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March 3, 2022

200543

Developpements Proximi-T Inc.
3500 Atwater, Suite 6
Montreal, Quebec
K3H 1Y5

TECHNICAL MEMORANDUM – GLOBAL STABILITY OF RETAINING WALLS

Re: RESPONSE TO CITY OF OTTAWA'S REVIEW COMMENTS - D07-12-21-0094
DATED OCTOBER 15, 2021 - ENGINEERING COMMENTS
SITE PLAN CONTROL APPLICATION
971 MONTREAL ROAD
OTTAWA, ONTARIO

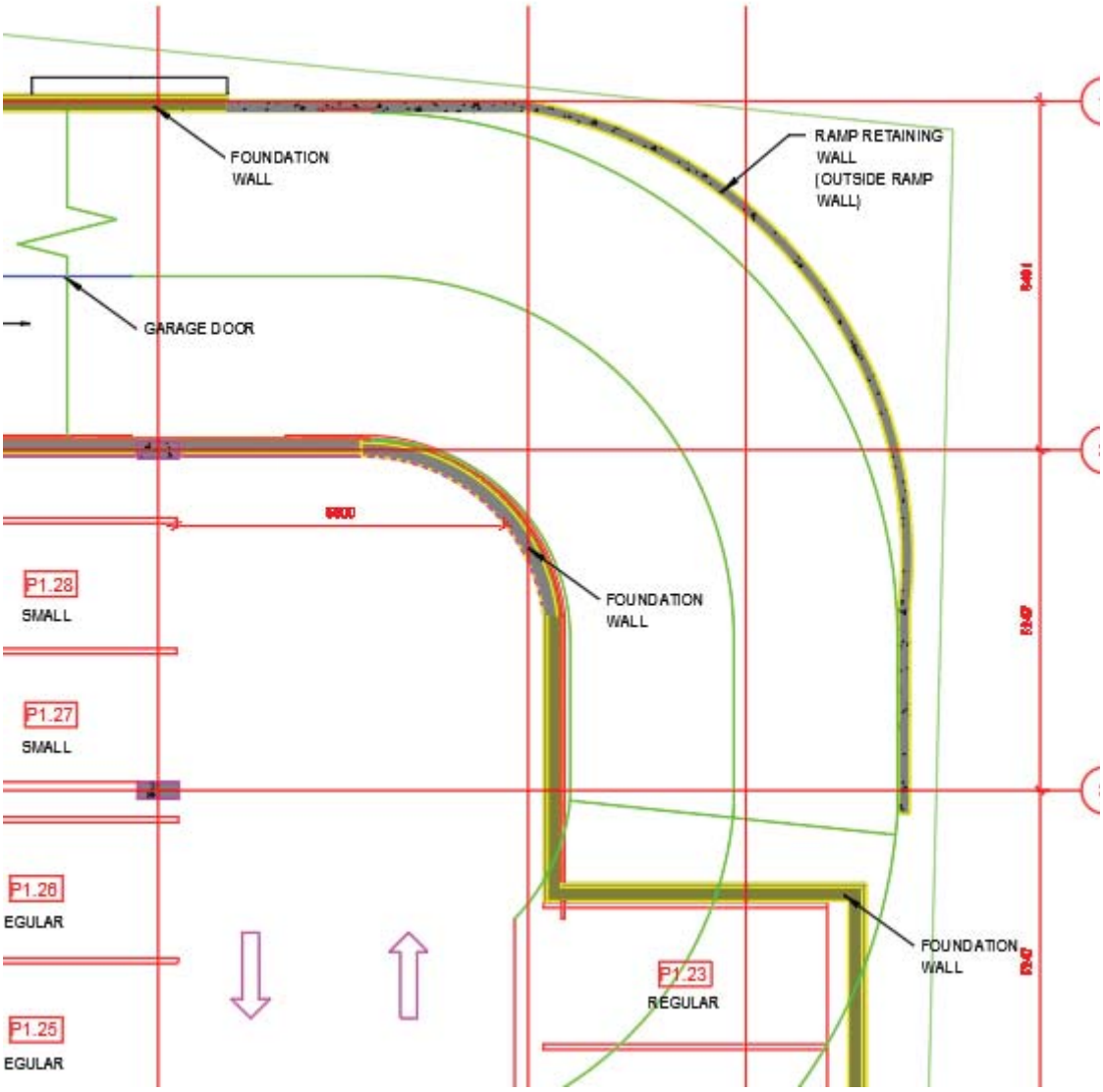
This geotechnical memorandum provides an assessment of the global stability of various retaining walls at the site in response to the City of Ottawa's comment copied below.

6. The underground parking garage walls are considered retaining walls (regardless if it forms part of the building) and are over 1m in exposed height and holding back adjacent lands. As per City of Ottawa Slope Stability Guidelines for Development Applications an engineering report is required to be prepared by a qualified engineer for any retaining walls 1m or greater in height that address the global stability of the wall. An Internal Compound Stability (ICS) analysis from a professional Geotechnical Engineer/ Structural Engineer licensed in the Province of Ontario is required to check for global stability. The report shall provide structural details of the retaining wall. The retaining wall design is required prior to planning approval not at the time of building permit application submission.

The proposed grading plan have been attached following the text of this response. Figure 1 on the following page provides an illustration of the foundation walls in proximity to the underground parking garage ramp.

For the purposes of this response, the ramp retaining wall located on the left side when facing down the ramp will be referred to as the inside ramp wall. The ramp retaining wall on the right side when facing down the ramp will be referred to as the outside ramp wall.

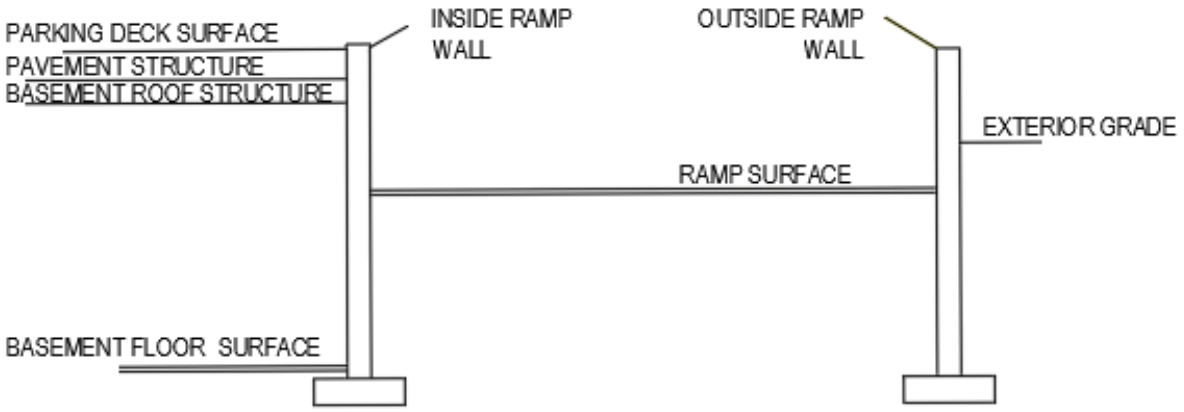
Figure 1 – Basement Foundation Sketch



A review of the proposed grading plan and basement plan indicates that:

- The inside ramp wall varies in height from 0 metres to 2.5 metres.
- The inside ramp wall is directly above the basement foundation wall.
- The outside ramp wall varies in height from 0 metres to 2.5 metres.
- As section through the ramp retaining walls is illustrated in Figure 2.

Figure 2 – Section Through Ramp

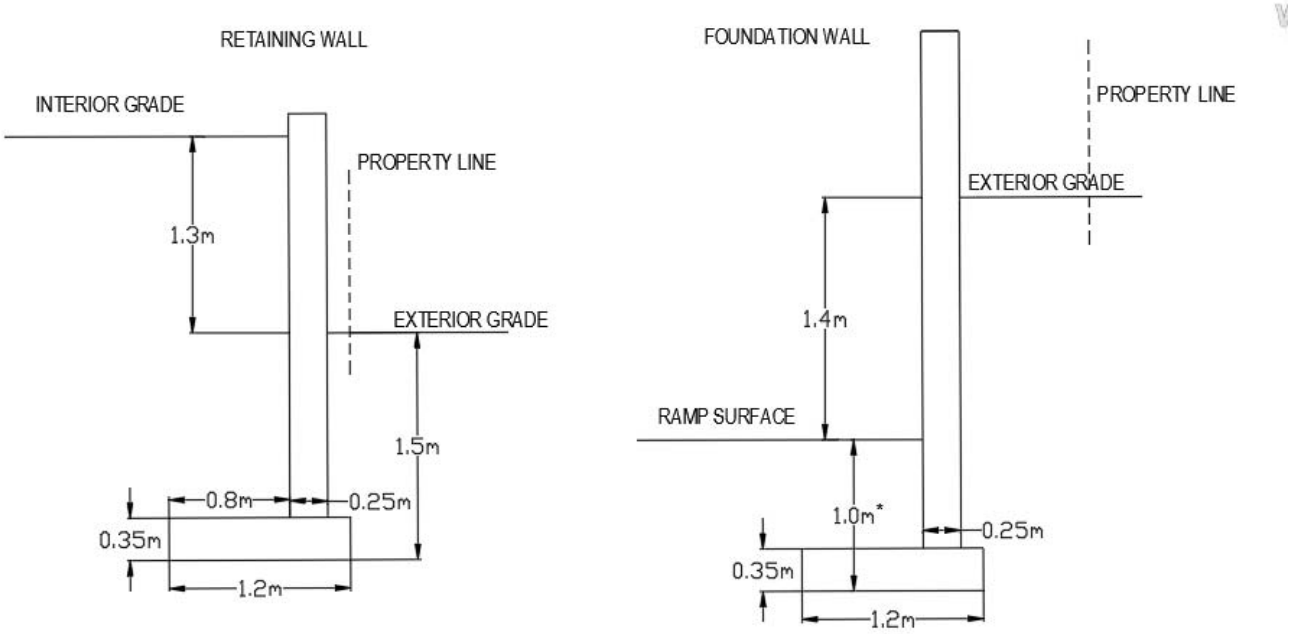


- The outside ramp wall ties into the building foundation about 3.5 metres from the basement garage door opening. The ramp elevation at this location is about 104.0 metres
    - The outside ramp wall projects above the height of the ramp surface by between 0.1 and 1.9 metres.
    - The outside ramp wall projects above the grade along the outside of the wall by between 0.5 and 1.1 metres.
    - The resulting difference in soil height between the ramp surface and the exterior grade varies between 0.37 to -0.77 m.

- Based on the differences in elevation between the ramp surface and exterior grade as was as the structure of the ramp, there are no sections of the ramp walls that have retained soil exceeding 1.0 metres.
- There is a difference in elevation between the surface of the ramp and the exterior grade along the portion of the basement foundation wall that projects to the outside ramp wall of between 0.77 and 1.4 metres. Global stability for this portion of the foundation will be considered in the Geotechnical Memorandum included with this response.
- There is a difference in elevation between the surface of the ramp and the exterior grade along the portion of the basement foundation wall that projects to the outside ramp wall of between 0.77 and 1.4 metres. Global stability for this portion of the foundation will be considered in the Geotechnical Memorandum included with this response.
- From section AA of the Grading Plan, the retaining wall along the west side of the building will be extended from the west foundation wall. This retaining wall will support a thickness of soil equal to about 0.5 metres. Since 0.5 metres is much less than 1.0 metres, no global stability assessment is required for this retaining wall.
- The retaining wall north of the building (including a short return section along the west property line before the building) will retain between 1.1 and 1.3 metres. Global stability for this portion retaining wall will be considered in the Geotechnical Memorandum included with this response.

The retaining and foundation sections assessed are illustrated in the following Figure 3. It is considered that the retaining walls will be constructed of cast in place concrete and will be designed by a structural engineer.

Figure 3 – Sketch of Retaining Wall and Foundation Wall Sections



*It is considered that bedrock will likely be encountered at approximately 1 m below the ramp surface at this location. The 1.0m distance may vary with the bedrock surface elevation.

The internal stability of the retaining walls was assessed considering the minimum factors of safety as indicated below. Earth pressures were assessed using the Coulomb Theory of earth pressure. Seismic earth pressure was considered using the Mononobe Okabe Eqations for earth pressure. Activating and Resisting forces were assessed by means of an excel spreadsheet.

Minimum Factor Of Safety	Static	Seismic
Sliding (Base / Internal)	1.5	1.13
Overturning	2.0	1.5
Global Stability	1.5*	1.1

*As per City of Ottawa Slope Stability Guidelines for Development Applications.

The boreholes indicate that the subsurface conditions consist of fill or glacial till over bedrock. The retained soil will likely consist of compacted fill material. The soil parameters used to complete the global stability assessment for the retaining walls are as follows:

*Fill Material**
Effective cohesion – 1 kPa
Angle of effective internal friction – 33 degrees
Unit weight – 21.0 kN
Compacted Granular
Effective cohesion – 0 kPa
Angle of effective internal friction – 38 degrees
Unit weight – 22.0 kN

* Fill Material to consist of native glacial till, or imported sand and gravel compacted to a minimum of 95% SPMDD.

From OBC SB-1: Table 1.2 the PGA for Ottawa (Orleans) = 0.304.
Horizontal Seismic Coefficient:
$k_h = 0.5 * PGA$
$k_h = 0.15$

The stability analyses were completed using an Excel Spreadsheet. The Analyses produced the following results:

	Retaining Wall		Foundation Wall	
Calculated Factor Of Safety	Static	Seismic	Static	Seismic
Sliding (Base / Internal)	3.18	2.47	2.73	2.12
Overturning	2.34	1.82	2.49	1.93

Since the above calculated factors of safety are well in excess of the minimum factors of safety, the retaining wall is considered to be internally stable.

The Global stability assessment for both the retaining wall and the foundation wall sections was completed using GeoStudio: Slope/W (2019 R2) slope stability software. The results of the analysis are provided on the attached slope stability sheets.

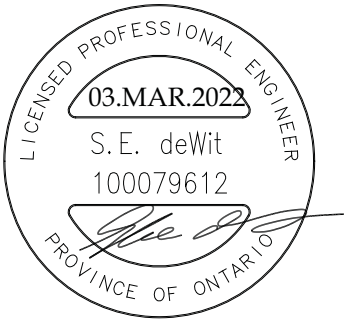
From the analysis, as summarized on the attached slope stability figures, the minimum factor of safety for the retaining wall from a Global Stability perspective under static conditions is FS = 2.99 and under seismic conditions FS = 1.92. The minimum factor of safety for the foundation wall from a Global Stability perspective under static conditions is FS = 2.62 and under seismic conditions FS = 1.69. The attached figures below show the minimum factors of safety for the above conditions (static and seismic) as well as the critical surface. The minimum factor of safety for a stable slope under static conditions is FS = 1.5. The minimum factor of safety for a stable slope under seismic conditions is FS = 1.1.

Based on the assessment of the global stability of the proposed retaining wall and foundation wall, as well as the results of the analyses for sliding and overturning, it is the professional opinion of the

undersigned geotechnical engineer that the proposed retaining wall and foundation wall will be stable in the long term.

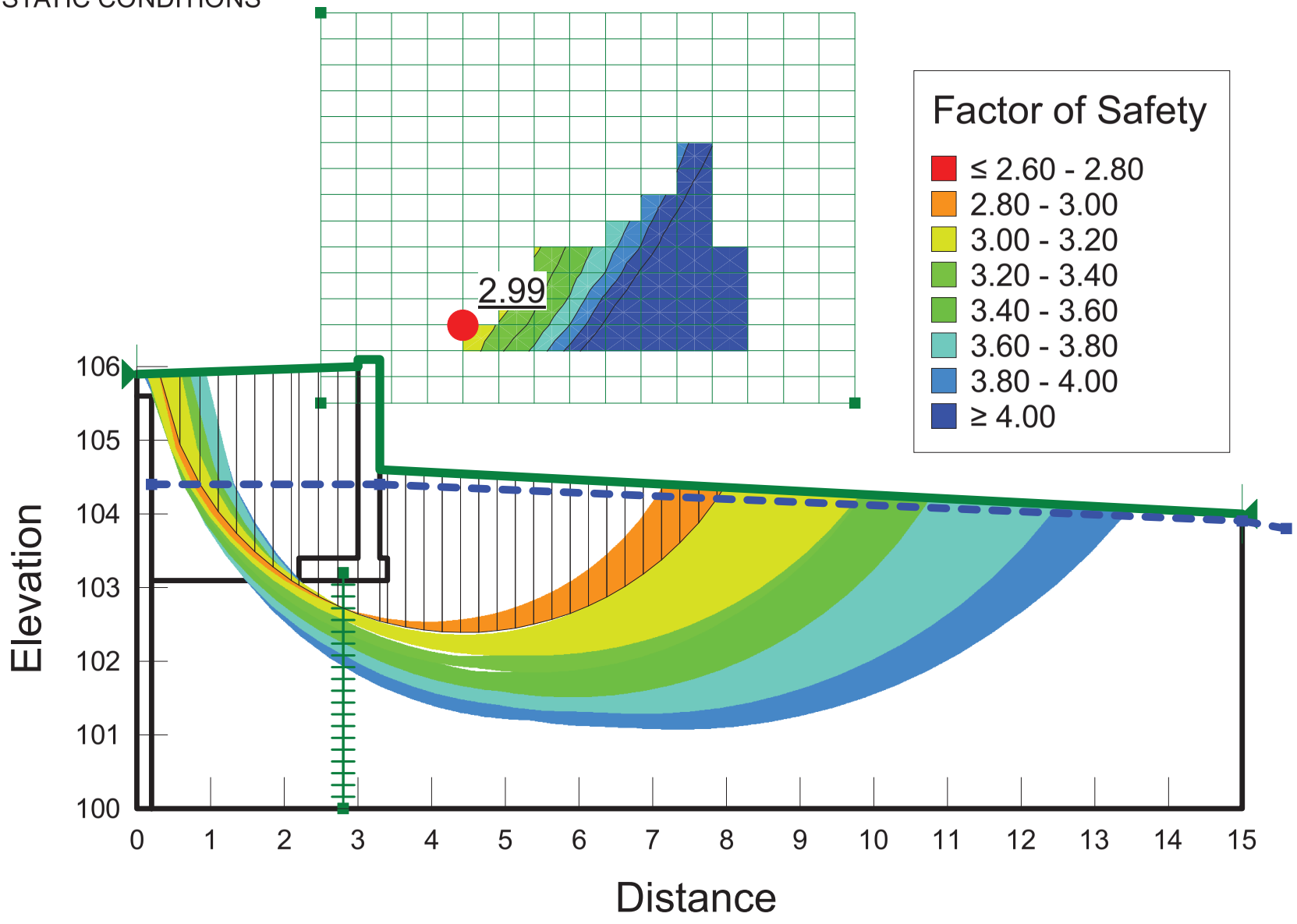
We trust that this report provides sufficient information for your present purposes. If you have any questions concerning this information or if we can be of further assistance to you, please do not hesitate to contact our office.

Yours truly,
Kollaard Associates Inc.

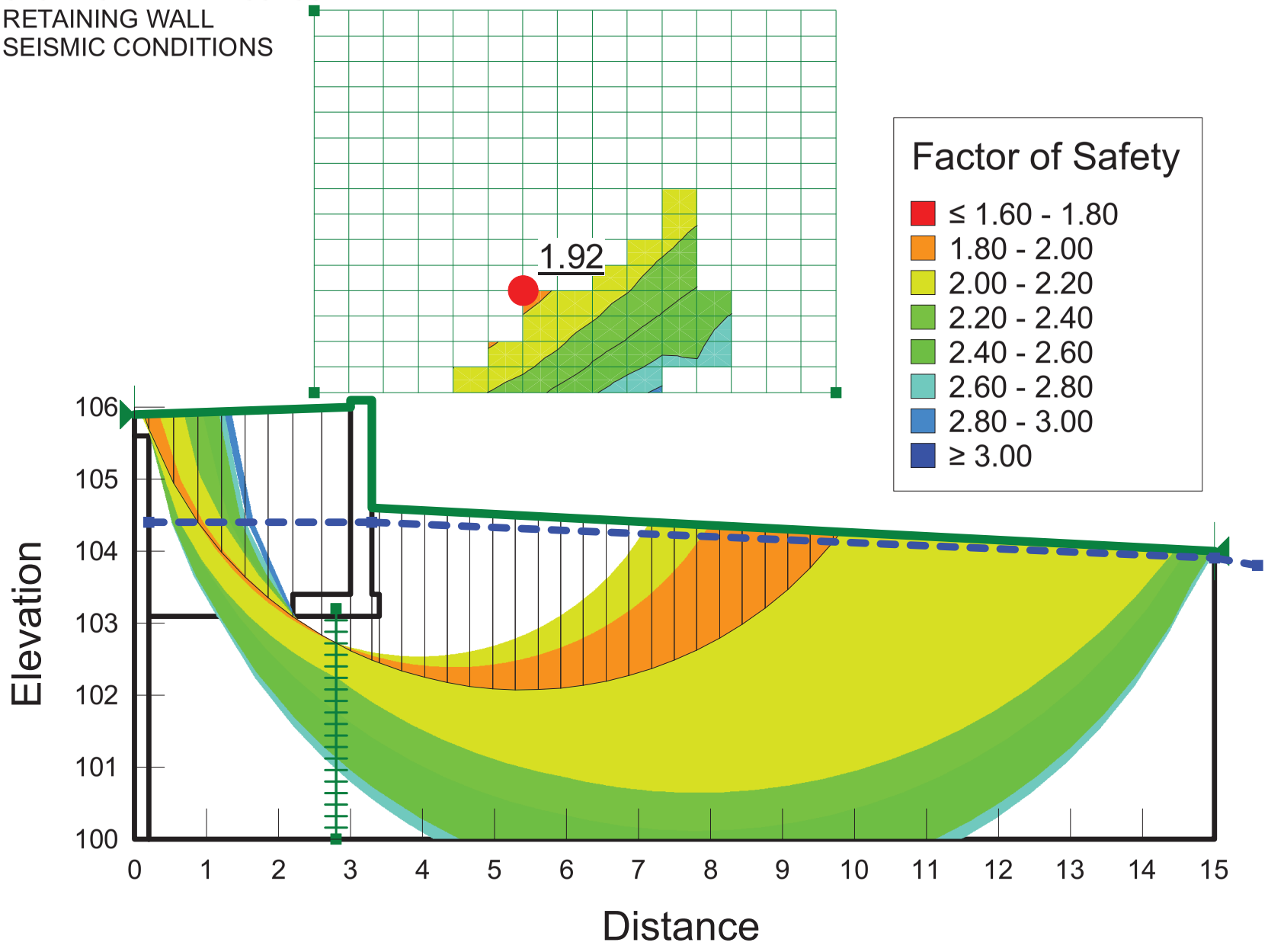


Steve deWit, P.Eng.

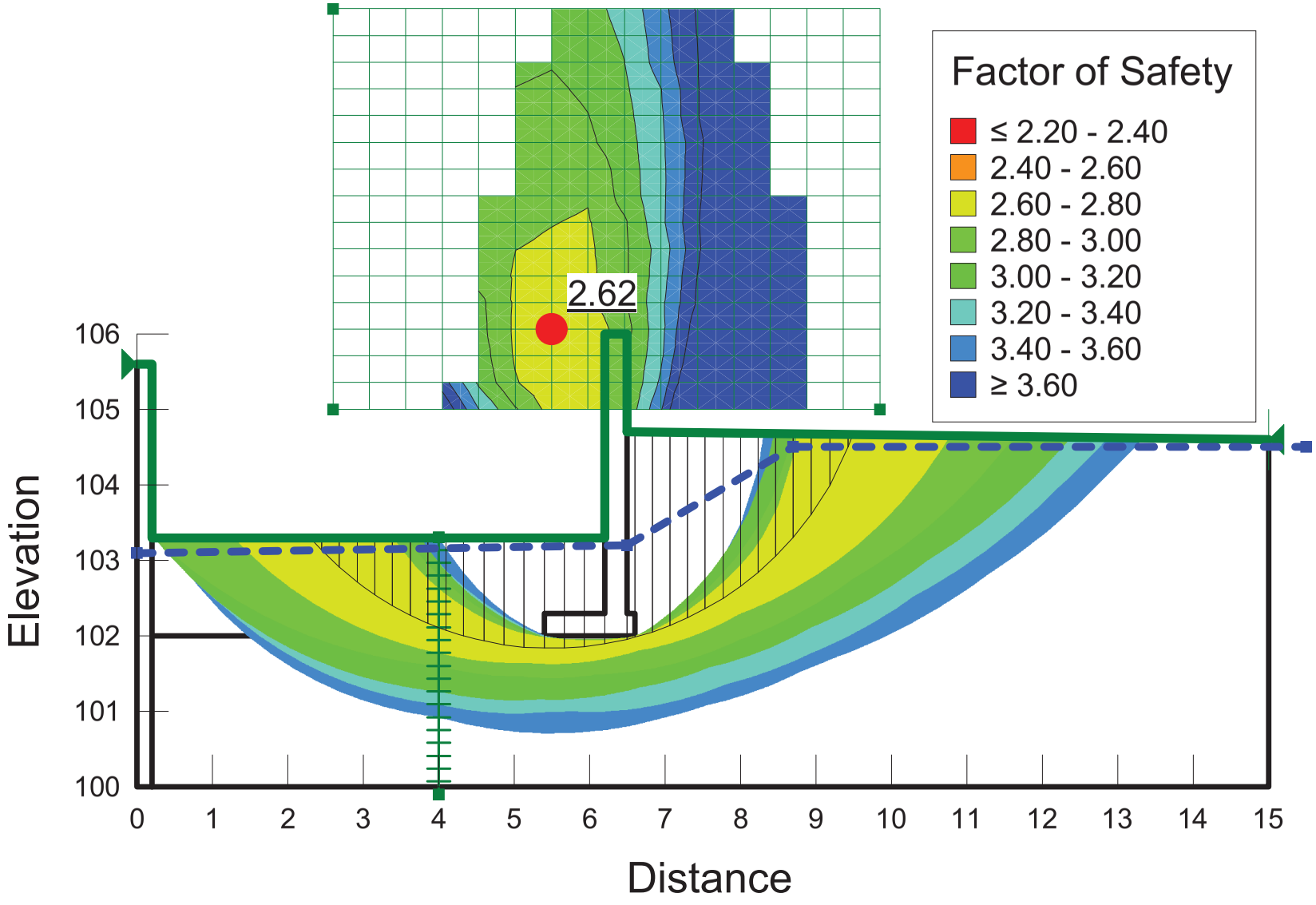
SLOPE STABILITY ASSESSMENT
RETAINING WALL
STATIC CONDITIONS



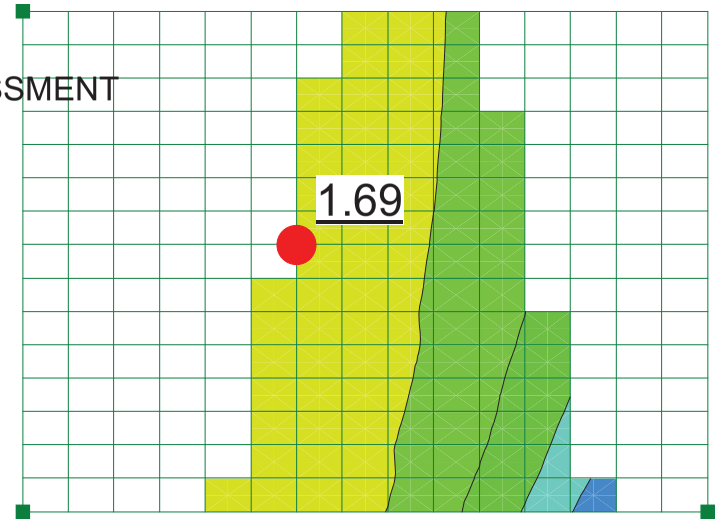
SLOPE STABILITY ASSESSMENT
RETAINING WALL
SEISMIC CONDITIONS

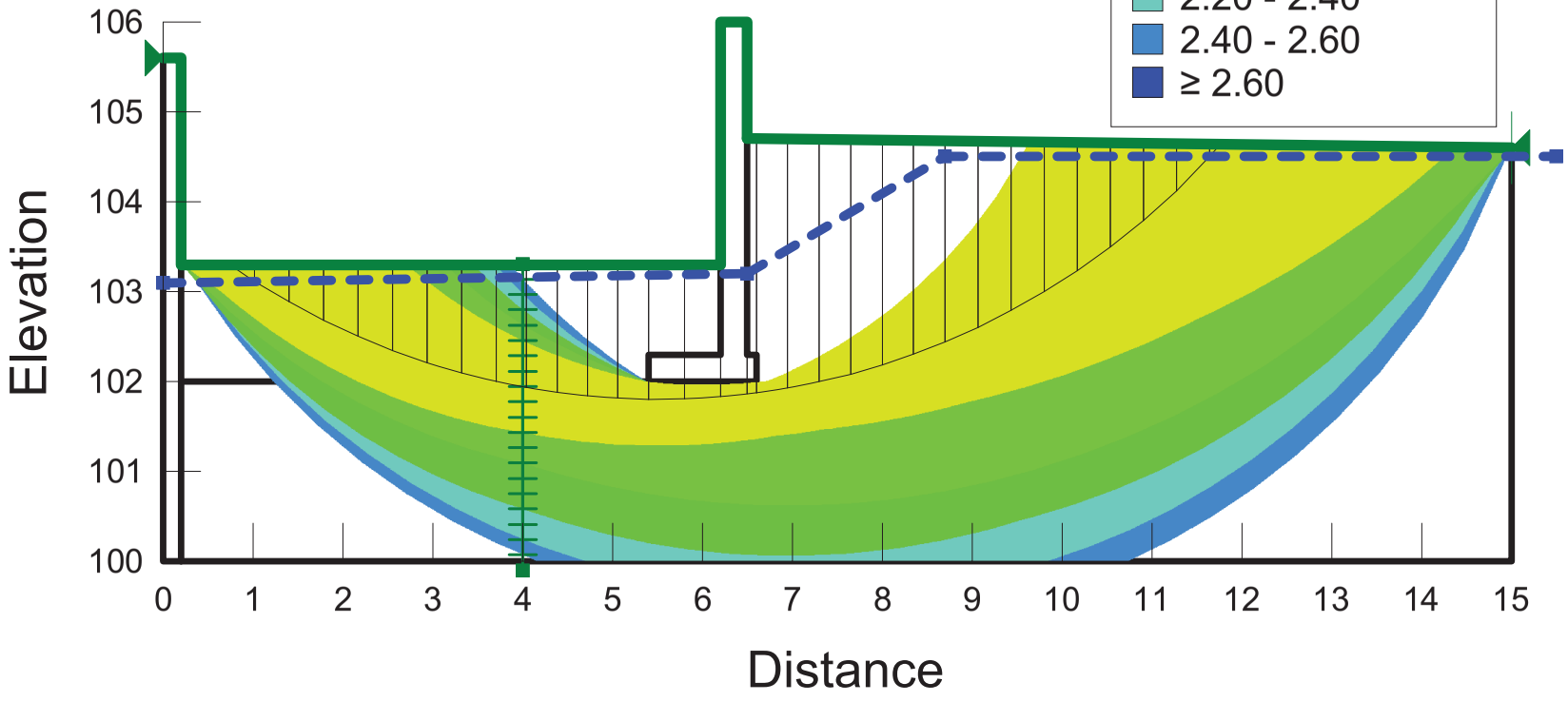


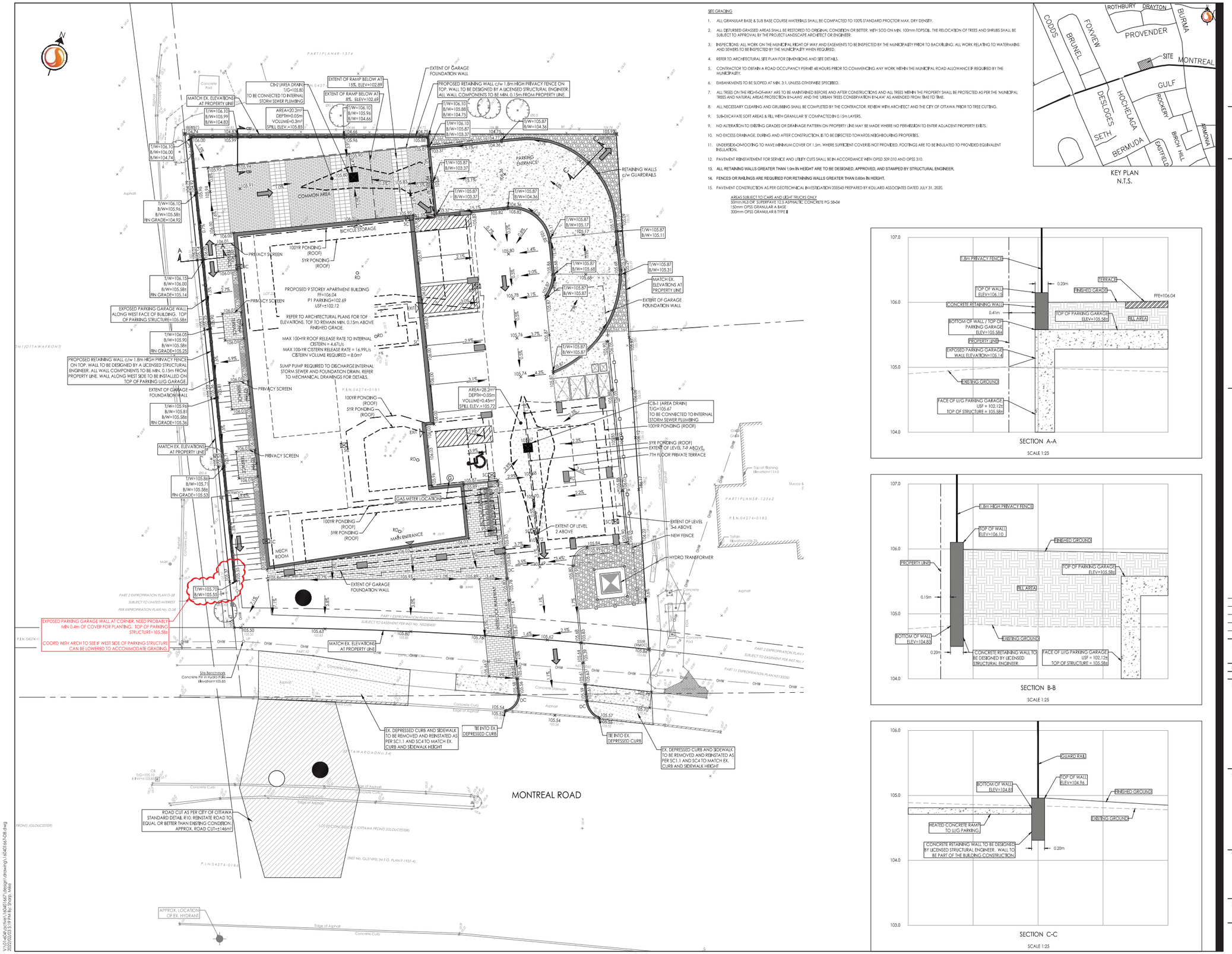
SLOPE STABILITY ASSESSMENT
FOUNDATION WALL
STATIC CONDITIONS



SLOPE STABILITY ASSESSMENT
FOUNDATION WALL
SEISMIC CONDITIONS







SITE GRADING

1. ALL GRANULAR BASE & SUB BASE COURSE MATERIALS SHALL BE COMPACTED TO 100% STANDARD PROCTOR MAX. DRY DENSITY.
2. ALL DISTURBED GRASSED AREAS SHALL BE RESTORED TO ORIGINAL CONDITION OR BETTER. WITH SOD ON MIN. 100mm TOPSOIL. THE RELOCATION OF TREES AND SHRUBS SHALL BE SUBJECT TO APPROVAL BY THE PROJECT LANDSCAPE ARCHITECT OR ENGINEER.
3. INSPECTIONS: ALL WORK ON THE MUNICIPAL RIGHT OF WAY AND EASEMENTS TO BE INSPECTED BY THE MUNICIPALITY PRIOR TO BACKFILLING. ALL WORK RELATING TO WATERMAINS AND SEWERS TO BE INSPECTED BY THE MUNICIPALITY WHEN REQUIRED.
4. REFER TO ARCHITECTURAL SITE PLAN FOR DIMENSIONS AND SITE DETAILS.
5. CONTRACTOR TO OBTAIN A ROAD OCCUPANCY PERMIT 48 HOURS PRIOR TO COMMENCING ANY WORK WITHIN THE MUNICIPAL ROAD ALLOWANCE IF REQUIRED BY THE MUNICIPALITY.
6. EMBANKMENTS TO BE SLOPED AT MIN. 3:1, UNLESS OTHERWISE SPECIFIED.
7. ALL TREES ON THE RIGHT-OF-WAY ARE TO BE MAINTAINED BEFORE AND AFTER CONSTRUCTIONS AND ALL TREES WITHIN THE PROPERTY SHALL BE PROTECTED AS PER THE 'MUNICIPAL TREES AND NATURAL AREAS PROTECTION BY-LAWS' AND THE 'URBAN TREES CONSERVATION BY-LAW' AS AMENDED FROM TIME TO TIME.
8. ALL NECESSARY CLEARING AND GRUBBING SHALL BE COMPLETED BY THE CONTRACTOR. REVIEW WITH ARCHITECT AND THE CITY OF OTTAWA PRIOR TO TREE CUTTING.
9. SUB-EXCAVATE SOFT AREAS & FILL WITH GRANULAR 'B' COMPACTED IN 0.15m LAYERS.
10. NO ALTERATION TO EXISTING GRADES OR DRAINAGE PATTERN ON PROPERTY LINE MAY BE MADE WHERE NO PERMISSION TO ENTER ADJACENT PROPERTY EXISTS.
11. NO EXCESS DRAINAGE, DURING AND AFTER CONSTRUCTION, IS TO BE DIRECTED TOWARDS NEIGHBOURING PROPERTIES.
12. UNDERSIDE-OF-FOOTING TO HAVE MINIMUM COVER OF 1.5m. WHERE SUFFICIENT COVER IS NOT PROVIDED, FOOTINGS ARE TO BE INSULATED TO PROVIDED EQUIVALENT INSULATION.
13. PAVEMENT REINSTATEMENT FOR SERVICE AND UTILITY CUTS SHALL BE IN ACCORDANCE WITH OPSD 509.010 AND OPSS 310.
14. **ALL RETAINING WALLS GREATER THAN 1.0m IN HEIGHT ARE TO BE DESIGNED, APPROVED, AND STAMPED BY STRUCTURAL ENGINEER.**
15. **FENCES OR RAILINGS ARE REQUIRED FOR RETAINING WALLS GREATER THAN 0.60m IN HEIGHT.**
16. PAVEMENT CONSTRUCTION AS PER GEOTECHNICAL INVESTIGATION 200543 PREPARED BY KOLLARD ASSOCIATES DATED JULY 31, 2020.

AREAS SUBJECT TO CARS AND LIGHT TRUCKS ONLY:
50mm HL3 OR SUPERPAVE 12.5 ASPHALTIC CONCRETE PG 58-34
150mm OPSS GRANULAR A BASE
300mm OPSS GRANULAR B TYPE II

KEY PLAN
N.T.S.

SECTION A-A
SCALE 1:25

SECTION B-B
SCALE 1:25

SECTION C-C
SCALE 1:25

Stantec

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

Legend

- 99.99 — ORIGINAL GROUND ELEVATION
- × 99.99 — PROPOSED ELEVATION
- × 99.99 / 98.88 — PROPOSED LOT CORNER ELEVATION / EXISTING ELEVATION AT LOT CORNER
- 2.0% — FLOW DIRECTION AND GRADE
- FF=99.99 — FINISHED FIRST FLOOR ELEVATION
- TOF=99.99 — TOP OF FOUNDATION ELEVATION
- USF=99.99 — UNDERSIDE OF FOOTING ELEVATION
- TERRACING 3:1 SLOPE MAXIMUM (UNLESS OTHERWISE SHOWN)
- PROPOSED SWALE
- DIRECTION OF OVERLAND FLOW
- PROPOSED VALVE BOX
- PROPOSED SANITARY SEWER MANHOLE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED CATCHBASIN
- SC — PROPOSED DEPRESSED CURB LOCATION
- MAX PONDING LIMITS
- SC — APPROXIMATE LOCATION OF PROPOSED SCUPPER. REFER TO ARCHITECTURAL PLANS FOR DETAILS.
- RD — APPROXIMATE LOCATION OF PROPOSED ROOF DRAIN. REFER TO ARCHITECTURAL PLANS FOR DETAILS.

Notes

2	ISSUED TO ARCHITECTURE FOR COORDINATION	MJS	KJK	22.02.03
1	ISSUED FOR REVIEW	WAJ	KJK	21.06.18
Revision		By	Appd.	YY.MM.DD
File Name: 160401667-DB.dwg		WAJ	KJK	WAJ	21.04.22
		Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project
12318407 CANADA INC.

971 MONTREAL ROAD

OTTAWA, ON

Title
GRADING PLAN

Project No.	Scale	Sheet	Revision
160401667	1:150 (0, 1.5, 4.5, 7.5m)		
Drawing No.			
GP-1		3 of 5	2

PLAN # 18536

D07-12-21-0094

ORIGINAL SHEET - ARCH D