



275 – 3001 Wayburne Drive
Burnaby, BC V5G 4W3 Canada
T: 604.874.1245 • www.exp.com

Memorandum

Date: October 7, 2019
To: Althea Utimati, M.Eng., PMP
Company: UBC Project Services
Email: althea.utimati@mail.ubc.ca

Reference No.: VAN-00247190-A0
Total No. of Pages: 4

Prepared By/Email: Pranay Saha, M.Eng., P.Eng. pranay.saha@exp.com
Project Name: Museum of Anthropology Great Hall Seismic Upgrading
6393 NW Marine Drive, Vancouver, BC
Subject: **Geotechnical Review - Temporary Construction Access Road – Revision 1**
Distribution/Email: Gary Cheema gary.cheema@sbw.ca
Anne Gingras anne@milkovicharchitects.ca

As requested, EXP Services Inc. (EXP) has conducted a geotechnical review of the proposed temporary access road through the existing reflection pond at the above-referenced site that is required for the proposed construction. A memorandum providing our review comments and recommendations for the proposed construction was issued on June 4, 2019. Subsequent to issuance of our memorandum, the project Civil Engineer, CoreGroup Consultants (CoreGroup) has completed the access road design. The original memorandum has been revised in order to incorporate the current access road design. It is understood that the access road will be used by heavily loaded construction vehicles, mobile and crawler cranes. The following information was reviewed by EXP as part of this geotechnical review:

- Site plan, profile and cross-section drawings of the proposed construction access road, prepared by CoreGroup, dated September 18, 2019;
- Loading information of the construction vehicles and crane, provided by Smith Brothers and Wilson (SBW); and,
- Geotechnical reports completed within the proximity of the subject site, available in EXP's database.

This geotechnical review comprised a review of the existing information, conducting geotechnical analysis, and preparation of this memorandum.

Review of available information: Reviewed information on the site plan of the proposed access road indicates that existing approximately 3m wide gravel road will be extended to cross over the existing reflection pond to access the Great Hall. The extended portion over the pond will also be used as a laydown area. Access road will continue from the north end of the laydown area and will merge with the upper access road, creating an overall loop.

Based on our review of the access road cross-section drawings, we understand that the width of the proposed access road will vary from approximately 4m to 6m. It is also understood that existing gravel access road will be widened with installation of 150mm base course toward the hillside and full structure (base + sub-base) toward the downward sloped area along the proposed alignment.



Memorandum (cont'd)

*Re: Geotechnical Review - Temporary Construction Access Road – Revision 1
Museum of Anthropology Great Hall Seismic Upgrade
Reference No.: VAN-00247190-A0
October 7, 2019*

EXP (then Trow Associates Inc.) prepared a geotechnical review report for the subject reflection pond (Trow Report No. 101-03046, dated March 4, 2010). Based on the Trow report for the existing reflection pond renovation, the bottom of the pond reportedly consists of 100 to 150mm thick pea gravel, underlain by 100 to 150mm bentonite liner which in turn is underlain by about 300mm silty clay placed over native dense to very dense till-like soils.

Based on our review of the provided loading information of the construction vehicles, it is understood that the access road needs to be capable to support the following loading:

- During crane lift of a 250 Ton Liebherr LTM 1250-5.1 mobile crane, the total loading will be supported on 4 – 2m x 5m outrigger pads and is planned to transfer each outrigger loading on a 4.3m x 1.8m (14' X 6') wooden pad. Based on these specifications, a minimum soil bearing resistance of ~125 kPa is required at the outrigger pad locations;
- A minimum plan area of 9.3m x 8.3m area will be required for the mobile crane;
- A Manitowoc 4100W crawler crane will be utilized for the erection of precast beam. A minimum 9.7m x 6.4m area in plan dimensions would be required for crane lift. The outrigger loading information during crawler crane lift was not available to us at the time this memorandum was prepared; and,
- During transportation of precast beam via dolly, the estimated loading per axle will be 16,500 lbs (~7.5 tonne) / dolly axle (based on 20 axles).

Recommendations for temporary access road / Laydown area at Reflection Pond: Based on the construction vehicle configuration and loading, the construction of access road through the existing reflection pond should consist of the following:

- Drain out the pond;
- Remove existing pea gravel, underlying bentonite layer, and silty clay from the entire footprint of the access road / laydown area, in order to expose native undisturbed till-like soil deposit. Based on the available information, the stripping depth should be in the order of 600mm below the pond bottom;
- Geotechnical Engineer to review and approve the exposed subgrade soils;
- Place 600mm of 75mm minus crushed granular sub-base, placed in two individual 300mm lifts and compacted to not less than 95 percent of the material's MPMDD;
- Place 300mm of 19mm minus crushed granular base, compacted to not less than 95 percent of the material's MPMDD;
- If the finished elevation of the access road requires raising, then the sub-base thickness should be increased accordingly;
- The access road side slopes should be at an inclination of no steeper than 2H:1V;
- The nearest edge of any outrigger should be offset a minimum of 2m horizontal distance away from top edge of the access road/laydown area;



Memorandum (cont'd)

*Re: Geotechnical Review - Temporary Construction Access Road – Revision 1
Museum of Anthropology Great Hall Seismic Upgrade
Reference No.: VAN-00247190-A0
October 7, 2019*

- It is our opinion that should the access road be constructed in accordance with recommendations provided above, the in-situ soils at the crane pad locations would have satisfactory resistance to support the maximum crane outrigger load mentioned above and thus the crane lift is feasible from a geotechnical engineering perspective. Specifications with regards to thickness and material type for the outrigger pads were unknown at the time this memorandum was prepared. Outrigger pad should be adequately designed to support the loading.
- Geotechnical Engineer should review and approve the road subgrade, subsequent placement and compaction of subgrade fill, subbase, and granular base fill.
- As discussed earlier the actual loading during crane lift is not available for the crawler crane; therefore, a geotechnical review of the proposed crawler crane lift should be completed prior to mobilization of that crane in the site.

Recommendations for temporary perimeter access road: Based on the construction vehicle configuration

- A minimum of 1.5m clearance should be provided along both sides of the access road along the travel route of construction vehicle;
- The access road side slopes should be at an inclination of no steeper than 2H:1V;
- Strip off any topsoil, softened/ loosened disturbed soil and excavate to the required elevation to expose competent subgrade along the proposed access road;
- Strip all the vegetation and organic materials from the existing slope where fill will be placed;
- Excavation along the slope should be staged and the temporary cut slopes should be covered with polyethylene sheeting to prevent erosion during wet weather conditions;
- The fill slopes should be constructed using structural fill;
- The fill should be placed in horizontal lifts, regardless of the pre-existing topography;
- The fill should be compacted to not less than 95% of the material's MPMDD, as confirmed by in-place soil density testing;
- The fill should be stepped into adjoining slope areas, when constructing a lateral extension to the hillside. The steps should not be more than 0.6 m in height and have a horizontal length of not less than 1.5 times the height of the adjacent step. The recommended stepping will create a staggered transition between the pre-existing slope and the new fill that will provide the necessary stability at the interface between the existing slope face and the new fill slope extension;
- The constructed fill slope should be over-built at least 300 mm beyond the final position and then trimmed back to the final position after compaction;
- The placement and compaction of the fill slope should be reviewed by the Geotechnical Engineer as it occurs;
- The minimum temporary access road structure will comprise of the following:
150mm 19mm minus crushed granular base, compacted to not less than 95% of the material's MPMDD, underlain by



Memorandum (cont'd)

Re: Geotechnical Review - Temporary Construction Access Road – Revision 1
Museum of Anthropology Great Hall Seismic Upgrade
Reference No.: VAN-00247190-A0
October 7, 2019

300mm 75mm minus crushed granular sub-base, compacted to not less than 95% of the material's MPMD, over Geotechnical Engineer approved subgrade;

- It should be noted that existing gravel road structure and subsurface soil conditions along the existing gravel road are unknown at this stage. It is recommended that a total of five (5) shallow test pits be conducted along the existing gravel road, in order to confirm the actual subsurface soil conditions and determine any road upgrading requirements to support the proposed heavily loaded construction vehicles; and;
- New access road structure should be overlapped at least 0.6m into the existing gravel road.

Remediation of Reflection Pond: Geotechnical Engineer should be present on full time basis during excavation within the pond area, in order to document actual pond structure. Upon completion of the project, pond should be reinstated to its pre-existing conditions using similar materials.

We trust that this memorandum meets your present needs. Should you have any questions regarding any aspect of the above-noted, please contact the undersigned.

Sincerely,

EXP Services Inc



Pranay Saha, P.Eng.
Geotechnical Engineer

Reviewed by:

Ben Weiss, P.Eng.
Senior Geotechnical Engineer