 2 was terminated in bedrock at a depth of 4.2 m below surface.

The generalized stratigraphy for this site based on the Boreholes 1 and 2 consist of surface layer of asphalt overlaying a granular sand fill layer underlain by a silty sand and/ or cobbles which is again underlain by a bedrock. The following tables summarizes the soils properties encountered in two boreholes. Elevation of 100.0 m has been assumed at the top of the boreholes.

Table 1: CPR OH Bridge BH1 Summary

Soil Type	Depth (BH Location)	Elevation (m)	Soil Properties
Asphalt	0 to 0.1 m	100 to 99.9 m	
Concrete	0.1 to 0.4 m	99.9 to 99.7 m	
Fill-SAND-Crushed GRAVEL, trace silt	0.4 to 0.8 m	99.7 to 99.3 m	Unit Weight (γ = 21 kN/m^3) Internal Friction Angle (ϕ = 32 Degrees) Moisture Content up to 1%
Fill-SAND-some gravel, some silt, wood, cobbles	0.8 to 3.8 m	99.3 to 96.2 m	Unit Weight (γ = 21 kN/m^3) Internal Friction Angle (ϕ = 32 Degrees) Moisture Content between 2% to 8%
Silty Sand- trace gravel, cobbles	3.8 to 9.5 m	96.2 to 90.5 m	Unit Weight (γ = 21 kN/m^3) Internal Friction Angle (ϕ = 30 Degrees) Moisture Content between 18 to 20%

Table 2: CPR OH Bridge BH2 Summary

Soil Type	Depth (BH Location)	Elevation (m)	Soil Properties
Asphalt	0 to 0.1 m	100 to 99.9 m	
Concrete	0.1 to 0.4 m	99.9 to 99.7 m	
Fill-SAND-some gravel, trace silt, Cobbles	0.4 to 0.8 m	99.7 to 99.3 m	Unit Weight (γ = 21 kN/m^3) Internal Friction Angle (ϕ = 32 Degrees) Moisture Content up to 2%
Sand with Cobbles	0.8 to 3.3 m	99.3 to 96.7 m	Unit Weight (γ = 21 kN/m^3) Internal Friction Angle (ϕ = 30 Degrees)
Bedrock- Migmatitic rock	3.3 to 4.2 m	96.7 to 95.8 m	RQD* = 85% UCS$^{\#}$ = 114 to 148 Mpa (correlated from point load test)

*RQD=Rock Quality Designation

$^{\#}$UCS= Unconfined Compressive Strength

The records of boreholes and laboratory testing results are enclosed with this letter report.

We trust this satisfies your present needs. If you have any questions or comments, please contact the undersigned at your convenience.

Yours Truly,

For DST Consulting Engineers Inc.

Deep Bansal, P.Eng
Geotechnical Engineer

RECORD OF BOREHOLE No BH1

1 OF 1

METRIC

W.P. 5013-E-0033 LOCATION CPR OH Bridge: STA 11+243, 2.1 m Rt (17T 0547217 E, 5051747) ORIGINATED BY SH

DIST HWY 529 BOREHOLE TYPE Hollow Stem Auger - 80 mm ID COMPILED BY DB

DATUM LOCAL DATE 2015 03 02 CHECKED BY BV

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, □ QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
100.0	GROUND SURFACE										
99.9	Asphalt										
99.7	Concrete										
0.4	FILL - SAND and CRUSHED GRAVEL - trace silt		AS1	AS							
99.3											
0.8	FILL-SAND-some to with gravel, some silt, cobbles, Loose to Dense, Brown		SS2	SS	65		99				25 63 (12)
	Wood										
	-Cobbles		SS3	SS	26		98				15 67 (18)
			SS4	SS	8						24 59 (17)
			SS5	SS	14		97				14 72 (14)
96.2											
3.8	Silty Sand- , trace to some gravel, Brown, Loose to Dense		SS6	SS	10		96				3 83 (14)
			SS7	SS	36		95				
	-Cobbles		SS8	SS	50+		94				Advancing using casing
			SS9	SS	7		93				10 57 (33)
			SS10	SS	14		92				1 61 (38)
	-Cobbles		SS11	SS	50+		91				Advancing using casing
90.5											
9.5	End of Borehole at 9.5 m										Dry Upon Completion

Note: Elevation of 100 m has been assumed at the top of BH

NR = NO RECOVERY $+^3$, $\times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

ON_MOT GS-TB-020477 CPR BRIDGE.GPJ DST_MIN.GDT 4/8/15

ENCLOSURE 1

RECORD OF BOREHOLE No BH2

1 OF 1

METRIC

W.P. 5013-E-0033 LOCATION CPR OH Bridge: STA 11+218, 2.2 m Lt (17T 0547254 E, 5051744 N) ORIGINATED BY SH

DIST HWY 529 BOREHOLE TYPE Hollow Stem Auger - 80 mm ID COMPILED BY DB

DATUM LOCAL DATE 2015 03 03 CHECKED BY BV

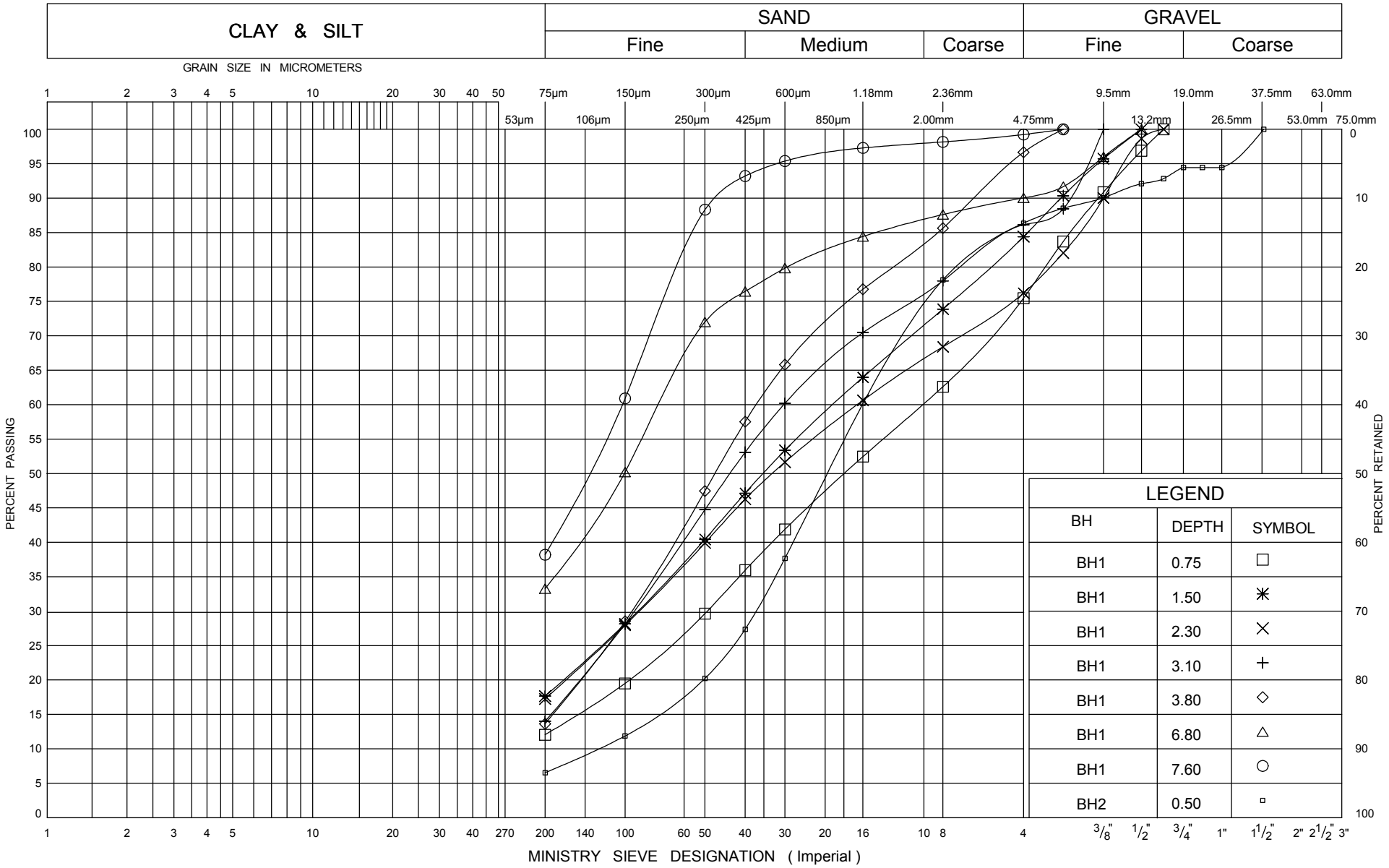
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE □ QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
100.0	GROUND SURFACE										
99.9 / 0.1	Asphalt										
99.7 / 0.4	Concrete										
99.3 / 0.8	Fill-Sand-some gravel, trace silt, Cobbles		AS1	AS							13 80 (7)
	Sand- with Cobbles		SS2	SS	50+		99				Advancing using casing
							98				
96.7							97				
3.3	Bedrock-Migmatitic rock RQD = 85% TCR=80%		RC1	RC							
95.8							96				
4.2	END OF BOREHOLE at 4.2 m Note: Elevation of 100 m has been assumed at the top of BH										Dry Upon Completion

NR = NO RECOVERY $+^3, \times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

ON_MOT GS-TB-020477 CPR BRIDGE.GPJ DST_MIN.GDT 4/8/15

ENCLOSURE 2

UNIFIED SOIL CLASSIFICATION SYSTEM



ONTARIO MOT GRAIN SIZE GS-TB-020477 CPR BRIDGE.GPJ DST_MIN.GDT 4/7/15

Ministry of Transportation Ontario

GRAIN SIZE DISTRIBUTION
SAND

ENCLOSURE 1

W P 5013-E-0033

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