BRITISH COLUMBIA
The Best Place on Earth

Ministry of Transportation and Infrastructure
Geotechnical and Materials Engineering

Southern Interior Region
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Kamloops, BC
V2C-2T3

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TECHNICAL MEMORANDUM

January 17, 2017

Ministry of Transportation and Infrastructure
Southern Interior Region
Kamloops, B.C.
V2C 2T3

Attention: Mr. Scott McKenzie

GEOTECHNICAL RECOMMENDATIONS – FOUNDATIONS FOR BRIDGE
GREEN MOUNTAIN ROAD BRIDGE No. 06155

The following Technical Memo provides our geotechnical recommendations to support current highway design and construction requirements for the proposed bridge foundations for the above noted project.

The Ministry of Transportation and Infrastructure (the Ministry) is planning to replace the existing Green Mountain Road Bridge No. 06155, located on Green Mountain Road approximately 11 km west of Penticton, B.C. The existing single span steel girder bridge has reached the end of its service life and needs to be replaced.

GEOTECHNICAL INVESTIGATION

The Geotechnical investigation for the project consisted of putting down four boreholes (TH15-01 to TH15-04), as indicated on the attached drawing, "Penticton Green Mountain No.2 Bridge Foundation Investigation", No 6155-21. One borehole was drilled near either end of the bridge, TH15-01 at the east end to 9.7 m below ground level (mbgl) and TH15-02 at the west end to 5.3 mbgl. One borehole was drilled in the road approximately 30 m from each end of the bridge, TH15-03 east of the bridge to 7.3 mbgl, and TH15-04 west of the bridge to 5.2 mbgl.

The boreholes were put down with a truck-mounted rotary drill rig utilizing wash rotary drilling techniques through soil and wireline coring using a diamond bit through bedrock. Standard Penetration Testing (SPT) was completed within each of the boreholes at regular intervals to obtain disturbed soils samples as well as to determine relative densities (SPT – N values) for the strata.

EXISTING SURFACE AND SUBSURFACE CONDITIONS

The bridge spans over Shingle Creek. The creek bottom cross section is relatively flat with steep side slopes, with the creek flowing to the west. The lands surrounding the creek vary from near level to steep slopes. Most of the land surrounding the bridge and road is forested, with the area to the north of the road supporting some grass surfaced fields.

The general area is underlain by Alluvial deposits comprised of poorly graded sands and gravels with cobbles and boulders. The sands and gravels vary in density from very loose to very dense. Typically the sands and gravels become denser with depth, however a layer of silty sands and gravels (SM) encountered in TH15-03 was very loose at depth. It is possible that pockets of this material may be encountered across the site.

The granular deposits are underlain by bedrock. The British Columbia Geological Survey identifies the underlying bedrock in the area as Granodioritic Intrusive Rocks of the Okanagan Batholith, which is consistent with the bedrock encountered during the site investigation. Bedrock was encountered at 2.3 mbgl at the west side of the bridge and 6.4 mbgl at the east side of the bridge. Bedrock was encountered at greater depths in the boreholes drilled in the road further away from the bridge at depths of 4.7 mbgl to the west and 7.0 mbgl to the east. Where cored, in boreholes TH15-01 and TH15-02, the strong to very strong bedrock was found to have joints spaced moderately close to very close. A bedrock outcrop was noted in the creek bed on the west bank close to the existing bridge abutment. To the west of the bridge there is bedrock outcropping on the south side of the road.

Due to the granular nature of the deposits and the presence of Shingle Creek, it is expected that groundwater will be controlled by the creek and should be encountered at or above the existing creek level.

GEOTECHNICAL RECOMMENDATIONS

After reviewing the site geological conditions, the results of the subsurface geotechnical investigation and the bridge abutment location plans it was found that spread footings are feasible for the bridge foundations. However there is the potential that spread footings may be subject to scour. A separate hydrotechnical report providing mitigation measures has been prepared and the recommendations of this report are only valid if appropriate scour protection is provided as set out in the hydrotechnical report.

Foundations and Excavations

The east abutment foundation should be founded 3mbgl on the competent undisturbed native sands and gravels. The west abutment foundation should be founded on bedrock, encountered at 2.4 mbgl.

Prior to the placement of any components of the retaining walls and related fills, all loose or disturbed materials, existing fills, topsoil’s, organics and other deleterious materials are to be

removed from the subject areas. The base of foundation excavation areas are to be inspected by the Geotechnical Engineer, or approved representative, prior to the placement of any wall elements including concrete or fill materials.

The subgrade soils underlying the foundations may be susceptible to possible disturbance if exposed to construction traffic, weather elements, and groundwater seepage. Proper care and attention will need to be adhered to, in order to maintain the integrity of the subgrade soils during early stages of construction. This will include proper site grading (temporary and permanent) to facilitate good drainage control. A skim coat of concrete could be considered to protect the foundation soil elements and to act as a working surface during construction.

All excavation slopes are to be maintained to meet the Workers Compensation Board of British Columbia requirements.

Groundwater seepage may be present within any of the excavations, and particularly where excavations are at or below the level of the creek. Contingencies should be included to effectively manage groundwater flows within excavations. This may require staged excavation works, and proper surface grading of excavation surfaces, as well as proper dewatering of excavations.

Foundations Design Parameters

The undisturbed portions of the natural compact to dense sand and gravel deposits with variable proportions of cobbles and boulders encountered at EL 601.2 within the test hole put down near the east abutment location would be considered an acceptable foundation stratum to support the proposed bridge and related fills. Where bedrock is encountered it will provide a suitable foundation stratum, for the test hole near the west abutment this was encountered at EL 602.0. For foundation design purposes the following parameters, determined according to the procedures outlined in the Canadian Foundation Engineering Manual, 4th Edition, are considered acceptable for foundations supported as described below:

- An Ultimate Geotechnical Bearing Capacity of 1000 kPa using a Geotechnical Resistance Factor of 0.5 for abutments founded on dense sands and gravels or bedrock.
- A Serviceability Limit State bearing capacity of 500 kPa for foundations between 1.8 m and 2.2 m wide with a maximum allowable deformation of 25 mm on granular soils.
- A Serviceability Limit State bearing capacity of 1000 kPa for foundations between 1.8 m and 2.2 m wide with a maximum allowable deformation of 5 mm on bedrock.

Resistance to base sliding may be calculated using an angle of friction of 35°.

Retaining Wall Foundation Design Parameters

The west retaining wall should be founded on bedrock, and where bedrock is not encountered the west retaining wall should be founded on compact sands and gravels at EL 602.0. The parameters provided above for the abutment foundations is considered suitable.

The east retaining wall is to be founded at EL 602.4 in compact sand and gravel deposits. For foundation design purposes the following parameters, determined according to the procedures outlined in the Canadian Foundation Engineering Manual, 4th Edition, are considered acceptable for foundations supported as described below:

- An Ultimate Geotechnical Bearing Capacity of 350 kPa using a Geotechnical Resistance Factor of 0.5 for abutments founded on dense sands and gravels or bedrock.
- A Serviceability Limit State bearing capacity of 250 kPa for a 1.6 m wide foundation with a maximum allowable deformation of 25 mm on granular soils.

Resistance to base sliding may be calculated using an angle of friction of 35°.

Site Seismicity

Seismic hazard models from the 2015 National Building Code provide Peak Ground Accelerations (PGA) of 0.033g and 0.078g for the 1:475 and 1:2,475 year earthquake, respectively.

The site is underlain by relatively shallow bedrock and based on this the site is classified as Site Class B as per Table 4.1 of CAN/CSA-S6-14.

Lateral Earth Pressures

Lateral earth pressures are a function of (a) type and amount of wall movement, (b) shear strength parameters of the soil, (c) unit weight of the soil, and (d) drainage conditions in the backfill. The soil to be used as backfill is classified as Bridge End Fill (BEF). The aggregate properties and gradation of BEF shall be in compliance with Tables 202-B and 202-C, respectively, in Standard Specifications for Highway Construction Section 202-Granular Surfacing, Base and Sub-Bases.

The backfill pressures for the design of head walls can be determined from the following formulas:

Active Loads

$$P_a(\text{kN/m}) = \frac{1}{2} K_a \gamma H^2$$

Passive Loads

$$P_p(\text{kN/m}) = \frac{1}{2} K_p \gamma D^2$$

Where Ka = 0.271
Kp = 3.690

Ka and Kp were determined using Rankine's earth pressure theory with, ø = 35°
γ = unit weight of soil in kN/m3 (assume γ = 21 kN/m3)
H = height of wall in meters, measured from base of the footing to top of ground
D = depth of footing in meters

The active pressure can be assumed to act at H/3 from the base of the footing. The passive pressure can be assumed to act at D/3 from the base of the footing.

NOTE: The above coefficients are calculated based on the assumptions that the wall is vertical, and that the slope at the top of the wall is flat. If these conditions do not apply then the coefficients given above are invalid, and the geotechnical engineer must be contacted and given the proper wall geometry.

CLOSING

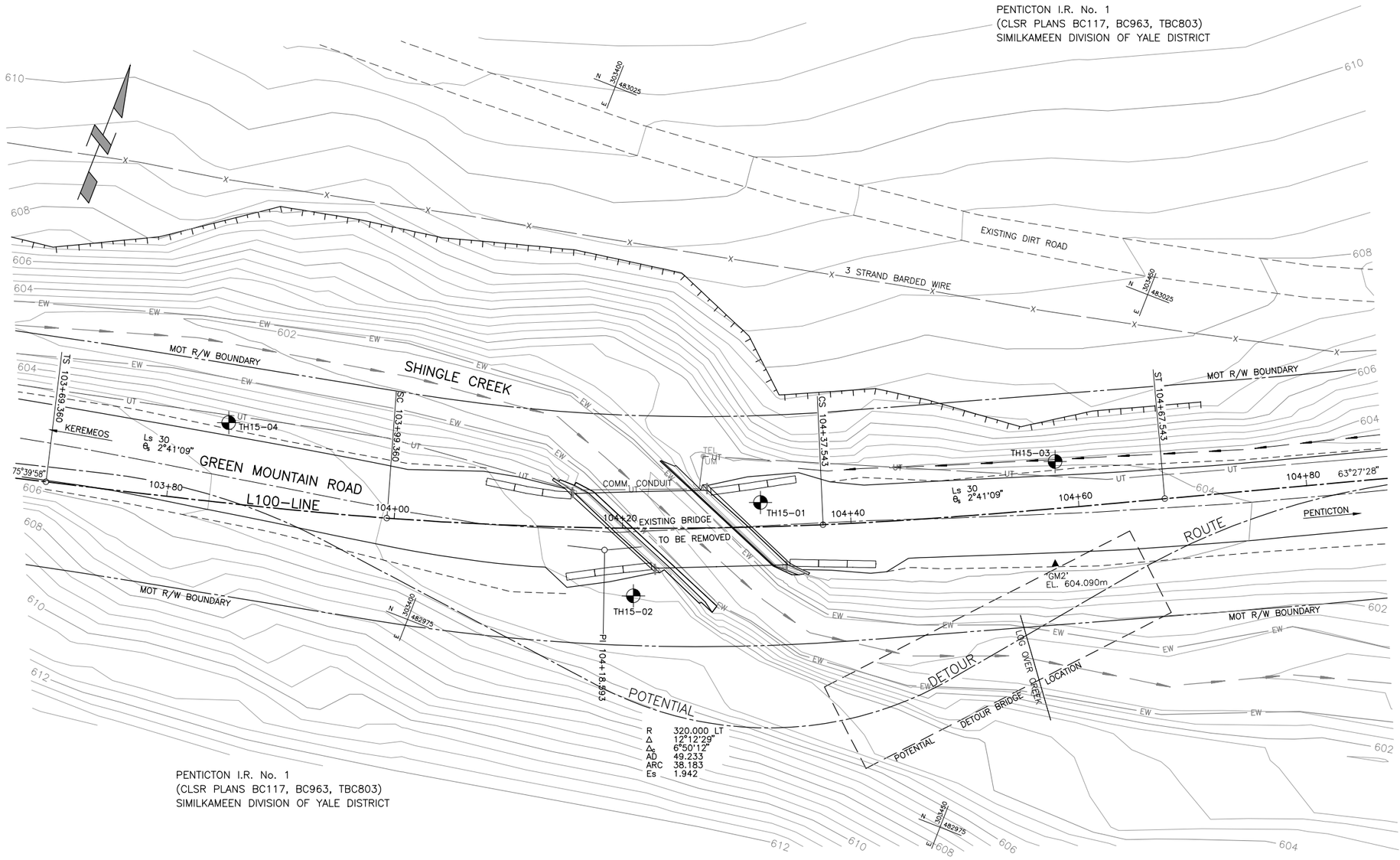
We trust that the information presented above is sufficient for your present needs. If we can be of further assistance on this or other related concerns, please feel free to call the undersigned.

Regards,

	Reviewed by:
Michael George, P.Eng.	Tom Kneale, P.Eng.
Senior Geotechnical Engineer	Manager, Geohazards and Slope Stability
Geotechnical & Materials Engineering	Geotechnical & Materials Engineering

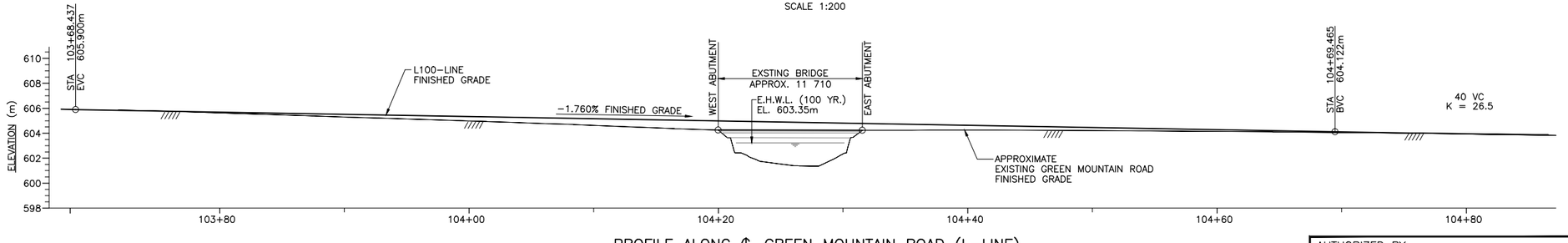
Attachments:
Penticton Green Mountain No.2 Bridge Foundation Investigation, Drawing No. 6155-12
Borehole Logs TH15-01 to TH15-04
2010 National Building Code Seismic Hazard Calculation

PENTICTON I.R. No. 1
(CLSR PLANS BC117, BC963, TBC803)
SIMILKAMEEN DIVISION OF YALE DISTRICT

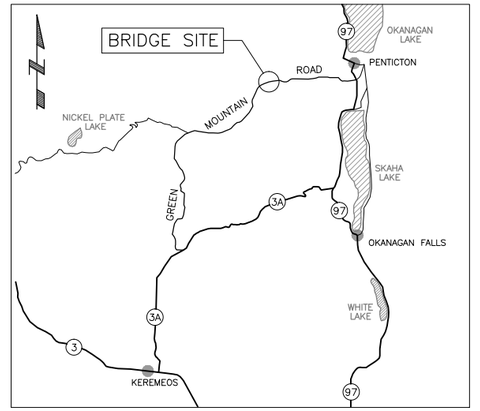


PENTICTON I.R. No. 1
(CLSR PLANS BC117, BC963, TBC803)
SIMILKAMEEN DIVISION OF YALE DISTRICT

PLAN
SCALE 1:200



PROFILE ALONG ℄ GREEN MOUNTAIN ROAD (L-LINE)
SCALE 1:200



THE SITE IS LOCATED APPROXIMATELY 9KM WEST OF PENTICTON ON GREEN MOUNTAIN ROAD.

LOCATION PLAN
N.T.S.

LIST OF DRAWINGS	
DWG. No.	TITLE
6155-11	SITE PLAN
6155-12	GENERAL ARRANGEMENT
6155-13	WEST ABUTMENT
6155-14	EAST ABUTMENT
6155-15	WEST ABUTMENT RETAINING WALL
6155-16	EAST ABUTMENT RETAINING WALL
6155-17	PRECAST CONCRETE BOX STRINGER
6155-18	SUPERSTRUCTURE
6155-19	STEEL POSTS, THRIE BEAM AND TRANSITION DETAILS
6155-20	STEEL RAILING
6155-21	SUMMARY LOGS

ROAD DRAWINGS	
DWG. No.	TITLE
R2-960-001	KEY PLAN
R2-960-002	LEGEND
R2-960-101-102	PLAN
R2-960-201	PROFILE
R2-960-301-303	TYPICAL SECTIONS
R2-960-401-402	GEOMETRICS, LANING AND DRAINAGE
R2-960-601-602	SIGNING AND PAVEMENT MARKINGS

NOTES:

1. SURVEY BY: MOT. 2015
2. DATUM: GEODETIC
3. BENCH MARK: BM #1 – 'GM2' – ELEV. 604.090m
   N 483000.109, E 303451.032
   BM #2 – 'GM3' – ELEV. 606.978m
   N 482959.860, E 303314.599
   BM #3 – 'G12653' – ELEV. 603.560m
   N 483055.822, E 303524.248
4. FOR BOREHOLE DATA SEE DWG. 6155-21.

Rev	Date	Description	Init

REVISIONS

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure
Southern Interior Region

OKANAGAN SHUSWAP HIGHWAY DISTRICT
GREEN MOUNTAIN ROAD

PENTICTON GREEN MOUNTAIN No.2 BRIDGE SITE PLAN

AUTHORIZED BY

REGIONAL MANAGER ENGINEERING
DATE

REGIONAL DIRECTOR, HIGHWAYS
DATE

PREPARED UNDER THE DIRECTION OF

ENGINEER OF RECORD
DATE

DESIGNED JB DATE JAN 2017
CHECKED KW DATE JAN 2017
DRAWN AJP DATE JAN 2017
SCALE AS NOTED
NEGATIVE No.

FILE No. | PROJECT No. | REG. | DRAWING No. 6155-11

SUMMARY LOG

Drill Hole #: **TH15-01**

Ministry of Transportation and Infrastructure

Project: **Green Mountain Road Bridge #06155**

Location: Penticton

Datum: UTM NAD83 | Alignment: L100

Northing/Easting: 482995.8 , 303425.1 | Station/Offset: 104+32.1 2.1m LEFT

Elevation: 604.1 m

Prepared by: Ministry of Transportation & Infrastructure

Logged by: MS | Reviewed by: MCG

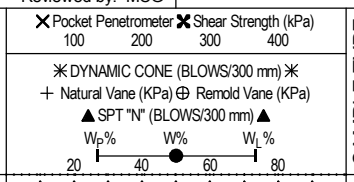
Date(s) Drilled: Sept 15, 2015

Drilling Company: Sea to Sky Drilling

Driller: Chad Brown

Drill Make/Model: Mobile B53

Drilling Method: Wash Rotary



DEPTH (m)	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
0				Asphalt 2" 0.05m			604
				GRAVEL, fine (Basecourse) 0.3m	GP		
				GRAVEL, fine, sandy, brown, moist to wet, loose			
1							603
		1	13		GP SB	{G:65 S:30 F:5}	
2							602
				SAND and GRAVEL, fine, moist, compact 2.44m			
3		2	42		GP	{G:60 S:40 F:}	601
				GRAVEL, fine to coarse, sandy, moist, very dense 3.66m			
4							600
		3	42			{G:65 S:35 F:}	
5					GP SB		599
6		4	0				598
				GRANODIORITE, grey, moderately spaced joints, strong to very strong, slightly weathered (Bedrock) 6.4m			
7		5	0				597
					BR		
8							596
				GRANODIORITE, grey, very close joints, strong to very strong, slightly weathered (Bedrock) 8.69m			
9					BR		595
				End of Hole at 9.7m - Grinding core 9.73m			
10							

4 (1) 26 (2) 54 (3) 50 for 4" (4) 50 for 1" (5)

Legend

Sample Type:

A-Auger | C-Core | G-Grab | V-Vane

L#-Lab Sample | S-Split Spoon | O-Odex (air rotary) | W-Wash (mud return) | T-Shelby Tube

Final Depth of Hole: 9.7 m

Depth to Top of Rock: 6.4 m

MOT-SOIL-REV2 GREEN_MOUNTAIN_RD_2_GINT.GPJ MOT-DRAFT-REV2.GDT 17-01-18

SUMMARY LOG

Drill Hole #: **TH15-02**

Ministry of Transportation and Infrastructure

Project: **Green Mountain Road Bridge #06155**

Location: Penticton

Datum: UTM NAD83 | Alignment: L100

Northing/Easting: 482984.1 , 303417.7 | Station/Offset: 104+21.0 5.9m RIGHT

Elevation: 604.4 m

Date(s) Drilled: Sept 16, 2015

Drilling Company: Sea to Sky Drilling

Driller: Chad Brown

Drill Make/Model: Mobile B53

Drilling Method: Wash Rotary

Prepared by: Ministry of Transportation & Infrastructure

Logged by: MS Reviewed by: MCG

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; DYNAMIC CONE (BLOWS/300 mm); Natural Vane (KPa) / Remold Vane (KPa); SPT "N" (BLOWS/300 mm); W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
0							SAND, trace of sand, dark brown, moist, very loose	SP		604
1		3		1	50				{G: S:95 F:5}	603
							1.68m GRAVEL, sandy	GP		
2							2.29m GRANODIORITE, grey, moderately spaced joints, strong to very strong, slightly weathered (Bedrock)	BR		602
3										601
4										600
5							5.33m End of Hole at 5.3m			599
6										598
7										597
8										596
9										595
10										

Legend

Sample Type:

- A-Auger
- C-Core
- G-Grab
- V-Vane
- L#-Lab Sample
- S-Split Spoon
- O-Odex (air rotary)
- W-Wash (mud return)
- T-Shelby Tube

Final Depth of Hole: 5.3 m

Depth to Top of Rock: 2.3 m

MOT-SOIL-REV2 GREEN_MOUNTAIN_RD_2_GINT.GPJ MOT-DRAFT-REV2.GDT 17-01-18

SUMMARY LOG

Ministry of Transportation and Infrastructure

Drill Hole #: TH15-03

Project: **Green Mountain Road Bridge #06155**
Location: Penticton
Datum: UTM NAD83
Northing/Easting: 483008.5 , 303447.8
Elevation: 604.2 m
Alignment: L100
Station/Offset: 104+58.3 4.1m LEFT

Prepared by: Ministry of Transportation & Infrastructure
Logged by: MS Reviewed by: MCG

Date(s) Drilled: Sept 15, 2015
Drilling Company: Sea to Sky Drilling
Driller: Chad Brown
Drill Make/Model: Mobile B53
Drilling Method: Wash Rotary

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; DYNAMIC CONE (BLOWS/300 mm); Natural Vane (KPa) / Remold Vane (KPa); SPT "N" (BLOWS/300 mm); W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
0							Asphalt 5" 0.13m			604
							GRAVEL, fine to coarse, sandy, brown, moist, dense 0.46m	GP		
1		36		1	25		GRAVEL, fine to coarse, sandy, cobbles, brown, moist to wet, dense becoming compact with depth		{G:55 S:40 F:5}	603
2								GP		602
3		19		2	25				{G:60 S:40 F:}	601
4							SAND, silty, trace of fine gravel, grey, moist to wet, very loose 3.96m			600
		3		3	67			SM	{G:5 S:60 F:35}	
5										599
6		4		4	21		GRAVEL, fine to coarse, sandy, silty, grey, moist to wet, very loose 5.79m	GM	{G:55 S:25 F:20}	598
							GRAVEL, fine to coarse, sandy, grey, moist to wet, very loose 6.25m	GP		
7							GRANODIORITE (Bedrock) 7.01m	BR	Poor recovery	597
							End of Hole at 7.3m 7.32m			
8										596
9										595
10										

Legend
Sample Type:
A-Auger; C-Core; G-Grab; V-Vane
L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Final Depth of Hole: 7.3 m
Depth to Top of Rock: 7.0 m

MOT-SOIL-REV2 GREEN_MOUNTAIN_RD_2_GINT.GPJ MOT-DRAFT-REV2.GDT 17-01-18

SUMMARY LOG

Drill Hole #: **TH15-04**

Ministry of Transportation and Infrastructure

Project: **Green Mountain Road Bridge #06155**

Location: Penticton

Datum: UTM NAD83 | Alignment: L100

Northing/Easting: 482985.4 , 303379.2 | Station/Offset: 103+84.7 7.0m LEFT

Elevation: 605.1 m

Date(s) Drilled: Sept 15, 2015

Drilling Company: Sea to Sky Drilling

Driller: Chad Brown

Drill Make/Model: Mobile B53

Drilling Method: Wash Rotary

Prepared by: Ministry of Transportation & Infrastructure

Logged by: MS Reviewed by: MCG

DEPTH (m)	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
0	Asphalt 0.1m	GP		605
	GRAVEL, fine (Basecourse) 0.25m			
	GRAVEL, fine to coarse, sandy, cobbles	GP		
1	1.07m			604
	SAND, trace fine gravel, trace silt, dark brown, moist, very loose	SP	{G:5 S:90 F:5}	
2	2.29m			603
	SAND, some fine gravel, grey brown, moist, compact	SP	{G:10 S:90 F:}	
3				602
4	4.27m			601
	SAND and GRAVEL, fine to coarse, trace of silt, grey, moist, very dense	GP	{G:55 S:40 F:5}	
	4.72m			
5	GRANODIORITE (Bedrock)	BR		600
	5.18m			
	End of Hole at 5.2m			
6				599
7				598
8				597
9				596
10				

Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400

DYNAMIC CONE (BLOWS/300 mm)

Natural Vane (KPa) Remold Vane (KPa)

SPT "N" (BLOWS/300 mm)

W_P% W% W_L% 20 40 60 80

SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SPT "N"
	1	25	2
	2	58	25
	3	55	57

Legend

Sample Type:

A-Auger | C-Core | G-Grab | V-Vane

L#-Lab Sample | S-Split Spoon | O-Odex (air rotary) | W-Wash (mud return) | T-Shelby Tube

Final Depth of Hole: 5.2 m

Depth to Top of Rock: 4.7 m

MOT-SOIL-REV2 GREEN_MOUNTAIN_RD_2_GINT.GPJ MOT-DRAFT-REV2.GDT 17-01-18

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

January 19, 2017

Site: 49.4676 N, 119.7134 W User File Reference: Penticton Green Mountain Road Bridge

Requested by: ,

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.089	0.131	**0.167**	0.164	**0.145**	**0.106**	**0.073**	**0.032**	**0.010**	**0.078**	**0.136**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.013	0.036	0.056
Sa(0.1)	0.019	0.053	0.081
Sa(0.2)	0.029	0.073	0.108
Sa(0.3)	0.033	0.078	0.111
Sa(0.5)	0.031	0.071	0.100
Sa(1.0)	0.021	0.051	0.072
Sa(2.0)	0.013	0.032	0.047
Sa(5.0)	0.0039	0.011	0.019
Sa(10.0)	0.0016	0.0042	0.0063
PGA	0.012	0.033	0.049
PGV	0.021	0.056	0.085

References

National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français

Natural Resources Canada Ressources naturelles Canada

Canada