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Geotechnical Engineering

Environmental Engineering

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Trillium Line Level 3 Proximity Study

Proposed Multi-Storey Building
1040 Somerset Street West
Ottawa, Ontario

Prepared For

Claridge Homes

November 30, 2020

Report: PG2674-3

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

1.0 Introduction

Paterson Group (Paterson) was commissioned by Claridge Homes to conduct a Level 3 Trillium Line proximity study for the proposed multi-storey building to be located at 1040 Somerset Street West in the City of Ottawa.

The objective of the current study is to:

❑ Review all current information provided by the City of Ottawa with regards to the infrastructure of the Trillium Line.

❑ Liaison between the City of Ottawa and the Claridge Homes consultant team involved with the aforementioned project.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains a collaboration of architectural, civil, structural and geotechnical design information as they pertain to the aforementioned project.

2.0 Development Details

It is understood that the proposed development will consist of a multi-storey building with 7 to 9 levels of underground parking. Further, it is understood that the underground parking levels will occupy the majority of the site. The Trillium Line railway corridor borders the east side of the subject site.

The following is known about the Trillium Line in the vicinity of the subject site:

❑ The Trillium Line rail runs parallel to the east boundary of the site.

❑ The existing Trillium Line rail is anticipated to be located near the ground surface at approximate geodetic elevation 58 m, while 1040 Somerset Street west is located up the slope to the west at approximate geodetic elevation 63 m.

❑ Based on the subsurface profile at 1040 Somerset Street West, bedrock is expected at a depth of approximately 13.7 m, corresponding to approximate geodetic elevation 49.5 m.

3.0 Construction Methodology and Impact Review

Paterson has prepared a construction methodology summary along with possible impacts to the adjacent segment of the Trillium Line based on the current building design details. Table 2 - Construction Methodology and Impact Review in Appendix 1 presents the anticipated construction items, impact review and mitigation program recommended for the Trillium Line. One of the main issues will be vibrations associated with the bedrock blasting removal program. It is recommended that a vibration monitoring program be implemented to ensure vibration levels remain below recommended tolerances. Details of a recommended vibration monitoring program are presented below.

3.1 Vibration Monitoring and Control Program

Due to the presence of the existing Trillium Line railway, the contractor should take extra precaution to minimize vibrations. The monitoring program will be required for the full construction duration for blasting operations, dewatering, backfilling and compaction, construction traffic and other construction activities. The purpose of the vibration monitoring and control program (VMCP) is to provide a description of the measures to be implemented by the contractor to manage excavation operations and any other vibration sources during the construction of the proposed development. The VMCP will also provide a guideline for assessing results against the relevant vibration impact assessment criteria and recommendations to meet the required limits.

The monitoring program will incorporate real time results at the Trillium Line corridor, adjacent to the subject site. The monitoring equipment should consist of a tri-axial seismograph, capable of measuring vibration intensities up to 254 mm/s at a frequency response of 2 to 250 Hz. The monitoring equipment is to be placed at the east boundary of the 1040 Somerset Street West site, which is adjacent to the Trillium Line rail corridor.

The location should be reviewed periodically throughout construction to ensure that the monitoring equipment remains along the railway alignment at the closest radius to the construction activities. The vibration monitor locations should be approved by the project manager prior to installation.

During construction, the vibration monitor will be relocated periodically to the ‘worst case’ locations for each construction activity. When an event is triggered, Paterson will review the results and provide any necessary feedback. Otherwise, the vibration results will be summarized in the weekly report.

Proposed Vibration Limits

The excavation operations should be planned and conducted under the supervision of a licensed professional engineer who is an experienced bedrock excavation consultant. The following table outlines the vibration limits for the Trillium Line railway:

Table 1 - Structure Vibration Limits for the Confederation Line Tunnel

Dominant Frequency Range (Hz)	Peak Particle Velocity (mm/s)	Event	Description of Event
<10	all	none	no action required
<40	>10	trigger level	Warning e-mail sent to contractor.
<40	≥15	exceedance level	Exceedance e-mail and phone call to the contractor. All operations are ceased to review on-site activities.
>40	>15	trigger level	Warning e-mail sent to contractor.
>40	≥25	exceedance level	Exceedance e-mail and phone call to the contractor. All operations are ceased to review on-site activities.

Monitoring Data

The monitoring protocol should include the following information:

Trigger Level Event

- ☐ Paterson will review all vibrations over the established warning level, and;
- ☐ Paterson will notify the contractor if any vibrations occur due to construction activities and are close to exceedance level.

Exceedance Level Event

- ☐ Paterson will notify all the relevant stakeholders via email
- ☐ Ensure monitors are functioning
- ☐ Issue the vibration exceedance result

The data collected should include the following:

- ☐ Measured vibration levels
- ☐ Distance from the construction activity to monitoring location
- ☐ Vibration type

Monitoring should be compliant with all related regulations.

3.2 Incident/Exceedance Reporting

In case an incident/exceedance occurs from construction activities, the Senior Project Management and any relevant personnel should be notified immediately. A report should be completed which contains the following:

- ☐ Identify the location of vibration exceedance
- ☐ The date, time and nature of the exceedance/incident
- ☐ Purpose of the exceeded monitor and current vibration criteria
- ☐ Identify the likely cause of the exceedance/incident
- ☐ Describe the response action that has been completed to date
- ☐ Describe the proposed measures to address the exceedance/incident.

The contractor should implement mitigation measures for future excavation or any construction activities as necessary and provide updates on the effectiveness of the improvement. Response actions should be pre-determined prior to excavation, depending on the approach provided to protect elements. Processes and procedures should be in-place prior to completing any vibrations to identify issues and react in a quick manner in the event of an exceedance.

4.0 Proximity Study Requirement Responses

Paterson was informed by the City of Ottawa that a Trillium Line Proximity Study - Level 3 should be completed for the proposed development. The following tables list the applicable requirements for Level 1, Level 2, and Level 3 studies and the response location for each item:

Table 2
List of Confederation Line Level 1 Proximity Study Requirements

Level 1 Projects	Response
A site plan of the development with the centreline or reference line of the Trillium Line structure and/or right-of-way located and the relevant distances between the Trillium Line and developer's structure shown clearly;	See Trillium Line Proximity Plan (Drawing No. PG2674-3 dated November 30, 2020).
Plan and cross-sections of the development locating the Trillium Line structure/right-of-way and founding elevations relative to the development, including any underground storage tanks and associated piping;	Refer to the Trillium Line Proximity Plan (Drawing No. PG2674-3 dated November 30, 2020) and Cross-Section A-A presented in Appendix A.
A geotechnical investigation report showing up-to-date geotechnical conditions at the site of the development. The geotechnical investigation shall be prepared in accordance with the Geotechnical Investigation and Reporting Guidelines for Development Applications in the City;	Refer to Geotechnical Investigation: Paterson Group Report PG2674-2 Revision 1 dated November 30, 2020 presented in Appendix B.
Structural, foundation, excavation and shoring drawings;	Structural, foundation, excavation, and shoring drawings, will be provided prior to the Site Plan Agreement. Based on current design details, the proposed building foundation will consist of conventional footings placed directly over a clean, bedrock surface. No negative impacts are anticipated for the Trillium Line due to the proposed building location.
Acknowledgment that the potential for noise, vibration, electro-magnetic interference and stray current from Trillium Line operations have been considered in the design of the project, and appropriate mitigation measures applied.	A Noise Control Study prepared by Novatech Engineering Consultants Ltd. dated April 2, 2013 is presented in Appendix C.

Table 3
List of Confederation Line Level 2 Proximity Study Requirements

Level 2 Projects	Response
A structural analysis or calculations of the effects of loadings, including construction loading, on the Trillium Line structure, and demonstrating that the Trillium Line will not be adversely affected by the development, including solutions to mitigate any impact on the Trillium Line structure.	No building loads will be imposed on the subject alignment of the Trillium Line as the adjacent building foundations of the proposed development will be constructed at an elevation below the bottom of railway infrastructure. Further, the proposed building will not be located within the lateral support zone of the railway infrastructure. Refer to the Cross-Section A-A provided in Appendix A and the Proximity Assessment Report PG2674-LET.01 dated November 30, 2020 presented in Appendix D.
Documentation showing that the excavation support system and permanent structure adjacent to the Trillium Line property are designated for at-rest earth pressures.	The temporary shoring system will be designed for at-rest earth pressures as required by the site Geotechnical Investigation Report.
Structural drawings, including foundation plans, sections and details, floor plans, column and wall schedules and loads on foundation for the development. The relationship of the development to the Trillium Line structure should be depicted in both plan and section.	Refer to the Trillium Line Proximity Plan (Drawing No. PG2674-2 dated November 30, 2020) and Cross-Section A-A presented in Appendix A.
Shoring design criteria and description of excavation and shoring method.	The temporary shoring for the overburden along the east boundary of the site, adjacent to the Trillium Line, is anticipated to consist of soldier piles and lagging or steel sheet piles. At the beginning of, and during excavation, the geotechnical engineer will review the stability of the rock face underlying the overburden. Following the review of the rock face, the geotechnical engineer will determine if rock reinforcement is required, and if so, the extent to which rock reinforcement is required. This determination will include consideration for the Trillium Line railway. Refer to Proximity Assessment Report PG2674-LET.01 dated November 30, 2020 presented in Appendix D.
Groundwater control plan, including the determination of the short-term (during construction) and long-term effects of dewatering on the Trillium Line railway and provision of assurances that the influences of dewatering will have no impact on the Trillium Line railway.	The design of the temporary shoring system and dewatering plans for the site will take into consideration the adjacent Trillium Line railway. These drawings and plans will be forwarded once they are available.

Table 3 (continued)
List of Confederation Line Level 2 Proximity Study Requirements

Level 2 Projects	Response
Identification of utility installations proposed through or adjacent to the Trillium Line property.	At the time of writing this report, the civil design is not known. These plans will be forwarded once they are completed.
Proposal for a pre-construction condition survey of the Trillium Line structure, including a survey to confirm locations of existing walls and foundations.	A thorough pre-construction survey of the Trillium Line will be completed.
Monitoring plan for movement of the shoring and Trillium Line railway prior to and during construction of the development, including an Action Protocol.	A monitoring plan to evaluate potential movement of the Trillium Line structure will be performed during the construction period.

Table 4
List of Confederation Line Level 3 Proximity Study Requirements

Level 3 Projects	Response
A general Ontario Building Code (OBC) compliance review, specifically including Section 3.12 Rapid Transit Stations, and including a plan depicting egress routes from the station.	An OBC review and egress routes from the station will be provided as the project design progresses.
Wind and snow load analyses.	Wind and snow load analysis will be provided as the project design progresses.
Drawings/documentation of construction method, hoarding, construction access, and haul routes.	Drawings of construction method, hoarding, construction access, and haul routes will be prepared by the Contractor and will be provided prior to construction.
Details of remedial work to municipal structures to support roof at wall opening, including structural loads, and calculations.	The railway in the vicinity of the subject site is not located within a tunnel, therefore this comment is not considered to be applicable.
Details of stairs, doors, sprinklers and ventilation for the development connection.	This proposed development will not be connected to the Trillium Line or a station, therefore, this comment is not considered to be applicable.
Provision of architectural finish material selection, including samples.	These finish materials will be provided as the project design progresses.
Wayfinding and signage plans.	These details will be provided as the project design progresses.
Landscape plans.	Landscape plans will be provided as the project design progresses.
Drawings of collector booth, CCTV, intercom, fire alarm, easier access elevator, all designated in conformance with the relevant OC Transpo Design Guidelines, including accessibility requirements.	These details will be provided as the project design progresses.
Provision of construction record (as-built) reproducible drawings and electronic files for municipal documentation records. The electronic file and the drawings are to be in Microstation (.dgn) format.	These drawings will be provided by the Contractor at the completion of construction.

We trust that this information satisfies your immediate request.

Best Regards,

Paterson Group Inc.

Scott Dennis

Scott S. Dennis, P.Eng.

LICENSED PROFESSIONAL ENGINEER
Nov. 30, 2020
S. S. DENNIS
100519516
Scott Dennis
PROVINCE OF ONTARIO

David J. Gilbert, P.Eng.

Report Distribution

- ☐ Claridge Homes (3 copies)
- ☐ Paterson Group (1 copy)

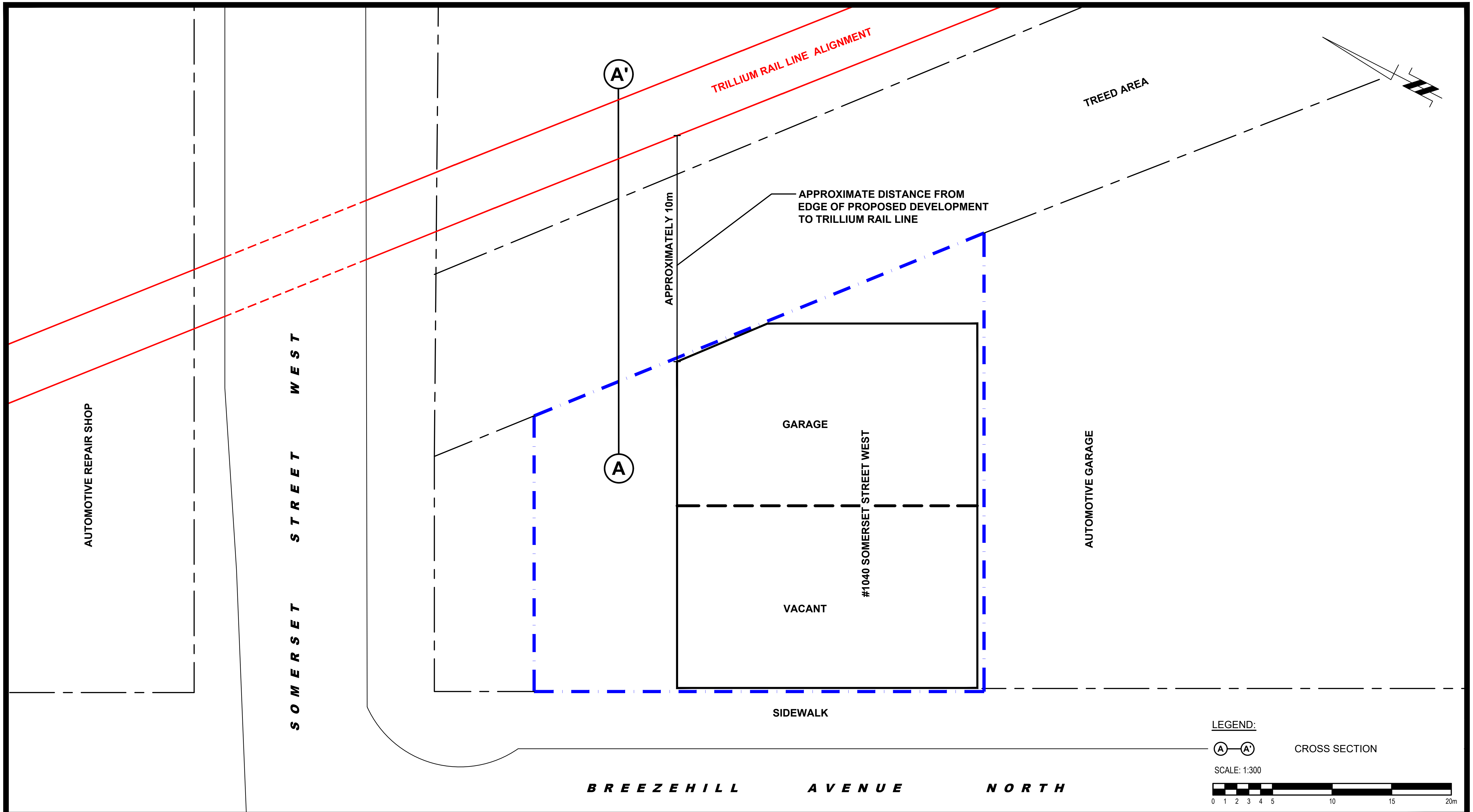
APPENDIX A

Trillium Line Proximity Plan

Cross-Section A-A

Survey Plan

Construction Methodology and Impact Review



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

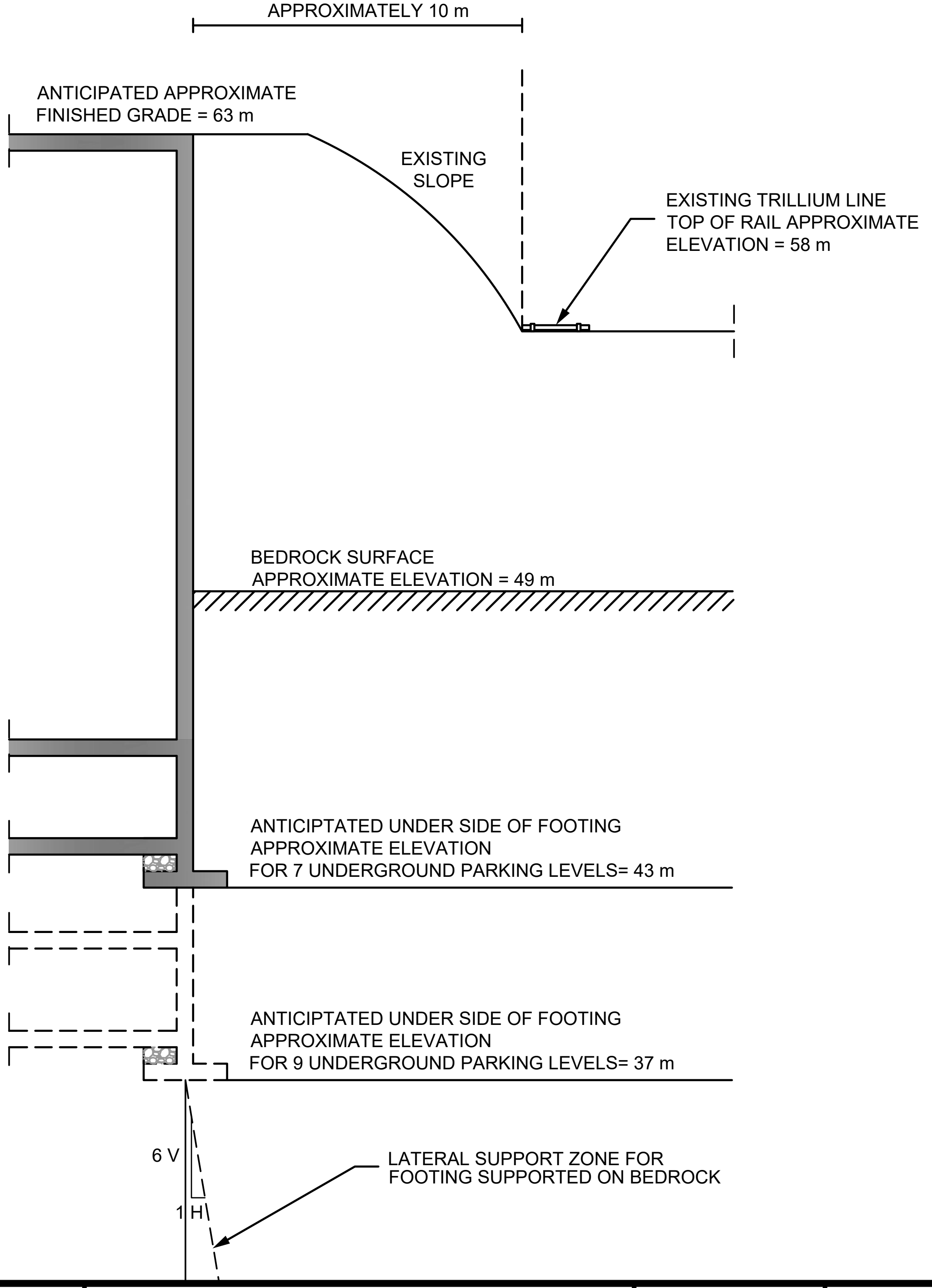
CLARIDGE HOMES
GEOTECHNICAL INVESTIGATION
1040 SOMERSET STREET WEST
OTTAWA, ONTARIO

Title:
TRILLIUM LINE PROXIMITY PLAN

Scale: 1:300
Date: 11/2020
Drawn by: YA
Report No.: PG2674-2
Checked by: NP
Dwg. No.: PG2674-3
Approved by: SD
Revision No.:

p:\autocad drawings\geotechnical\pg26xx\pg2674\pg2674-3-trillium proximity plan.dwg

CROSS SECTION A -A '



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344
www.patersongroup.ca

CLARIDGE HOMES
TRILLIUM LINE PROXIMITY STUDY
1040 SOMERSET STREET WEST
OTTAWA, ONTARIO

Title:
CROSS SECTION A - A'

Date: 11/2020	Report No.: PG2674-1
Scale: N.T.S.	Drawn by: YA
Checked by: NP	Approved by: SD
Drawing No.: PG2674-2	

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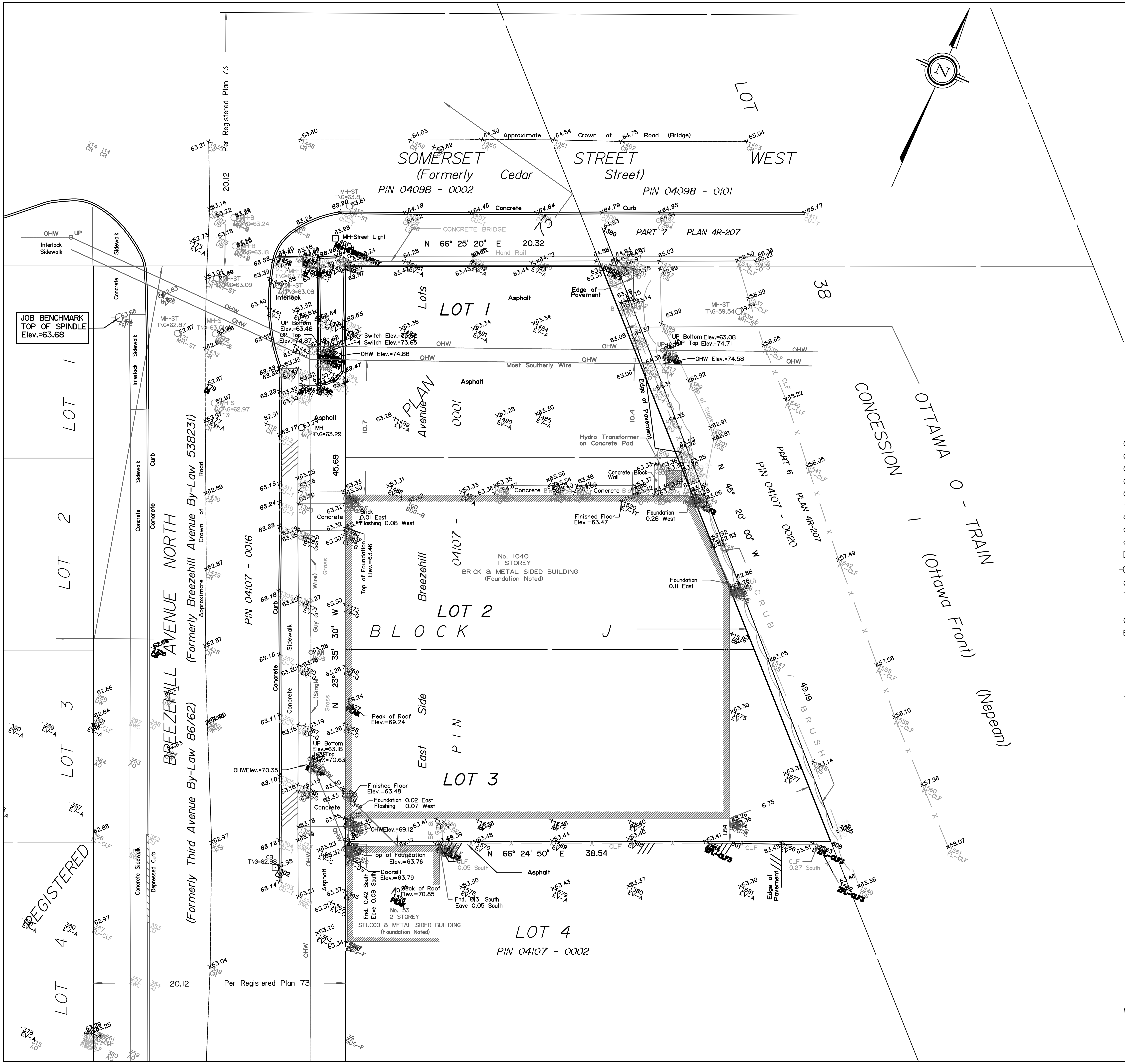

TOPOGRAPHICAL PLAN OF

LOTS 1, 2 and 3
East Side Breezehill Avenue North
PART OF BLOCK J
REGISTERED PLAN 73
CITY OF OTTAWA

Prepared by Annis, O'Sullivan, Vollebekk Ltd.
Field Work Completed April 5, 2012

Scale 1 : 200

8.0 6.0 4.0 2.0 0 4 8 Metres

Metric

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

Date

Edward M. Lancaster, O.L.S.

Plan Revised - Arpil 13, 2012 - "Ottawa O - Train" added

Notes & Legend

	Denotes	
○ MH–ST	"	
○ MH–S	"	Maintenance Hole (Sanitary)
○ MH–B	"	Maintenance Hole (Bell)
○ MH–T	"	Maintenance Hole (Traffic)
○ MH	"	Maintenance Hole (Unidentified)
—— OHW ——	"	Overhead Wires
○ UP	"	Utility Pole
○ AN	"	Anchor
○ LS	"	Light Standard
□ CB	"	Catch Basin
⌖ FH	"	Fire Hydrant
⊗ WV	"	Water Valve
T/G	"	Top of Grate
○ B	"	Bollard
CLF	"	Chain Link Fence
BF	"	Board Fence
+ 65.00	"	Location of Elevations
+ 65.00	"	Location of Elevations (Top of Curb)
Fnd.	"	Foundation
Switch	"	Electrical Transformer on UP
————	"	Property Line

Bearings are grid.

SITE AREA = 1345. m²

BOUNDARY INFORMATION COMPILED FROM FIELD SURVEY, REGISTRY OFFICE RECORDS AND OFFICE RECORDS.

ELEVATION NOTES

1. Elevations shown are referred to geodetic datum.
2. It is the responsibility of the user of this information to verify that the job benchmark has not been altered or disturbed and that it's relative elevation and description agrees with the information shown on this drawing.

UTILITY NOTES

1. This drawing cannot be accepted as acknowledging all of the utilities and it will be the responsibility of the user to contact the respective utility authorities for confirmation.
2. Only visible surface utilities were located.
3. A field location of underground plant by the pertinent utility authority is mandatory before any work involving breaking ground, probing, excavating etc.

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com
Ontario Land Surveyors

Job No. 12909-12 Claridge Lts 1 2 3 PL 73 T F1 ig

Construction Methodology and Impact Review

Construction Item	Potential Impact	Mitigation Program
Item A - Installation of Temporary Shoring System - Where adequate space is not available for the overburden to be sloped, the overburden along the perimeter of the proposed building footprint will need to be shored in order to complete the construction of the underground parking levels. The shoring system is anticipated to consist of a soldier pile and lagging or interlocking sheet pile system along the east side of the site adjacent to the Trillium Line.	Vibration issues during shoring system installation	Design of the temporary shoring system, in particular vibrations during installation, will take into consideration the presence of the proposed Trillium Line. Installation of the shoring system is not anticipated to have an adverse impact on the Trillium Line, nonetheless, a series of vibration monitoring devices are recommended to be installed to monitor vibrations. The vibration monitors would be remotely connected to permit real time monitoring and a vibration monitoring program would be implemented as detailed in Subsection 3.1 - Vibration Monitoring and Control Program of Paterson Group Report PG2674-3 dated November 30, 2020.
Item B - Bedrock Blasting and Removal Program - Blasting of the bedrock will be required for the proposed building and parking garage structure construction. It is expected that up to approximately 6 to 12 m of bedrock removal is required based on the current design concepts for the proposed development.	Structural damage of Trillium Line due to vibrations from blasting program.	Structural damage to the Trillium Line during bedrock blasting and removal is not anticipated, nonetheless, a series of vibration monitoring devices are recommended to be installed along rail corridor to monitor vibrations. The vibration monitors would be remotely connected to permit real time monitoring and a vibration monitoring program would be implemented as detailed in Subsection 3.1 - Vibration Monitoring and Control Program of Paterson Group Report PG2674-3 dated November 30, 2020.
Item C - Construction of Footings and Foundation Walls - The proposed building will include 7 to 9 levels of underground parking. Therefore, the footings will be placed over a clean, surface sounded limestone bedrock bearing surface.	Building footing loading on adjacent Trillium Line, and excavation within the lateral support zone of the Trillium Line.	Due to the distance between the proposed building and the Trillium Line, the zone of influence from the proposed footings will not intersect the rail line structure. Further, although the underground parking levels for the proposed building will extend approximately 20 to 26 m below existing ground surface, due to the approximate 10 m distance between the proposed building and rail line structure, the building excavation will not impact the lateral support zone of the Trillium Line.

APPENDIX B

Geotechnical Investigation:

Report PG2674-2 Revision 1

dated November 30, 2020

patersongroup

Geotechnical Engineering

Environmental Engineering

Hydrogeology

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Materials Testing

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Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Claridge Homes to conduct a geotechnical investigation for the proposed multi-storey building to be located at 1040 Somerset Street West, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the geotechnical investigation were to:

❏ Determine the subsoil and groundwater conditions at this site by means of boreholes.

❏ Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

An environmental investigation was carried out in conjunction with the geotechnical program and the findings are presented under separate cover.

2.0 Proposed Development

Although drawings were not available during the preparation of this report, it is understood that the proposed development at the subject site will consist of a multi-storey building with 7 to 9 levels of underground parking. Further, the footprint of the underground parking is anticipated occupy the entire site.

The subject site is currently occupied by a single-storey commercial building which will be demolished prior to construction of the proposed multi-storey building.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation consisted of 1 borehole (BH 1-20) which was carried out on November 17, 2020 to a depth of 25.6 m below the existing ground surface. Previous investigations at this site consisted of 4 boreholes in April and May 2012 (BH 1-12 through BH 4-12), 2 boreholes on October 27, 2014 (BH 5-14 and BH 6-14), and 1 borehole on February 12, 2015 (BH 7-15). In addition, 4 boreholes (BH 1 through BH 4) were placed across the subject site as part of the environmental investigation program in May 2007. The borehole locations were distributed in a manner to provide general coverage of the subject site. The locations of the boreholes are illustrated on Drawing PG2674-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a truck- or track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations, sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split-spoon (SS) sampler. Rock cores (RC) were obtained using 47.6 mm inside diameter coring equipment. All samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags, and rock cores were placed in cardboard boxes. All samples were transported to our laboratory for further examination and classification. The depths at which the auger, split spoon and rock core samples were recovered from the boreholes are shown as AU, SS and RC, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as “N” values on the Soil Profile and Test Data sheets. The “N” value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Rock samples were recovered in BH 1-20 using a core barrel and diamond drilling techniques. The depths at which rock core samples were recovered from the boreholes are shown as RC on the Soil Profile and Test Data sheets in Appendix 1.

A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section (core run) of bedrock and are shown on the borehole logs. The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section (core run). The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one core run over the length of the core run. These values are indicative of the quality of the bedrock.

Subsurface conditions observed in the boreholes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

A 19 mm PVC groundwater monitoring well was installed in BH 1-20, BH 5-14, BH 6-14, BH 7-15, BH 1-12, BH 3-12, and BH 3 to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

All samples from the current geotechnical investigation will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The borehole locations were determined by Paterson personnel taking into consideration the presence of underground and aboveground services. The location and ground surface elevation at each borehole location was surveyed by Paterson personnel. The boreholes were surveyed with respect to a temporary benchmark (TBM), consisting of the top spindle of the fire hydrant located at the southwest corner of the intersection of Somerset Street West and Breezehill Avenue North. A geodetic elevation of 63.67 m was provided by Annis, O’Sullivan, Vollebekk for this TBM. Borehole locations and ground surface elevations at the borehole locations are presented on Drawing PG2674-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is generally occupied by a single-storey commercial building, with an associated asphalt-paved access lane and parking area on the northern end of the site. The site is bordered by Somerset Street West to the north, Breezehill Avenue North to the west, a commercial property to the south, and the Trillium rail corridor to the east. A 1375 mm watermain is also located underlying Breezehill Avenue North, to the west of the subject site.

The existing ground surface across the site is relatively level at approximate geodetic elevation 63 m, however, a slope is located beyond the eastern property line, extending downward approximately 5 m to the Trillium rail corridor. .

4.2 Subsurface Profile

Overburden

The subsurface profile at the borehole locations consists of fill underlying the asphalt surface, extending to approximate depths of 3 to 4.7 m below the existing ground surface. The fill was generally observed to consist of a silty sand to sand and gravel with occasional coal, slag, glass, wood pieces, brick fragments, and concrete fragments.

Underlying the fill, a silty clay deposit was encountered, generally consisting of a very stiff to stiff, brown to grey silty clay with occasional traces of sand.

A glacial till deposit was encountered underlying the silty clay at approximate depths of 8.0 and 8.3 m in BH 1-20 and BH 1-12, respectively. The glacial till deposit was observed to consist of a silty sand to silty clay with gravel, cobbles, and boulders.

Practical refusal to augering was encountered in BH 1-12 at an approximate depth of 13.6 m below the existing ground surface.

Specific details of the subsurface profile at each test hole location are presented on the Soil Profile and Test Data sheets in Appendix 1.

Bedrock

Bedrock was cored at BH 1-20 from depths of 13.7 to 25.6 m, and consisted of limestone with interbedded shale seams. Based on the RQDs of the recovered rock core, the bedrock can be classified as good to excellent in quality.

4.3 Groundwater

Groundwater level readings were recorded at the monitoring well locations and are presented in Table 1.

Table 1 - Summary of Groundwater Level Readings

Test Hole Number	Ground Elevation (m)	Groundwater Levels (m)		Recording Date
		Depth	Elevation	
BH 1-20	63.22	7.75	55.47	November 26, 2020
BH 3-12	63.27	3.63	59.64	November 11, 2014
BH 5-14	63.46	3.41	60.05	November 11, 2014
BH 6-14	63.47	3.15	60.32	November 11, 2014
BH 7-15	63.49	3.62	59.87	February 19, 2015
BH 3	-	3.83	-	June 4, 2007

Note: The ground surface elevations at the test hole locations were referenced to a TBM consisting of the top of spindle of a fire hydrant located at the southwest corner of Breezehill Avenue and Somerset Street West. A geodetic elevation of 63.67 m was provided for the TBM.

It should be noted that surface water can become perched within a recently backfilled borehole, which can lead to a higher than normal groundwater level readings.

The long-term groundwater level can also be estimated based on the observed colour, moisture levels and consistency of the recovered soil samples. Based on these observations, the groundwater is expected between 5 to 6 m depth. Groundwater levels are subject to seasonal fluctuations and therefore could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. It is recommended that the proposed multi-storey building be founded on shallow footings placed on clean, surface sounded bedrock.

Considering the close proximity of the west embankment of the Somerset Street overpass to the northern end of the subject site, the shoring design will have to include support for the foundation west embankment. It is recommended that the foundation dimensions and location of the footing for the west embankment be determined to ensure the shoring does not encounter the existing foundation.

In addition, due to the close proximity of the adjacent 1375 mm diameter watermain, which is located less than 5 to 6 m from the west property boundary along Breezehill Avenue, additional precautions should be taken during excavation activities to ensure that the existing service is not affected. In particular, the temporary shoring system along Breezehill Avenue is recommended to consist of a secant pile wall socketed into the bedrock in order to minimize lateral movement of the shoring system.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Due to the anticipated founding level of the proposed multi-storey building, it is expected that all existing overburden material will be excavated from within the footprint of the underground parking levels for the proposed multi-storey building.

Bedrock Removal

It is expected that line-drilling in conjunction with hoe-ramming or controlled blasting will be required to remove the bedrock for the underground parking levels. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming. Furthermore, rock grinding may be considered to complete the bedrock removal along vertical surfaces and lessen the effects of over break encountered with other mechanical methods. Grinding of the bedrock also provides a better prepared surface for installation of the waterproofing system.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocities (PPV) measured at the structures should not exceed 25 mm/s during the blasting program to reduce the risks of damage to existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Vibration Considerations

Construction operations are also the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipments could be a source of vibrations: piling rig, hoe ram, compactor, dozer, crane, truck traffic, etc. The construction of the temporary shoring system using soldier piles, sheet piling, and/or secant piles will require the use of this equipment. Vibrations, whether caused by blasting operations or by construction operations, could be the cause of the source of detrimental vibrations on the adjoining buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). It should be noted that these guidelines are for today's construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, it is recommended that a pre-construction survey be completed to minimize the risks of claims during or following the construction of the proposed building.

A vibration monitoring program should be implemented during the construction of the temporary shoring system and bedrock blasting program to ensure that the neighbouring structures and utilities are not negatively impacted by the proposed building's construction.

Fill Placement

Excavated limestone bedrock could be used as select subgrade material around the proposed building footings, provided the excavated bedrock is suitably crushed to 50 mm in its longest dimension and approved by the geotechnical consultant at the time of placement. Alternatively, an engineered fill such as an OPSS Granular A or Granular B Type II, compacted to 98% of its standard Proctor maximum dry density (SPMDD), could be placed around the proposed footings.

Watermain Monitoring Program

The following vibration monitoring program is recommended to ensure that excessive movements and vibrations do not occur at the watermain location:

☐ Install 2 inclinometers located adjacent to the 1375 mm diameter watermain and the shoring face. Daily monitoring events should be completed during the excavation program until the tiebacks are stressed and then weekly during the construction program until the foundation extends above exterior finished grade. An alert level with 3 mm of movement will require an assessment. An action level with movement greater than 6 mm will require immediate attention and possible mitigation measures. A visual inspection of the excavation side slopes will also be completed along with the inclinometer monitoring events.

☐ Periodically monitor the vibration levels within an existing valve chamber along the subject section of watermain. If the vibration monitor cannot be placed within the valve chamber, the monitor will be placed at ground surface in the immediate area of shoring works.

☐ If the vibration limits noted in Table 2 are exceeded, the site superintendent will be notified by Paterson personnel of the exceedance and the shoring/excavation operation will be stopped. The project surveyor will survey the watermain level (within the valve chamber) to ensure pipe movement has not occurred. If pipe movement is not observed based on the survey results, the shoring/excavation operation will resume.

The following vibration limits are recommended for the shoring/excavation operation to be completed adjacent to the 1375 mm diameter watermain.

Table 2 - Vibration Limits for Work Completed Adjacent to Watermain

Location of Vibration Monitor	Peak Particle Velocity (mm/s)	Frequency (Hz)
Inside the Valve Chamber	15	4 to 12
	25	>40
At Ground Surface (within 3 m of watermain)	10	4 to 12
	25	>40

Note: The values should be interpolated between 12 and 40 Hz.

Weekly reporting of our findings and recommendations will be provided to the owner and the City of Ottawa. Any mitigation measures contemplated for implementation will be discussed with the owner and City of Ottawa personnel.

5.3 Foundation Design

Bearing Resistance Values

Footings placed on clean, surface sounded bedrock can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **4,000 kPa**, incorporating a geotechnical resistance factor of 0.5.

A factored bearing resistance value at ULS of **6,000 kPa**, incorporating a geotechnical resistance factor of 0.5, could be used for footings founded on limestone bedrock if the bedrock is free of seams, fractures and voids within 1.5 m below the founding level. This could be verified by completing and probing 50 mm diameter drill holes to a depth of 1.5 m below the founding level within the footprint(s) of the footing(s). At least one drill hole should be completed per major footing. The drill hole inspection should be carried out by the geotechnical consultant.

Settlement

Footings bearing on an acceptable bedrock bearing surface and designed using the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending down and out from the bottom edge of the footing at a minimum of 1H:6V (or flatter) passes only through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete. A weathered bedrock bearing medium will require a lateral support zone of 1H:1V (or flatter).

5.4 Design for Earthquakes

Shear wave velocity testing was completed for the subject site to accurately determine the applicable seismic site classification for the proposed building in accordance with Table 4.1.8.4.A of the Ontario Building Code 2012. The shear wave velocity testing was completed by Paterson personnel. The results of the shear wave velocity test are provided in Figures 2 and 3 in Appendix 2.

Field Program

The seismic array testing location was placed on the western end of the site in an approximate north-south direction as presented in Drawing PG2674-1, attached to the present report. Paterson field personnel placed 21 horizontal 4.5 Hz. geophones mounted to the surface by means of two 75 mm ground spikes attached to the geophone land case. The geophones were spaced at 1 m intervals and connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was also connected to a computer laptop and a hammer trigger switch attached to a 12 pound dead blow hammer. The hammer trigger switch sends a start signal to the seismograph. The hammer is used to strike an I-Beam seated into the ground surface, which creates a polarized shear wave. The hammer shots are repeated between four (4) to eight (8) times at each shot location to improve signal to noise ratio.

The shot locations are also completed in forward and reverse directions (i.e.- striking both sides of the I-Beam seated parallel to the geophone array). The shot locations were 0.4 m away from the first geophone, 1.6, 11.5, and 18.5 m away from the last geophone, and at the centre of the seismic array.

Data Processing and Interpretation

Interpretation for the shear wave velocity results were completed by Paterson personnel. Shear wave velocity measurement was made using reflection/refraction methods. The interpretation is performed by recovering arrival times from direct and refracted waves. The interpretation is repeated at each shot location to provide an average shear wave velocity, V_{s30}, of the upper 30 m profile, immediately below the building's foundation. The layer intercept times, velocities from different layers and critical distances are interpreted from the shear wave records to compute the bedrock depth at each location. The bedrock velocity was interpreted using the main refractor wave velocity, which is considered a conservative estimate of the bedrock velocity due to the increasing quality of the bedrock with depth. It should be noted that as bedrock quality increases, the bedrock shear wave velocity also increases.

The Vs_{30} was calculated using the standard equation for average shear wave velocity provided in the Ontario Building Code (OBC) 2012, and as presented below:

$$V_{s30} = \frac{Depth_{OfInterest}(m)}{\left(\frac{(Depth_{Layer1}(m)}{Vs_{Layer1}(m/s)} + \frac{Depth_{Layer2}(m)}{Vs_{Layer2}(m/s)}\right)}$$

$$V_{s30} = \frac{30m}{\left(\frac{30m}{2{,}076m/s}\right)}$$

$$V_{s30} = 2{,}076m/s$$

Based on the results of the seismic testing, the average shear wave velocity, Vs_{30}, for foundations placed on bedrock is 2,076 m/s. Therefore, a **Site Class A** is applicable for design of the proposed building, as per Table 4.1.8.4.A of the OBC 2012. The soils underlying the subject site are not susceptible to liquefaction.

5.5 Basement Slab

All overburden soil will be removed from the subject site leaving the bedrock as the founding medium for the lower basement floor slab. It is expected that the basement area will be mostly parking and the recommended pavement structure noted in Subsection 5.8 will be applicable.

However, if storage or other uses of the lower level where a concrete floor slab will be used, it is recommended that the upper 200 mm of sub-slab fill consists of 19 mm clear crushed stone. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

In consideration of the groundwater conditions encountered at the time of the fieldwork, a subfloor drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the clear crushed stone layer under the lower level floor slab.

5.6 Basement Wall

It is understood that the lower basement walls are to be poured against a waterproofing system, which will be placed against the exposed bedrock face. A nominal coefficient for at-rest earth pressure of 0.05 is recommended in conjunction with a bulk unit weight of 24.5 kN/m^3 (effective 15.5 kN/m^3) for this condition. A seismic earth pressure component will not be applicable for the foundation wall which is to be poured against the bedrock face. It is expected that the seismic earth pressure will be transferred to the underground floor slabs, which should be designed to accommodate these pressures. A hydrostatic groundwater pressure should be added for the portion below the groundwater level.

Where soil is to be retained, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m^3. Undrained conditions are anticipated (i.e. below the groundwater level). Therefore, the applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

Two distinct conditions, static and seismic, must be reviewed for design calculations. The parameters for design calculations for the two conditions are presented below.

Static Conditions

The static horizontal earth pressure (p_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained material
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Conditions

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}).

The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45 - a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity ($9.81\ m/s^2$)

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Rock Anchor Design

The geotechnical design of grouted rock anchors in sedimentary bedrock is based upon two possible failure modes. The anchor can fail either by shear failure along the grout/rock interface or by pullout of a 60 to 90 degree cone of rock with the apex of the cone near the middle of the bonded length of the anchor. It should be noted that interaction may develop between the failure cones of anchors that are relatively close to one another resulting in a total group capacity smaller than the sum of the load capacity of each anchor taken individually.

A third failure mode of shear failure along the grout/steel interface should also be reviewed by a qualified structural engineer to ensure all typical failure modes have been reviewed. Typical rock anchor suppliers, such as Dywidag Systems International (DSI Canada) or Williams Form Engineering, have qualified personnel on staff to recommend appropriate rock anchor size and materials.

It is recommended that anchors in close proximity to each other be grouted at the same time to ensure any fractures or voids are completely in-filled and that fluid grout does not flow from one hole to an adjacent empty one.

Anchors can be of the “passive” or the “post-tensioned” type, depending on whether the anchor tendon is provided with post-tensioned load or not prior to being put into service. To resist seismic uplift pressures, a passive rock anchor system can be used. It should be noted that a post-tensioned anchor will take the uplift load with much less deflection than a passive anchor.

Regardless of whether an anchor is of the passive or the post tensioned type, it is recommended that the anchor be provided with a bonded length, or fixed anchor length, at the base of the anchor, which will provide the anchor capacity, as well an unbonded length, or free anchor length, between the rock surface and the start of the bonded length. As the depth at which the apex of the shear failure cone develops is midway along the bonded length, a fully bonded anchor would tend to have a much shallower cone, and therefore less geotechnical resistance, than one where the bonded length is limited to the bottom part of the overall anchor.

Permanent anchors should be provided with corrosion protection. As a minimum, this requires that the entire drill hole be filled with cementitious grout. The free anchor length is provided by installing a plastic sleeve to act as a bond break.

Grout to Rock Bond

Generally, the unconfined compressive strength of limestone ranges between 60 and 120 MPa, which is stronger than most routine grouts. A factored tensile grout to rock bond resistance value at ULS of **1.0 MPa**, incorporating a resistance factor of 0.3, can be used. A minimum grout strength of 40 MPa is recommended.

Rock Cone Uplift

As discussed previously, the geotechnical capacity of the rock anchors depends on the dimensions of the rock anchors and the configuration of the anchorage system. Based on existing subsoils information, a **Rock Mass Rating (RMR) of 69** was assigned to the bedrock, and Hoek and Brown parameters (**m and s**) were taken as **0.575 and 0.00293**, respectively.

Recommended Rock Anchor Lengths

Rock anchor lengths can be designed based on the required loads. Rock anchor lengths for some typical loads have been calculated and are presented on the following page. Load specified rock anchor lengths can be provided, if required.

For our calculations the following parameters were used.

Table 3 - Parameters used in Rock Anchor Review

Grout to Rock Bond Strength - Factored at ULS	1.0 MPa
Compressive Strength - Grout	40 MPa
Rock Mass Rating (RMR) - Good quality Limestone Hoek and Brown parameters	69 m=0.575 and s=0.00293
Unconfined compressive strength - Limestone bedrock	60 MPa
Unit weight - Submerged Bedrock	15 kN/m^3
Apex angle of failure cone	60°
Apex of failure cone	mid-point of fixed anchor length

From a geotechnical perspective, the fixed anchor length will depend on the diameter of the drill holes. Recommended anchor lengths for a 75 and 125 mm diameter hole are provided in Table 4 below.

Table 4 - Recommended Rock Anchor Lengths - Grouted Rock Anchor

Diameter of Drill Hole (mm)	Anchor Lengths (m)			Factored Tensile Resistance (kN)
	Bonded Length	Unbonded Length	Total Length	
75	1.2	0.6	1.8	250
	1.9	0.8	2.7	500
	3.0	1.5	4.5	1000
125	1.1	0.5	1.6	250
	1.5	0.7	2.2	500
	2.6	1.0	3.6	1000

It is recommended that the anchor drill hole diameter be within 1.5 to 2 times the rock anchor tendon diameter and the anchor drill holes be inspected by geotechnical personnel and should be flushed clean prior to grouting. The use of a grout tube to place grout from the bottom up in the anchor holes is further recommended.

The geotechnical capacity of each rock anchor should be proof tested at the time of construction. More information on testing can be provided upon request. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day grout is prepared.

5.8 Pavement Structure

The proposed lower basement slab will be considered a rigid pavement structure. The following rigid pavement structure is suggested to support car parking only.

Table 5 - Recommended Rigid Pavement Structure - Car Only Parking Areas

Thickness (mm)	Material Description
125	**Wear Course -** Concrete slab
300 to 500	**BASE** - OPSS Granular A (thickness will depend on required pipe cover and other subfloor surfaces)
	SUBGRADE - Bedrock

It is recommended that the concrete slab to be used as a rigid pavement structure consist of category C2 concrete with a strength of 32 MPa at 28 days and air entrainment of 5 to 8 percent.

For design purposes, the pavement structure presented in the following table could be used for the design of access lanes.

Table 6 - Recommended Pavement Structure - Access Lanes

Thickness (mm)	Material Description
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Existing fill, or OPSS Granular B Type I or II material placed over bedrock.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable vibratory equipment.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that the portion of the proposed building foundation walls located below the long-term groundwater table (approximate geodetic elevation 58 m) be placed against a groundwater infiltration control system which is fastened to the temporary shoring system or vertical bedrock face. Also, a perimeter foundation drainage system will be required as a secondary system to account for any groundwater which comes in contact with the proposed building's foundation walls.

For the portion of the groundwater infiltration control system installed against the vertical bedrock face, the following is recommended:

❏ Line drill the excavation perimeter.
❏ Hoe ram any irregularities and prepare bedrock surface. Shotcrete areas to fill in cavities and smooth out angular features at the bedrock surface, as required based on site inspection by Paterson.
❏ Place a suitable membrane against the prepared bedrock surface, such as a bentomat liner system or equivalent. The membrane liner should extend from geodetic elevation 58 m down to the footing level. The membrane liner should also extend horizontally a minimum 600 mm below the footing at underside of footing level.
❏ Place a composite drainage layer, such as Delta Drain 6000 or equivalent, over the membrane (as a secondary system). The composite drainage layer should extend from finished grade to underside of footing level.
❏ Pour foundation wall against the composite drainage system.

It is recommended that 100 mm diameter sleeves at 3 m centres be cast in the footing or at the foundation wall/footing interface to allow the infiltration of any water that breaches the waterproofing system to flow to an interior perimeter drainage pipe. The perimeter drainage pipe should direct water to sump pit(s) within the lower basement area.

Subfloor Drainage

Subfloor drainage may be required to control water infiltration due to groundwater lowering within the bedrock. For design purposes, we recommend that 150 mm diameter perforated pipes be placed at approximate 6 to 8 m centres. The spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Concrete Mud Slab

To lessen the potential groundwater infiltration at the base of the excavation, consideration should be given to pouring a 100 mm thick concrete mud slab using 20 MPa compressive strength concrete directly on the bedrock surface prior to pouring footings. The purpose of the concrete mud slab is to provide a uniform layer to restrict the bulk of the groundwater infiltration. The effectiveness of the concrete mud slab is dependent on pouring a uniform layer on a flat surface avoiding pits and horizontal surfaces from deeper excavations. More details can be provided once the excavation plan is available.

6.2 Protection of Footings Against Frost Action

It is expected that the underground parking levels will not require protection against frost action due to the founding depth. Unheated structures, such as the access ramp, may required to be insulated against the deleterious effect of frost action. A minimum of 2.1 m of soil cover alone, or a minimum of 0.6 m of soil cover, in conjunction with foundation insulation, should be provided in this regard.

6.3 Excavation Side Slopes and Temporary Shoring

The side slopes of the shallow excavations anticipated at this site should either be cut back at acceptable slopes or be retained by shoring systems from the start of the excavation until the structure is backfilled. Based on the depth of the proposed structure and the proximity to property lines, it is anticipated that a temporary shoring system will be required to support the excavation.

Unsupported Excavations

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by "cut and cover" methods and excavations will not be left open for extended periods of time.

Rock Stabilization

Excavation side slopes in sound bedrock can be carried out using almost vertical side walls. Where the excavation extends into the bedrock, horizontal rock anchors may be required at specific locations to prevent pop-outs of the bedrock, especially in areas where fractures in the bedrock are conducive to the failure of the bedrock surface.

The requirement for horizontal rock anchors will be evaluated during the excavation operations and should be discussed with the structural engineer during the design stage.

Temporary Shoring

Temporary shoring will be required to support the overburden soils. The design and implementation of these temporary systems will be the responsibility of the excavation contractor and their design team. Inspections and approval of the temporary system will also be the responsibility of the shoring designer. Geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system. The designer should also take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner's representative prior to implementation.

On the north, east, and south sides of the excavation, the temporary shoring system may consist of a soldier pile and lagging system or interlocking steel sheet piles. However, on the west side of the excavation along Breezehill Avenue, due to the proximity of the 1375 mm diameter watermain, the temporary shoring system is recommended to consist of a secant pile wall which is socketed into the bedrock. Further, the secant pile wall design should include tie backs and walers to provide lateral support.

Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be added to the earth pressures described below. These systems can be cantilevered, anchored or braced.

The toe of the shoring is recommended to be adequately supported to resist toe failure, if required, by means of rock bolts or extending the piles into the bedrock through pre-augered holes if a soldier pile and lagging system is used.

The earth pressures acting on the shoring system may be calculated using the following parameters.

Table 7 - Soil Parameters for Shoring System Design

Parameters	Values
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Unit Weight (γ), kN/m^3	20
Submerged Unit Weight (γ), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible.

The dry unit weight should be used above the groundwater level while the effective unit weight should be used below the groundwater level.

The hydrostatic groundwater pressure should be added to the earth pressure distribution wherever the effective unit weights are used for earth pressure calculations. If the groundwater level is lowered, the dry unit weight for the soil should be used full weight, with no hydrostatic groundwater pressure component.

For design purposes, the minimum factor of safety of 1.5 should be calculated.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for bedding for sewer and water pipes when placed on soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material's SPMDD.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce the potential differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

6.5 Groundwater Control

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

The rate of flow of groundwater into the excavation through the overburden and bedrock should be moderate for the expected subsurface conditions at this site. It is anticipated that pumping from open sumps will be sufficient to control the groundwater influx through the sides of the excavations.

Groundwater Control for Building Construction

A temporary Ministry of Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required if more than 400,000 L/day of ground and/or surface water are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Impacts on Neighbouring Properties

Based on the existing groundwater level, the extent of any significant groundwater lowering will take place within a limited range of the proposed building. Based on the proximity of neighbouring buildings and minimal zone impacted by the groundwater lowering, the proposed development will not negatively impact the neighbouring structures. It should be noted that no issues are expected with respect to groundwater lowering that would cause long term adverse effects to adjacent structures surrounding the proposed building.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be carried out in a manner to avoid the introduction of frozen materials, snow or ice into the trenches. Precaution must be taken where excavations are carried in proximity of existing structures which may be adversely affected due to the freezing conditions. In particular, it should be recognized that where a shoring system is used, the soil behind the shoring system will be subjected to freezing conditions and could result in heaving of the structure(s) placed within or above frozen soil. Provisions should be made in the contract document to protect the walls of the excavations from freezing, if applicable.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a moderate to very aggressive corrosive environment.

6.8 Slope Stability Analysis

A slope section was analysed along the east property boundary where a slope is located within the railway easement to the east of the subject site. The cross section location is presented on Drawing PG2674-1 - Test Hole Location Plan in Appendix 2.

The existing soils along the approximately 5 m high slope are noted to consist primarily of fill. The majority of the slope surface is brush covered with some construction debris.

The analysis of slope stability was carried out using SLIDE, a computer program that permits a two-dimensional slope stability analysis using several methods, including the Bishop's method, which is a widely used and accepted analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to those favouring failure. Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsoil and groundwater conditions, a factor of safety greater than one is usually required to ascertain than the risks of failure are acceptable. A minimum factor of safety of 1.5 is generally recommended for conditions where the failure of the slope would endanger permanent structures. An analysis considering seismic loading was also completed. A horizontal acceleration of 0.16g was considered for the sections for the seismic loading condition. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

It should be noted that the majority of the soil within the subject site will be removed as part of the proposed building construction. The removal of the soil along the top of slope as part of the redevelopment works will increase the overall slope stability factor of safety beyond what is currently present. Also, the proposed building will not be negatively impacted by the neighbouring slope due to the proposed founding level being located well below any failure circles associated with the existing slope.

The results of the stability analysis for the existing static conditions at Section A are presented on Figure 4 in Appendix 2. The factor of safety for the slope was less than 1.5 for Section A. Figure 6 presents our analysis which includes the proposed building footprint. The factor of safety for this slope condition is slightly improved, but still less than 1.5 when the proposed building is included.

The results of the analyses including seismic loading are shown on Figures 5 and 7 for the slope section. The results indicate that the factor of safety for both conditions are greater than 1.1.

6.9 Protection of Existing Watermain (Breezehill Avenue)

Due to the close proximity of the existing watermain, which is located approximately 5 to 6 m from the west property boundary along Breezehill Avenue, extra precautions should be taken at the time of excavation. A secant pile wall socketed into the bedrock and supported with walers and tie backs is recommended to provide lateral support to the watermain during the excavation.

As an extra measure, a monitoring program is required to ensure the lateral support zone of the watermain has not been impacted. The monitoring program will consist of installation of two inclinometers between the shoring system and the existing watermain. In addition, the excavation side slope should be monitored by the geotechnical consultant on a daily basis during until tie backs are stressed and weekly until the foundation extends above exterior finished grade. An alert level for any movement greater than 3 mm should be assessed immediately. An action level for movement of 6 mm will require immediate investigation and possible mitigation measures.

Weekly reporting including inspection findings and recommendations should be provided to the owner and the City by the geotechnical consultant.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- Review of the geotechnical aspects of the excavating contractor's shoring design, prior to construction.
- Observation of all bearing surfaces prior to the placement of concrete.
- Inspection of the foundation waterproofing and all foundation drainage systems.
- Sampling and testing of the concrete and fill materials used.
- Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- Observation of all subgrades prior to backfilling.
- Field density tests to determine the level of compaction achieved.
- Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program performed by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A geotechnical investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine its suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Claridge Homes or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

Scott Dennis

LICENSED PROFESSIONAL ENGINEER
Nov. 30, 2020
S. S. DENNIS
100519516
Scott Dennis
PROVINCE OF ONTARIO

Scott S. Dennis, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution

- ☐ Claridge Homes (e-mail copy)
- ☐ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1040 Somerset Street West
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

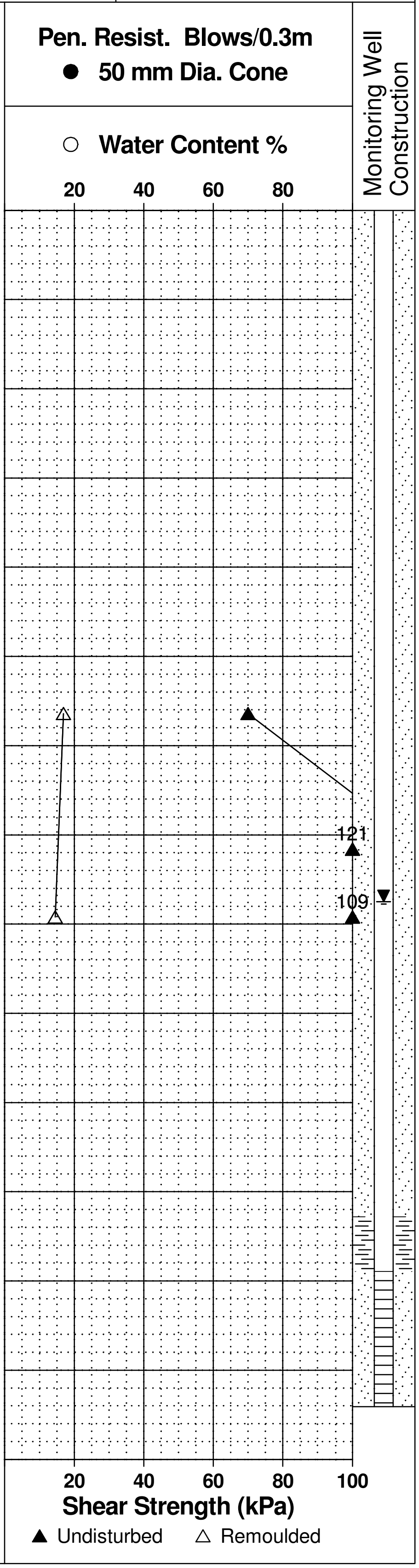
DATE November 17, 2020

FILE NO. PG2674

HOLE NO. BH 1-20

SOIL DESCRIPTION		SAMPLE			
GROUND SURFACE		TYPE	NUMBER	% RECOVERY	N VALUE or RQD
Asphaltic concrete	0.05	AU	1		
FILL: Grey sand and gravel	0.91				
FILL: Black gravelly sand	1.37	SS	2	75	27
FILL: Brown sand, some silt and gravel	2.13	SS	3	17	5
FILL: Dark brown silty sand, some clay, trace gravel	3.35	SS SS	4 5	25 17	5 22
FILL: Brown silty sand, some gravel, cobbles and boulders	4.65	SS	6	50	50+
Stiff, grey **CLAYEY SILT**	5.18	SS	7	83	4
Stiff to very stiff, grey **SILTY CLAY**	8.03	SS	8	100	2
GLACIAL TILL: Grey silty sand with clay, gravel, cobbles and boulders	13.74	SS SS SS SS SS SS SS	9 10 11 12 13 14 15	75 21 33 50 43 42	3 20 9 20 34 33 34
		SS	16	100	50+

DEPTH (m)	ELEV. (m)
0	63.22
1	62.22
2	61.22
3	60.22
4	59.22
5	58.22
6	57.22
7	56.22
8	55.22
9	54.22
10	53.22
11	52.22
12	51.22
13	50.22
14	49.22



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1040 Somerset Street West
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE November 17, 2020

FILE NO. PG2674

HOLE NO. BH 1-20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
						14	49.22
		RC	1				
		RC	2	94	88		
						15	48.22
		RC	3	100	92		
						16	47.22
						17	46.22
		RC	4	100	100		
						18	45.22
		RC	5	100	90		
						19	44.22
BEDROCK: Good to excellent quality, grey limestone with shale seams							
						20	43.22
		RC	6	100	100		
						21	42.22
		RC	7	100	100		
						22	41.22
						23	40.22
		RC	8	100	95		
						24	39.22
		RC	9	100	95		
						25	38.22
25.55							
End of Borehole (GWL @ 7.75m - Nov. 25, 2020)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**
20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1040 Somerset Street West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located at the southwest corner of Breezehill Avenue and Somerset Street West. Geodetic elevation = 63.669m.

REMARKS

BORINGS BY CME 55 Power Auger

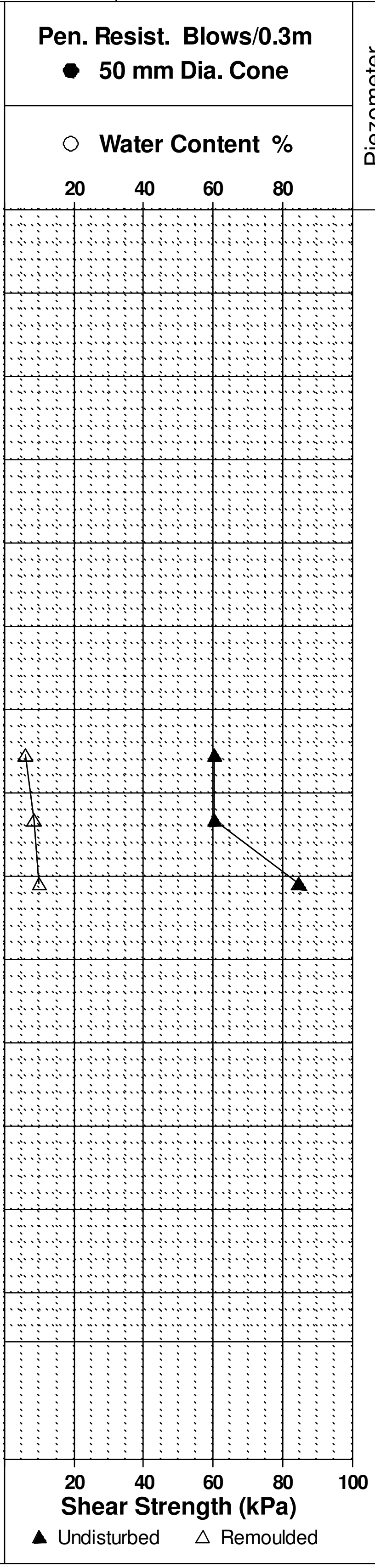
DATE April 20, 2012

FILE NO. PG2674

HOLE NO. BH 1-12

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE				
FILL: Brown silty sand with clay and gravel	SS	1	42	5
	SS	2	25	13
	SS	3	29	45
	SS	4	100	50+
3.70				
Very loose, grey **SILTY SAND** with clay	SS	5	83	3
	SS	6	92	1
5.25				
Stiff, grey **SILTY CLAY**	SS	7	100	1
	SS	8	100	P
Stiff, grey **SILTY CLAY**	SS	9	100	P
	SS	10	100	P
8.30				
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles	SS	11	75	P
	SS	12	8	11
	SS	13	58	4
	SS	14	50	20
	SS	15	67	50+
	SS	16	67	24
	SS	17	80	50+
13.59				
End of Borehole Practical refusal to augering at 13.59m depth.				

DEPTH (m)	ELEV. (m)
0	63.28
1	62.28
2	61.28
3	60.28
4	59.28
5	58.28
6	57.28
7	56.28
8	55.28
9	54.28
10	53.28
11	52.28
12	51.28
13	50.28



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1040 Somerset Street West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located at the southwest corner of Breezehill Avenue and Somerset Street West. Geodetic elevation = 63.669m.

REMARKS

BORINGS BY CME 55 Power Auger

DATE May 3, 2012

FILE NO. PG2674

HOLE NO. BH 2-12

SOIL DESCRIPTION		SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.28
Asphaltic concrete	0.05						
FILL: Crushed stone	0.15						
FILL: Black gravel with silty sand	1.45	AU	1			1	62.28
FILL: Brown silty sand with gravel and boulders	3.73	SS	2	25	9	2	61.28
		SS	3	33	9	3	60.28
		SS	5	42	0		
Grey **SILTY CLAY** with sand	6.02	SS	5	50	3	4	59.28
		SS	6	92	3	5	58.28
		SS	7	100	2	6	57.28
End of Borehole							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1040 Somerset Street West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located at the southwest corner of Breezehill Avenue and Somerset Street West. Geodetic elevation = 63.669m.

REMARKS

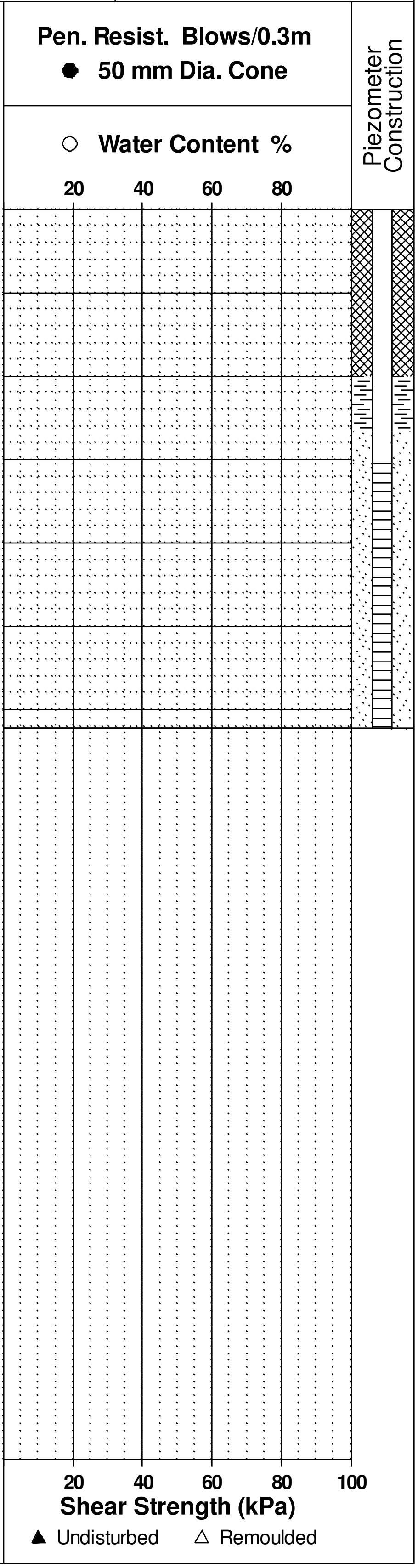
BORINGS BY CME 55 Power Auger

DATE May 3, 2012

FILE NO. PG2674

HOLE NO. BH 3-12

SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.27
Asphaltic concrete	0.05						
FILL: Crushed stone	0.25						
FILL: Brown silty sand with gravel, coal and concrete		SS	1	33	29	1	62.27
		SS	2	8	3	2	61.27
	2.21						
FILL: Brown silty sand with gravel and cobbles		SS	3	33	14		
		SS	4	42	81	3	60.27
	3.73						
Grey **SILTY CLAY,** trace sand		SS	5	58	6	4	59.27
		SS	6	67	2	5	58.27
		SS	7	100	3	6	57.27
	6.22						
End of Borehole							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1040 Somerset Street West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located at the southwest corner of Breezehill Avenue and Somerset Street West. Geodetic elevation = 63.669m.

REMARKS

BORINGS BY CME 55 Power Auger

DATE May 3, 2012

FILE NO. PG2674

HOLE NO. BH 4-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.29
Asphaltic concrete 0.05							
FILL: Brown silty sand with gravel, coal, slag, glass		SS	1	33	27	1	62.29
		SS	2	8	3	2	61.29
		SS	3	25	5	3	60.29
3.73		SS	4	42	16		
Grey **SILTY CLAY** with sand		SS	5	42	26	4	59.29
		SS	6	17	2	5	58.29
6.02		SS	7	100		6	57.29
End of Borehole							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1040 Somerset Street West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located at the southwest corner of Breezehill Avenue and Somerset Street West. Geodetic elevation = 63.669m.

REMARKS

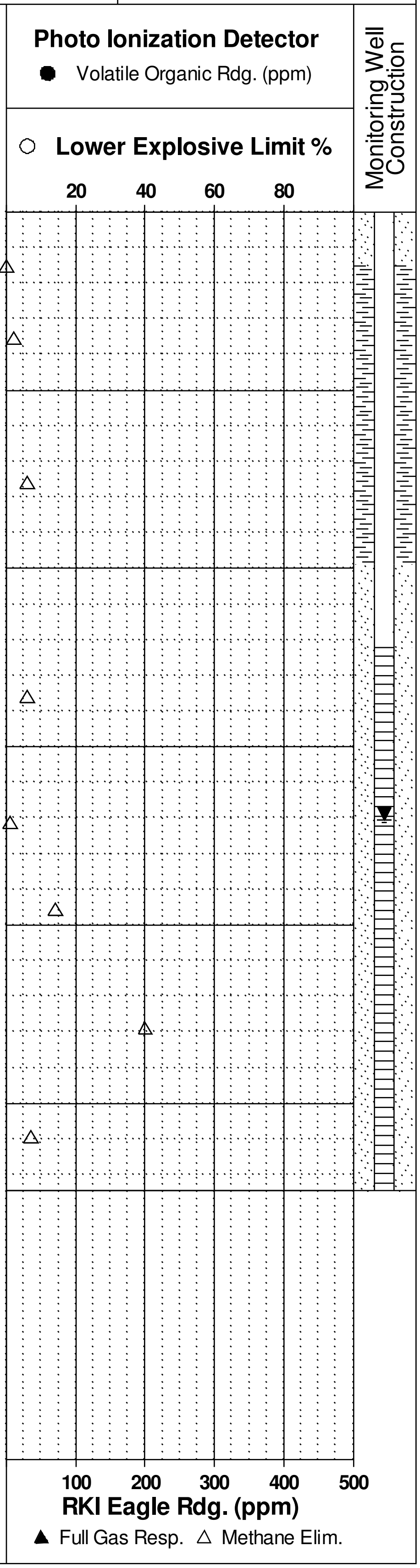
BORINGS BY Jack Hammer

DATE October 27, 2014

FILE NO. PE2636

HOLE NO. BH 5-14

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.46
Concrete 0.20							
		AU	1				
		SS	2	29			
						1	62.46
FILL: Sand and gravel		SS	3	71			
						2	61.46
		SS	4	50			
						3	60.46
3.60		SS	5	50			
Brown **SILTY CLAY**		SS	6	100			
4.22						4	59.46
		SS	7	100			
Brown **CLAYEY SILT,** some sand and gravel						5	58.46
5.49		SS	8	83			
End of Borehole							
(GWL @ 3.41m-Nov. 11, 2014)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1040 Somerset Street West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located at the southwest corner of Breezehill Avenue and Somerset Street West. Geodetic elevation = 63.669m.

REMARKS

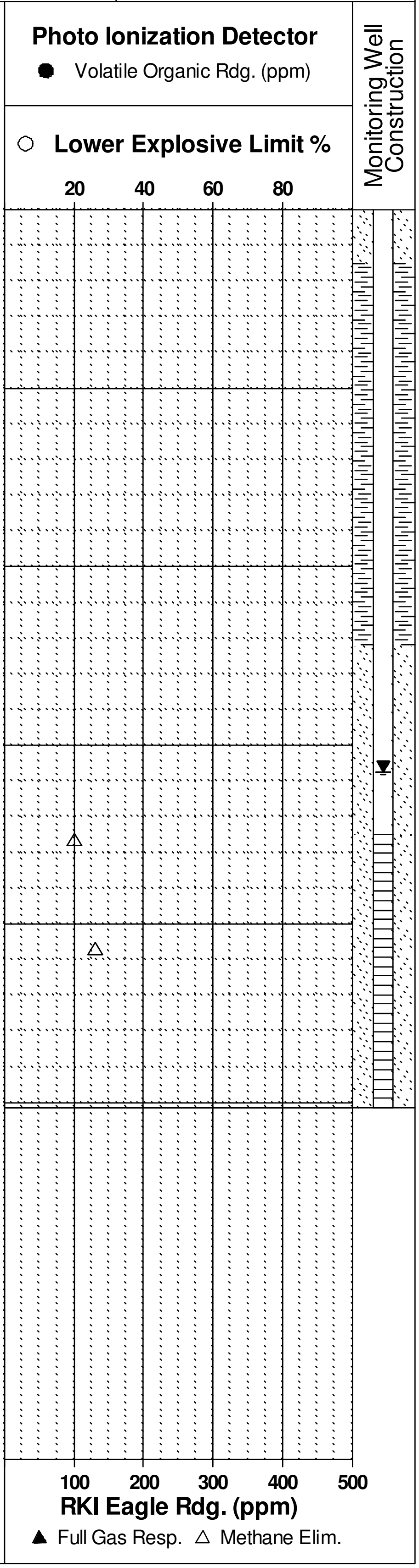
BORINGS BY Jack Hammer

DATE October 27, 2014

FILE NO. PE2636

HOLE NO. BH 6-14

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.47
Concrete	0.25						
FILL: Inferred cobbles and boulders						1	62.47
						2	61.47
		RC	1				
	3.15	RC	2			3	60.47
FILL: Brown silty sand with gravel		SS	3	46			
	4.11	SS	4	100		4	59.47
Brown **SILTY CLAY**	5.03					5	58.47
End of Borehole (GWL @ 3.15m-Nov. 11, 2014)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1040 Somerset Street West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located at the southwest corner of Breezehill Avenue and Somerset Street West. Geodetic elevation = 63.669m.

REMARKS

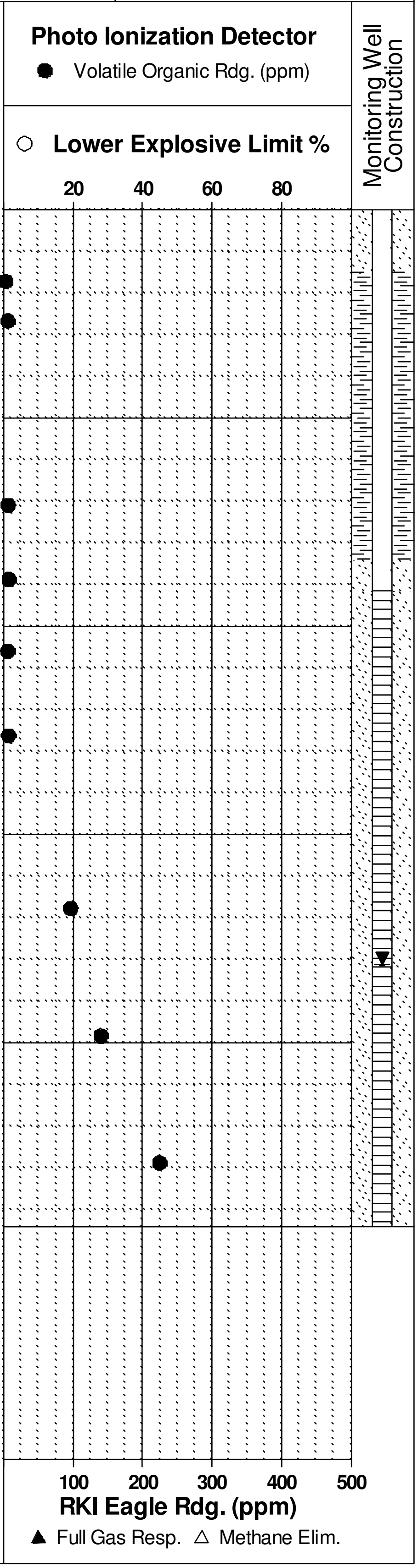
BORINGS BY Portable Drill

DATE February 12, 2015

FILE NO. PE2636

HOLE NO. BH 7-15

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	63.49
Concrete slab 0.23						
FILL: Crushed stone, trace sand and silt 0.46	AU	1				
	AU	2				
					1	62.49
FILL: Blast rock, some sand and gravel, trace silt and clay	AU	3				
	RC	1	25			
					2	61.49
	AU	4				
		5				
3.00					3	60.49
	SS	6	75			
Brown **SILTY CLAY,** trace sand						
	SS	7	100		4	59.49
- grey by 4.5m depth	SS	8	100			
4.88						
End of Borehole						
(GWL @ 3.62m - Feb. 19, 2015)						



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Phase I-II Environmental Site Assessment
1040 Somerset Street West
Ottawa, Ontario

DATUM

REMARKS

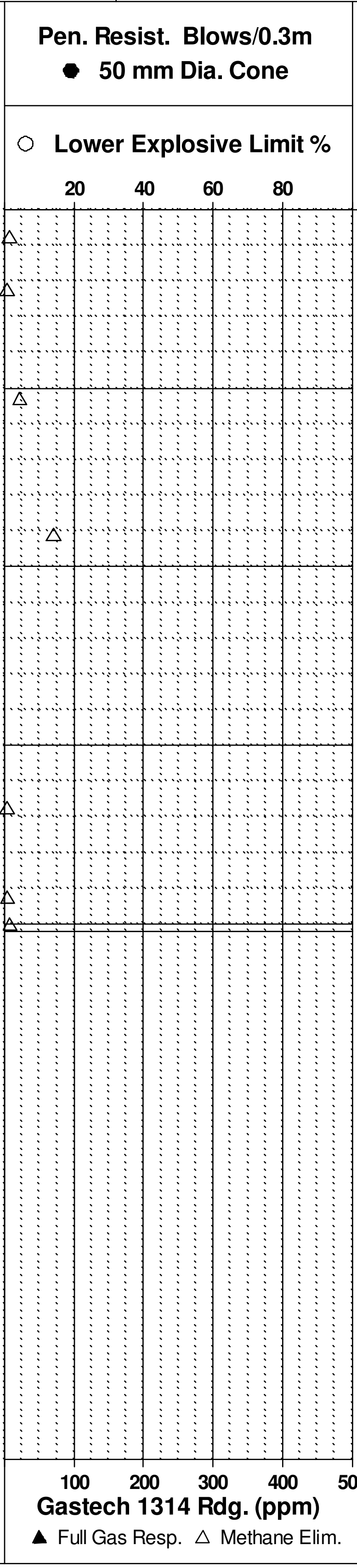
BORINGS BY CME 55 Power Auger

DATE May 29, 07

FILE NO. PE1148

HOLE NO. BH 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Monitoring Well Construction
GROUND SURFACE						0		
FILL: Brown sandy topsoil with gravel	▨	AU	1					
	▨	AU	2					
0.60								
FILL: Coal	▨	SS	3	25	28	1		
1.68								
FILL: Brown silty sand, some organic matter near the top and with some cobbles by 3.7m depth	▨	SS	4	12	5	2		
	▨					3		
	▨	SS	5	25	35			
	▨	SS	6	27	85+			
	▨	AU	7			4		
4.04								
End of Borehole Practical refusal to augering @ 4.04m depth								



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Phase I-II Environmental Site Assessment
1040 Somerset Street West
Ottawa, Ontario

DATUM

REMARKS

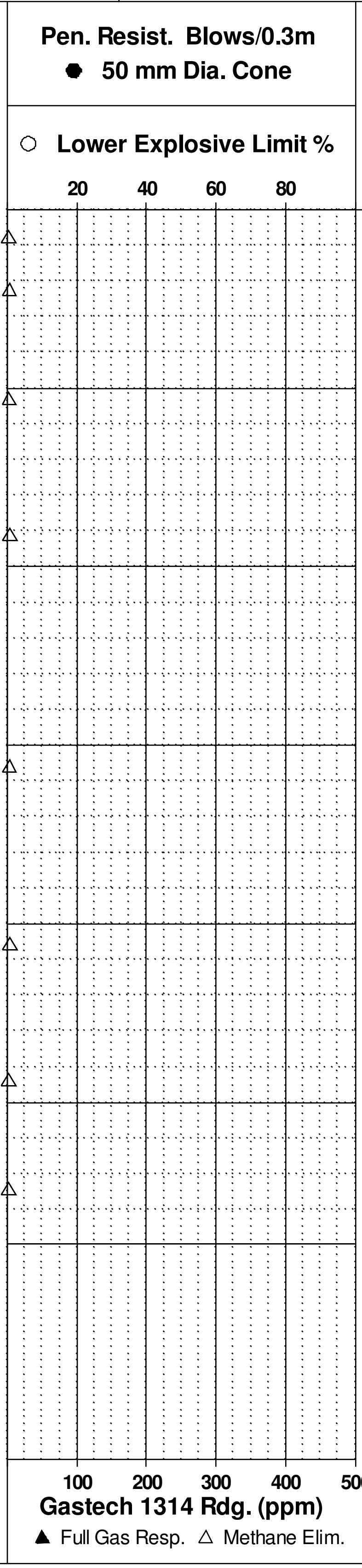
BORINGS BY CME 55 Power Auger

DATE May 29, 07

FILE NO. PE1148

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
20mm Asphaltic concrete		AU	1				
FILL: Crushed stone 0.60		AU	2				
FILL: Brown silty sand, trace wood pieces		SS	3	25	15	1	
- trace coal by 1.7m depth		SS	4	50	3		
						2	
- with cobbles by 2.7m depth							
		SS	5	40	50+	3	
3.81							
Loose, grey **CLAYEY SILT**		SS	6	12	9	4	
4.57							
		SS	7	33	4	5	
Grey **SILTY CLAY**							
		SS	8	100	3		
5.79							
End of Borehole							



Monitoring Well Construction

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Phase I-II Environmental Site Assessment
1040 Somerset Street West
Ottawa, Ontario

DATUM

REMARKS

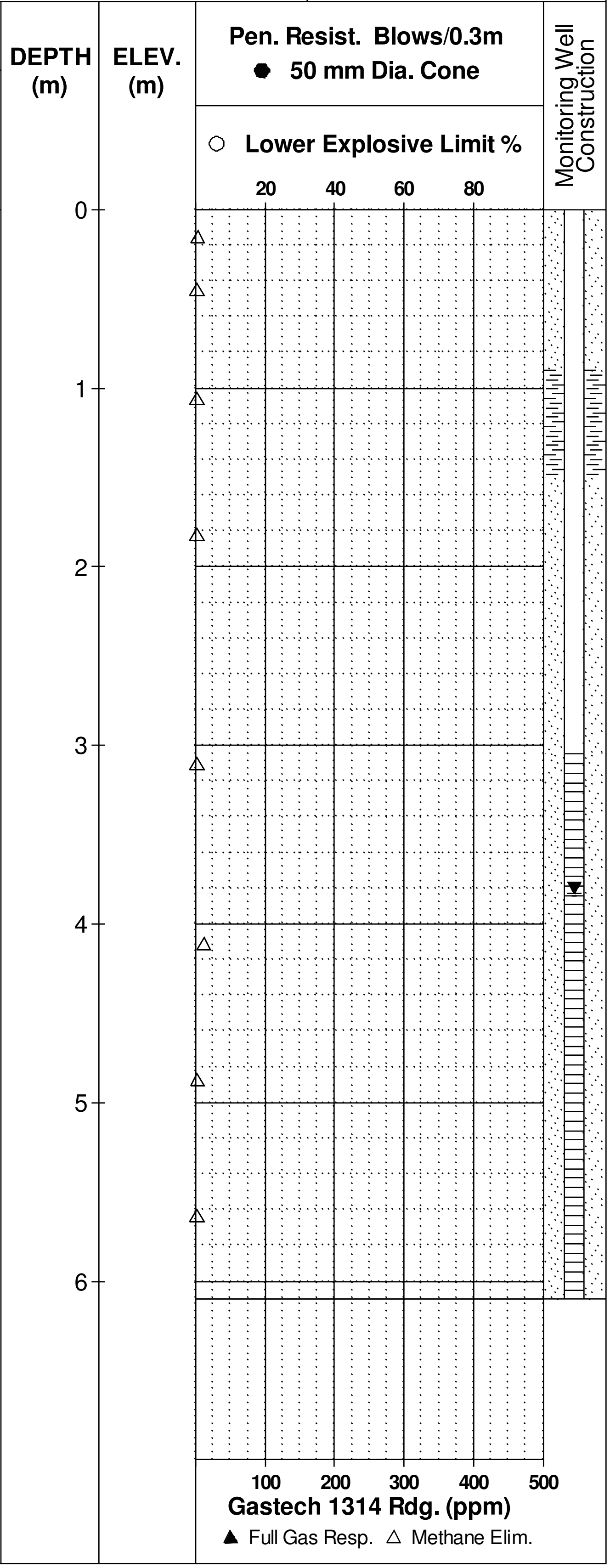
BORINGS BY CME 55 Power Auger

DATE May 29, 07

FILE NO. PE1148

HOLE NO. BH 3

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE				
20mm Asphaltic concrete over crushed stone **FILL** 0.30	AU	1		
FILL: Brown silty sand with gravel, asphalt and brick pieces, occasional coal pieces	AU	2		
	SS	3	17	14
	SS	4	25	15
3.66	SS	5	25	50+
Grey **SILTY CLAY**, trace sand	SS	6	67	5
	SS	7	100	2
6.10	SS	8	100	1
End of Borehole (GWL @ 3.83m-June 4/07)				



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Phase I-II Environmental Site Assessment
1040 Somerset Street West
Ottawa, Ontario

DATUM

REMARKS

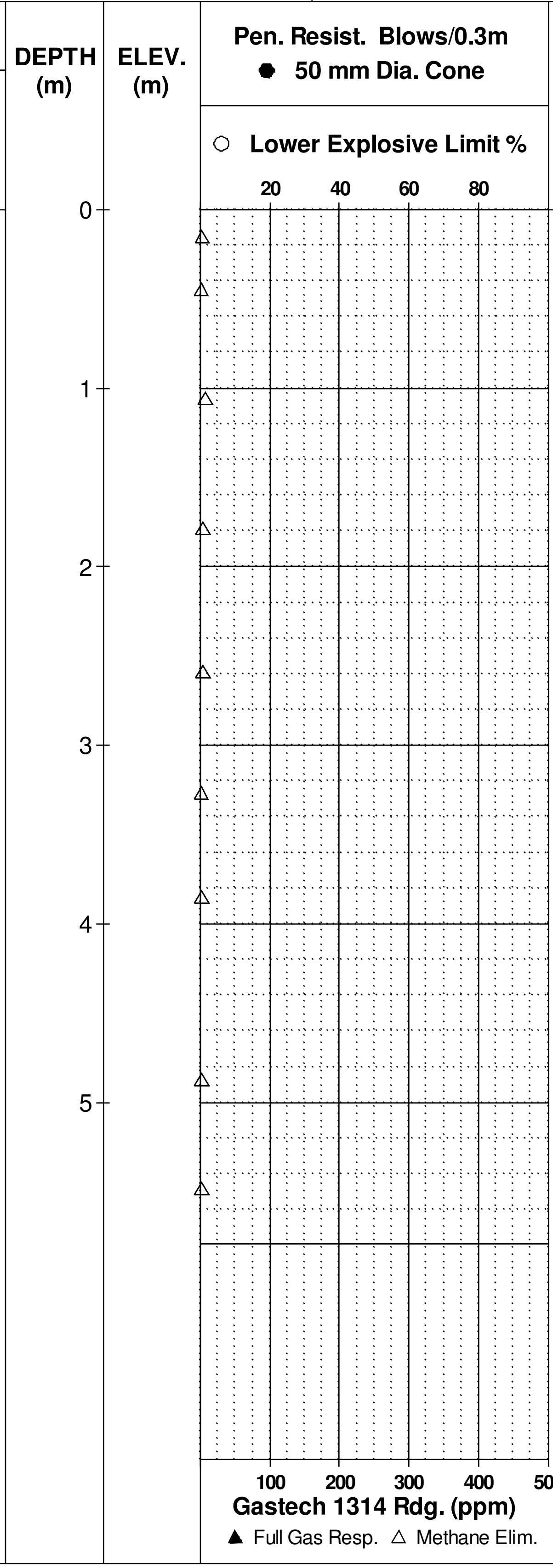
BORINGS BY CME 55 Power Auger

DATE May 29, 07

FILE NO. PE1148

HOLE NO. BH 4

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE				
20mm Asphaltic concrete over crushed stone with asphalt 0.30	AU	1		
FILL	AU	2		
FILL: Brown silty sand with gravel, brick pieces and cobbles with depth, trace coal	SS	3	25	27
	SS	4	57	7
	SS	5	25	19
	SS	6	35	73+
3.81	SS	7	67	50+
Grey **SILTY CLAY**, some sand	SS	8	100	1
	SS	9	100	1
5.79 End of Borehole				



Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC% - Natural moisture content or water content of sample, %
LL - Liquid Limit, % (water content above which soil behaves as a liquid)
PL - Plastic limit, % (water content above which soil behaves plastically)
PI - Plasticity index, % (difference between LL and PL)

Dxx - Grain size which xx% of the soil, by weight, is of finer grain sizes
These grain size descriptions are not used below 0.075 mm grain size
D10 - Grain size at which 10% of the soil is finer (effective grain size)
D60 - Grain size at which 60% of the soil is finer

Cc - Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu - Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

p'_o - Present effective overburden pressure at sample depth
p'_c - Preconsolidation pressure of (maximum past pressure on) sample
Ccr - Recompression index (in effect at pressures below p'_c)
Cc - Compression index (in effect at pressures above p'_c)

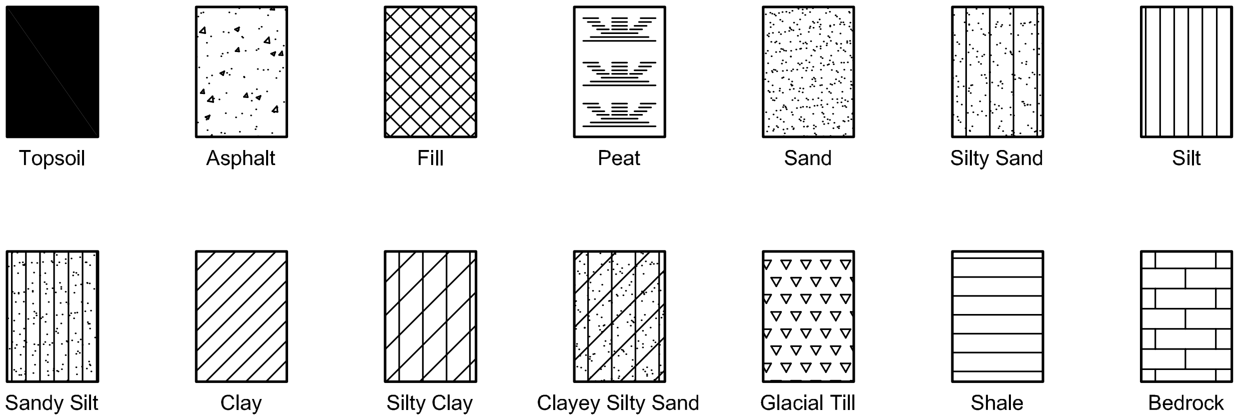
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

k - Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

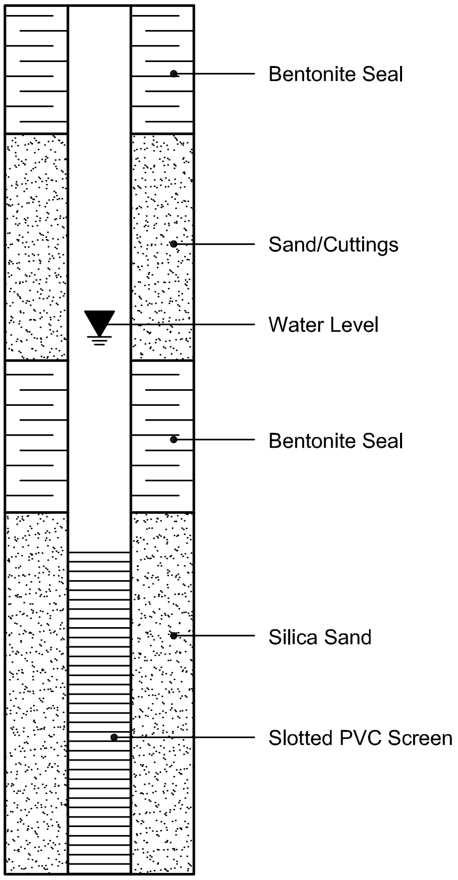
SYMBOLS AND TERMS (continued)

STRATA PLOT

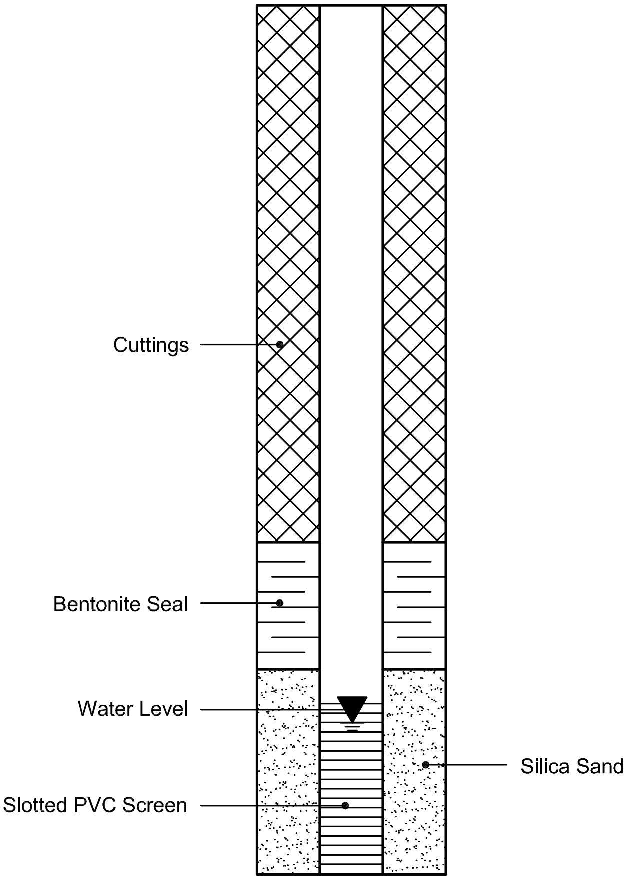


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29707

Report Date: 26-Nov-2020

Order Date: 20-Nov-2020

Project Description: PG2674

	Client ID:	BH 1-20 SS3 5'-7'	-	-	-
	Sample Date:	17-Nov-20 10:00	-	-	-
	Sample ID:	2047666-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	94.2	-	-	-
General Inorganics					
pH	0.05 pH Units	7.76	-	-	-
Resistivity	0.10 Ohm.m	21.2	-	-	-
Anions					
Chloride	5 ug/g dry	87	-	-	-
Sulphate	5 ug/g dry	282	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 2 - SHEAR WAVE VELOCITY PROFILE AT SHOT LOCATION +22.6 m

FIGURE 3 - SHEAR WAVE VELOCITY PROFILE AT SHOT LOCATION -0.4 m

FIGURES 4 TO 7 - SLOPE STABILITY SECTIONS

DRAWING PG2674-1 - TEST HOLE LOCATION PLAN

FIGURE 1

KEY PLAN

FIGURE 2 – Shear Wave Velocity Profile at Shot Location +22.6 m

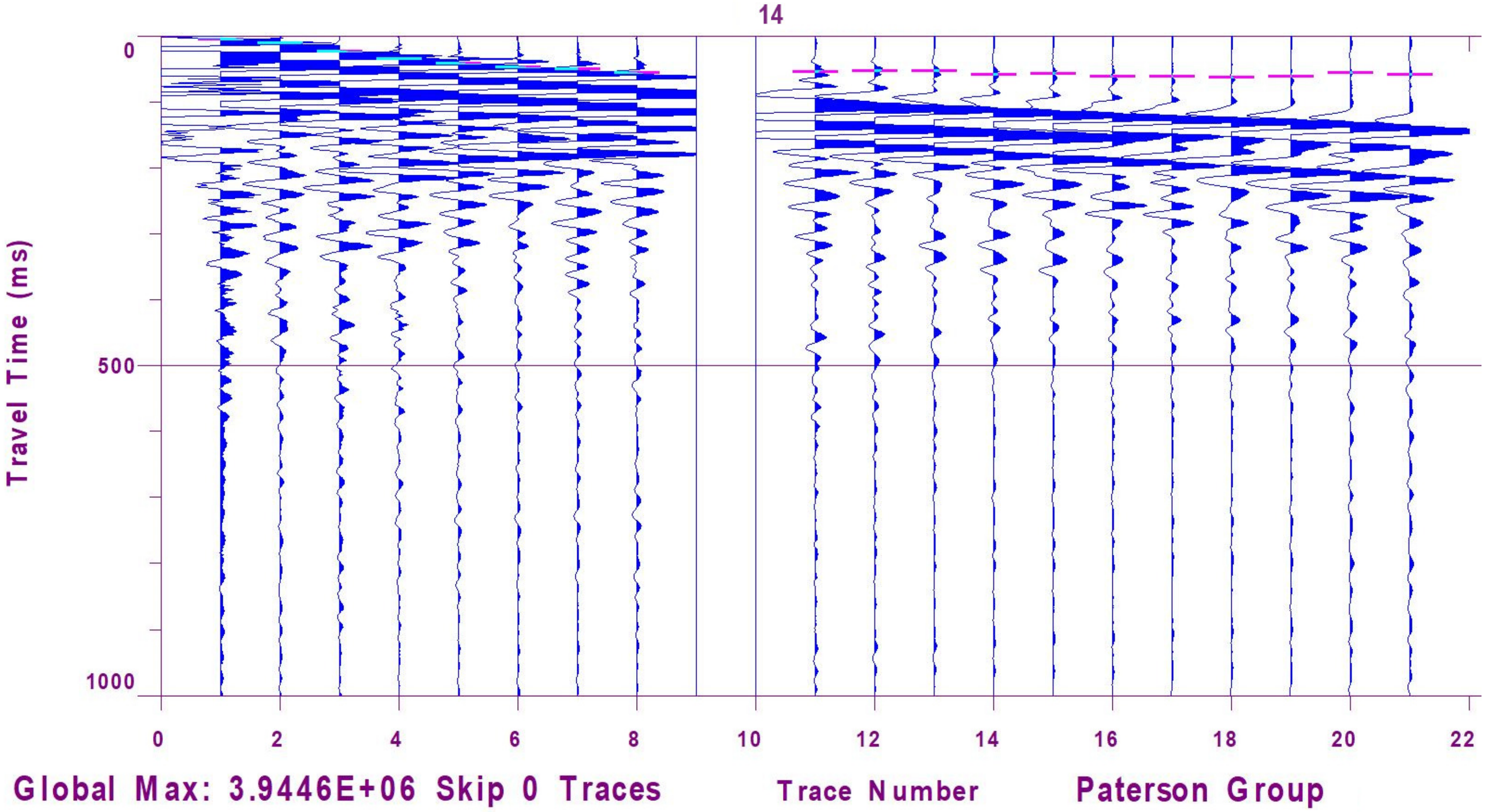


FIGURE 3 – Shear Wave Velocity Profile at Shot Location -0.4 m

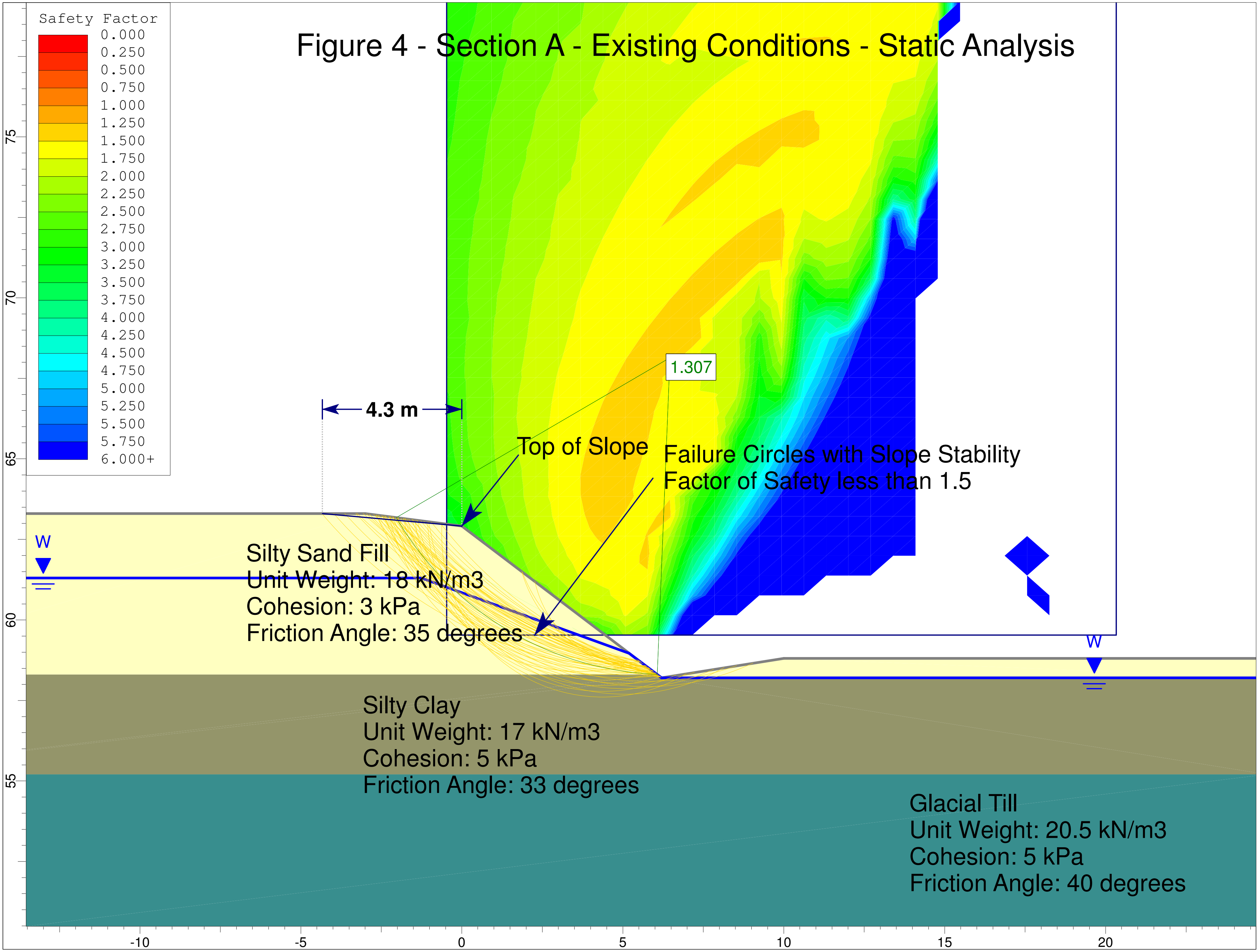


Figure 4 - Section A - Existing Conditions - Static Analysis

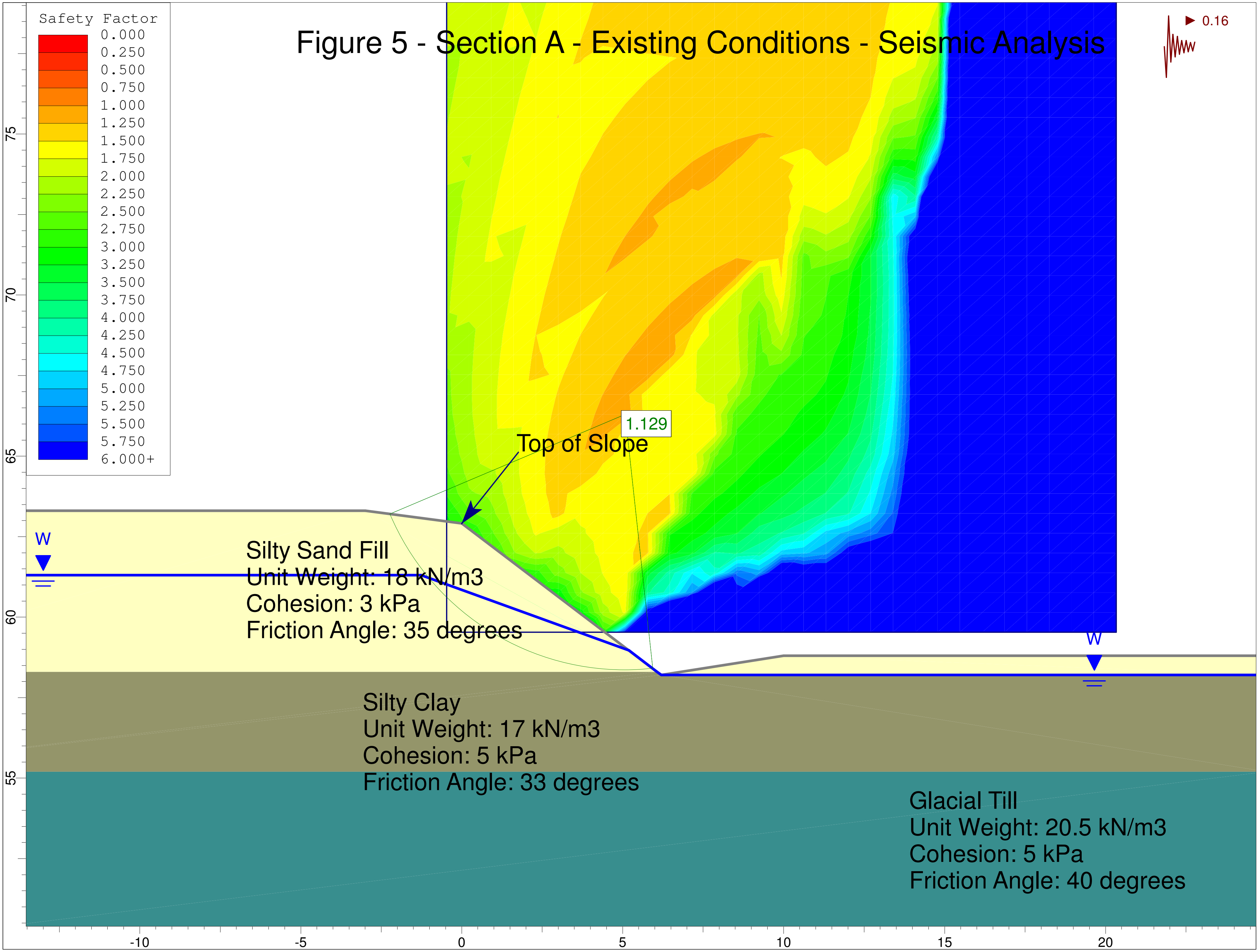


Figure 5 - Section A - Existing Conditions - Seismic Analysis

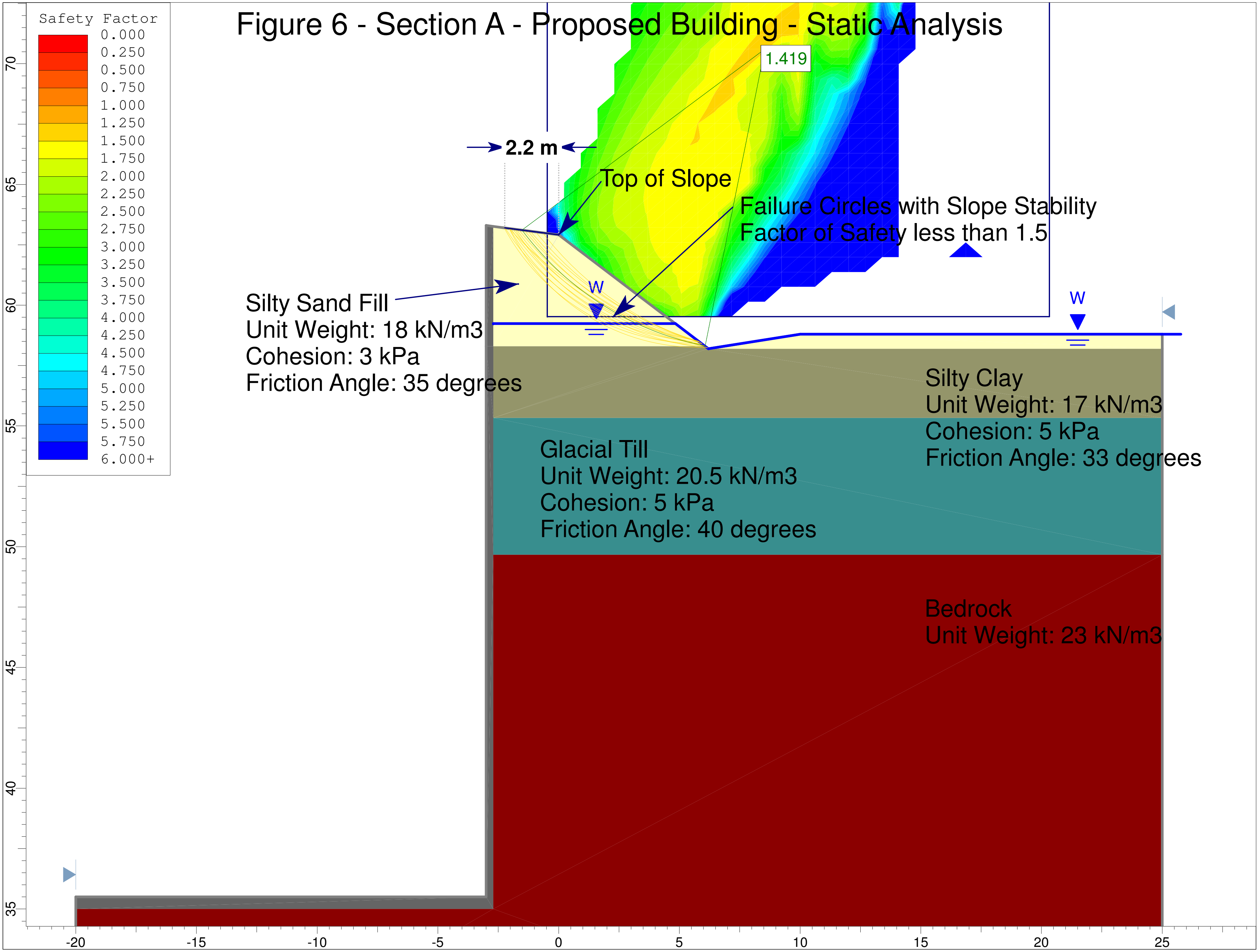


Figure 6 - Section A - Proposed Building - Static Analysis

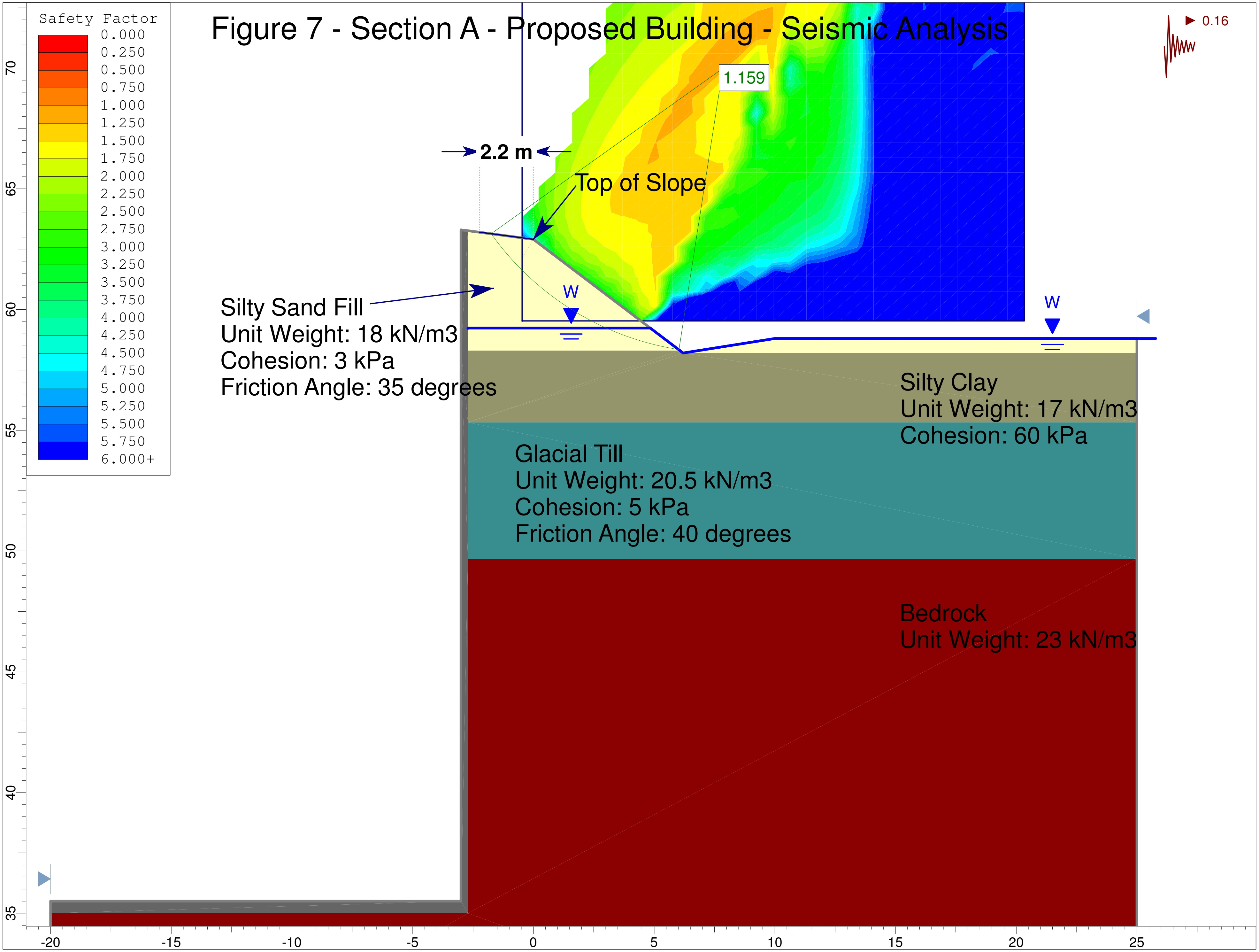
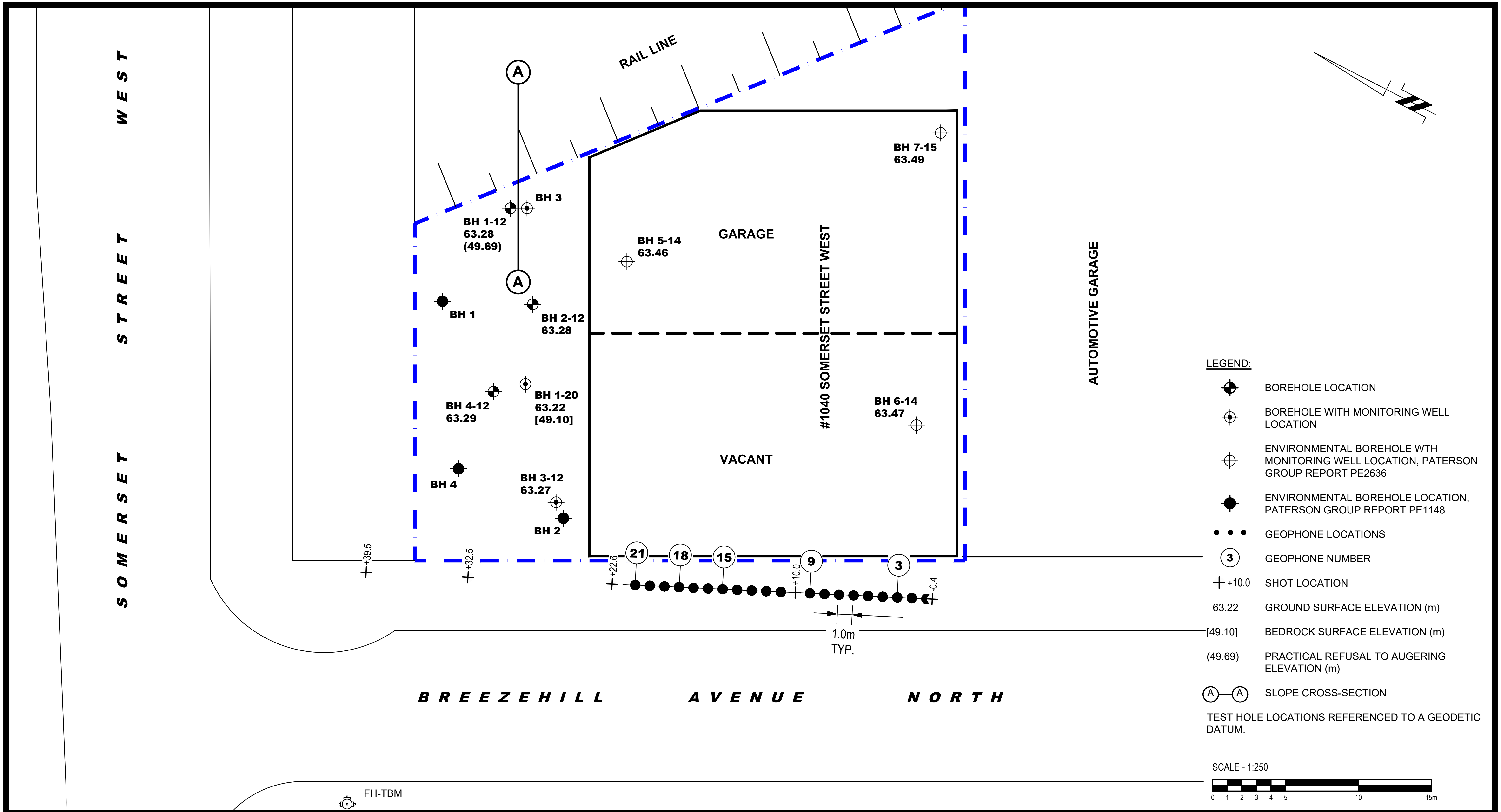


Figure 7 - Section A - Proposed Building - Seismic Analysis



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
3	SHEAR WAVE VELOCITY TEST LOCATION ADDED	24/11/2020	DP
2	NEW BOREHOLE ADDED	19/11/2020	DG
1	NEW ENVIRONMENTAL BOREHOLES ADDED	03/06/2015	CDS

CLARIDGE HOMES
GEOTECHNICAL INVESTIGATION
1040 SOMERSET STREET WEST

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:250
Date: 04/2014
Drawn by: MPG
Report No.: PG2674-2
Checked by: SD
Drawing No.: PG2674-1
Approved by: DJG
Revision No.: 3

c:\users\nicholas\desktop\2674\pg2674-1 rev3.dwg

APPENDIX C

Noise Control Study

prepared by Novatech Engineering Consultants

dated April 2, 2013

1040 SOMERSET STREET WEST

OTTAWA, ONTARIO

NOISE CONTROL STUDY

Prepared By:

NOVATECH ENGINEERING CONSULTANTS LTD.
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

April 2nd, 2013
Novatech File: 112191-0
Ref. Report #: R-2013-031

NOVATECH
ENGINEERING
CONSULTANTS LTD.

April 2nd, 2013

City of Ottawa
Planning and Growth Management Department
Planning and Infrastructure Approvals Branch
Infrastructure Approvals Division
110 Laurier Street West, 4th Floor
Ottawa, ON
K1P 1J1

Attention: **Mr. Josh White**

Reference: **Residential Condominium Development - 1040 Somerset Street W.**
Noise Control Study (Our File No.: 112191)

Enclosed for your review is the Noise Control Study for the Residential Condominium, located at 1040 Somerset Street W.

The study evaluates the impact of noise from traffic on Somerset Street W, the O-Train, and outlines noise attenuation measures to mitigate the impacts.

Please contact the undersigned should you have any questions on this report.

Yours truly,

NOVATECH ENGINEERING CONSULTANTS LTD.

Greg MacDonald, P.Eng.
Senior Project Manager

Suite 200, 240 Michael Cowpland Dr., Ottawa, ON K2M 1P6 Tel: (613) 254-9643 Fax: (613) 254-5867
www.novatech-eng.com
Consulting Engineers & Planners

TABLE OF CONTENTS

Appendices

Tables

Figures

Plans

1.0 INTRODUCTION

This report is submitted on behalf of Claridge Homes for the Residential Condominium Development, located at 1040 Somerset Street W. to address the noise study requirements from the City of Ottawa.

This study assesses the impact of traffic noise on the proposed development and outlines the recommended mitigation measures.

2.0 BACKGROUND

2.1 Project Description

The proposed Residential Condominium development (1040 Somerset St. W.) is located east of Hintonburg, west of Chinatown and north of highway 417 in the City of Ottawa. The existing property is currently occupied by Paradise Auto Repair INC. and CampuCorps Mentoring as seen in Figure 1 - Existing Conditions. The proposed re-development of the site will consist of a 38 storey condominium with 338 units. A total of 160 underground parking spaces will be provided on 7 levels of underground parking.

Figure 1 – Existing Conditions

2.2 NOISE SOURCES

The City of Ottawa Official Plan stipulates that a noise study shall be prepared when a new development is proposed within 100 metres of an arterial or major collector roadway, or a rapid-transit corridor.

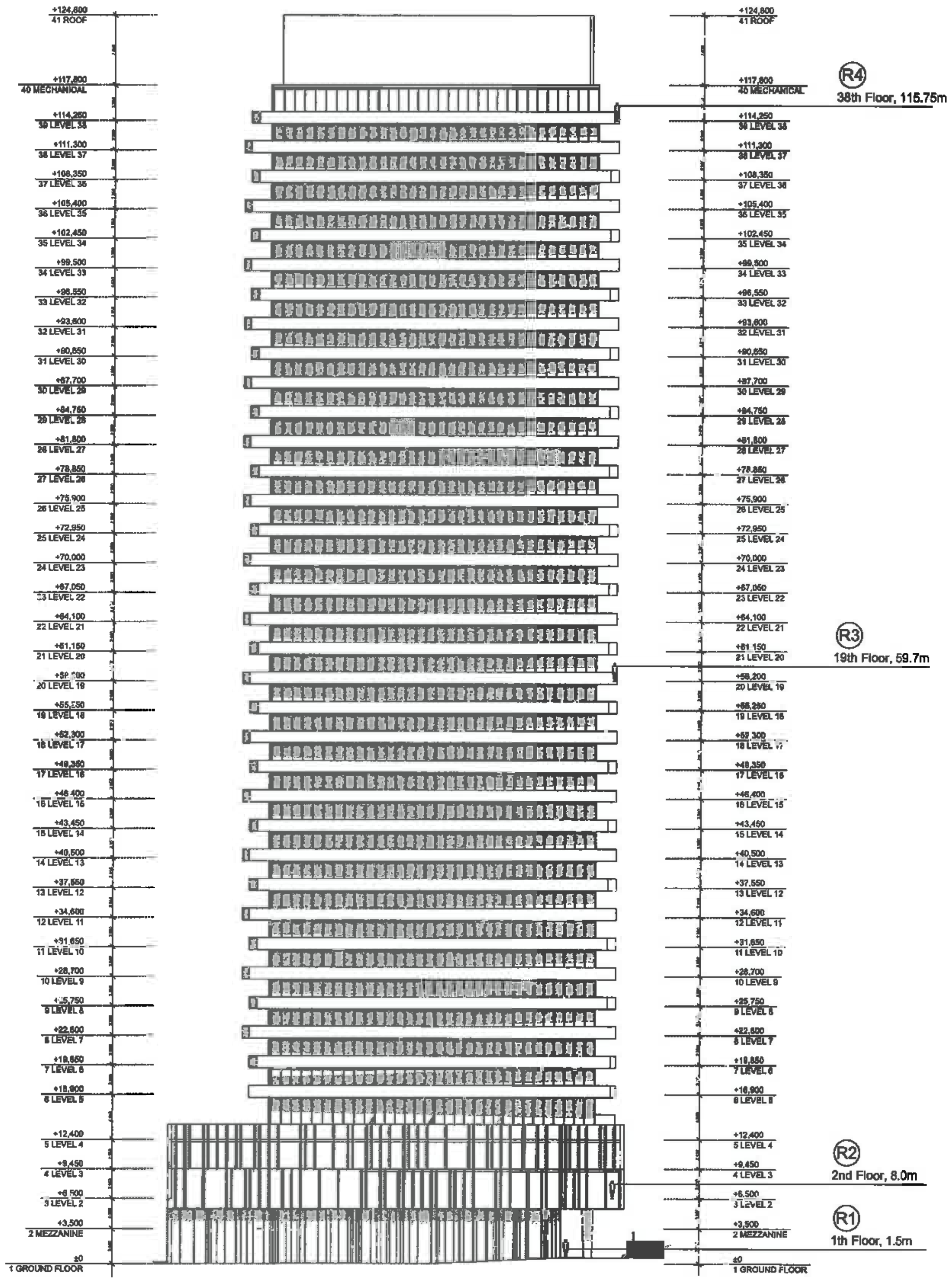
For the purpose of this report the building will be analyzed as it is within 100m of the primary noise sources of Somerset St. W and the O-Train.

Somerset Street W consists of one eastbound and one westbound undivided lanes with a posted speed limit of 50km/h. Table 1 of the City of Ottawa Official Plan titled 'Road of Right-of-Way Protection' defines Somerset Street W as follows:

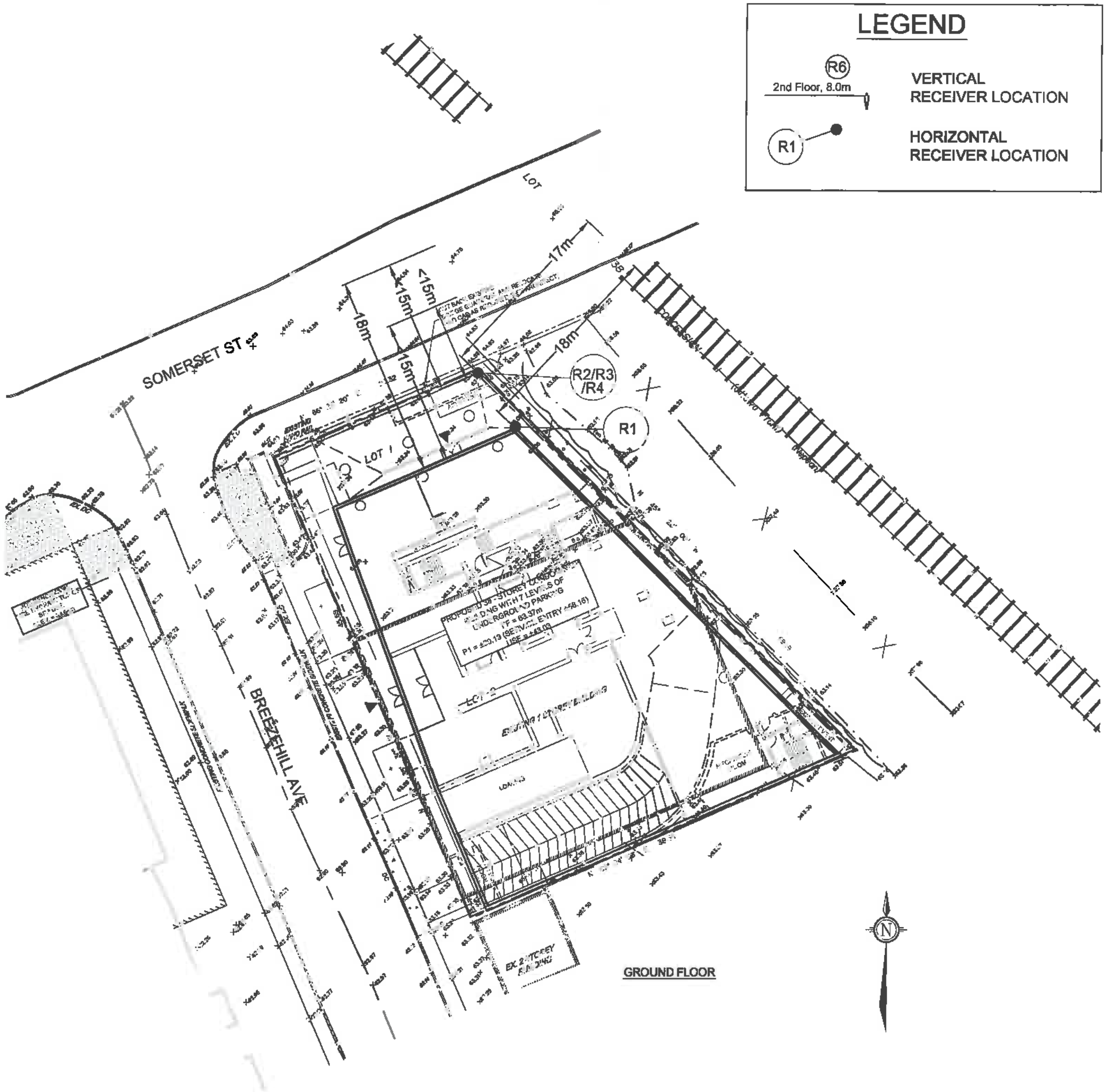
Road	ROW to be Protected	Classification	Sector
Somerset St. West	20	Arterial	Urban

Currently, the O-Train consists of one track running perpendicular to Somerset Street W, east of the proposed development. OC Transpo is planning on adding a second track, increasing the frequency of trains and changing the number of cars per train. The two scenarios (current and future) are described in the following table (also see appendix C - Correspondence). Note: the current trains have two locomotives and one car but were modeled in the STAMSON software with one locomotive and two cars. The future trains will have two locomotives and were modeled in the STAMSON software with one locomotive and one car. This was done because at one time, only one locomotive is powering the train while the other runs idle.

Scenario	Engine Type	Welded Track	Speed	Train Frequency per Day	Cars per Train	Locomotives per Train
Current	Diesel	Yes	85km/h	128/13 (day/night)	2	1
Future	Diesel	Yes	85km/h	226/22 (day/night)	1	1



EAST ELEVATION



NOVATECH
ENGINEERING
CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

SCALE

1:500

0 5 10 15 metres
1 : 500

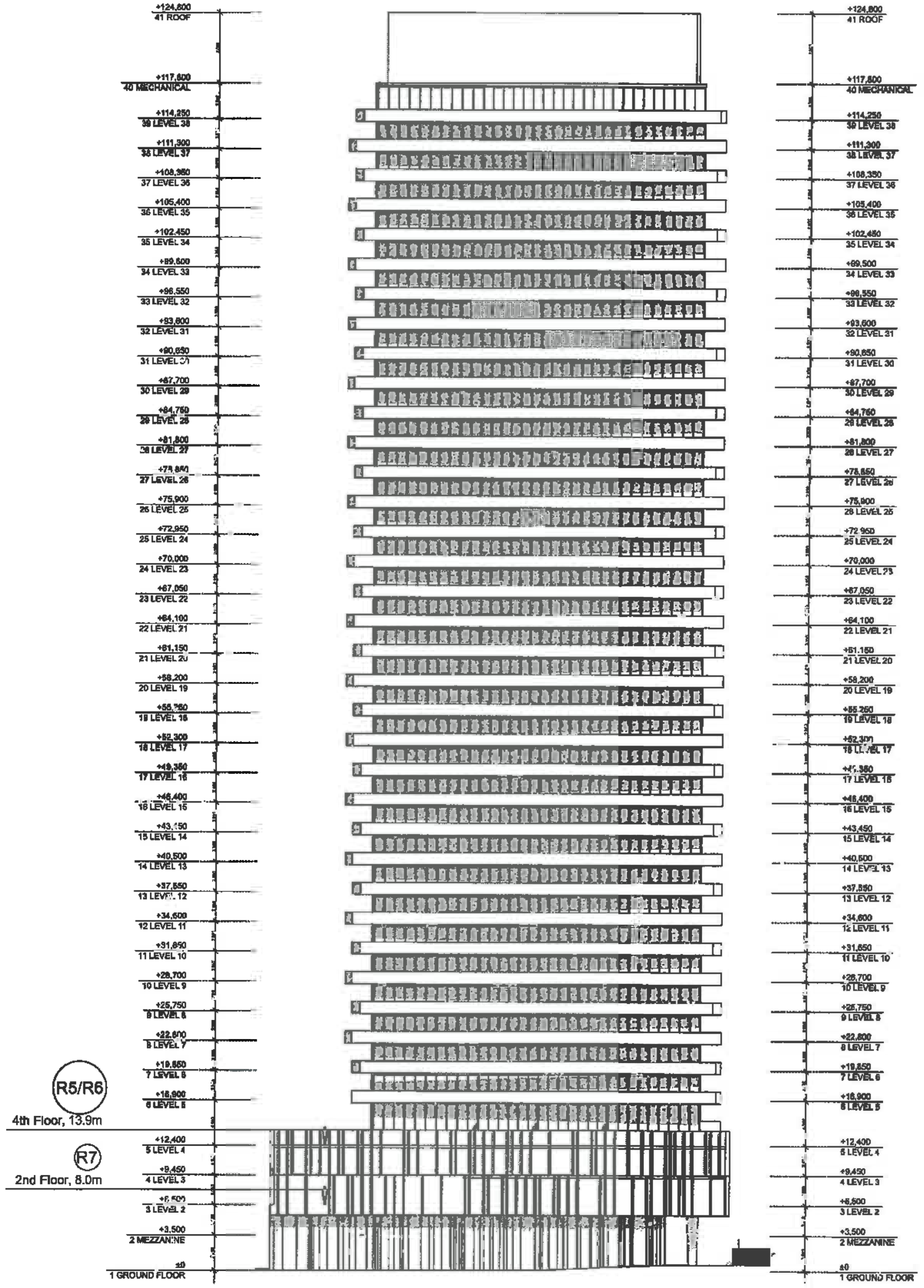
1040 SOMERSET STREET W

RECEIVER LOCATION PLAN

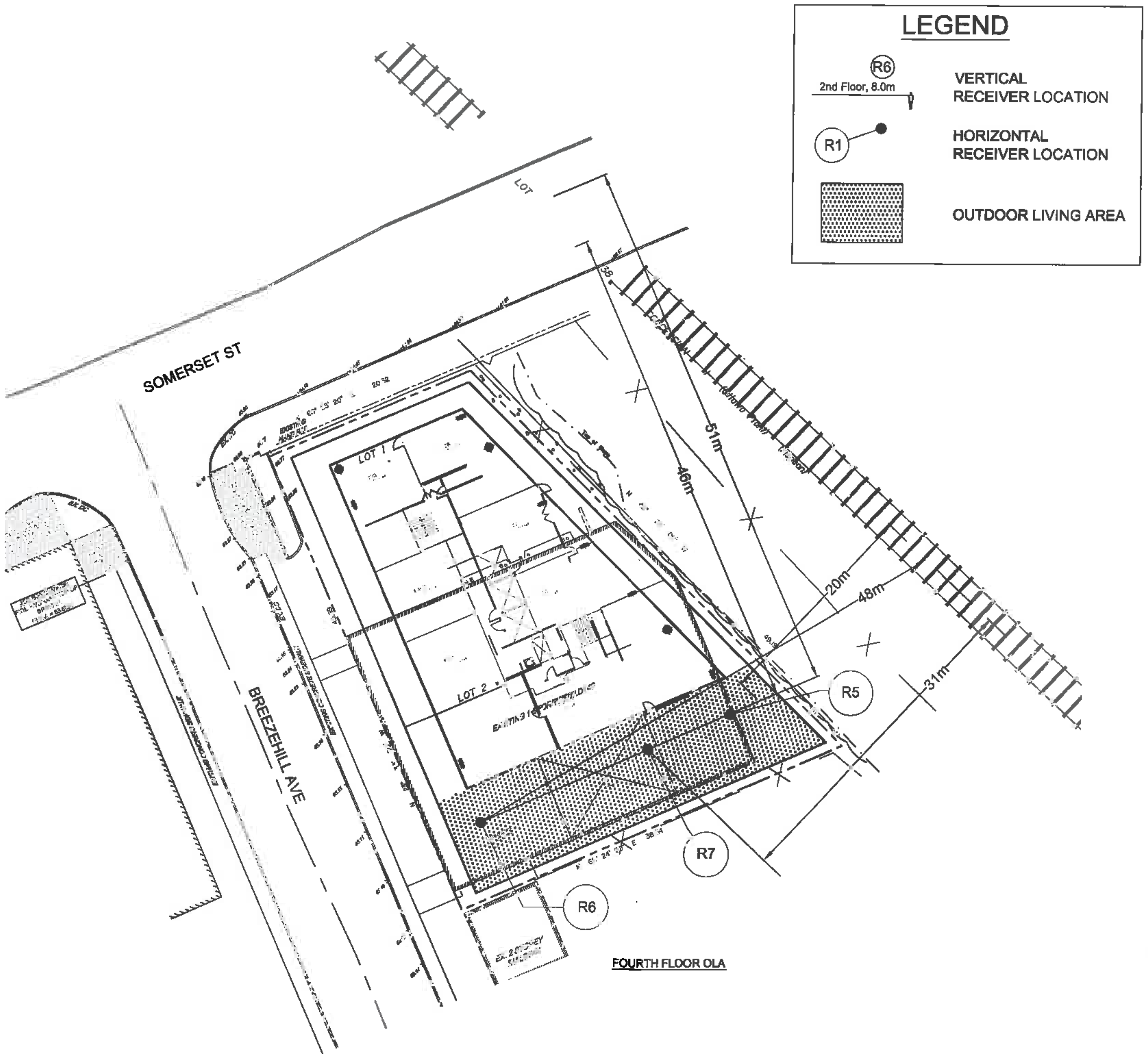
MAR. 2013

112191

FIGURE 2



EAST ELEVATION



NOVATECH
ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

SCALE

1:500

0 5 10 15 metres
1 : 500

1040 SOMERSET STREET W

RECEIVER LOCATION PLAN - OLAs

MAR. 2013 | 112191 | FIGURE 3

3.20 CITY OF OTTAWA NOISE CONTROL GUIDELINES

3.1 Sound Level Criteria

The City of Ottawa is concerned with noise from aircraft, roads, transitways and railways as expressed in the City of Ottawa Official Plan (May 2003) since it can affect the quality of life of residents. To protect residents from unacceptable levels of noise, the City of Ottawa has specific environmental noise control guidelines, which are based on the technical guidelines and recommendations prepared by the Ontario Ministry of Environment. The City of Ottawa's *Environmental Noise Control Guidelines (ENCG)*, Final Draft - May 10, 2006 has been used for the purpose of this report.

The quantitative sound level criteria, which require that specific outdoor and indoor living areas of residential developments meet certain energy equivalent sound levels (Leq), are summarized in *Table 1 and Table 2*, respectively. Compliance with the outdoor sound level criteria will generally ensure compliance with the indoor sound level criteria when normal construction materials are utilized.

Table 1: City of Ottawa Outdoor Noise Level Criteria

Time Period	Receiver Location	Noise Level Criteria (Leq)
Daytime (07:00 – 23:00)	Outdoor Living Area (OLA)	55 dBA
Daytime (07:00 – 23:00)	Plane of Window (POW) at Living/Dining Rooms	55 dBA
Nighttime (23:00 – 07:00)	Plane of Window (POW) at Bedrooms/Sleeping Quarter	50 dBA

The outdoor living area is defined as that part of an outdoor amenity area, which is provided for the quiet enjoyment of the outdoor environment during the daytime period. These amenity areas are typically backyards, gardens, terraces and patios.

Table 2: City of Ottawa Indoor Noise Level Criteria

Time Period	Receiver Location	Noise Level Criteria (Leq)	
		Roadways, Transitways and LRT	Rail (diesel engins/locomotives)
Daytime (07:00 – 23:00)	General offices, reception areas, retail stores, etc.	50 dBA	45 dBA
	Living/dining areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, individual or semi-private offices, conference rooms, reding rooms, etc.	45 dBA	40 dBA

Nighttime (23:00 – 07:00)	Sleeping quarters of hotels/motels	45 dBA	40 dBA
	Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	40 dBA	35 dBA

Table 3: City of Ottawa Facade Material Requirement For Rail Noise Only

Assessment Location	Distance to Railway (m)	Sound Level	Facade Material Requirement
Plane of Bedroom Window	less than 100m	Leq_{24hr} less than or equal to 60dBA	no additional requirement
		Leq_{24hr} greater than 60dBA	Brick veneer or acoustically equivalent
	greater than 100m	Leq_{24hr} less than or equal to 60 dBA	No additional requirement
		Leq_{24hr} greater than 60dBA	No additional requirement

3.2 Noise Attenuation Requirements

When sound levels are predicted to be less than the specified criteria for the daytime and night-time conditions, no attenuation measures are required by the proponent. As the noise criteria is exceeded, a combination of attenuation measures are available to modify the development environment. These attenuation measures may include:

- Construction of a noise barrier wall and/or berm;
- Installation of a forced air ventilation system with provision for central air conditioning;
- Installation of central air conditioning;
- Custom building design, construction and/or acoustic insulation.

If noise levels are expected to exceed the applicable sound level criteria, the City of Ottawa recommends a warning clause be registered on title. This warning clause serves to alert potential buyers and/or renters of the possible noise condition and of any limitations that may exist on his/her property. The warning clause would be registered on title and incorporated in the Subdivision Agreement and in the Agreement of Purchase and Sale.

Noise attenuation requirements at the Outdoor Living Areas (OLA) and Plane of Window (POW) are outlined in *Table 4.*

Table 4: City of Ottawa Noise Attenuation Requirements

Noise Level (dBA)				Noise Attenuation Requirements
Daytime (07:00-23:00)		Nighttime (23:00-07:00)		
Unattenuated	Attenuated	Unattenuated	Attenuated	
OUTDOOR LIVING AREA (OLA)				
OLA < 55				None
55 < OLA < 60				Noise Clause Type A
OLA > 60	OLA < 55			Noise Barrier
OLA > 60	OLA > 55			Noise Barrier Noise Clause Type B
PLANE OF WINDOW (POW)				
POW < 55		POW < 50		None
55 < POW < 65		50 < POW < 60		Forced Air Ventilation Noise Clause Type C
POW > 65		POW > 60		Central Air Conditioning Noise Clause Type D Building Façade Analysis

The wording of the warning clauses to be placed on title and included in the Site Plan Agreement, Condominium Agreement and the Offer of Purchase and Sale are as follows:

Type A

"Purchasers/tenants are advised that sound levels due to increasing road traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of Environment's noise criteria."

Type B

"Purchasers/tenants are advised that despite the inclusion of noise control features in this development and within the building units, sound levels due to increasing road traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of the Environment's noise criteria."

Type C

"This dwelling unit is fitted with a forced air heating system and the ducting, etc was sized to accommodate a central air conditioning system. Installation of central air conditioning by the occupant will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the City's and the Ministry of Environment's noise criteria. (Note: The location and installation of the outdoor air conditioning device should be done so as to comply with noise criteria of MOE Publication NPC-216, Residential Air Conditioning Devices and thus minimize the noise impacts both on and in the immediate vicinity of the subject property.")

Type D

"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the City's and the Ministry of Environment's noise criteria."

4.0 PREDICTION OF OUTDOOR NOISE LEVELS

4.1 Roadway Traffic

Noise levels from Somerset Street were assessed using the ultimate road and traffic data from Table 1.7 of the City of Ottawa's Environmental Noise Control Guidelines. The traffic and roadway parameters used for sound level predictions are shown in Table 5.

Table 5: Traffic and Roadway Parameters

	Somerset St. West (Booth to Bronson)
Roadway Classification	2-Lane Urban Arterial
Annual Average Daily Traffic (AADT)	15,000 veh/day
Day/Night Split (%)	92/8
Medium Trucks (%)	7
Heavy Trucks (%)	5
Posted Speed	50Km/hr

4.2 NOISE LEVEL ANALYSIS

The noise levels were analyzed using Version 5.03 of the STAMSON computer program issued by the MOE. Proposed grades were required for the software and were obtained from the Grading Plan (contained in the back of this report) as well as the Architect's elevations (see figures 2 and 3). Receiver locations used in the noise simulations are shown on Figures 2 and 3.

4.3 Noise Level Results

Simulated noise levels for the condominium units and the outdoor living area on the fourth floor exceed the allowable noise level criteria resulting in the requirement for a building façade analysis and warning clauses.

The predicted noise levels at the selected receiver locations are illustrated in *Table 6*. Daytime and night time noise levels are shown for the plane of window (POW). Also see Figure 2 - Receiver Location Plan.

Table 6: Simulation Results

Receiver	**Daytime Noise Levels Leq (dBA)**		**NIghttime Noise Levels Leq (dBA)**	
	Current	**Future**	**Current**	**Future**
R_1	73.08	74.73	65.96	67.53
R_2	73.81	75.51	66.70	68.31
R_3	74.37	76.15	67.28	68.96
R_4	74.37	76.15	67.28	68.96
R_5 (OLA)	57.70	59.68	-	-
R_6 (OLA)	48.75	50.70	-	-
R_7 (OLA)	52.47	54.57	-	-

4.4 Implementation

The City of Ottawa ENCG requires that noise clauses be applied for residential and commercial when noise levels are above 55dBA and wall & window construction be reviewed when noise levels exceed 60 dBA. Noise Clauses and window & wall construction are to be applied for sleeping quarters when noise levels exceed 45 dBA. For this case, the acoustical insulation factor (AIF) method recognized by the City of Ottawa is used to assess the wall and window requirements.

The Acoustic Insulation Factor (AIF) is used as a measure of the reduction of outdoor noise provided by the elements of the outer surface of a building. The difference between the indoor noise criterion and the outdoor noise level establishes the acoustical insulation requirement for the exterior shell. The exterior shell is comprised of primarily two components; windows and walls (patio doors are treated as windows). Canada Mortgage and Housing (CMHC) Standards [1] require that no component transmit more than 1/N of the total sound power that would give the maximum acceptable noise level inside the room. Thus, in a room with two exterior components, neither should transmit more than one-half of the total allowable sound power. Mathematically, this basic requirement can be expressed as:

---

[1] Road and Rail Noise: Effects on Housing, CMHC, Ottawa. Publication NHA #185 1/78, 1978

Required AIF = L_{eg} *(Outside)* – L_{eg} *(Inside)* + $10 \log_{10} (N)$ +2dBA

Where, N = Number of components;
L = Sound Level expressed on a common decibel scale.

The acoustical insulation factor for living rooms and bedrooms giving the highest results are calculated as follows:

- Living Rooms; AIF $_{\text{Day-time}}$ = 76 dBA – 45 dBA + 10log(2) dBA + 2dBA = *36 dBA*

- Bedrooms; AIF $_{\text{Night-time}}$ = 69 dBA – 40 dBA + 10log(2) dBA + 2dBA = *34 dBA*

Tables from the document entitled "Acoustic In.sulation Factor: A Rating for the Insulation of Buildings Against Outdoor Noise", produced by the Division of Building Research, National Research Council of Canada, June 1980 (J.D. Quirt) were used to assess the exterior facade against the required AIF. This reference material is included in Appendix B.

In order to assess the façade against the required AIF, percentage of window to room area and exterior wall to room area are required. These percentages were based on information provided by the architect (see appendix C) and can be found in Table 7.

Table 7: Percentage Window and Wall Area to Room Area

Description	Values	
Number and Type of Components Forming Building Envelope = 2 (Windows and Exterior Walls)	**Typical Living Area**	**Typical Bedroom**
Percentage of Window Area to Total Floor Area of Room	22%	44%
Percentage of Wall Area to Total Floor Area of Room	3%	6%

Using the percentage of window area to room area, and the required acoustical insulation factor (AIF), Table 5 in Appendix B was used to identify the various window assembles that would satisfy the required AIF. Similarly, Table 6.3 in Appendix B was used to select the typical wall assembly that would satisfy the required AIF. The highest results of this exercise are provided in Table 8.

Table 8: Selected Window and Wall Assemblies to Meet AIF

Description	AIF	Window Assembly Options	Typical Wall Assembly
Residential Unit	34	▪ 2 mm – 63 mm – 2 mm ▪ 3 mm – 50 mm – 3 mm ▪ 4 mm – 40 mm – 4 mm ▪ 3 mm – 32 mm – 6 mm ▪ 6 mm – 30 mm – 6 mm	Brick veneer or acoustically equivalent
Notes: 1. "2 mm – 6 mm – 2 mm" denotes 2 mm glass, 6 mm air space and 2 mm glass.			

Tables 11 and 12 in Appendix B were used to convert the AIF values to Sound Transmission Class, or STC values. The Highest results are summarized in Table 9.

Table 9: Equivalent Sound Transmission Class , STC Values

Windows			Walls		
AIF	Conversion	STC	AIF	Conversion	STC
36	STC – 2 = AIF	36	34	STC + 3 = AIF	33

The attenuation measures required to satisfy the City of Ottawa noise criteria and the noise clauses that are to be included on title and in the Agreement of Purchase and Sale for the various dwelling units are summarized in Table 10.

Table 10 - Required Noise Attenuation Measures

Units	Attenuation Measure	Notice on Title
All residential Dwellings	Central Air Conditioning Required	D
Outdoor Living Areas	No Attenuation Measures Required	A

5.0 CONCLUSIONS

An analysis of the roadway traffic along Somerset Street W and the O-Train indicates attenuation measures will be necessary for the condominium.

The following is a summary of the attenuation measures and notice requirements to be placed on title for all residential units.

1040 Somerset Street W

- Provide Central Air Conditioning
- Provide window assembly to meet a sound transmission class, **STC of 36.**
- Provide wall assembly to meet a sound transmission class, **STC of 33.**
- <u>Notice on title</u>: *"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the City's and the Ministry of Environment's noise criteria."*

NOVATECH ENGINEERING CONSULTANTS LTD.

Prepared by:

Adam Lambros, B.Eng
E.I.T.

Reviewed by:

G.J. MacDONALD

Greg MacDonald, P. Eng
Senior Project Manager

APPENDIX A

SOUND LEVEL CALCULATIONS

```
STAMSON 5.0          NORMAL REPORT         Date: 06-03-2013 15:32:34
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r1_c.te               Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train (day/night)
-------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+--------------+-------+------+------+------+----
  1.             ! 128.0/13.0   !  85.0 !  1.0 !  2.0 !Diesel! Yes

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2             : -90.00 deg   90.00 deg
Wood depth                  :      0       (No woods.)
No of house rows            :      0 / 0
Surface                     :      1       (Absorptive ground surface)
Receiver source distance    :  18.00 / 18.00  m
Receiver height             :   1.50 / 1.50   m
Topography                  :      3       (Elevated; no barrier)
No Whistle
Elevation                   :   5.00 m
Reference angle             :   0.00

Results segment # 1: O-Train (day)
----------------------------------

LOCOMOTIVE (0.00 + 71.19 + 0.00) = 71.19 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.44  73.38  -1.14  -1.05   0.00   0.00   0.00  71.19
----------------------------------------------------------------------

WHEEL (0.00 + 58.53 + 0.00) = 58.53 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.54  61.00  -1.22  -1.25   0.00   0.00   0.00  58.53
----------------------------------------------------------------------

Segment Leq : 71.42 dBA

Total Leq All Segments: 71.42 dBA

Results segment # 1: O-Train (night)
------------------------------------

LOCOMOTIVE (0.00 + 64.27 + 0.00) = 64.27 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.44  66.46  -1.14  -1.05   0.00   0.00   0.00  64.27
----------------------------------------------------------------------

WHEEL (0.00 + 51.61 + 0.00) = 51.61 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.54  54.07  -1.22  -1.25   0.00   0.00   0.00  51.61
----------------------------------------------------------------------

Segment Leq : 64.50 dBA

Total Leq All Segments: 64.50 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
```

```
Road gradient       :      0 %
Road pavement       :      1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Somerset W (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  18.00 / 18.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
---------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Somerset E (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.68 + 0.00) = 64.68 dBA
Angle1 Angle2 Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
  -90     90   0.00  65.47   0.00  -0.79   0.00   0.00   0.00   0.00  64.68
--------------------------------------------------------------------------

Segment Leq : 64.68 dBA

Results segment # 2: Somerset E (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
```

```
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
------------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Total Leq All Segments: 68.10 dBA

Results segment # 1: Somerset W (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.08 + 0.00) = 57.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00  -0.79   0.00   0.00   0.00   0.00  57.08
------------------------------------------------------------------------------

Segment Leq : 57.08 dBA

Results segment # 2: Somerset E (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Total Leq All Segments: 60.50 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 73.08
                         (NIGHT): 65.96
```

```
STAMSON 5.0        NORMAL REPORT        Date: 06-03-2013 15:32:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r1_f.te             Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train N (day/night)
------------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             ! 113.0/11.0  !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 1: O-Train N (day/night)
------------------------------------------
Angle1   Angle2            : -90.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  18.00 / 18.00  m
Receiver height            :   1.50 / 1.50   m
Topography                 :      3       (Elevated; no barrier)
No Whistle
Elevation                  :   5.00 m
Reference angle            :   0.00

Rail data, segment # 2: O-Train S (day/night)
------------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             ! 113.0/11.0  !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 2: O-Train S (day/night)
------------------------------------------
Angle1   Angle2            : -90.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  18.00 / 18.00  m
Receiver height            :   1.50 / 1.50   m
Topography                 :      3       (Elevated; no barrier)
No Whistle
Elevation                  :   5.00 m
Reference angle            :   0.00

Results segment # 1: O-Train N (day)
-----------------------------------

LOCOMOTIVE (0.00 + 70.50 + 0.00) = 70.50 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------
   -90     90   0.44  72.69  -1.14  -1.05   0.00   0.00   0.00  70.50
--------------------------------------------------------------------

WHEEL (0.00 + 56.23 + 0.00) = 56.23 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------
   -90     90   0.54  58.69  -1.22  -1.25   0.00   0.00   0.00  56.23
--------------------------------------------------------------------

Segment Leq : 70.66 dBA

Results segment # 2: O-Train S (day)
-----------------------------------

LOCOMOTIVE (0.00 + 70.50 + 0.00) = 70.50 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------
   -90     90   0.44  72.69  -1.14  -1.05   0.00   0.00   0.00  70.50
```

```
----------------------------------------------------------------------

WHEEL (0.00 + 56.23 + 0.00) = 56.23 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.54  58.69  -1.22  -1.25   0.00   0.00   0.00  56.23
----------------------------------------------------------------------

Segment Leq : 70.66 dBA

Total Leq All Segments: 73.67 dBA

Results segment # 1: O-Train N (night)
--------------------------------------

LOCOMOTIVE (0.00 + 63.40 + 0.00) = 63.40 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.44  65.58  -1.14  -1.05   0.00   0.00   0.00  63.40
----------------------------------------------------------------------

WHEEL (0.00 + 49.12 + 0.00) = 49.12 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.54  51.59  -1.22  -1.25   0.00   0.00   0.00  49.12
----------------------------------------------------------------------

Segment Leq : 63.56 dBA

Results segment # 2: O-Train S (night)
--------------------------------------

LOCOMOTIVE (0.00 + 63.40 + 0.00) = 63.40 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.44  65.58  -1.14  -1.05   0.00   0.00   0.00  63.40
----------------------------------------------------------------------

WHEEL (0.00 + 49.12 + 0.00) = 49.12 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.54  51.59  -1.22  -1.25   0.00   0.00   0.00  49.12
----------------------------------------------------------------------

Segment Leq : 63.56 dBA

Total Leq All Segments: 66.57 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
```

```
Surface                    :      2       (Reflective ground surface)
Receiver source distance  :  18.00 / 18.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1        (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
---------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Somerset E (day/night)
-------------------------------------------
Angle1   Angle2             : -90.00 deg   90.00 deg
Wood depth                  :      0       (No woods.)
No of house rows            :      0 / 0
Surface                     :      2       (Reflective ground surface)
Receiver source distance    :  15.00 / 15.00  m
Receiver height             :   1.50 / 1.50   m
Topography                  :      1       (Flat/gentle slope; no barrier)
Reference angle             :   0.00

Results segment # 1: Somerset W (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.68 + 0.00) = 64.68 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00  -0.79   0.00   0.00   0.00   0.00  64.68
--------------------------------------------------------------------------

Segment Leq : 64.68 dBA

Results segment # 2: Somerset E (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
--------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Total Leq All Segments: 68.10 dBA

Results segment # 1: Somerset W (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.08 + 0.00) = 57.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
```

```
   -90     90   0.00  57.87   0.00  -0.79   0.00   0.00   0.00   0.00  57.08
---------------------------------------------------------------------------

Segment Leq : 57.08 dBA

Results segment # 2: Somerset E (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
---------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Total Leq All Segments: 60.50 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 74.73
                         (NIGHT): 67.53
```

```
STAMSON 5.0        NORMAL REPORT        Date: 06-03-2013 15:33:14
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r2_c.te              Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train (day/night)
-----------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+--------------+-------+------+------+------+----
  1.             ! 128.0/13.0   !  85.0 !  1.0 !  2.0 !Diesel! Yes

Data for Segment # 1: O-Train (day/night)
----------------------------------------
Angle1   Angle2          : -90.00 deg   90.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0 / 0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance :  17.00 / 17.00  m
Receiver height          :   8.00 / 8.00   m
Topography               :      3       (Elevated; no barrier)
No Whistle
Elevation                :   5.00 m
Reference angle          :   0.00

Results segment # 1: O-Train (day)
----------------------------------

LOCOMOTIVE (0.00 + 72.07 + 0.00) = 72.07 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.24  73.38  -0.67  -0.63   0.00   0.00   0.00  72.07
----------------------------------------------------------------------

WHEEL (0.00 + 59.40 + 0.00) = 59.40 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.34  61.00  -0.73  -0.87   0.00   0.00   0.00  59.40
----------------------------------------------------------------------

Segment Leq : 72.30 dBA

Total Leq All Segments: 72.30 dBA

Results segment # 1: O-Train (night)
------------------------------------

LOCOMOTIVE (0.00 + 65.15 + 0.00) = 65.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.24  66.46  -0.67  -0.63   0.00   0.00   0.00  65.15
----------------------------------------------------------------------

WHEEL (0.00 + 52.48 + 0.00) = 52.48 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.34  54.07  -0.73  -0.87   0.00   0.00   0.00  52.48
----------------------------------------------------------------------

Segment Leq : 65.38 dBA

Total Leq All Segments: 65.38 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
```

```
Road gradient       :      0 %
Road pavement       :      1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth       :   0.00
    Number of Years of Growth         :   0.00
    Medium Truck % of Total Volume    :   7.00
    Heavy Truck  % of Total Volume    :   5.00
    Day (16 hrs) % of Total Volume    :  92.00

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   8.00 / 8.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth       :   0.00
    Number of Years of Growth         :   0.00
    Medium Truck % of Total Volume    :   7.00
    Heavy Truck  % of Total Volume    :   5.00
    Day (16 hrs) % of Total Volume    :  92.00

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :   8.00 / 8.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
----------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Results segment # 2: Somerset E (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
```

```
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
-----------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Total Leq All Segments: 68.48 dBA

Results segment # 1: Somerset W (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
-----------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Results segment # 2: Somerset E (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
-----------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Total Leq All Segments: 60.88 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 73.81
                         (NIGHT): 66.70
```

```
STAMSON 5.0        NORMAL REPORT        Date: 06-03-2013 15:33:32
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r2_f.te              Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train N (day/night)
-------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             ! 113.0/11.0  !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 1: O-Train N (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :   8.00 / 8.00   m
Topography                :      3       (Elevated; no barrier)
No Whistle
Elevation                 :   5.00 m
Reference angle           :   0.00

Rail data, segment # 2: O-Train S (day/night)
-------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             ! 113.0/11.0  !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 2: O-Train S (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :   8.00 / 8.00   m
Topography                :      3       (Elevated; no barrier)
No Whistle
Elevation                 :   5.00 m
Reference angle           :   0.00

Results segment # 1: O-Train N (day)
-----------------------------------

LOCOMOTIVE (0.00 + 71.38 + 0.00) = 71.38 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------
   -90     90   0.24  72.69  -0.67  -0.63   0.00   0.00   0.00  71.38
---------------------------------------------------------------------

WHEEL (0.00 + 57.10 + 0.00) = 57.10 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------
   -90     90   0.34  58.69  -0.73  -0.87   0.00   0.00   0.00  57.10
---------------------------------------------------------------------

Segment Leq : 71.54 dBA

Results segment # 2: O-Train S (day)
-----------------------------------

LOCOMOTIVE (0.00 + 71.38 + 0.00) = 71.38 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------
   -90     90   0.24  72.69  -0.67  -0.63   0.00   0.00   0.00  71.38
```

```
----------------------------------------------------------------------

WHEEL (0.00 + 57.10 + 0.00) = 57.10 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.34  58.69  -0.73  -0.87   0.00   0.00   0.00  57.10
----------------------------------------------------------------------

Segment Leq : 71.54 dBA

Total Leq All Segments: 74.55 dBA

Results segment # 1: O-Train N (night)
--------------------------------------

LOCOMOTIVE (0.00 + 64.28 + 0.00) = 64.28 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.24  65.58  -0.67  -0.63   0.00   0.00   0.00  64.28
----------------------------------------------------------------------

WHEEL (0.00 + 49.99 + 0.00) = 49.99 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.34  51.59  -0.73  -0.87   0.00   0.00   0.00  49.99
----------------------------------------------------------------------

Segment Leq : 64.44 dBA

Results segment # 2: O-Train S (night)
--------------------------------------

LOCOMOTIVE (0.00 + 64.28 + 0.00) = 64.28 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.24  65.58  -0.67  -0.63   0.00   0.00   0.00  64.28
----------------------------------------------------------------------

WHEEL (0.00 + 49.99 + 0.00) = 49.99 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.34  51.59  -0.73  -0.87   0.00   0.00   0.00  49.99
----------------------------------------------------------------------

Segment Leq : 64.44 dBA

Total Leq All Segments: 67.45 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
```

```
Surface                    :      2       (Reflective ground surface)
Receiver source distance   :  15.00 / 15.00  m
Receiver height            :   8.00 / 8.00   m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
Angle1   Angle2            : -90.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      2       (Reflective ground surface)
Receiver source distance   :  15.00 / 15.00  m
Receiver height            :   8.00 / 8.00   m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00

Results segment # 1: Somerset W (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
----------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Results segment # 2: Somerset E (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
----------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Total Leq All Segments: 68.48 dBA

Results segment # 1: Somerset W (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
```

```
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
--------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Results segment # 2: Somerset E (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
--------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Total Leq All Segments: 60.88 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 75.51
                         (NIGHT): 68.31
```

```
STAMSON 5.0        NORMAL REPORT        Date: 06-03-2013 15:33:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r3_c.te             Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train (day/night)
-------------------------------------------
Train            ! Trains      ! Speed !# loc !# Cars! Eng  !Cont
Type             !             !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             ! 128.0/13.0  !  85.0 !  1.0 !  2.0 !Diesel! Yes

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :  59.70 / 59.70  m
Topography                :      3       (Elevated; no barrier)
No Whistle
Elevation                 :   5.00 m
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

LOCOMOTIVE (0.00 + 72.84 + 0.00) = 72.84 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  73.38  -0.54   0.00   0.00   0.00   0.00  72.84
----------------------------------------------------------------------

WHEEL (0.00 + 60.45 + 0.00) = 60.45 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  61.00  -0.54   0.00   0.00   0.00   0.00  60.45
----------------------------------------------------------------------

Segment Leq : 73.08 dBA

Total Leq All Segments: 73.08 dBA

Results segment # 1: O-Train (night)
------------------------------------

LOCOMOTIVE (0.00 + 65.91 + 0.00) = 65.91 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  66.46  -0.54   0.00   0.00   0.00   0.00  65.91
----------------------------------------------------------------------

WHEEL (0.00 + 53.53 + 0.00) = 53.53 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  54.07  -0.54   0.00   0.00   0.00   0.00  53.53
----------------------------------------------------------------------

Segment Leq : 66.15 dBA

Total Leq All Segments: 66.15 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
```

```
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :  59.70 / 59.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :  59.70 / 59.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
--------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Results segment # 2: Somerset E (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
```

```
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
--------------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Total Leq All Segments: 68.48 dBA

Results segment # 1: Somerset W (night)
-----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
--------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Results segment # 2: Somerset E (night)
-----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
--------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Total Leq All Segments: 60.88 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 74.37
                         (NIGHT): 67.28
```

```
STAMSON 5.0        NORMAL REPORT        Date: 06-03-2013 15:34:06
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r3_f.te              Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train N (day/night)
---------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             ! 113.0/11.0  !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 1: O-Train N (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :       0      (No woods.)
No of house rows          :       0 / 0
Surface                   :       1      (Absorptive ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :  59.70 / 59.70  m
Topography                :       3      (Elevated; no barrier)
No Whistle
Elevation                 :   5.00 m
Reference angle           :   0.00

Rail data, segment # 2: O-Train S (day/night)
---------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             ! 113.0/11.0  !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 2: O-Train S (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :       0      (No woods.)
No of house rows          :       0 / 0
Surface                   :       1      (Absorptive ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :  59.70 / 59.70  m
Topography                :       3      (Elevated; no barrier)
No Whistle
Elevation                 :   5.00 m
Reference angle           :   0.00

Results segment # 1: O-Train N (day)
------------------------------------

LOCOMOTIVE (0.00 + 72.15 + 0.00) = 72.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  72.69  -0.54   0.00   0.00   0.00   0.00  72.15
----------------------------------------------------------------------

WHEEL (0.00 + 58.15 + 0.00) = 58.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  58.69  -0.54   0.00   0.00   0.00   0.00  58.15
----------------------------------------------------------------------

Segment Leq : 72.32 dBA

Results segment # 2: O-Train S (day)
------------------------------------

LOCOMOTIVE (0.00 + 72.15 + 0.00) = 72.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  72.69  -0.54   0.00   0.00   0.00   0.00  72.15
```

```
------------------------------------------------------------------

WHEEL (0.00 + 58.15 + 0.00) = 58.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------
   -90     90   0.00  58.69  -0.54   0.00   0.00   0.00   0.00  58.15
------------------------------------------------------------------

Segment Leq : 72.32 dBA

Total Leq All Segments: 75.33 dBA

Results segment # 1: O-Train N (night)
------------------------------------

LOCOMOTIVE (0.00 + 65.04 + 0.00) = 65.04 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------
   -90     90   0.00  65.58  -0.54   0.00   0.00   0.00   0.00  65.04
------------------------------------------------------------------

WHEEL (0.00 + 51.04 + 0.00) = 51.04 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------
   -90     90   0.00  51.59  -0.54   0.00   0.00   0.00   0.00  51.04
------------------------------------------------------------------

Segment Leq : 65.21 dBA

Results segment # 2: O-Train S (night)
------------------------------------

LOCOMOTIVE (0.00 + 65.04 + 0.00) = 65.04 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------
   -90     90   0.00  65.58  -0.54   0.00   0.00   0.00   0.00  65.04
------------------------------------------------------------------

WHEEL (0.00 + 51.04 + 0.00) = 51.04 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------
   -90     90   0.00  51.59  -0.54   0.00   0.00   0.00   0.00  51.04
------------------------------------------------------------------

Segment Leq : 65.21 dBA

Total Leq All Segments: 68.22 dBA

Road data, segment # 1: Somerset W (day/night)
-----------------------------------------

Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Somerset W (day/night)
-------------------------------------------

Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
```

```
Surface                      :       2        (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height              :  59.70 / 59.70  m
Topography                   :       1        (Flat/gentle slope; no barrier)
Reference angle              :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
Angle1   Angle2              : -90.00 deg   90.00 deg
Wood depth                   :      0       (No woods.)
No of house rows             :      0 / 0
Surface                      :      2       (Reflective ground surface)
Receiver source distance     :  15.00 / 15.00  m
Receiver height              :  59.70 / 59.70  m
Topography                   :      1       (Flat/gentle slope; no barrier)
Reference angle              :   0.00

Results segment # 1: Somerset W (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
-----------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Results segment # 2: Somerset E (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
-----------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Total Leq All Segments: 68.48 dBA

Results segment # 1: Somerset W (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------------
```

```
   -90     90   0.00  57.87   0.00    0.00    0.00    0.00    0.00    0.00  57.87
--------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Results segment # 2: Somerset E (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00    0.00    0.00    0.00    0.00    0.00  57.87
--------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Total Leq All Segments: 60.88 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 76.15
                         (NIGHT): 68.96
```

```
STAMSON 5.0        NORMAL REPORT        Date: 06-03-2013 15:34:29
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4_c.te               Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train (day/night)
------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             ! 128.0/13.0  !  85.0 !  1.0 !  2.0 !Diesel! Yes

Data for Segment # 1: O-Train (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           : 115.75 / 115.75 m
Topography                :      3       (Elevated; no barrier)
No Whistle
Elevation                 :   5.00 m
Reference angle           :   0.00

Results segment # 1: O-Train (day)
---------------------------------

LOCOMOTIVE (0.00 + 72.84 + 0.00) = 72.84 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------
   -90     90   0.00  73.38  -0.54   0.00   0.00   0.00   0.00  72.84
---------------------------------------------------------------------

WHEEL (0.00 + 60.45 + 0.00) = 60.45 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------
   -90     90   0.00  61.00  -0.54   0.00   0.00   0.00   0.00  60.45
---------------------------------------------------------------------

Segment Leq : 73.08 dBA

Total Leq All Segments: 73.08 dBA

Results segment # 1: O-Train (night)
-----------------------------------

LOCOMOTIVE (0.00 + 65.91 + 0.00) = 65.91 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------
   -90     90   0.00  66.46  -0.54   0.00   0.00   0.00   0.00  65.91
---------------------------------------------------------------------

WHEEL (0.00 + 53.53 + 0.00) = 53.53 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------
   -90     90   0.00  54.07  -0.54   0.00   0.00   0.00   0.00  53.53
---------------------------------------------------------------------

Segment Leq : 66.15 dBA

Total Leq All Segments: 66.15 dBA

Road data, segment # 1: Somerset W (day/night)
---------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
```

```
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           : 115.75 / 115.75 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           : 115.75 / 115.75 m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
----------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Results segment # 2: Somerset E (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
```

```
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
------------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Total Leq All Segments: 68.48 dBA

Results segment # 1: Somerset W (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Results segment # 2: Somerset E (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Total Leq All Segments: 60.88 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 74.37
                         (NIGHT): 67.28
```

```
STAMSON 5.0        NORMAL REPORT        Date: 06-03-2013 15:34:48
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4_f.te            Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train N (day/night)
-------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+--------------+-------+------+------+------+----
  1.             ! 113.0/11.0   !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 1: O-Train N (day/night)
-------------------------------------------
Angle1   Angle2            : -90.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  17.00 / 17.00  m
Receiver height            : 115.75 / 115.75 m
Topography                 :      3       (Elevated; no barrier)
No Whistle
Elevation                  :   5.00 m
Reference angle            :   0.00

Rail data, segment # 2: O-Train S (day/night)
-------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+--------------+-------+------+------+------+----
  1.             ! 113.0/11.0   !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 2: O-Train S (day/night)
-------------------------------------------
Angle1   Angle2            : -90.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  17.00 / 17.00  m
Receiver height            : 115.75 / 115.75 m
Topography                 :      3       (Elevated; no barrier)
No Whistle
Elevation                  :   5.00 m
Reference angle            :   0.00

Results segment # 1: O-Train N (day)
------------------------------------

LOCOMOTIVE (0.00 + 72.15 + 0.00) = 72.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  72.69  -0.54   0.00   0.00   0.00   0.00  72.15
----------------------------------------------------------------------

WHEEL (0.00 + 58.15 + 0.00) = 58.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  58.69  -0.54   0.00   0.00   0.00   0.00  58.15
----------------------------------------------------------------------

Segment Leq : 72.32 dBA

Results segment # 2: O-Train S (day)
------------------------------------

LOCOMOTIVE (0.00 + 72.15 + 0.00) = 72.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  72.69  -0.54   0.00   0.00   0.00   0.00  72.15
```

```
----------------------------------------------------------------------

WHEEL (0.00 + 58.15 + 0.00) = 58.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  58.69  -0.54   0.00   0.00   0.00   0.00  58.15
----------------------------------------------------------------------

Segment Leq : 72.32 dBA

Total Leq All Segments: 75.33 dBA

Results segment # 1: O-Train N (night)
--------------------------------------

LOCOMOTIVE (0.00 + 65.04 + 0.00) = 65.04 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  65.58  -0.54   0.00   0.00   0.00   0.00  65.04
----------------------------------------------------------------------

WHEEL (0.00 + 51.04 + 0.00) = 51.04 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  51.59  -0.54   0.00   0.00   0.00   0.00  51.04
----------------------------------------------------------------------

Segment Leq : 65.21 dBA

Results segment # 2: O-Train S (night)
--------------------------------------

LOCOMOTIVE (0.00 + 65.04 + 0.00) = 65.04 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  65.58  -0.54   0.00   0.00   0.00   0.00  65.04
----------------------------------------------------------------------

WHEEL (0.00 + 51.04 + 0.00) = 51.04 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  51.59  -0.54   0.00   0.00   0.00   0.00  51.04
----------------------------------------------------------------------

Segment Leq : 65.21 dBA

Total Leq All Segments: 68.22 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth       :   0.00
    Number of Years of Growth         :   0.00
    Medium Truck % of Total Volume    :   7.00
    Heavy Truck  % of Total Volume    :   5.00
    Day (16 hrs) % of Total Volume    :  92.00

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2          : -90.00 deg   90.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0 / 0
```

```
Surface                    :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height            : 115.75 / 115.75 m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00

Road data, segment # 2: Somerset E (day/night)
---------------------------------------------
Car traffic volume  :  6072/528   veh/TimePeriod  *
Medium truck volume :   483/42    veh/TimePeriod  *
Heavy truck volume  :   345/30    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   7500
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Somerset E (day/night)
-------------------------------------------
Angle1   Angle2            : -90.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height            : 115.75 / 115.75 m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00

Results segment # 1: Somerset W (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
----------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Results segment # 2: Somerset E (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 65.47 + 0.00) = 65.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     90   0.00  65.47   0.00   0.00   0.00   0.00   0.00   0.00  65.47
----------------------------------------------------------------------------

Segment Leq : 65.47 dBA

Total Leq All Segments: 68.48 dBA

Results segment # 1: Somerset W (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
```

```
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Results segment # 2: Somerset E (night)
--------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.87 + 0.00) = 57.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  57.87   0.00   0.00   0.00   0.00   0.00   0.00  57.87
------------------------------------------------------------------------------

Segment Leq : 57.87 dBA

Total Leq All Segments: 60.88 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 76.15
                         (NIGHT): 68.96
```

```
STAMSON 5.0        NORMAL REPORT        Date: 07-03-2013 11:11:03
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r5_c.te              Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train (day/night)
-------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+--------------+-------+------+------+------+----
  1.             ! 128.0/13.0   !  85.0 !  1.0 !  2.0 !Diesel! Yes

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -75.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  23.00 / 23.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
No Whistle
Barrier angle1            : -75.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :   4.50 / 4.50   m
Source elevation          :  -5.00 m
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       4.00 !        1.50 !       -1.42 !        10.98
       0.50 !        1.50 !       -2.10 !        10.30

LOCOMOTIVE (0.00 + 56.79 + 0.00) = 56.79 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -75     90   0.12  73.38  -2.08  -0.65   0.00   0.00 -13.86  56.79
----------------------------------------------------------------------

WHEEL (0.00 + 42.94 + 0.00) = 42.94 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -75     90   0.23  61.00  -2.28  -0.86   0.00   0.00 -14.92  42.94
----------------------------------------------------------------------

Segment Leq : 56.97 dBA

Total Leq All Segments: 56.97 dBA

Results segment # 1: O-Train (night)
------------------------------------

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       4.00 !        1.50 !       -1.42 !        10.98
       0.50 !        1.50 !       -2.10 !        10.30
```

```
LOCOMOTIVE (0.00 + 49.87 + 0.00) = 49.87 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -75     90   0.12  66.46  -2.08  -0.65   0.00   0.00 -13.86  49.87
----------------------------------------------------------------------

WHEEL (0.00 + 36.02 + 0.00) = 36.02 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -75     90   0.23  54.07  -2.28  -0.86   0.00   0.00 -14.92  36.02
----------------------------------------------------------------------

Segment Leq : 50.05 dBA

Total Leq All Segments: 50.05 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume    :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume    :   230/115   veh/TimePeriod
Posted speed limit    :    50 km/h
Road gradient         :     0 %
Road pavement         :     1 (Typical asphalt or concrete)

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           :  15.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  51.00 / 51.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  15.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume    :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume    :   230/115   veh/TimePeriod
Posted speed limit    :    50 km/h
Road gradient         :     0 %
Road pavement         :     1 (Typical asphalt or concrete)

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
Angle1   Angle2           :  15.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  46.00 / 46.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  15.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
```

```
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        0.28 !        12.68

ROAD (0.00 + 46.56 + 0.00) = 46.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
    15     90   0.00  63.71   0.00  -5.31  -3.80   0.00   0.00  -8.03  46.56
--------------------------------------------------------------------------

Segment Leq : 46.56 dBA

Results segment # 2: Somerset E (day)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        0.15 !        12.55

ROAD (0.00 + 46.56 + 0.00) = 46.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
    15     90   0.00  63.71   0.00  -4.87  -3.80   0.00   0.00  -8.48  46.56
--------------------------------------------------------------------------

Segment Leq : 46.56 dBA

Total Leq All Segments: 49.57 dBA

Results segment # 1: Somerset W (night)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        0.28 !        12.68

ROAD (0.00 + 46.56 + 0.00) = 46.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
    15     90   0.00  63.71   0.00  -5.31  -3.80   0.00   0.00  -8.03  46.56
--------------------------------------------------------------------------

Segment Leq : 46.56 dBA

Results segment # 2: Somerset E (night)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
```

```
       1.50 !        1.50 !        0.15 !        12.55

ROAD (0.00 + 46.56 + 0.00) = 46.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------------
    15     90   0.00  63.71   0.00  -4.87  -3.80   0.00   0.00  -8.48  46.56
---------------------------------------------------------------------------

Segment Leq : 46.56 dBA

Total Leq All Segments: 49.57 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 57.70
                         (NIGHT): 52.83
```

```
STAMSON 5.0        NORMAL REPORT        Date: 07-03-2013 11:07:10
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r5_f.te              Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train N (day/night)
---------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+--------------+-------+------+------+------+----
  1.             ! 113.0/11.0   !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 1: O-Train N (day/night)
-------------------------------------------
Angle1   Angle2            : -75.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  23.00 / 23.00  m
Receiver height            :   1.50 / 1.50   m
Topography                 :      4       (Elevated; with barrier)
No Whistle
Barrier angle1             : -75.00 deg   Angle2 : 90.00 deg
Barrier height             :   1.50 m
Elevation                  :  12.40 m
Barrier receiver distance  :   4.50 / 4.50   m
Source elevation           :  -5.00 m
Receiver elevation         :  12.40 m
Barrier elevation          :  12.40 m
Reference angle            :   0.00

Rail data, segment # 2: O-Train S (day/night)
---------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+--------------+-------+------+------+------+----
  1.             ! 113.0/11.0   !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 2: O-Train S (day/night)
-------------------------------------------
Angle1   Angle2            : -75.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  23.00 / 23.00  m
Receiver height            :   1.50 / 1.50   m
Topography                 :      4       (Elevated; with barrier)
No Whistle
Barrier angle1             : -75.00 deg   Angle2 : 90.00 deg
Barrier height             :   1.50 m
Elevation                  :  12.40 m
Barrier receiver distance  :   4.50 / 4.50   m
Source elevation           :  -5.00 m
Receiver elevation         :  12.40 m
Barrier elevation          :  12.40 m
Reference angle            :   0.00

Results segment # 1: O-Train N (day)
------------------------------------

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver     ! Barrier      ! Elevation of
Height  (m) ! Height  (m)  ! Height  (m)  ! Barrier Top  (m)
------------+--------------+--------------+--------------
       4.00 !         1.50 !        -1.42 !        10.98
       0.50 !         1.50 !        -2.10 !        10.30

LOCOMOTIVE (0.00 + 56.10 + 0.00) = 56.10 dBA
```

```
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -75     90   0.12  72.69  -2.08  -0.65   0.00   0.00 -13.86  56.10
------------------------------------------------------------------------

WHEEL (0.00 + 40.64 + 0.00) = 40.64 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -75     90   0.23  58.69  -2.28  -0.86   0.00   0.00 -14.92  40.64
------------------------------------------------------------------------

Segment Leq : 56.22 dBA

Results segment # 2: O-Train S (day)
-------------------------------------

Barrier height for grazing incidence
-------------------------------------
Source      ! Receiver     ! Barrier      ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       4.00 !         1.50 !       -1.42 !        10.98
       0.50 !         1.50 !       -2.10 !        10.30

LOCOMOTIVE (0.00 + 56.10 + 0.00) = 56.10 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -75     90   0.12  72.69  -2.08  -0.65   0.00   0.00 -13.86  56.10
------------------------------------------------------------------------

WHEEL (0.00 + 40.64 + 0.00) = 40.64 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -75     90   0.23  58.69  -2.28  -0.86   0.00   0.00 -14.92  40.64
------------------------------------------------------------------------

Segment Leq : 56.22 dBA

Total Leq All Segments: 59.23 dBA

Results segment # 1: O-Train N (night)
---------------------------------------

Barrier height for grazing incidence
-------------------------------------
Source      ! Receiver     ! Barrier      ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       4.00 !         1.50 !       -1.42 !        10.98
       0.50 !         1.50 !       -2.10 !        10.30

LOCOMOTIVE (0.00 + 48.99 + 0.00) = 48.99 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -75     90   0.12  65.58  -2.08  -0.65   0.00   0.00 -13.86  48.99
------------------------------------------------------------------------

WHEEL (0.00 + 33.53 + 0.00) = 33.53 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -75     90   0.23  51.59  -2.28  -0.86   0.00   0.00 -14.92  33.53
------------------------------------------------------------------------

Segment Leq : 49.11 dBA

Results segment # 2: O-Train S (night)
---------------------------------------

Barrier height for grazing incidence
-------------------------------------
Source      ! Receiver     ! Barrier      ! Elevation of
```

```
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       4.00 !        1.50 !       -1.42 !       10.98
       0.50 !        1.50 !       -2.10 !       10.30

LOCOMOTIVE (0.00 + 48.99 + 0.00) = 48.99 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -75     90   0.12  65.58  -2.08  -0.65   0.00   0.00 -13.86  48.99
----------------------------------------------------------------------

WHEEL (0.00 + 33.53 + 0.00) = 33.53 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -75     90   0.23  51.59  -2.28  -0.86   0.00   0.00 -14.92  33.53
----------------------------------------------------------------------

Segment Leq : 49.11 dBA

Total Leq All Segments: 52.12 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           :  15.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  51.00 / 51.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  15.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
Angle1   Angle2           :  15.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  46.00 / 46.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            :  15.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
```

```
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       1.50 !        1.50 !        0.28 !       12.68

ROAD (0.00 + 46.56 + 0.00) = 46.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    15     90   0.00  63.71   0.00  -5.31  -3.80   0.00   0.00  -8.03  46.56
----------------------------------------------------------------------------

Segment Leq : 46.56 dBA

Results segment # 2: Somerset E (day)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       1.50 !        1.50 !        0.15 !       12.55

ROAD (0.00 + 46.56 + 0.00) = 46.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    15     90   0.00  63.71   0.00  -4.87  -3.80   0.00   0.00  -8.48  46.56
----------------------------------------------------------------------------

Segment Leq : 46.56 dBA

Total Leq All Segments: 49.57 dBA

Results segment # 1: Somerset W (night)
---------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       1.50 !        1.50 !        0.28 !       12.68

ROAD (0.00 + 46.56 + 0.00) = 46.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    15     90   0.00  63.71   0.00  -5.31  -3.80   0.00   0.00  -8.03  46.56
----------------------------------------------------------------------------

Segment Leq : 46.56 dBA

Results segment # 2: Somerset E (night)
---------------------------------------

Source height = 1.50 m
```

```
Barrier height for grazing incidence
------------------------------------
Source       ! Receiver     ! Barrier     ! Elevation of
Height   (m) ! Height   (m) ! Height  (m) ! Barrier Top  (m)
-------------+--------------+-------------+--------------
       1.50 !         1.50 !        0.15 !        12.55

ROAD (0.00 + 46.56 + 0.00) = 46.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
    15     90   0.00  63.71   0.00  -4.87  -3.80   0.00   0.00  -8.48  46.56
----------------------------------------------------------------------------

Segment Leq : 46.56 dBA

Total Leq All Segments: 49.57 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 59.68
                         (NIGHT): 54.04
```

```
STAMSON 5.0        NORMAL REPORT        Date: 07-03-2013 11:29:16
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r6_c.te              Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train (day/night)
-------------------------------------------
Train             ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type              !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
  1.             ! 128.0/13.0  !  85.0 !  1.0 !  2.0 !Diesel! Yes

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2           : -10.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  48.00 / 48.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
No Whistle
Barrier angle1            : -10.00 deg   Angle2 : 90.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :  29.50 / 29.50  m
Source elevation          :  -5.00 m
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       4.00 !        1.50 !       -7.66 !         4.74
       0.50 !        1.50 !       -9.81 !         2.59

LOCOMOTIVE (0.00 + 47.76 + 0.00) = 47.76 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -10     90   0.12  73.38  -5.67  -2.86   0.00   0.00 -17.08  47.76
----------------------------------------------------------------------

WHEEL (0.00 + 33.95 + 0.00) = 33.95 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -10     90   0.23  61.00  -6.20  -3.09   0.00   0.00 -17.74  33.95
----------------------------------------------------------------------

Segment Leq : 47.94 dBA

Total Leq All Segments: 47.94 dBA

Results segment # 1: O-Train (night)
------------------------------------

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       4.00 !        1.50 !       -7.66 !         4.74
       0.50 !        1.50 !       -9.81 !         2.59
```

```
LOCOMOTIVE (0.00 + 40.84 + 0.00) = 40.84 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------
   -10     90   0.12  66.46  -5.67  -2.86   0.00   0.00 -17.08  40.84
--------------------------------------------------------------------

WHEEL (0.00 + 27.03 + 0.00) = 27.03 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------
   -10     90   0.23  54.07  -6.20  -3.09   0.00   0.00 -17.74  27.03
--------------------------------------------------------------------

Segment Leq : 41.02 dBA

Total Leq All Segments: 41.02 dBA

Road data, segment # 1: Somerset W (day/night)
---------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: Somerset W (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  51.00 / 51.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 0.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :  38.00 / 38.00  m
Source elevation          :   0.00 m
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
---------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: Somerset E (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  46.00 / 46.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 0.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :  38.00 / 38.00  m
Source elevation          :   0.00 m
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
```

```
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       1.50 !        1.50 !       -7.74 !         4.66

ROAD (0.00 + 38.20 + 0.00) = 38.20 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------------
   -90      0   0.00  63.71   0.00  -5.31  -3.01   0.00   0.00 -17.18  38.20
---------------------------------------------------------------------------

Segment Leq : 38.20 dBA

Results segment # 2: Somerset E (day)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       1.50 !        1.50 !       -8.75 !         3.65

ROAD (0.00 + 37.92 + 0.00) = 37.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------------
   -90      0   0.00  63.71   0.00  -4.87  -3.01   0.00   0.00 -17.91  37.92
---------------------------------------------------------------------------

Segment Leq : 37.92 dBA

Total Leq All Segments: 41.07 dBA

Results segment # 1: Somerset W (night)
---------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       1.50 !        1.50 !       -7.74 !         4.66

ROAD (0.00 + 38.20 + 0.00) = 38.20 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
---------------------------------------------------------------------------
   -90      0   0.00  63.71   0.00  -5.31  -3.01   0.00   0.00 -17.18  38.20
---------------------------------------------------------------------------

Segment Leq : 38.20 dBA

Results segment # 2: Somerset E (night)
---------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
```

```
      1.50          1.50         -8.75            3.65

ROAD (0.00 + 37.92 + 0.00) = 37.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90      0   0.00  63.71   0.00  -4.87  -3.01   0.00   0.00 -17.91  37.92
--------------------------------------------------------------------------

Segment Leq : 37.92 dBA

Total Leq All Segments: 41.07 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 48.75
                         (NIGHT): 44.06
```

```
STAMSON 5.0        NORMAL REPORT        Date: 07-03-2013 11:34:26
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r6_f.te              Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train N (day/night)
--------------------------------------------
Train              ! Trains        ! Speed !# loc !# Cars! Eng  !Cont
Type               !               !(km/h) !/Train!/Train! type !weld
-------------------+---------------+-------+------+------+------+----
  1.               ! 113.0/11.0  !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 1: O-Train N (day/night)
-------------------------------------------
Angle1   Angle2             : -10.00 deg   90.00 deg
Wood depth                  :      0       (No woods.)
No of house rows            :      0 / 0
Surface                     :      1       (Absorptive ground surface)
Receiver source distance    :  48.00 / 48.00  m
Receiver height             :   1.50 / 1.50   m
Topography                  :      4       (Elevated; with barrier)
No Whistle
Barrier angle1              : -10.00 deg   Angle2 : 90.00 deg
Barrier height              :   1.50 m
Elevation                   :  12.40 m
Barrier receiver distance   :  29.50 / 29.50  m
Source elevation            :  -5.00 m
Receiver elevation          :  12.40 m
Barrier elevation           :  12.40 m
Reference angle             :   0.00

Rail data, segment # 2: O-Train S (day/night)
--------------------------------------------
Train              ! Trains        ! Speed !# loc !# Cars! Eng  !Cont
Type               !               !(km/h) !/Train!/Train! type !weld
-------------------+---------------+-------+------+------+------+----
  1.               ! 113.0/11.0  !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 2: O-Train S (day/night)
-------------------------------------------
Angle1   Angle2             : -10.00 deg   90.00 deg
Wood depth                  :      0       (No woods.)
No of house rows            :      0 / 0
Surface                     :      1       (Absorptive ground surface)
Receiver source distance    :  48.00 / 48.00  m
Receiver height             :   1.50 / 1.50   m
Topography                  :      4       (Elevated; with barrier)
No Whistle
Barrier angle1              : -10.00 deg   Angle2 : 90.00 deg
Barrier height              :   1.50 m
Elevation                   :  12.40 m
Barrier receiver distance   :  29.50 / 29.50  m
Source elevation            :  -5.00 m
Receiver elevation          :  12.40 m
Barrier elevation           :  12.40 m
Reference angle             :   0.00

Results segment # 1: O-Train N (day)
------------------------------------

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       4.00 !        1.50 !       -7.66 !         4.74
       0.50 !        1.50 !       -9.81 !         2.59

LOCOMOTIVE (0.00 + 47.07 + 0.00) = 47.07 dBA
```

```
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -10     90   0.12  72.69  -5.67  -2.86   0.00   0.00 -17.08  47.07
------------------------------------------------------------------------

WHEEL (0.00 + 31.65 + 0.00) = 31.65 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -10     90   0.23  58.69  -6.20  -3.09   0.00   0.00 -17.74  31.65
------------------------------------------------------------------------

Segment Leq : 47.19 dBA

Results segment # 2: O-Train S (day)
-------------------------------------

Barrier height for grazing incidence
-------------------------------------
Source       ! Receiver     ! Barrier      ! Elevation of
Height  (m)  ! Height  (m)  ! Height  (m)  ! Barrier Top  (m)
-------------+--------------+--------------+--------------
       4.00 !         1.50 !        -7.66 !         4.74
       0.50 !         1.50 !        -9.81 !         2.59

LOCOMOTIVE (0.00 + 47.07 + 0.00) = 47.07 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -10     90   0.12  72.69  -5.67  -2.86   0.00   0.00 -17.08  47.07
------------------------------------------------------------------------

WHEEL (0.00 + 31.65 + 0.00) = 31.65 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -10     90   0.23  58.69  -6.20  -3.09   0.00   0.00 -17.74  31.65
------------------------------------------------------------------------

Segment Leq : 47.19 dBA

Total Leq All Segments: 50.20 dBA

Results segment # 1: O-Train N (night)
---------------------------------------

Barrier height for grazing incidence
-------------------------------------
Source       ! Receiver     ! Barrier      ! Elevation of
Height  (m)  ! Height  (m)  ! Height  (m)  ! Barrier Top  (m)
-------------+--------------+--------------+--------------
       4.00 !         1.50 !        -7.66 !         4.74
       0.50 !         1.50 !        -9.81 !         2.59

LOCOMOTIVE (0.00 + 39.96 + 0.00) = 39.96 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -10     90   0.12  65.58  -5.67  -2.86   0.00   0.00 -17.08  39.96
------------------------------------------------------------------------

WHEEL (0.00 + 24.55 + 0.00) = 24.55 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------
   -10     90   0.23  51.59  -6.20  -3.09   0.00   0.00 -17.74  24.55
------------------------------------------------------------------------

Segment Leq : 40.08 dBA

Results segment # 2: O-Train S (night)
---------------------------------------

Barrier height for grazing incidence
-------------------------------------
Source       ! Receiver     ! Barrier      ! Elevation of
```

```
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       4.00 !        1.50 !       -7.66 !         4.74
       0.50 !        1.50 !       -9.81 !         2.59

LOCOMOTIVE (0.00 + 39.96 + 0.00) = 39.96 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -10     90   0.12  65.58  -5.67  -2.86   0.00   0.00 -17.08  39.96
----------------------------------------------------------------------

WHEEL (0.00 + 24.55 + 0.00) = 24.55 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -10     90   0.23  51.59  -6.20  -3.09   0.00   0.00 -17.74  24.55
----------------------------------------------------------------------

Segment Leq : 40.08 dBA

Total Leq All Segments: 43.09 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  51.00 / 51.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 0.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :  38.00 / 38.00  m
Source elevation          :   0.00 m
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  46.00 / 46.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 0.00 deg
Barrier height            :   1.50 m
Elevation                 :  12.40 m
Barrier receiver distance :  38.00 / 38.00  m
Source elevation          :   0.00 m
```

```
Receiver elevation        :  12.40 m
Barrier elevation         :  12.40 m
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !       -7.74 !         4.66

ROAD (0.00 + 38.20 + 0.00) = 38.20 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90      0   0.00  63.71   0.00  -5.31  -3.01   0.00   0.00 -17.18  38.20
--------------------------------------------------------------------------

Segment Leq : 38.20 dBA

Results segment # 2: Somerset E (day)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !       -8.75 !         3.65

ROAD (0.00 + 37.92 + 0.00) = 37.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90      0   0.00  63.71   0.00  -4.87  -3.01   0.00   0.00 -17.91  37.92
--------------------------------------------------------------------------

Segment Leq : 37.92 dBA

Total Leq All Segments: 41.07 dBA

Results segment # 1: Somerset W (night)
--------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !       -7.74 !         4.66

ROAD (0.00 + 38.20 + 0.00) = 38.20 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90      0   0.00  63.71   0.00  -5.31  -3.01   0.00   0.00 -17.18  38.20
--------------------------------------------------------------------------

Segment Leq : 38.20 dBA

Results segment # 2: Somerset E (night)
--------------------------------------

Source height = 1.50 m
```

```
Barrier height for grazing incidence
------------------------------------
Source       ! Receiver     ! Barrier      ! Elevation of
Height   (m) ! Height   (m) ! Height   (m) ! Barrier Top  (m)
-------------+--------------+--------------+--------------
        1.50 !         1.50 !        -8.75 !         3.65

ROAD (0.00 + 37.92 + 0.00) = 37.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90      0   0.00  63.71   0.00  -4.87  -3.01   0.00   0.00 -17.91  37.92
----------------------------------------------------------------------------

Segment Leq : 37.92 dBA

Total Leq All Segments: 41.07 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 50.70
                         (NIGHT): 45.21
```

```
STAMSON 5.0        NORMAL REPORT        Date: 07-03-2013 11:11:48
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r7_c.te              Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train (day/night)
-------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+--------------+-------+------+------+------+----
  1.             ! 128.0/13.0   !  85.0 !  1.0 !  2.0 !Diesel! Yes

Data for Segment # 1: O-Train (day/night)
-----------------------------------------
Angle1   Angle2            : -90.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  31.00 / 31.00  m
Receiver height            :   1.50 / 1.50   m
Topography                 :      4       (Elevated; with barrier)
No Whistle
Barrier angle1             : -90.00 deg   Angle2 : 90.00 deg
Barrier height             :   7.40 m
Elevation                  :   6.50 m
Barrier receiver distance  :   1.50 / 1.50   m
Source elevation           :  -5.00 m
Receiver elevation         :   6.50 m
Barrier elevation          :   6.50 m
Reference angle            :   0.00

Results segment # 1: O-Train (day)
----------------------------------

Barrier height for grazing incidence
------------------------------------
Source       ! Receiver     ! Barrier      ! Elevation of
Height   (m) ! Height   (m) ! Height   (m) ! Barrier Top  (m)
-------------+--------------+--------------+-------------
       4.00 !         1.50 !         1.06 !          7.56
       0.50 !         1.50 !         0.90 !          7.40

LOCOMOTIVE (0.00 + 51.87 + 0.00) = 51.87 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  73.38  -3.15   0.00   0.00   0.00 -18.35  51.87
----------------------------------------------------------------------

WHEEL (0.00 + 39.07 + 0.00) = 39.07 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.05  61.00  -3.31  -0.15   0.00   0.00 -18.46  39.07
----------------------------------------------------------------------

Segment Leq : 52.09 dBA

Total Leq All Segments: 52.09 dBA

Results segment # 1: O-Train (night)
------------------------------------

Barrier height for grazing incidence
------------------------------------
Source       ! Receiver     ! Barrier      ! Elevation of
Height   (m) ! Height   (m) ! Height   (m) ! Barrier Top  (m)
-------------+--------------+--------------+-------------
       4.00 !         1.50 !         1.06 !          7.56
       0.50 !         1.50 !         0.90 !          7.40
```

```
LOCOMOTIVE (0.00 + 44.95 + 0.00) = 44.95 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  66.46  -3.15   0.00   0.00   0.00 -18.35  44.95
----------------------------------------------------------------------

WHEEL (0.00 + 32.15 + 0.00) = 32.15 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.05  54.07  -3.31  -0.15   0.00   0.00 -18.46  32.15
----------------------------------------------------------------------

Segment Leq : 45.17 dBA

Total Leq All Segments: 45.17 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  51.00 / 51.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            : 118.30 m
Elevation                 :   6.50 m
Barrier receiver distance :   3.00 / 3.00   m
Source elevation          :   0.00 m
Receiver elevation        :   6.50 m
Barrier elevation         :   6.50 m
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  46.00 / 46.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            : 118.30 m
Elevation                 :   6.50 m
Barrier receiver distance :   3.00 / 3.00   m
Source elevation          :   0.00 m
Receiver elevation        :   6.50 m
Barrier elevation         :   6.50 m
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
```

```
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       1.50 !        1.50 !        1.12 !         7.62

ROAD (0.00 + 38.46 + 0.00) = 38.46 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  63.71   0.00  -5.31   0.00   0.00   0.00 -19.93  38.46
--------------------------------------------------------------------------

Segment Leq : 38.46 dBA

Results segment # 2: Somerset E (day)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       1.50 !        1.50 !        1.08 !         7.58

ROAD (0.00 + 38.91 + 0.00) = 38.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  63.71   0.00  -4.87   0.00   0.00   0.00 -19.93  38.91
--------------------------------------------------------------------------

Segment Leq : 38.91 dBA

Total Leq All Segments: 41.70 dBA

Results segment # 1: Somerset W (night)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
       1.50 !        1.50 !        1.12 !         7.62

ROAD (0.00 + 38.46 + 0.00) = 38.46 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  63.71   0.00  -5.31   0.00   0.00   0.00 -19.93  38.46
--------------------------------------------------------------------------

Segment Leq : 38.46 dBA

Results segment # 2: Somerset E (night)
-------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
----------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+-------------
```

```
       1.50 !        1.50 !        1.08 !        7.58

ROAD (0.00 + 38.91 + 0.00) = 38.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------------
   -90     90   0.00  63.71   0.00  -4.87   0.00   0.00   0.00 -19.93  38.91
----------------------------------------------------------------------------

Segment Leq : 38.91 dBA

Total Leq All Segments: 41.70 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 52.47
                         (NIGHT): 46.78
```

```
STAMSON 5.0        NORMAL REPORT        Date: 07-03-2013 11:12:25
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r7_f.te              Time Period: Day/Night 16/8 hours
Description:


Rail data, segment # 1: O-Train N (day/night)
----------------------------------------------
Train             ! Trains        ! Speed !# loc !# Cars! Eng  !Cont
Type              !               !(km/h) !/Train!/Train! type !weld
------------------+---------------+-------+------+------+------+----
  1.              ! 113.0/11.0   !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 1: O-Train N (day/night)
-------------------------------------------
Angle1    Angle2             : -90.00 deg   90.00 deg
Wood depth                   :      0       (No woods.)
No of house rows             :      0 / 0
Surface                      :      1       (Absorptive ground surface)
Receiver source distance  :  31.00 / 20.00  m
Receiver height              :   1.50 / 1.50   m
Topography                   :      4       (Elevated; with barrier)
No Whistle
Barrier angle1               : -90.00 deg   Angle2 : 90.00 deg
Barrier height               :   7.40 m
Elevation                    :   6.50 m
Barrier receiver distance :   1.50 / -9.50  m
Source elevation             :  -5.00 m
Receiver elevation           :   6.50 m
Barrier elevation            :   6.50 m
Reference angle              :   0.00

Rail data, segment # 2: O-Train S (day/night)
----------------------------------------------
Train             ! Trains        ! Speed !# loc !# Cars! Eng  !Cont
Type              !               !(km/h) !/Train!/Train! type !weld
------------------+---------------+-------+------+------+------+----
  1.              ! 113.0/11.0   !  85.0 !  1.0 !  1.0 !Diesel! Yes

Data for Segment # 2: O-Train S (day/night)
-------------------------------------------
Angle1    Angle2             : -90.00 deg   90.00 deg
Wood depth                   :      0       (No woods.)
No of house rows             :      0 / 0
Surface                      :      1       (Absorptive ground surface)
Receiver source distance  :  31.00 / 20.00  m
Receiver height              :   1.50 / 1.50   m
Topography                   :      4       (Elevated; with barrier)
No Whistle
Barrier angle1               : -90.00 deg   Angle2 : 90.00 deg
Barrier height               :   7.40 m
Elevation                    :   6.50 m
Barrier receiver distance :   1.50 / -9.50  m
Source elevation             :  -5.00 m
Receiver elevation           :   6.50 m
Barrier elevation            :   6.50 m
Reference angle              :   0.00

Results segment # 1: O-Train N (day)
------------------------------------

Barrier height for grazing incidence
------------------------------------
Source       ! Receiver     ! Barrier      ! Elevation of
Height   (m) ! Height   (m) ! Height   (m) ! Barrier Top  (m)
-------------+--------------+--------------+--------------
       4.00 !          1.50 !         1.06 !          7.56
       0.50 !          1.50 !         0.90 !          7.40

LOCOMOTIVE (0.00 + 51.18 + 0.00) = 51.18 dBA
```

```
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  72.69  -3.15   0.00   0.00   0.00 -18.35  51.18
--------------------------------------------------------------------------

WHEEL (0.00 + 36.77 + 0.00) = 36.77 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.05  58.69  -3.31  -0.15   0.00   0.00 -18.46  36.77
--------------------------------------------------------------------------

Segment Leq : 51.33 dBA

Results segment # 2: O-Train S (day)
--------------------------------------

Barrier height for grazing incidence
--------------------------------------
Source      ! Receiver     ! Barrier      ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       4.00 !         1.50 !         1.06 !         7.56
       0.50 !         1.50 !         0.90 !         7.40

LOCOMOTIVE (0.00 + 51.18 + 0.00) = 51.18 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  72.69  -3.15   0.00   0.00   0.00 -18.35  51.18
--------------------------------------------------------------------------

WHEEL (0.00 + 36.77 + 0.00) = 36.77 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.05  58.69  -3.31  -0.15   0.00   0.00 -18.46  36.77
--------------------------------------------------------------------------

Segment Leq : 51.33 dBA

Total Leq All Segments: 54.34 dBA

Results segment # 1: O-Train N (night)
----------------------------------------

Barrier height for grazing incidence
--------------------------------------
Source      ! Receiver     ! Barrier      ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       4.00 !         1.50 !         5.78 !        12.27
       0.50 !         1.50 !         7.44 !        13.94

LOCOMOTIVE (0.00 + 62.89 + 0.00) = 62.89 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.00  65.58  -1.25   0.00   0.00   0.00  99.00 163.33
   -90     90   0.39  65.58  -1.74  -0.96   0.00   0.00   0.00  62.89
--------------------------------------------------------------------------

 * Bright Zone !

WHEEL (0.00 + 48.55 + 0.00) = 48.55 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
--------------------------------------------------------------------------
   -90     90   0.05  51.59  -1.31  -0.15   0.00   0.00  99.00 149.13
   -90     90   0.50  51.59  -1.87  -1.17   0.00   0.00   0.00  48.55
--------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 63.05 dBA
```

```
Results segment # 2: O-Train S (night)
--------------------------------------

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       4.00 !        1.50 !        5.78 !        12.27
       0.50 !        1.50 !        7.44 !        13.94

LOCOMOTIVE (0.00 + 62.89 + 0.00) = 62.89 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.00  65.58  -1.25   0.00   0.00   0.00  99.00 163.33
   -90     90   0.39  65.58  -1.74  -0.96   0.00   0.00   0.00  62.89
----------------------------------------------------------------------

 * Bright Zone !

WHEEL (0.00 + 48.55 + 0.00) = 48.55 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     90   0.05  51.59  -1.31  -0.15   0.00   0.00  99.00 149.13
   -90     90   0.50  51.59  -1.87  -1.17   0.00   0.00   0.00  48.55
----------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 63.05 dBA

Total Leq All Segments: 66.06 dBA

Road data, segment # 1: Somerset W (day/night)
----------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: Somerset W (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  51.00 / 51.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            : 118.30 m
Elevation                 :   6.50 m
Barrier receiver distance :   3.00 / 3.00   m
Source elevation          :   0.00 m
Receiver elevation        :   6.50 m
Barrier elevation         :   6.50 m
Reference angle           :   0.00

Road data, segment # 2: Somerset E (day/night)
----------------------------------------------
Car traffic volume  :  4048/2024  veh/TimePeriod
Medium truck volume :   322/161   veh/TimePeriod
Heavy truck volume  :   230/115   veh/TimePeriod
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: Somerset E (day/night)
--------------------------------------------
```

```
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  46.00 / 46.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      4       (Elevated; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            : 118.30 m
Elevation                 :   6.50 m
Barrier receiver distance :   3.00 / 3.00   m
Source elevation          :   0.00 m
Receiver elevation        :   6.50 m
Barrier elevation         :   6.50 m
Reference angle           :   0.00

Results segment # 1: Somerset W (day)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.12 !         7.62

ROAD (0.00 + 38.46 + 0.00) = 38.46 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  63.71   0.00  -5.31   0.00   0.00   0.00 -19.93  38.46
------------------------------------------------------------------------------

Segment Leq : 38.46 dBA

Results segment # 2: Somerset E (day)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.08 !         7.58

ROAD (0.00 + 38.91 + 0.00) = 38.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  63.71   0.00  -4.87   0.00   0.00   0.00 -19.93  38.91
------------------------------------------------------------------------------

Segment Leq : 38.91 dBA

Total Leq All Segments: 41.70 dBA

Results segment # 1: Somerset W (night)
--------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.12 !         7.62

ROAD (0.00 + 38.46 + 0.00) = 38.46 dBA
```

```
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  63.71   0.00  -5.31   0.00   0.00   0.00 -19.93  38.46
------------------------------------------------------------------------------

Segment Leq : 38.46 dBA

Results segment # 2: Somerset E (night)
---------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.08 !         7.58

ROAD (0.00 + 38.91 + 0.00) = 38.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
------------------------------------------------------------------------------
   -90     90   0.00  63.71   0.00  -4.87   0.00   0.00   0.00 -19.93  38.91
------------------------------------------------------------------------------

Segment Leq : 38.91 dBA

Total Leq All Segments: 41.70 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 54.57
                         (NIGHT): 66.08
```

APPENDIX B

ACCOUSTIC INSULATION FACTOR TABLES

Bedrooms

TABLE 5: Acoustic Insulation Factor for Various Types of Windows

Window area as a percentage of total floor area of room[1]														Single glazing	Double glazing of indicated glass thickness					Triple Glazing	
4	5	6	8	10	13	16	20	25	32	40	50	63	80		2mm and 2mm glass	3mm and 3mm glass	4mm and 4mm glass	3mm and 6mm glass	6mm and 6mm glass	3mm, 3mm and 3mm glass	3mm, 3mm and 6mm glass
Acoustic Insulation Factor (AIF)[2]														Thickness	Interpane spacing in mm[3]					Interpane spacings in mm[5]	
35	34	33	32	31	30	29	28	27	26	25	24	23	22	2mm	6						
36	35	34	33	32	31	30	29	28	27	26	25	24	23		13						
37	36	35	34	33	32	31	30	29	28	27	26	25	24	3mm	15	6					
38	37	36	35	34	33	32	31	30	29	28	27	26	25	4mm, 6mm	18	13	6				
39	38	37	36	35	34	33	32	31	30	29	28	27	26		22	16	13	6	6	6,6	
40	39	38	37	36	35	34	33	32	31	30	29	28	27	9mm[4]	28	20	16	13	13	6,10	6,6
41	40	39	38	37	36	35	34	33	32	31	30	29	28		35	25	20	16	16	6,15	6,10
42	41	40	39	38	37	36	35	34	33	32	31	30	29	12mm[4]	42	32	25	20	20	6,20	6,15
43	42	41	40	39	38	37	36	35	34	33	32	31	30		50	40	32	25	24	6,30	6,20
44	43	42	41	40	39	38	37	36	35	34	33	32	31		63	50	40	32	30	6,40	6,30
45	44	43	42	41	40	39	38	37	36	35	34	33	32		80	63	50	40	37	6,50	6,40
46	45	44	43	42	41	40	39	38	37	36	35	34	33		100	80	63	55	50	6,65	6,50
47	46	45	44	43	42	41	40	39	38	37	36	35	34		125	100	80	75	70	6,80	6,65
48	47	46	45	44	43	42	41	40	39	38	37	36	35		150	125	100	95	90	6,100	6,80
49	48	47	46	45	44	43	42	41	40	39	38	37	36			150	125	110	100		6,100
50	49	48	47	46	45	44	43	42	41	40	39	38	37				150	135	125		

Source: National Research Council, Division of Building Research, June 1980.

Explanatory Notes:

1) Where the calculated percentage window area is not presented as a column heading, the nearest percentage column in the table values should be used.

2) AIF data listed in the table are for well-fitted weatherstripped units that can be opened. The AIF values apply only when the windows are closed. For windows fixed and sealed to the frame, add three (3) to the AIF given in the table.

3) If the interpane spacing or glass thickness for a specific double-glazed window is not listed in the table, the nearest listed values should be used.

4) The AIF ratings for 9mm and 12mm glass are for laminated glass only; for solid glass subtract two (2) from the AIF values listed in the table.

5) If the interpane spacings for a specific triple-glazed window are not listed in the table, use the listed case whose combined spacings are nearest the actual combined spacing.

6) The AIF data listed in the table are for typical windows, but details of glass mounting, window seals, etc. may result in slightly different performance for some manufacturers' products. If laboratory sound transmission loss data (conforming to ASTM test method E-90) are available, these should be used to calculate the AIF.

Bedrooms

Table 6.3 - Acoustic Insulation Factor for Various Types of Exterior Wall

	Percentage of exterior wall area to total floor area of room											Type of Exterior Wall
	16	20	25	32	40	50	63	80	100	125	160	
Acoustic Insulation Factor	39	38	37	36	35	34	33	32	31	30	29	EW1
	41	40	39	38	37	36	35	34	33	32	31	EW2
	44	43	42	41	40	39	38	37	36	35	34	EW3
	47	46	45	44	43	42	41	40	39	38	37	EW4
	48	47	46	45	44	43	42	41	40	39	38	EW1R
	49	48	47	46	45	44	43	42	41	40	39	EW2R
	50	49	48	47	46	45	44	43	42	41	40	EW3R
	55	54	53	52	51	50	49	48	47	46	45	EW5
	56	55	54	53	52	51	50	49	48	47	46	EW4R
	58	57	56	55	54	53	52	51	50	49	48	EW6 BLOCK/BRICK
	59	58	57	56	55	54	53	52	51	50	49	EW7 or EW5R BLOCK [illegible]
	63	62	61	60	59	58	57	56	55	54	53	EW8 CONCRETE

Source : National Research Council, Division of Building Research, December 1980.

Explanatory Notes :

1) Where the calculated percentage wall area is not presented as a column heading, the nearest percentage column in the table should be used.
2) The common structure of walls EW1 to EW5 is composed of 12.7 mm gypsum board, vapour barrier, and 38 x 89 mm studs with 50 mm (or thicker) mineral wool or glass fibre batts in inter-stud cavities.
3) EW1 denotes exterior wall as in Note 2), plus sheathing, plus wood siding or metal siding and fibre backer board.
   EW2 denotes exterior wall as in Note 2), plus rigid insulation (25-30 mm), and wood siding or metal siding and fibre backer board.
   EW3 denotes simulated mansard with structure as in Note 2), plus sheathing, 28 x 89 mm framing, sheathing, and asphalt roofing material.
   EW4 denotes exterior wall as in Note 2), plus sheathing and 20 mm stucco.
   EW5 denotes exterior wall as in Note 2), plus sheathing, 25 mm air space, 100 mm brick veneer.
   EW6 denotes exterior wall composed of 12.7 mm gypsum board, rigid insulation (25-50 mm), 100 mm back-up block, 100 mm face brick.
   EW7 denotes exterior wall composed of 12.7 mm gypsum board, rigid insulation (25-50 mm), 140 mm back-up block, 100 mm face brick.
   EW8 denotes exterior wall composed of 12.7 mm gypsum board, rigid insulation (25-50 mm), 200 mm concrete.
4) R signifies the mounting of the interior gypsum board on resilient clips.
5) An exterior wall conforming to rainscreen design principles and composed of 12.7 mm gypsum board, 100 mm concrete block, rigid insulation (25-50 mm), 25 mm air space, and 100 mm brick veneer has the same AIF as EW6.
6) An exterior wall described in EW1 with the addition of rigid insulation (25-50 mm) between the sheathing and the external finish has the same AIF as EW2.

Bedrooms

TABLE 11: Approximate conversion from STC to AIF for windows and doors:

Window (or door) area expressed as percentage of room floor area	Acoustic Insulation Factor (AIF)
80	STC-5
63	STC-4
50	STC-3
40	STC-2
32	STC-1
25	STC
20	STC+1
16	STC+2
12.5	STC+3
10	STC+4
8	STC+5
6.3	STC+6
5	STC+7
4	STC+8

Note: For area percentages not listed in the table use the nearest listed value.

Examples: For a window whose area = 20% of the room floor area and STC = 32 the AIF is 32 + 1 = 33.

For a window whose area = 60% of the room floor area and STC = 29 the AIF is 29 - 4 = 25.

AIF = STC - 2

AIF = 34 dBA

∴ STC = 36

Bedrooms

TABLE 12: Approximate conversion from STC to AIF for exterior walls:

Exterior wall area expressed as percentage of room floor area	Acoustic Insulation Factor (AIF)
200	STC-10
160	STC-9
125	STC-8
100	STC-7
80	STC-6
63	STC-5
50	STC-4
40	STC-3
32	STC-2
25	STC-1
20	STC
16	STC+1
12.5	STC+2
10	STC+3
8	

Note: For area percentages not listed in the table use the nearest listed value.

Example: For a wall whose area = 120% of room floor area and STC = 48 the AIF is 48 - 8 = 40.

AIF = STC + 3

AIF = 34 dBA

∴ STC = 31

Living Area

TABLE 5: Acoustic Insulation Factor for Various Types of Windows

Window area as a percentage of total floor area of room[1]														Single glazing	Double glazing of indicated glass thickness					Triple Glazing	
4	5	6	8	10	13	16	20	25	32	40	50	63	80		2mm and 2mm glass	3mm and 3mm glass	4mm and 4mm glass	3mm and 6mm glass	6mm and 6mm glass	3mm, 3mm and 3mm glass	3mm, 3mm and 6mm glass
Acoustic Insulation Factor (AIF)[2]														Thickness	Interpane spacing in mm[3]					Interpane spacings in mm[5]	
35	34	33	32	31	30	29	28	27	26	25	24	23	22	2mm	6						
36	35	34	33	32	31	30	29	28	27	26	25	24	23		13						
37	36	35	34	33	32	31	30	29	28	27	26	25	24	3mm	15	6					
38	37	36	35	34	33	32	31	30	29	28	27	26	25	4mm, 6mm	18	13	6				
39	38	37	36	35	34	33	32	31	30	29	28	27	26		22	16	13	6	6	6,6	
40	39	38	37	36	35	34	33	32	31	30	29	28	27	9mm[4]	28	20	16	13	13	6,10	6,6
41	40	39	38	37	36	35	34	33	32	31	30	29	28		35	25	20	16	16	6,15	6,10
42	41	40	39	38	37	36	35	34	33	32	31	30	29	12mm[4]	42	32	25	20	20	6,20	6,15
43	42	41	40	39	38	37	36	35	34	33	32	31	30		50	40	32	25	24	6,30	6,20
44	43	42	41	40	39	38	37	36	35	34	33	32	31		63	50	40	32	30	6,40	6,30
45	44	43	42	41	40	39	38	37	36	35	34	33	32		80	63	50	40	37	6,50	6,40
46	45	44	43	42	41	40	39	38	37	36	35	34	33		100	80	63	55	50	6,65	6,50
47	46	45	44	43	42	41	40	39	38	37	36	35	34		125	100	80	75	70	6,80	6,65
48	47	46	45	44	43	42	41	40	39	38	37	36	35		150	125	100	95	90	6,100	6,80
49	48	47	46	45	44	43	42	41	40	39	38	37	36			150	125	110	100		6,100
50	49	48	47	46	45	44	43	42	41	40	39	38	37				150	135	125		

Source: National Research Council, Division of Building Research, June 1980.

Explanatory Notes:

1) Where the calculated percentage window area is not presented as a column heading, the nearest percentage column in the table values should be used.
2) AIF data listed in the table are for well-fitted weatherstripped units that can be opened. The AIF values apply only when the windows are closed. For windows fixed and sealed to the frame, add three (3) to the AIF given in the table.
3) If the interpane spacing or glass thickness for a specific double glazed window is not listed in the table, the nearest listed values should be used.
4) The AIF ratings for 9mm and 12mm glass are for laminated glass only; for solid glass subtract two (2) from the AIF values listed in the table.
5) If the interpane spacings for a specific triple-glazed window are not listed in the table, use the listed case whose combined spacings are nearest the actual combined spacing.
6) The AIF data listed in the table are for typical windows, but details of glass mounting, window seals, etc. may result in slightly different performance for some manufacturers' products. If laboratory sound transmission loss data (conforming to ASTM test method E-90) are available, these should be used to calculate the AIF.

Living Area

Table 6.3 - Acoustic Insulation Factor for Various Types of Exterior Wall

	Percentage of exterior wall area to total floor area of room											Type of Exterior Wall
	16	20	25	32	40	50	63	80	100	125	160	
Acoustic Insulation Factor	39	38	37	36	35	34	33	32	31	30	29	EW1
	41	40	39	38	37	36	35	34	33	32	31	EW2
	44	43	42	41	40	39	38	37	36	35	34	EW3
	47	46	45	44	43	42	41	40	39	38	37	EW4
	48	47	46	45	44	43	42	41	40	39	38	EW1R
	49	48	47	46	45	44	43	42	41	40	39	EW2R
	50	49	48	47	46	45	44	43	42	41	40	EW3R
	55	54	53	52	51	50	49	48	47	46	45	EW5
	56	55	54	53	52	51	50	49	48	47	46	EW4R
	58	57	56	55	54	53	52	51	50	49	48	EW6 BLOCK/BRICK
	59	58	57	56	55	54	53	52	51	50	49	EW7 or EW5R BLOCK/
	63	62	61	60	59	58	57	56	55	54	53	EW8 CONCRETE

Source : National Research Council, Division of Building Research, December 1980.

Explanatory Notes :

1) Where the calculated percentage wall area is not presented as a column heading, the nearest percentage column in the table should be used.

2) The common structure of walls EW1 to EW5 is composed of 12.7 mm gypsum board, vapour barrier, and 38 x 89 mm studs with 50 mm (or thicker) mineral wool or glass fibre batts in inter-stud cavities.

3) EW1 denotes exterior wall as in Note 2), plus sheathing, plus wood siding or metal siding and fibre backer board.
EW2 denotes exterior wall as in Note 2), plus rigid insulation (25-30 mm), and wood siding or metal siding and fibre backer board.
EW3 denotes simulated mansard with structure as in Note 2), plus sheathing, 28 x 89 mm framing, sheathing, and asphalt roofing material.
EW4 denotes exterior wall as in Note 2), plus sheathing and 20 mm stucco.
EW5 denotes exterior wall as in Note 2), plus sheathing, 25 mm air space, 100 mm brick veneer.
EW6 denotes exterior wall composed of 12.7 mm gypsum board, rigid insulation (25-50 mm), 100 mm back-up block, 100 mm face brick.
EW7 denotes exterior wall composed of 12.7 mm gypsum board, rigid insulation (25-50 mm), 140 mm back-up block, 100 mm face brick.
EW8 denotes exterior wall composed of 12.7 mm gypsum board, rigid insulation (25-50 mm), 200 mm concrete.

4) R signifies the mounting of the interior gypsum board on resilient clips.

5) An exterior wall conforming to rainscreen design principles and composed of 12.7 mm gypsum board, 100 mm concrete block, rigid insulation (25-50 mm), 25 mm air space, and 100 mm brick veneer has the same AIF as EW6.

6) An exterior wall described in EW1 with the addition of rigid insulation (25-50 mm) between the sheathing and the external finish has the same AIF as EW2.

Living Room

TABLE 11: Approximate conversion from STC to AIF for windows and doors:

Window (or door) area expressed as percentage of room floor area	Acoustic Insulation Factor (AIF)
80	STC-5
63	STC-4
50	STC-3
40	STC-2
32	STC-1
25	STC
20	STC+1
16	STC+2
12.5	STC+3
10	STC+4
8	STC+5
6.3	STC+6
5	STC+7
4	STC+8

Note: For area percentages not listed in the table use the nearest listed value.

Examples: For a window whose area = 20% of the room floor area and STC = 32 the AIF is 32 + 1 = 33.

For a window whose area = 60% of the room floor area and STC = 29 the AIF is 29 - 4 = 25.

AIF = STC+1

AIF = 36dBA

∴ STC = 35dBA

Living Room

TABLE 12: Approximate conversion from STC to AIF for exterior walls:

Exterior wall area expressed as percentage of room floor area	Acoustic Insulation Factor (AIF)
200	STC-10
160	STC-9
125	STC-8
100	STC-7
80	STC-6
63	STC-5
50	STC-4
40	STC-3
32	STC-2
25	STC-1
20	STC
16	STC+1
12.5	STC+2
10	STC+3
8	

Note: For area percentages not listed in the table use the nearest listed value.

Example: For a wall whose area = 120% of room floor area and STC = 48 the AIF is 48 - 8 = 40.

AIF = 36dBA

AIF = STC + 3

∴ STC = 33

APPENDIX C

Correspondence

From: Pepin, Eric [Eric.Pepin@transpo.ottawa.on.ca]
Sent: January-15-13 2:12 PM
To: Justin Gauthier
Cc: Baxter, Emily
Subject: RE: 1040 Somerset Street West

Follow Up Flag: Follow up
Flag Status: Completed

Good afternoon Justin,
Please find below our response relating to your request:

1. Is there a whistle/bell (frequency, location, etc.):
   1. The vehicle sounds a bell when approaching and leaving a station.
   2. There is a warning bell at the Brookfield pedestrian grade crossing. The grade crossing emergency warning device sounds a bell, there is not engine bell or whistle sounded at this crossing.
   3. An engine bell is sounded by a train that is passing another movement (train, track units) that is standing on an adjacent track.
2. Are the trains diesel, electric, etc.:
   1. Diesel.
3. What is the train speed (incl. max.):
   1. 85 km/hr
4. Trains frequency:
   1. Current frequency: at a maximum of 141 one-way daily trips. Among those trips, 128 of the trips occur during the daytime hours between 07:00 and 23:00 and 13 occur during the nighttime hours between 23:00 and 07:00.
   2. New frequency: The new schedule has not yet been determined, however, the following should help: approximately 7 services each way providing vehicles 14 pass bys per hour. During the weekdays and Saturdays, there will be approximately 113 trips in each direction during the 16 hour day-time period between 07:00 and 23:00 (i.e. a total of 226 vehicles pass bys during week day and Saturday daytime hours of 07:00 to 23:00). During weekdays and Saturday night periods of 8hours between 23:00 and 7:00 there would be 11 trips in each direction providing a total of 22 trips.
5. Locomotives per train (engines):
   1. Two engines per train; each car contains an engine.
6. Cars per train:
   1. Two cars per train.
7. Type of rail (welded or not):
   1. Continuous welded rail.

Additional information:
There will be an O-Train Service Shutdown from April 27, 2013 until August 30, 2013.
A new passing siding will be constructed between Gladstone and Somerset and one in the Brookfield area.

Please let me know if you require further information.

Regards,

Eric Pépin | **Project Manager** | **Gestionnaire de projets**
Rail Implementation Office | **Bureau de mise en oeuvre du réseau ferroviaire**
Planning and Infrastructure | **Urbanisme et infrastructure**

City of Ottawa | Ville d'Ottawa
tel/tél. : 613-580-2424, ext./poste 22645
www.ottawalightrail.ca
Please consider the impact on the environment before printing.

From: Justin Gauthier [mailto:j.gauthier@novatech-eng.com]
Sent: January 04, 2013 9:38 AM
To: Pepin, Eric
Subject: 1040 Somerset Street West

Hi Eric,

Following our conversation, here is the information we discussed quickly that we would require to complete our noise control study for the proposed residential development at 1040 Somerset Street West (corner of Somerset St W/Breezehill Ave N, along track corridor):

- Is there a whistle/bell (frequency, location, etc.),
- Are the trains diesel, electric, etc.,
- What is the train speed (incl. max.),
- Trains frequency,
- Locomotives per train (engines),
- Cars per train
- Type of rail (welded or not).

If you could also confirm the various upcoming downtimes/changes (twinning/new equip/etc.) as well as the hours of operation. Any other information you have that you believe might be helpful would also be appreciated. Thanks in advance and don't hesitate to call me to discuss anything further.

Regards,

Justin Gauthier, B.A.Sc.
EIT

Novatech Engineering Consultants Ltd.
Suite 200, 240 Michael Cowpland Drive
Kanata, Ontario, Canada, K2M 1P6
Phone: 613.254.9643 x217
Fax: 613.254.5867
Email: j.gauthier@novatech-eng.com
Website: www.novatech-eng.com

From: Pepin, Eric [Eric.Pepin@transpo.ottawa.on.ca]
Sent: January-21-13 1:08 PM
To: Justin Gauthier
Subject: FW: OTRN- Vehicle Bells

Follow Up Flag: Follow up
Flag Status: Completed

Justin,
Please find information below as requested.
Also as requested, both engines are running when the Train is in movement.
Regards,

Eric Pépin | Project Manager | Gestionnaire de projets
Rail Implementation Office | Bureau de mise en oeuvre du réseau ferroviaire
Planning and Infrastructure | Urbanisme et infrastructure
City of Ottawa | Ville d'Ottawa
tel/tél. : 613-580-2424, ext./poste 22645
www.ottawalightrail.ca

From: Morrison, Kenneth
Sent: January 21, 2013 12:52 PM
To: Pepin, Eric
Cc: Steen, Brian; Peter W. Fedun
Subject: RE: OTRN- Vehicle Bells

Hi Eric,

There are not any set protocols for the sounding of engine bells when approaching a station.

Section 13(a) of the Canadian Rail Operating Rules states:
The engine bell must be rung when:
(i) an engine is about to move, except when switching requires frequent stopping and starting after the initial move;
(ii) passing any movement standing on an adjacent track;
(iii) approaching, passing or moving about station facilities or shop track areas;

The O-Train superintendent has indicated that the O-Train operators will commence sounding three engine bells from a distance of approximately 50m when approaching a station. The O-Train operators will sound 4-5 bells when leaving a station, which takes approximately 5-7 seconds.

Regards,
Ken

From: Pepin, Eric
Sent: January 21, 2013 9:08 AM
To: Morrison, Kenneth
Cc: Steen, Brian; Peter W. Fedun
Subject: OTRN- Vehicle Bells

Hello Ken.

We would require some information relating to the sounding of the bells when approaching a station:

01- At what distance from the station does the train have to sound the bell;

02- How long does the bell have to sound when a train is the leaving the station.

Thank you for your help.

Eric Pépin | **Project Manager** | **Gestionnaire de projets**
Rail Implementation Office | Bureau de mise en oeuvre du réseau ferroviaire
Planning and Infrastructure | Urbanisme et infrastructure
City of Ottawa | Ville d'Ottawa
tel/tél. : 613-580-2424, ext./poste 22645
www.ottawalightrail.ca

From: Rob Cadeau [rcadeau@architectsalliance.com]
Sent: March-19-13 5:22 PM
To: Justin Gauthier
Subject: Re: 1040 Somerset St Ottawa

Follow Up Flag: Follow up
Flag Status: Completed

Hi Justin,

Thanks for the drawings, thats great.

For the windows, assume the following.

In all cases the window spans the full width of the unit. Vertically the floor to ceiling clear height is 9', the window will span 8' with a continuous horizontal insulated spandrel across the top that drops 12" down from the underside of slab. Across the unit face, the bedroom width will be 3300, with the width of the living room face being the remainder. When you have a 2 bedroom unit, the corner will be where the living/ dining area is and the bedrooms are split to either side, again with a width of 3300 across the face of the glass, the living room being the remaining corner glazing wall. The living/ dining / kitchen will extend the full depth of the unit with the living area occupying the first 3000 depth of this. When the living dining is at a corner in a two bedroom unit, the living room will occupy the corner at approx 3000 x 3000 with the dining area being the remainder back to the bedroom wall.

In the podium there are some skinnier 1 bedrooms, in these assume the bedroom will be a 2800 width minima and the living room being the remainder of the width. You will notice also 2 storey duplex units at the south end of the podium surrounding a courtyard. These will have the bedroom on the second level across the full width and the living room across the full width of the lower level.

Hope this answers your question, call if you need to discuss.

Rob Cadeau B Arch, OAA, MRAIC
Associate

architectsAlliance
317 Adelaide St. W. | 2nd Fl. | Toronto ON | M5V 1P9 | 416 593 6500 x 244

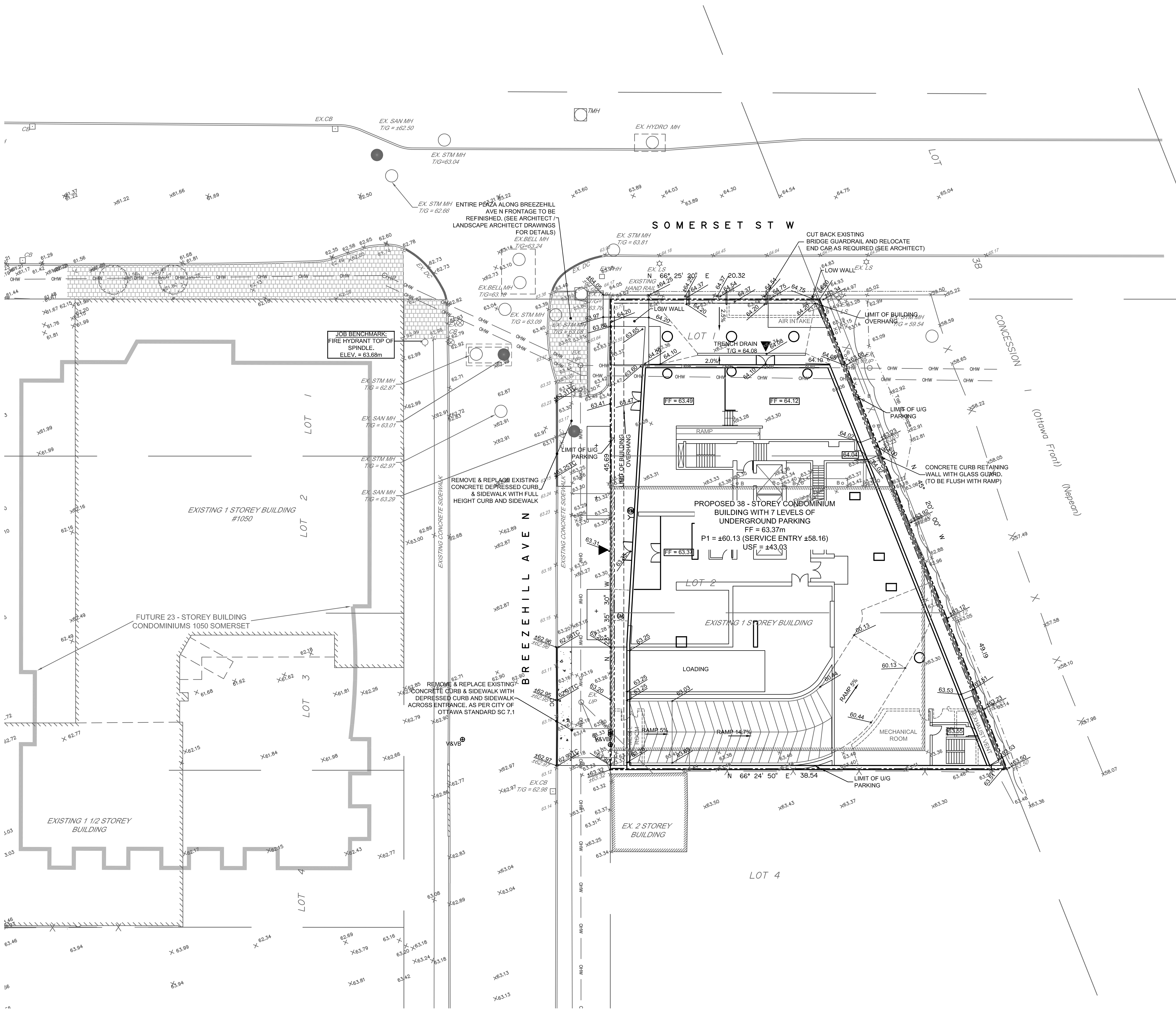
On 2013-03-19, at 3:39 PM, Justin Gauthier <j.gauthier@novatech-eng.com> wrote:

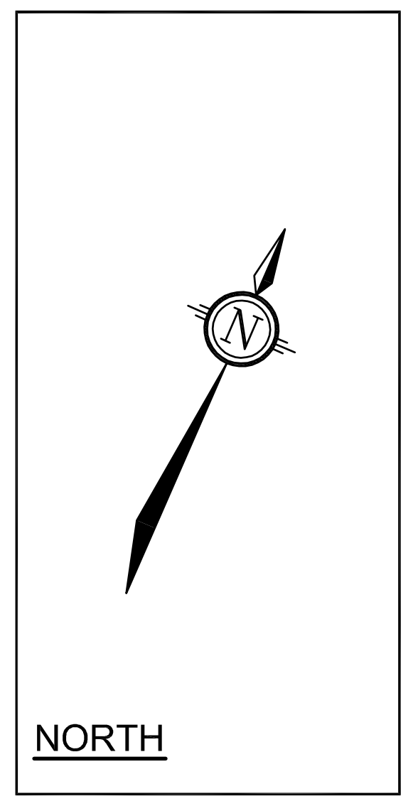
Hi Rob,

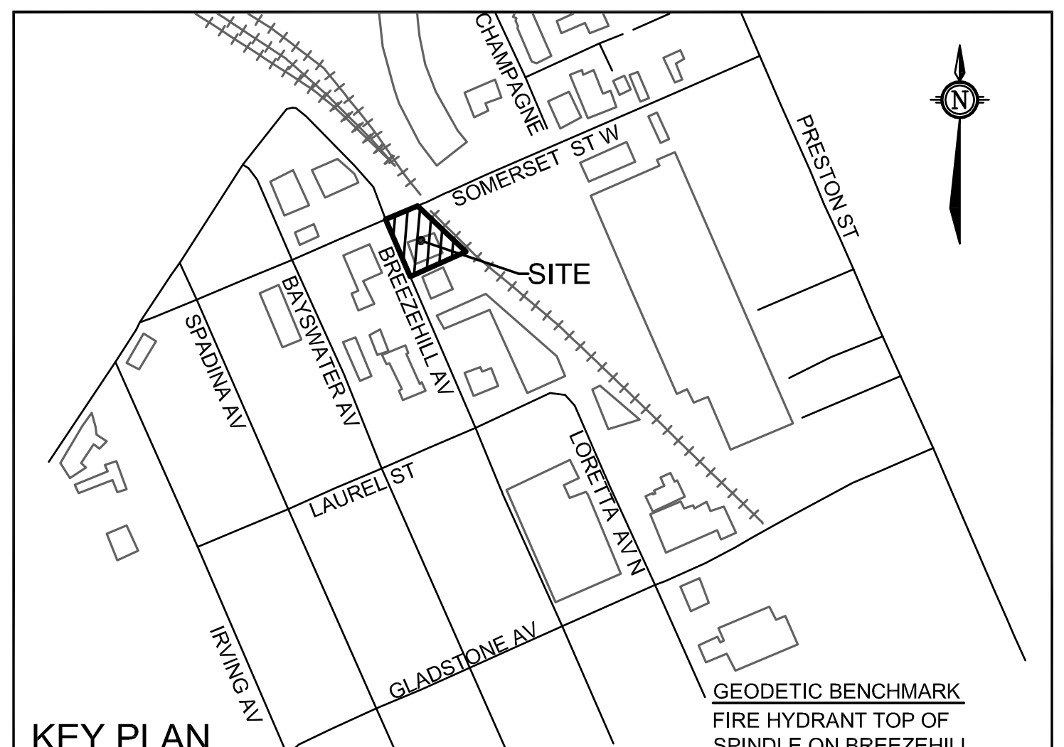
Following our discussion, if you could please send me the unit/window(glazing) assumptions for our NCS today it would be greatly appreciated. Also, I did send two (2) emails to the team with both CAD/PDF of our latest drawings for coordination.

Regards,

Justin Gauthier, B.A.Sc.
EIT







GEODETIC BENCHMARK
FIRE HYDRANT TOP OF
SPINDLE ON BREEZEHILL
AVE. ELEV. = 63.68m

GENERAL NOTES:

1) COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.

2) DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.

3) OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA BEFORE COMMENCING CONSTRUCTION.

4) BEFORE COMMENCING CONSTRUCTION OBTAIN AND PROVIDE PROOF OF COMPREHENSIVE, ALL RISK AND OPERATIONAL LIABILITY INSURANCE FOR $5,000,000.00. INSURANCE POLICY TO NAME OWNERS, ENGINEERS AND ARCHITECTS AS CO-INSURED.

5) RESTORE ALL DISTURBED AREAS ON-SITE AND OFF-SITE, INCLUDING TRENCHES AND SURFACES ON PUBLIC ROAD ALLOWANCES TO EXISTING CONDITIONS OR BETTER TO THE SATISFACTION OF THE CITY OF OTTAWA AND ENGINEER.

6) REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL, ORGANIC MATERIAL AND DEBRIS UNLESS OTHERWISE INSTRUCTED BY ENGINEER. EXCAVATE AND REMOVE FROM SITE ANY CONTAMINATED MATERIAL. ALL CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.

7) ALL ELEVATIONS ARE GEODETIC.

8) REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARDSURFACE AREAS AND DIMENSIONS.

9) REFER TO STORMWATER MANAGEMENT REPORT(R-2013-004, DATED JAN. 31, 2013) AND SERVICING DESIGN BRIEF (R-2013-003, DATED JAN. 31, 2013) PREPARED BY NOVATECH ENGINEERING CONSULTANTS LTD.

10) SAW CUT AND KEY GRIND ASPHALT AT ALL ROAD CUTS AND ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).

11) PROVIDE LINE/PARKING PAINTING.

12) CONTRACTOR TO PROVIDE THE CONSULTANT WITH A GRADING PLAN INDICATING THE AS-BUILT ELEVATION OF EVERY DESIGN GRADE ON THIS PLAN.

13) REFER TO GEOTECHNICAL REPORT (No. PG 2674-1, DATED MAY 21, 2012) PREPARED BY PATERSON GROUP FOR SUBSURFACE CONDITIONS, CONSTRUCTION RECOMMENDATIONS, AND GEOTECHNICAL INSPECTION REQUIREMENTS . THE GEOTECHNICAL CONSULTANT IS TO REVIEW ON-SITE CONDITIONS AFTER EXCAVATION PRIOR TO PLACEMENT OF THE GRANULAR MATERIAL.

14) ALL MATERIALS AND CONSTRUCTION METHODS SHALL BE IN ACCORDANCE WITH THE CITY OF OTTAWA STANDARDS AND SPECIFICATIONS AND ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS. ONTARIO PROVINCIAL STANDARDS WILL APPLY WHERE NO CITY STANDARDS ARE AVAILABLE.

15) ALL PRIVATE APPROACHES MUST BE CONSTRUCTED AS PER CITY SPECIFICATION SC13.

GRADING NOTES:

1) ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED PAVED AREAS.

2) EXPOSED SUBGRADES IN PROPOSED PAVED AREAS SHOULD BE PROOF ROLLED WITH A LARGE STEEL DRUM ROLLER AND INSPECTED BY THE GEOTECHNICAL CONSULTANT.

3) ANY SOFT AREAS EVIDENT FROM THE PROOF ROLLING SHOULD BE SUBEXCAVATED AND REPLACED WITH SUITABLE MATERIAL THAT IS FROST COMPATIBLE WITH THE EXISTING SOILS.

4) THE GRANULAR BASE SHOULD BE COMPACTED TO AT LEAST 100 % OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE. ANY ADDITIONAL GRANULAR FILL USED BELOW THE PROPOSED PAVEMENT SHOULD BE COMPACTED TO AT LEAST 95 % OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE.

5) GRADE AND/OR FILL BEHIND PROPOSED CURB AND BETWEEN BUILDINGS AND CURBS, WHERE REQUIRED TO PROVIDE POSITIVE DRAINAGE.

6) MINIMUM OF 2% GRADE FOR ALL GRASS AREAS UNLESS OTHERWISE NOTED.

7) ALL GRADES BY CURBS ARE EDGE OF PAVEMENT GRADES UNLESS OTHERWISE INDICATED.

8) ALL CURBS SHALL BE BARRIER CURB (150mm) UNLESS OTHERWISE NOTED AND CONSTRUCTED AS PER CITY OF OTTAWA STANDARDS (SC1.1).

9) REFER TO LANDSCAPE PLAN FOR PLANTING AND OTHER LANDSCAPE FEATURE DETAILS.

EROSION AND SEDIMENT CONTROL NOTES :

1) ALL EROSION AND SEDIMENT CONTROLS ARE TO BE INSTALLED TO THE SATISFACTION OF THE ENGINEER AND THE CITY OF OTTAWA. THEY ARE TO BE APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION. THESE PRACTICES ARE TO BE IMPLEMENTED IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL AND SHOULD INCLUDE AS A MINIMUM THOSE MEASURES INDICATED ON THE PLAN.

2) TO PREVENT SURFACE EROSION FROM ENTERING THE DITCH OR STORM SYSTEM DURING CONSTRUCTION, FILTER CLOTH WILL BE PLACED UNDER GRATES OF CATCHBASINS AND STRUCTURES. A LIGHT DUTY SILT FENCE BARRIER WILL ALSO BE INSTALLED ALONG THE PROPERTY LINES. THESE CONTROL MEASURES WILL REMAIN IN PLACE UNTIL VEGETATION HAS BEEN ESTABLISHED AND CONSTRUCTION IS COMPLETE.

3) THE SEDIMENT CONTROL MEASURES SHALL ONLY BE REMOVED WHEN, IN THE OPINION OF THE ENGINEER, THE MEASURES ARE NO LONGER REQUIRED. NO CONTROL MEASURES MAY BE PERMANENTLY REMOVED WITHOUT PRIOR AUTHORIZATION FROM THE ENGINEER.

4) THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ACCIDENTAL DISCHARGES OF SEDIMENT MATERIAL INTO ANY DITCH OR STORM SEWER SYSTEM. APPROPRIATE RESPONSE MEASURES, INCLUDING ANY REPAIRS TO EXISTING CONTROL MEASURES OR THE IMPLEMENTATION OF ADDITIONAL CONTROL MEASURES, SHALL BE CARRIED OUT BY THE CONTRACTOR WITHOUT DELAY.

5) THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.

6) ROADWAYS ARE TO BE SWEPT AS REQUIRED OR AS DIRECTED BY THE ENGINEER AND/OR MUNICIPALITY.

7) THE CONTRACTOR SHALL ENSURE PROPER DUST CONTROL IS PROVIDED WITH THE APPLICATION OF WATER (AND IF REQUIRED, CALCIUM CHLORIDE) DURING DRY PERIODS.

LEGEND

62.99	PROPOSED ELEVATION
62.97x	*EXISTING ELEVATION*
62.97x	*EXISTING TOP OF CURB ELEVATION*
62.99TC	PROPOSED TOP OF CURB ELEVATION
5.0% →	PROPOSED SLOPE
DC	PROPOSED DEPRESSED CURB
═ ═ ═	PROPOSED LIMIT OF UNDERGROUND PARKING
— — —	PROPOSED LIMIT OF BUILDING OVERHANG
— - —	BOUNDARY LINE
V&VB ⊗	PROPOSED WATER VALVE LOCATION
DC	*EXISTING DEPRESSED CURB*
▲	*EXISTING HYDRO TRANSFORMER*
B●	*EXISTING BOLLARD*
SP ⊗	*EXISTING WATER STANDPIPE*
EX. LS ☼	*EXISTING LAMP STANDARD*
EX. UP ○	*EXISTING UTILITY POLE*
T/V	*EXISTING TOP OF VALVE*
T/G	*EXISTING TOP OF GRATE*
□	*EXISTING CATCH BASIN*
-○-	*EXISTING FIRE HYDRANT*
SANMH ●	*EXISTING SANITARY MANHOLE*
STMMH ○	*EXISTING STORM MANHOLE*
EX. V&VB ⊗	*EXISTING VALVE & VALVE BOX*
— OHW —	*EXISTING OVERHEAD WIRES*
✺	*EXISTING TREES / VEGETATION*
═	*EXISTING CURB*
EX UP ●—)	*EXISTING UTILITY POLE C/W GUY WIRES*
—x—x—x—	*EXISTING FENCE*

PAVEMENT STRUCTURE:

PARKING AREAS: (RIGID PAVEMENT)	125mm CONC SLAB 150mm 20mm CLEAR STONE
ACCESS LANES:	40mm HL3 - SUPERPAVE 12.5 50mm HL8 - SUPERPAVE 19.0 150mm GRANULAR 'A' 400mm GRANULAR 'B'

* REFER TO GEOTECH REPORT

M:\2012\112191\CAD\Design\112191-GR.dwg, PLANS-B1, Apr 03, 2013 - 9:39am, jgauthier

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

CLARIDGE HOMES

CLARIDGE HOMES
SUITE 2001,
210 GLADSTONE AVENUE,
OTTAWA , ONTARIO
K2P 0Y6.

NOTE:
CONTRACTOR TO CONFIRM ELEVATIONS OF INFRASTRUCTURE IN THE STREET PRIOR TO EXTENDING SERVICES INTO THE SITE AND SHALL NOTIFY ENGINEER OF ANY DISCREPANCIES IMMEDIATELY.

No.	REVISION	DATE	BY
01.	ISSUED WITH SITE PLAN APPLICATION	JAN 31/13	GJM

SCALE
1:200
1:200
0 2 4 6 8

DESIGN JAG
CHECKED GJM
DRAWN MTM
CHECKED JAG
APPROVED GJM

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
G.J. MacDONALD
2013/04/03
PROVINCE OF ONTARIO

NOVATECH
ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

LOCATION
CITY OF OTTAWA
1040 SOMERSET STREET WEST

DRAWING NAME
GRADING AND EROSION SEDIMENT CONTROL PLAN

PROJECT No. 112191-01
REV REV # 01
DRAWING No. 112191-GR

PLANB1.DWG - 1000mmx707mm

APPENDIX D

Proximity Assessment:

PG2674-LET.01 dated November 30, 2020

patersongroup

Consulting Engineers

154 Colonnade Road South
Ottawa, Ontario
Canada, K2E 7J5
Tel: (613) 226-7381
Fax: (613) 226-6344

Geotechnical Engineering
Environmental Engineering
Hydrogeology
Geological Engineering
Materials Testing
Building Science
Archaeological Services

www.patersongroup.ca

November 30, 2020
Report: PG2674-LET.01

Claridge Homes
210 Gladstone Avenue
Ottawa, Ontario
K2P 0Y6

Attention: **Mr. Shawn Malhotra**

Subject: **Proximity Assessment**
Proposed Multi-Storey Building
1040 Somerset Street West - Ottawa

Dear Sir,

Further to your request and authorization, Paterson Group (Paterson) prepared the current letter report to summarize construction issues which could occur due to the proximity of the proposed development with respect to the subject alignment of the Trillium Line located adjacent to the site. The following letter should be read in conjunction with Paterson Group Report PG2674-3 dated November 30, 2020.

1.0 Background Information

Based on current plans, it is understood that the proposed development will consist of a multi-storey building. The proposed building will have 7 to 9 levels of underground parking which will occupy the majority of the site.

The following sections summarize our existing soils information and construction precautions for the proposed development, which may impact the subject alignment of the Trillium Line.

It should be noted that the information submitted as part of the current Proximity Study will be supplemented with construction plans issued for construction, such as dewatering and discharge plans.

2.0 Subsurface Conditions

Based on existing geotechnical information, the subsurface conditions in the immediate area of the subject site and subject Trillium Line alignment consist of the following:

- ❏ Existing surface grade is at an elevation of approximately 63 m in the location of the proposed building, descending to the east of the site to approximate geodetic elevation 58 m in the location of the Trillium Line.
- ❏ The overburden thickness is approximately 13.7 m.
- ❏ Bedrock surface elevation is at approximately geodetic elevation 49.5 m.
- ❏ The bedrock underlying the site consists of limestone with interbedded shale seams which is generally of good to excellent quality. Unconfined compressive strengths of similar limestone bedrock formations typically exceed 80 MPa.

Trillium Line Location

Available drawings indicate that the Trillium Line is located approximately 10 m from the property line at the subject site. The top of rail (TOR) is anticipated to be located at approximate elevation 58 m (geodetic) adjacent to the proposed development site. The founding elevation of the proposed building adjacent to the rail line extends below the rail. However, the Trillium Line railway is not located within the building's lateral support zone, and will not be adversely affected. Further, the proposed building is not located within the rail line's lateral support zone, and will not impose any additional lateral load on the building.

3.0 Construction Precautions and Recommendations

Influence of Proposed Development on Trillium Line

Based on existing soils information and building design details, the footings of the proposed building will be founded on good quality bedrock. Based on the approximate distance of 10 m between the proposed building and the Trillium Line railway, no lateral loads from the proposed building will be transferred to the railway and the Trillium Line will not be undermined.

Excavation and Temporary Shoring

The overburden along the perimeter of the proposed building footprint will need to be shored in order to complete the construction of the underground parking levels. Bedrock removal is also anticipated, which will be completed by line drilling, blasting and/or hoe ramming. The blasting and hoe ramming will be carried out by a contractor specializing in bedrock removal.

It is anticipated that the temporary shoring system adjacent to the Trillium Line corridor will consist of soldier piles and lagging or steel sheet piles designed for at-rest earth pressures, using a pressure coefficient of K_0=0.5 as per the geotechnical design recommendations outlined in Paterson Group Report PG2674-2 dated November 30, 2020.

The geotechnical engineer will review the stability of the rock face underlying the overburden. Following the review of the rock face, the geotechnical engineer will determine if rock reinforcement is required, and if so, the extent to which rock reinforcement is required. This determination will include consideration for the Trillium Line.

A seismograph would be installed on the eastern site boundary, adjacent to the Trillium Line corridor, to monitor vibrations during the bedrock removal program. A program detailing trigger levels and action levels is provided in Section 3.1 of the Paterson Group Report PG2674-3 dated November 30, 2020.

Pre-Construction Survey

A pre-construction survey will be required for the Trillium Line. Any existing structures in the immediate area of the proposed building will also undergo a pre-construction survey as per standard construction practices, where bedrock blasting will be required.

Groundwater Control

Groundwater observations during the recent geotechnical investigation indicated groundwater levels at an approximate depth of 7.8 m below the existing ground surface and within the silty clay layer. The design of the temporary shoring system and dewatering plans for the site will take into consideration the adjacent Trillium Line railway. These plans will be forwarded once they are available.

4.0 Conclusions and Recommendations

Based on the currently available information for the subject alignment of the proposed building and the existing subsurface information, the proposed building will not negatively impact the existing Trillium Line. It should be noted that the information submitted as part of the current Proximity Study will be supplemented with construction plans issued for construction, dewatering and discharge plans, and field monitoring program as described in the application conditions.

We trust that this information satisfies your immediate request.

Best Regards,

Paterson Group Inc.

Patey

Nicole R. Patey, EIT

LICENSED PROFESSIONAL ENGINEER
Nov. 30, 2020
S. S. DENNIS
100519516
Scott Dennis
PROVINCE OF ONTARIO

Scott Dennis

Scott S. Dennis, P.Eng.