CODE OF PRACTICE FOR CITY SERVICES
& LAND DEVELOPMENT

ENGINEERING STANDARDS MANUAL

SECTION 2

EARTHWORKS

SECTION 2.0 EARTHWORKS

2.1 SCOPE

The purpose of this part of the Engineering Standards Manual is to provide:

a) The engineering requirements for earthworks associated with subdivision and land development projects.
b) The criteria for performance.
c) Methods for design and construction control.
d) Methods for the assessment and protection of slope stability.
e) Methods of assessing the suitability of both natural and filled ground for the founding of roads, buildings, services and other works.
f) Methods for the control of erosion and siltation.

This part of the standard does not provide methods for:

a) Evaluation of existing natural ground or uncontrolled fill.
b) Assessing retaining wall and backfill construction.
c) Contractual aspects of earthfills.
d) A verification method for the New Zealand Building Code – Section B1.

2.2 PERFORMANCE CRITERIA

Earthworks shall:

- Meet all criteria of the District Plan
- Not unnecessarily alter ground levels on the contour of the land
- Be sale and stable and geotechnically sound
- Provide an accessible building platform within each allotment of a subdivision appropriate to the zoning of the land
- Provide adequate foundations for roads and services
- Not unnecessarily alter the natural land form or interfere with natural features unless otherwise consented to pursuant to the District Plan
- Cater for surface and ground water flows
- Not generate undue nuisance from noise, dust or vegetation disposal

2.3 TECHNICAL RESPONSIBILITIES

2.3.1

Where any land subdivision or development involves bulk earthworks, the assessment of slope stability, or the detailed evaluation of the suitability of natural ground for the foundations of buildings, streets, services or other works, then a soils engineer shall be appointed by the developer to carry out the following functions:

a) Prior to detailed planning of any development to undertake site inspection and such investigations of subsurface conditions as may be required.

b) Before work commences to review the drawings and specifications defining the earthworks proposed, and submit a written report on foundation and stability aspects and any proposed departures from this Code and associated standards.

c) Before work commences and during construction to determine the extent of further specialists soils engineering services required (including investigation and geological work).

d) Before and during construction to determine the method and frequency of construction control tests to be carried out, determine the reliability of the testing and to evaluate the significance of test results and field inspection reports in assessing the quality of the finished work.

e) During construction to provide regular inspection. Wwhile a daily visit might be regarded as reasonable on earthwork construction on minor projects, inspection on a nearly full time basis is often necessary on major projects.

f) On completion to submit a written report attesting to the compliance of the earthworks with the specifications, and as to the suitability of the development for building construction.

2.3.2

All geotechnical investigation and completion reports shall be prepared by a Professional Engineer who is experienced in the practice of geotechnical engineering and registered under the Engineers Registration Act 1924 and who has professional indemnity insurance.

2.3.3

The owner's representative may act as the soils engineer if possessing the aforementioned qualifications and experience.

2.3.4

The construction control testing shall be carried out by a competent person, under the control of the soils engineer in a laboratory with International Accreditation New Zealand registration, or similar approved accreditation authority registration, in all relevant tests.

2.4 INVESTIGATIONS AND REPORTING

Site investigations and reporting shall be carried out in accordance with:

- NZS 4402:1986 Methods of Testing Soils for Civil Engineering Purposes;
- NZS 4431:1989 Code of Practice for Earth fill for Residential Development;
- NZS 4404: 2004 Code of Practice for Land Urban Subdivision.

Together, these documents provide a rational approach to undertaking site investigations and preparing associated reports for projects involving bulk earthworks.

PHASE	INVESTIGATIONS	REPORTING	REGULATORY
1	Preliminary Investigation*	Preliminary geotechnical assessment report and sketch design	Subdivision Concept Plans and initial discussion
2	Comprehensive Investigation	Geotechnical Investigation Report	Resource Consent Application Scheme Plan Approval (Section 223 Certificate)
3	Supplementary Investigation*	Supplementary Reports and Detailed Engineering	Engineering Design Submission and Approval
4	Construction Observation	Field reporting and information gathering and feedback to design	Design amendments and re-approvals
5		Specific Restrictions, Geotechnical Completion Report and As Builts	Subdivision Release (Section 224 Certificate)
6	Performance Evaluation	Supplementary Reports	Ongoing reports on long term restrictions or requirements.

Table 2.1 provides a typical methodology for investigations and reporting for subdivisional development.

* This investigation and associated reports may be integrated with the comprehensive investigation depending on the size and impact of the proposed development.

2.4.1 PRELIMINARY INVESTIGATION

2.4.1.1

The purpose of the preliminary investigation is:

a) To access the general suitability of a site for its proposed use
b) To gain an appreciation of design requirements
c) To ascertain possible construction difficulties
d) To enable the preparation of concept reports and plans for initial discussions
e) To identify obvious hazards
f) To determine the requirements for a comprehensive geotechnical investigation.

2.4.1.2

The preliminary investigation should cover the following factors:

a) Ownership of the land
b) Regional geology
c) Topography and predominant features
d) Drainage and ground water regimes
e) Local subsoil conditions
f) Stability

2.4.1.3

The preliminary investigation should be based on:

a) A visual inspection of the site
b) A review of existing information
   - Geotechnical maps
   - Existing reports (where readily available)
   - Aerial photographs
c) Local knowledge (where available)

2.4.2 COMPREHENSIVE INVESTIGATION AND GEOTECHNICAL INVESTIGATION REPORT

2.4.2.1

The purpose of the comprehensive investigation is:

d) To enable the preparation of a Geotechnical Investigation Report
e) To identify hazards and recommend mitigating measures
f) To identify special foundation and siting requirements
g) To enable the preparation of a detailed earthworks design
h) To enable the development of a construction methodology

2.4.2.2

The Geotechnical Investigation Report should cover the following factors:

a) The factors for a preparatory evaluation (2.4.1.2) but in more detail
b) Special design or construction requirements
c) Special foundation requirements
d) Services
e) Access
f) Effluent Disposal
g) Non-engineered fills
h) A statement of professional opinion as to the suitability of the land for the proposed development – refer NZS 4404 : 1981 Appendix A.

2.4.2.3

The Comprehensive Investigation and Geot4echnical Investigation Report should be based on:

a) The requirements for a preparatory report (2.4.1.2) but in more detail
b) Subsoil investigation
c) Slope stability analysis
d) Experience from adjoining or similar projects.

2.4.3 SUPPLEMENTARY INVESTIGATIONS AND REPORTS

2.4.3.1

The purpose of a supplementary investigation is:

a) To obtain specific design details, e.g. CBR's
b) To analyse construction exigencies
c) To make amendments to the Investigation Report

2.4.3.2

The supplementary reports should cover the following factors:

a) Connections with the Comprehensive Report
b) Design and construction requirements for special items such as road subgrades and retaining walls

2.4.3.3

The supplementary investigations and reports should be based on the specific requirements for the purpose.

2.4.4 CONSTRUCTION OBSERVATION AND REPORTING

2.4.4.1

The purpose of construction observation and reporting is:

a) To enable the preparation of an Eathworks Completion Report
b) To verify the quality of construction
c) To monitor the quality of construction
d) To gather information

Note: The supplementary and construction reports should be written as addenda to the investigation or completion reports as appropriate

2.4.4.2

Construction reports should cover the following factors:

a) Earthworks volumes
b) Compaction tests and laboratory reports
c) General observations
d) Construction procedures

2.4.4.3

Construction observation and reporting should be based on:

a) Regular inspections and testing
b) Laboratory test results

2.4.5 EARTHWORKS COMPLETION REPORT

2.4.5.1

The purpose of an Earthworks Completion Report is:

a) To confirm and elaborate on the findings of the Investigation Report.
b) To describe all the activities associated with the extent of earthworks.
c) To provide a professional statement of adequacy and compliance.
d) To confirm and define specific site requirements.

2.4.5.2

Earthworks completion reports should contain:

a) A description of construction activities.
b) A description of the control testing (and results) carried out.
c) Identification and re-evaluation of situations arising during construction.
d) Descriptions of specific foundation and siting limitations or requirements. This may result in notices being registered on the titles of the affected sites, the earliest possible notification of these requirements should therefore be given.
e) A registered engineers certification of the works.

2.5 SETTLEMENT AND SLOPE STABILITY CRITERIA

Settlement and slope stability criteria shall be assessed in accordance with section 2.5.3.2 of NZS 4404:1981, which describes the settlement, bearing capacity, shrinkage and expansion and slope stability factors that need to be determined in providing a suitable foundation platform.

2.6 COMPACTION STANDARDS

Compaction standards shall be in accordance with Section 205.5 of NZS 4404:1981, which describes the relative compaction, air voids, shear strength, relative density and field relative compaction tests that need to be carried out on fill material during the investigation and construction phases of a project.

2.7 EARTHWORKS DESIGN REQUIREMENTS

2.7.1

Earthworks design shall be carried out in accordance with the requirements of the Geotechnical Investigation Report.

2.7.2

Earthworks designs shall show:

a) Existing and proposed contours
b) The extent of works
c) Underfill drainage
d) Rock profiles – where appropriate
e) Stockpiling areas
f) Stabilising measures
g) Existing services

2.7.2 MINIMUM REQUIREMENTS:

a) Slopes steeper than 1 vertical to 5 horizontal shall be subject to specific design.
b) Works within adjoining properties shall require the approval of the affected landowners.
c) Ponding or flow restrictions to natural stormwater runoff shall not be permitted, unless by specific agreement for temporary situations.
d) Cuts and fills of over 4.0m shall be subject to specific design including the type of underfill drainage required to cope with the higher lands.
e) Existing services affected by earthworks shall be evaluated for adequacy and shall be upgraded or relocated as necessary.

2.10.2.4

Retaining structure, drainage and excavations may be subject to obtaining a building consent.

2.10.3 RETAINING STRUCTURES

2.10.3.1

Repairs to retaining structures should be carried out under close control and may be subject to obtaining a building consent.

2.10.3.2

The maintenance of retaining structures should not involve more than clearing of overgrowth and making sure that the drainage systems are functioning properly.

2.10.4 SUBSOIL DRAINAGE

2.10.4.1

The failure of underfill or subsoil drains could result in significant alterations to the ground water regimes and subsequently cause potentially disastrous slope failures.

2.10.4.2

Upon notification of a potential ground water problem a Council officer shall inspect the site and make recommendations on the next steps or whether further investigation is required. Where possible, subsoil drainage outlets shall also be inspected.

2.10.4.3

All remedial works on subsoil drainage shall be subject to specific design and approval.