

Terms of Reference: Geotechnical Report

Effective Date: December 1, 2025

1.0. Purpose

The purpose of this Terms of Reference (ToR) is to outline the minimum requirements for preparing Geotechnical Reports in support of development applications within the Town of Innisfil. The reports identify soil and groundwater conditions to inform foundation design, slope stability, pavement design, and construction feasibility.

2.0. Applicability

Geotechnical Reports are required for all developments involving any of the following:

- New buildings or structures
- Earthworks (cut and fill operations)
- Road construction or expansion
- Stormwater management facilities
- Any site where subsurface conditions may impact safety or constructability

This requirement applies to the following development applications:

- Official Plan Amendment
- Zoning By-law Amendment;
- Plan of Subdivision
- Plan of Condominium
- CPPS By-Law
- Site Plan Control
- Site Alteration Permit
- As determined necessary by the Town's Planning and Development Engineering Services.

3.0. Study Scope and Content

The scope of a geotechnical investigation and the resulting recommendations will vary based on the complexity of the project. The Town has outlined three levels of complexity – low, medium, and high – along with examples for each category. Corresponding requirements for scope and content are provided for each level. If there is any uncertainty regarding the appropriate complexity classification, the Town should be consulted before finalizing the investigation.

It is important to note that subsurface conditions cannot be fully determined prior to the geotechnical investigation. As a result, the complexity classification may change as new information becomes available during the course of the project. In some cases, a single project may exhibit varying levels of complexity across different areas or phases. This Terms of Reference document is intended as a guideline and cannot address every possible scenario.

The Engineer is responsible for adjusting the scope and recommendations as required, and the Town reserves the right to request additional information or clarification at any stage.

The Town recognizes that certain analyses or detailed recommendations may only become feasible as the project design advances. However, any supplemental geotechnical reports or updates required to address these aspects must be submitted prior to final approval of the project. These additional submissions should clearly reference the original investigation and provide sufficient detail to support the design and construction requirements.

3.1. Low Complexity Developments

Types of Projects:

- Buildings which have three storeys or less and have a maximum gross floor area of 600m².
- Site servicing (water, sewer, utilities, stormwater management)
- Culverts with less than 3m spans.
- Embankments less than 4.5m depth.

Study Scope and Content:

The Geotechnical Report for a low-complexity development shall include, at a minimum, the following sections;

1. Introduction
2. Site and Project Description
3. Physiography and Geology
4. Subsurface Conditions (Soils and Groundwater)
 - a. Advancement of geotechnical boreholes to identify the locations and thickness of soil strata, groundwater elevations, recover soil samples, and perform in-situ testing. The number, spacing, and depth of boreholes shall be based on the recommendations in the CFEM.
 - b. Standard Penetration Tests (SPT) shall be conducted in accordance with the CFEM at all borehole locations.
 - c. Additional in-situ tests such as Cone Penetration Tests (CPT or DCPT), Field Vane Test (FVT), etc. may be required at the discretion of the Geotechnical Engineer.
 - d. Installation of groundwater monitoring wells.
 - e. Soil sampling to perform classification and index testing (Grain Size Distribution, Moisture Content, Atterberg Limits, etc.)
5. Foundation Design Parameters:
 - a. Geotechnical Resistance Factors
 - b. Maximum Geotechnical Resistance (ULS)
 - c. Maximum Geotechnical Reaction (SLS) and Estimated Settlement

- d. Minimum Footing Dimensions and Embedment Depth
6. Seismic Site Classification
7. Frost Treatments for Foundations, Pavements, Culverts, etc.
8. Basic Earth Pressure Design Parameters
9. Slab-on-Grade Design Parameters:
 - a. Modulus of Subgrade Reaction
 - b. Moisture Barrier / Drainage Layers - Materials and Compaction
10. Engineered Fill / Embankment Construction
11. Site Servicing:
 - a. Pipe Bedding / Embedment Materials
 - b. Trench Backfill Procedures
 - c. Trench Safety / OHSA Soil Types
 - d. Temporary Groundwater Control
 - e. Stormwater Management Facilities (Liners, Embankments, Hydrostatic Uplift).
 - f. Trench Plugs
12. Pavement Design:
 - a. Confirmation that the Town's minimum pavement structure design is sufficient for the project.
 - b. If the Town's minimum pavement structure is not sufficient, provide a detailed pavement design in accordance with AASHTO Guide for the Design of Pavement Structures, and any applicable MTO supplements. All input/output parameters shall be given including but not limited to design life, ESAL parameters, subgrade resilient modulus, initial and terminal serviceability, reliability level, standard deviation, layer coefficients, and structural numbers.
13. Excess Soils Considerations (O.Reg. 406/19)
14. Appendices:
 - a. Borehole / Test Pit Logs
 - b. Site Drawings and Borehole / Test Pit Layout Map
 - c. Laboratory Reports (Grain Size Distribution, Moisture Content, Atterberg Limits)
 - d. Standard Drawings and Procedures
 - e. Environmental Testing Results

3.2. Medium Complexity Developments

Types of Projects:

- Buildings which have four storeys to a maximum of 8 storeys, or a gross floor area greater than 600m².
- Structural culverts greater than 3m spans.

- Trenchless service installations.
- Single short span bridges and pedestrian bridges.
- Embankments greater than 4.5m depth.
- Retaining structures and temporary protection systems.
- Slope stability analysis.

Scope and Content:

The Geotechnical Report for a medium-complexity development shall include, at a minimum, the following sections;

1. All items listed for Low Complexity projects.
2. Buoyancy analysis for utilities and structures.
3. Corrosivity and Sulphate Attack.
4. Detailed Soil Parameters for site-specific soils and imported aggregate, including but not limited to:
 - a. Unit weight, submerged unit weight, internal friction angle, cohesion, modulus of subgrade reaction.
 - b. Calculated earth pressure coefficients for the at-rest, active, and passive conditions.
 - c. Earth pressure design parameters for drained and undrained conditions should be provided.
 - d. Coefficient of Friction and Resistance to Sliding.
5. Trenchless Service Installation Design:
 - a. Annular Pressure Parameters and Hydrofracture Mitigation.
 - b. Tunnel Excavation and Face Support.
 - c. Ground Support and Stabilization.
 - d. Entry and Exit Pits.
 - e. Requirements for Settlement Monitoring.
6. Global Stability Analysis for Retaining Walls and Embankments.
7. Slope Stability Analysis:
 - a. Slope Geometry (height, inclination)
 - b. Location of Structures
 - c. Erosion Risks and Mitigation Measures
 - d. Factor of Safety Calculations
 - e. Risk of Instability and Mitigation Measures

3.3. High Complexity Developments

Types of Projects:

- Buildings greater than 8 storeys.
- Long span or multiple span bridges.

- Embankments greater than 4.5m depth, or where compressible soils are encountered, or stability/settlement tolerance is minimal.
- Deep foundation systems.
- Raft foundation systems.

Scope and Content:

The Geotechnical Report for a high-complexity development shall include, at a minimum, the following sections;

1. All items listed for Medium Complexity projects.
2. Advanced Seismic Design:
 - a. Advanced Geophysical Testing
 - b. Liquefaction Assessment
 - c. Seismic Lateral Earth Pressure Design Parameters
3. Bridge Designs:
 - a. CHBDC Consequence Level and Site Understanding Classification
 - b. Global Stability Analysis of Abutments, Retaining Walls, and Embankments.
 - c. Approach Embankment Settlement Analysis.
4. Deep Foundation Design:
 - a. Bearing Capacity
 - b. Geotechnical Axial and Lateral Capacity
 - c. Settlement Analysis (Single and Group)
 - d. Negative Skin Friction / Downdrag
 - e. Load Testing Requirements
 - f. Construction Considerations
5. Raft Foundations:
 - a. Modulus of Subgrade Reaction
 - b. Settlement Analysis (non-uniform loading)
 - c. Buoyancy Analysis
6. Advanced geotechnical testing may be required depending on loading and subsurface conditions. For high complexity projects the Geotechnical Engineer should consider additional in-situ and/or laboratory testing such as Pressuremeter Testing, Unconfined Compression Testing, Direct Shear Testing, Triaxial Compression Testing, etc.

If any of the above sections are not relevant to an application, a brief explanation under the section stating why it is not applicable must be provided.

4.0. Study Methodology and Standards

The Geotechnical Report shall be prepared in accordance with the latest version of the following guidelines and standards:

- Canadian Foundation Engineering Manual (CFEM)

- Ontario Building Code (OBC)
- Canadian Highway Bridge Design Code (CHBDC)
- National Concrete Masonry Association (NCMA) Design Manual for Segmental Retaining Walls
- Town of Innisfil Engineering Design Standards
- Professional standards established by Professional Engineers Ontario (PEO)

5.0. Submission Requirements

All Geotechnical Reports must be signed and sealed by a licensed geotechnical engineer licensed in the Province of Ontario. All drawings must be stamped, signed, and dated by a Professional Engineer. The submission package shall include;

- Digital copy of the report
- Include borehole logs, laboratory test data, foundation design tables, site drawings/maps, any advanced geotechnical testing reports, engineering analysis and software export files.
- All supporting documentation, model inputs/outputs, and figures
- The Town may require a peer review at the applicant's expense.

6.0. Consultation

Early coordination with the Town's engineering staff is encouraged, especially for complex geotechnical conditions or large-scale developments.

7.0. Validity and Updates

Unless otherwise approved by the Town, Geotechnical Reports are valid up to three (3) years from the date of publication, provided there are no substantial site alterations or newly identified site-specific findings. The Town reserves the right to ask for additional/updated scope during the review process, if necessary.