



SECTION 4 GEOTECHNICAL REQUIREMENTS

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Appendix A *Inspection Report & Certificate of Land Stability
For Building Development*

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4.1 SCOPE

This section sets out the requirements and conditions for the approval of earthworks and/or building foundation preparation on land proposed for subdivision whether for residential, business or recreational purposes.

No trees shall be removed, no fill material and no excavation or any work involving the disturbance of the land surface other than that of an investigatory nature shall be carried out on land to be subdivided until a resource consent has been granted by the Council, and any appeals to the Planning Tribunal or objections to the Council under S.357 of the Resource Management Act have been disposed of or withdrawn.

4.2 GEOTECHNICAL REPORTS

Two geotechnical reports will generally be required. First, a preliminary report prepared and signed by a registered engineer experienced in geotechnics, which includes an assessment of the following matters as appropriate:

- Extent and nature of any existing fill on the site;



- Details of any services within or near the site, and of how they are going to be provided if necessary (see section 3).
- Extent of new fill and compaction measures proposed;
- Stability of existing and recontoured sloping ground and batters;
- Suitability of the land (or recontoured land where earthworks are proposed) for the founding of buildings, roads and services, in terms of strength and settlement.
- Details of any earth retaining structures proposed as part of the subdivision works.
- The extent and nature of any site contamination.
- Subsoil drainage requirements.

The acceptable factor of safety against slope failure is 1.5. A lesser factor of safety may be accepted where the effect of any slope movement would be minor and the area is defined by a building line restriction or consent notice.

This report should be submitted with the application.

Details of the second report required are given in clause 4.14 of this section.

4.3 REFUSAL OF CONSENT

Section 106 of the Resource Management Act directs the Council not to grant a subdivision consent in circumstances where the land, or any structure on the land may be subject to damage by erosion, falling debris, subsidence, slippage or inundation unless provision is made to the Council's satisfaction for works to avoid, remedy or mitigate these effects.

For land which may have characteristics of the type referred to above, if the subdivision is to proceed, details of the works proposed to avoid, remedy or mitigate the effects of such characteristics are required. Remedial measures which may be considered include:

- The isolation of unstable or weak areas by means of a building line restriction.
- The installation of drainage measures (such as buttress or counterfort drains) to stabilise saturated unstable slopes.
- Recommendations on the specific design of foundations, in which case the provisions of NZS 3604:1990 "Code of Practice for Light Timber Framed Buildings not requiring specific design" will not apply.

4.4 STANDARDS AND RELATED DOCUMENTS

The following documents will be used as a guide in assessing geotechnical reports:

- a) The New Zealand Building Code Handbook and approved documents.
- b) NZS 4402:Parts 1-7: 1988 - Methods of Testing Soils for Civil Engineering Purposes.
- c) NZS 4404:1981 - Code of Practice for Urban Land Subdivision.
- d) NZS 4431: 1989 - Code of Practice for Earth Fill for Residential Development.
- e) NZS 4203: 1984 and 1992 - Code of Practice for General Structural Design and Design Loadings for Buildings.



- f) Report - 'The Territorial Local Authority and Responsibility for Land Stability'. Territorial Government Landslip Committee 1978.
- g) Auckland Regional Water Board - 'Urban Earthworks - A Guideline for Erosion Control'.
- h) Regional Water Board - 'General Authorisation for the Discharge of Sediment Laden Stormwater'.

4.5 CONSENT NOTICES

Where a subdivision consent is granted subject to a condition being complied with on a continuing basis by the subdividing owner and subsequent owners, the Council will issue a consent notice to be registered on the title of the affected land.

4.6 EARTHWORKS DESIGN

The design of bulk earthworks shall generally be in accordance with the requirements of NZS 4431: 1989, Code of Practice for Earth Fill for Residential Development and the New Zealand Building Code.

4.7 INFORMATION TO BE SUPPLIED WITH ENGINEERING DRAWINGS AND SPECIFICATIONS

4.7.1 Fill Areas

Where earth fill exceeding 100 square metres in area or over 1 metre in depth is proposed on any lot, the following information shall be supplied with the engineering drawings and specification.

- a) A plan showing the levels of the existing site, the final proposed contours, the existing watercourses and overland flow paths, together with information on the water table, the ground surface of the area concerned, and logs of any bores taken during investigations.
- b) A plan showing the disposition of lots and the extent of cut and fill together with a plan showing batter slopes and field drainage, also proposed watercourse alignments and overland flow paths, and existing and proposed services which will be affected by the earthworks.
- c) A plan and specification for the design and construction of all silt retention areas.
- d) An engineering specification fully describing compaction criteria giving moisture/density test results on the soils to be compacted and the proposed control measures to be employed. The proposed foundation bearing capacity shall be included.
- e) The name of the geotechnical engineer, who will be responsible for controlling operations on the site to ensure compliance with the approved engineering drawings and specification.
- f) Areas to be protected.



- g) A list of the Contractor's proposed compacting equipment.

4.7.2 Cut Areas

Where excavations exceeding 100 square metres in area or over 1 metre in depth or are within 20m of any boundary, are proposed on any lot, the following information shall be supplied with the engineering drawings and specifications.

- a) A plan showing the existing site, the final proposed contours, the existing watercourses and overland flow paths, and logs of any bores taken during investigations.
- b) A plan showing the boundaries of lots and the extent of cut and fill together with a plan showing batter slopes and field drainage, also proposed watercourse alignments and overland flow paths, and existing and proposed services which will be affected by the earthworks.
- c) A plan and specification for the design and construction of all silt retention areas.
- d) Areas to be protected.
- e) A plan and specification of proposed foundation bearing capacity.
- f) Any consents required by Section 237 of the Public Works Act.

4.8 CONSTRUCTION AND QUALITY CONTROL

A registered engineer experienced in geotechnics shall be appointed by the subdivider to supervise the works and -

- i) To determine the methods and frequency of construction control tests and to evaluate the significance and reliability of the test results.
- ii) To provide regular inspection during construction.
- iii) To determine the extent of any further geotechnical investigation works which may be required.

4.9 SITE PREPARATION

Before any earthworks are commenced, areas of cut and fill should be clearly defined, and where necessary or as directed, sufficient fencing or barriers should be provided around trees or other features that are to be protected. Adequate provision should also be made for the control of erosion, surface water run-off and siltation.

All rubbish, vegetation, debris, etc, shall be removed from earthworks areas and disposed of to an approved landfill prior to the commencement of topsoil stripping. All earthwork areas should be stripped of all topsoil and such soft or organic material as may be determined by the Geotechnical Engineer to be unsuitable.

The stripped ground surface should be prepared and then inspected by the Geotechnical Engineer before any filling is placed thereon.



4.10 SEDIMENT (SILT) CONTROL

The subdivider shall take measures to control silt contaminated stormwater. The subdivider shall ensure that stormwater is directed into approved silt retention areas at all times. The design and construction of the silt retention areas shall be in accordance with the Auckland Regional Council publication “Erosion and Sediment Control Guidelines for Earthworks” (Technical Publication No.2) to the approval of the Council Engineer and the Auckland Regional Council. These silt retention areas are to be constructed and maintained by the subdivider until such time as the land becomes stabilised to the satisfaction of the Council.

Details of methods available to control erosion and sediment loss are given in Appendix B to this section.

4.11 SUBSOIL DRAINAGE

To prevent the problems of surface springs and scouring at the toe of fills it is essential that subsoil drains be constructed in any valley floor (the thalweg) prior to filling in such a way that they will continue to operate after development is complete.

4.12 INSPECTIONS

Inspections shall be made by the Geotechnical Engineer at the following times:

- a) After any part of the existing ground has been finally stripped and prepared, and before the placing of any fill on that ground.
- b) After any drain has been installed and before the drain is covered by fill.
- c) Such other times as the Geotechnical Engineer considers necessary to enable him/ her to assess the general standard of earthworks and to reasonably satisfy himself/ herself that:
 - i) Fill is not placed over soft or organic material.
 - ii) That all areas of existing ground showing seepage or potential seepage emission have relief drains provided.
 - iii) Unsuitable material is not incorporated into the fill.
 - iv) The compaction operations are systematic, the moisture content of the fill material is suitable and the degree of compaction appears to be consistent and satisfactory, in order to attain the specified bearing capacity.

4.13 QUALITY CONTROL TESTS

4.13.1 General

During the construction of earth fills some or all of the following quality control tests shall be made on the fill material:

- a) Tests to determine whether the moisture content is suitable for the type of material being used to achieve optimum results.



- b) In-situ field density tests to determine whether the degree of compaction is up to the specified minimum.
- c) Tests to determine the maximum dry density for the soil tested in each in-situ field density test.
- d) Such other tests as may be specified by the Geotechnical Engineer for control testing of fills of particular soil types, providing that the soil property tested shall be related to the in-situ density or moisture content of the fill by a laboratory investigation. Such tests may include shear strength tests, cone penetrometer tests and Proctor needle tests.

4.13.2 Particular Tests

Testing shall be more frequent under any of the following circumstances:

- a) During the first 4,000 cubic metres of fill carried out on the project.
- b) On the final layer of not less than 1.0m in depth.
- c) When soil type or conditions are variable.
- d) When the Geotechnical Engineer or the Council Engineer is in any doubt about the adequacy of construction methods or soil properties.
- e) When a decision to reject work based on the judgement of the Geotechnical Engineer or the Council Engineer is disputed.
- f) When relatively small quantities of fill are concentrated in localised areas or placed discontinuously over a long period of time.

4.13.3 Location of Tests

The location of tests by the Geotechnical Engineer (except in the case of (d) and (e) above, when it shall be the Council Engineer), who shall select them so as to test material likely to be further from the specified quality. In addition, a proportion of tests shall be taken at random locations to check the average standard being obtained.

4.13.4 Tests under carriageways

Where filling is carried out under proposed carriageways, further testing will be required as specified in Section 8 (Road Design and Construction) of this code.

4.13.5 Test records

All field and laboratory test data shall be recorded in a systematic manner that will allow the results to be identified and allow the calculations to be checked at a later date, if necessary. All control test results shall have recorded the time, date, location and reduced level. Test results relating to sections of fill that have been subsequently removed or reworked and recompacted shall be noted accordingly.



4.14 INSPECTION REPORT AND CERTIFICATE OF LAND STABILITY FOR BUILDING DEVELOPMENT (SEE APPENDIX A)

On completion of construction the Geotechnical Engineer shall furnish to the Council Engineer a report describing the extent of the inspection and the results of testing, together with a Statement of Professional Opinion (Final Geotechnical Certificate) as to the compliance of the filled ground to the specification, the suitability of filled ground for specified types of building construction and where applicable, the suitability of the original ground for specified types of building construction, and the provisions undertaken to provide an adequate factor of safety against instability.

Where appropriate, the final report shall be accompanied by a drawing showing:

- (a) positions of building line restrictions isolating unstable or weak areas.
- (b) areas generally abutting proposed building lines (if any) within which building foundations will require specific design by a registered engineer and where the provisions of NZ 3604:1990 “NZ Standard Code of Practice for light timber frame buildings not requiring specific design” do not apply.
- (c) areas where building development can be carried out in accordance with NZ 3604:1990 referred to above without unacceptable differential settlement or risk of slope failure.
- (d) The location of any drainage or other measures to ensure stability against subsidence.