ONTARIO POWER GENERATION

PLANT Engineering Services
Leadership in Engineering

Design Build Specifications for Glen Access Road Improvement Niagara Operations

Project No.: BK280859

Document No.: NF28-SPEC-13110-0001

January 2, 2019

Prepared by:

_____ Date: Jan. 9, 2019

Allan Zheng, P.Eng.
Plant Supervisor, Technical
Plant Engineering Services, Niagara Operations

Approved by:

for _____ Date: Jan. 9, 2019

Ryan Ball, P.Eng.
Plant Technical Support Manager
Plant Engineering Services, Niagara Operations

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1. INTRODUCTION

OPG plans to retain a Design Build Contractor to carry out the design and construction of Glen Access Road Improvement Project in 2019. The roadway shall be kept open during all phases of the project work.

Background:

The Glen Access Road is located along the west bank of the Niagara River gorge and descends from the Niagara Parkway to the Sir Adam Beck 2 (SAB2) Powerhouse. The road was built in the 1950's during the construction of SAB2 and provides the only vehicular access to both SAB1 & SAB2 powerhouses.

The access road ranges in width from 22 ft (6.71 m) to 55 ft (16.8 m). It is approximately 6,562 ft (2 km) in length, and it carries two-way traffic. With the exception of the north and south sections, the access road is unpaved.

Previous Work:

In 2012, OPG hired Golder Associates to conduct drilling investigation, survey of the road, gravel road upgrade recommendations, and provide recommendations for road pavement design. The Report (#NF28-REP-13110-0001) - Glen Access Road / North SAB1 Tailrace Road – Investigations and Recommendations for Road Upgrade was issued December 2013 (in Appendix A).

In 2012, a new rock fall fence was installed along the road to mitigate the potential for High Risk incidents due to falling rocks. The concrete foundations for the rock fence are shallow which may impact the grading design.

In 2015, OPG hired Laroque to survey the road. The survey drawings are included in Appendix A. It is to be noted that since 2015, the road surface has been changed slightly as OPG have been regraded the road and place some new granular A material as part of annual maintenance work.

Soil chemical test results in 2015 indicated that the soil at that time was clean. However, the test results have passed the expiry date.

OPG's Plan:

In general, OPG plans to pave portions of the Glen Access Road, improve the grade and subgrade, improve the surface drainage, clean the ditches, repair the damaged guiderails, repair broken cables ducts, repair or replace culverts/outlet drainage, reduce soil erosion at the culvert outlet to improve the long term slope stability and repair/add some signs.

- from Niagara Parkway to Chainage 44+00:
    - Option 1 Granular road, dust control measures shall be included as part of the design.
    - Option 2: Asphalt Pavement:

      OPG has some concerns on the asphalt pavement:

        - Freezing rain is common in Niagara Region. The asphalt road may become more slippery than granular road for de-icing/snow removal operation.
        - Public safety concern: this long and steep paved road may become a potential skateboarding attraction.

  Unless it can be proved otherwise, OPG's preferred option is granular road.

- from Chainage 44+00 to SAB2 Gate: Asphalt pavement
    - The design life for new pavement should be min. 30 years.
    - Pavement design shall be not lower than Golder's recommendation in the 2013 report (in Appendix A)

2. SCOPE OF WORK

The Design Build Contractor shall have complete responsibility for the design and construction of the Glen Access Road Improvement Project accordingly to the Agreement, the Specifications, standards and codes and OPG requirements.

The detailed scope of work includes the following:

2.1 Design

2.1.1. General Requirements

A. Submit a work plan including designer qualifications, additional investigation required, schedule and cost etc.

B. Provide QA/QC Plan within 3 weeks after the Contract is awarded. The plan shall include an Inspection and Testing Plan Checklist (ITP). At the minimum, OPG Engineer would like to witness all of the hold points prior to cover.

C. Participate in 6 milestone meetings (kick-off, field work planning, on-site safety, field work wrap-up, 50% complete, 90% complete, about 2 hours each).

D. Provide a presentation and meeting at OPG Niagara Office at the completion of the Design Basis Report and at 90% of Design Completion.

E. Participate a Workshop to discuss the Value engineering, Constructibility, Operatibility and Maintenatibility and Safety Review by Design (COMS Review) with OPG. Assume 3 hours.

F. Submit drawings, calculations and technical specifications for OPG to accept at 50% and 100% stage. The OPG review turnaround is 10 business days.

G. Review OPG provided information including topographic survey, soil testing, drawings, rock fence drawings, inspection reports, Geotechnical report (by Golder Associates, Dated December 2013) etc, which are included in Appendix A.

H. Conduct a field visit to inspect the current condition of the road and understand the proposed scope of work.

2.1.2. Concept Drawings and Technical Specifications

A. Provide concept drawings and technical specifications to cover the complete scope of work. The DB Contractor shall include the design and construction assumptions clearly in the proposal.

B. For uncertain scope at the proposal stage, DB Contractor shall include the design and construction assumptions clearly in the proposal.

2.1.3. Proposed Investigations

A. Provide a list of proposed investigations that is required for the detailed design. Submit site specific safety and environment plan, as part of work plan prior to field inspections. At a minimum, the following field investigations shall be included:

1) Guiderail embedded depth investigation and design review. Obtain Permit to Break ground prior to digging.

   OPG prefers to keep these guiderails as they are relatively new. This investigation is to support a design review on the guiderails and to provide a cost effective alternative.

2) Conduct chemical road material sampling. OPG had material tests in 2015 and the material was tested to be clean. However, the test result dates have been expired so the new tests are required.

   If the material is clean, the surplus material may be stored inside OPG facility for future use.

3) Conduct a terrestrial survey by a qualified biologist, to identify any endangered species in the vicinity of work areas and determine an action plan if they are to interfere with the design and construction. Of special concern is the Butternut tree. Any endangered species are to be flagged in the field and coordinates recorded.

4) Conduct a topographic survey to reflect the current condition.

2.1.4. Design Basis Memorandum

A. Prepare a Design Basis Memorandum describing the design basis method and provide commentary on the selection of appropriate design parameters to meet the performance specification for a Municipal Two Lane Road with normal truck traffic.

1) Traffic volumes on Glen Access Road are estimated at less than the minimum for a municipal road and thus the Proponent shall provide commentary on the flexible pavement design selection. However, the road will be used by heavy equipment for station operation and maintenance uses (unit overhauls, transformers, concrete repair work etc.)

2) The design shall be carried out as per Ontario Ministry of Transportation Pavement Design and Rehabilitation Manual 2013 and City Of St. Catherine Engineering Manual (Roads), which includes the following:

   - Clearing and Grubbing: The road allowance (existing granular road, and 3m from the centre line of the ditch) shall be cleared of all trees, shrubs and other obstructions for the width required for the proper installation of all roads, services, and other works. The existing falling rocks along the road are to be dispose to a designated area within OPG SAB facility. For the DB Contractor's safety during construction, the overhead falling trees and rocks on the cliff may need to be cleared.

3) Geometric Roadway Design Criteria:
    - Min. slope 0.5%, both longitudinal or cross sectional
    - Min. pavement width: 8.5 m if possible. The laneway and curb shall be painted.
4) Min. Pavement Structure: not lower than the Geotechnical Report by Golder in Appendix A.
5) Road subdrains: to be determined by DB Contractor. At a minimum, the downstream cliff slope shall be protected from any potential accumulated surface run off, for the long term slope stability of the road. Select the most appropriate drainage method to reduce the water content of the existing and new subgrade and road base to provide the base stability to allow for pavement longevity.
6) Surface drainage from the road and adjacent land (cliff) must be addressed. The design shall include surface treatment method for the cliff soil erosion.
7) The grade near the guiderails shall be designed and constructed to minimize surface erosion at the area and potential soil erosion to the downstream slope along the Niagara River.
8) The Proponent should strive to incorporate as much of the existing road and road base into the new road cross section as possible to reduce the quantity of surplus materials to be disposed off site.
9) The grade and ditch at the concrete barriers (near the gate at the Niagara Parkway) shall be designed to minimize the soil erosion that cause the concrete jersey barrier movement.
10) Review the slope and gradient of the ditch and provide rock checks as required to reduce erosion potential to the ditch.
11) Existing chainage markers locations shall be verified and posts repositioned if needed. Additional chainage locations every 500 ft are to be identified and chainage post installed beside the guiderails.
12) Prepare scope of work and itemized quantity take-offs as part of the design specifications/drawings.
13) Design the proper asphalt tie in details for the existing steel grating at the lower gate.

2.1.5. Ditch

A. The ditch and all drainage paths should cleared including fallen rocks from the cliff, trees, vegetations and other debris etc.

B. If the existing ditch is not wide or deep enough, it shall be widened and deepened and provide a riprap (with geotextile cloth) liner. Due to the slope, rock check dams shall be considered in the design to reduce erosion as some sections of the rock bedding are vulnerable to erosion.

C. Some sections of the ditch were lined with riprap and wire meshes. If they are in good condition, there is no need to change.

D. The ditch's side slope shall not be steeper than 1Vertical to 1 horizontal slope

E. Design and construct a new ditch west of the steel grating at the lower gate. This is to prevent the cliff leakage water from running onto the road.

2.1.6. Culvert

A. Replace three culverts at Chainage 26+00 (Labelled C4 in Appendix B), Chainage 36+00 (Labelled C3 in Appendix B) and Chainage 54+00 ((Labelled C1 in Appendix B).

- Material: Corrugated Steel Culvert, hot dip galvanized. Min. 30 years of design service life. The design shall consider the extensive use of salt on the road.
- Min diameter: Conduct design review to confirm the existing diameter to pass 25 years of storm flow, and add 150 mm of diameter. This is to make future culvert replacement easier.
- Min. slope of culvert: 1.5%
- Design new metal screening at inlet (galvanized or aluminum) to prevent debris and animals from blocking the culvert.
- At Culvert C3, design new end treatment to reduce or eliminate the soil and slope erosion. Due to steep slope, permanent stairs and anchoring points for OPG staff to do maintenance on the downstream slope in the future are not required. The end treatment shall be extended down to the shoreline of Niagara River. The existing jersey barriers and fencing and signs do not need to be replaced.
- Minimize the culvert joint to reduce the use of coupling.
- The minimum embedment shall be 450 mm and shall consider the future maximum load requirements for the intent use.

B. Clean all other culverts and inspect their condition. Replace the culverts if they are found to be more than 25% material loss due to corrosion.

C. Clean the ditch under the steel grating at the gate Design new end treatment for Culvert 3, chainage 36+00, to address slope erosion.

D. Assess whether new culvert is required due to the recent changes of drainage piping installation at the Niagara Parkway.

2.1.7. Signs

A. Design drawing to include all the signs along the road, including speed limit signs, chainage signs, rock falling signs and public safety signs etc.

B. Design and install three new rock falling signs to be placed on the rock fence.

C. Adjust all tilted signs to upright position and corrected facing direction.

D. Replace all damaged signs along the road (see detail in Appendix A , Larocque Survey drawing).

E. Current chainage signs are 400’ spacing, increase the number of signs to 200 spacing and install behind the steel guiderails.

2.1.8. Cable Duct

A. Repair broken conduits and connections, as indicated on the Larocque Group survey (in Appendix A).

B. If the existing guiderail were not installed to meet engineering standards, consider bury the cable ducts.

2.1.9. Steel Guiderails

A. The existing guiderails are relatively new. The height of the guiderails are slightly lower than MTO standards. OPG prefers to keep the guiderails if it can meet the design requirement in order to reduce cost.

B. Repair the damaged guiderails as shown in Appendix A Larocque survey drawings.

2.1.10. Rock Fence

A. The existing rock fence has shallow concrete foundations, some of them are exposed. The road grading shall incorporate this into consideration.

B. The rock fence has a deflection zone of 2.32 m for 500 KJ system and 3.15 m for 1000 KJ system. Consider the deflection zone when determining the painted roadway lines on asphalt section, while maintaining two-way road standards.

2.1.11. Engineering support during project execution

A. It is anticipated that knowledgeable quality control personnel from the Proponent will regularly be on-site to make decisions on the suitability of the existing materials for re-use in the new road (and other quality control issues) so that the road can be constructed as designed. It is recognized that weaker sub-grade conditions or unsuitable base may be exposed and would require a remove and replace decision to quickly be made based on these field conditions.

B. Prepare engineer stamped as built survey drawings (Record Drawings) for all of the work performed. The construction and record drawings shall be prepared in accordance the requirements of PEO Guideline “Use of Professional Engineer’s Seal”.

C. Prepare a Project Completion Report to include the work completed. It shall include the work activities, machine, manpower use, material, QA/QC documentation, project cost and schedule, record drawings, as built survey and construction photographs (Before, during and after construction) etc.

2.2 Construction

2.2.1. Permits and approvals

A. Obtain all permits and approvals from OPG, municipalities and Niagara Parks Commission.

2.2.2. General Requirements

A. Submit a detailed work plan, site specific safety and environment plan and traffic management to ensure traffic is not closed and project safety during all stages of the construction.

B. Weekly project meetings to discuss the project progress, schedule update, cost update, work forecasts, risks and issues.

2.2.3. Construction

A. Conduct the work as per design drawings, technical specifications, standards, codes and all other industrial best practices.

B. Coordinate with designer for design submissions.

Engage in design engineer to inspect the site to fulfil the duty to stamp the record drawings. Engage in QA/QC activities and submit test results including: soil chemical testing, gradation, compaction, compaction test, mix design, galvanizing certificate etc.

Report to designer and/or OPG Engineer for different field conditions and changes of scope.

C. Submit ITP and engage in the designer and OPG engineer for milestone inspections and sign offs.

D. Coordinate with the designer and submit project completion report, record drawings and as built survey etc.

3. LAWS, STANDARDS AND CODES

All work shall conform to:

- The laws and regulations of Canada, the Province of Ontario, local municipalities
- Professional Engineer Ontario
- Ontario Ministry of Transportation, OPSS and OPSD
- Ontario Ministry of Labor Occupational Health & Safety Act
- Ontario Electrical Safety Code
- Ontario Building Code

- Ontario Ministry of Natural Resources Endangered Species Act, 2007
- OPG Drafting Consultant Package
- City of Niagara Falls Engineering Standards
- Niagara Parks Commission Engineering Standards
- Transportation Association of Canada Manual (TAC),
- Design Standards for Ontario Highways from the Ministry of Transportation Ontario (MTO)
- Roadside Safety Manual

The Proponent shall clearly state in its proposal any exceptions or deviations it intends to take to these standards.

Should any law, standard or code be revised, the Proponent and OPG will make each other aware of the revision to discuss adoption of the revision.

Should conflict occur between the applicable laws, standards or codes and this Standard Technical Specification, the most stringent requirements shall govern.

4. MINIMUM QUALIFICATION

The engineer who carries out the work and stamps the technical documents should:

- Be a professional engineer registered in the Province of Ontario, and
- Should have minimum 10 years design experience of road design and construction.
- Should be familiar with Ontario Ministry of Transportation standards, specifications and guidelines and municipal engineering standards
- Should provide a list of past projects for OPG to check references.

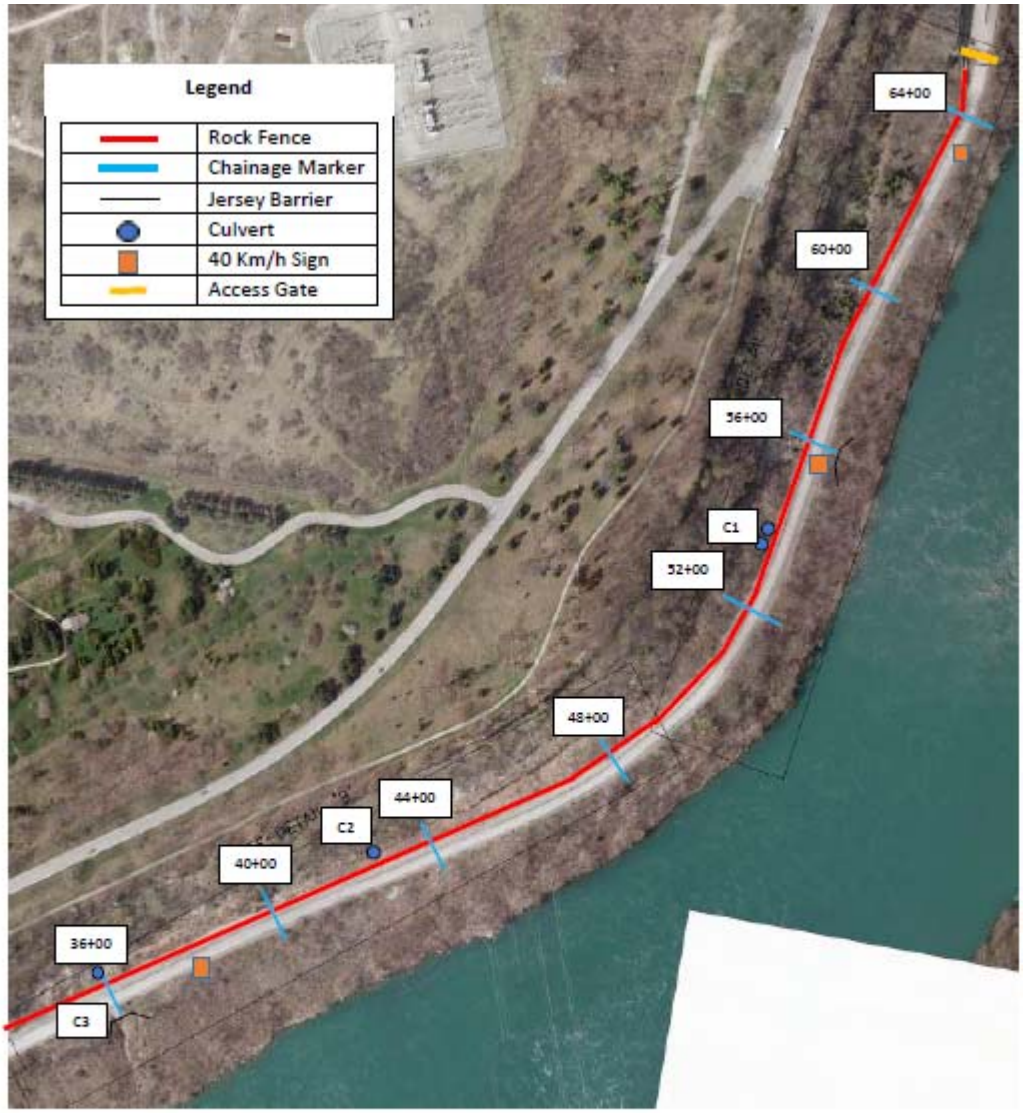
5. DOCUMENTATION

- All final documentation shall be in electronic form and shall become the property of OPG. Drawings shall be in AutoCAD format and as a PDF.
- If any OPG drawings and data are required, the Proponent shall contact the project engineer.
- One copy of the final technical specification and drawing package will be required, as well as the electronic files.

APPENDIX A - Documents Included for Reference

- The Larocque Group - Survey Drawing
- Golder Report 2013
- Rock Fence Drawings
- OPG Drafting Consultant Package (under Drafting)

APPENDIX B – Labelled Site Maps Identifying Chainages and Culverts

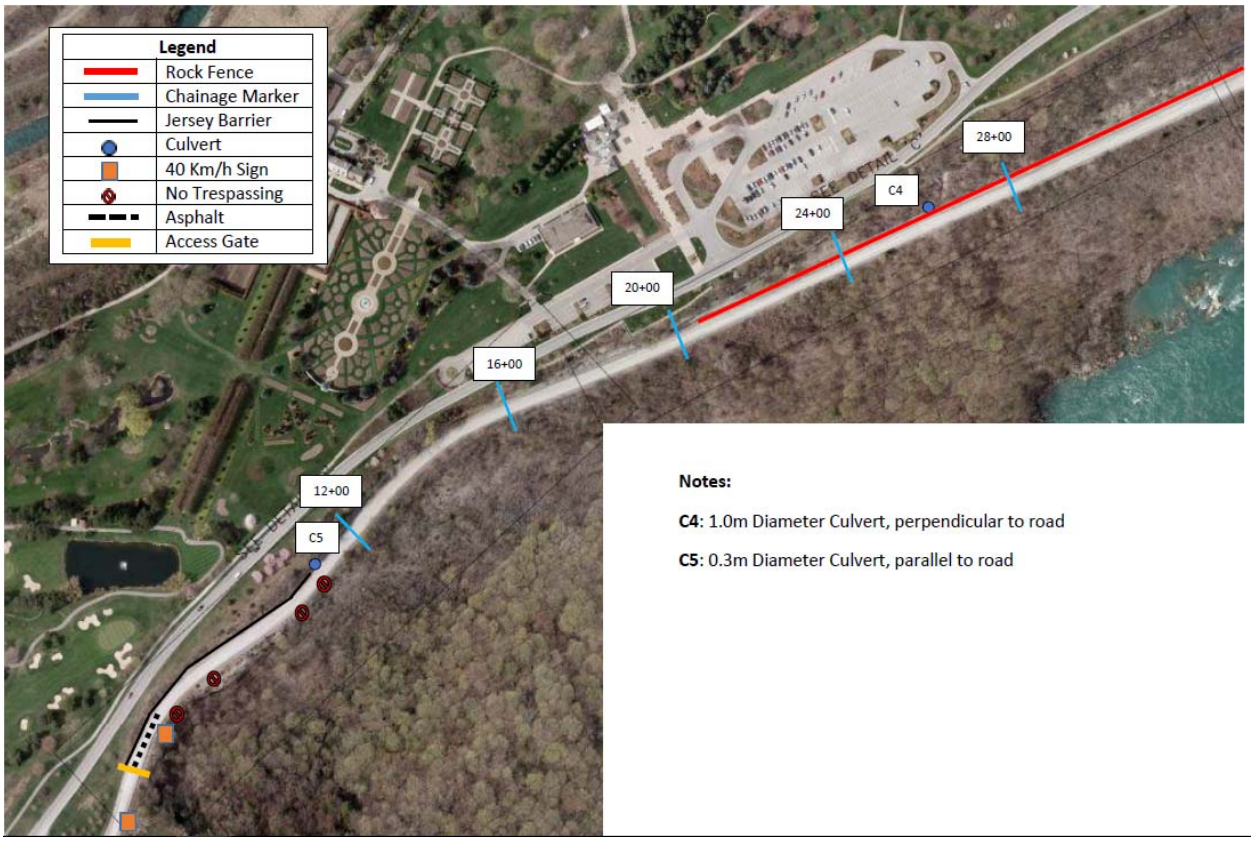


Notes:

C1: 1.0m diameter metal culvert, parallel with road

C2: 1.0m diameter metal culvert, perpendicular to road

C3: 1.0m diameter metal culvert, perpendicular to road



Notes:

C4: 1.0m Diameter Culvert, perpendicular to road

C5: 0.3m Diameter Culvert, parallel to road