Geotechnical Study

Introduction

Geotechnical investigations gather data about subsurface soil and rock conditions of a proposed development site and then make recommendations on the performance and design standards for structures to ensure they are safe.

These studies, regulated by Engineers and Geoscientists of BC (EGBC), involve desktop reviews and on-site drilling for core samples. Qualified Professionals (QPs) with relevant experience are essential.

What does a Geotech do?

Geotechnical engineering involves the assessment of subsurface soil and rock conditions for any development project. This work includes the analysis of ground stability, foundation design, and the impact of soil and rock properties on construction. The main aspects that geotechnical engineering addresses include:

- Soil and Rock Characteristics: Determining the type, distribution, and engineering properties of soil and rock.
- Groundwater Conditions: Assessing the water table levels and potential impacts on construction.
- Seismic Response and Stability: Evaluating the site's response to seismic activity and ensuring design stability.
- Slope Stability and Hazard Assessment: Identifying potential landslide or erosion risks and proposing mitigation measures.

Geotechnical engineers' activity often includes site investigations, drilling operations, and the development of geotechnical reports and recommendations for construction projects.

Why is it requested?

- To identify risks related to ground stability and foundation design.
- To assess soil performance for stormwater percolation.
- To ensure the stability of future municipal roads and utilities.
- To address hillside hazard lands and general stability for roads and buildings.

Scope of Work

There are four types of geotechnical investigations that may be undertaken, as outlined below.

1. Preliminary Geotechnical Assessment (Desktop Feasibility Study)

Purpose: To provide an initial understanding of the geotechnical conditions of a site without conducting physical site visits.

Components:

- Review of existing geological maps and soil surveys, from government, industry and academic sources, as well as from a consultant's past investigations in the area.
- Examination of topographic maps, surficial soils maps, geological maps, and aerial photographs.
- Analysis of water well databases for groundwater information.
- Assessment of previous geotechnical studies in the area.
- Consideration of the general elements of the proposed development.
- Creation of a summary memo/report outlining the results of the review and identification of potential geotechnical issues and recommendations for further investigation.

2. Geotechnical Assessment Level 1 (Site Reconnaissance and Preliminary Testing)

Purpose: To provide a more detailed evaluation of site conditions with limited on-site investigation, if the Level 1 assessment identified potential issues that require more on-site verification and detailed analysis.

Components:

- Site visit to observe surface conditions and geological features.
- Review of proposed development plans and grading layouts.
- Excavation of test pits to determine soil type and bearing capacity.
- Limited borehole drilling to assess soil stratigraphy if needed.
- Initial laboratory testing of soil samples.
- Preliminary report with recommendations for site preparation and potential foundation options.
- (no seismic testing is included in a Level 1)

3. Geotechnical Assessment Level 2 (Comprehensive Site Investigation)

Purpose: To provide a thorough assessment of the geotechnical conditions for detailed design and construction planning, if the preliminary investigation indicates complex subsurface conditions that would materially impact the development design.

Components:

- Detailed site investigation including multiple boreholes drilled to bedrock.
- Ground penetrating radar to locate underground utilities and identify subsurface anomalies.
- Extensive soil sampling and laboratory testing for mechanical and chemical properties.
- Seismic testing including shear-wave velocity measurement and seismic site classification.

- Assessment of geohazards such as landslides, rockfalls, and soil liquefaction potential.
- Creation of a comprehensive report with detailed design recommendations for foundations, retaining structures, and slope stabilization, erosion and sediment controls for water / wind, any special requirements for roads, utilities, building or structures, roof and permitter drain design, and construction of detention or infiltration ponds.

4. Assessment Level 3: Building Permit and Certification of BC Building Code Schedules

Purpose: To provide final geotechnical recommendations and certifications required for building permits.

Components:

- Additional site-specific investigations as needed.
- Preparation of a Landslide Assessment Assurance Statement if required.
- Certification of geotechnical conditions in accordance with the BC Building Code.
- Detailed foundation design recommendations.
- Final report submission including Schedule B (Assurance of Professional Design) and Schedule C-B (Assurance of Professional Field Review and Compliance).

Report Details

The following outlines a table of contents for a comprehensive geotechnical report.

- **Executive Summary**: A brief summary of findings and key recommendations.
- **Terms of Reference**: Outline of the scope of work and specific objectives of the geotechnical study.
- **Project Details**: Background information, site description, and overview of proposed development plans.
- **Site Investigation**: Detailed description of site reconnaissance, test pit and borehole locations, and field observations.
- **Laboratory Testing**: Results of soil and rock testing, including mechanical properties and chemical analysis.
- **Evaluation and Analysis**: Interpretation of data, assessment of soil and rock properties, and evaluation of site stability.
- **Design Recommendations**: Specific recommendations for foundation design, slope stabilization, drainage, and other geotechnical aspects.
- **Plans/Drawings/Statements**: Site grading plans, stormwater management plans, construction management plans, and other relevant drawings.
- **References/Appendices**: List of literature references and appendices with detailed data, test results, and supplementary information.

Due diligence / securing land	 Preliminary Geotech Assessment (Desktop Feasibility Study)
Concept Development	 Preliminary Geotech Assessment (Desktop Feasibility Study). For any challenging site or project of significant scale, a Level 1 is recommended.
Development Permit	• If required by site conditions or development characteristics, a Level 2 is recommended.
Building Permit	 If required by site conditions or development characteristics, a Level 3 is recommended. o It is common to require drilling for each building site to confirm the construction design specifications for that building's foundations and seismic design.
Construction / Post- Construction	Possible site inspection.

What is generally required at each stage in the development process?