

**PROPOSED REVISIONS TO QUALIFICATION PROCEDURES
FOR ESP'S
In The FOUNDATION CATEGORY**

B7. Foundations Engineering Category

Qualification Criteria

The following qualification requirements are applicable to all Specialties within Foundations Engineering Category:

- Applicant shall hold or be eligible to hold a valid Certificate of Authorization from PEO;
- Applicant shall hold or be eligible to hold a valid Certificate of Authorization from the APGO-PGO for the Hydrogeology and for the Rock Engineering Specialties; and
- Applicant's Key Personnel shall be licensed with PEO, or, for the Hydrogeology and for the Rock Engineering Specialties, be licensed with APGO and shall be listed on the Applicant's Certificate of Authorization.

The complexity level of the Specialties requirements is defined as follows:

Low Complexity:

The Applicant must meet the following requirements for this complexity:

- The Service Provider shall demonstrate a clear understanding of the scope of low complexity Foundation Engineering work as described in the Qualification Procedures for Engineering Service Providers – Policy and Guidelines.
- The Service Provider shall demonstrate sufficient staff resources to execute Low complexity assignments that includes
 - Minimum of one Key Personnel licensed in Ontario with a minimum of 5 years' experience
 - Identifying one the Key Personnel licensed in Ontario with a minimum of 5 years' experience as MTO Principal Contact
 - Technician(s) to conduct fieldwork
 - The Organization Chart shall show the key staff, responsibility, and reporting relationships
- For each Key Personnel, the Service Provider shall submit a minimum three (3) Foundation reports, that meet or exceed low complexity requirements demonstrating the company's key personnel involvement in the foundation investigation and design of the report

- The Service Provider shall retain or own a laboratory that is registered in RAQS - Soil and Rock Including Testing for Foundation Engineering - Low Complexity

Scope

- Foundation Engineering and Foundation Construction Quality Management
- Subsurface/Groundwater/Site Conditions are simple and of low complexity
- Foundation Investigation commensurate with low complexity of work
- Foundation Engineering simple analysis and reporting commensurate with complexity of work.

Typical Low Complexity Projects

- Short span culverts (< 3 m)
- Embankment fills/cuts < 4.5 m at sites with competent subsurface conditions and simple construction considerations – no major dewatering/unwatering; temporary shoring, etc.
- Swamp crossings with depth to swamp firm bottom less than 4 m
- Light standards
- Toe retaining walls

Medium Complexity:

The Applicant must meet the following requirements for this complexity:

- The Service Provider shall demonstrate a clear understanding of the scope of medium complexity Foundation Engineering work as described in the Qualification Procedures for Engineering Service Providers – Policy and Guidelines.
- The Service Provider shall demonstrate sufficient staff resources to execute Medium complexity assignments that includes
 - Minimum two (2) Key Personnel licensed in Ontario with minimum of 10 years' experience
 - Identifying one the Key Personnel licensed in Ontario with a minimum of 10 years' experience as MTO Principal Contact
 - Technicians to conduct fieldwork
 - The Organization Chart shall show the key staff, responsibility, and reporting relationships
- For each Key Personnel listed on the RAQS application, the Service Provider shall submit a minimum of three (3) Foundation reports that meet or exceed

medium complexity requirements demonstrating the company's key personnel's involvement in the foundation investigation and design of the report and/or worked on three (3) Foundation projects that met or exceeded medium complexity requirements demonstrating company's key personnel's involvement in the foundation investigation and design of the report

- The Service Provider shall Own a laboratory that is registered in RAQS - Soil and Rock Including Testing for Foundation Engineering - Medium Complexity

Scope

- Foundation Engineering Foundation Construction Quality Management
- Foundation Investigation commensurate with medium complexity of work
- Foundation Engineering analysis and reporting commensurate with complexity of work

Typical Medium Complexity Projects

- Tunnels and Trenchless projects with favourable cover and diameters less than 1 metre
- Hydrogeological – simple horizontal and vertical hydraulic connections
- Rock Engineering – rock mechanics for foundations built in or on rock and rock mass stabilization
- Geotechnical (Structures and Embankments)
 - Bridges
 - Retaining Walls
 - Culverts with spans > 3 m and also for spans < 3 m with challenging subsurface/groundwater conditions
 - Embankment fills/cuts > 4.5 m high
 - Swamp crossing where depth of swamp to firm bottom is >4 m and < 6 m)
 - ~~High Mast Light Poles~~
 - ~~Overhead Signs~~
 - Temporary Protection Systems

High Complexity:

The Applicant must meet the following requirements for this complexity:

- The Service Provider shall demonstrate a clear understanding of the scope of high complexity Foundation Engineering work as described in the Qualification Procedures for Engineering Service Providers – Policy and Guidelines.
- The Service Provider shall be previously approved in medium complexity for a minimum of 3 years and have demonstrated acceptance performance.

- The Service Provider shall demonstrate sufficient staff resources to execute High complexity assignments that includes
 - Minimum two (2) Key Personnel licensed in Ontario with a minimum of 15 years' experience
 - Minimum one (1) Key Personnel licensed in Ontario with a minimum of 10 years' experience
 - Identifying one the Key Personnel licensed in Ontario with a minimum of 15 years' experience as MTO Principal Contact and previously approved in medium/high complexity for a minimum of 3 years.
 - Technicians to conduct fieldwork
 - The Organization Chart shall show the key staff, responsibility, and reporting relationships
- For each Key Personnel listed on the RAQS application, the Service Provider shall submit a minimum of three (3) Foundation reports that meet or exceed high complexity requirements demonstrating the company's key personnel's involvement in the foundation investigation and design of the report and/or worked on three (3) Foundation projects that met or exceeded high complexity requirements demonstrating company's key personnel's involvement in the foundation investigation and design of the report
- The Service Provider shall Own a laboratory that is registered in RAQS - Soil and Rock Including Testing for Foundation Engineering - High Complexity

Scope

- Foundation Engineering Foundation Construction Quality Management
- Foundation Investigation commensurate with high complexity of work
- Foundation Engineering analysis and reporting commensurate with high complexity of work

Typical High Complexity Projects

- Tunnels and Trenchless projects with low cover and diameters > 1 metre
- Hydrogeological – complex horizontal and vertical hydraulic connections
- Rock Engineering – complex rock mechanics for foundations built on or in rock and complex rock mass stabilization
- Geotechnical (Structures and Embankments)
 - Bridges (long spans, multiple) in complex subsurface conditions
 - Retaining Walls
 - Culverts with spans > 3 m and also for spans < 3 m with complex subsurface/groundwater conditions
 - Embankment fills/cuts > 4.5 m high in soft, compressible soils and where stability/settlement analyses are rigorous

- Critical Swamp crossings (depth of swamp to firm bottom is > 6 m)
- ~~High Mast Light Poles~~
- ~~Overhead Signs~~
- ~~Temporary Protection Systems~~

Additional qualification requirements for each Specialty are outlined below:

1. Geotechnical (Structures and Embankments) – High Complexity Specialty

Applicant's Key Personnel shall demonstrate experience in successfully completing high complexity projects in Ontario or other similar jurisdictions in Canada or USA involving designing foundations for structures and embankments including:

- Extensive stability or settlement analysis
- Large scale and/or large scope projects
- Severe subsurface conditions
- Requirement for complex engineering analysis or innovative recommendations
- Potential legal implications
- Potential Construction Problems, Delays and Claims

Typical Projects

Large/Complex Bridges and Culverts

Bridges and culverts in complex subsurface conditions. Multiple (more than 3) span bridges. Project with significant scope and scale such as multiple bridges. May require analyses for:

- Seismic Condition
- Downdrag and Lateral Forces on Deep Foundations
- Effect of settlement on adjacent structures
- Foundation Design in Artesian Condition
- Foundation Design in Highly Sensitive Clays
- Large diameter caissons in water and non-cohesive soil
- Pile Load capacities with Static and Dynamic methods
- Cofferdam in unfavourable conditions

Critical Embankment Designs

Cut or fill embankments >4.5m high in complex subsurface conditions where requirements for stability and settlement analyses are extensive. May involve the following:

- Critical Stability and Settlement analyses
- Ground improvement
- Preloading and Surcharging
- Stage Construction
- Instrumentation and Monitoring
- Wick Drain Design

Critical Swamp Crossings

Depth of swamp to firm bottom >6m

- Embankment Design in full swamp excavation
- Embankment Design in partial swamp excavation
- Embankment Design without any swamp excavation

2. Geotechnical (Structures and Embankments) – Medium Complexity

Applicant's Key Personnel shall demonstrate experience in successfully completing medium complexity projects in Ontario or other similar jurisdictions in Canada or USA involving designing foundations for structures and embankments including:

- Requirement for engineering analysis and recommendations
- Limited stability or settlement analysis

Typical Projects

Routine Bridges

Single span and multiple (less than three) span bridges in routine, competent subsurface conditions

Complex Culverts

Routine, competent subsurface conditions with opening size more than 3m equivalent diameter

Embankment Designs

Cut or fill embankments more than 4.5m high in medium complexity subsurface conditions where requirements for stability and settlement analyses are limited

Swamp Crossings

Depth of swamp to firm bottom more than 4m but less than 6m

3. Geotechnical (Structures and Embankments) – Low Complexity

Applicant's Key Personnel shall demonstrate experience in successfully completing medium complexity projects in Ontario or other similar jurisdictions in Canada or USA involving designing foundations for structures and embankments including:

- Limited requirement for engineering analysis and recommendations.
- Minimal requirement for stability or settlement analysis

Typical Projects:

- High Mast Lighting Foundation
- Noise Barrier Foundation
- Simple Culverts: Routine, competent subsurface conditions, opening size less than 3m equivalent diameter
- Simple Embankment Designs: Cut or fill embankments <4.5m high in routine, competent subsurface conditions where requirements for stability and settlement analyses are minimal
- Swamp Crossings: Swamp treatments specified by MTO standards (usually depth to firm bottom less than 4m) and where specialized removal and replacement are not required (for example, engineered fills, earth reinforcement or specialized geometric design treatments).

4. Hydrogeological – High Complexity Specialty

Applicant's Key Personnel shall demonstrate experience in successfully completing high complexity projects in Ontario or other similar jurisdictions in Canada or USA involving geo-environmental engineering including groundwater management.

General Guidelines

High risk of influence: Complex hydrogeological regime; sensitive site conditions; existing structures and utilities, high risk and severe consequences, legal implications. Extensive investigation and monitoring with consideration of quantitative aspects. Requirements of analysis and reporting

Specific Guidelines

Projects involve groundwater investigation, analyses of distribution and movement of groundwater, management, control and monitoring for design and construction of foundations and geotechnical systems, including structure foundations, cut slopes, excavations, drainage and filters, cofferdams, 'wick drains', construction dewatering and groundwater taking permits. Groundwater quantity and high impact assessment to determine the hydrogeological effect and – potential of settlement of existing

structures and utilities due to drawdown of water and resulting settlements, drawdown in areas of compressible soils.

5. Hydrogeological – Medium Complexity Specialty

Applicant's Key Personnel shall demonstrate experience in successfully completing medium complexity projects in Ontario or other similar jurisdictions in Canada or USA involving geo-environmental engineering including groundwater management.

General Guidelines

Low to medium risk of influence: Moderate site investigation required such as borehole investigation, borehole permeability testing etc. Analysis and reporting required. More focus on quantitative than qualitative aspect.

Specific Guidelines

Projects involve groundwater quantity and **moderate impact assessment** to determine the hydrogeological effect and feasibility of mitigation, (e.g. groundwater drawdown due to artesian penetration during pile installation, groundwater drawdown due to excavation cut adjacent to private wells, decommissioning of MTO patrol yards. PTTW related to dewatering for structural and non-structural works.

6. Hydrogeological – Low Complexity Specialty

Applicant's Key Personnel shall demonstrate experience in successfully completing low complexity projects in Ontario or other similar jurisdictions in Canada or USA involving geo-environmental engineering including groundwater management.

General Guidelines

Low to negligible risk of influence – minimal consequences: Limited site investigation and analysis (desktop study, site reconnaissance) and reporting; no hydrogeological in situ testing; no analysis

Specific Guidelines

Projects involve groundwater quantity assessment only (e.g. levels & flow in soil/rock, dewatering for small culverts etc.); no water quality issues; site is in the remote area; no well water users in vicinity; no impact assessment required.

7. Rock Engineering– High Complexity Specialty

Applicant's Key Personnel shall demonstrate experience in successfully completing high complexity projects in Ontario or other similar jurisdictions in Canada or USA involving complex rock mechanics engineering to assess the mechanical behaviour of rock and rock masses; and to provide engineering solutions for the design, construction and maintenance of structures built in or on rock and for complex rock mass stabilization such as those involving rock anchors, rock bolts, shotcreting, rock drains and concrete buttresses

General Guidelines

Project specific Term of Reference will outline the required investigation and assessment, scope of the work and reporting requirements within the specified study area and shall govern where any conflict exist with this guideline.

Specific Guidelines

Rock Engineering investigation shall characterize the physical and mechanical properties of the rock. The characterization shall consider anisotropy, heterogeneity and discontinuity. The method of investigation shall consider the site conditions and project requirements. Methods of investigation include visual observation, geological, geophysical, Lidar, Sonar and rock coring. Detailed rock description of rock mass structure that includes the intact rock and the nature and occurrence of discontinuities, in-situ stresses, groundwater, durability, weathering and erosion shall be provided.

The Rock Engineering Design Report shall include, identification of basic failure mechanisms, Stability assessment and Foundation Assessment.

A Rock Engineering Design Report shall provide a summary of remedial options in a tabular format which identifies and presents overview assessments of the advantages, disadvantages, risks/consequences and relative costs of the different options. Options to be considered include "Do Nothing", "Monitoring" and "Rock Removal" (OPSS 202) to remove unstable or potentially unstable rock including manual scaling, machine scaling, trim blasting, recommendations for the limits and method of rock removal shall be provided; and high-resolution images of each rock mass requiring rock removal.

Rock Stabilization (OPSS 203): Establish the limits of the existing rock slope (i.e. offset distance from edge of pavement to face of cut, rock slope height, length and width at the site location, limits to be recommended, colour images of locations to be stabilized; rock bolts, spacing and inclination of rock bolts; size and properties of the bolts if different from the bolts specified in OPSS 203; dimensions of the holes to be

drilled for grouted rock bolts; grout material to fill annular space between drilled hole and rock bolt, testing requirements including acceptance criteria; rock drains, shotcrete, or concrete buttresses; the size, properties, and installation pattern and depths of dowels and reinforcing steel, and properties of concrete.

Special provisions to be included in the contract package for all related aspects of the work shall be provided.

8. Rock Engineering– Medium Complexity Specialty

Applicant’s Key Personnel shall demonstrate experience in successfully completing medium complexity projects in Ontario or other similar jurisdictions in Canada or USA involving rock mechanics engineering to assess the mechanical behavior of rock and rock masses; and to provide engineering solutions for the design, construction and maintenance of structures built in or on rock.

General Guidelines

Project specific Term of Reference will outline the required investigation and assessment, scope of the work and reporting requirements within the specified study area and shall govern where any conflict exist with this guideline. As a guideline see “Rock Engineering – High Complexity”

9. Rock Engineering – Low Complexity Specialty

Applicant’s Key Personnel shall demonstrate experience in successfully completing low complexity projects in Ontario or other similar jurisdictions in Canada or USA involving limited rock mechanics engineering and the application of standard designs applicable to foundations built in or on rock.

General Guidelines

Project specific Term of Reference will outline the required investigation and assessment, scope of the work and reporting requirements within the specified study area and shall govern where any conflict exist with this guideline. As a guideline see “Rock Engineering – High Complexity”.

Tunnelling - General

The Scope of Work includes:

- Planning and conducting foundation investigations to determine the subsurface model and groundwater conditions at proposed tunnelling/trenchless crossings;
- Assessing and evaluating the subsurface model/groundwater conditions and providing and comparing alternative tunnelling/trenchless methods for new, replacement, insertion, closed fit based on advantages, disadvantages, costs, risks and consequences;
- Recommending a preferred option with the understanding that the MTO does not prescribe a method but rather transfers the selection to the contractor;
- Provide recommendations for construction considerations related to the tunnelling/trenchless activity such as entry/exit portals, temporary shoring, dewatering;
- Specify any restrictions/requirements regarding tunnelling/trenchless methods for inclusion in the contract documents depending on the excavation diameter, highway traffic volumes and subsurface/groundwater conditions;
- Produce project specific risk registers that identifies risks in the context of likelihood, impact and mitigation;
- Produce project specific subsurface conditions baseline reporting;
- Provide recommendations for roadway settlement monitoring; and
- Provide Foundation Engineering Construction Oversight.

The complexity ratings of Foundations Engineering services are defined in [Table 1](#).

10. Tunnelling – High Complexity Specialty**High Complexity Specialty**

Applicant's Key Personnel shall demonstrate experience in successfully completing high complexity projects in Ontario or other similar jurisdictions in Canada or USA involving tunnelling in soil and rock.

- Provide a Foundation Investigation and Design Report;

- Include SP's/NSSP's in the contract package;
- Settlement monitoring is a requirement; and
- Oversight to be provided by Foundation Engineering Specialist.

11. Tunnelling – Medium Complexity Specialty

Applicant's Key Personnel shall demonstrate experience in successfully completing medium complexity projects in Ontario or other similar jurisdictions in Canada or USA involving tunnelling in soil and rock.

- Provide a Foundation Investigation and Design Report;
- Include SP's/NSSP's in the contract package;
- Settlement monitoring is a requirement; and
- Oversight to be provided by Foundation Engineering Specialist.

12. Tunnelling – Low Complexity Specialty

Applicant's Key Personnel shall demonstrate experience in successfully completing low complexity projects in Ontario or other similar jurisdictions in Canada or USA involving tunnelling in soil and rock.

- Provide a Foundation Investigation and Design Report on an exemption basis;
- Include SP's/NSSP's in the contract package; and
- Settlement monitoring is a requirement unless risk assessment demonstrates otherwise.

Table 1: Complexity ratings for tunnelling specialty services

Excavation Diameter (\emptyset)	≤ 300 mm		$1\text{ m} \geq \emptyset > 300$ mm		$2\text{ m} \geq \emptyset > 1$ m		$\emptyset > 2$ m
Design Cover* (m)	≥ 1.5 m	< 1.5 m	$\geq 3\emptyset$ and > 1.5 m	$< 3\emptyset$ or < 1.5 m	$\geq 3\emptyset$	$< 3\emptyset$	N/A
King's Highway	Low	Medium	Low	Medium	Medium	High	High
400 Series Freeway	Low	High	Medium	High	High	High	High

* Design cover is the proposed vertical distance measured from the lowest ground elevation to the crown of the tunnel