engineering new zealand
te ao rangahau

GEOTECHNICAL REPORTS
GUIDELINE AND TEMPLATE

August 2023

Summary

For a project to succeed, there must be clear communication between all parties involved (eg geotechnical engineer, structural engineer, client etc). All parties in a project need to understand the requirement of their services by the others involved. Engineering New Zealand has heard from regulatory bodies, engineers and architects that there's a need for consistency in the geotechnical reports provided.

Engineering New Zealand, in collaboration with the New Zealand Geotechnical Society (NZGS), the Engineering General Practitioners Group, Structural Engineering Society New Zealand (SESOC), and engineers from Christchurch and Tauranga councils, has produced this guideline and report template to be used by engineers to communicate geotechnical findings to other disciplines on simple, low-risk projects.

This is only a template report – it isn't a substitute for professional engineering advice or judgement. It includes geotechnical considerations and issues that generally need to be addressed to support typical residential development projects. Other geotechnical issues and risks that have not been included in this template may need to be addressed. Care should be taken that the template is adequately adjusted for every project's specific requirements and geological–geotechnical conditions.

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REQUIREMENTS OF A REPORT

A geotechnical report should:

- provide an appropriate level of geotechnical advice and recommendations concerning the specific project requirements at the proposed project's location, and
- meet the needs of the other stakeholders (eg BCA, architect, client, structural engineer).

Communication

Geotechnical reports will vary depending on the specifics of each project but should typically contain the information in the following template. It's unlikely that every part of the template below will be exactly applicable to each project. The template provides a communication tool for stakeholders to collaborate and convey important information. This guideline is a good starting point for forming the geotechnical brief and confirming the required scope.

Relevant information

It's likely that some additional material not included in this template may be required to satisfy local regulatory requirements or reflect project- or region-specific variables. The report's author is responsible for adding sections as appropriate so that these aspects are appropriately addressed.

Use of standards and guidelines

The report's recommendations should comply with the current New Zealand Building Code and consider the most recent New Zealand guidelines and standards issued by professional societies and MBIE.

Writing and review

The preparation of the geotechnical assessment and reporting should be carried out by suitably qualified geotechnical professionals and signed off by registered Professional Engineering Geologists (PEngGeol) and/or Chartered Professional Engineers (CPEng) in the geotechnical practice field, experienced in the specific geological and geotechnical conditions and risks anticipated for the project as appropriate. It's worthwhile noting that only CPEng (not PEngGeol) can undertake design work for the primary structure of residential work.

Similarly, the review and acceptance of such reports from the Consenting Authorities should be carried out by adequately qualified geotechnical professionals also experienced in the specific conditions expected for the project.

COLLABORATION BETWEEN STAKEHOLDERS

Because foundations and some designs, such as retaining structures and screw piles, sit between geotechnical and structural engineering, they require active collaboration between the disciplines. That collaboration is encouraged in Module 1 of the MBIE Earthquake geotechnical engineering practice modules. The Ministry of Education has excellent documentation concerning collaboration. We recommend that architects and engineers review that information and adopt the principles and procedures as appropriate to the scale of the project.

Scope and client communication

Geotechnical investigation and reporting requirements can change depending on the works proposed at a particular site. The client needs to communicate as much detail as possible regarding the project to the geotechnical engineer early in the project. By doing so, the engineer understands the required scope and can plan their investigation and design based on the client's needs.

For instance, if a retaining wall is planned, the geotechnical engineer may do specific investigations at the location of the proposed retaining wall. They can then detail geotechnical parameters to be considered by the structural engineer for retaining wall design.

Alternatively, the client may need to understand the site's geotechnical conditions before they can plan their project. The geotechnical engineer should plan to be involved over multiple stages: early in the project and later, once the project is detailed and specific geotechnical recommendations can be provided.

Impact on adjacent properties

Construction activities can often affect adjacent properties. Therefore, investigations should cover all factors that may affect an adjacent property, including features such as:

- slopes and retaining walls
- adjacent buildings
- structures and buried services
- pipes conveying water, gas or sewage
- ground settlement or movement or changes in groundwater levels during and after construction activities on the site.

Early engagement

Overall costs are reduced when engineers are engaged early in the project and work collaboratively. International research shows that the costs of a quality ground investigation are repaid – often by a factor of over 10 – in savings on projects or reductions in cost overruns caused by unforeseen conditions.[1]

Construction monitoring and PS4

Engineers need to agree on who will be undertaking construction monitoring for all stages of the project and put that information into the construction monitoring schedule.

The structural and geotechnical engineers need to agree early on who will be signing the PS4 for geotechnical-related work and who will be undertaking construction monitoring.

Temporary stability during construction and permanent stability of the site should be considered in the inspections proposed by the geotechnical engineer/engineering geologist.

Geotechnical Database

We encourage engineers to upload the results of geotechnical investigations into the New Zealand Geotechnical Database (NZGD). Approval from a client can be incorporated into contract documentation for a project.

1 www.building.govt.nz/building-code-compliance/b-stability/b1-structure/practice-advisory-17

REPORT TEMPLATE

GEOTECHNICAL ASSESSMENT REPORT

Project details

PROJECT STREET ADDRESS	45 Fictitious Street, Unrealton
CLIENT DETAILS	Clients R Us
PROJECT LOCATION	
REVISION NUMBER	0
PREPARED BY	N Gineer BEng FEngNZ
REVIEWED BY	P Erson CPEng no. 76543
DATE	01/01/2020
JOB NUMBER	12345
COMPANY DETAILS	123 Physical Street, Placeville, 04 123 4567, office@company.com

SUMMARY

SITE DESCRIPTION	• Address • Proposed works • Soil profile: description of typical soil profile or ground mode (adequately adjusted and interpreted for the works proposed at the site, at the location of foundations, retaining walls, slopes etc) • Groundwater: (median depth or expected range) consider seasonal variation and climate change (sensitivity of groundwater conditions to change)
GEOTECHNICAL HAZARDS	• Summary of geotechnical hazards affecting the site • Example: summary of liquefaction analysis results listing expected settlement
FOUNDATION RECOMMENDATIONS AND ASSOCIATED CONSTRAINTS	• Suitable/preferred foundation option(s) • Varying options depending on different development approaches (ie heavy/lightweight, regular/irregular etc)

GEOTECHNICAL DESIGN PARAMETERS	• Relevant geotechnical design parameters to be considered in design, such as:
	  • foundations
	  • retaining walls
	  • earthworks
	  • slope
	  • subsoil class.

FURTHER WORKS	• Additional investigation required • Additional investigation as the project progresses • Additional design and interaction with the structural engineer • Construction monitoring

1. Introduction

- Scope and project description
- Parties involved
- Intended purpose of the report
- Engagement of the engineer (Construction monitoring? PS4?)

2. Site description

The site description outlines characteristics of the site and neighbouring area, considering factors such as:

- slope
- elevation
- services
- neighbouring sites
- proposed development.

3. Area geology

3.1 Review of publicly available geological mapping and information

3.2 Regional geology and seismicity

4. Review of available information

4.1 Recent/past earthquakes and precedent site performance (including observations regarding site and slope instabilities like rockfall, flooding, settlement, or deformation of existing structures (building retaining walls) condition and performance.

4.2 Existing geotechnical records (including relevant NZGD information).

4.3 Flooding (information and assessment by regional maps or other specialists). If uncertain, this should include recommendations for specialist assessment if considered necessary.

4.4 Summary of previous geotechnical assessment reports for the site.

5. Geotechnical investigations

5.1 Previous site investigations

5.2 Current site investigations

- Logs should be done to NZGS Field Description of Soil and Rock.
- Investigation locations should be included in a site plan either in the body of the report or in the appendices.

6. Subsurface conditions

6.1 Ground model and typical soil profile (adjusted to all the works proposed)

6.2 Groundwater (depth of groundwater assumed for geotechnical design and taking into account anticipated or predicted seasonal fluctuations)

6.3 Rationale for proposed geotechnical parameters

6.4 Uncertainties and assumptions in the ground model and groundwater model

6.5 Site subsoil class (as per NZS1170.5)

7. Geotechnical hazards

These should be included as appropriate to the site and development. If analysis or detailed assessment is undertaken, such as liquefaction analysis, the details must be included.

7.1 Liquefaction potential and effects

7.2 Lateral spreading potential and effects

7.3 Expansive soils

7.4 Compressible soils

7.5 Mass movement, including rockfall and landslide risk

7.6 Uncontrolled fill

7.7 Stability of existing slopes

7.8 Erosion and drainage

7.9 Sensitive and collapsible soils

7.10 Contamination

7.11 Falling debris

7.12 Subsidence

7.13 Slippage

7.14 Inundation

7.15 Other relevant information

8. Geotechnical recommendations

8.1 Safety in Design

8.2 Foundations (as appropriate to the site and development)
Foundation concerns and options are included in this section. Detailed design is likely to be outside this report's scope and is expected to be provided as a separate report once the most suitable foundation solution has been chosen for the project.

- 8.2.1 Shallow foundation options
- 8.2.2 Ground improvement options
- 8.2.3 Deep foundation options
- 8.2.4 Bearing capacity
- 8.2.5 Building lateral resistance (sliding/passive bearing/pile lateral resistance)
- 8.2.6 Soil vertical and lateral spring stiffness
- 8.2.7 Pile design parameters
- 8.2.8 Pavement design considerations/parameters
- 8.2.9 Maintenance requirements and end-of-life recommendations

8.3 Filling and earthworks (as appropriate to the site and development)

- 8.3.1 Cut batters
  - 8.3.1.1 Temporary and permanent batters
  - 8.3.1.2 Comment on excavations near boundaries or structures of varying importance levels (il1 to il4).
  - 8.3.1.3 Assess the impact of deformation and the risk of batter failure on adjacent property and confirm any mitigation measures required to manage these risks.
- 8.3.2 Site won material/stockpiling

8.4 Retaining walls (as appropriate to the site and development)

- Include an assessment of existing walls and parameters for new walls as options discussion if appropriate.
- Depth of slip plane to be retained
- Max cut/fill limit considering deep-seated failure
- Soil description, cohesive, cohesionless
- Drained parameters, c', phi'
- Undrained parameters, su, c

8.5 Slope design

- Design of proposed new slopes
- Analysis type

8.6 Other engineering considerations

Include other engineering considerations in this section, for example:

- Is the site suitable for soakage (consider slope stability etc)?
- Who is undertaking stormwater/wastewater management?
- Is groundwater recharge required to maintain stability?

Future geotechnical involvement

- Outline further geotechnical investigations as required
  - Detailed design of ground improvement/foundations (to be done as part of a separate report)
- Design plan review by the geotechnical engineer
  - Geotechnical construction monitoring:
  - Inspection of earthworks to confirm stability
  - Subgrade inspection to confirm bearing capacity and ground conditions
  - Installation of fill material
  - Confirmation of compaction
  - Stability monitoring
  - Final inspection to confirm site suitability following construction works
    - Removal of boulders
    - Installation of erosion control
    - Confirmation of final unretained slope angles

9. Conclusions

Discuss the risks to understand how the engineer concluded the recommendation/design.
Discuss Safety in Design as required.

Mention the expected next steps required.

10. Limitations

11. References

12. Appendices

For examples of good practice, see the New Zealand Geotechnical Society.

- **Drawings:** Site plan showing footprint of proposed works (if available at the time of reporting) and location of geotechnical investigations.
- **Investigation logs:** Logs of all investigations carried out.
- **Analysis outputs:** Liquefaction analysis logs, slope stability assessment logs, static settlement calculations.
- **Geotechnical cross sections:** Useful to the structural engineer and regulatory checkers. Cross sections must show the relevant investigation points to scale on the section and note their offset from the drawn section. The section should also show the proposed location of the structure or development, pre- and post-development ground levels, and site boundaries.
- **Safety in design:** The Safety in Design risk register, which should align with the conclusions.
- **Statement of professional opinion:** as required.

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