PART 2 : EARTHWORKS

1.0 GENERAL

This part covers the clearing, excavation, and fill work associated with all aspects of the works.

1.1 Standards

Unless superseded by these specifications, the following standards shall apply:

- NZS 4431 — Code of Practice for Earthfill for Residential Development
- NZTA Specification F/1 — Earthworks Construction (The sections on topsoiling and grassing between road boundaries and batter slopes continuing beyond the road boundaries are superseded by sections in Part 7 : Landscape Works in this Standard Technical Specification).
- Environment Waikato Erosion and Sediment Control — Guidelines for Soil Disturbing Activities

2.0 PREPARATION FOR EARTHWORKS

Before any earthworks are commenced, areas of cut and fill should be clearly defined. Where necessary, sufficient fencing or barriers should be provided around trees or other features to be protected. All site activities including clearing, storage, cutting and filling must be kept away from the root zone of trees (best defined as the extent of the canopy). Adequate provision should also be made for the control of erosion, surface water run-off and siltation.

Specifications for the work should include the following:

(a) All rubbish, vegetation and debris should be removed from earthworks areas prior to the commencement of topsoil stripping. Areas on which fill is to be placed, or from which cut is to be removed, and haul roads should be stripped of all topsoil and such unsuitable soft or organic material. Special care should be taken to ensure that organic materials and areas of old uncompacted filling are not overlooked through being overlaid by other soils.

(b) Any open air burning of vegetation should be supervised at all times and carried out in such a manner as to prevent smoke nuisance to neighbouring areas.

The burning of materials that generate toxic emissions is prohibited.

Burning of vegetation can result in large numbers of people being adversely affected from smoke and fumes.

Any costs resulting from abatement action carried out by Council will be charged to the owner of the land.

These requirements are supported by the Health Act 1956, the Hamilton City Fire Prevention Bylaw 1993, and the Hamilton District Plan.

(c) Stripping should be carried out as a specific operation with areas being stripped in large enough increments to ensure that there is an adequate margin of stripped ground beyond any current cutting or filling operation. Particular care should be taken to ensure that overspill is not left in an uncompacted state anywhere on the site, when constructing temporary haul roads.

(d) All stripped material should be deposited in temporary stockpiles or permanent dumps, in locations where there is no possibility of the material being unintentionally covered by, or incorporated into, structural fills.

(e) Where a fill abuts against sloping ground, benches should be cut into the ground to prevent the development of a continuous surface of low shear strength.

(f) The perimeter of all sealed areas to be excavated shall be cut with suitable cutting equipment to a sufficient depth to ensure that the pavement and sealed surface outside the ripped or excavated area is not disturbed.

(g) Pervious drains or similar subsoil seepage control systems should be installed (as necessary) to lead seepage away from all springs and potential areas of ground water under or adjacent to fills in order to -

- Prevent saturation of the fill before construction of the fill is complete;
- Prevent internal erosion (piping); and
- Prevent internal ground water pressures which would detrimentally reduce shear strengths.

(h) Subsoil drains should discharge via flexible jointed pipes to an outlet approved by the Engineer, preferably a stable watercourse or a piped stormwater system. The position of all subsoil drains should be recorded on the "as-built" plan.

(i) The stripped ground surface should be prepared and then inspected by the geotechnical engineer before any fill is placed thereon.

3.0 FILL CONSTRUCTION

The quality of fill material and required control testing should be determined and specified before the placing of fill commences. Fill should be placed in a systematic and uniform manner with near horizontal layers of uniform thickness (less than 225mm) of material being deposited and compacted progressively across the fill area.

Before any loose layer of fill is compacted, the water content should be suitable for the compaction required and as uniform as possible. Any compacted layer which has deteriorated after an interruption in the earthmoving operation, should be rectified before further material is placed over it.

Fill batter faces should be compacted as a separate operation, or alternatively, overfilled and cut back.

Where testing shows the compaction achieved in the field to be below the specified minimum, all material represented by the test should be further compacted or removed as necessary. (Methods specified by a geotechnical engineer will be considered as an alternative to this method.)

4.0 TEMPORARY DRAINAGE AND EROSION CONTROL

During the construction period, measures should be taken to prevent excessive water-logging of surface materials yet to be excavated or compacted or both, and to prevent fill material from being eroded and redeposited at lower levels. Such measures should include:

(a) The surfaces of fills and cuts should be graded to prevent ponding.

(b) Temporary drains should be constructed at the toe of steep slopes to intercept surface run-off and to lead drainage away to a stable watercourse or pipe storm-water system.

(c) Surface water should be prevented from discharging over batter faces by drains formed to intercept surface run-off and discharge via stable channels or pipes, preferably into stable watercourses or piped stormwater systems.

(d) The upper surface of fills should be compacted with rubber tyred or smooth wheeled plant when rain is impending, or when the site is to be left unattended.

(e) The completed battered surfaces of fills should be compacted with sheepsfoot or similar non-smooth compaction plant to reduce run-off velocities.

(f) Silt traps and retention ponds shall be constructed where they are necessary. These should be cleaned out, as required to ensure that adequate silt storage is maintained.

(g) Temporary barriers or fences choked with brush, sacking or the like, should be used to reduce flow velocities and to trap silt.

(h) Sections of natural ground should be left unstripped to act as grass (or other vegetation) filters for run-off from adjacent areas.

(i) All earthwork areas should be retopsoiled and grassed or hydroseeded as soon as possible after completion of the earthworks and drainage works.

5.0 INSPECTION AND QUALITY CONTROL

The engineer shall provide an adequate level of inspection and testing in order to enable proper evaluation of furnishing of the general quality of the finished work and the furnishing of a report as to the compliance of the work with the specifications. This is not to be construed as a guarantee or warranty but rather a record of the engineer's professional opinion based on reasonable care.

Visual inspection shall be made by the 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) At such other times as the engineer considers necessary to enable the general standard of earthworks to be assessed and reasonably satisfied that -

i) Fill is not placed over soft or organic material or peat;

ii) All areas of existing ground showing seepage or potential seepage emission have relief drains provided;

iii) Compaction operations are systematic, the water content of fill material appears on visual inspection to be suitable and the degree of compaction appears to be consistently satisfactory.

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

(a) Tests to determine whether the water content is suitable;

(b) Insitu density tests to determine whether the degree of compaction is up to the specified minimum;

(c) Where appropriate tests to determine the maximum dry density for the soil tested in each insitu field density test;

(d) Such other tests as may be specified by the geotechnical engineer for control testing of fills or particular soil types, providing that the soil property tested shall be related to insitu density or water content of the fill by a laboratory investigation. Such tests include shear strength tests, cone penetrometer tests, and Proctor needle tests.

Once the filling work is progressing as a steady operation with uniform construction methods, and provided that -

(a) Adequate construction effort is being maintained, and

(b) Adequate visual inspection is being maintained, and

(c) The specification requirements are being met,

then the minimum frequency of control testing shall generally be one insitu density test (or equivalent) for each 2000 cu.m or 1.0m lift of fill.

Testing shall be more frequent than specified above, under any of the following circumstances:

i) During the first 4000 cu.m of filling carried out on the project.

ii) On the final layer of not less than 1.0 m depth.

iii) When soil type or conditions are variable.

iv) When the geotechnical engineer or their inspector is in any doubt about the adequacy of construction methods or soil properties.

v) When a decision to reject work based on the judgement of the geotechnical engineer is disputed, and

vi) When relatively small quantities of fill are concentrated in localised areas or placed discontinuously over a long period of time.

The locations of tests shall be decided by the geotechnical engineer, who should select them so as to test material likely to be furthest from the specified quality. In addition, a proportion of tests should be taken at random locations to check the average standard being obtained.

All field and laboratory test data should 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 should have recorded the time, date, location and elevation. Test results relating to sections of fill that have been subsequently removed or reworked and recompacted should be noted accordingly.

6.0 COMPACTION OF NATURAL SUBGRADE FOR ROADING

Clause 11.3 of NZTA Specification F/1 is replaced by the following:

The Contractor shall test the natural subgrade using a scala penetrometer according to Part 3, Section 2 : Testing - Scala Penetrometer.

The testing depth (i.e. depth of penetration) and the required CBR value shall be included in the specification within the contract documents.

Recording of results shall be as per the approved quality plan.

Should the test results show that the natural subgrade is up to the required CBR value, no compaction will be required.

If the test results indicate otherwise, the Contractor shall use suitable compaction equipment in a reasonable attempt to improve the strength of the natural subgrade, or with the Engineer's consent, undercut to waste and backfill with suitable material.

7.0 FINAL DOCUMENTATION

7.1 "As-Built" Drawings

An accurate "as built" record shall be maintained as work progresses in accordance with Volume 1 Part 2 Section 2.4.3 of the Development Manual.

7.2 Geotechnical Engineer's Report

At completion of construction, a geotechnical engineer's report shall be provided in accordance with Checklist 2.2 of Volume 4 of this Manual.

8.0 DISPOSAL OF SURPLUS EXCAVATED MATERIAL

Excavated material surplus to requirements or unsuitable for reuse in the works shall be removed to fill sites by the Contractor. It shall be the Contractor's responsibility to arrange fill sites and to ensure that any sites used have all of the necessary consents.