APPENDIX 'A'

GEOTECHNICAL REPORT

PLESSIS ROAD UNDERPASS STUDY

TEST HOLE LOCATION PLAN

Winnipeg

- SHALLOW TEST HOLE
- INTERMEDIATE TEST HOLE
- DEEP TEST HOLE
- LIFT STATION TEST HOLE
- VIBRATING WIRE PIEZOMETER

TH NO.	Northing	Easting	TH NO.	Northing	Easting
TH12-S01	5528594.39	641834.40	TH12-S07	5527906.40	641793.73
TH12-S02	5528469.05	641825.87	TH12-S09	5527867.51	641833.67
TH12-S03	5528344.56	641841.13	TH12-S12	5527844.87	642029.05
TH12-S04	5528159.64	641834.21	TH12-S14	5527837.72	642273.47
TH12-I01	5528145.39	641852.06	TH12-S10	5527834.97	641622.23
TH12-S05	5528060.34	641880.45	TH12-S11	5527828.94	641404.66
TH12-I02	5528037.12	641819.27	TH12-S13	5527825.87	642160.47
TH12-D04	5527999.43	641879.39	TH12-I05	5527819.41	641939.50
TH12-D02	5527994.87	641806.75	TH12-I03	5527809.58	641549.54
TH12-D01	5527980.50	641779.17	TH12-S18	5527797.53	641737.76
TH12-D03	5527982.63	641853.68	TH12-S15	5527643.02	641733.62
TH12-L01	5527936.38	641779.55	TH12-S16	5527520.20	641734.03
TH12-S08	5527914.34	641849.60	TH12-S17	5527368.02	641737.95

GENERAL NOTES:

1. ALL UNITS ARE IN METRIC (m) .
2. AERIAL DATED 2009.

AECOM

DILLON CONSULTING

0 37.5 75 150m

SCALE: 1:5000

B-001

P:\60273041\000-CADD\02-SHEETS\B\60273041-20-SHT-B-001_RX.dwg

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

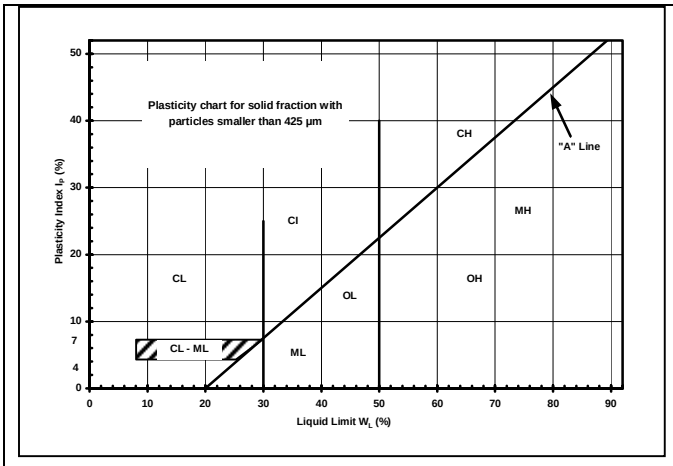
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				AECOM Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		AECOM
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Su (kPa)	**CONSISTENCY**
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	**COMPACTNESS**
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D01
LOCATION: Plessis South Bound/CN Rail Intersection, West Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.70

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SLOTTED PIEZOMETER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0			SAND (Fill) - some gravel, some clay - brown, dry						232
1			CLAY (Fill) - trace sand, trace gravel - grey, dry, firm		G146				
2			CLAY - grey, dry, firm - intermediate plasticity		S147	6		- 3, 3, 3 blows/150 mm - SPT Recovery: 20%	231
3					S148	2		- 3, 0, 2 blows/150 mm - SPT Recovery: 100%	230
4									229
5					S149	3		- 2, 1, 2 blows/150 mm - SPT Recovery: 100%	228
6					S150	4		- 2, 2, 2 blows/150 mm - SPT Recovery: 100%	227
7									226
8			- trace silt inclusions, moist, soft below 7.62 m		S151	3		- 2, 1, 2 blows/150 mm - SPT Recovery: 100%	225
9					S152	3		- 2, 1, 2 blows/150 mm	224
10					G153				223
11									222
12					G154				221
13									220
14									219
15									218

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✤ Field Vane ✤ (kPa) 50 100 150 200

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 23.77 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/26
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D01
LOCATION: Plessis South Bound/CN Rail Intersection, West Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.70

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SLOTTED PIEZOMETER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
15								217
16								216
17			- some sand, trace gravel		G155			215
18					G156			214
19			LIMESTONE DOLOMITIC (Bedrock) - light grey to white, mottled yellow, core angle: 90 degrees - fine to medium grained, no foliation - moderately close spacing, rough undulating joints, slightly altered joints - R2 to R3 (weak to medium strong) - fossiliferous, vuggy - fractured to 20.73 m below ground surface		S157	55/ 152mm	- 55 blows/150 mm	213
20					C1		- C1 RQD: 9% - Core Recovery: 45%	212
21					C2		- C2 RQD: 71% - Core Recovery: 87%	211
22								210
23					C3		- C3 RQD: 96% - Core Recovery: 100%	209
24			END OF TEST HOLE AT 23.77 m IN BEDROCK Notes: 1. Power auger refusal at 19.20 m below ground surface on BEDROCK. 2. HQ coring below 19.20 m. 3. Seepage observed at 18.41 m below ground surface. 4. Installed 25 mm diameter standpipe piezometer (SP12-02) to 21.34 m with 3.05 m of screen bottom, and 0.90 m stick-up. Above ground protective casing installed. 5. Test hole backfilled with sand up to 17.83 m, grouted from 17.83 to 13.72 m, plugged with bentonite to 12.19 m, backfilled with auger cuttings to 0.61 m and sealed with bentonite to ground surface. 6. Ground water monitoring: - October 26, 2012 at 11.50 m (Elev. 221.20 m) - December 03, 2012 at 9.60 m (Elev. 223.10 m) - April 15, 2013 at 10.19 m (Elev. 222.50 m) - June 20, 2013 at 10.69 m (Elev. 222.0 m)					208
25								207
26								206
27								205
28								204
29								203
30								

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✤ Field Vane ✤ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 23.77 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/26
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D02
LOCATION: Plessis South Bound/CN Rail Intersection, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.99

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ▬ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ✤ Field Vane ✤ (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
0		SAND - gravelly, trace organics - brown to black, moist to wet, loose to compact							
1			■	G96		●			232
2		CLAY - grey, moist to wet, stiff	■	G97		●			231
3									230
		- trace roots, black, wet, toxic odour, steel bar debris up to 3.96 m							
4		- trace organics, moist to wet	■	G99		●			229
5			▯	T100		■ ●	× △		228
			■	G101		●			
6									227
7		- soft, wet below 7.01 m	■	G102		●			226
8			▯	T103			△		225
9		- trace silt inclusions (< 5 mm dia.)	■	G104		●			224
10									223
			■	G105		●			
11			▯	T106			△		222
12			■	G107		●			221
13			■	G108		●			220
14			▯	T109		⊢——⊣	△		219
15									

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 21.95 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/22
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D02
LOCATION: Plessis South Bound/CN Rail Intersection, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.99

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ▬ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
15									
				G110					
16									217
				G111					
17									216
				G112					
18									215
19		LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - close spacing, rough undulating joints, slightly altered joints - R2 to R3 (weak to medium strong) - fossiliferous, filled vuggs - high calcium limestone		C1				- C1 RQD: 26% - Core Recovery: 66%	214
20									213
21				C2				- C2 RQD: 72% - Core Recovery: 100%	212
22		END OF TEST HOLE AT 21.95 m IN BEDROCK Notes: 1. Power auger refusal at 18.90 m below ground surface on BEDROCK. 2. HQ coring below 18.90 m. 3. Test hole grouted up to 13.72 m, plugged with bentonite from 13.72 to 12.80 m and backfilled with auger cuttings to ground surface.							211
23									210
24									209
25									208
26									207
27									206
28									205
29									204
30									

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 21.95 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/22
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D03
LOCATION: Plessis North Bound/CN Rail Intersection, East Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 233.28

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
0		SAND (Fill) - some gravel - dark brown, moist to dry							233
1		CLAY (Fill) - some sand, trace gravel - black to brown, moist to dry		G113					232
2		CLAY - dark brown, dry, firm - intermediate plasticity		G115					231
3		- some silt, light brown		T116			△		230
4				G117					229
5		- grey, firm to stiff		G118					228
6				T119			△		227
7		- moist to wet, soft below 6.01 m		G120					226
8				G121					225
9				T122		■ ⊢ ● ⊣	△ × +		224
10		- firm to soft below 9.60 m		G123					223
11				G124					222
12				T125			△		221
13									220
14				G126					219
15									

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 22.25 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/23
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D03
LOCATION: Plessis North Bound/CN Rail Intersection, East Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 233.28

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
15								218
16								217
17				G127				216
18		- some gravel, trace cobbles below 17.98 m		G128				215
19		LIMESTONE DOLOMITIC (Bedrock) - light grey to white, mottled yellow, core angle: 90 degrees - fine to medium grained, no foliation - close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous, vuggy - healed joint - slightly altered joint below 20.12 m		C1			- C1 RQD: 73% - Core Recovery: 92%	214
20								213
21		- rough planar joint		C2			- C2 RQD: 60% - Core Recovery: 94%	212
22		END OF TEST HOLE AT 21.95 m IN BEDROCK Notes: 1. Power auger refusal at 18.90 m below ground surface on BEDROCK. 2. HQ coring below 18.90 m. 3. Test hole backfilled with bentonite and auger cuttings.						211
23								210
24								209
25								208
26								207
27								206
28								205
29								204
30								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 22.25 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/23
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D04
LOCATION: Plessis North Bound/CN Rail Intersection, East Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 175 mm HSA	ELEVATION (m): 233.08

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0		TOPSOIL - some gravel, trace sand - black, dry		G129				
1		CLAY - grey, dry, firm - intermediate plasticity						232
2				G131				231
3		SILT - light brown, moist to wet, soft		G132				230
4		CLAY - grey, dry, stiff - intermediate plasticity						229
5				T133			Gravel: 0%, Sand: 6.6%, Silt: 21.4%, Clay: 72.0%	228
6		- firm below 6.01 m		G134				227
7				G135				226
8				T136				225
9		- trace silt inclusions, moist to wet, soft below 9.14 m		G137				224
10				G138				223
11				T139				222
12				G140				221
13				G141				220
14				T142				219
15								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100
■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21
Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 23.77 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/24
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D04
LOCATION: Plessis North Bound/CN Rail Intersection, East Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 175 mm HSA	ELEVATION (m): 233.08

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | ☐ Lab Vane ☐ | △ Pocket Pen. △ | ✪ Field Vane ✪ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
15							
16				G143			217
17		- trace gravel, wet below 16.76 m		G144			216
18		LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - moderately close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous, filled vuggs - high calcium limestone - rough planar joint		C1		- C1 RQD: 33% - Core Recovery: 82%	215
19							214
20				C2		- C2 RQD: 35% - Core Recovery: 100%	213
21							212
22				C3		- C3 RQD: 45% - Core Recovery: 100%	211
23				C4		- C4 RQD: 99% - Core Recovery: 100%	210
24		END OF TEST HOLE AT 23.77 m IN BEDROCK Notes: 1. Power auger refusal at 17.68 m below ground surface on BEDROCK. 2. HQ coring below 17.68 m. 3. Seepage observed at 16.76 m below ground surface. 4. Test hole backfilled with bentonite and auger cuttings.					209
25							208
26							207
27							206
28							205
29							204
30							

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 23.77 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/24
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-I01
LOCATION: Plessis Road North Bound, East Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 231.78

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker | Dynamic Cone | SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100 | Total Unit Wt (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane | QU | Lab Vane | Pocket Pen. | Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		FILL - clayey, some silt, trace sand - light brown to grey, moist, loose to compact					
1		CLAY - silty, trace sand - brown to grey, moist, soft to stiff - high plasticity		G7			231
				G8			
2				S9	6	- 3,3,3 blows/150 mm	230
		- grey below 2.1 m					
3				G10		Gravel: 0%, Sand: 1.0%, Silt: 12.5%, Clay: 86.5%	229
4				G11			228
		- stiff below 4.0 m					
5							227
6				G12			226
7				G13			225
8				T14			224
9				G15			223
		END OF TEST HOLE AT 9.14 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					
10							222
11							221
12							220
13							219
14							218
15							217

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 9.14 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/9
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-I02
LOCATION: Plessis Road South Bound, West Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.34

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	SLOTTED PIEZOMETER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0			TOPSOIL - some clay, some sand, trace gravel, trace organics - dark brown, moist, loose						232
1			CLAY (Fill) - trace silt, trace sand - grey, moist to dry, very stiff - low to intermediate plasticity		G51				231
2			SILT - some clay, trace sand - light brown to grey, moist to dry, firm - low plasticity						230
3			CLAY - some silt - greyish brown, moist, firm - intermediate plasticity - brown below 2.29 m		G52				229
4			- grey below 3.81 m						228
5					G53 T54			- Tube Recovery: 100%	227
6					G55				226
7									225
8			- silt inclusions, trace gravel below 7.62 m - up to 12.70 mm thick sub-rounded limestone clast		T56			- Tube Recovery: 100%	224
9					G57				223
10									222
11					T58			- Tube Recovery: 100%	221
12			END OF TEST HOLE AT 11.28 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Installed 25 mm diameter standpipe piezometer (SP12-01) to 10.67 m with 3.05 m of screen bottom, and 0.82 m stick-up. Above ground protective casing installed. 3. Test hole backfilled with sand up to 7.01 m, plugged with bentonite to 6.40 m, backfilled with auger cuttings to 0.61 m and sealed with bentonite to ground surface. 4. Ground water monitoring: - October 24, 2012 at 10.21 m (Elev. 222.13) - December 03, 2012 at 6.18 m (Elev. 226.20 m) - April 15, 2013 at 4.78 m (Elev. 227.60m) - June 20, 2013 at 4.58 m (Elev. 227.70 m)					220
13									219
14									218
15									

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 11.28 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-I03
LOCATION: Dugald Road East Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.93

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker | Dynamic Cone | SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100 | Total Unit Wt (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane | QU | Lab Vane | Pocket Pen. | Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	ASPHALT (114 mm) CLAY FILL (Subbase) - trace sand, trace organic - grey, moist					
1	CLAY - some organic - dark brown, moist, stiff - intermediate plasticity - grey, trace organics		G84			232
2						231
3	- silt inclusions below 3.05 m		G85			230
4						229
5	- silt lens (up to 25.4 mm thick)		T86		- Tube Recovery: 100%	228
6						227
7	- trace gravel, laminated, intermediate to high plasticity below 6.10 m		S87		- 3,3,5 blows/150 mm - SPT Recovery: 100%	226
8			G88			225
9						224
10			T89		- Tube Recovery: 100%	223
11	END OF TEST HOLE AT 9.75 m IN CLAY Notes: 1. No seepage observed. 2. Test hole remained open to 9.14 m below ground surface after completion of drilling. 3. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.					222
12						221
13						220
14						219
15						

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 9.75 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/11/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-I05
LOCATION: Dugal Road East Bound, South Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 229.94

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0		Sand and Gravel (Fill) - trace silt - brown, moist, compact		G16				
1		CLAY - trace silt - brown to black, moist, stiff - intermediate plasticity - silty to 1.52 m - some silt, brownish grey to grey below 1.52 m		G17				229
2								228
3				G18				227
4								226
5				G19				225
6				G20				224
7								223
8				G21				222
9		END OF TEST HOLE AT 7.62 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.						221
10								220
11								219
12								218
13								217
14								216
15								

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | ☐ Lab Vane ☐ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/9
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-L01
LOCATION: East of Plessis Road		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.06

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	TOPSOIL - some clay, some organics, trace sand - dark brown, moist, hard - grey, dry, intermediate plasticity below 0.30 m		G27			232
1	SILT - some clay, trace sand - light grey to grey, moist, soft - low to intermediate plasticity		G28			231
2	CLAY - brown, moist, firm to stiff - intermediate to high plasticity - greyish brown below 1.52 m					230
3			G29			229
4						228
5			G30			227
			T31		- Tube Recovery: 100%	
	- grey, soft to firm below 5.18 m					
6						226
7						225
8			G32			224
			T33		- Tube Recovery: 100%	
9						223
10						222
11			G34			221
	- silt inclusions, soft below 10.67 m					
12						220
13						219
14			G35			218
15						

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 17.98 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-L01
LOCATION: East of Plessis Road		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.06

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
15								
16								216
				G36				
17								215
		- limestone cobble up to 0.08 m thick		G37				
18		END OF TEST HOLE AT 17.98 m ON BEDROCK Notes: 1. Power auger refusal at 17.98 m below ground surface on BEDROCK. 2. Seepage observed at 10.97 m below ground surface. 3. Test hole remained open to 12.80 m below ground surface after completion of drilling. 4. Test hole backfilled with auger cuttings upon completion.						214
19								213
20								212
21								211
22								210
23								209
24								208
25								207
26								206
27								205
28								204
29								203
30								

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 17.98 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S01
LOCATION: Plessis Road North Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.68

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0		ASPHALT (114 mm) CONCRETE (Base) - grey, dry, bonded						232
1		SILT - clayey, trace sand - brown, moist, soft - low to intermediate plasticity		G165				
				G166				231
2		CLAY - trace sand - brown, moist, stiff - intermediate plasticity, silt lenses (up to 25.4 mm thick dia.) - greyish brow, laminated below 1.52 m		G167				
								230
3		- grey, firm below 3.05 m		S168	6		- 2, 2, 4 blows/150 mm - SPT Recovery: 100%	
4		- moist to wet below 3.96 m		G169				229
								228
5		END OF TEST HOLE AT 4.57 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.						
6								227
7								226
8								225
9								224
10								223
11								222
12								221
13								220
14								219
15								218

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 4.57 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S02
LOCATION: Plessis Road South Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.39

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0		ASPHALT (114 mm) CONCRETE (Base) - grey, dry, bonded						232
1		FILL (Subbase) - some clay, some sand, trace gravel - greyish black, moist, firm						
		CLAY - brown, moist, stiff - intermediate plasticity, laminated		G170				231
2								230
3				G171				
		- silt inclusions, firm below 3.05 m						229
				G172				
4		- silty sand pocket - greyish brown, trace gravel, trace oxidation below 3.66 m						
				G173				228
5				S174	6		- 2, 2, 4 blows/150 mm - SPT Recovery: 100%	
		END OF TEST HOLE AT 5.03 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.						227
6								226
7								
								225
8								
								224
9								
								223
10								
								222
11								
								221
12								
								220
13								
								219
14								
								218
15								

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 5.03 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S03
LOCATION: Plessis Road North Bound, East Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.38

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		TOPSOIL (Fill) - some clay, trace sand, trace organics - greyish black, moist, stiff		G175			232
1		CLAY - brown, moist, stiff - intermediate plasticity, silt inclusions, laminated		G176			231
2				G177			230
3		- greyish brown, trace oxidation below 3.05 m - silt lens (up to 50.80 mm thick dia.)		S178	7	- 2, 3, 4 blows/150 mm - SPT Recovery: 100%	229
4							
		- firm below 4.50 m		G179			228
5				G180			227
6		- grey below 5.79 m					
				S181	8	- 2, 3, 5 blows/150 mm - SPT Recovery: 100%	226
7		END OF TEST HOLE AT 6.55 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					225
8							224
9							223
10							222
11							221
12							220
13							219
14							218
15							

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 6.55 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S04
LOCATION: Plessis Road South Bound, West Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 231.85

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		TOPSOIL (Fill) - some clay, some organics, trace sand - dark brown, moist, soft					
1		SILT - some clay, trace organics - brown, moist, soft - low to intermediate plasticity		G182			231
2		CLAY - brown, moist, stiff - intermediate plasticity, laminated		G183			230
3		- greyish brown, trace oxidation below 2.74 m - silt lens (up to 50.80 mm thick dia.)		S184	9	- 2, 4, 5 blows/150 mm - SPT Recovery: 100%	229
4							228
5		- grey, soft to firm below 5.03 m		S185	9	- 2, 4, 5 blows/150 mm - SPT Recovery: 100%	227
6		- silt inclusions, trace sand below 5.79 m		G186			226
				S187	7	- 2, 3, 4 blows/150 mm - SPT Recovery: 100%	
7		END OF TEST HOLE AT 6.55 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					225
8							224
9							223
10							222
11							221
12							220
13							219
14							218
15							217

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 6.55 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S05
LOCATION: Plessis Road North Bound, East Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.23

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ▬ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
0		TOPSOIL - organic, trace roots - black, moist	■	G1		●	+		232
1		CLAY - trace sand, trace silt - brownish grey, moist, stiff to very stiff - intermediate plasticity	■	G2		●	+ △		231
2		- brown, wet, stiff, high plasticity below 1.8 m	■	G3		●	+ △		230
3			▯	T4		■ ●	+ × △		229
4			■	G5		●	+ △		228
			■	G6		●			
5		END OF TEST HOLE AT 4.57 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.							227
6									226
7									225
8									224
9									223
10									222
11									221
12									220
13									219
14									218
15									

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 4.57 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/9
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S07
LOCATION: Plessis Road South Bound, West Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.19

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		FILL - sandy, some gravel, some clay - brown, moist to dry, very stiff					232
1		SILT - some clay, trace sand - light grey to grey, moist, soft to firm - low plasticity					231
		CLAY - brown, moist to dry, stiff - intermediate plasticity		G38			
2		- trace oxidation, silt inclusions below 2.28 m					230
3		- greyish brown - grey, firm below 3.20 m		G39			229
4							228
				G40		Gravel: 0%, Sand: 0%, Silt: 12.4%, Clay: 87.6% - Tube Recovery: 100%	
5				T41			227
6		- moist to wet, soft below 6.01 m					226
7							225
				G42			
8				T43		- Tube Recovery: 100%	224
		END OF TEST HOLE AT 8.23 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					
9							223
10							222
11							221
12							220
13							219
14							218
15							

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 8.23 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S08
LOCATION: Plessis Road North Bound, East Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.21

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker | Dynamic Cone | SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100 | Total Unit Wt (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane | QU | Lab Vane | Pocket Pen. | Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	TOPSOIL - organic - black, moist					232
		GRAB	G22			
1	CLAY - dark grey, dry, hard - intermediate plasticity, dessicated - silt inclusions to 1.52 m					231
		GRAB	G23			
2						230
3	- grey, moist to wet, firm to stiff, high plasticity below 2.74 m	GRAB	G24			229
4						228
	soft to firm, wet below 4.26 m	GRAB	G25			
5		SHELBY TUBE	T26			227
6		GRAB	G26B			226
	END OF TEST HOLE AT 6.10 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					
7						225
8						224
9						223
10						222
11						221
12						220
13						219
14						218
15						

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 6.10 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/9/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S09
LOCATION: Plessis/Dugald Intersection, North East Corner Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.26

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		TOPSOIL - some clay, some organics, trace sand - dark brown, moist					232
1		CLAY - trace sand - brown, moist, stiff - intermediate plasticity - silt lens (25.4 mm thick) - greyish brown, silt inclusions, firm, trace oxidation below 1.52 m		G158			231
2							230
3				G159			
				S160		- 1, 2, 3 blows/150 mm - SPT Recovery: 100%	229
4		- grey, intermediate to high plasticity below 3.35 m					
				G161			228
5							227
6				S162		- 1, 2, 3 blows/150 mm - SPT Recovery: 100%	226
7							225
				G163			
8							224
9				S164		- 1, 2, 3 blows/150 mm - SPT Recovery: 100%	223
10		END OF TEST HOLE AT 9.60 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings and sealed with bentonite at ground surface upon completion.					222
11							221
12							220
13							219
14							218
15							

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

LOGGED BY: Sam O. | COMPLETION DEPTH: 9.60 m
REVIEWED BY: Omer Eissa | COMPLETION DATE: 12/10/27
PROJECT ENGINEER: Zeyad Shukri |

AECOM

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S10
LOCATION: Dugald Road West Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.07

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	ASPHALT (114 mm) SAND and GRAVEL Fill (Base) - brown, dry, loose					
1	CLAY (Fill) - trace sand - grey, moist to dry, very stiff - intermediate plasticity		G74			232
2	CLAY - brown, moist, stiff - intermediate plasticity		G75			231
3	- silt inclusions, laminated, trace oxidation below 2.13 m		T76		- Tube Recovery: 100%	230
4						229
5			S77		- 3,3,4, blows/150 mm - SPT Recovery: 100% Gravel: 0%, Sand: 0%, Silt: 32.5%, Clay: 67.5%	228
6	- brown to grey, soft to firm		G78			227
7						226
8	- grey, moist, intermediate to high plasticity below 7.62 m - silt lens (up to 25.4 mm thick)		T79		- Tube Recovery: 100%	225
9	END OF TEST HOLE AT 8.23 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.					224
10						223
11						222
12						221
13						220
14						219
15						

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 8.23 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S11
LOCATION: Dugald Road West Bound, North Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.65

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0		SAND and GRAVEL (Fill) - trace clay, trace organics - brown, dry, loose						232
1		CLAY - trace sand, trace gravel - grey, moist, stiff - intermediate plasticity		G80				231
2		- silt inclusions, silt lens (up to 51 mm thick) below 1.52 m						230
3				S81	7		- 2,3,4 blows/150 mm - SPT Recovery: 100%	229
4		- greyish brown, trace oxidation, laminated below 4.27 m						228
5				T82			- Tube Recovery: 100%	227
6				G83				226
7		END OF TEST HOLE AT 6.10 m IN CLAY Notes: 1. No seepage observed. 2. Test hole remained open to 4.57 m below ground surface after completion of drilling. 3. Test hole backfilled with auger cuttings upon completion.						225
8								224
9								223
10								222
11								221
12								220
13								219
14								218
15								

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 6.10 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/11/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S12
LOCATION: Dugald Road West Bound, North Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.99

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0		SAND and GRAVEL (Fill) - trace clay, trace organics - brown, moist, loose						
1		CLAY (Fill) - trace gravel, trace sand - grey, moist to dry, stiff to very stiff - intermediate plasticity		G71				232
2				G72				231
3		- brown, very stiff, intermediate to high plasticity - silt seam (0.61 m thick) - grey, wet, oxidized - low plasticity		T73				230
4		END OF TEST HOLE AT 3.35 m IN CLAY Notes: 1. Seepage observed at 0.30 m below ground surface. 2. No sloughing observed. 3. Test hole backfilled with auger cuttings and sealed with bentonite upon completion.						229
5								228
6								227
7								226
8								225
9								224
10								223
11								222
12								221
13								220
14								219
15								

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | ☐ Lab Vane ☐ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 3.35 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S13
LOCATION: Dugald Road East Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.99

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
0		ASPHALT (152 mm)							
		SAND and GRAVEL FILL (Base)							
		- brown, dry, loose							
1		- some organic, some sand, trace clay, trace gravel							232
		- dark brown, moist to dry							
		CLAY - trace sand, trace gravel		G59		●	△		
		- grey, moist to dry, stiff							
2		- intermediate plasticity							231
		- greyish brown, silt inclusions, trace oxidation below 1.52 m							
3				G60		●	△		230
		- trace sand, trace gravel							
		- grey, wet							
4		- silt lens (25.4 mm thick) below 3.05 m							229
				G61		●—●	+ △		
5				T62			+ △	- Tube Recovery: 100%	228
		- greyish brown, moist, firm below 5.18 m							
6									227
7									226
				G63		●	+ △		
8		END OF TEST HOLE AT 7.62 m IN CLAY							225
		Notes:							
9		1. No seepage observed.							224
		2. Test hole remained open to 3.66 m below ground surface after completion of drilling.							
10		3. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.							223
11									222
12									221
13									220
14									219
15									

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S14
LOCATION: Dugald Road West Bound, North Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.28

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		SAND and GRAVEL (Fill)- trace clay, trace organics - brown, dry, loose					233
1		CLAY (Fill) - trace sand - grey, moist to dry, stiff to very stiff - intermediate plasticity		G65			232
2		CLAY - brown, moist, stiff - intermediate plasticity, silt inclusions - silt lens (up to 0.61 m thick), trace oxidation below 2.29 m					231
3				G66			
				S67	7	- 3,3,4 blow/150 mm - SPT Recovery: 100%	230
4		- trace sand - grey, moist, firm to stiff below 3.35 m					229
5		- trace silt, greyish brown, laminated below 4.57 m		G68			228
6							
7		- grey - sand lenses (0.02 m thick) up to 7.16 m		T69		- Tube Recovery: 100%	227
				G70			226
8		END OF TEST HOLE AT 7.62 m IN CLAY Notes: 1. No seepage observed. 2. Test hole remained open to 3.66 m below ground surface after completion of drilling. 3. Test hole backfilled with auger cuttings upon completion.					225
9							224
10							223
11							222
12							221
13							220
14							219
15							

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S15
LOCATION: Plessis Road South Bound, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.35

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0		SAND and GRAVEL (Fill)- trace clay - brown, dry, loose - clayey, some organic						233
1		- dark brown, moist to dry, stiff to very stiff CLAY - grey to dark grey, moist to dry, stiff to very stiff - low to intermediate plasticity		G90				232
2		- brown, moist, stiff below 2.13 m - intermediate plasticity, silt inclusions		G91				231
3		- silt lenses (up to 76.2 mm thickness) to 3.50 m		S92	6		- 2,3,3 blows/150 mm - SPT Recovery: 100%	230
4								229
5		- firm below 4.57 m		T93			- Tube Recovery: 100%	228
6				G94				
		- grey, high plasticity below 6.10 m		S95	7		- 2,3,4 blows/150 mm - SPT Recovery: 100%	227
7		END OF TEST HOLE AT 6.55 m IN CLAY Notes: 1. No seepage observed. 2. Test hole remained open to 3.96 m below ground surface after completion of drilling. 3. Test hole backfilled with auger cuttings upon completion.						226
8								225
9								224
10								223
11								222
12								221
13								220
14								219
15								

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 6.55 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S16
LOCATION: Plessis Road South Bound, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.55

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		SAND and GRAVEL (Fill) - trace clay, trace organics - brown, moist, loose to compact					233
1		CLAY (Fill) - trace organics, trace sand - dark brown to black, moist, stiff - low to intermediate plasticity	■	G188			232
2		CLAY - trace sand - brown, moist, firm to stiff - intermediate plasticity, silt inclusions, laminated					231
3			■	G189			230
4		- silt lens (up to 76.20 mm thick) - trace oxidation below 3.51 m	■	G190			229
5		- grey, below 4.57 m	⊠	S191	7	- 2, 3, 4 blows/150 mm - SPT Recovery: 100%	228
6		END OF TEST HOLE AT 5.03 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					227
7							226
8							225
9							224
10							223
11							222
12							221
13							220
14							219
15							

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 5.03 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S17
LOCATION: Plessis Road South Bound, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.53

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker | Dynamic Cone | SPT (Standard Pen Test) (Blows/300mm); Total Unit Wt (kN/m³); Plastic MC Liquid

UNDRAINED SHEAR STRENGTH: Torvane | QU | Lab Vane | Pocket Pen. | Field Vane (kPa)

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		SAND and GRAVEL (Fill) - trace clay, trace organics - brown, moist, loose to compact					233
1		CLAY (Fill) - trace organics, trace sand - dark brown to black, moist, stiff - low to intermediate plasticity		G192			232
2		CLAY - brown, moist, stiff - intermediate plasticity, silt inclusions, laminated		G193			231
3		- greyish brown, firm below 3.05 m - sand and silt lens (up to 63.50 mm thick)		S194	4	- 1, 1, 3 blows/150 mm - SPT Recovery: 100%	230
4		- trace gravel below 3.96 m		G195			229
5		END OF TEST HOLE AT 4.57 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					228
6							227
7							226
8							225
9							224
10							223
11							222
12							221
13							220
14							219
15							

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 4.57 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S18
LOCATION: Plessis/Dugald Intersection, South West Corner Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.47

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0		TOPSOIL - some clay, some organics, trace sand - dark brown, moist to dry						232
1		SILT - some clay, trace sand - grey, moist, firm to stiff - low plasticity - trace oxidation	GRAB	G44				231
2		CLAY - brown, moist, firm to stiff - intermediate plasticity, silt inclusions						230
3			GRAB	G45				229
		- grey below 3.35 m	SHELBY TUBE	T46			- Tube Recovery: 100%	
4								228
			GRAB	G47				
5								227
6		- firm, intermediate to high plasticity below 5.79 m - trace sand, trace gravel - sand lenses (0.02 m thick) up to 7.16 m	SHELBY TUBE	T48			- Tube Recovery: 100%	226
7			GRAB	G49				225
			GRAB	G50				
8		END OF TEST HOLE AT 7.62 m IN CLAY Notes: 1. No seepage observed. 2. Test hole remained open to 4.57 m below ground surface after completion of drilling. 3. Test hole backfilled with auger cuttings upon completion.						224
9								223
10								222
11								221
12								220
13								219
14								218
15								

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | ☐ Lab Vane ☐ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

P:\60273041\000-CADD\02-SHEETS\B\60273041-FIG-00-0000-B-TestholeLocPlan.dwg

AECOM

DILLON CONSULTING

Winnipeg

PLESSIS UNDERPASS STUDY

0 37.5 75 150m

SCALE: 1:5000

Supplemental Testhole Location Plan

B-002

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B01**
LOCATION: Plessis East Abutment, N: 5528000.9 E: 641834.1		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.54

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		SAND and GRAVEL (Fill) - some silt, some clay - brown, moist, compact						233
1								
			■	G14		△		232
2		CLAY - trace gravel - brown, moist , firm - high plasticity						
			■	G15				231
3		SILT - trace gravel - grey, moist, soft - low to intermediate plasticity						230
4		CLAY - trace gravel - brown, moist , firm - high plasticity - greyish brown, silt inclusions below 4.6 m						
			■	G16		△		229
5								228
6			■	G17		△		
7		- grey, soft below 7.0 m						227
			■	G18		△		226
8								225
9			■	G19		△		
10								224
			■	G20		△		223
11								222
12			■	G21		△		
13								221
			■	G22		△		220
14								219
15			■	G23				218
16								
			■	G24				217
17		- gravelly below 16.8 m						216
18								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ❁ Field Vane ❁ (kPa) 50 100 150 200

LOG OF TEST HOLE SUPPLEMENTAL INVESTIGATION-BRIDGE TEST HOLE LOGS-PRU-60273041.GPJ UMA WINN.GDT 8/7/13

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.69 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 7/30/13
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B01**
LOCATION: Plessis East Abutment, N: 5528000.9 E: 641834.1		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.54

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
18		LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - close to moderately close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous - fractured to 20.1 m (Elev. 213.4) below ground surface - competent rock (RQD > 70%) below 20.1 m		G25 C1			C1 RQD: 22%Core Recovery: 64%	215
19								
				C2			C2 RQD: 51%Core Recovery: 88%	214
20								
								213
21				C3			C3 RQD: 79%Core Recovery: 92%	
								212
22								
				C4			C4 RQD: 79%Core Recovery: 94%	211
23								
								210
24				C5			C5 RQD: 93%Core Recovery: 98%	
								209
25		END OF TEST HOLE AT 24.69 m IN BEDROCK Notes: 1. Power auger refusal at 18.05 m below ground surface on BEDROCK. 2. HQ coring below 18.05 m. 3. Test hole sealed with bentonite up to 3.05 m and grouted from 3.05 to ground surface.						208
26								
								207
27								
								206
28								
								205
29								
								204
30								
								203
31								
								202
32								
								201
33								
								200
34								
								199
35								
								198
36								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

LOG OF TEST HOLE SUPPLEMENTAL INVESTIGATION-BRIDGE TEST HOLE LOGS-PRU-60273041.GPJ UMA WINN.GDT 8/7/13

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.69 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 7/30/13
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B02**
LOCATION: Plessis North Pier, N: 5527999.0 E: 641663.6		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 232.96

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0		ASPHALT (300 mm)							
		SAND and GRAVEL (Base) - light brown, dry, compact - medium to coarse grained							
1		CLAY (Fill) - some gravel, some sand, trace organics - brown, moist, firm - Intermediate plasticity		G1			+		232
2									231
3				G2			+		230
		ORGANICS - wood chips - brown to black, moist to wet - hydrocarbon (diesel fuel)		G3					
4									229
				G4					
5		CLAY - greyish brown, moist, firm - high plasticity							228
6				G5					227
7									226
				G6					
8		- grey, trace silt inclusions, soft below 7.62 m							225
9				G7					224
10									223
				G8					
11		- trace gravel below 11 m							222
12				G9					221
13									220
				G10					
14									219
15				G11					218
16				G12					217
17									216
				G13					
18		- silty, wet, some gravel							

LOG OF TEST HOLE SUPPLEMENTAL INVESTIGATION-BRIDGE TEST HOLE LOGS-PRU-60273041.GPJ UMA WINN.GDT 8/7/13

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 26.21 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 7/31/13
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B02**
LOCATION: Plessis North Pier, N: 5527999.0 E: 641663.6		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 232.96

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
18		- cobbly, some boulders below 17.7 m							
19		LIMESTONE (Bedrock) - light grey, core angle: 90 degrees - fine to medium grained, no foliation - close to moderately close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous, vuggy to 21.6 m - fractured to 21.6 m (Elev. 211.4) below ground surface		C1				C1 RQD: 40%Core Recovery: 70%	214
20									213
21				C2				C2 RQD: 48%Core Recovery: 93%	212
22		- competent rock (RQD > 70%) below 21.6 m - mottled yellow to 21.95 m							211
23				C3				C3 RQD: 75%Core Recovery: 92%	210
24				C4				C4 RQD: 81%Core Recovery: 90%	209
25									208
26				C5				C5 RQD: 85%Core Recovery: 96%	207
27		END OF TEST HOLE AT 26.21 m IN BEDROCK Notes: 1. Power auger refusal at 18.5 m below ground surface on BEDROCK. 2. HQ coring below 18.5 m. 3. Seepage observed at 17.5 m below ground surface. 4. Test hole grouted up to 18.3 m and sealed with bentonite to ground surface.							206
28									205
29									204
30									203
31									202
32									201
33									200
34									199
35									198
36									

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 26.21 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 7/31/13
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

LOG OF TEST HOLE SUPPLEMENTAL INVESTIGATION-BRIDGE TEST HOLE LOGS-PRU-60273041.GPJ UMA WINN.GDT 8/7/13

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B03**
LOCATION: Plessis South Pier, N: 5527960.9 E: 641831.2		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.64

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		ASPHALT (381 mm)						233
		SAND and GRAVEL (Base) - brown, moist to dry, compact						
1		CLAY (Fill) - some silt, some sand, trace gravel, trace organics - brown, moist, soft to firm		G26				232
2		CLAY - silty - brown, dry, soft to firm - high plasticity, silt inclusions						231
3				G27				230
4								229
		- greyish brown below 4.6 m		G28				
5								228
6		- grey, soft, trace gravel below 6.1 m		G29				227
7								226
				G30				
8								225
9								224
10								223
				G31				
11								222
12				G32				221
13								220
				G33				
14								219
15				G34				218
16								217
				G35				
17		- wet below 16.8 m						216
18								

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200

LOG OF TEST HOLE SUPPLEMENTAL INVESTIGATION-BRIDGE TEST HOLE LOGS-PRU-60273041.GPJ UMA WINN.GDT 8/7/13

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.69 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 8/1/13
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B03**
LOCATION: Plessis South Pier, N: 5527960.9 E: 641831.2		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.64

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
18				G36					215
19				G37					
20		LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - close to moderately close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous, vuggy - fractured to 21.6 m (Elev. 212.0) below ground surface		C1				C1 RQD: 15%Core Recovery: 45%	214
21				C2				C2 RQD: 62%Core Recovery: 97%	213
22		- competent rock (RQD > 70%) below 21.6 m							212
23				C3				C3 RQD: 78%Core Recovery: 99%	211
24				C4				C4 RQD: 83%Core Recovery: 97%	210
25		END OF TEST HOLE AT 24.69 m IN BEDROCK Notes: 1. Power auger refusal at 19.2 m below ground surface on BEDROCK. 2. HQ coring below 19.2 m. 3. Seepage observed at 16.8 m below ground surface. 4. Test hole sealed with bentonite up to 19.8 m and grouted from 19.8 m to ground surface.							209
26									208
27									207
28									206
29									205
30									204
31									203
32									202
33									201
34									200
35									199
36									198

LOG OF TEST HOLE SUPPLEMENTAL INVESTIGATION-BRIDGE TEST HOLE LOGS-PRU-60273041.GPJ UMA WINN.GDT 8/7/13

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.69 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 8/1/13
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B04**
LOCATION: Plessis West Abutment, N: 5527982.0 E: 641811.9		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.00

SAMPLE TYPE ■ GRAB ▯ SHELBY TUBE ☒ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0		SAND and GRAVEL (Fill) - trace organics - brown, dry to moist, compact							233
1		CLAY (Fill) - some sand, some gravel, trace organics - dark brown to brown, moist, firm - intermediate plasticity		G38			△		232
2									231
3		SILT - light brown, moist, soft - low to intermediate plasticity CLAY - brown, moist, firm - high plasticity - silty to 3.4 m		G39			△		230
4									229
5		- greyish brown below 4.6 m - grey below 5.2 m		G40			△		228
6				G41			△		227
7									226
8				G42					225
9		- silt inclusions, moist to wet below 9.1 m		G43					224
10									223
11		- moist below 10.7 m		G44					222
12				G45					221
13									220
14		- moist to wet below 13.7 m		G46					219
15				G47					218
16				G48					217
17				G49					216
18				G50					

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 30.78 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 8/2/13
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

LOG OF TEST HOLE SUPPLEMENTAL INVESTIGATION-BRIDGE TEST HOLE LOGS-PRU-60273041.GPJ UMA WINN.GDT 8/7/13

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B04**
LOCATION: Plessis West Abutment, N: 5527982.0 E: 641811.9		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.00

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▨ SPLIT SPOON ▬ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ☢ Field Vane ☢ (kPa) 50 100 150 200	COMMENTS	ELEVATION
18									
19		LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - close to moderately close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous - fractured to 20.1 m (Elev. 212.9) below ground surface - competent rock below 20.1 m - mottled yellow to 21.8 m		G51					214
20				C1				C1 RQD: 56%Core Recovery: 75%	213
21				C2				C2 RQD: 82%Core Recovery: 96%	212
22									211
23				C3				C3 RQD: 92%Core Recovery: 98%	210
24				C4				C4 RQD: 78%Core Recovery: 95%	209
25									208
26		- ripple marks to 26.4 m		C5				C5 RQD: 64%Core Recovery: 75%	207
27				C6				C6 RQD: 80%Core Recovery: 98%	206
28									205
29				C7				C7 RQD: 81%Core Recovery: 99%	204
30				C8				C8 RQD: 94%Core Recovery: 99%	203
31		END OF TEST HOLE AT 30.78 m IN BEDROCK Notes: 1. Power auger refusal at 18.9 m below ground surface on BEDROCK. 2. HQ coring below 18.9 m. 3. Seepage observed at 15.24 m below ground surface. 4. sloughing observed at 19.8 m below ground surface in rock. 5. Test hole grouted up to 19.8 m and sealed with bentonite from 19.8 m to ground surface.							202
32									201
33									200
34									199
35									198
36									

AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 30.78 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 8/2/13
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

LOG OF TEST HOLE SUPPLEMENTAL INVESTIGATION-BRIDGE TEST HOLE LOGS-PRU-60273041.GPJ UMA WINN.GDT 8/7/13

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Memorandum

To	Eric Loewen, P.Eng	Page	1
CC			
Subject	Summary of Test Caisson Investigation - Plessis Road Underpass Project		
From	Zeyad Shukri		
Date	September 5, 2013	Project Number	60273041 (404.19.1.1)

A test caisson was advanced to verify the design assumptions, examine the feasibility of construction and assist in the selection of adequate equipment and proper construction practices. The drilling took place during the period between July 5th and July 9th, 2013. The test caisson was advanced on the west shoulder of Plessis Road south of the existing CN railway right-of-way as shown in Figure 1, Appendix A. Drilling was carried out by Subterranean (Manitoba) Ltd. using a track-mounted Soilmec SR-65 piling rig equipped with a 940 mm diameter flight auger and 760 mm core barrel. Due to the size and heavy weight of the drill rig, a pad was constructed using granular rock fill to support the weight of the equipment. The test caisson was advanced through the overburden with augers to practical refusal near the bedrock surface at a depth of 17.8 m below surface or approximate elevation 214.7 m. The core barrel was then employed to core into the bedrock to a termination depth of 78.5 feet (23.9 m) below ground surface or approximate elevation of 208.6 m.

The caisson was sleeved with an outer safety casing 4 feet (1.2 m) in diameter. The outer safety casing extended from ground surface to a depth of 25 feet (7.6 m) below surface. An inner sleeve was inserted into the test caisson to protect the walls of the test hole at deeper depths. The inner sleeve was 36 inch (0.91 m) in diameter and extended into the weathered zone of the bedrock to a depth of 69 feet (21 m) below surface. The rock socket below depth 69 feet (21 m) was advanced without the use of a sleeve or casing to support the side walls of the caisson.

The soil stratigraphy at the test caisson location consisted of a thin layer of topsoil underlain by a thick lacustrine clay deposit extending to approximately 17.8 m below ground surface. The clay was firm to soft in consistency and of high plasticity. Limestone bedrock was encountered at 17.8 m below ground surface. No noticeable till layer was observed between the clay deposit and the limestone bedrock. The top 3.8 m of the bedrock was weathered (poor quality) and consisted of highly permeable rubble and fractured rock. Competent bedrock (fair quality) was encountered at a depth of 21.6 m below ground surface or approximate elevation of 210.9 m. A detailed log showing the soil stratums encountered is provided in Appendix A. Photos taken during the drilling are attached in Appendix B.

Very significant water inflow in the test caisson was observed from the weathered bedrock zone. The water in the test caisson stabilized at 10.6 m below the ground surface upon completion of drilling (i.e. elevation of 221.9 m). The test caisson was backfilled with 30 MPa concrete from termination depth up to 11.5 m below ground surface. Stabilized fill was used to backfill the hole from the depth of 11.5 m up to ground surface.

Caisson advancement was completed in approximately 12 hours of drilling. Additional time was required for site preparation including a granular pad placement at the caisson location, carrying out a pumping test post drilling and backfilling the caisson with concrete and stabilized fill.

For production caissons, the uncased socket length should be a minimum of one socket diameter within sound, competent bedrock. The minimum shaft diameter of the rock socket should not be less than 760 mm and the maximum diameter should be selected to suit the locally available coring equipment. The rock sockets should not be spaced closer than 2.5 socket diameters, centre to centre.

To summarize, based on observations from the test caisson drilling, the following practices are recommended for the installation of the bridge caissons:

- Sleeving from ground surface to the bedrock contact as a minimum, and sufficiently into the significantly weathered bedrock as required to maintain a stable excavation.

- Due to difficulties noted when retrieving the rock cores from the bottom of the caisson, a special core barrel was necessary to crush the rock core in the hole prior to retrieving the core to surface making it difficult to evaluate the quality of the cores. The special core barrel may be needed to crush the rock cores during construction.

- Video inspection of the test caisson is recommended to confirm the quality of the rock socket due to the encountered difficulties of evaluating the quality of the recovered cores in the test caisson. However, if pumping of groundwater to inspect the socket would tend to destablilize the excavation due to pumping of fine sand through the fractured zone, an alternate method to retrieve the intact portions of the socket core should be utilized. This should be combined with maintaining an excess water head inside the inner casing and probing the base of the socket with a weighted steel probe bar after cleaning and immediately before tremie concrete placement.

- The Soilmec SR-65 or equivalent drill rig is capable of drilling deep caissons to the required depth in a time-efficient manner.

- Tremie placement of concrete will be required due to the large amount of water seepage from the bedrock aquifer.

- The depth to competent bedrock is expected to vary across the site and it should be recognized that the test holes advanced at the bridge abutment and pier locations are more representative of expected ground conditions at those locations.

The geotechnical report dated March 2013 should be consulted for additional information and full geotechnical recommendations. We trust the information provided herein is sufficient for your purposes.

Please don't hesitate to contact me should you have any questions or concerns.

Submitted by:

Zeyad Shukri, M.Sc
Senior Geotechnical Engineer

Elliott E. Drumright

Elliott E. Drumright, P.E.
Associate Engineer

Reviewed by:

Patrick C. Chang, P.E., P.Eng.
Senior Project Engineer

Appendix A

Figure 1 / Logs

AECOM

DILLON CONSULTING

Winnipeg

PLESSIS UNDERPASS STUDY

Testhole Location Plan

0 37.5 75 150m

SCALE: 1:5000

B-002

P:\60273041\000-CADD\02-SHEETS\B\60273041-20-SHT-B-002_RX.dwg

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

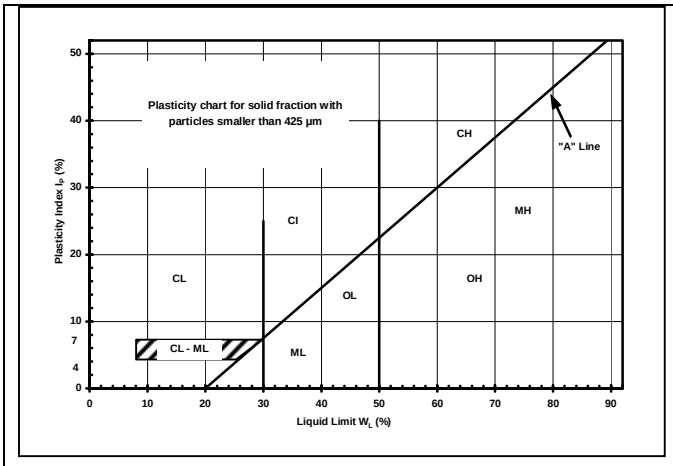
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				AECOM Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		AECOM
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Su (kPa)	**CONSISTENCY**
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	**COMPACTNESS**
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: Test Caisson
LOCATION: Plessis South Bound/CN Rail Intersection, West of Sidewalk		PROJECT NO.: 60273041
CONTRACTOR: Subterranean (Manitoba) LTD.	METHOD: Track Mounted Soilmec SR-65	ELEVATION (m): 232.50

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
0			CLAY - brown, moist, stiff - high plasticity, silt lenses							232
1										231
2										230
3										229
4			- greyish brown below 3.66 m							228
5										227
6			- grey, soft to firm below 5.49 m							226
7										225
8										224
9										223
10										222
11										221
12										220
13										219
14										218
15										

LOG OF TEST HOLE TEST CAISSON LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/17

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 23.93 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 13/7/9
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: Test Caisson
LOCATION: Plessis South Bound/CN Rail Intersection, West of Sidewalk		PROJECT NO.: 60273041
CONTRACTOR: Subterranean (Manitoba) LTD.	METHOD: Track Mounted Soilmec SR-65	ELEVATION (m): 232.50

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
15									217
16									216
17			- wet below 16.76 m - fractured rock, cobbles and boulders below 17.53 m						215
18			LIMESTONE (Bedrock) - weathered - light grey to white - fine to medium grained, no foliations - R2, weak strength rock - suspected cavity (< 0.5 m) - fractured to 20.9 m below ground surface						214
19									213
20									212
21									211
22			- competent rock at 21.6 m below ground surface, R3 (medium strong) - light grey to white - fine to medium grained, no foliations - Rough planar joints						210
23									209
24			END OF TEST CAISSON AT 23.9 m IN BEDROCK Notes: 1. bedrock encounterd at 17.8 m below ground surface. 2. Seepage observed at 16.7 m below ground surface, static water level at 10.7 m below ground surface. 3. 0.76 m diameter coring below 17.8 m. 4. Test caisson backfilled with concrete up to 11.4 m, plugged with stabilized fill from 11.4 to ground surface.						208
25									207
26									206
27									205
28									204
29									203
30									

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | ☐ Lab Vane ☐ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

LOG OF TEST HOLE TEST CAISSON LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/17

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 23.93 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 13/7/9
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Memorandum

To	Bob Paetsch	Page	1
CC	Brent Knezacek		
Subject	CN Railway Detour Stability Analysis		
From	Omer Eissa		
Date	April 22th, 2013	Project Number	60273041

Introduction

AECOM was retained by the City of Winnipeg to provide preliminary design including geotechnical engineering services for the proposed Plessis Road Underpass in Winnipeg, Manitoba. As part of the works, the CN railway tracks crossing Plessis Road will have to be relocated south of the existing crossing for the duration of the bridge construction. The location of the railway detour (shoofly) in relation to the underpass and bridge structure is shown in the drawing labelled Draft CR-01 attached in Appendix A. This memorandum summarizes the stability analysis results for the proposed CN railway detour embankment at the location of the bridge construction.

The proposed CN railway embankment is seven (7) meters wide at the top of the embankment and consists of railway ties over a ballast layer of 0.47 m thickness. A sub-ballast layer lies under the ballast layer and extends from a thickness of 0.3 m at the centre of the embankment with a cross fall of 1:40 towards the edges of the embankment. The shoofly is expected to perform as a temporary detour for the duration of the bridge construction. The shoofly embankment is located approximately 17 m measured from the centreline of the south existing CN track to the centreline of the north detour track. Proposed shoofly plan and cross-sections are shown in Figure CS-16 attached in Appendix A.

Stability Modelling

The proposed shoofly embankment shown in Figure CS-16 was modelled using the soil strength parameters presented in Table -01 below.

Table 01: Strength Parameters for Slope Stability Analysis

Material	Unit Weight (kN/m)	Cohesion (kPa)	Angle of Internal Friction (°)	Modulus of Elasticity (kPa)	Poisson's Ratio
Ballast	20	0	40	115,000	0.33
Sub-ballast	20	0	40	115,000	0.33
Granular Fill	19	0	38	100,000	0.33
Native Clay	17	5	17	6000	0.4

The analysis was conducted using the Sigma/W and Slope/W Geo Studio software. A stepped analysis showing each stage of the construction was modelled in Sigma/W. The purpose of a stepped or (treed) analysis is to import the soil stress state from the initial in-situ model and recalculate the soil stress redistribution and pore-water response for each construction stage. The embankment loading was modelled according to the CN memo dated 2011, November 22, titled "Design Criteria for the Shoring Walls submitted by the Consultant". The surcharge due to the Cooper-E90 loading as per AREMA-2010 was modelled as a 90 kips axle load at 5 ft spacing over an 8-ft-long tie for a resulting surcharge of approximately 110 kPa. A Slope/W stability analysis was conducted for the critical stage of construction where the detour embankment is loaded with Cooper E90 train loads nearby the bridge excavation (Case-05e). Table-02 below lists and describes the cases of stability modelling representing the stages of embankment and bridge construction.

Water conditions were modelled in the in-situ Sigma/W model based on the site groundwater monitoring results. The groundwater table measured on site between December 2012, to April 2013 fluctuated between elevations 226.5 to 228.2 m. Groundwater was modelled in the in-situ model at elevation 229 m.

Table 02: List and Description of Modelling Stages

Analysis ID	Analysis Type	Construction Condition
Case-01a	Sigma/W- In Situ	Initial Condition
Case-02b	Sigma/W- Stress Redistribution	Detour Excavation
Case-03c	Sigma/W- Stress Redistribution	Embankment fill Placement
Case-04d	Sigma/W- Stress Redistribution	Bridge Excavation + Embankment Loading
Case- 05e	Slope/W – Stress Imported Analysis	Slope Stability with imported stress conditions from Case-04d
Case-02	Slope/W – Morgenstern-Price Analysis	Slope Stability without imported stress conditions

Analysis results are presented graphically in Figures 01- 06 attached in Appendix A.

Analysis Results

An adequate factor of safety (FS) against slope instability must be achieved for short term and long term conditions of the detour embankment. A design factor of safety of at least 1.5 is considered satisfactory for the long term condition of an unloaded embankment. For the case of the loaded embankment with one or two train loads, a factor of safety of at least 1.3 is considered adequate.

The embankment as shown in Figure CS16 did not meet the design target factors of safety against slope instability. A well-compacted granular layer of 1.0 m thickness was therefore incorporated into the embankment between the sub-ballast and subgrade layers. The granular fill can be regarded as an extension of the sub-ballast layer with respect to material type and compaction criteria. The purpose of this layer is to replace weaker subgrade material as well as function as a pad to distribute the embankment load onto a larger area of the subgrade. Factors of safety for the embankment after extending the sub-ballast layer, i.e.: inclusion of the granular layer, are presented in Table-03. Figures outlining individual analysis results are attached in Appendix A.

Table-03 Factor of Safety Against Slope Instability

Case	Loading Conditions	Computed F.S	Design F.S
Case-05e	North track loaded	1.36	1.3
	South track loaded	1.63	1.3
	Both tracks loaded	1.35	1.3
	No train loads	1.86	1.5
Case-02	North track loaded	1.31	1.3
	South track loaded	1.59	1.3
	Both tracks loaded	1.31	1.3
	No train loads	1.97	1.5

We trust the information provided is sufficient for your purposes. Please don't hesitate to contact the undersigned should you have any questions or concerns.

Prepared by,

Omer Eissa, P.Eng
Geotechnical Engineer

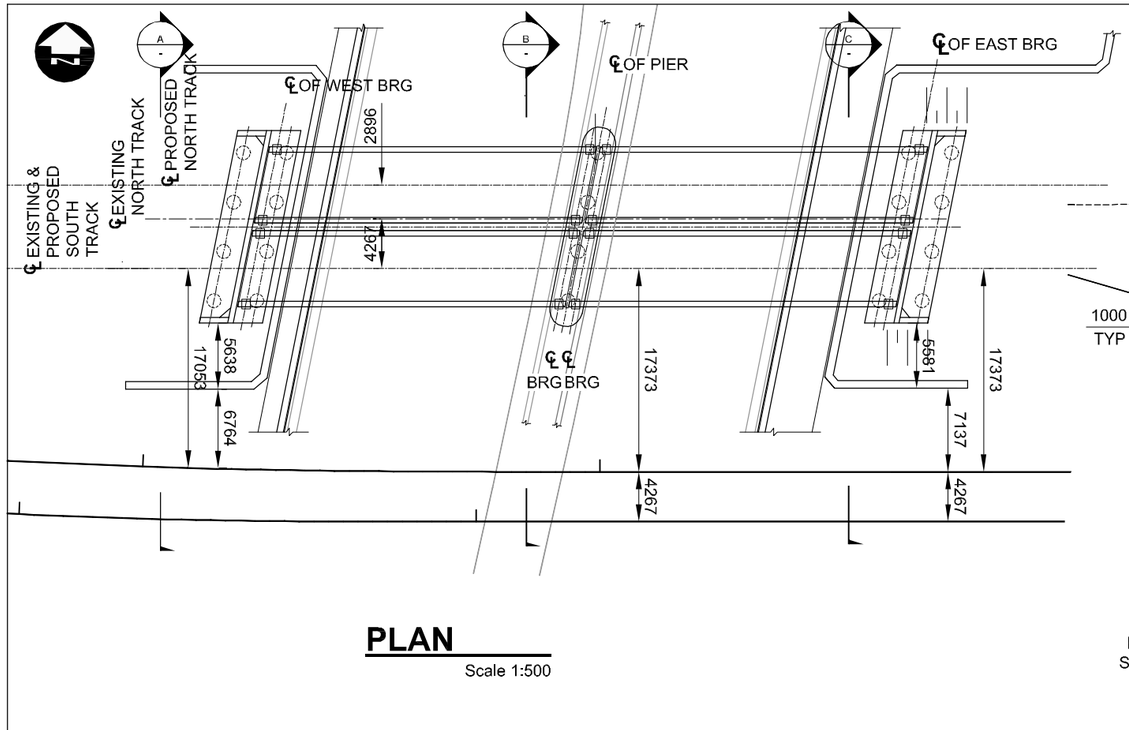
Reviewed by,

Zeyad Shukri
Senior Geotechnical Engineer

AECOM

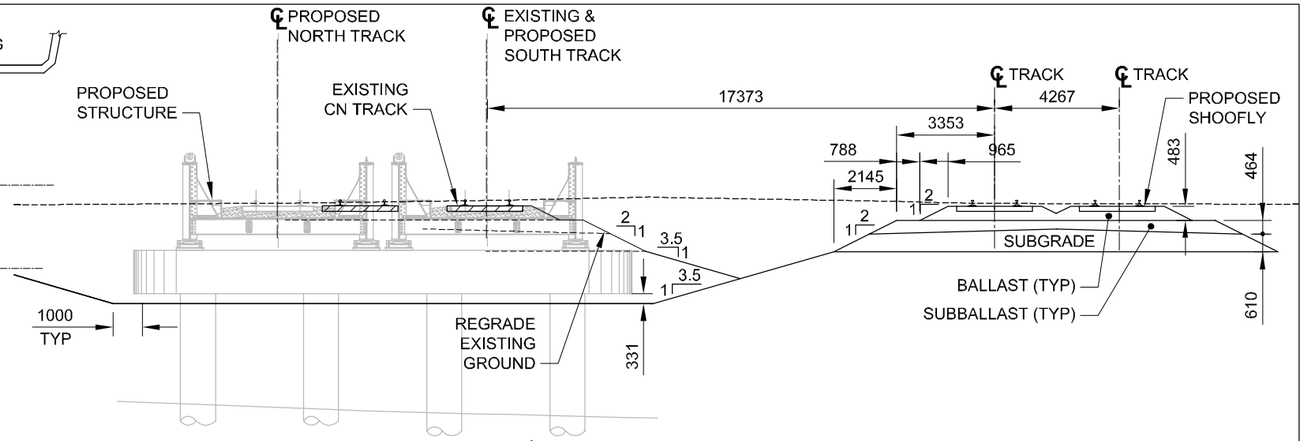
Appendix A

Figures



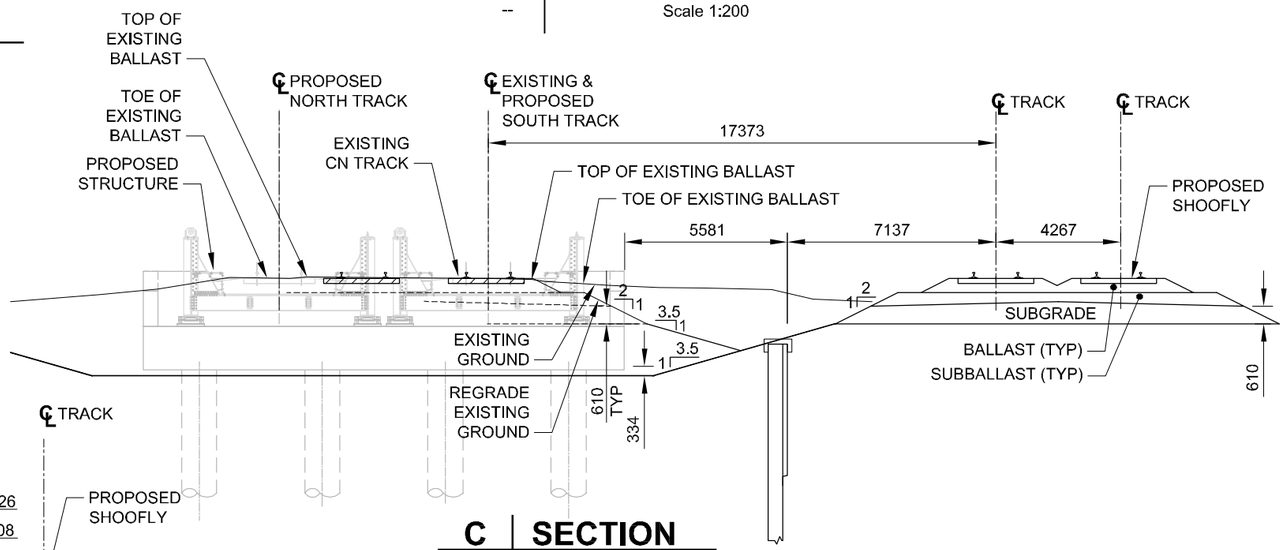
PLAN

Scale 1:500



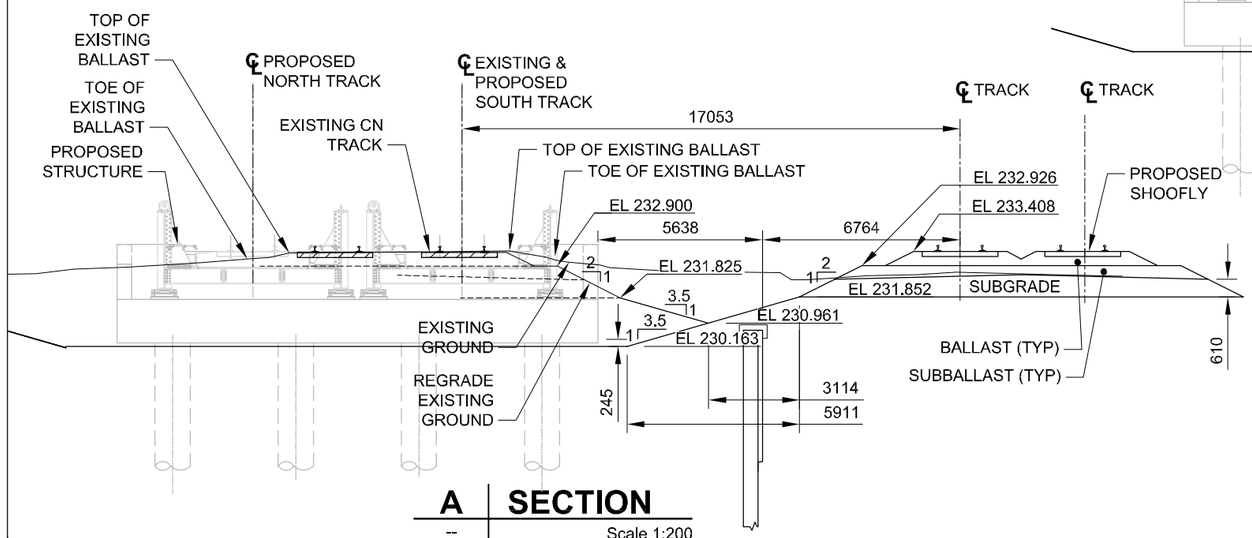
B | SECTION

-- Scale 1:200



C | SECTION

-- Scale 1:200



A | SECTION

-- Scale 1:200

P:\60273041\000-CADD\02-SHEETS\CS\02 Concept\60273041-20-SHE-CS-0016.dwg

AECOM

DILLON CONSULTING

Winnipeg

PLESSIS UNDERPASS STUDY

2 SPAN SINGLE TRACK TPG OPTION
SOUTH TRACK ALIGNMENT

FIGURE CS16

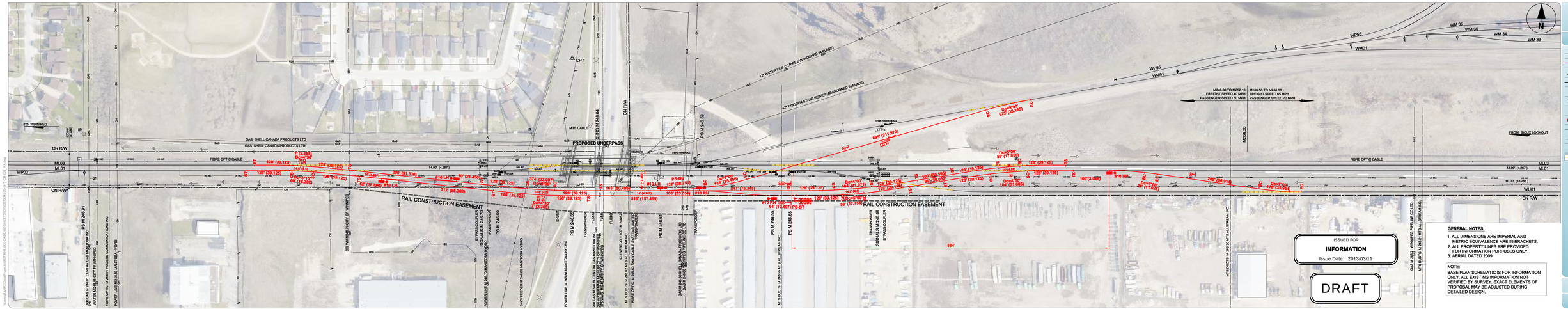

PROPOSED UNDERPASS
RAIL CONSTRUCTION EASEMENT
RAIL CONSTRUCTION EASEMENT
CN R/W
CN R/W
CN R/W
CN R/W
CP 1
MTS CABLE
FIBRE OPTIC CABLE
FIBRE OPTIC CABLE
GAS SHELL CANADA PRODUCTS LTD
GAS SHELL CANADA PRODUCTS LTD
12" WATER LINE (1) PIPE (ABANDONED IN PLACE)
42" WOODEN STAVE SEWER (ABANDONED IN PLACE)
TO WINNIPEG
FROM SIOUX LOOKOUT
WP03
WU01
ML03
ML01
WP55
WP56
WM01
WM 36
WM 35
WM 34
WM 33
M246.30 TO M252.10
FREIGHT SPEED 40 MPH
PASSENGER SPEED 50 MPH
M183.50 TO M246.30
FREIGHT SPEED 65 MPH
PASSENGER SPEED 70 MPH
M254.30
884'
ISSUED FOR
INFORMATION
Issue Date: 2013/03/11
DRAFT
GENERAL NOTES:
1. ALL DIMENSIONS ARE IMPERIAL AND METRIC EQUIVALENCE ARE IN BRACKETS.
2. ALL PROPERTY LINES ARE PROVIDED FOR INFORMATION PURPOSES ONLY.
3. AERIAL DATED 2009.
NOTE:
BASE PLAN SCHEMATIC IS FOR INFORMATION ONLY. ALL EXISTING INFORMATION NOT VERIFIED BY SURVEY. EXACT ELEMENTS OF PROPOSAL MAY BE ADJUSTED DURING DETAILED DESIGN.
Wimpey
PLESSIS ROAD UNDERPASS STUDY
TRACK SHOOFLY SOUTH OPTION
CROSSING PLANKS
CENTERLINE PROP TRACK
CP 000 CONTROL POINT
RAILWAY R/W
EXISTING DITCH FLOW ARROW
EXISTING CULVERT
POWER SWITCH
PROPOSED POWER SWITCH
OVERHEAD POWER LINE WITH POLE
OVERHEAD CNT LINE WITH POLE
BLOWER
RAIL REMOVE /REALIGN
AECOM
DILLON CONSULTING
0 7.5 15 30m
SCALE: 1:1000
DRAFT CR-001

Figure 1:

Name: Sigma - Insitu
Kind: SIGMA/W
Method: Insitu

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Insitu Ko: 0.66666667
Unit Weight: 17 kN/m³

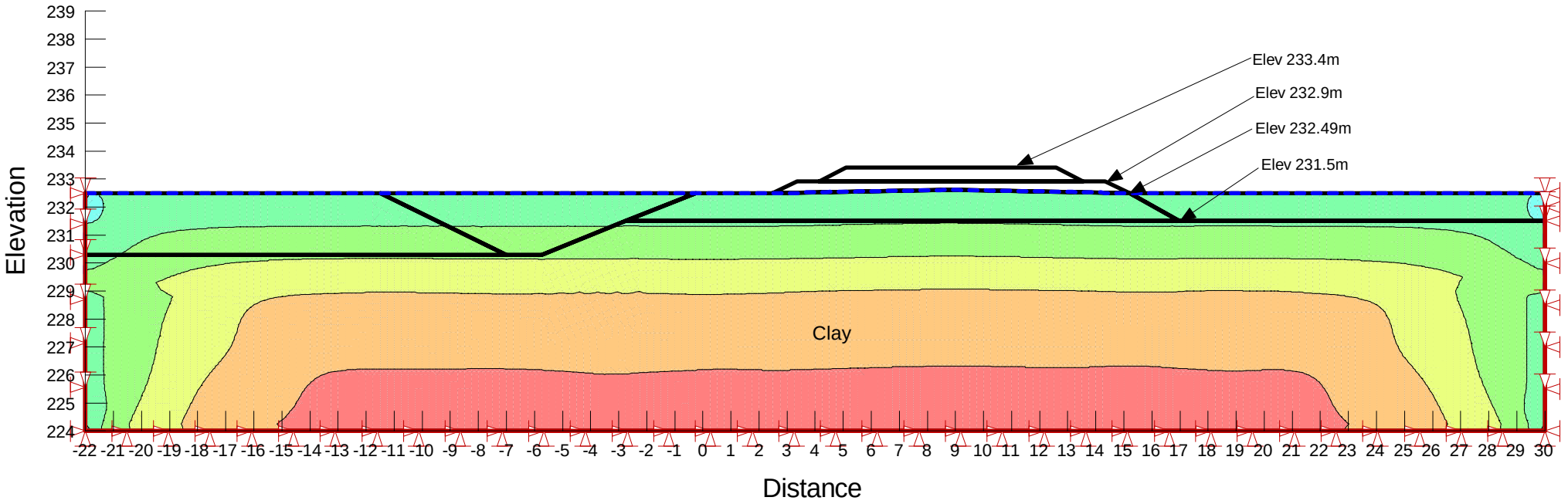


Figure 2:

Name: ShooFly Excavation
Kind: SIGMA/W
Method: Load/Deformation

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

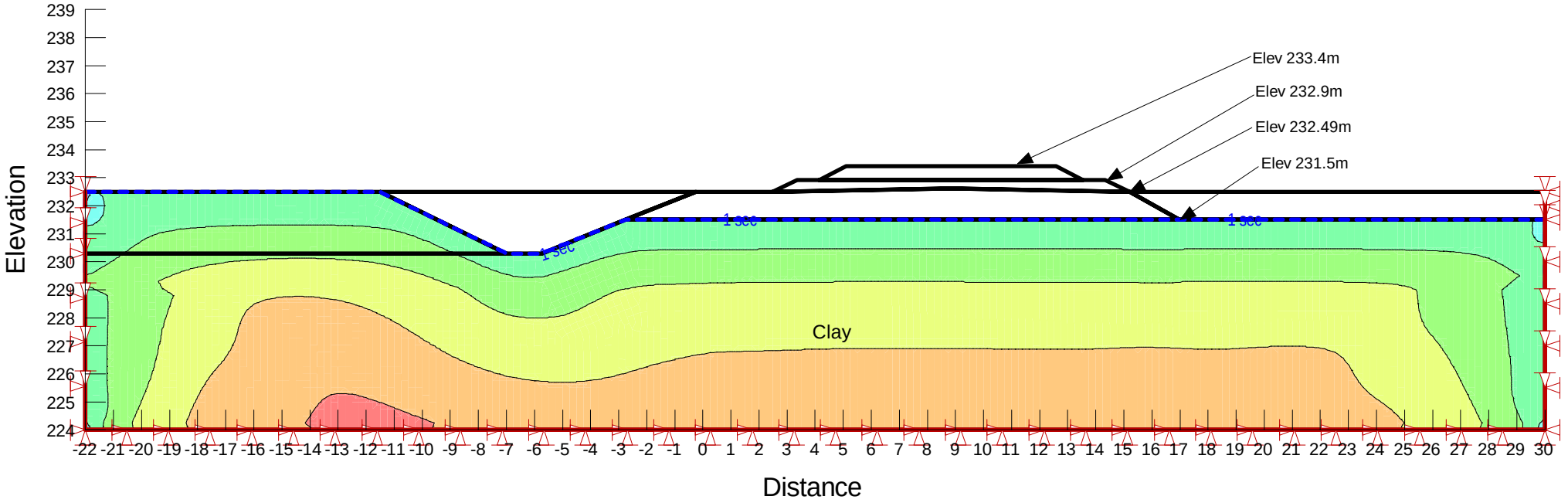


Figure 3:

Name: Embankment Fill
Kind: SIGMA/W
Method: Load/Deformation

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.334
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Unit Weight: 19 kN/m³

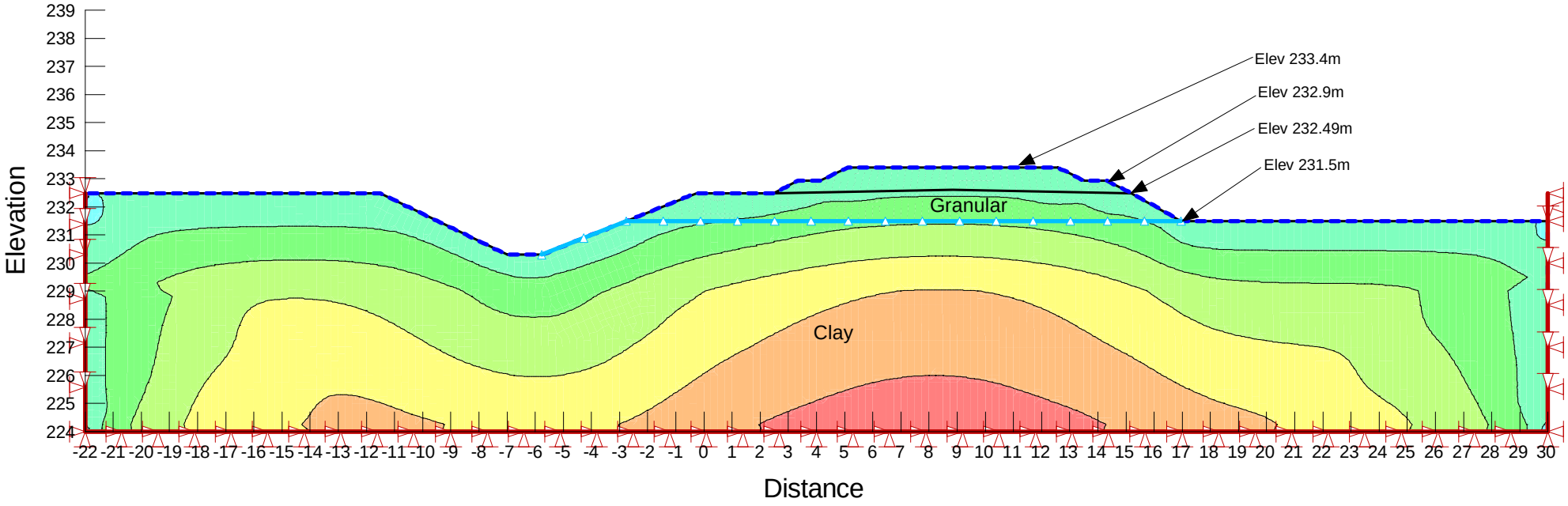


Figure 4:
Name: Bridge Excavation and Surcharge Loading
Kind: SIGMA/W
Method: Load/Deformation
Load Condition: Two Surcharge loads of 110 kPa

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.334
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Unit Weight: 19 kN/m³

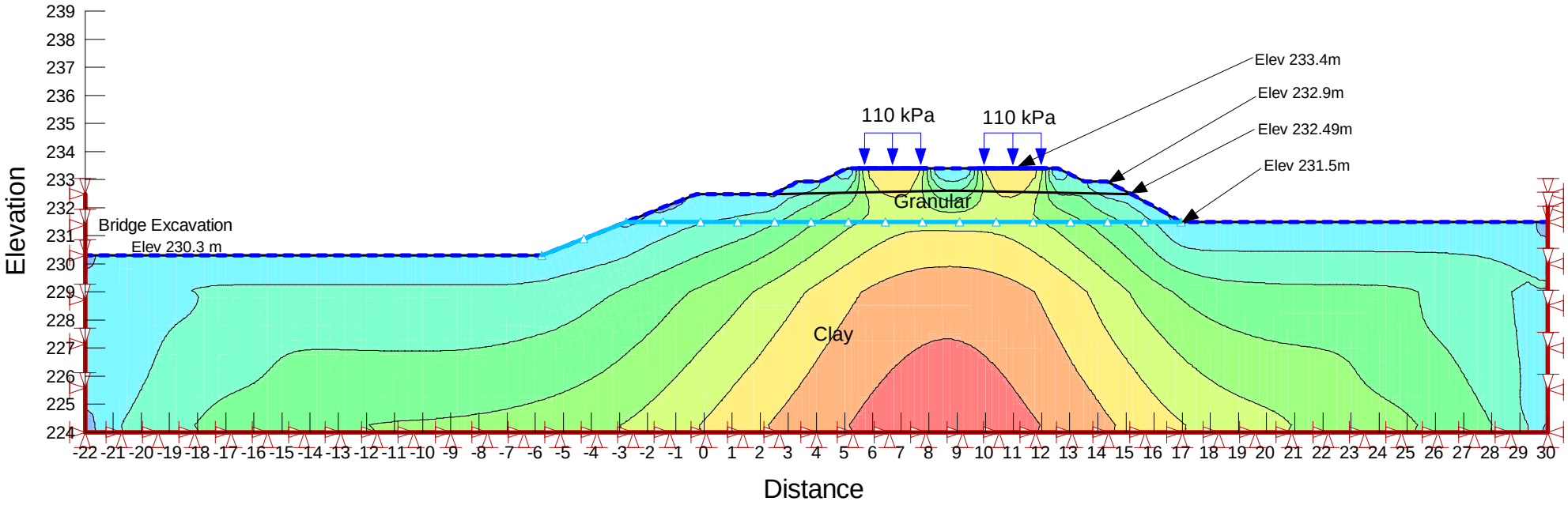


Figure 5:
Name: Bridge Excavation Stability Analysis
Kind: SLOPE/W
Method: SIGMA/W Stress
Loading Condition: Surcharge loads of 110 kPa on each Track

Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 17 °
Phi-B: 0 °

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °

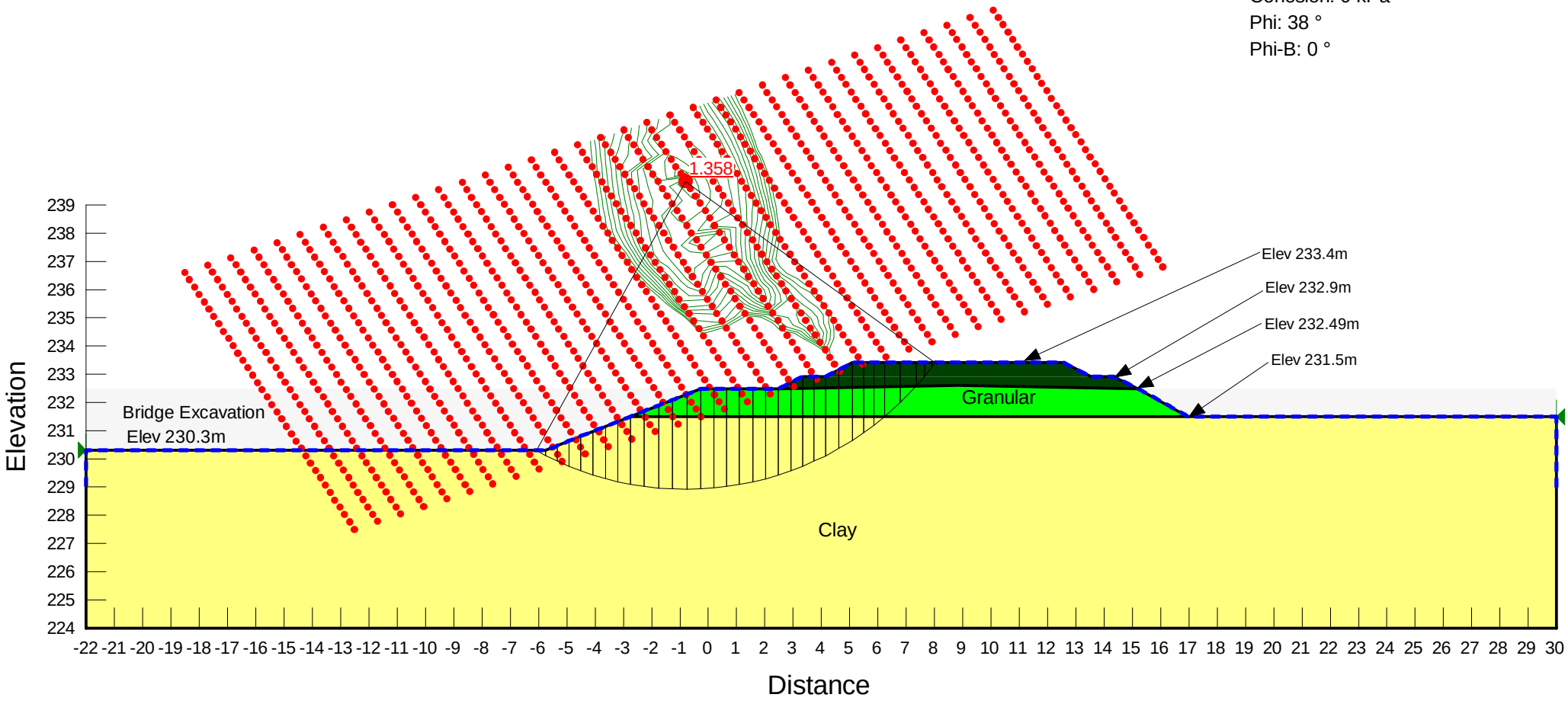
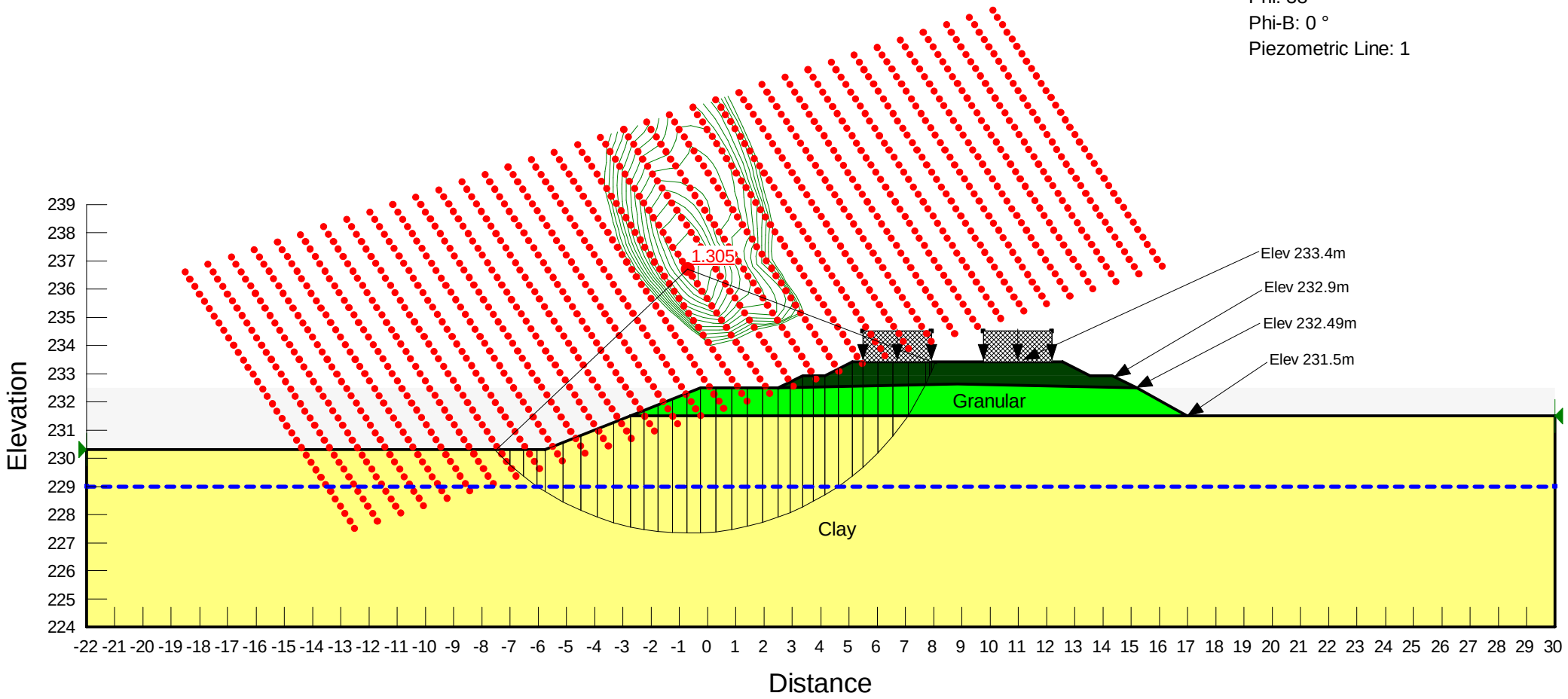


Figure 6:
Name: Stability Analysis
Kind: SLOPE/W
Method: Morgenstern-Price
Loading Condition: Surcharge loads of 110 kPa on each Track

Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 17 °
Phi-B: 0 °
Piezometric Line: 1

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °
Piezometric Line: 1

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °
Piezometric Line: 1



AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

Memorandum

To	Brent Knezacek	Page	1
CC	Tanya Worms		
Subject	CN Railway Detour Stability Analysis		
From	Mustafa Alkiki		
Date	October 31, 2013	Project Number	60273041 (404.19.2)

Introduction

AECOM was retained by the City of Winnipeg to provide a detailed design including geotechnical engineering services for the proposed Plessis Road Underpass in Winnipeg, Manitoba. As part of the project, the existing CN railway tracks crossing Plessis Road will have to be relocated south of the existing crossing for the duration of the bridge construction. The location of the railway detour (shoofly) in relation to the underpass and bridge structure is shown in the attached drawing Number CS-0005, Appendix A. In addition, we understand that excavation work will be carried out at the junction between the railway detour and Plessis Road. This memorandum summarizes the stability analysis results for the proposed CN railway detour embankment at the bridge location and further at the intersection with Plessis Road.

The proposed CN railway embankment is approximately 7.46 meters wide at the top of the embankment and consists of railway ties over a ballast layer of 0.48 m thickness. A sub-ballast layer lies under the ballast layer and extends from a thickness of 0.3 m at the centre of the embankment with a cross fall of 1:40 towards the edges of the embankment. A well-compacted granular layer of 1.0 m thickness lies between the sub-ballast and subgrade layers. The shoofly is expected to perform as a temporary detour for the duration of the bridge construction. The shoofly embankment is located approximately 17 m from the centerline of the south existing CN track to the centerline of the north detour track. The proposed shoofly plan and cross-sections are shown in Figures CS-0004 and CS-0005, attached in Appendix A.

Stability Modelling

The proposed shoofly embankment shown in Figures CS-004 and CS-0005 was modelled using the soil strength parameters presented in Table 01, below.

Table 01: Strength Parameters for Slope Stability Analysis

Material	Unit Weight (kN/m)	Cohesion (kPa)	Angle of Internal Friction (°)	Modulus of Elasticity (kPa)	Poisson's Ratio
Ballast	20	0	40	120,000	0.25
Sub-ballast	20	0	40	120,000	0.25
Granular Fill	19	0	38	100,000	0.33
Native Clay	17	5	18	6,000	0.4

The analysis was conducted using Sigma/W and Slope/W Geo Studio software. A stepped analysis showing each stage of the construction was modelled in Sigma/W. The purpose of a stepped (or treed) analysis is to import the soil stress state from the initial in-situ model and recalculate the soil stress redistribution and pore-water response for each construction stage. The embankment loading was modelled according to the CN memorandum dated November 22, 2011 and titled "Design Criteria for the Shoring Walls submitted by the Consultant". The surcharge due to the Cooper-E90 loading as per AREMA-2010 was modelled as a 90 kips axle load at 5 ft spacing over an 8-ft-long tie for a resulting surcharge of approximately 110 kPa. A Slope/W stability analysis was conducted for the critical stage of construction where the detour embankment is loaded with Cooper E90 train loads nearby the bridge excavation. Three cases were considered in the analysis:

Case 1: A maximum excavation depth up to +230 m was modeled with side slope of 2:1 (north side excavation).
Case 2: A maximum excavation depth up to +226 m and side slope of 4:1 (north side excavation).
Case 3: A maximum excavation depth up to +228.5 m and side slope of 4:1 (south side excavation).

Table 02, below, lists and describes the cases of stability modelling representing the stages of embankment and bridge construction.

Water conditions were modelled in the in-situ Sigma/W model based on the site groundwater monitoring results. The groundwater table measured on-site between December 2012 and June 2013 fluctuated between elevations of 226.5 to 228.2 m. Groundwater was modelled in the in-situ model at elevation 228 m.

Table 02: List and Description of Modelling Stages

Analysis ID	Analysis Type	Construction Condition
Case-01a	Sigma/W- In Situ	Initial Condition
Case-01b	Sigma/W- Stress Redistribution	Detour Excavation
Case-01c	Sigma/W- Stress Redistribution	Embankment Fill Placement
Case-01d	Sigma/W- Stress Redistribution	Bridge Excavation + Embankment Loading
Case- 01e	Slope/W – Stress Imported Analysis	Slope Stability with Imported Stress Conditions from Case-01d
Case- 01f	Slope/W – Morgenstern-Price Analysis	Slope Stability without Imported Stresses
Case-02a	Sigma/W- Stress Redistribution	Roadside Excavation + Embankment Loading
Case-02b	Slope/W – Stress Imported Analysis	With Imported Stress Conditions from Case-02a
Case-02c	Slope/W – Morgenstern-Price Analysis	Slope Stability without Imported Stresses

Analysis ID	Analysis Type	Construction Condition
Case-03a	Sigma/W- Stress Redistribution	Roadside Excavation + Embankment Loading
Case-03b	Slope/W – Stress Imported Analysis	With Imported Stress Conditions from Case-03a
Case-03c	Slope/W – Morgenstern-Price Analysis	Slope Stability without Imported Stresses

Analysis results are presented graphically in Figures 01 through 012, attached in Appendix A.

Analysis Results

An adequate factor of safety (FS) against slope instability must be achieved for short- and long- term conditions of the detour embankment. A design factor of safety of at least 1.5 is considered satisfactory for the long-term condition of an unloaded embankment. For the case of the loaded embankment with one or two train loads, a factor of safety of at least 1.3 is considered adequate.

For Case 1, the embankment as shown in Figures CS-004 and CS-005 meets the design target factors of safety against slope instability. Stability analysis for Case 2, as shown in Figure 10 in Appendix A, meets the design target factors of safety by utilizing a platform of 7.5 m wide at + 230 m and then excavating with 4:1 slope to the final level of +226 m along Plessis Road. Figure 10 shows the dimensions of the proposed geometry required to fulfill design factors of safety for Case 2. Stability analysis for Case 3 revealed that in order to meet the design factor of safety against slope instability, a 2.74 m wide buttress should be placed to maintain the native granular soil, and the excavation can be extended with a 4:1 slope to the final level of +228.5 along Plessis Road. Factors of safety for the three cases are presented in Table 03. Figures outlining individual analysis results are attached in Appendix A.

Table 03: Factor of Safety Against Slope Instability

Case	Loading Conditions	Computed F.S	Design F.S	Figure No.
Case-01e	North track loaded	1.32	1.3	-
	South track loaded	1.58	1.3	-
	Both tracks loaded	1.33	1.3	05
	No train loads	1.64	1.5	-
Case-01f	North track loaded	1.31	1.3	-
	South track loaded	1.66	1.3	-
	Both tracks loaded	1.31	1.3	06
	No train loads	1.73	1.5	-
Case-02b	North track loaded	1.38	1.3	-
	South track loaded	1.45	1.3	-
	Both tracks loaded	1.32	1.3	08
	No train loads	1.60	1.5	-
Case-02c	North track loaded	1.35	1.3	-
	South track loaded	1.43	1.3	-
	Both tracks loaded	1.33	1.3	09
	No train loads	1.52	1.5	-
Case-03b	Both tracks loaded	1.33	1.3	11
Case-03c	Both tracks loaded	1.32	1.3	12
	No train loads	1.83	1.5	-

We trust the information provided is sufficient for your purposes. Please don't hesitate to contact the undersigned should you have any questions or concerns.

Prepared by,

Mustafa Alkiki, EIT
Geotechnical Engineer-In-Training

Reviewed by,

Zeyad Shukri, M.Sc.
Senior Geotechnical Engineer

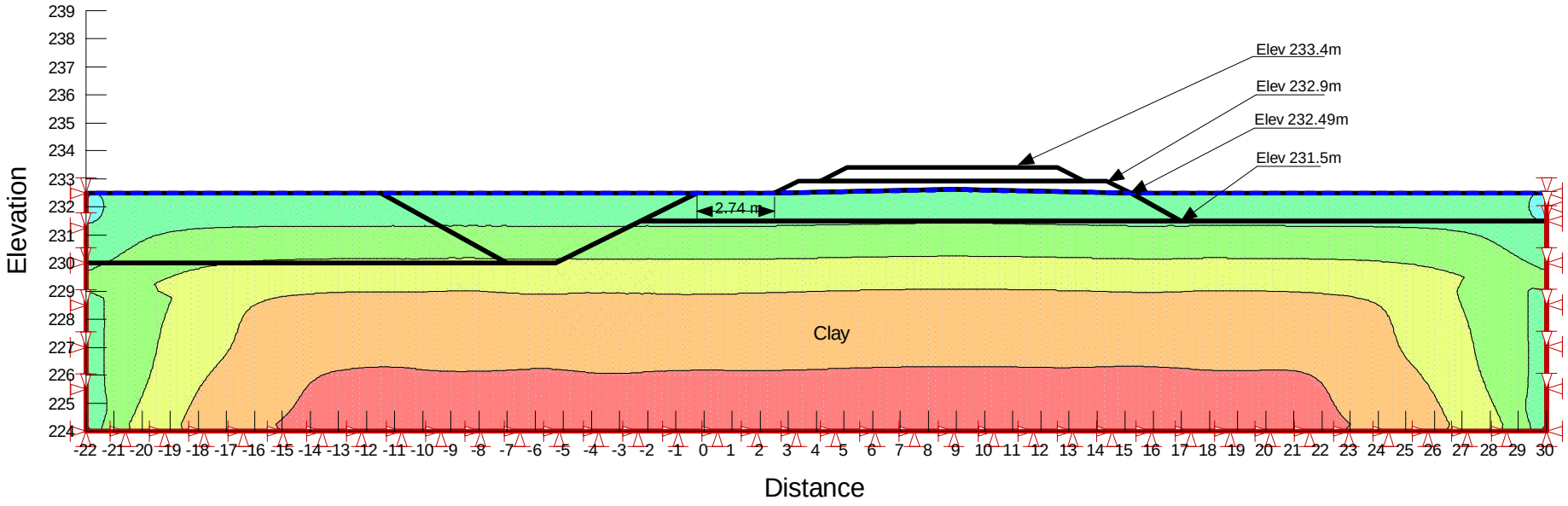
Patrick C. Chang, P.E., P.Eng.
Senior Project Engineer

Appendix A

Figures

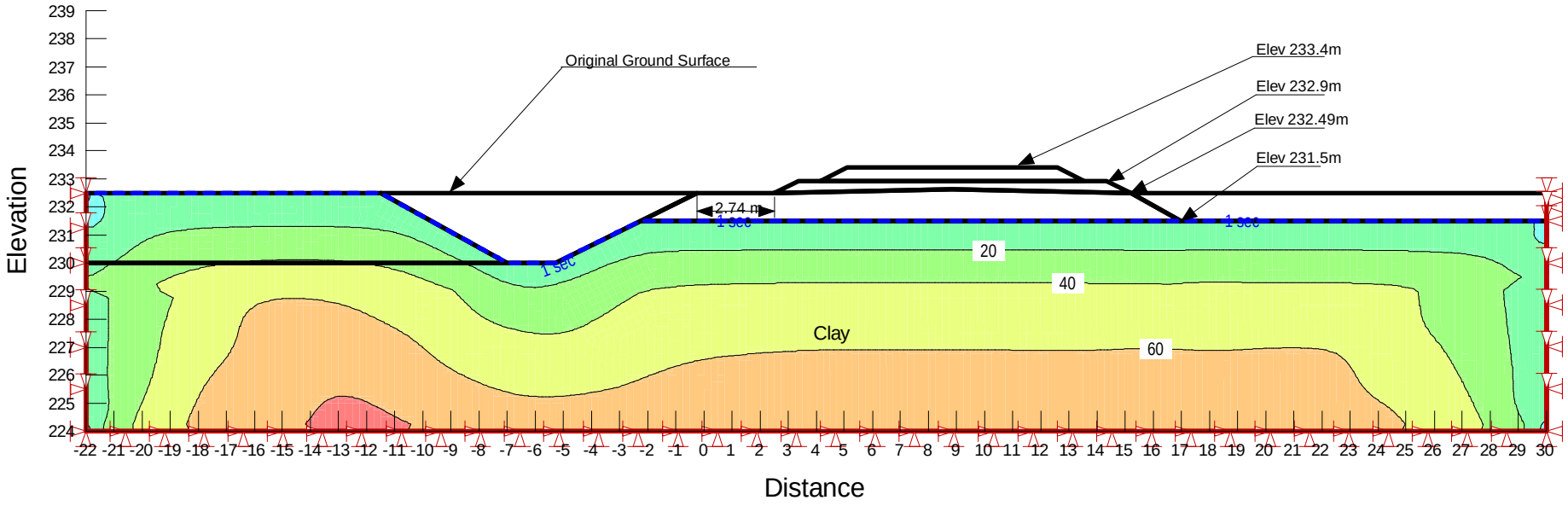
Plessis Rd Underpass
Name: Sigma - In-situ
Method: Method: Insitu
Kind: SIGMA/W
Figure 01: Case 01a

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Insitu Ko: 0.66666667
Unit Weight: 17 kN/m³



Plessis Rd Underpass
Name: ShooFly Excavation
Method: Method: Load/Deformation
Kind: SIGMA/W
Figure 02: Case 01b

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

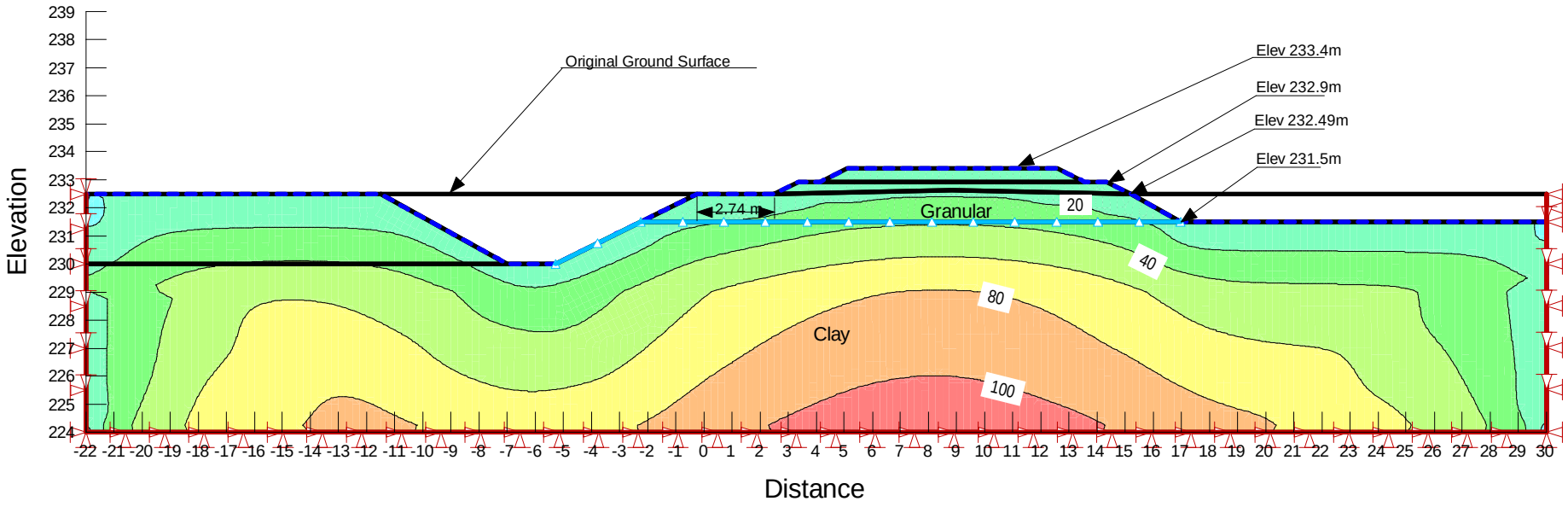


Plessis Rd Underpass
Name: Embankment Fill Placement
Method: Method: Load/Deformation
Kind: SIGMA/W
Figure 03: Case 01c

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.25
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Unit Weight: 19 kN/m³

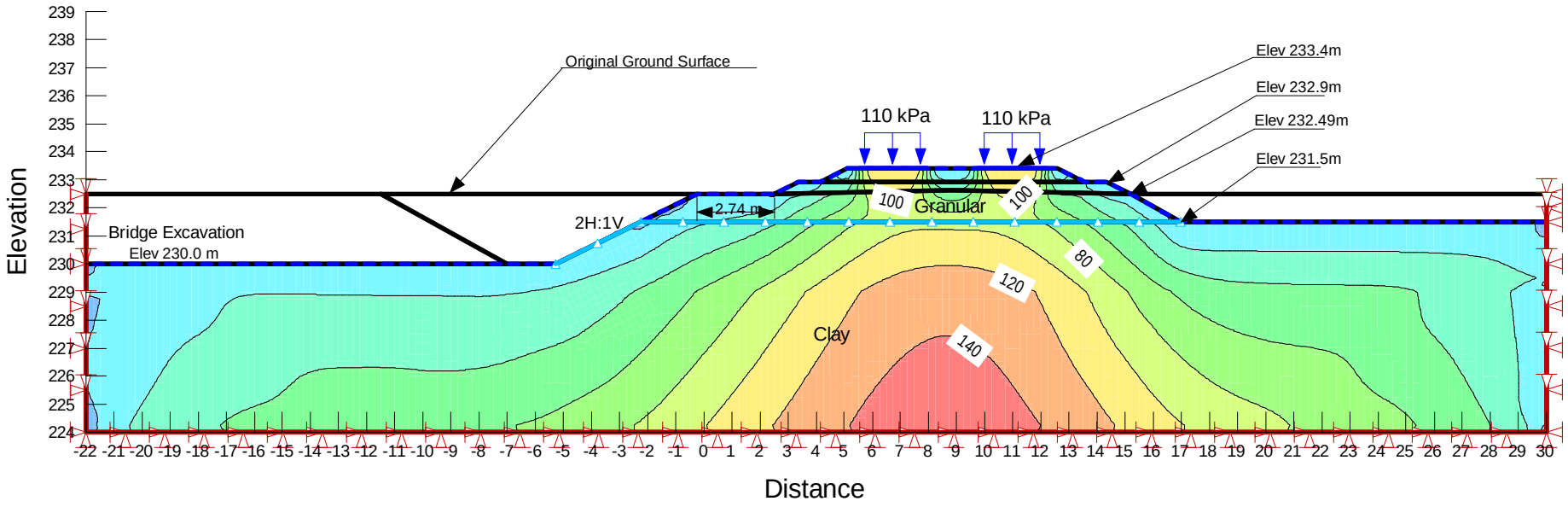


Plessis Rd Underpass
Name: Bridge Excavation and Surcharge Loading
Method: Method: Load/Deformation
Kind: SIGMA/W
Figure 04: Case 01d

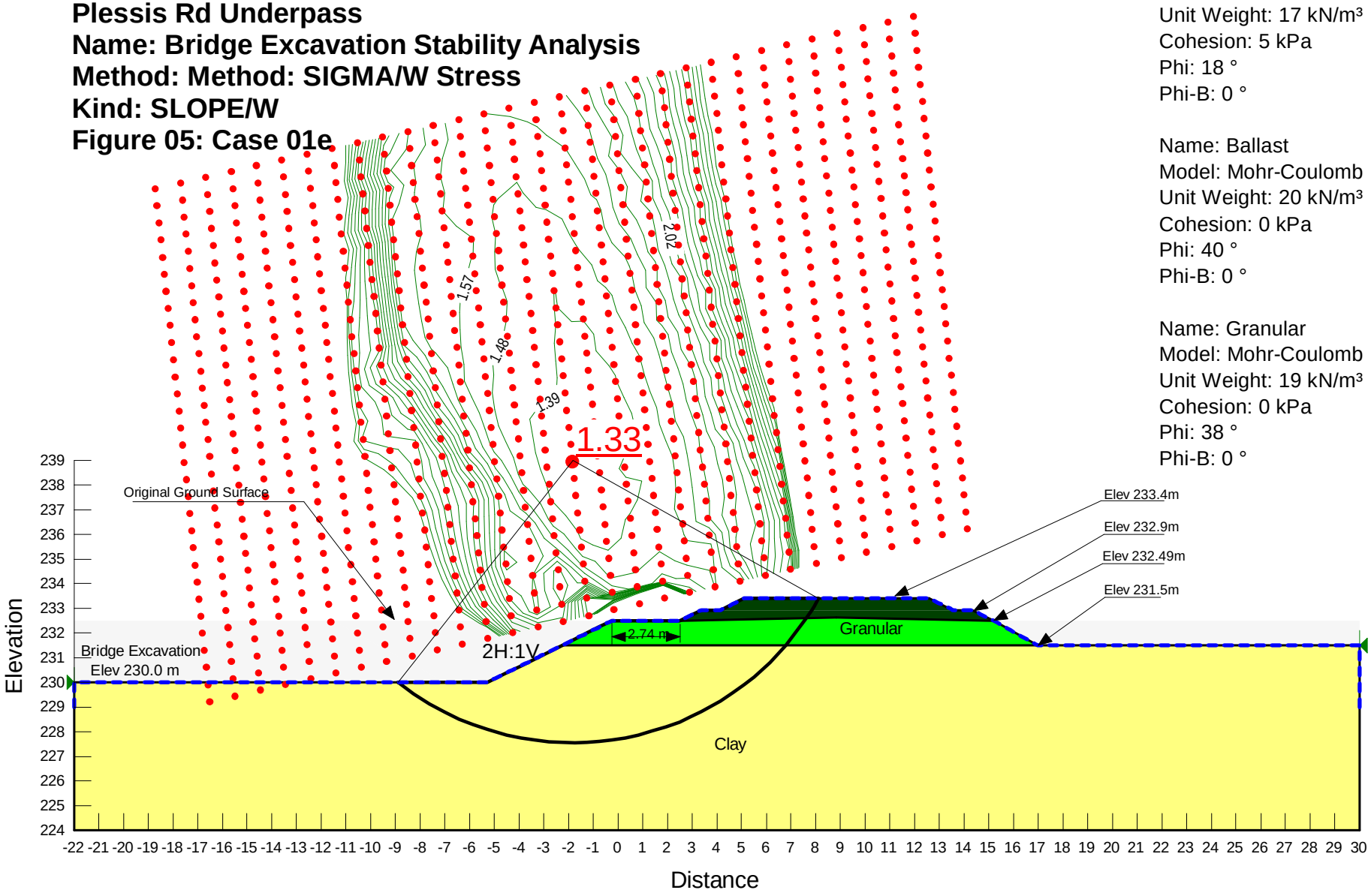
Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.25
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Unit Weight: 19 kN/m³



Plessis Rd Underpass
Name: Bridge Excavation Stability Analysis
Method: Method: SIGMA/W Stress
Kind: SLOPE/W
Figure 05: Case 01e

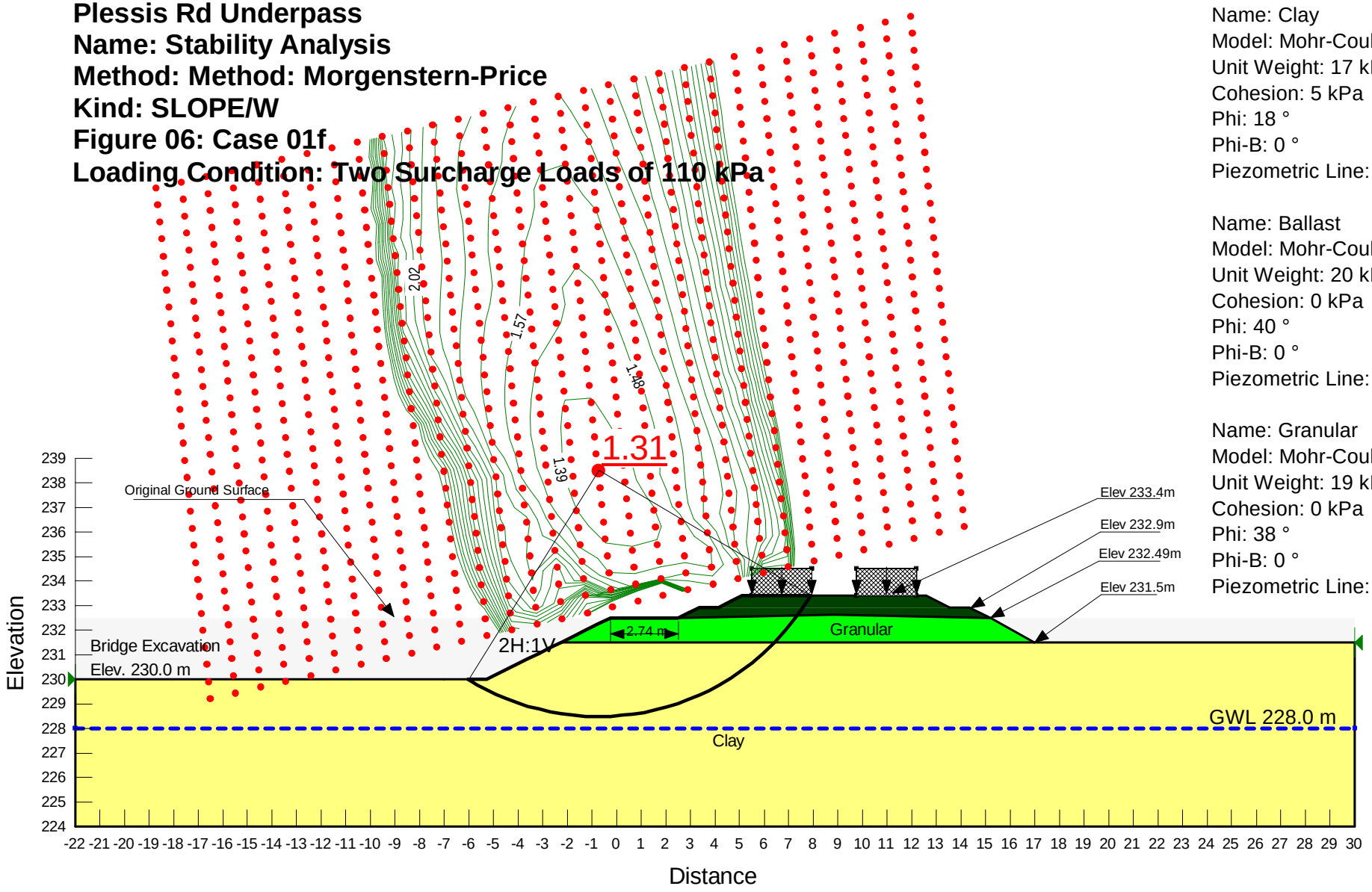


Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 18 °
Phi-B: 0 °

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °

Plessis Rd Underpass
Name: Stability Analysis
Method: Method: Morgenstern-Price
Kind: SLOPE/W
Figure 06: Case 01f
Loading Condition: Two Surcharge Loads of 110 kPa



Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 18 °
Phi-B: 0 °
Piezometric Line: 1

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °
Piezometric Line: 1

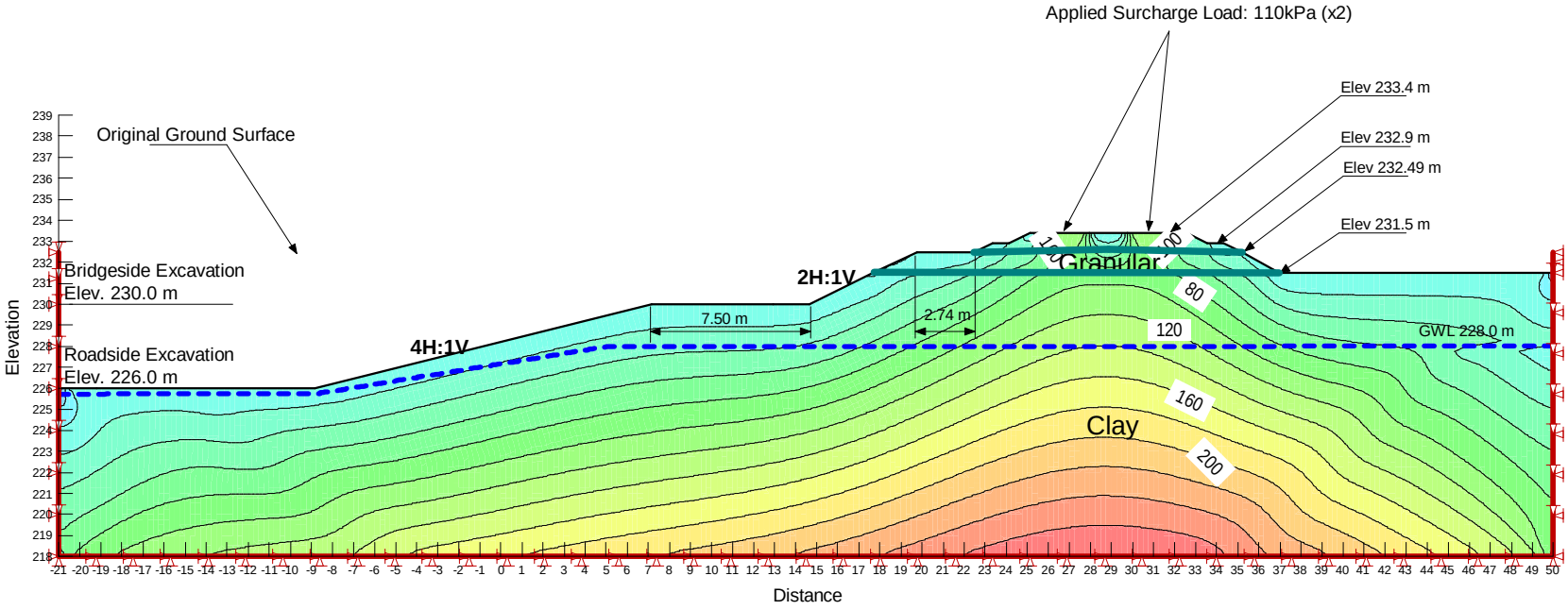
Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °
Piezometric Line: 1

Plessis Rd Underpass
Name: Roadside Excavation and Embankment Loading
Kind: SIGMA/W
Method: Load/Deformation
Loading Condition: Surcharge loads of 110 kPa on each Track
Figure 07: Case 02a

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Insitu Ko: 0.66666667
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.25
Insitu Ko: 0.33333333
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Insitu Ko: 0.5015015
Unit Weight: 19 kN/m³

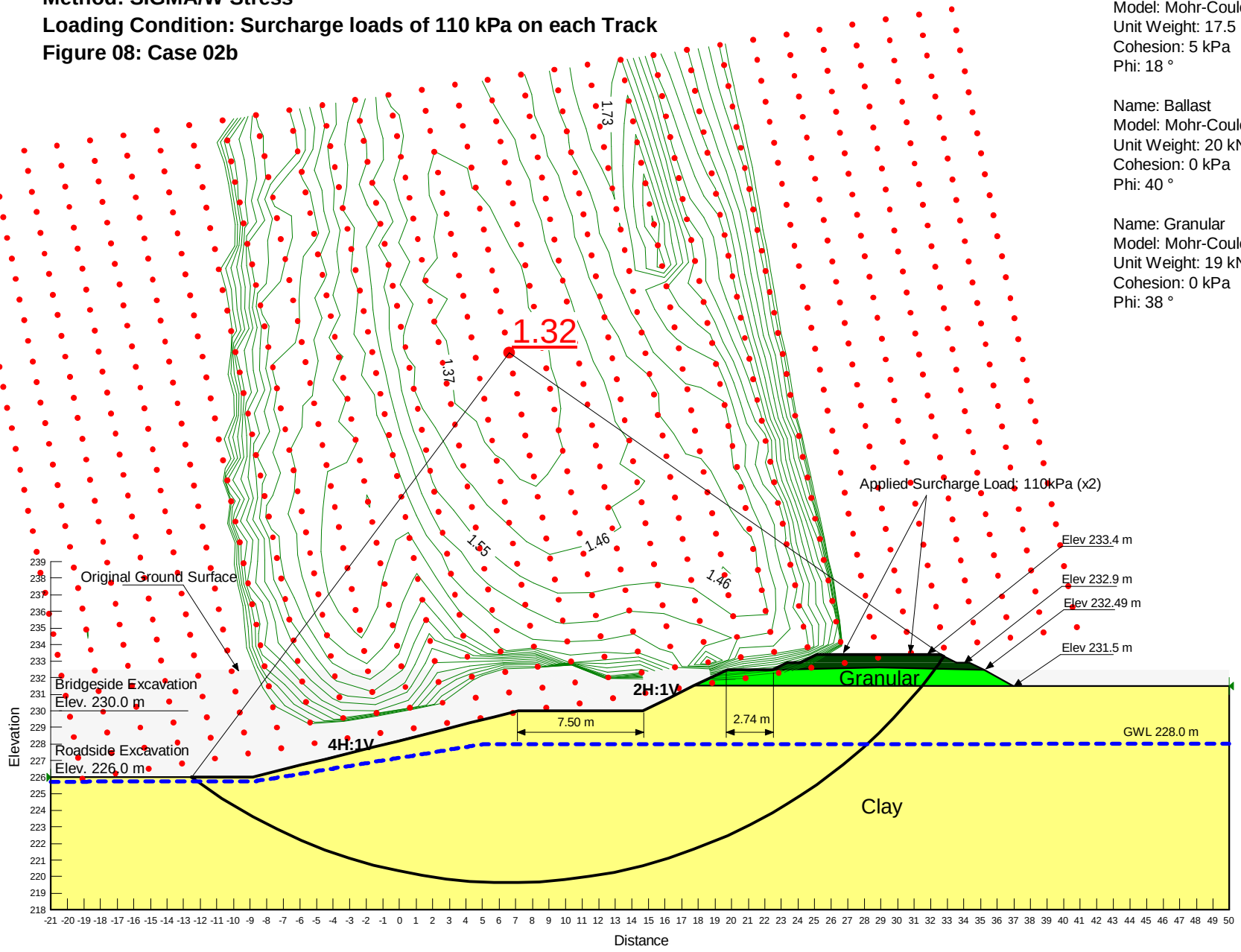


Plessis Rd Underpass
Name: Roadside Excavation Stability Analysis
Kind: SLOPE/W
Method: SIGMA/W Stress
Loading Condition: Surcharge loads of 110 kPa on each Track
Figure 08: Case 02b

Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17.5 kN/m³
Cohesion: 5 kPa
Phi: 18 °

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °

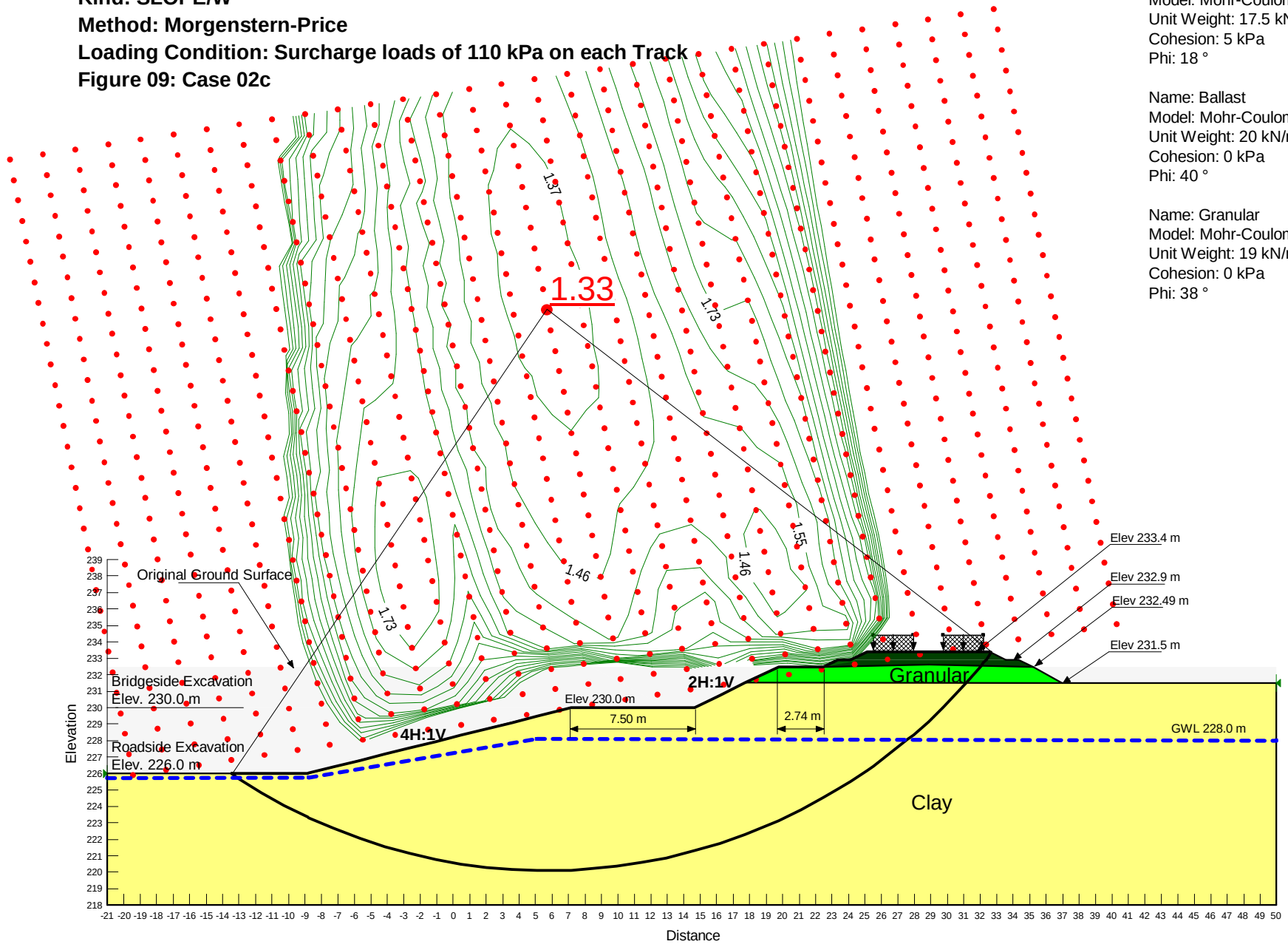


Plessis Rd Underpass
Name: Stability Analysis
Kind: SLOPE/W
Method: Morgenstern-Price
Loading Condition: Surcharge loads of 110 kPa on each Track
Figure 09: Case 02c

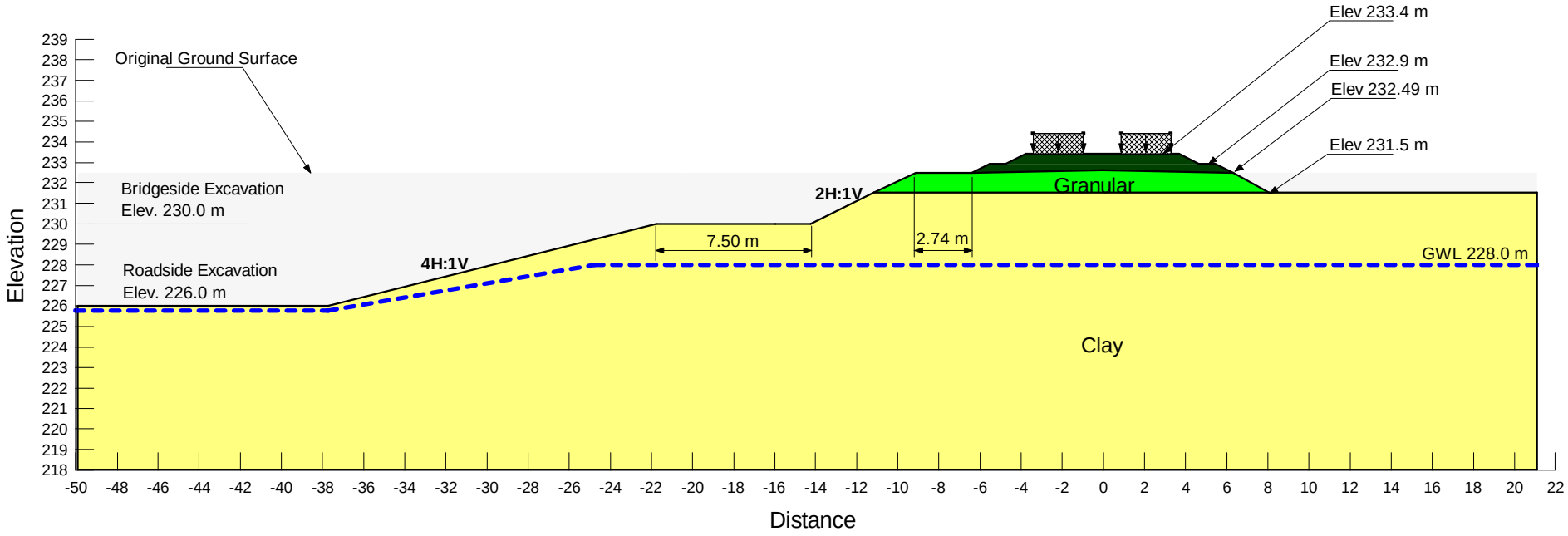
Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17.5 kN/m³
Cohesion: 5 kPa
Phi: 18 °

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °

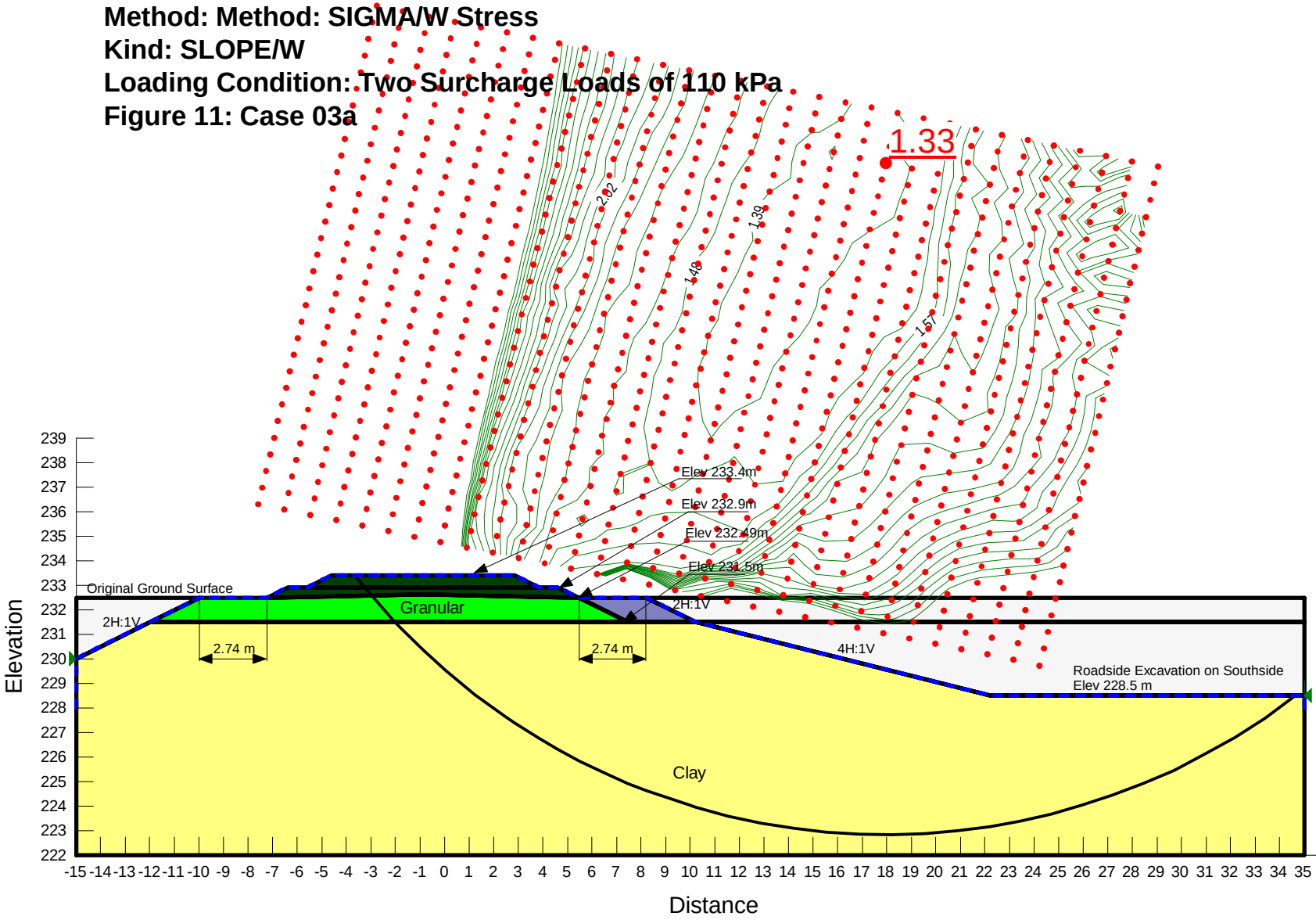
Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °



Plessis Rd Underpass
Name: Stability Analysis
Figure 10: Geometry for Case 02



Plessis Rd Underpass
Name: Roadside Excavation Stability Analysis
Method: Method: SIGMA/W Stress
Kind: SLOPE/W
Loading Condition: Two Surcharge Loads of 110 kPa
Figure 11: Case 03a



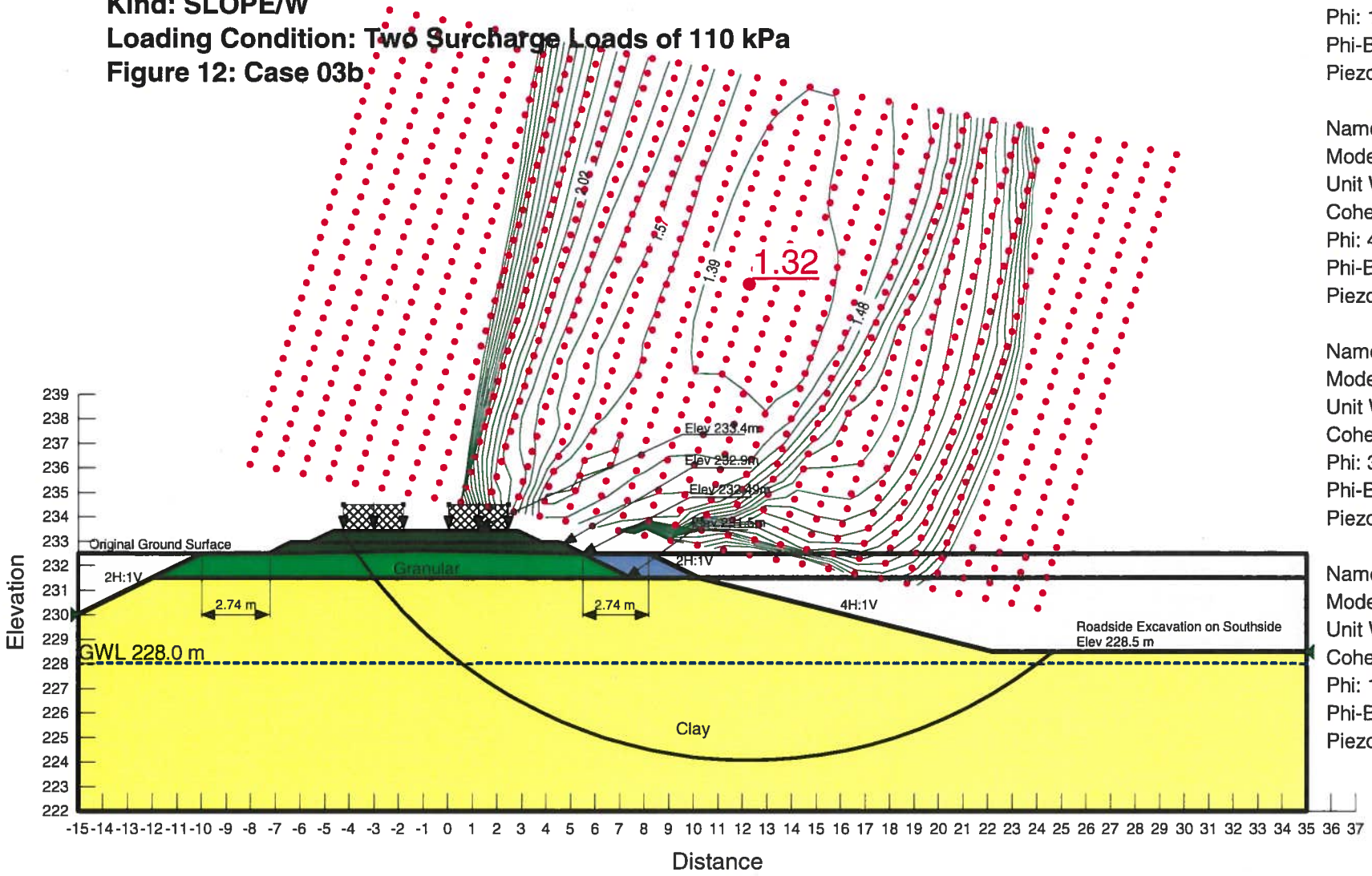
Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 18 °
Phi-B: 0 °

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °

Name: Clay Fill
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 3 kPa
Phi: 15 °
Phi-B: 0 °

Plessis Rd Underpass
Name: Stability Analysis - Roadside Excavation on Southside
Method: Method: Morgenstern-Price
Kind: SLOPE/W
Loading Condition: Two Surcharge Loads of 110 kPa
Figure 12: Case 03b

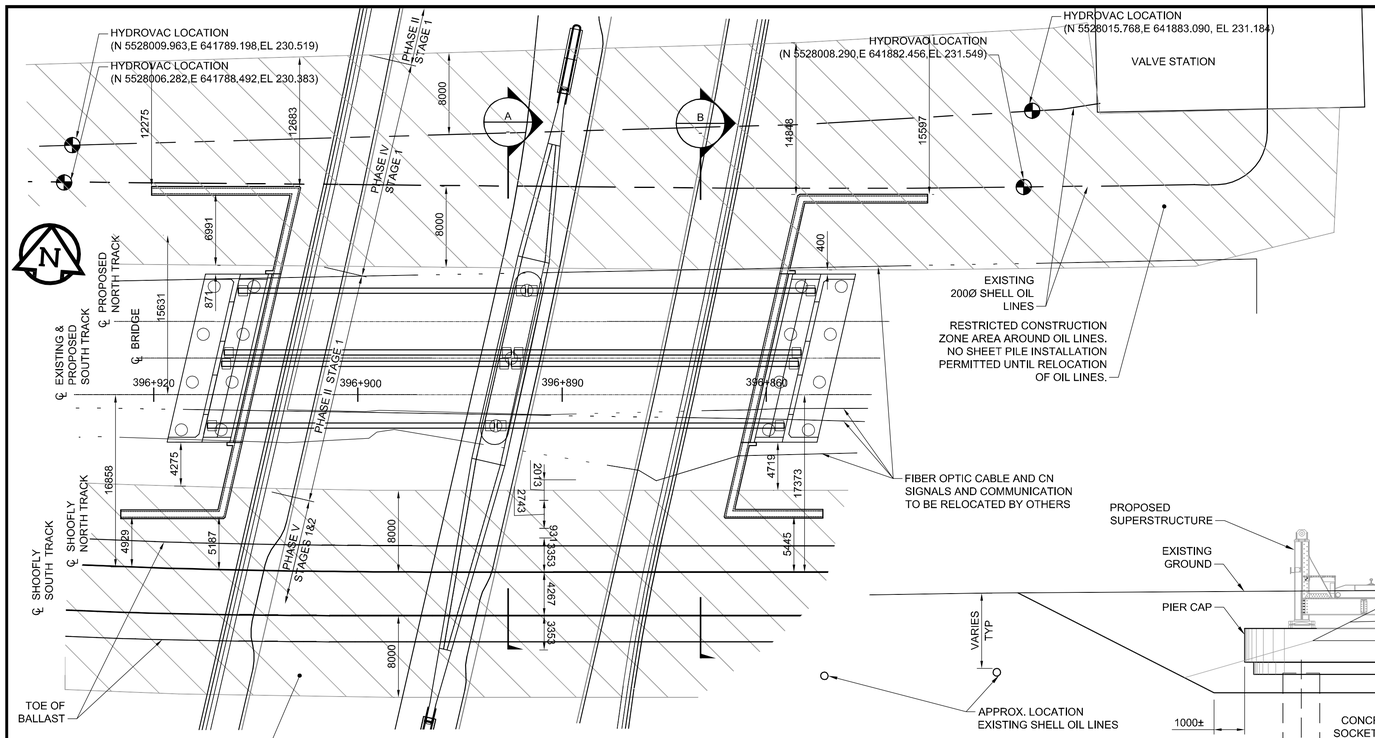


Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 18 °
Phi-B: 0 °
Piezometric Line: 1

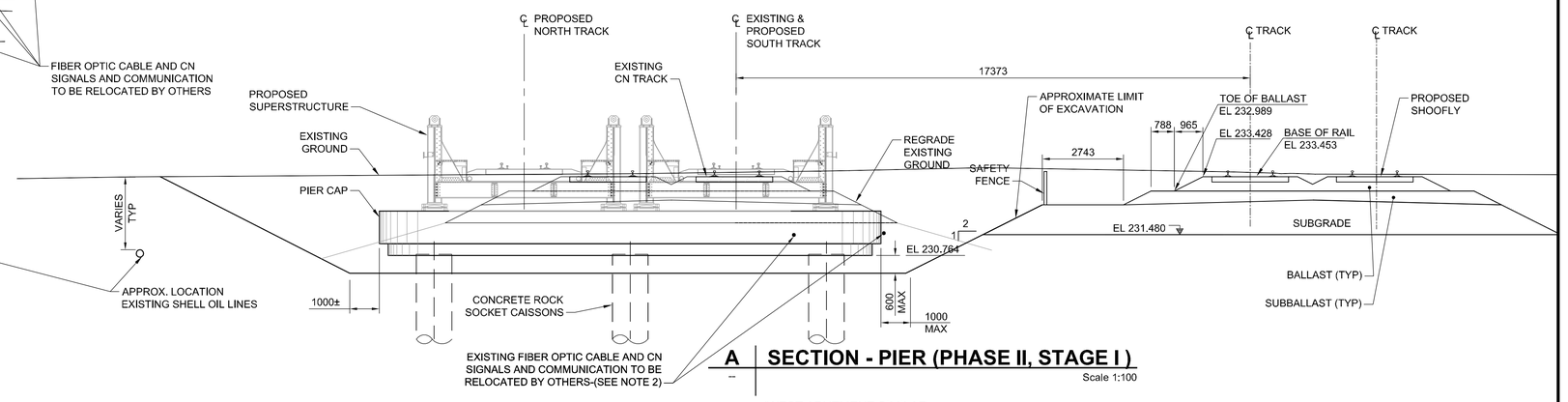
Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °
Piezometric Line: 1

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °
Piezometric Line: 1

Name: Clay Fill
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 3 kPa
Phi: 15 °
Phi-B: 0 °
Piezometric Line: 1

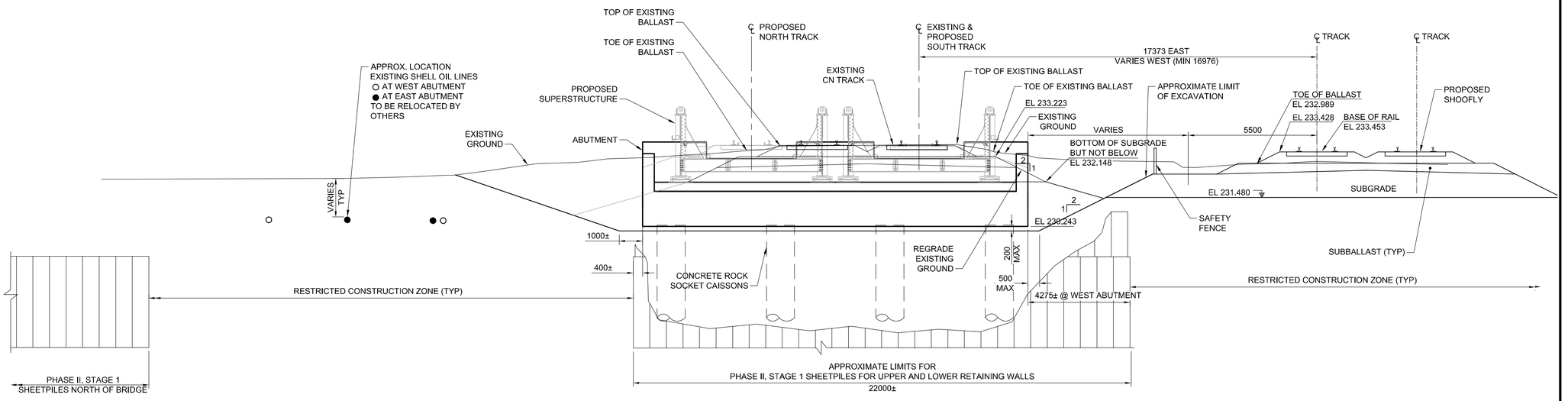


PLAN
Scale 1:300



A – SECTION - PIER (PHASE II, STAGE I)
Scale 1:100

(WEST ABUTMENT SIMILAR)



B – SECTION - EAST ABUTMENT (PHASE II, STAGE I)
Scale 1:100

(WEST ABUTMENT SIMILAR)

PROPOSED SEQUENCE OF WORK

BRIDGE PHASE II STAGE 1:

1. RAILWAY SHOOFLY (TEMPORARY DETOUR) CONSTRUCTED BY OTHERS.
2. RELOCATE RAIL TRAFFIC TO SHOOFLY BY OTHERS.
3. EXCAVATE FOR ABUTMENT AND PIER CONSTRUCTION TO LIMITS NOTED.
4. CONSTRUCT DRILLED CONCRETE CAISSONS, ABUTMENTS AND PIER CAP.
5. INSTALL STEEL SHEETPILES FOR UPPER AND LOWER RETAINING WALLS UNDER PROPOSED GIRDERS/SUPERSTRUCTURE. NO ADDITIONAL EXCAVATION ALLOWED BETWEEN SHOOFLY AND BRIDGE OR OVER OIL LINES.
6. CONTRACTOR TO PROVIDE PROTECTION OVER OIL LINES AS REQUIRED.
7. INSTALL SHEETPILES NORTH OF OIL LINE AND RESTRICTED CONSTRUCTION ZONE.

NOTES:
1. HYDRO EXCAVATION MAY BE REQUIRED FOR OIL LINES, FIBRE OPTIC CABLE AND CN SIGNALS AND COMMUNICATIONS.
2. SEE PLAN FOR APPROXIMATE LOCATION OF FIBER OPTIC CABLE AND CN SIGNALS AND COMMUNICATION.
3. SEE SPECIFICATIONS FOR OVERALL PROJECT PHASES AND STAGES.

BID OPPORTUNITY NO. 712-2013

LOCATION APPROVED
UNDERGROUND STRUCTURES

SUPV. U/G STRUCTURES COMMITTEE — DATE

NOTE:
LOCATION OF UNDERGROUND STRUCTURES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE, BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.

APEGM
Certificate of Authorization
AECOM Canada Ltd.
No. 4671 Date: 2013/10/15

B.M.
ELEV.

NO.	REVISIONS	DATE	BY
0	ISSUED FOR TENDER	2013/10/15	KC

AECOM

DESIGNED BY	FT/ZS	CHECKED BY	EBL
DRAWN BY	DJH	APPROVED BY	EBL
HOR. SCALE:	AS NOTED	RELEASED FOR CONSTRUCTION BY:	
VERTICAL:	AS NOTED		
DATE	2013-06-04	DATE	

ENGINEER'S SEAL

CONSULTANT DRAWING NO.
60273041-01-CS-004

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT

PLESSIS ROAD TWINNING AND GRADE SEPARATION AT CN REDDITT SUBDIVISION
CONTRACT 3

CITY DRAWING NUMBER
P-3346-2004

SHEET 04 OF 37

BRIDGE STAGING PLAN - SHEET 1

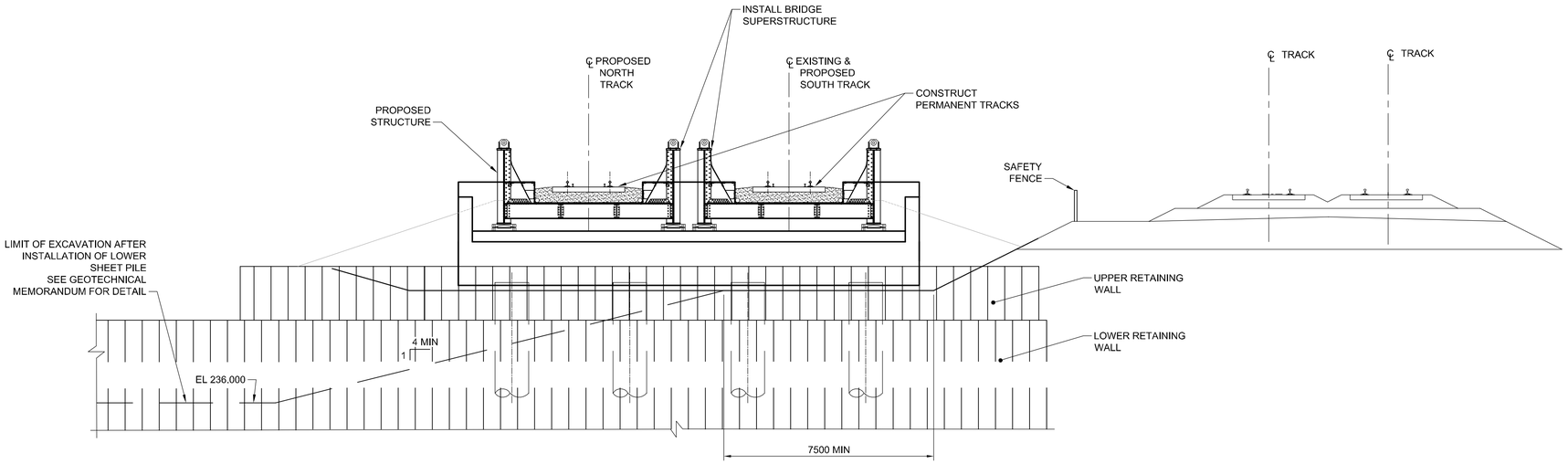
CS-0004

A1 – 841x594

2013-10-23

_AECOMKIND_DEFAULT.CTB

P:\60273041\000-CADD\02-SHEETS\CS\60273041-01-CS-004.DWG



A | SECTION - EAST ABUTMENT (PHASE IV, STAGE I)

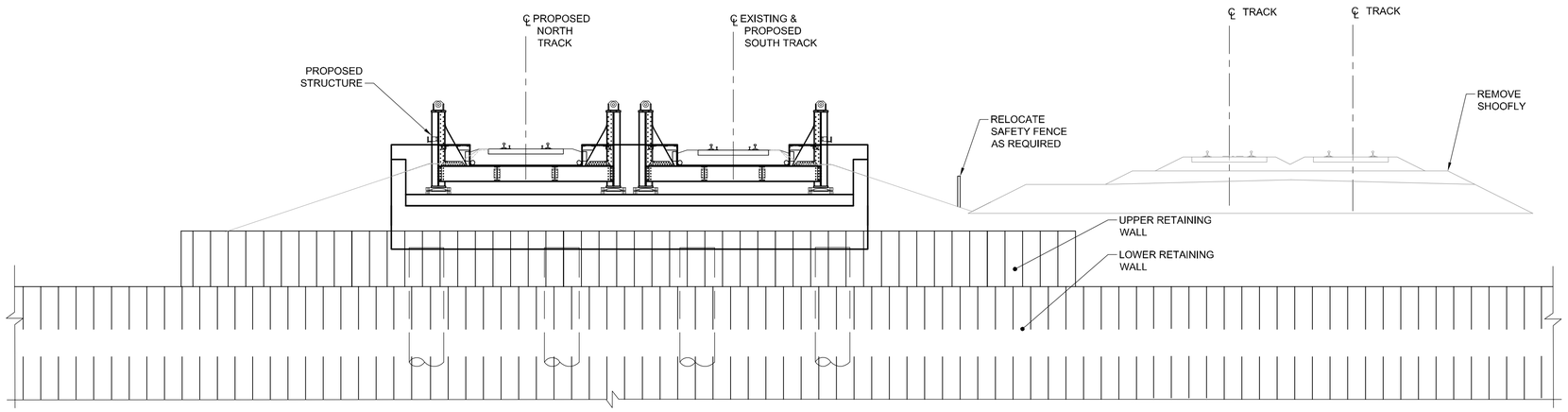
CS-0004 | Scale 1:100

(WEST ABUTMENT SIMILAR)

PROPOSED SEQUENCE OF WORK

BRIDGE PHASE IV, STAGE I:

1. INSTALL SUPERSTRUCTURE (BEARINGS, STEEL TPG SPANS, TRAINMAN'S WALKWAY, WATERPROOFING).
2. CONSTRUCT PERMANENT TRACKS OVER BRIDGE AND APPROACHES.
3. RELOCATE RAIL TRAFFIC TO NEW STRUCTURE, PUT MAIN TRACKS BACK INTO SERVICE.
4. RELOCATE FIBRE OPTIC CABLE AND CN SIGNALS AND COMMUNICATION ONTO NEW BRIDGE BY OTHERS.
5. INSTALL SHEET PILES IN RESTRICTED CONSTRUCTION ZONE NORTH OF BRIDGE AFTER OIL LINES RELOCATED BY OTHERS.



A | SECTION - EAST ABUTMENT (PHASE V, STAGE I & 2)

CS-0004 | Scale 1:100

(WEST ABUTMENT SIMILAR)

PROPOSED SEQUENCE OF WORK

BRIDGE PHASE V, STAGE I & 2:

1. REMOVE TEMPORARY RAILWAY SHOOFLY.
2. EXCAVATE BENEATH BRIDGE STRUCTURE.
3. INSTALL STEEL SHEETPILES SOUTH OF BRIDGE STRUCTURE.

APEGM
Certificate of Authorization
AECOM Canada Ltd.
No. 4671 Date: 2013/10/15

BID OPPORTUNITY NO. 712-2013

LOCATION APPROVED
UNDERGROUND STRUCTURES

SUPV. U/G STRUCTURES COMMITTEE _____ DATE _____

NOTE:
LOCATION OF UNDERGROUND STRUCTURES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE. BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.

B.M. ELEV.

NO.	REVISIONS	DATE	BY
0	ISSUED FOR TENDER	2013/10/15	KC

AECOM

DESIGNED BY	FT/ZS	CHECKED BY	EBL
DRAWN BY	DJH	APPROVED BY	EBL
HOR. SCALE:	AS NOTED	RELEASED FOR CONSTRUCTION BY:	
VERTICAL:	AS NOTED		
DATE	2013-06-04	DATE	

ENGINEER'S SEAL

CONSULTANT DRAWING NO.
60273041-01-CS-005

Winnipeg

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT

PLESSIS ROAD TWINNING AND GRADE SEPARATION AT CN REDDITT SUBDIVISION CONTRACT 3

CITY DRAWING NUMBER P-3346-2005

SHEET 05 OF 37

BRIDGE STAGING PLAN - SHEET 2

CS-0005