Role of the Geotechnical Engineer in the Land Development Process

1 LEGAL FRAMEWORK

Section 106 of the RMA and Section 72 of the Building Act are the ones that give legal impetus to the Geotechnical Engineer's role in the land development and building development processes. Typical Geotechnical Engineering processes during a Land Development life cycle are:

1.1 Pre-purchase / Feasibility Studies / Plan Changes

These are typically high level desktop studies to inform perspective purchasers (or existing land owners), or inform a structure plan (e.g. for plan change), of perceived geotechnical constraints to land development. These studies may comprise literature reviews, aerial photograph interpretations, geomorphic mapping and site walkovers, and will more often than not determine a likely scope of geotechnical works required to address any perceived constraints.

1.2 Geotechnical Investigation Report

A preliminary Geotechnical Investigation Report is sometimes executed in advance of any scheme plans being formed, in order provide a framework for Master Planning and/ or scheme design purposes. It would normally present Geotechnical engineering concepts to mitigate or eliminate geotechnical risk (e.g. slope instability, settlement, liquefaction, etc.).

Preliminary reports are usually not required where the landform is perceived to be geotechnically "straightforward".

The detailed Geotechnical Investigation Report (where relevant, following the preliminary report) can be factual and/ or interpretative. The interpretative content is generally commensurate with the development proposal at hand, and advances geotechnical engineering design concepts or geotechnical parameters to facilitate detailed design of structures (e.g. retaining walls, etc.).

The advance a Geotechnical Investigation Report, the consultant generally needs to be given copies of:

- The plan of Subdivision (Scheme Plan)
- Existing and proposed Site Contours Plans
- Selected Cross-sections at a natural scale showing profiles before and after earthworks
- Existing Underground Services Plans
- Proposed Earthworks and Silt Control Plans
- Proposed Underground Services Plans

If detailed earthworks plans are not available then at least preliminary proposals should be supplied. Generally speaking, only when proposed cut and fill depths are known can the Geotechnical Consultant properly plan field work and ensure that boreholes etc. are drilled in the most appropriate places to relevant depths. Also it is only with knowledge of the final design contours that thorough assessments of any adverse effects can be made, for example the effects on slope stability of the proposed development work.

These reports can also be used to support geotechnical Statements of Evidence in Environment Hearing for a specific development proposals (e.g. for Resource Consent).

Lander Geotechnical Consultants Limited
P O Box 97 385, Manukau, Auckland 2241
Phone: 027 488 6882
Email: shane@landergeotechnical.co.nz

1.3 Pre-Earthworks

Before Earthworks commence the Geotechnical Consultant should to be given several days' notice of the proposed commencement date of site clearing prior to earthworks. This gives them the time to schedule inspections and staffing, and to have a pre-construction meeting with the contractor.

Generally speaking the Consultant will be supplied with copies of approved engineering and earthworks drawings at this time, together with the Consent conditions, and will check to ensure these plans are consistent with those that formed the basis of the Geotechnical Investigation Report, and/ or have correctly interpreted any specific advice given in the report.

1.4 Earthworks Construction

The Geotechnical Consultant's role in the earthworks phase of the subdivisional development process is to regularly visit the site to inspect and test representative areas of the filling to ensure that its degree of compaction meets specific requirements. There are also requirements to inspect all site stripping, gully clearing, and subsoil drainage operations, etc. plus any other specific requirements imposed by the Consent conditions.

The recommended frequency of inspections is prescribed in NZS 4431:1989, "Code of Practice for Earth Fill for Residential Development" and varies between full time for major projects and occasionally for very minor projects. The Institute of Professional Engineers NZ (IPENZ) also provide a guideline on Construction Monitoring Levels (CM1 to CM5). However, the appropriate frequency of site inspections and testing is assessed by the Consultant for each project.

Earthworks contractors work long and variable hours and often the weather dictates unexpected changes to their programme. It is the writers' experience that it is prudent to endeavour to keep in constant touch with them regarding this issue. Even so, sometimes substantial amounts of work can take place between the Consultants visits!

Normally this is not a problem as most contractors understand their obligations and maintain a high standard of work at all times. However, it must be understood that the Geotechnical Consultant can only monitor good work practice and cannot enforce it unless they have full-time supervision brief.

Unfortunately, deleterious inclusions are occasionally found in certified earth fills and within unworked natural ground, usually at the time of preparation of the building platform or as a result of a site investigation undertaken for foundation design purposes.

Unless part of a specifically Engineered and Council approved project, Geotechnical Consultants generally do not in any way condone the placement of any organic or otherwise deleterious materials within any filling that is to be certified to Engineering standards, nor do they condone the incomplete stripping of topsoil to the incomplete mucking out of gullies. They will generally insist on proper underfill drainage, especially in natural gully features, and on the benching of sloping ground prior to filling and will take frequent photographs documenting the works.

Geotechnical Consultants will not knowingly certify any area of filling that has not been adequately stripped, undercut, benched and drained as appropriate. To help minimise the occurrence of deleterious inclusions in the completed works, it is of vital importance that the contractor gives the Consultant sufficient advance notice of any intention to commence filling in a new area or whenever he recommences filling in a partly completed area. He must not commence work until the Consultant has carried out their inspections and testing as necessary.

In the case of imported filling, where the greatest risk of contamination is present, a full-time clerk of works should be employed to confirm the quality of every load dumped on site. Generally, it is prudent for the Geotechnical Consultant to inspect and test the material at its source in order to approve its use.

1.5 Geotechnical Completion Report

This report provide a Statement of Professional Opinion as to the suitability of the land for future building development, taking into account the land development construction works. This report is used to support an application to the local authority in accordance with Section 224c of the RMA. Titles may be tagged with encumbrances, depending on any Geotechnical constraints highlighted in the Completion Report that may still prevail following the land development construction works.

Before preparation of the Geotechnical Completion Report, the Consultant needs to be given copies of:

- Fill As-built Plans showing areas of certified and uncertified fill
- Gradients As-built Plans clearly showing all areas of the land having gradients of 1 in 4 or greater
- Services As-built Plans
- Subsoil Drainage As-built Plans
- Any other Special As-built Plans

The As-Built's will normally contain a written statement from the Surveyor/Contractor Engineer that all earthworks, drainage and roading have been fully completed in accordance with the details shown on the as-built plans.

It should be noted that the placement of topsoil on the land following the completion of the bulk earthworks is an operation that is undertaken without our involvement. The Geotechnical Consultant may establish typical topsoil depths during the preparation of the Completion Report, but can take no responsibility for any construction problems that arise from the presence of final topsoil thicknesses in excess of the required minimum (up to 300mm topsoil depth is a generally acceptable maximum thickness).

It is often not possible to investigate every single proposed residential lot during the preparation of a Geotechnical Investigation Report. Accordingly, it may be necessary at the time of preparation of the Geotechnical Completion Report to undertake specific site investigation work on all previously uninvestigated lots that have either been cut or not affected by the earthworks.

2 LIMITATION OF LIABILITY

On any earthworks/ land development project where the Geotechnical Consultant has not been instructed to undertake full-time supervision, they should not be held liable for any consequential loss or damage to any building, roading, paving, retaining wall, landscaping works or services caused by the presence of any unsuitable/uncertifiable materials that may be subsequently discovered underlying or within any areas of filling they have certified, on the basis that such unsuitable/uncertifiable materials could only have been placed by the Contractor or others without our approval and without our knowledge.

Further, the Geotechnical Consultant should not be held liable for any consequential loss or damage to any building, roading, paving, retaining wall, landscaping works or services caused by the presence

of any unsuitable pre-existing materials that may be subsequently discovered within areas of unworked natural ground (such as offal pits, machinery dumps, rubbish tips etc.), unless is was reasonable to expect that such materials should have been revealed during the normal pre-development Geotechnical Investigation, or during the course of normal inspections as the works progressed, or as a result of subsequent specific site investigation work that the Geotechnical Consultant had been briefed to carry out on previously investigated cut or natural lots at the time of preparation of our Geotechnical Completion Report.

Prepared By:

Lander Geotechnical Consultants Limited