Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Parking Lot and Roadway Design Serving the Proposed RCMP Building on Lot 181
York Road, Niagara-On-The-Lake, Ontario

PAVEMENT REPORT

Date: 2011 09 29
Ref. N°: 124-P041600-100-CH-0001-00

LVM
1961 2011

Public Works and Government Services Canada

Parking Lot and Roadway Design Serving the Proposed RCMP Building on Lot 181 York Road, Niagara-On-The-Lake, Ontario

Pavement Report

LVM inc.

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Appendices

Property and Confidentiality

Test results mentioned herein are only valid for the sample(s) stated in this report.

LVM's subcontractors who may have accomplished work either on site or in laboratory are duly qualified as stated in our Quality Manual's procurement procedure. Should you require any further information, please contact your Project Manager."

REVISION AND PUBLICATION REGISTER		
Revision N°	Date	Modification And/Or Publication Details
00	2011-09-29	Issue of Final Report

EXECUTIVE SUMMARY

The purpose of this pavement design investigation was to determine the existing subsoil conditions in the vicinity of the proposed parking lots and the associated service roadways around the proposed RCMP building. The report will provide recommendations for the design and construction for the proposed roadways and parking lots, including site preparation, pavement drainage, the type and structure (layers) of the pavement based on the anticipated future traffic and excavation and dewatering considerations.

This report should be read in conjunction with our Geotechnical Investigation Report 124-P041600-0100-GE-0001-00, completed for the proposed RCMP building. It should be noted that both reports share the same relevant borehole and geotechnical finding information.

The investigation consisted of advancing boreholes (to between 1.5 m and 3.0 m depth) to determine the type and moisture condition of the subgrade and to identify any relevant subsoil conditions that might affect the pavement design, followed by the synthesis and analysis of this information providing recommendations for the most cost-effective construction approach.

INTRODUCTION

LVM inc. has completed a pavement design investigation for the proposed parking lots and associated service roadways around the proposed RCMP building, located at Lot 181, York Road, Niagara on the Lake, Ontario. This project was carried out at the request of Mr. Jack To, P.Eng., Public Works and Government Services Canada. The purpose of this investigation was to determine the general subgrade type and moisture conditions, and obtain samples for laboratory examination and testing.

The results of the geotechnical investigation have been summarized and recommendations developed for the design of the proposed parking lots and associated roadways.

This report should be read in conjunction with our Geotechnical Investigation Report 124-P041600-0100-GE-0001-00, completed for the proposed RCMP building. It should be noted that both reports share the same relevant borehole and geotechnical finding information.

1 PROJECT METHODOLOGY

The geotechnical investigation for this project consisted of the following components.

As part of the Geotechnical Investigation Report 124-P041600-0100-GE-0001-00, a total of fourteen boreholes were advanced to varying depths. For the pavement design portion, of the fourteen boreholes advanced, five boreholes were advanced to 3 m depth and three boreholes were advanced to 1.5 m depth in the vicinity of the proposed parking lots and associated roadways to determine the type and moisture condition of the subgrade. The location of the boreholes is indicated on the attached Borehole Location Drawings in Appendix 1 with the Borehole Logs provided in Appendix 2.

The boreholes were advanced using track-mounted continuous flight sold stem augering equipment supplied by Malone's Soil Samples Co. Ltd. under continuous supervision of an LVM field technician. Subsoil samples were obtained at regular intervals using a 50 mm OD split barrel sampler in conformance with the Standard Penetration Test (SPT) procedure (ASTM D1586).

The recovered subsoil samples were visually examined in the field and then preserved and transported to the LVM Toronto laboratory for examination and testing. Ground water observations were carried out in the open boreholes upon completion of the field work. The boreholes were then promptly backfilled upon completion in conformance with Ontario Regulation 903 requirements (and Ontario Regulation 468/10). In addition, ground surface elevations were surveyed by the client (PWGSC) sub-contractor (third-party) with this information included on the borehole logs attached in Appendix 2.

In the laboratory, each soil sample was examined as to its visual and textural characteristics. Moisture content determinations were carried out on all subgrade soil samples.

2 SUBSOIL CONDITIONS

The approximate borehole locations are indicated on the attached Borehole Location Drawings in Appendix 1, with the Borehole Logs provided in Appendix 2. The general subsoil conditions encountered are outlined briefly below.

The subgrade soil at the borehole locations was observed to consist of firm to hard silty clay, having Standard Penetration Test "N" values ranging from 7 to 32 blows per 300 mm of penetration. The in-situ moisture content of this material ranged from about 15.8 (moist) to 28.6 (wet) percent.

Groundwater measurements conducted in the open boreholes upon completion of drilling indicated that the groundwater level was below the borehole termination depth in all boreholes.

3 PAVEMENT DESIGN AND CONSTRUCTION RECOMMENDATIONS

Pavement design recommendations were developed by LVM in accordance with the AASHTO Pavement Design Method which includes consideration of traffic, subgrade soil, construction materials, environment, drainage, reliability, and material costs. The design procedure equates the predicted number of 18-kip equivalent single-axle load (ESAL) applications to the structural number (SN) indicative of the total pavement thickness required. The design was supplemented by considerable LVM experience with pavements of this type. The pavements have been designed for a 20-year pavement design life.

LVM has divided the pavement designs into two sections: light duty traffic and heavy duty traffic. LVM has assumed that the parking lots will only be required to support light duty traffic, while the service roadways must be designed to support heavy duty traffic (including fire trucks and garbage trucks).

Based on previous experience, LVM has assumed the design ESALs over a 20-year design life for a light duty pavement to be 200,000 with the design ESALs for the heavy duty pavement to be 400,000.

The LVM pavement design recommendations are contingent upon provision of a consistently competent, stable subgrade, which is properly drained and free of soft spots and objectionable materials such as organic material, and is capable of supporting the design traffic loads. Where exposed, the subgrade should be properly prepared, shaped and graded to provide uniform, continuous crossfall toward properly designed and constructed drainage. The prepared subgrade should be carefully proof-rolled in the presence of a qualified LVM representative, and any soft or wet spots or other obviously objectionable materials subexcavated and properly replaced with suitable, approved material (such as Granular B type I).

Prior to undertaking any pavement construction work, the pavement drainage and/or sub-drainage should be assessed, noting that provision of proper drainage is fundamental to the performance of the roadway to mitigate optional frost-related movements and minimize seasonal loss of subgrade support (subgrade softening in spring). Pavement ditches or subdrains should be installed such that they have an invert at least 0.6 m below the top of subgrade and are connected to a positive outlet.

Using the AASHTO DARWin 3.0 software, the pavement designs for the light duty and heavy duty traffic areas were developed and are described below, with the software output (design calculations) provided in Appendix 3.

3.1 LIGHT DUTY TRAFFIC PAVEMENT IN THE PARKING LOT AREAS

- Install new subdrains or ditches (as far in advance of the construction as possible);

- Subexcavate to the depth required for pavement installation, minimum 450 mm;
- The subgrade should be carefully proof-rolled and any soft or wet spots properly repaired with approved material;
- Construct the pavement subbase with 250 mm of 50 mm minus crushed concrete or crusher-run limestone meeting OPSS 1010 Granular B Type II specifications, placed in lifts not exceeding 150 mm loose thickness. Compact to 100 percent Standard Proctor Maximum Dry Density (SPMDD);
- Construct the pavement base with 150 mm of 25 mm minus crushed concrete or crusher-run limestone meeting OPSS 1010 Granular A gradation. Compact to 100 percent Standard Proctor Maximum Dry Density (SPMDD); and
- Place one lift of hot-mix asphalt concrete (50 mm of OPSS 1150 HL 3 surface course hot-mix asphalt), placed and compacted in conformance with OPSS 310 requirements.

3.2 HEAVY DUTY TRAFFIC PAVEMENT IN THE SERVICE ROADWAY AREAS

- Install new subdrains or ditches (as far in advance of the construction as possible);
- Subexcavate to the depth required for pavement installation, minimum 490 mm;
- The subgrade should be carefully proof-rolled and any soft or wet spots properly repaired with approved material;
- Construct the pavement subbase with 250 mm of 50 mm minus crushed concrete or crusher-run limestone meeting OPSS 1010 Granular B Type II specifications, placed in lifts not exceeding 150 mm loose thickness. Compact to 100 percent Standard Proctor Maximum Dry Density (SPMDD);
- Construct the pavement base with 150 mm of 25 mm minus crushed concrete or crusher-run limestone meeting OPSS 1010 Granular A gradation. Compact to 100 percent Standard Proctor Maximum Dry Density (SPMDD); and
- Place two lifts of hot-mix asphalt concrete (50 mm of OPSS 1150 HL 8 15% RAP, and 40 mm of OPSS 1150 HL 3 surface course hot-mix asphalt), placed and compacted in conformance with OPSS 310 requirements.

It is recommended that PGAC 58-22 be used in the HL 8 binder course and HL 3 surface course hot-mix asphalt mixes. The performance graded asphalt cement PGAC 58-22 should conform to OPSS 1101 requirements.

It should be noted that a systematic program of crack sealing is considered a necessity for all newly constructed pavements. As the pavements age, it will be necessary to complete routine maintenance in the form of regular crack sealing (every 2 to 3 years) and localized patching in areas exhibiting distress.

All pavement construction and maintenance work should only be completed during periods of favourable weather.

4 GENERAL COMMENTS

It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling and should not be interpreted as exact planes of geological change. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical and pavement design. Also, the subsoil and groundwater conditions have been determined at the borehole locations only. Additional boreholes and/or test pits would be necessary to determine the localized conditions between boreholes. Contractors bidding on, or undertaking the works, must conduct their own investigations, and interpretations of the factual borehole data, and draw their own conclusions as to how the subsoil and groundwater conditions may affect their construction techniques, scheduling and costs.

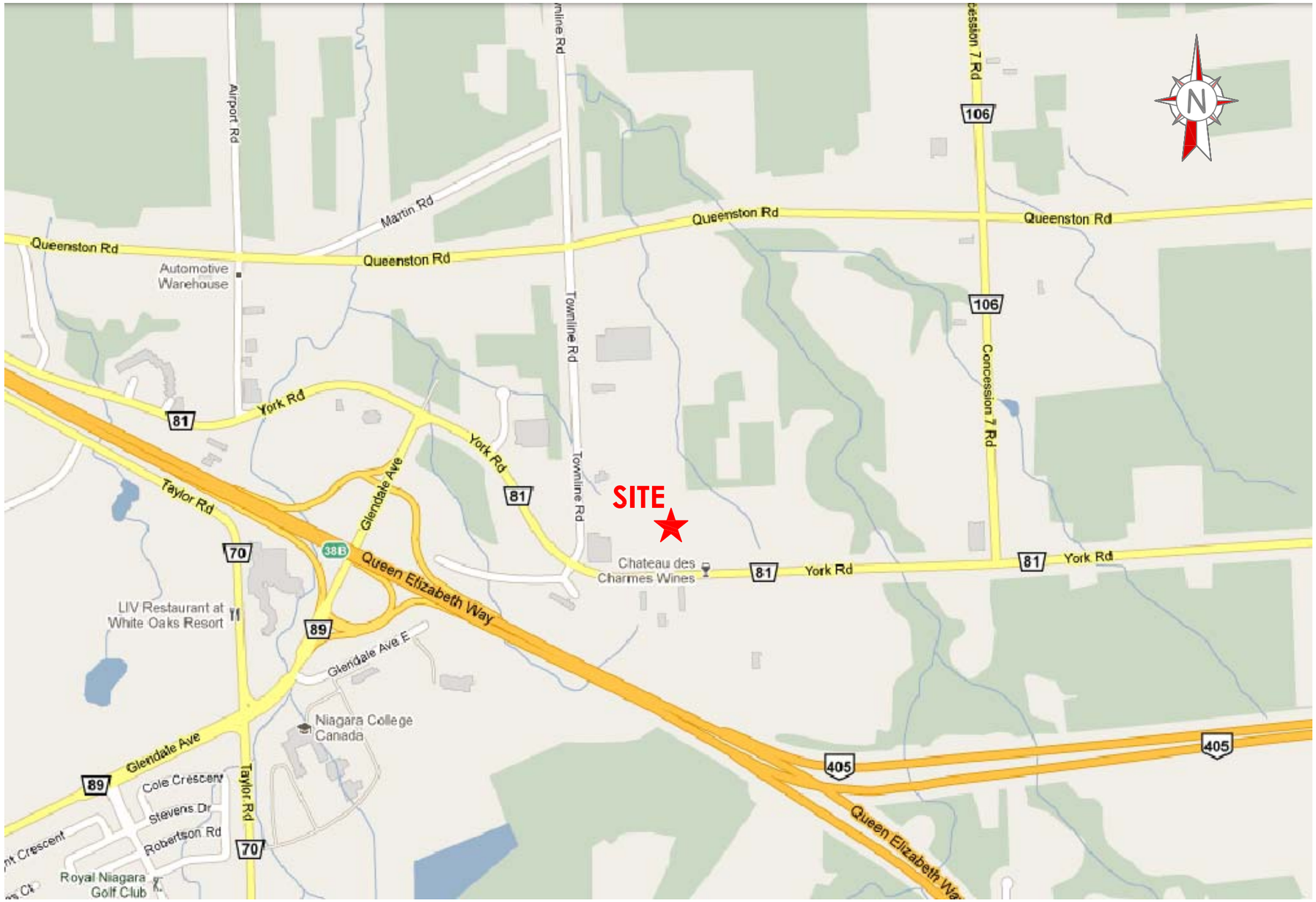
It is further noted that, depending on the time of year the field work was completed, water levels should be expected to vary, perhaps significantly from those observed at the time of this investigation.

Once prepared, construction traffic should be kept to a minimum across or along sections of the partially completed pavement structure, noting that the concentrated construction traffic is likely to be among the heaviest loads to which the pavement is subjected. Depending on the time of year and weather conditions when the work is completed, it may be necessary to use relatively light construction equipment and/or limit materials haul vehicles to reduced loads to mitigate potential damage to the subgrade.

It is recommended that all construction joints be cleaned with stiff bristle brooms and compressed air to remove all dust, dirt and other foreign matter. A tack coat should be applied to all construction joints prior to the placement of asphalt concrete to ensure an adequate bond between the old and new pavements.

The need for continuous construction supervision by a qualified, experienced technician, and quality control testing during construction projects cannot be over-emphasized. All materials and construction services required for pavement rehabilitation should be in accordance with Ontario Provincial Standard Specifications.

Appendix 1 Borehole Location Drawings



LEGEND :

SUBJECT SITE LOCATION

NOTES :
1-REFERENCES : GOOGLE MAP

Project

PROPOSED RCMP BUILDING
- PARKING LOT & SERVICE ROADWAYS

Lot 181 - York Road (Regional Road 81) and Townline Road, Niagara-on-the-Lake, Ontario

Title

LOCATION PLAN

LVM inc.
1821, Albion Road, Unit 7
Toronto (Ontario) M9W 5W8
Telephone : 416.213.1060
Fax : 416.213.1070

Prepared K.L.	Discipline GE
Drawn K.L.	Scale N.T.S.
Checked A.A.OBEID	Date 2011-09-28
Project manager A.A.OBEID	Sequence no. 01 of 03

M. dept.	Project	Work pckg.	Sub-w.p.	Disc.	Drawing no.	Rev.
124	P041600	100		GE	01	00

LEGEND :

BOREHOLE LOCATION

NOTES :
1-REFERENCES : GOOGLE MAP

Project

PROPOSED RCMP BUILDING
- PARKING LOT & SERVICE ROADWAYS

Lot 181 - York Road (Regional Road 81) and Townline Road, Niagara-on-the-Lake, Ontario

Title

SITE PLAN

LVM inc.
1821, Albion Road, Unit 7
Toronto (Ontario) M9W 5W8
Telephone : 416.213.1060
Fax : 416.213.1070

Prepared K.L.	Discipline GE
Drawn K.L.	Scale N.T.S.
Checked A.A.OBEID	Date 2011-09-28
Project manager A.A.OBEID	Sequence no. 02 of 03

M. dept.	Project	Work pckg.	Sub-w.p.	Disc.	Drawing no.	Rev.
124	P041600	100		GE	02	00

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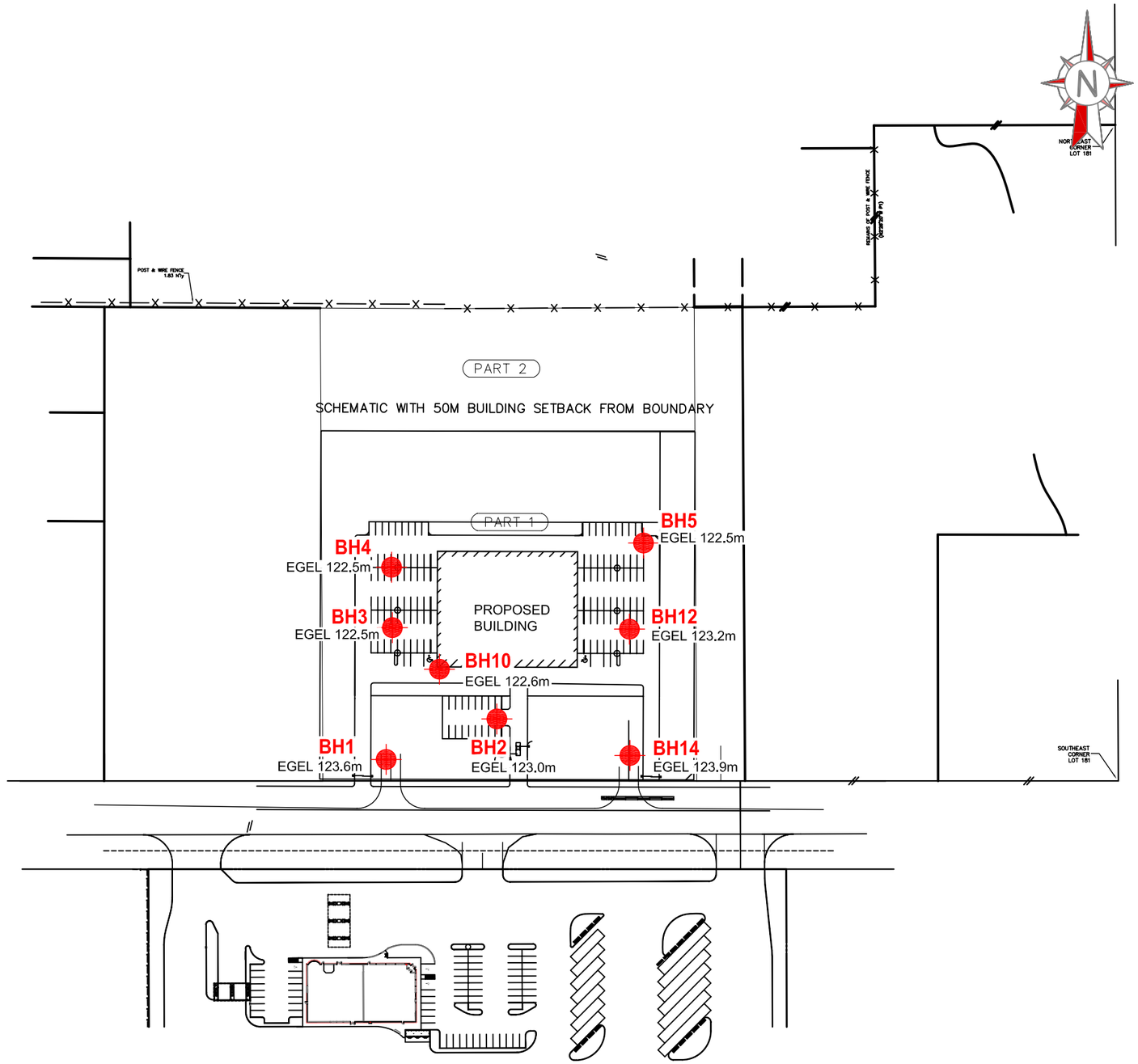

LEGEND :

BOREHOLE LOCATION

EGEL EXISTING GROUND ELEVATION

NOTES :
1-REFERENCES : BASED ON THE DRAWING PROVIDED BY CLIENT

Project

PROPOSED RCMP BUILDING - PARKING LOT & SERVICE ROADWAYS

Lot 181 - York Road (Regional Road 81) and Townline Road, Niagara-on-the-Lake, Ontario

Title

BOREHOLE LOCATION PLAN

LVM inc.
1821, Albion Road, Unit 7
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Telephone : 416.213.1060
Fax : 416.213.1070

Prepared	K.L.	Discipline	GE
Drawn	K.L.	Scale	N.T.S.
Checked	A.A.OBEID	Date	2011-09-28

Project manager: A.A.OBEID

Sequence no. 03 of 03

M. dept.	Project	Work pckg.	Sub-w.p.	Disc.	Drawing no.	Rev.
124	P041600	100		GE	03	00

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Appendix 2 Borehole Logs

LVM inc.

LOG OF BOREHOLE No.1

Project No. P041600-100 DRAWING No. BH 1

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: Lot 181, York Road, Niagara On The Lake

Date Drilled: 8/15/2011

Drill Type: Solid Stem Augers

Datum: Geodetic-As provided by Client

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value 20 40 60 80 / Shear Strength kPa 50 100 150 200	Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Natural Unit Weight g/cm³
		TOPSOIL (100 mm): sand, some silt, trace roots, brown	122.5 / 122.4	0				
		SILTY CLAY: trace sand, stiff to very stiff, brown and grey, moist to very moist		1				
		trace organic matter	120.7	2	450 kPa			
			119.4	3				

Terminated at 3.1 m

Borehole advanced uncased using continuous flight solid stem augering equipment on August 15, 2011 by Malone's Soil Samples Co. Ltd.

No water was encountered upon completion.

Coordinates: X 650046.50 Y 4779893.48

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	none

LVM inc.

LOG OF BOREHOLE No.2

Project No. P041600-100 DRAWING No. BH 2

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: Lot 181, York Road, Niagara On The Lake

Date Drilled: 8/15/2011

Drill Type: Solid Stem Augers

Datum: Geodetic-As provided by Client

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Natural Moisture Content % / Atterberg Limits (% Dry Weight) (10 20 30)	SAMPLES	Natural Unit Weight g/cm³
		TOPSOIL (125 mm): sand, some silt, trace roots, brown	123.0	0				
		SILTY CLAY: trace sand, stiff to very stiff, brown and grey, very moist	122.9					
		trace gravel	122.3	1				
		Terminated at 1.5 m	121.5					

Borehole advanced uncased using continuous flight solid stem augering equipment on August 15, 2011 by Malone's Soil Samples Co. Ltd.

No water was encountered upon completion.

Coordinates: X 650091.37 Y 4779912.85

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	none

LVM inc.

LOG OF BOREHOLE No.3

Project No. P041600-100 DRAWING No. BH 3

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: Lot 181, York Road, Niagara On The Lake

Date Drilled: 8/15/2011

Drill Type: Solid Stem Augers

Datum: Geodetic-As provided by Client

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Natural Moisture Content % / Atterberg Limits (% Dry Weight) (10 20 30)	SAMPLES	Natural Unit Weight g/cm³
		TOPSOIL (100 mm): sand, some silt, trace roots, brown	122.5 / 122.4	0				
		SILTY CLAY: trace sand, trace gravel, stiff to very stiff, brown and grey, moist to very moist		1	450 kPa			
		becoming pink and grey	120.6	2	450 kPa			
			119.4	3				

Terminated at 3.1 m

Borehole advanced uncased using continuous flight solid stem augering equipment on August 15, 2011 by Malone's Soil Samples Co. Ltd.

No water was encountered upon completion.

Coordinates: X 650045.96 Y 4779948.19

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	none

LVM inc.

LOG OF BOREHOLE No.4

Project No. P041600-100 DRAWING No. BH 4

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: Lot 181, York Road, Niagara On The Lake

Date Drilled: 8/15/2011

Drill Type: Solid Stem Augers

Datum: Geodetic-As provided by Client

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Natural Moisture Content % / Atterberg Limits (% Dry Weight) (10 20 30)	SAMPLES	Natural Unit Weight g/cm³
		TOPSOIL (125 mm): sand, some silt, trace roots, brown	122.5 / 122.4	0				
		SILTY CLAY: trace sand, trace gravel, stiff to very stiff, brown and grey, very moist		1				
			121.0					
		Terminated at 1.5 m						

Borehole advanced uncased using continuous flight solid stem augering equipment on August 15, 2011 by Malone's Soil Samples Co. Ltd.

No water was encountered upon completion.

Coordinates: X 650044.21 Y 4779973.17

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	none

LVM inc.

LOG OF BOREHOLE No.5

Project No. P041600-100 DRAWING No. BH 5

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: Lot 181, York Road, Niagara On The Lake

Date Drilled: 8/15/2011

Drill Type: Solid Stem Augers

Datum: Geodetic-As provided by Client

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Natural Moisture Content % / Atterberg Limits (% Dry Weight) (10 20 30)	SAMPLES	Natural Unit Weight g/cm³
		TOPSOIL (150 mm): sand, some silt, trace roots, brown	122.5 / 122.4	0				
		SILTY CLAY: trace sand, trace gravel, firm to very stiff, brown and grey, wet		1				
			121.0					
		Terminated at 1.5 m						

Borehole advanced uncased using continuous flight solid stem augering equipment on August 15, 2011 by Malone's Soil Samples Co. Ltd.

Coordinates: X 650147.90 Y 4779989.12

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	none

LVM inc.

LOG OF BOREHOLE No.10

Project No. P041600-100 DRAWING No. BH 10

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: Lot 181, York Road, Niagara On The Lake

Date Drilled: 8/15/2011

Drill Type: Solid Stem Augers

Datum: Geodetic-As provided by Client

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value 20 40 60 80 / Shear Strength kPa 50 100 150 200	Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Natural Unit Weight g/cm³
			122.6					
		TOPSOIL (150 mm): sand, some silt, trace roots, brown	122.4	0				
		SILTY CLAY: trace sand, stiff to hard, brown and grey, very moist						
			121.5	1	450 kPa			
		trace gravel						
				2				
			120.0					
		with thin seam of gravel (20 mm)						
			119.5	3				

Terminated at 3.1 m

Borehole advanced uncased using continuous flight solid stem augering equipment on August 15, 2011 by Malone's Soil Samples Co. Ltd.

No water was encountered upon completion.

Coordinates: X 650066.42 Y 4779932.09

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	none

LVM inc.

LOG OF BOREHOLE No.12

Project No. P041600-100 DRAWING No. BH 12

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: Lot 181, York Road, Niagara On The Lake

Date Drilled: 8/15/2011

Drill Type: Solid Stem Augers

Datum: Geodetic-As provided by Client

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value 20 40 60 80 / Shear Strength kPa 50 100 150 200	Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Natural Unit Weight g/cm³
		TOPSOIL (150 mm): sand, some silt, trace roots, brown	123.2 / 123.0	0				
		SILTY CLAY: trace sand, stiff to very stiff, brown and grey, very moist		1	450 kPa			
		trace gravel	121.4	2				
			120.1	3				

Terminated at 3.1 m

Borehole advanced uncased using continuous flight solid stem augering equipment on August 15, 2011 by Malone's Soil Samples Co. Ltd.

No water was encountered upon completion.

Coordinates: X 650144.10 Y 4779953.15

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	none

LVM inc.

LOG OF BOREHOLE No.14

Project No. P041600-100 DRAWING No. BH 14

Project: Geotechnical Investigation Sheet No. 1 of 1

Location: Lot 181, York Road, Niagara On The Lake

Date Drilled: 8/15/2011

Drill Type: Solid Stem Augers

Datum: Geodetic-As provided by Client

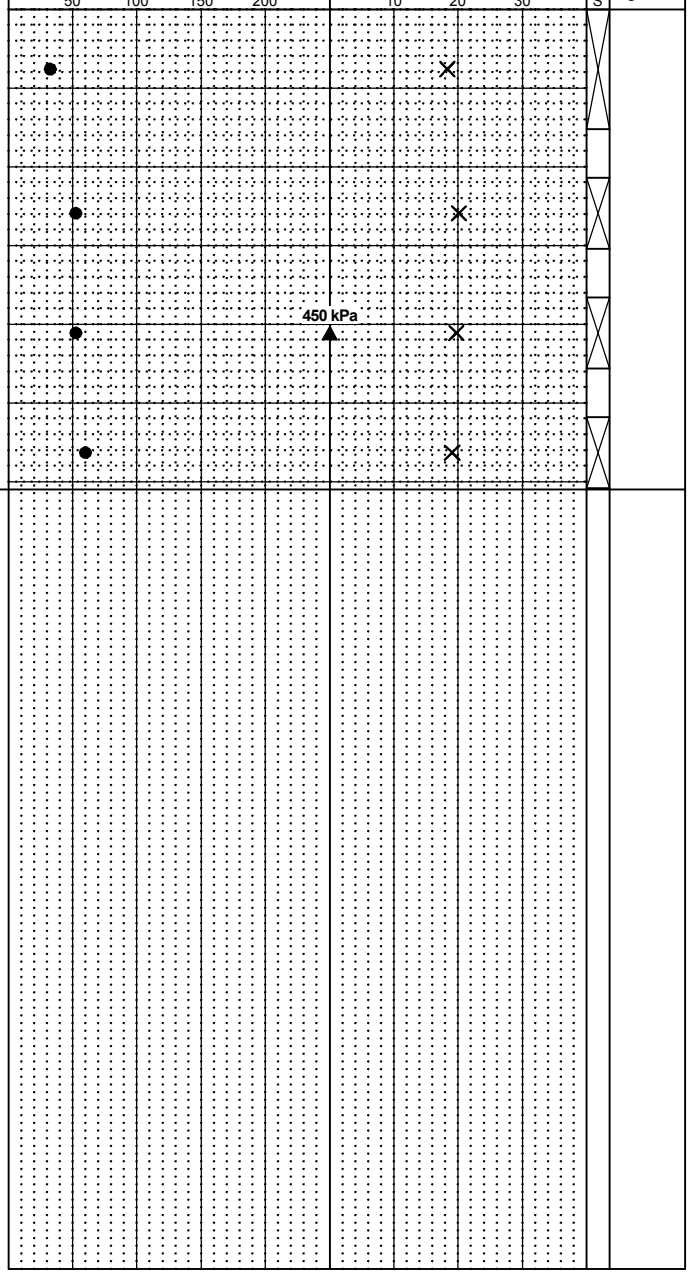
Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			123.9	
		TOPSOIL (150 mm): sand, some silt, trace roots, brown	123.7	0
		SILTY CLAY: trace sand, stiff to very stiff, brown and grey, very moist		
			122.8	1
		becoming pink and grey		
				2
			120.8	3
		Terminated at 3.1 m		

Borehole advanced uncased using continuous flight solid stem augering equipment on August 15, 2011 by Malone's Soil Samples Co. Ltd.

No water was encountered upon completion.

Coordinates: X 650147.28 Y 4779900.86



Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	none

LOG A GWGL02 P041600_BOREHOLE LOGS.GPJ LOG A GWGL02.GDT 8/31/11

Appendix 3 AASHTO DARWin Pavement Design and Analysis Results

1997 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

Parking Lots (Light Duty) - RCMP

Flexible Structural Design

80-kN ESALs Over Initial Performance Period	200,000
Initial Serviceability	4.4
Terminal Serviceability	2
Reliability Level	80 %
Overall Standard Deviation	0.44
Roadbed Soil Resilient Modulus	30,000 kPa
Stage Construction	1
Calculated Design Structural Number	74 mm

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(mm)	Width (m)	Calculated SN (mm)
1	HMA	0.42	1	50	-	21
2	Granular Base	0.14	1	150	-	21
3	Granular Subbase	0.14	0.9	250	-	32
Total	-	-	-	450	-	74

Layered Thickness Design

Thickness precision Actual

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Spec Thickness (Di)(mm)	Min Thickness (Di)(mm)	Elastic Modulus (kPa)	Width (m)	Calculated Thickness (mm)	Calculated SN (mm)
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-

*Note: This value is not represented by the inputs or an error occurred in calculation.

Optimized Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Cost (sq m/mm)	Min Thick (Di)(mm)	Max Thick (mm)	Width (m)	Optimum Thick (mm)	Calculated SN (mm)	Calculated Cost (sq m)
Total	-	-	-	-	-	-	-	-	-	-

1997 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

Service Roadways (Heavy Duty) - RCMP

Flexible Structural Design

80-kN ESALs Over Initial Performance Period	400,000
Initial Serviceability	4.2
Terminal Serviceability	2
Reliability Level	85 %
Overall Standard Deviation	0.44
Roadbed Soil Resilient Modulus	30,000 kPa
Stage Construction	1
Calculated Design Structural Number	85 mm

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(mm)	Width (m)	Calculated SN (mm)
1	HMA	0.42	1	90	-	38
2	Granular Base	0.14	1	150	-	21
3	Granular Subbase	0.14	0.9	250	-	32
Total	-	-	-	490	-	90

Layered Thickness Design

Thickness precision Actual

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Spec Thickness (Di)(mm)	Min Thickness (Di)(mm)	Elastic Modulus (kPa)	Width (m)	Calculated Thickness (mm)	Calculated SN (mm)
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-

*Note: This value is not represented by the inputs or an error occurred in calculation.

Optimized Layer Design