August 30, 2019 Project No. 18106595

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ADDENDUM NO. 2 – GEOTECHNICAL INVESTIGATION
PROPOSED SITE REDEVELOPMENT
WESTGATE MALL PHASE 1
OTTAWA, ONTARIO

1.0 INTRODUCTION

This letter serves as an addendum to, and provides additional information and clarifications to, Golder Associates Ltd.'s (Golder's) geotechnical report numbered 18106595-1000, titled "*Geotechnical Investigation Report, Proposed Site Redevelopment, Westgate Mall Phase 1, Ottawa, Ontario*", dated November 2018 and Addendum 1 to the geotechnical report titled "*Addendum No. 1 – Geotechnical Investigation, Proposed Site Redevelopment, Westgate Mall Phase 1, Ottawa Ontario"*, dated August 9, 2019. In this regard, this letter should be read in conjunction with the contents of the original geotechnical report including the "Important Information and Limitations" document included as part of that report.

2.0 ROCK ANCHORS

It is understood that additional guidance related to rock anchors is required for design of the proposed Phase 1 structure.

For design of grouted rock anchors, consideration should be given to four possible anchor failure modes.

i) Failure of the steel tendon or top anchorage;

ii) Failure of the grout/tendon bond;

iii) Failure of the rock/grout bond; and,

iv) Failure within the rock mass, or rock cone pull-out.

Potential failure modes i) and ii) are structural in nature and should be assessed by the structural engineer.

For potential failure mode iii), the unfactored ULS bond strength at the concrete/rock interface may be taken as 2,000 kilopascals. Using a resistance factor of 0.4, based on static test in tension during construction (as per OBC 2012), the factored ULS bond strength is 800 kPa. However, all drill holes must be drilled with equipment that will create a rough texture along the socket (i.e. tri-cone or air track drill).

For potential failure mode iv), the resistance should be calculated based on the buoyant weight of the potential mass of rock which could be mobilised by the anchor. This is typically considered as the mass of rock and

surface shear resistance within a cone (or wedge for a line of closely spaced anchors) having an apex at the tip of the anchor and having an apex angle of 60 degrees. For a group of anchors or for a line of closely spaced anchors the resistance must consider the potential overlap between the rock masses mobilized by individual anchors. The approximate density of rock is provided in the results of UCS testing in the geotechnical report and is also provided in Attachment 1. Based on the results of the laboratory testing, a buoyant unit weight of 16.5 kilonewtons per cubic metre can be used for the bedrock at this site.

Further guidelines by the geotechnical engineer can and must be provided for assessing the anchor resistance once the final anchor layout and loads have been established.

It is recommended that proof load tests be carried out on anchors to confirm their design (required by OBC 2012 for the use of a resistance factor of 0.4). For permanent anchors, the proof load tests should be carried out in accordance with Ontario Provincial Standard Specification (OPSS) 942 which specifies a testing load of 1.5 times the anchor service loads, and at least 10 percent of the anchors should be tested in this manner.

It is also recommended to carry out one pre-production performance test in accordance with OPSS 942 for each anchor type used on the project.

All rock anchors intended as permanent structural elements should be provided with double corrosion protection (in accordance with OPSS 942).

The installation and testing of the anchors should be observed by the geotechnical engineer. Care must be taken during grouting to ensure that the grouting is injected from the bottom of the anchor hole to bond the entire grouted length with a minimum of voids. It is also recommended that the anchor holes be thoroughly flushed with water to remove all debris, sludge, and rock flour prior to grouting. It is essential that sludge and rock flour be completely removed from the holes to be grouted to ensure an adequate bond between the grout and the rock.

Prestressing of the anchors prior to loading will reduce anchor movement due to service loads. However, the prestressed anchors will be subjected to higher loading conditions to a non-tensioned anchor.

3.0 CLOSURE

We trust that this report is sufficient for your present requirements. If you have any questions concerning this report, please feel free to contact the undersigned.

Yours truly,

Golder Associates Ltd.

Sarah Ghadbane, P.Eng.
Geotechnical Engineer

Nicolas LeBlanc, P.Eng.
Senior Geotechnical Engineer

SG/NRL/hdw
https://golderassociates.sharepoint.com/sites/30869g/deliverables/geotechnical report/addendum 2/18106595-001-l-rev1-addendum no 2-3008_19.docx

Attachments: Attachment 1 – Results of UCS Testing

Golder Associates Ltd.
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GOLDER

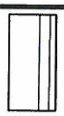
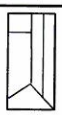
UNCONFINED COMPRESSIVE STRENGTH OF ROCK CORE

Project: RioCan Westgate Geotech Ottawa

Project No.: 18106595

Date: October 2, 2018

Location(s): See table below

Bore Hole No.	Depth (m)	Date Tested	Core Size	Diameter (mm)	Density (kg/m³)	Compressive Strength (MPa)	Failure Mode
18-01	11.39-11.50	Sep 27/18	NQ	44.8	2696	122.2	
18-02	8.39-8.50	Sep 27/18	NQ	44.7	2686	122.6	

REMARKS :
- Cores tested in vertical direction.
- Cores tested in air-dry condition.
- Specimen ends prepared with high-strength plaster, but un-restrained.
- L/D ratio's between 2.0:1 and 2.5:1
- Time to failure > 2 and < 15 minutes.
- This report constitutes a testing service only. Interpretation of results will be provided on request only.

TESTING WAS CARRIED OUT IN GENERAL ACCORDANCE WITH ASTM D7012 - Method C

SIGNED: Melanie Neland