

Owner: Village of Pemberton
(NAME OF OWNER)

Contract: Friendship Pedestrian Bridge
(TITLE OF CONTRACT)

Reference No. 2018-04
(OWNER'S CONTRACT REFERENCE NO.)

To All Tenderers:

Date: April 13, 2018

This addendum shall form part of the original documents for the above noted contract and all other segments of the contract shall remain in force except as noted below:

1. – Geotechnical Review Report

A geotechnical report has been prepared for this project and is included as Attachment #1 to this Addendum. The Contractor is should be aware that this report is for information only and that the Village of Pemberton has retained a geotechnical firm to complete the geotechnical review of the site for additional permitting requirements of the MoTI.

All tenderers shall acknowledge receipt of Addendum #3 (one (1) page) and the following Attachment:

- Attachment #1 – Preliminary Geotechnical Overview Report, Village of Pemberton Pedestrian Bridge Project (eight (8) pages)

by signing in the space provided and submitting this signed addendum including attachments with the tender. Tenders submitted without acknowledgment of this addendum may be considered incomplete.

Receipt acknowledged and conditions agreed _____ day of _____, 2018

Tenderer

Signature

END ADDENDUM #3



DWB Consulting Services Ltd.

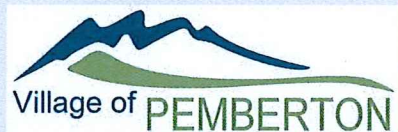
PRELIMINARY GEOTECHNICAL OVERVIEW REPORT

Village of Pemberton Pedestrian Bridge Project

Reference No: 2016-01

Engineering | Environmental | Forestry

Prepared for: Village of Pemberton



Prepared by: DWB Consulting Services Ltd.

Prince George Division

1579 – 9th Avenue Prince George BC V2L 3R8

250.562.5541 | www.dwbconsulting.ca

Date: 01.08.2017 | DWB file: 1762-147 | Revisions: 2



OQM | Organizational Quality
Management Program

Signature Page

DWB Consulting Services Ltd. is pleased to submit this report for your review. This report has been prepared using sound technical and professional judgement, based on our knowledge and experience, applicable regulatory framework, industry best management practices, and current understanding of project conditions, design, and project setting.

Report Title: Geotechnical Report – Village of Pemberton Friendship Trail Bridge Project

Prepared For: Village of Pemberton

Revision: 2

Written By:

Adel Alwaily, MASC, PEng.

Reviewed By:

Todd Wambolt, PEng., Megan Lavoie, EIT.

REVISION HISTORY			
Date	Version	Review Type ¹	Reviewed by (Name, Company)
30/06/2017	DRAFT	EDITORIAL	DWB
11/07/2017	1	Professional Review	DWB
01/08/2017	2	Client Review	Dan Estey, ISL
09/30/2017	2	Owner Review	Village of Pemberton

¹ Editorial Review: Reviewed for formatting, grammar, spelling, etc.

Professional Review: Reviewed for content and professional signoff

Client Review: Reviewed by client

Owner Review: Reviewed by owner

Regulatory Review: Reviewed by regulatory agency (i.e. DFO) if necessary

Peer Review: Reviewed for content and errors by peer

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6.0 CLOSURE..... 3

1.0 INTRODUCTION

The Village of Pemberton is planning to build a new pedestrian/cycling bridge south of the highway 99 Red Bridge No. 443. DWB Consulting Services Ltd. (DWB) was retained by Village of Pemberton to design the new bridge. The new bridge will be built on two steel pipe pile piers in the water, one out of current wetted area and two abutments. This report provides the foundation engineering recommendations for the foundation design and the slope stability analysis for the bridge abutments.

2.0 INFORMATION AND SITE INVESTIGATION

The bridge pile foundation design is based on the borehole logs for Red Bridge No. 443 provided by the client as shown in Appendix A. Seven soil samples have been taken from the bridge location to understand the surface soil classification and sieve analyses for the samples can be found in Appendix B.

The scope of work for this assessment includes the following:

- 1- Pile analysis and design for the proposed new pedestrian/cycling bridge.
- 2- Abutment slope stability analysis.

From bore holes logs, and for simplicity, the soil profile has been modeled as two layers of soils as described in Table 1 and pile capacity is summarized as shown in table 2 below.

Table 1: Soil Properties used in Pile Design

Layer	Soil Description	Thickness (m)	Soil Unit weight (γ) (kN/m ³)	Soil Friction Angle (ϕ) (Degree)	Soil Cohesion (c) (kPa)
Layer 1	Sandy SILT	8.0	20.3	29.8	29.9
Layer 2	Compact SAND	20.0	19.2	36.8	0.0

Table 2: Pile Capacity using 406 ϕ x 16mm Piles

Pile Size	Pile Penetration depth (m)	Pile End Condition	Pile Ultimate Capacity (kN)	Pile Allowable Capacity (kN)	Pile Lifting Capacity (kN)
406 ϕ x 16mm	26m	Closed	3,700	1,850	1,465
406 ϕ x 16mm	16m	Open	1,395	698	756

3.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

The bridge was modeled and analyzed using STAAD Pro software. The structure was designed to ensure strength and serviceability necessary to resist the applied loads in accordance with the applicable building code and the Canadian Highway Bridge Design Code. Appropriate load combinations will be applied according to the 2014 Canadian Highways Bridge Design Code, the pile applied load is shown in Table 3

Table 3: Piles Loading

	Piles		
	Abutments	Pier 1	Pier 2&3
Forces (kN)	Vertical piles 2.4m Spacing	Vertical piles 4.0m Spacing	Vertical piles 4.0m Spacing
Service Load (SLS)	234	697	697
Ultimate Load (ULS) (Long Term)	330	980	980
Ultimate Load (ULS) (Short Term)	353	1,677	1,300
Ultimate Load (Uplift) (Short Term)	14	561	402
Pile Design			
Pile Size (mm)	406 ϕ x 12 mm	406 ϕ x 16 mm	406 ϕ x 16 mm
Pile Penetration Depth (m)	20*	30*	26
Pile End (Open / Close)	Open	Closed	Closed
Geotechnical Capacity (kN)			
Compression (Ultimate)	1,395	3,700	3,700
Uplift (Ultimate)	756	1,465	1,465
Compression (Allowable)	698	1,850	1,850
Settlement	1.0 mm	3.0 mm	3.0 mm
Geotechnical Resistance Factor			
Service Load (SLS) / Code Limit	0.34	0.38	0.38
Ultimate Load (ULS) (Long Term)	0.24	0.26	0.26
Ultimate Load (ULS) (Short Term)	0.25	0.35	0.35
Ultimate Load (Uplift) (Short Term)	0.02	0.27	0.22
Status (As per CHBDC S6-14-Table 6.2)	PASS	PASS	PASS

Note:-

* Including 4.0m scour

The pile driving will be performed by using a 6,000lb drop hammer. Pile driving criteria is as shown in Table 4 below:

Table 4: Piles Driving Criteria Using 6,000lb Drop Hammer

Pile Driving Criteria	Piles		
	Abutment	Pier 1	Pier 2&3
Hammer Drop Distance (m / ft)	1.52 / 5	2.13 / 7	1.98 / 6.5
Pile Set (Blows/inch)	4	10	8
Pile Stress Ratio (WEAP Analysis)	88%	92%	83%

4.0 SLOPE STABILITY ASSESSMENT

1- West Abutment:

The abutment in general is flat; therefore no slope stability assessment is required.

2- East Abutment:

Slope stability assessment has been carried out using the soil samples collected from the east abutment pits (E1, E2, and E3).

The local slope stability assessment shows that the achieved mean safety factor for the abutment and the gravel trail are 1.60 and 1.89 respectively. Both exceed the minimum required mean safety factor of 1.5.

The required side slope for the abutment and the trail as shown in the figure 1 below.

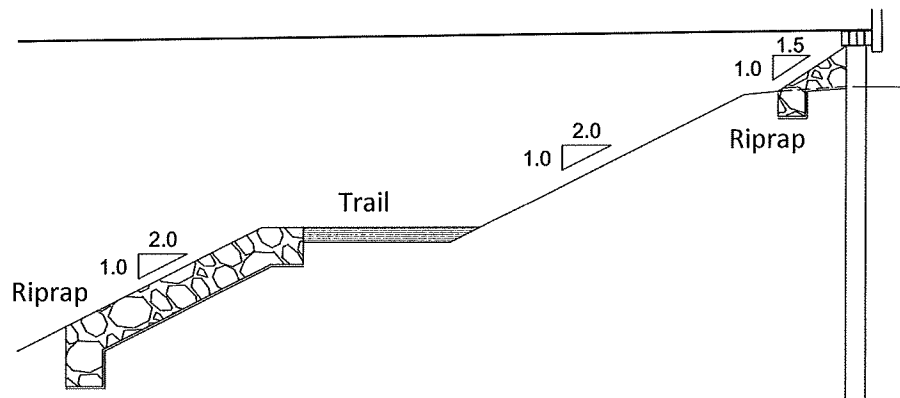


Figure 1: Minimum Side Slope Requirement (Matching Existing Slope)

5.0 CONSTRUCTION REVIEW

To be completed

6.0 CLOSURE

To be completed

Appendix A

Bore Hole Logs

Ministry of Transportation and Highways BOREHOLE LOG Geotechnical and Materials Branch Hole No. 79-1

Project **PEMBERTON - PORTAGE ROAD, RED BRIDGE**

Location **STA 3+04.4, 4m LT** Elevation **206.4m**

Driller **B. LINTOTT** Method **DIAMOND DRILL** Dates **79-8-2/7**

Drilling Details	Depth (m)	Sample Type	Blowcount	Recovery (%)	Shear Strength	Gradation		Index Properties		Classification	Description	Other Tests
						Gravel	Sand	W _L	W _P			
	1										ML firm sandy SILT	
	2										SP SAND and GRAVEL 2.1m	
	3										SM 10% ORGANIC	
	4										soft and firm silty SAND and organic SILT	
	5										OH 25% ORGANIC	
	6										OH 10% ORGANIC	
	7										ML 5% ORGANIC	
	8										SM compact SAND 8.5m	M
	9										traces of gravel and silt	
	10										SP	
	11										SP	
	12										SP	
	13										SP	
	14										SP	
	15										SP	
	16										SP	
	17										SP	
	18										SP	

SAMPLE TYPE: A - Auger, C - Core, D - Denison, S - Split Spoon, T - Shelby Tube, W - Wash

SHEAR STRENGTH: U - Unconfined Compression, L_v - Lab Vane, F_v - Field Vane, R - Remoulded

TESTS: M - Mechanical Analysis, QRS - Triaxial Compression, C - Consolidation, DS - Direct Shear, W_L, W_P - Liquid Plastic Limits, W - Moisture Content

File No. 01-13-09

Drawn BK-DHA

Sheet 1 of 2

Ministry of Transportation and Highways BOREHOLE LOG Geotechnical and Materials Branch Hole No. 79-1

Project **PEMBERTON - PORTAGE ROAD, RED BRIDGE**

Location **STA 3+04.4, 4m LT** Elevation **206.4m**

Driller **B. LINTOTT** Method **DIAMOND DRILL** Dates **79-8-2/7**

Drilling Details	Depth (m)	Sample Type	Blowcount	Recovery (%)	Shear Strength	Gradation		Index Properties		Classification	Description	Other Tests
						Gravel	Sand	W _L	W _P			
	19										SP compact SAND traces of gravel and silt	
	20										SP	
	21										SP	
	22										SP	
	23										SP	
	24										SP	
	25										SP	
	26										SP	
	27										SP	
	28										SP	
	29										SP	
	30										SP	
	31										SP	
	32										SP	
	33										SP	
	34										SP	
	35										SP	
	36										SP	

SAMPLE TYPE: A - Auger, C - Core, D - Denison, S - Split Spoon, T - Shelby Tube, W - Wash

SHEAR STRENGTH: U - Unconfined Compression, L_v - Lab Vane, F_v - Field Vane, R - Remoulded

TESTS: M - Mechanical Analysis, QRS - Triaxial Compression, C - Consolidation, DS - Direct Shear, W_L, W_P - Liquid Plastic Limits, W - Moisture Content

File No. 01-13-09

Drawn BK-DHA

Sheet 2 of 2

Ministry of Transportation and Highways BOREHOLE LOG Geotechnical and Materials Branch Hole No. 79-3

Project **PEMBERTON - PORTAGE ROAD, RED BRIDGE**

Location **STA 6+69 m, 1m LT** Elevation **206.36m**

Driller **B. LINTOTT** Method **DIAMOND DRILL** Dates **79-7-27/8**

Drilling Details	Depth (m)	Sample Type	Blowcount	Recovery (%)	Shear Strength	Gradation		Index Properties		Classification	Description	Other Tests
						Gravel	Sand	W _L	W _P			
	1										SP loose GRAVEL, driller's inter.	
	2										ML 5% organic	
	3										OH 20% organic	
	4										soft to firm silty SAND	
	5										ML 5% organic	
	6										SANDY SILT	
	7										ML 5% organic	
	8										SM compact silty SAND slightly organic	M
	9										driller's interpretation	
	10										SP compact SAND some with fine gravel some silt	M
	11										SP	
	12										SP	
	13										SP	
	14										SP	
	15										SP	
	16										SP	
	17										SP	
	18										SP dense layer	

SAMPLE TYPE: A - Auger, C - Core, D - Denison, S - Split Spoon, T - Shelby Tube, W - Wash

SHEAR STRENGTH: U - Unconfined Compression, L_v - Lab Vane, F_v - Field Vane, R - Remoulded

TESTS: M - Mechanical Analysis, QRS - Triaxial Compression, C - Consolidation, DS - Direct Shear, W_L, W_P - Liquid Plastic Limits, W - Moisture Content

File No. 01-13-09

Drawn BK-DHA

Sheet 1 of 2

Ministry of Transportation and Highways BOREHOLE LOG Geotechnical and Materials Branch Hole No. 79-5

Project **PEMBERTON - PORTAGE ROAD, RED BRIDGE**

Location **STA 6+69 m, 1m LT** Elevation **206.36m**

Driller **B. LINTOTT** Method **DIAMOND DRILL** Dates **79-7-27/8**

Drilling Details	Depth (m)	Sample Type	Blowcount	Recovery (%)	Shear Strength	Gradation		Index Properties		Classification	Description	Other Tests
						Gravel	Sand	W _L	W _P			
	19										SP dense layer compact SAND some with fine gravel, some silt	
	20										SP	
	21										SP	
	22										SP	
	23										SP	
	24										SP	
	25										SP	
	26										SP	
	27										SP	
	28										SP	
	29										SP	
	30										SP	
	31										SP	
	32										SP	
	33										SP	
	34										SP	
	35										SP	
	36										SP	

SAMPLE TYPE: A - Auger, C - Core, D - Denison, S - Split Spoon, T - Shelby Tube, W - Wash

SHEAR STRENGTH: U - Unconfined Compression, L_v - Lab Vane, F_v - Field Vane, R - Remoulded

TESTS: M - Mechanical Analysis, QRS - Triaxial Compression, C - Consolidation, DS - Direct Shear, W_L, W_P - Liquid Plastic Limits, W - Moisture Content

File No. 01-13-09

Drawn BK-DHA

Sheet 2 of 2

Ministry of Transportation and Highways BOREHOLE LOG Geotechnical and Materials Branch Hole No. 86-0

Project **PEMBERTON - PORTAGE RD, RED BRIDGE**

Location **STA 5+56.2, 6.0m LT** Elevation **207.62m**

Driller **M. SHAWWOOD** Method **DIAMOND DRILL** Dates **86/09/10**

Drilling Details	Depth (m)	Sample Type	Blowcount	Recovery (%)	Shear Strength	Gradation		Index Properties		Classification	Description	Other Tests
						Gravel	Sand	W _L	W _P			
	1										driller reports sandy GRAVEL	
	2										OH 5% organic firm silty SANDY ORGANIC CLAY	
	3										SM loose silty SAND	
	4										driller reports sandy GRAVEL	
	5										OH 5% organic soft sandy organic CLAY	
	6										ML soft to firm sandy SILT and sandy organic CLAY	
	7										OH 5% organic soft sandy organic CLAY	
	8										ML soft to firm sandy SILT and sandy organic CLAY	
	9										OH	
	10										very sandy SILT	
	11										SP loose to compact silty, gravelly SAND	
	12										SP	
	13										SP	
	14										SP	
	15										SP	
	16										SP	
	17										SP	
	18										SP compact silty SAND	

SAMPLE TYPE: A - Auger, C - Core, D - Denison, S - Split Spoon, T - Shelby Tube, W - Wash

SHEAR STRENGTH: U - Unconfined Compression, L_v - Lab Vane, F_v - Field Vane, R - Remoulded

TESTS: M - Mechanical Analysis, QRS - Triaxial Compression, C - Consolidation, DS - Direct Shear, W_L, W_P - Liquid Plastic Limits, W - Moisture Content

File No. 01-13-09

Drawn BK-DHA

Sheet 1 of 2

Ministry of Transportation and Highways BOREHOLE LOG Geotechnical and Materials Branch Hole No. 86-0

Project **PEMBERTON - PORTAGE RD, RED BRIDGE**

Location **STA 5+56.2, 6.0m LT** Elevation **207.62m**

Driller **M. SHAWWOOD** Method **DIAMOND DRILL** Dates **86/09/10**

Drilling Details	Depth (m)	Sample Type	Blowcount	Recovery (%)	Shear Strength	Gradation		Index Properties		Classification	Description	Other Tests
						Gravel	Sand	W _L	W _P			
	19										compact silty SAND	
	20										SP	
	21										SP	
	22										SP	
	23										SP	
	24										SP	
	25										SP	
	26										SP	
	27										SP	
	28										SP	
	29										SP	
	30										SP	
	31										SP	
	32										SP	
	33										SP	
	34										SP	
	35										SP	
	36										SP	

SAMPLE TYPE: A - Auger, C - Core, D - Denison, S - Split Spoon, T - Shelby Tube, W - Wash

SHEAR STRENGTH: U - Unconfined Compression, L_v - Lab Vane, F_v - Field Vane, R - Remoulded

TESTS: M - Mechanical Analysis, QRS - Triaxial Compression, C - Consolidation, DS - Direct Shear, W_L, W_P - Liquid Plastic Limits, W - Moisture Content

File No. 01-13-09

Drawn BK-DHA

Sheet 2 of 2

SOIL CLASSIFICATION		
MAJOR DIVISIONS	SYMBOL	SOIL TYPE
GRAVEL & GRAVELLY SOILS	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GM*	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC*	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
SAND & SANDY SOILS	SM*	SILTY SANDS, SAND-SILT MIXTURES
	SC*	CLAYEY SANDS, SAND-CLAY MIXTURES
	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	MH	INORGANIC SILTS, MICACEOUS OR DIATOM-ACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
FINE GRAINED SOILS	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
ORGANIC SOILS	PI	PEAT AND OTHER HIGHLY ORGANIC SOILS
TOPSOIL	TS	TOPSOIL WITH ROOTS, ETC.
COBBLES	SB	ROCK FRAGMENTS AND COBBLES, PARTICLE SIZE 75 mm TO 300 mm DIAMETER
BOULDERS	LB	BOULDERS, PARTICLE SIZE OVER 300 mm IN DIAMETER

* GM₂, GC₂, SM₂, SC₂, 12 - 20%
GM₂, GC₂, SM₂, SC₂, 20 - 30%
GM₂, GC₂, SM₂, SC₂, 30 - 40%
GM₂, GC₂, SM₂, SC₂, 40 - 50%
passing No. 200 sieve

SAMPLE TYPE: A - Auger, C - Core, D - Denison, P - Pitcher Sampler, S - Split Spoon, T - Shelby Tube, W - Wash

SHEAR STRENGTH: U - Unconfined Compression, L_v - Lab Vane, F_v - Field Vane, R - Remoulded

TESTS: M - Mechanical Analysis, QRS - Triaxial Compression, C - Consolidation, DS - Direct Shear, W_L, W_P - Liquid Plastic Limits, W - Moisture Content

Blowcount - Standard Penetration Test (ASTM 1586)

PREPARED BY: GEOTECHNICAL & MATERIALS BRANCH

DRAWING NO. INDEX REG. NO. SHT. NO. R 22091 1 of 1

REVISIONS: Date Description Initial

GOVERNMENT OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
BRIDGE ENGINEERING BRANCH

NORTH VANCOUVER DISTRICT
PEMBERTON PORTAGE ROAD
RED BRIDGE
BOREHOLE DATA - SHEET 1

PREPARED UNDER THE DIRECTION OF: 86-06-06 SUPERVISING GEOTECHNICAL ENGINEER

DATE: 86-07-18

SCALE: DRAWN: DHA 8/6/86 CHECKED: MGElect

RECOMMENDED: 46-07-18

DATE: 1988 14

DRAWING NO. 443-27

Ministry of Transportation
and Highways

CONE PENETROMETER LOG

Geotechnical and
Materials Branch

HOLE NO
86-01

Project RED BRIDGE

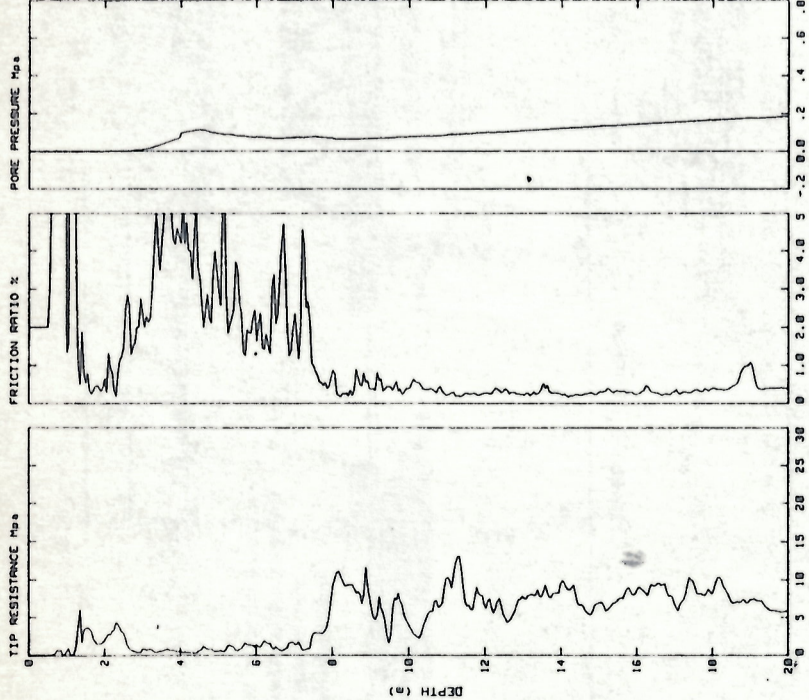
File No

Location STN: 5 + 63 O/S: 0.4 m RT

Elevation 205.985

Engineer TOM OXLAND

Date 04/21/86 14:37



Ministry of Transportation
and Highways

CONE PENETROMETER LOG

Geotechnical and
Materials Branch

HOLE NO
86-01

Project RED BRIDGE

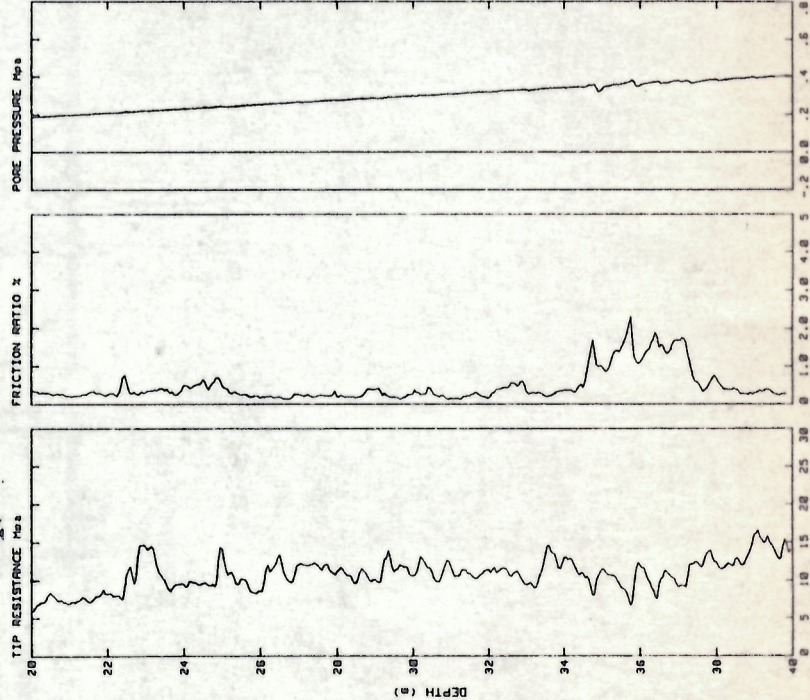
File No

Location STN: 5 + 65 O/S: 0.4 m RT

Elevation 205.985

Engineer TOM OXLAND

Date 04/21/86 14:37



SOIL CLASSIFICATION

MAJOR DIVISIONS	SYMBOL	SOIL TYPE
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SAND & SANDY SOILS	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
	SM*	SILTY SANDS
	SC*	CLAYEY SANDS
SILTS AND CLAYS LL < 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	MH	INORGANIC SILTS, MICACEOUS OR DIATOM-ACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
SILTS AND CLAYS LL > 50	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
	PI	PEAT AND OTHER HIGHLY ORGANIC SOILS
	TS	TOPSOIL WITH ROOTS, ETC.
COBBLES	SB	ROCK FRAGMENTS AND COBBLES, PARTICLE SIZE 75 mm TO 300 mm DIAMETER
BOULDERS	LB	BOULDERS, PARTICLE SIZE OVER 300 mm IN DIAMETER
* GM _s , GC _s , SM _s , SC _s , 12 - 20% GM _s , GC _s , SM _s , SC _s , 20 - 30% GM _s , GC _s , SM _s , SC _s , 30 - 40% GM _s , GC _s , SM _s , SC _s , 40 - 50% passing No. 200 sieve		

SAMPLE TYPE
A - Auger
C - Core
D - Densom
P - Pitcher Sampler
S - Split Spoon
T - Shelby Tube
W - Wash

SHEAR STRENGTH
U - Unconfined Compression
L_v - Lab Vane
F_v - Field Vane
R - Remoulded

TESTS
M - Mechanical Analysis
QRS - Triaxial Compression
C - Consolidation
DS - Direct Shear
W_L - Liquid Plastic Limits
W - Moisture Content

Blowcount - Standard Penetration Test (ASTM 1586)

PREPARED BY:
GEOTECHNICAL & MATERIALS
BRANCH

DRAWING NO.
INDEX
NEG NO
SHEET NO
R 92092 1 of 1

REVISIONS
Date
Description
Initial

GOVERNMENT OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
BRIDGE ENGINEERING BRANCH

NORTH VANCOUVER DISTRICT
PEMBERTON PORTAGE ROAD
RED BRIDGE
BOREHOLE DATA - SHEET 2

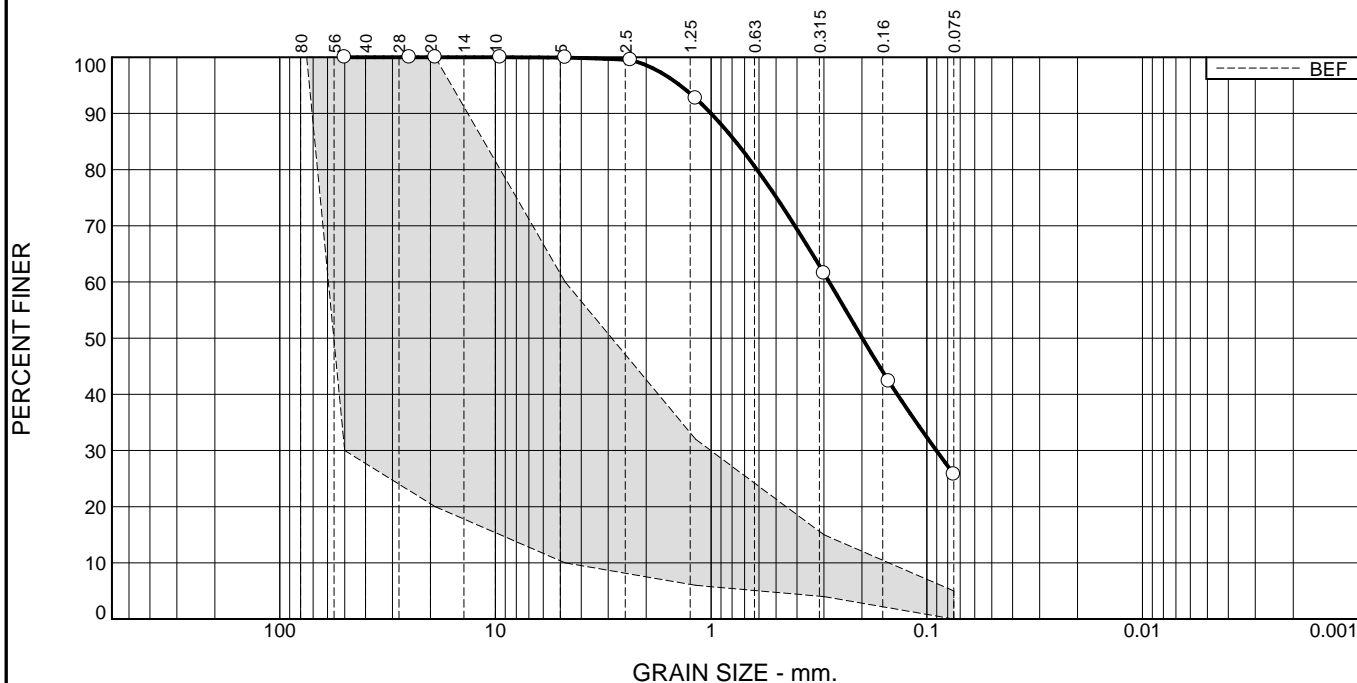
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SCALE
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CHECKED
DATE
ACCEPTED FOR CONSTRUCTION
DATE
RESOLUTIVE DIRECTION OF ENGINEERING

443-28

Appendix B

Sieve Analysis

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	1.3	27.6	45.2	25.8	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
50 mm	100.0	30.0 - 100.0	
25mm	100.0		
19mm	100.0	20.0 - 100.0	
9.5mm	100.0		
4.75mm	99.9	10.0 - 60.0	X
2.36mm	99.5		
1.18mm	92.7	6.0 - 32.0	X
0.3mm	61.6	4.0 - 15.0	X
0.15mm	42.3		
0.075mm	25.8	0.0 - 5.0	X

* BEF

Material Description

silty SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 1.0008 D₈₅= 0.7703 D₆₀= 0.2837
D₅₀= 0.1991 D₃₀= 0.0903 D₁₅=
D₁₀= C_u= C_c=

Remarks

Natural Moisture 15.0%

Date Received: June 25, 2017 **Date Tested:** June 26, 2017

Tested By: JZ

Checked By: _____

Title: _____

Location: Side-bar 50m U/S
Sample Number: 1

Date Sampled: June 20, 2017

DWB Consulting Services Ltd.

Client: SURESPAN

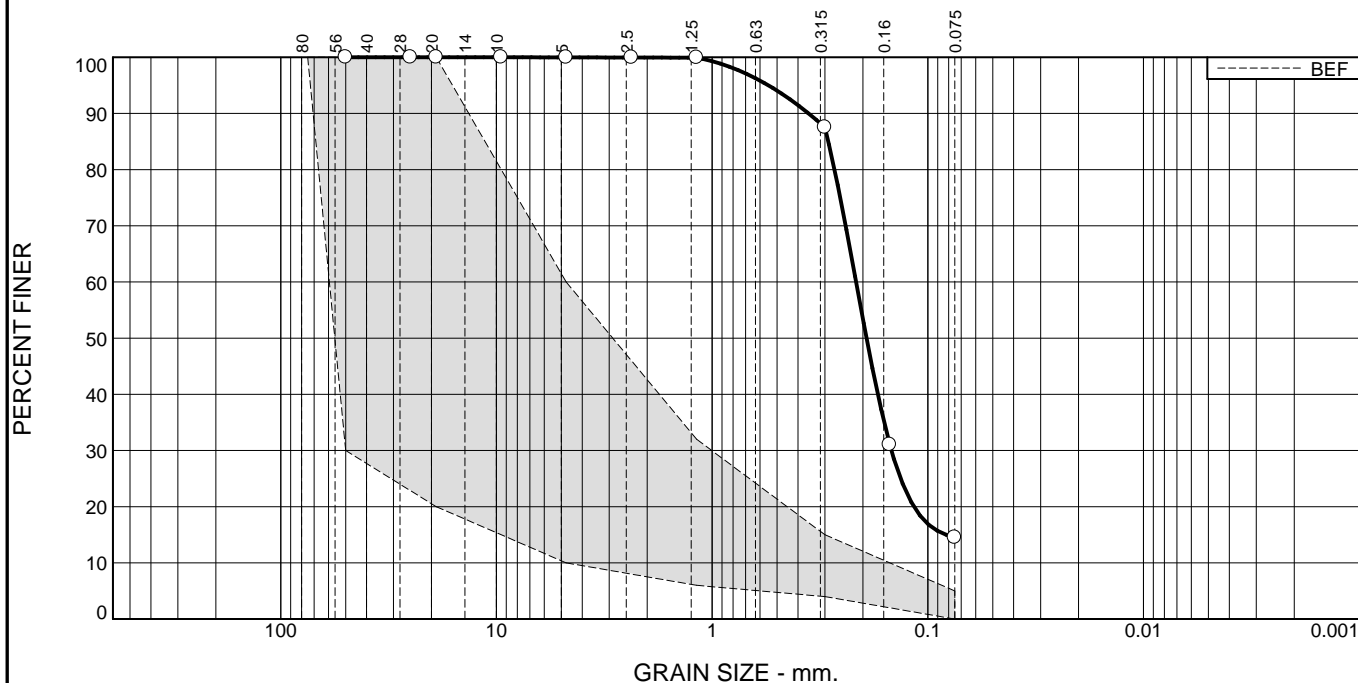
Project: Pemberton Pedestrian Bridge

Prince George, BC

Project No: 1762-147

Figure

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	7.7	77.7	14.5	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
50 mm	100.0	30.0 - 100.0	
25mm	100.0		
19mm	100.0	20.0 - 100.0	
9.5mm	100.0		
4.75mm	100.0	10.0 - 60.0	X
2.36mm	100.0		
1.18mm	99.9	6.0 - 32.0	X
0.3mm	87.5	4.0 - 15.0	X
0.15mm	31.0		
0.075mm	14.5	0.0 - 5.0	X

* BEF

Material Description

SAND with some fines

PL= **Atterberg Limits (ASTM D 4318)** LL= PI=

USCS (D 2487)= **Classification** AASHTO (M 145)=

Coefficients
D₉₀= 0.3572 D₈₅= 0.2893 D₆₀= 0.2150
D₅₀= 0.1923 D₃₀= 0.1475 D₁₅= 0.0822
D₁₀= C_u= C_c=

Remarks

Natural Moisture 22.8%

Date Received: June 25, 2017 Date Tested: June 26, 2017

Tested By: JZ

Checked By: _____

Title: _____

Location: Bed Materials #2, Boat Launch, W side
Sample Number: 1

Date Sampled: June 20, 2017

DWB Consulting Services Ltd.

Client: SURESPAN

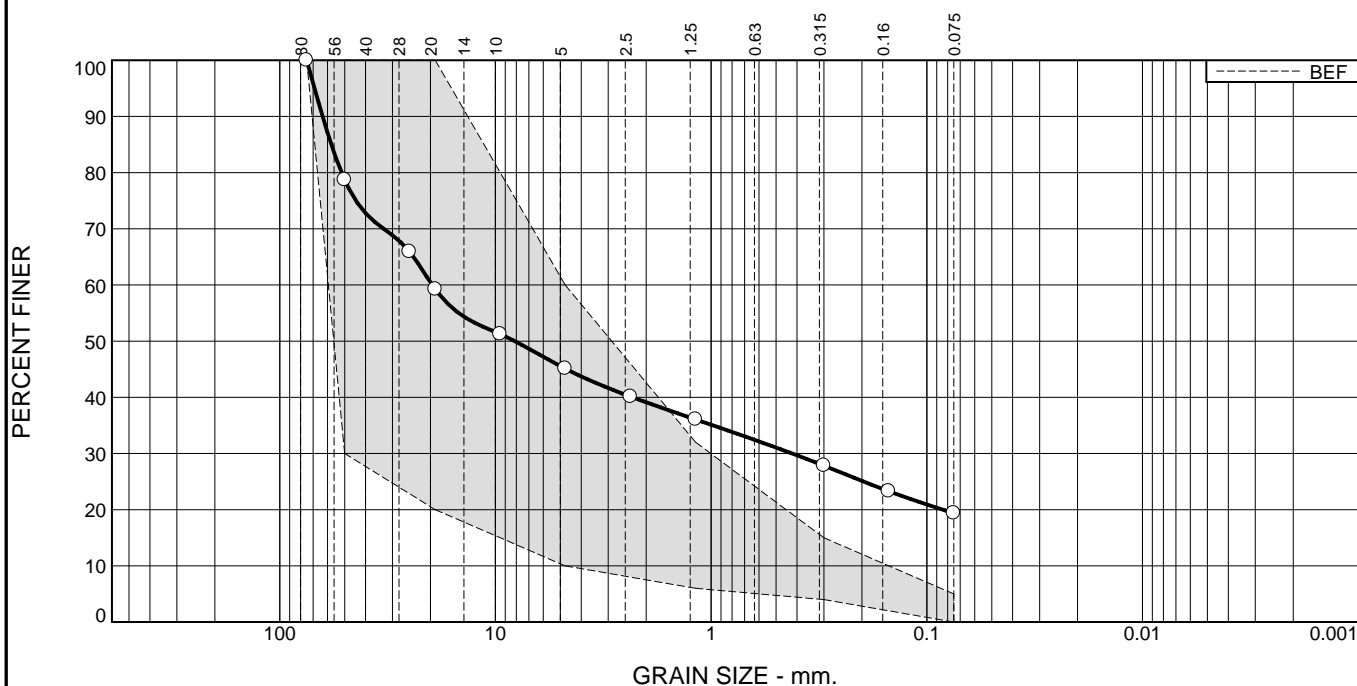
Project: Pemberton Pedestrian Bridge

Prince George, BC

Project No: 1762-147

Figure

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	40.7	14.2	6.0	9.0	10.7	19.4	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
75 mm	100.0	100.0	
50 mm	78.7	30.0 - 100.0	
25 mm	65.9		
19 mm	59.2	20.0 - 100.0	
9.5 mm	51.2		
4.75 mm	45.1	10.0 - 60.0	
2.36 mm	40.1		
1.18 mm	36.1	6.0 - 32.0	X
0.3 mm	27.8	4.0 - 15.0	X
0.15 mm	23.3		
0.075 mm	19.4	0.0 - 5.0	X

* BEF

Material Description

sandy GRAVEL with some fines

PL= **Atterberg Limits (ASTM D 4318)** LL= PI=

USCS (D 2487)= **Classification** AASHTO (M 145)=

Coefficients
D₉₀= 63.2795 D₈₅= 57.6342 D₆₀= 19.6258
D₅₀= 8.1423 D₃₀= 0.4211 D₁₅=
D₁₀= C_u= C_c=

Remarks

Natural Moisture: 6.0%
Sampling Location: 10U 516459
5573792

Date Received: June 25, 2017 Date Tested: June 26, 2017

Tested By: JZ

Checked By:

Title:

Location: West Abutment Pit W1
Sample Number: 1

Date Sampled: June 20, 2017

DWB Consulting Services Ltd.

Client: SURESPAN

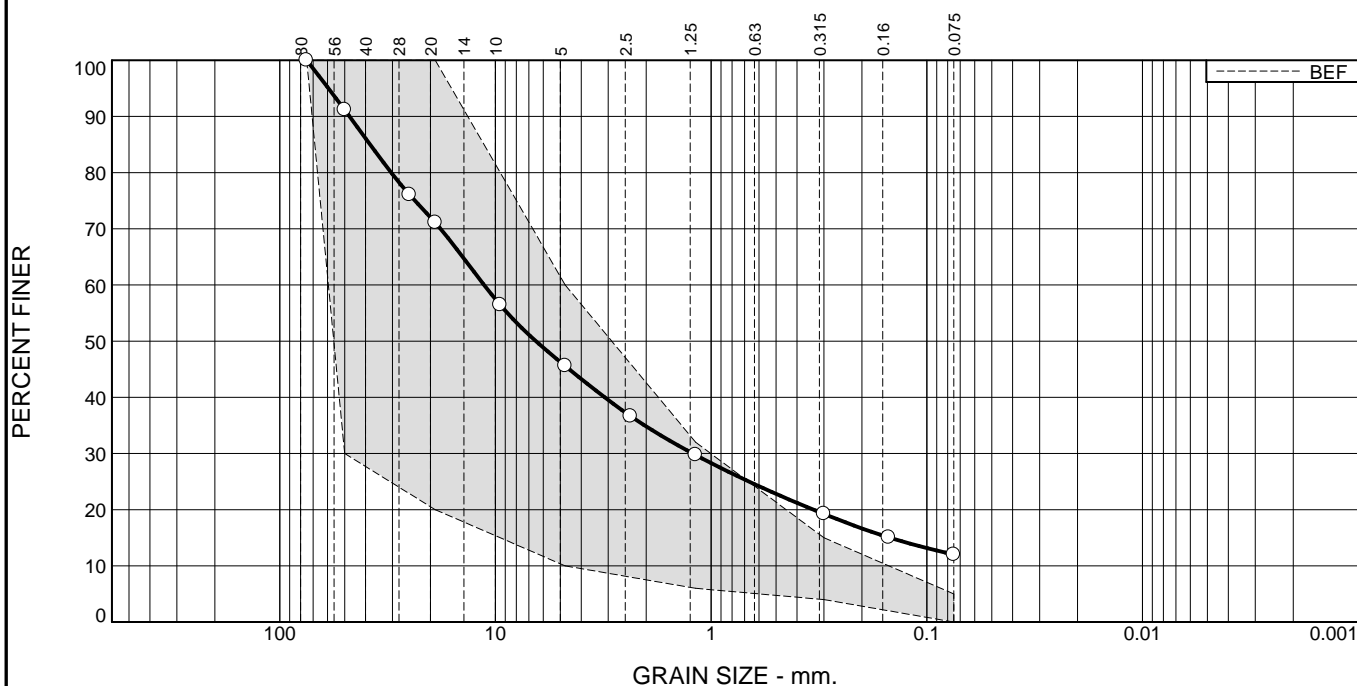
Project: Pemberton Pedestrian Bridge

Prince George, BC

Project No: 1762-147

Figure

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.9	25.5	10.8	13.2	9.6	12.0	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
75 mm	100.0	100.0	
50 mm	91.2	30.0 - 100.0	
25 mm	76.1		
19 mm	71.1	20.0 - 100.0	
9.5 mm	56.4		
4.75 mm	45.6	10.0 - 60.0	
2.36 mm	36.6		
1.18 mm	29.7	6.0 - 32.0	
0.3 mm	19.2	4.0 - 15.0	X
0.15 mm	15.1		
0.075 mm	12.0	0.0 - 5.0	X

* BEF

Material Description

sandy GRAVEL with some fines

PL= **Atterberg Limits (ASTM D 4318)** LL= PI=

USCS (D 2487)= **Classification** AASHTO (M 145)=

Coefficients
D₉₀= 47.4529 D₈₅= 38.1183 D₆₀= 11.2920
D₅₀= 6.4916 D₃₀= 1.2159 D₁₅= 0.1484
D₁₀= C_u= C_c=

Remarks

Moisture Content: 5.7%
Sampling Location: 10U 516455
5573795

Date Received: Jun 23, 2017 Date Tested: Jun 25, 2017

Tested By: JZ

Checked By: _____

Title: _____

Location: West Abutment Pit W2
Sample Number: 1

Date Sampled: Jun 20, 2017

DWB Consulting Services Ltd.

Client: SURESPAN

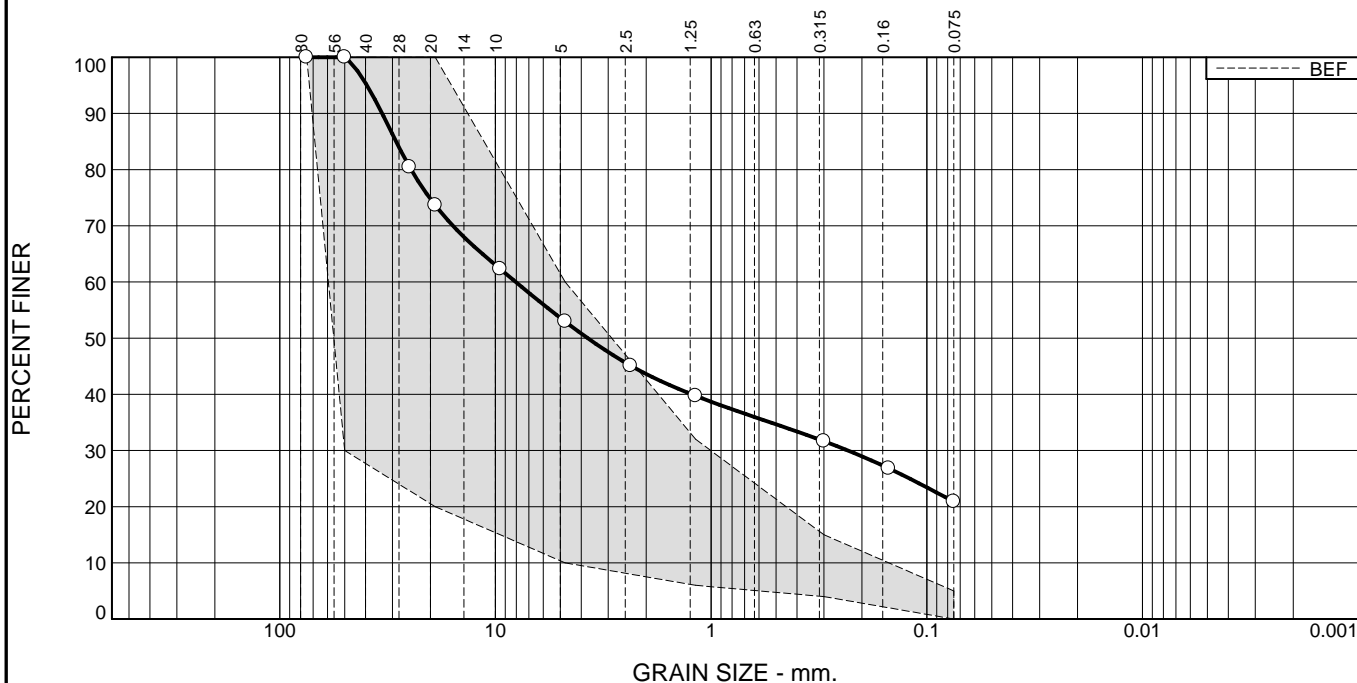
Project: Pemberton Pedestrian Bridge

Prince George, BC

Project No: 1762-147

Figure

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	26.3	20.8	9.3	9.9	12.8	20.9	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
75 mm	100.0	100.0	
50 mm	100.0	30.0 - 100.0	
25 mm	80.5		
19 mm	73.7	20.0 - 100.0	
9.5 mm	62.3		
4.75 mm	52.9	10.0 - 60.0	
2.36 mm	45.1		
1.18 mm	39.7	6.0 - 32.0	X
0.3 mm	31.6	4.0 - 15.0	X
0.15 mm	26.8		
0.075 mm	20.9	0.0 - 5.0	X

* BEF

Material Description

sandy gravel with some fines

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 33.5308 D₈₅= 28.8705 D₆₀= 8.0495
D₅₀= 3.7365 D₃₀= 0.2325 D₁₅=
D₁₀= C_u= C_c=

Remarks

Natural moisture 5.8% Location coordinates 516470, 5573793

Date Received: June 24, 2017 Date Tested: June 26, 2017

Tested By: JZ

Checked By:

Title:

Location: W Abutment Pit W3
Sample Number: 1

Date Sampled: June 20, 2017

DWB Consulting Services Ltd.

Client: SURESPAN

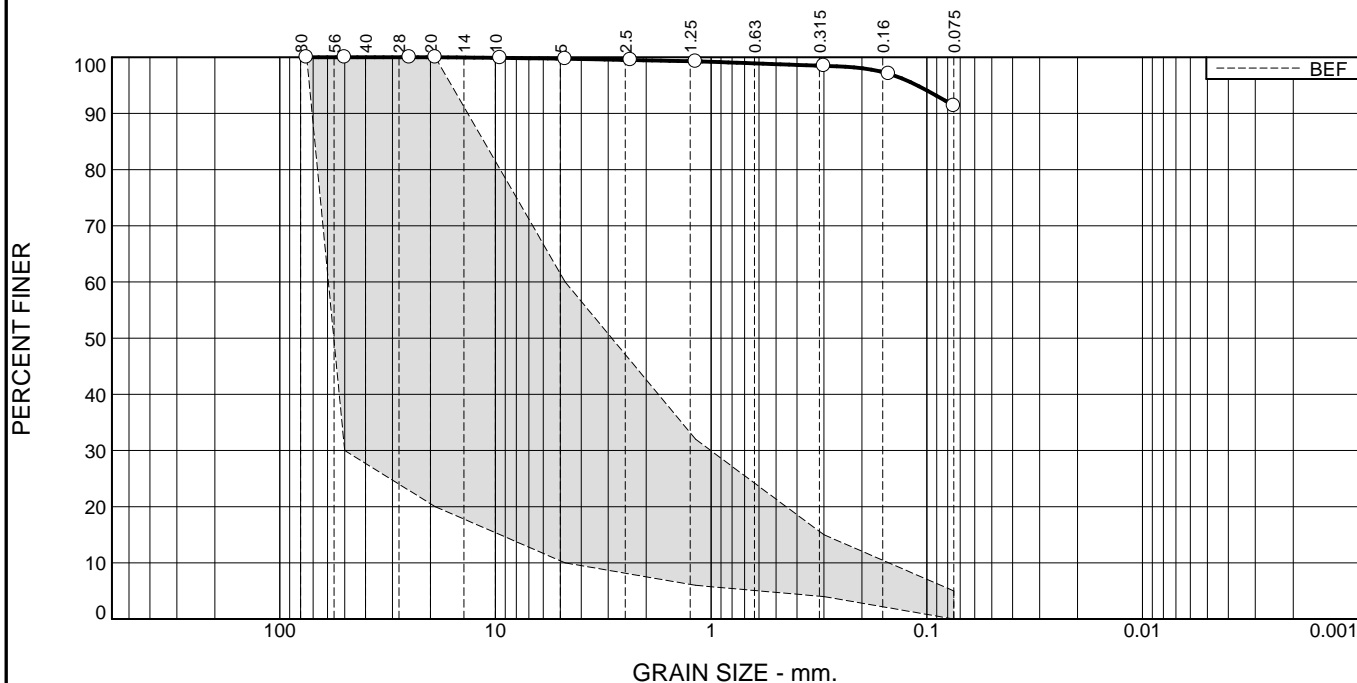
Project: Pemberton Pedestrian Bridge

Prince George, BC

Project No: 1762-147

Figure

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.2	0.8	7.3	91.4	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
75 mm	100.0	100.0	
50 mm	100.0	30.0 - 100.0	
25 mm	100.0		
19 mm	100.0	20.0 - 100.0	
9.5 mm	99.9		
4.75 mm	99.7	10.0 - 60.0	X
2.36 mm	99.5		
1.18 mm	99.3	6.0 - 32.0	X
0.6 mm	98.5	4.0 - 15.0	X
0.3 mm	97.1		
0.15 mm	91.4	0.0 - 5.0	X
0.075 mm	91.4		

* BEF

Material Description

FINES with trace of gravel and sand

PL= **Atterberg Limits (ASTM D 4318)** LL= PI=

USCS (D 2487)= **Classification** AASHTO (M 145)=

Coefficients
D₉₀= D₈₅= D₆₀=
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks
Moisture Content: 14.8% Sampling Location: 10U 516488
5573801

Date Received: Jun 24, 2017 Date Tested: Jun 26, 2017

Tested By: JZ

Checked By:

Title:

Location: West Pier Pit W4
Sample Number: 1

Date Sampled: Jun 20, 2017

DWB Consulting Services Ltd.

Client: SURESPAN

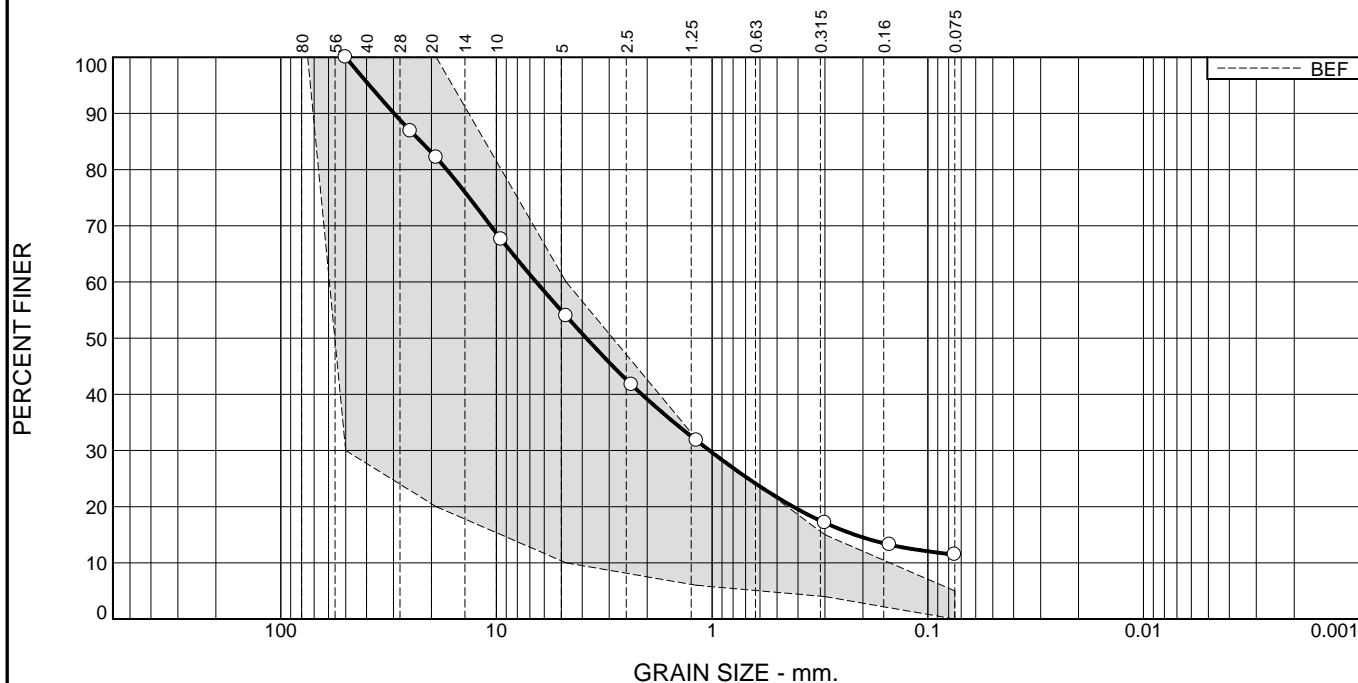
Project: Pemberton Pedestrian Bridge

Prince George, BC

Project No: 1762-147

Figure

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	17.8	28.3	14.8	19.0	8.6	11.5	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
50 mm	100.0	30.0 - 100.0	
25mm	86.9		
19mm	82.1	20.0 - 100.0	
9.5mm	67.6		
4.75mm	53.9	10.0 - 60.0	
2.36mm	41.7		
1.18mm	31.8	6.0 - 32.0	
0.3mm	17.1	4.0 - 15.0	X
0.15mm	13.2		
0.075mm	11.5	0.0 - 5.0	X

* BEF

Material Description

gravel and sand with some fines

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D₉₀= 29.8092 D₈₅= 22.4021 D₆₀= 6.5392
D₅₀= 3.8324 D₃₀= 1.0287 D₁₅= 0.2179
D₁₀= C_u= C_c=

Remarks

Natural Moisture 8.6%
Location Coordinates 10U 516571
5573815

Date Received: June 26, 2017 Date Tested: June 27, 2017

Tested By: JZ

Checked By:

Title:

Location: E Abutment Pit E1
Sample Number: 1

Date Sampled: June 20, 2017

DWB Consulting Services Ltd.

Client: SURESPAN

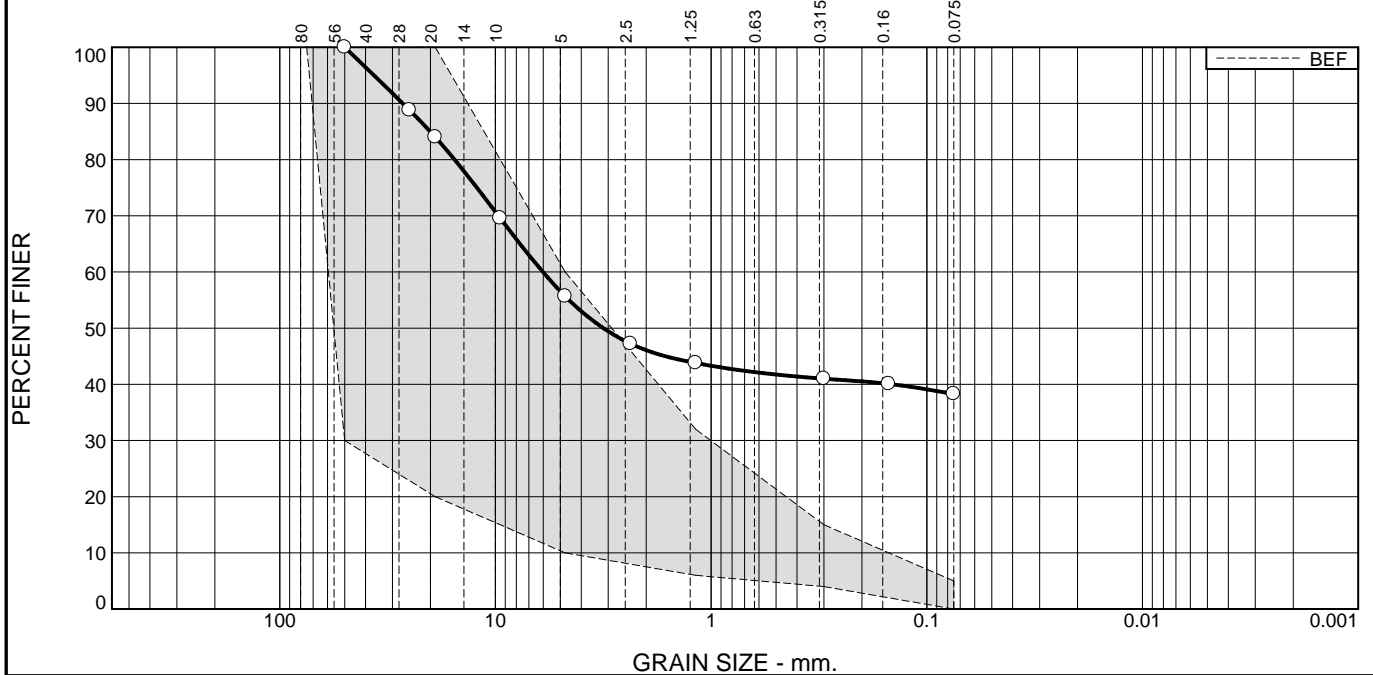
Project: Pemberton Pedestrian Bridge

Prince George, BC

Project No: 1762-147

Figure

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.9	28.4	9.6	4.6	3.2	38.3	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
50 mm	100.0	30.0 - 100.0	
25mm	88.8		
19mm	84.0	20.0 - 100.0	
9.5mm	69.6		
4.75mm	55.7	10.0 - 60.0	
2.36mm	47.2		
1.18mm	43.8	6.0 - 32.0	X
0.3mm	41.0	4.0 - 15.0	X
0.15mm	40.1		
0.075mm	38.3	0.0 - 5.0	X

* BEF

Material Description

gravel and silt with some sand

PL= **Atterberg Limits (ASTM D 4318)** LL= PI=

USCS (D 2487)= **Classification** AASHTO (M 145)=

Coefficients
D₉₀= 26.8942 D₈₅= 20.0588 D₆₀= 6.0242
D₅₀= 3.1607 D₃₀= D₁₅=
D₁₀= C_u= C_c=

Remarks

Natural Moisture 9.9%
Location Coordinates 10U 516509
5573808

Date Received: June 26, 2017 Date Tested: June 27, 2017

Tested By: JZ

Checked By: _____

Title: _____

Location: E Abutment Edge Row/Toe of Fill Pit 2
Sample Number: 1

Date Sampled: June 21, 2017

DWB Consulting Services Ltd.

Client: SURESPAN

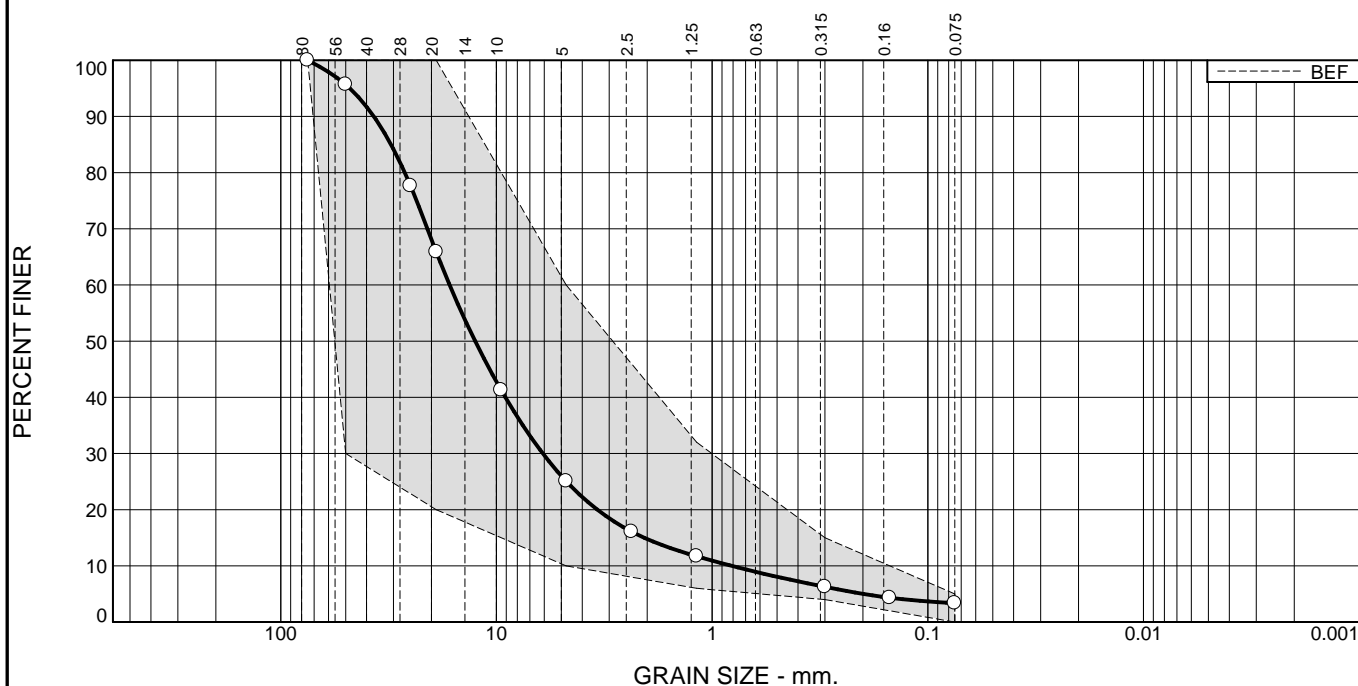
Project: Pemberton Pedestrian Bridge

Prince George, BC

Project No: 1762-147

Figure

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	34.0	40.9	10.3	7.3	4.1	3.4	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
75 mm	100.0	100.0	
50 mm	95.7	30.0 - 100.0	
25 mm	77.6		
19 mm	65.9	20.0 - 100.0	
9.5 mm	41.3		
4.75 mm	25.1	10.0 - 60.0	
2.36 mm	16.1		
1.18 mm	11.7	6.0 - 32.0	
0.3 mm	6.3	4.0 - 15.0	
0.15 mm	4.3		
0.075 mm	3.4	0.0 - 5.0	

* BEF

Material Description

sandy GRAVEL with trace fines

PL= **Atterberg Limits (ASTM D 4318)** LL= PI=

USCS (D 2487)= **Classification** AASHTO (M 145)=

Coefficients
D₉₀= 37.0321 D₈₅= 30.8187 D₆₀= 16.4813
D₅₀= 12.5465 D₃₀= 6.0942 D₁₅= 2.0643
D₁₀= 0.8118 C_u= 20.30 C_c= 2.78

Remarks

Natural Moisture 2.3%

Date Received: June 24, 2017 Date Tested: June 26, 2017

Tested By: JZ

Checked By: _____

Title: _____

Location: E Abutment Pit- E3
Sample Number: 1

Date Sampled: June 20, 2017

DWB Consulting Services Ltd.

Client: SURESPAN

Project: Pemberton Pedestrian Bridge

Prince George, BC

Project No: 1762-147

Figure