

COFFS HARBOUR CITY COUNCIL



**DEVELOPMENT SPECIFICATION
DESIGN**

1112 Earthworks (Roadways)

Version 1 01 January 2009

1112 EARTHWORKS (ROADWAYS)

1 SCOPE AND GENERAL

1.1 SCOPE

The work to be executed under this worksection consists of:

- removal of topsoil,
- all activities and quality requirements associated with site regrading, the excavation of cuttings, the haulage of material and the construction of embankments to the extent defined in the Drawings and worksection,
- removal and replacement of any unsuitable material,
- any spoil or borrow activities associated with earthworks, and
- any additional processing of selected material for the selected material zone.

1.2 QUALITY

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are given in 0161 *Quality (Construction)*.

1.3 REFERENCED DOCUMENTS

The following documents referred to in this worksection shall be deemed as the latest edition of the Australian Standards, including amendments and supplements.

Worksections

- 0161 Quality (Construction)*
- 0250 Open space – landscaping*
- 1101 Control of traffic*
- 1102 Control of erosion and sedimentation*
- 1111 Clearing and grubbing*
- 1113 Stabilisation*
- 1351 Stormwater drainage (Construction)*
- 1352 Pipe drainage*
- 1353 Precast box culverts*
- 1354 Drainage structures*

Standards

- | | |
|---------------|---|
| AS 1289 | Methods of testing soils for engineering purposes |
| AS 1289.6.1.1 | Soil strength and consolidation tests—Determination of the California Bearing Ratio of a soil—Standard laboratory method for a remoulded specimen |
| AS 1289.3.3.1 | Soil classification tests—Calculation of the plasticity index of a soil |
| AS 1289.5.1.1 | Soil compaction and density tests—Determination of the dry density/moisture content relation of a soil using standard compactive effort |
| AS 1289.5.4.1 | Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio |
| AS 1289.5.7.1 | Soil compaction and density tests—Compaction control test—Hilf density ratio and Hilf moisture variation (rapid method) |
| AS 2187 | Explosives—Storage, transport and use |
| AS 2187.1 | Storage |
| AS 2187.2 | Use of explosives |

Other publications

- AUSTROADS *Explosives in Roadworks, Users Guide 1982*
- EPA Environmental Noise guide for local Government *Criteria road traffic noise*.

Department of Transport and Regional Services (DOTARS)
Australian Code for the Transport of Explosives by Road and Rail

2 PRELIMINARIES

2.1 NATURAL SURFACE AND EARTHWORKS MATERIALS

Natural surface

Contractor's survey system: The Contractor shall submit details of the Contractor's proposed survey system to the Superintendent for approval, within 14 days of possession of site being granted and in any case prior to commencement of clearing and grubbing or earthworks.

Verify accuracy of ground model: Computer generated road design data files in the format of the approved software containing the ground model may be supplied to the Contractor, as advised prior to commencement of the Contract.

If desired, the Contractor, may verify the accuracy of the model by field surveys.

If the Contractor considers any areas of the model not to be representative, or submitted plans to be inaccurate, the Contractor shall give not less than seven (7) days notice, prior to commencement of Works, to the Superintendent to allow checking.

If the subsequent check survey reveals the ground model and plans to be correct, then the Contractor shall bear the cost of the check survey.

Earthworks materials

Material characteristics: The Contractor shall be responsible for any assumptions made by the Contractor in relation to the nature and types of the materials encountered in excavations and the bulking and compaction characteristics of materials incorporated in embankments.

The estimated quantity for general earthworks at any cutting includes all types of materials which may be encountered in the cutting.

Embankment material deficiency: Where material from excavations is acceptable for use in embankments, but the Contractor elects to:

- Spoil it, or
- Use it for the Contractor's own purposes, or
- Use it as a source of pavement materials, or
- Construct embankments with dimensions in excess of those specified,

and a deficiency of material for embankment construction is thereby created, the Contractor shall make good that deficiency from sources of material meeting the quality requirements specified in

Benching in cuttings.

The cost of making good such deficiency of material shall be borne by the Contractor.

2.2 PROTECTION OF EARTHWORKS

Care of the works

The Contractor's responsibility for care of the Works shall include the protection of earthworks.

Erosion and sedimentation control

The Contractor shall install effective erosion and sedimentation control measures in accordance with *1102 Control of erosion and sedimentation* prior to commencing earthworks and shall maintain these control measures for the duration of the contract.

Drainage of working areas

Adequate drainage of all working areas shall be maintained throughout the period of construction to ensure run-off of water without ponding, except where ponding forms part of an approved erosion and sedimentation control system.

Salinity prevention

In salt affected areas, the Contractor shall take adequate precautions to minimise ingress of surface water into the groundwater table.

Wet weather precautions

When rain is likely or when work is not proposed to continue in a working area on the following day, precautions shall be taken to minimise ingress of any excess water into earthworks material.

Ripped material remaining in cuttings and material placed on embankments shall be sealed off by adequate compaction to provide a smooth tight surface.

Wet material

Should insitu or stockpiled material become over wet as a result of the Contractor not providing adequate protection of earthworks, the Contractor shall be responsible for replacing and/or drying out the material and for any consequent delays to the operations.

2.3 SETTING OUT OF EARTHWORKS**Batter profiles**

Before earthworks operations commence and after survey controls are in place, batter profiles shall be established by the Contractor and the necessary pegs driven at 25 m intervals or at each cross section shown on the Drawings, whichever is the lesser.

The chainage/station, offset from control line and slope distance to finished surface level, shall be clearly marked on each peg.

Profile location

The batter profiles shall be repositioned by the Contractor at each change in the slope of the batter and at intervals of not more than 5 m of vertical height.

Retention and removal of pegs

All pegs and batter profiles shall be maintained in their correct positions. They shall be removed by the Contractor on completion of the contract or separable part.

Additional pegs

The foregoing shall be the minimum requirement. Additional pegs and profiles may be required to suit the Contractor. These shall not be painted with the same colours used for the specified setting out pegs and stakes.

Transitions cuttings/embankments

The position and extent of all transitions from cuttings to embankments and foundations for shallow embankments shall be marked with clearly labelled stakes in accordance with **Transition from cut to fill** and **Foundations for embankments**.

2.4 STOCKPILE SITES**Additional stockpile sites**

The Contractor shall obtain the written consent of the Superintendent to the use of any stockpile site which is not shown on the Drawings.

Proposals in this regard shall be submitted at least three working days before stockpiling is due to commence and shall specify the maximum dimensions of the proposed stockpile.

Clearing and grubbing

Any clearing and grubbing required for these sites shall be carried out in accordance with *1111 Clearing and grubbing*.

Temporary erosion and sedimentation control measures shall be taken in accordance with *1102 Control of erosion and sedimentation*.

Restoration

Restoration of stockpile sites following completion of the work shall be carried out in accordance with *0250 Open space – landscaping*.

3 REMOVAL OF TOPSOIL

3.1 SCOPE**Definition**

Topsoil is surface soil which is reasonably free from subsoil, refuse, clay lumps and stones.

Prerequisites

Removal of topsoil from any section of the Works shall only commence after erosion and sedimentation controls have been implemented and when clearing, grubbing and disposal of materials have been completed on that section of the Works in accordance with *1102 Control of erosion and sedimentation* and *1111 Clearing and grubbing*.

Extent of work

Topsoil throughout the length of the Work shall be removed and stockpiled separately clear of the work with care taken to avoid contamination by other materials.

The work shall include the following:

- Cuttings
 - . Removal of the topsoil to a depth quoted in Annexure 213A or as directed by the Superintendent.
- Embankments
 - . Removal of topsoil over the base of embankments up to the depth below the natural surface quoted in Annexure A, or as directed by the Superintendent.
 - . For those embankments or sections of embankment where the height of embankment from natural surface to underside of pavement is less than two metres, topsoil which is deeper than the depth quoted in Annexure A shall be removed to its full depth as directed by the Superintendent.
- Other locations
 - . Removal of topsoil as directed by the Superintendent.

3.2 SURVEY AFTER REMOVAL OF TOPSOIL**Establish surface level**

Where payment is on a 'Schedule of Rates' basis, and unless alternative arrangements have been made by the Superintendent, after removing the topsoil, the Contractor shall determine the surface levels in each cutting and embankment at sufficient locations to determine the volume of excavation for general earthworks and the volume of compacted fill.

Schedule of these surface levels

A schedule of these surface levels shall be submitted to the Superintendent for approval at least three working days before commencement of any work which will alter the ground surface as surveyed.

This action constitutes a HOLD POINT.

The Superintendent's approval to the submitted schedule of surface levels is required prior to the release of the hold point.

3.3 TOPSOIL STOCKPILES**Site survey**

Where payment is on a 'Schedule of Rates' basis, at least three working days before stockpiling of topsoil at any site, the Contractor shall submit, for the approval of the Superintendent, a site survey which will be sufficient to subsequently measure the volume placed in stockpile.

Height and batter

The maximum height of stockpiles shall not exceed 2.5 m and the maximum batter slope shall not exceed 2 horiz : 1 vert.

Stockpile material and trimming

Topsoil stockpiles shall not contain any timber or other rubbish and shall be trimmed to a regular shape.

Erosion control

To minimise erosion, stockpile batters shall be track rolled or stabilised by other means acceptable to the Superintendent.

Seeding stockpile

Where seeding of stockpiles to encourage vegetation cover is specified, such work shall be carried out in accordance with *0250 Open space – landscaping*.

4 CUTTINGS**4.1 SCOPE**

Construction of cuttings shall include all operations associated with the excavation of material within the limits of the batters including benching, treatment of cutting floors and transition from cut to fill.

4.2 EXCAVATION

Excavated material prepared for incorporation into the works

Materials encountered in cuttings shall be loosened and broken down as required so that they are acceptable for incorporation in the Works. In this regard, the Contractor's attention is drawn to **Unsuitable material** and **Embankment construction** and **Embankment material**.

Batter slopes

Cuttings shall have batter slopes as shown on the Drawings or as redetermined by the Superintendent on the basis of site inspection and investigation during the excavation.

The tops of cuttings shall be neatly rounded to the dimensions shown on the Drawings.

Batters to be even

In all cuttings, undulations in the general plane of the batter shall not be permitted except that batters may require progressive flattening at the ends of cuttings due to the presence of less stable material.

Unstable material

Cut faces shall be cleaned of loose or unstable material progressively as the excavation proceeds.

Blending material

Where, after the removal of topsoil as specified in **Removal of topsoil**, material of variable quality or moisture content is encountered, the Contractor shall adjust his excavation methods to ensure blending of the materials, to obtain material meeting the requirements of **Embankment material**.

Variation for batter slopes

Where the Superintendent redetermines the batter slope of any section of a cutting after it has been completed in accordance with this Clause, the Superintendent shall order a Variation to the Contract for the resetting out, removal of additional material and retrimming of the batter.

This Variation shall include all additional costs incurred by the Contractor who shall not have any further claim upon the Principal as a result of the redetermination of the batter slope.

4.3 BATTER TOLERANCES

Batter tolerances

The tolerances for the excavation of batters are given in Table 3.1.

Table 3.1 Excavation tolerances for batters

Location	Tolerance (mm)	
	Slope 1:1 or flatter	'Steeper than 1:1
Toe of batter and level of table drain	+ 0 -150	+ 0 -200
2 m above table drain and higher	+ 300 -300	+ 300 -600
Between level of table drain and 2 m above table drain	pro rata basis	pro rata basis

Excavation beyond Batter Line

If the Contractor excavates the batter beyond the batter slope line and the tolerance applicable thereto, the Superintendent may authorise a minor change in the general slope of the batter to suit the convenience of the Contractor, but such a change shall not be regarded as a redetermination of the batter slope under **Excavation**.

The cost of any increase in excavation quantities resulting from such change in batter slope shall be borne by the Contractor.

Alternatively the Contractor shall submit details of the material and/or methods proposed to restore the specified slope and stability of the batter for the Superintendent's approval.

Restoration of batter slope

For batters steeper than 1:1, if any section of the batter up to a height of 3 m above the table drain level has been over excavated beyond the tolerance limit specified, the Superintendent may direct that the batter be restored to the average batter slope using randomly mortared stone.

The stone shall be similar to the sound rock in the cutting and the mortar shall be coloured to match the colour of the rock.

The cost of restoring batters shall be borne by the Contractor.

4.4 BENCHING IN CUTTINGS

Cut batters shall be benched as shown on the Drawings to provide drainage and erosion control. Notwithstanding the tolerances permitted under **Batter tolerances**, bench widths shall not be less than shown on the Drawings.

Benches shall be maintained and cleaned of loose stones and boulders regularly throughout the Contract period.

The cost of such maintenance and cleaning of benches shall be borne by the Contractor.

4.5 TREATMENT OF FLOORS OF CUTTINGS

Excavation level

The floors of cuttings shall be excavated, parallel to the designed grade line, to a designed floor level which shall be at the underside of the selected material zone or where there is no selected material zone, to the underside of the pavement subbase.

The floors shall then be trimmed to a level of not more than 50 mm above or below the designed floor level.

Where the Superintendent considers that any underlying material is unsuitable for pavement support, the Superintendent may direct that it be removed in accordance with **Unsuitable material**.

Floor material ripped

The Contractor shall rip or loosen all material in the floor to a minimum depth of 200 mm below the designed floor level for the width of the selected material zone (or subbase layer, where no selected material zone). The maximum dimension of any particles in the ripped or loosened zone shall not exceed 150 mm.

CBR testing

Prior to ripping or loosening the cutting floor the Contractor shall determine the CBR of the material in the floor by AS 1289.6.1.1. Sufficient tests shall be taken to represent all the various materials which may exist in the cutting floor. If material in the floors of cuttings has a CBR value less than the value quoted in Annexure A, the Superintendent will direct the action to be taken.

Inspection by Superintendent

Ripped or loosened material shall be made available for inspection by the Superintendent before recompaction commences.

This action constitutes a HOLD POINT.

The Superintendent's approval of the ripped or loosened material is required prior to the release of the hold point. Ripped or loosened material shall be recompacted in accordance with **Compaction and moisture requirements**. No account shall be taken of the volume involved in loosening when measuring the volume of excavations.

Level tolerances

After recompaction, the floors of cuttings shall be re-trimmed parallel with the finished wearing surface. The tolerances for the trimmed levels are given in Annexure A. Prior to placing any subsequent layers over the completed cutting floor, the Contractor shall present the completed surface to the Superintendent for inspection. The Contractor shall verify as part of the quality system that the completed surface has achieved full conformance with all respects of this worksection.

This action shall constitute a HOLD POINT.

The Superintendent's approval of the completed cutting floor is required prior to the release of the hold point.

4.6 TRANSITION FROM CUT TO FILL

Intersection line

After the removal of topsoil and before the excavation of any cutting commences the Contractor shall survey and mark the position of the intersection line between cutting and embankment occurring at the underside of the selected material zone or pavement subbase.

Terrace construction

Following excavation to the cutting floor, a terrace shall be excavated for the width of the selected material zone (or subbase layer, where no selected material zone) to a depth of 900 mm below and parallel to the cutting floor, as shown in Figure 4.1, unless otherwise approved by the Superintendent.

Extent of terrace

The terrace shall extend into the cut to the point where the cutting floor is 900 mm below the original stripped surface, or a distance of 20 metres, whichever is the lesser.

Excavated quantity

The material excavated shall be either incorporated in the embankments or spoiled as directed by the Superintendent.

Material incorporated in embankments shall be included in the excavated volume for General Earthworks and material spoiled shall be included in the excavated volume of Unsuitable Material to Spoil.

Quality and compaction

The material placed above the terrace shall satisfy the requirements of **Embankment material** and shall be compacted in accordance with **Compaction and moisture requirements**.

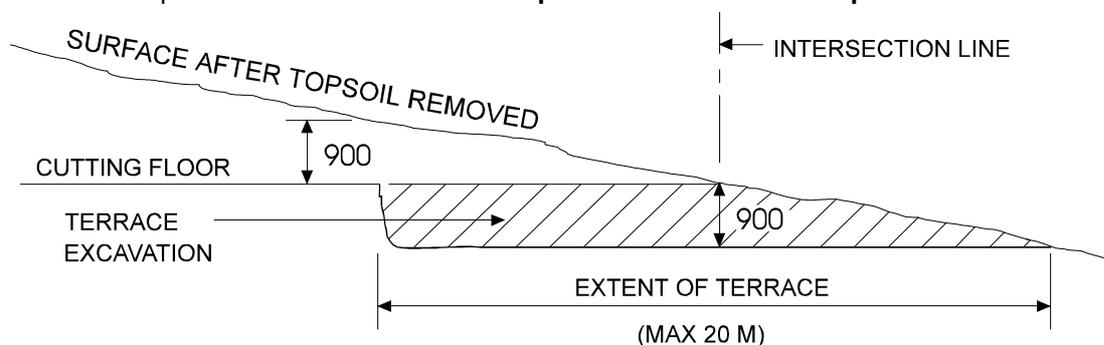


Figure 4.1 Transition from cut to fill

5 BLASTING

5.1 GENERAL

Contractor to obtain licences

When explosives are permitted to be used by the Superintendent and the contractor wishes to undertake blasting, the Contractor shall obtain all necessary licences from the appropriate authorities, and shall comply with all Government and Council regulations relating to transport, storage, handling and the use of explosives and also to the rules set out in AS 2187, Parts 1 and 2.

The transport of explosives shall be in accordance with the Australian Code for the Transport of Explosives by Road and Rail.

The requirements of the Environment Protection Authority (EPA) shall be complied with.

The Contractor shall be liable for any accident, damage or injury to any person, property or thing, resulting from the use of explosives.

Pre-blast survey

Before the start of blasting operations, the Contractor, in the presence of the Superintendent, shall conduct a survey to determine and record the existing condition of all structures likely to be affected by any blast.

Extent of survey

The survey shall include all structures (including utility services) within 500 m of any blast but shall be extended where the maximum instantaneous charge proposed is likely to produce peak particle velocities greater than allowable at structures more remote from a blast site.

A written report of the survey, supported by photographs where necessary, together with a list of any existing defects in the structures, shall be submitted to the owner of each structure and to the Superintendent before blasting commences.

The Contractor shall advise the Superintendent of the proposed maximum instantaneous charge and the Contractor's validation of the adequacy of the proposed structural survey at least three working days before the survey is due to commence.

The Superintendent may direct amendments to the scope of the survey as a result of blast monitoring during the work.

All costs associated with the surveys and reports shall be borne by the Contractor.

Proposed blasting procedure

Before each blasting operation, the Contractor shall submit to the Superintendent written details of the proposed blasting procedure including the quantity and type of explosive to be detonated, the blasting pattern to be used and measures proposed to limit noise and to ensure that vibration from blasting does not adversely affect nearby structures.

This action constitutes a HOLD POINT.

The Superintendent's sighting of the necessary licences and approval to the submitted details of blasting operations is required prior to the release of the hold point.

Release of the hold point does not in any way reduce the Contractor's responsibility set out in **Contractor to obtain licences.**

Ground vibration

Ground vibration caused by blasting shall not exceed the values of peak particle velocity listed in Table 5.1.

Table 5.1 Limiting peak particle velocity

Point of Potential Damage (within 1 km of blasting site)	Peak Particle Velocity
Completed and cured bridge structures or sub-structures (eg completed abutment)	25 mm/sec
Bridgeworks and structural retaining walls under construction	20 mm/sec
Residential premises, schools, hospitals and other buildings	5 mm/sec (with 10% not to exceed 10 mm/sec)
Buildings or monuments of historical significance	2 mm/sec

Advice to residents

The Contractor shall advise all residents within a radius of 1 km, by letter drop before blasting operations commence, of the likely times, frequency and duration of blasting and precautions being taken to ensure that damage to property will not result.

Time limits

Unless otherwise approved, blasting operations shall be confined to the periods Mondays to Fridays (excluding public holidays), 9 am to 3 pm.

Safety precautions

When blasting operations are being carried out, precautions shall be taken relating to the safety of persons and animals and the road shall be closed to traffic and the appropriate signs erected in accordance with 1101 *Control of traffic*.

A standard warning procedure such as that given in the AUSTROADS *Explosives in Roadworks, Users Guide 1982*, shall be established and observed at all times.

5.2 PRESPLITTING

Where presplitting is carried out the spacing of presplit drill holes shall not exceed 750 mm centre to centre.

5.3 BLASTING RECORDS

Records to be kept

The Contractor shall maintain accurate records of each blast showing the details listed below:

- Date and time of blast
- Location, number and diameter of holes loaded

- Depth of each hole loaded
- Inclination of holes
- Maximum and minimum burden
- Types of explosives used
- Charge distribution in each hole
- Maximum instantaneous charge
- Delay periods and sequence
- Total amount of charges in the blast
- Length and type of stemming in each hole

Record preparation

The records shall be prepared as holes are loaded and signed by the Powderman. A copy shall be provided to the Superintendent on the day of the blast.

5.4 CONTROL OF AIR BLAST OVER-PRESSURE

Application

This Clause shall apply only where a noise sensitive location exists within 1 km of the blasting site.

Noise control manual

The Contractor's attention is drawn to the recommendations given in the EPA Noise Control Manual for the reduction of air blast over-pressure.

Noise limitations

The noise emanating from blasting operations shall not exceed an over-pressure level of 115 decibels (linear peak) at any noise sensitive location (such as residential premises, schools or hospitals). Up to 10% of the total number of blasts may exceed this value provided a level of 120 decibels is not exceeded at any time.

Monitoring of air blast over-pressure

The Contractor shall arrange for the monitoring of air blast over-pressure to ensure compliance with the specified limits.

All monitoring shall be carried out by personnel possessing current NATA registration for such monitoring.

All test results shall be reported on NATA endorsed test certificates which shall include a clear statement as to compliance or non-compliance with the requirements of this worksection.

In general, a monitoring location will be near the perimeter of the noise sensitive location at the point closest to the maximum charge.

The Contractor shall submit a copy of the monitoring record to the Superintendent.

Excessive air blast over-pressure

In the event that the measured air blast over-pressure exceeds the specified limits, the Contractor shall suspend further blasting work and shall submit to the Superintendent proposals detailing any additional steps and precautions the Contractor shall take to ensure that for any future blast, the limiting over-pressure shall not be exceeded.

The Contractor shall not resume any blasting until such proposals have been submitted.

5.5 CONTROL OF GROUND VIBRATION

Monitoring vibrations

The Contractor shall arrange for the monitoring of ground vibrations to ensure compliance with the peak particle velocity limits shown in Table 5.1. All monitoring shall be carried out by personnel possessing current NATA registration for such monitoring.

All test results shall be reported on NATA endorsed test certificates which shall include a clear statement as to compliance or non-compliance with the requirements of this Part of the worksection.

In general, a monitoring location shall be near the perimeter of the structure or building at the point closest to the maximum charge.

The Contractor shall submit a copy of the monitoring record to the Superintendent.

Blasting site relationship

To minimise the risk of peak particle velocity limits being exceeded, the Contractor shall develop a blasting site relationship between peak particle velocity, distance and blasting charge.

Maximum instantaneous charge

For the first blast, monitors shall be set up at not less than five points at varying distances away from the blasting site. The Maximum Instantaneous Charge for the first blast shall not exceed that calculated from the following formula:

$$- MIC = 0.5[D/(PPV/1140)^{-0.625}]^2$$

where

- MIC = Maximum Instantaneous Charge in kilograms
- D = Distance in metres from charge to the point of potential damage
- PPV = limiting peak particle velocity from Table 5.1.

A log-log (base 10) graph of measured peak particle velocity (vertical axis) versus Scaled Distance (horizontal axis) shall be plotted, where

$$\text{Scaled distance} = D/(MIC)^{0.5}$$

The mean regression line shall be obtained by the least squares method.

Adjustment of blast design

For subsequent blasts, the MIC and other aspects of blast design may be adjusted provided that further ground vibration monitoring is undertaken and the mean regression line redetermined to demonstrate that peak particle velocity limits are not exceeded.

The Contractor shall make the regression line plots available to the Superintendent, if so requested.

6 UNSUITABLE MATERIAL**6.1 DEFINITION**

Unsuitable material is that occurring below the designed floor level of cuttings and below the nominated depth for stripping topsoil beneath embankments, which the Superintendent deems to be unsuitable for embankment or pavement support in its present position.

6.2 EXTENT OF EXCAVATION

Such material shall be excavated to the extent directed by the Superintendent. Material removed as unsuitable, as directed by the Superintendent, shall be spoiled in accordance with **Spoil**.

6.3 FLOOR INSPECTION

After removal of the unsuitable material, the floor of the excavation shall be re-presented to the Superintendent for inspection, prior to backfilling with replacement material, to determine whether a sufficient depth of unsuitable material has been removed.

This action constitutes a HOLD POINT.

The Superintendent's approval to the floor of the excavation is required prior to the release of the hold point.

Prior to placing replacement material the excavated surface shall be compacted in accordance with **Compaction and moisture requirements**.

6.4 REPLACEMENT MATERIAL

The unsuitable material which has been removed shall be replaced with material from cuttings, or with material borrowed in accordance with **Borrow**, of the quality specified in **Embankment material**. Replacement material is deemed to form part of embankment construction. It shall be placed in accordance with **Placing fill for embankment construction** and compacted in accordance with **Compaction and moisture requirements**.

6.5 INAPPROPRIATE CONSTRUCTION ACTIVITIES

All costs associated with reworking or replacing any material which the Superintendent deems to have become unsuitable because of inappropriate construction activities shall be borne by the Contractor.

7 EMBANKMENT CONSTRUCTION

7.1 SCOPE

Embankment construction includes:

- all operations associated with the preparation of the foundation areas on which fill material is to be placed, the placing and compacting of approved material within areas from which unsuitable material has been removed in accordance with **Unsuitable material**,
- the placing and compacting of fill material and of materials of specified quality in nominated zones throughout the Works and
- all other activities required to produce embankments as specified to the alignment, grading and dimensions shown on the Drawings.

It also includes any pretreatment such as breaking down or blending material or drying out material containing excess moisture.

7.2 EMBANKMENT MATERIAL

Location and quality

Material for embankment construction shall be obtained from the cuttings within the Works in accordance with **Benching in cuttings**, supplemented by borrow in accordance with **Borrow** and from other sources as approved by the Superintendent if necessary.

The material shall be free of tree stumps and roots, clay, topsoil, steel, organic material and other contaminants and shall be capable of being compacted in accordance with **Compaction and moisture requirements**.

Selection of material

The work shall be programmed so that material of the quality specified in **Placing fill for embankment construction** and **Selected material zone** for the upper zones of the formation is available when required.

7.3 FOUNDATIONS FOR EMBANKMENTS

Inspection

Following removal of topsoil in accordance with **Removal of topsoil**, the embankment foundation area shall be made available for inspection by the Superintendent.

This action constitutes a HOLD POINT.

The Superintendent's approval to the embankment foundation is required prior to the release of the hold point.

Unsuitable material

Where the Superintendent considers that any underlying material is unsuitable, the Superintendent may direct that it be removed and replaced in accordance with **Unsuitable material**.

Foundations for shallow embankments

Shallow embankments: Shallow embankments are those embankments of a depth less than 1.5 metres from the top of pavement to natural surface. After removal of topsoil the Contractor shall survey and work out the extent of the area of shallow embankments.

Unsuitable material: Material in the foundations for shallow embankments which does not meet the requirements specified in Annexure A, shall be deemed unsuitable in accordance with **Unsuitable material** and shall be replaced by material of the specified quality.

Preparation of foundations: Foundations for shallow embankments shall be prepared for embankment construction after removing topsoil and unsuitable material, by loosening the material exposed to a depth of 200 mm, adjusting the moisture content of the loosened material and compacting as specified in **Compaction and moisture requirements**.

The Contractor shall use equipment and techniques to minimise surface heaving or other foundation damage.

Other embankments

Preparation: For all other embankments the foundation shall be prepared by grading and levelling the general area, adjusting the moisture content where necessary and compacting the top 200 mm as specified in **Compaction and moisture requirements**.

Bridging layer: Where a bridging layer has been specified as a foundation treatment in the Contract documents, it shall be supplied and placed as part of General Earthworks.

The bridging layer shall consist of free-draining granular material with or without geotextile interlayer as specified on the Drawings.

The granular material shall be end-dumped and spread in a single layer and in sufficient depth to allow the passage of earthmoving equipment with minimal surface heaving.

The compaction requirements of **Compaction and moisture requirements** shall not apply to the bridging layer.

Where it is necessary to import suitable material from off site and no suitable borrow source is available as provided in **Natural surface and earthworks materials**, the supply and placing of the bridging layer shall be treated as a Variation to the Contract.

Seepage from foundations: A bridging layer may also be employed, subject to the approval of the Superintendent, where ground water or seepage is encountered in the foundation area or where the Contractor demonstrates that it is impracticable to achieve the degree of compaction specified for the foundation in **Compaction and moisture requirements**.

A bridging layer shall not be acceptable if its proximity to the pavement is likely to affect the pavement design.

Working platform: As an alternative to a bridging layer, the Superintendent may approve of a working platform created by the chemical stabilisation of in situ material in accordance with 1113 *Stabilisation*.

7.4 HILLSIDE EMBANKMENTS

Horizontal terraces

Where embankments are to be constructed on or against any natural slopes or the batters of existing embankments, the existing slope or batter, if it is steeper than 4 horizontal to 1 vertical in any direction shall be cut in the form of horizontal terraces over the whole area to be covered by new filling.

The existing slope or batter shall be stepped in successive terraces, each at least 1 metre in width, the terraces to be cut progressively as the embankment is placed.

Wherever possible terraces shall coincide with natural discontinuities.

Subsoil drainage may be required in some instances.

Material thus excavated shall be compacted as part of the new embankment material.

Excavated volume

No account shall be taken of the material removed in terracing when determining the General Earthworks excavated volume.

7.5 PLACING FILL FOR EMBANKMENT CONSTRUCTION

Uniformity of material

The methods of excavation, transport, depositing and spreading of the fill material shall be selected so as to ensure that the placed material is uniformly mixed.

Embankment stability

The embankment shall be constructed so as to derive its stability from the adequate compaction of the fine material embedding the large rock pieces rather than mechanical interlock of the rock pieces.

The fine material shall be compacted to meet the requirements of **Compaction and moisture requirements**.

Layer thickness

Fill material for embankment construction shall be placed in layers parallel to the grade line and compacted in accordance with **Compaction and moisture requirements**.

The layers shall be of uniform compacted thickness not exceeding 200 mm, except that where more than 25% by volume of the filling consists of rock with any dimension larger than 150 mm, the Superintendent may approve an increase in the compacted layer thickness to 300 mm, provided that the relative compaction specified in **Compaction and moisture requirements** is attained.

Maximum size rock pieces

The maximum dimension, measured in any direction, of rock pieces in the fill material for embankment construction shall not exceed two-thirds of the approved compacted layer thickness.

Any larger rock pieces shall be reduced in size for incorporation in the embankment layers.

Grading of fill material

Rock material shall be broken down and evenly distributed through the fill material, and sufficient fine material shall be placed around the larger material as it is deposited to fill the voids and produce a dense, compact embankment.

Where the Superintendent considers insufficient fine material is present to fill the voids, additional fine material shall be obtained from other places in the work or by a change in the method of winning fill material.

Reworking stony patches

Stony patches with insufficient fine material to fill the voids shall be reworked with additional fine material being blended in to achieve a dense, compact layer.

The cost of any reworking shall be borne by the Contractor.

Equipment selection for placement

In placing embankment layers, the Contractor shall use equipment and techniques to avoid surface heaving or other damage to the foundations and underlying embankment layers.

CBR value

After compaction, embankment material in the zone(s) below the selected material zone (or subbase layer, where no selected material zone) shall have a CBR value not less than that quoted in Annexure A for the depth(s) specified in Annexure A.

Test method

The CBR value of the material shall be determined by Test Method AS 1289.6.1.1

Sources of material and processing

The Contractor shall be responsible for determining suitable sources of material and for any processing to satisfy these quality requirements.

7.6 EMBANKMENT BATTERS**Batter slopes**

The batter slopes shown on the Drawings represent the estimated requirements for the expected types of materials, and may be subject to redetermination by the Superintendent according to the Superintendent's assessment of the materials encountered.

Slope tolerances

When completed, the average planes of the batters of embankments shall conform to those shown on the Drawings or as determined by the Superintendent.

For a vertical distance to 1 m below the shoulder, no point on the completed batter shall vary from the specified slope line by more than 150 mm when measured at right angles to the slope line.

At distances greater than 1 m vertically below the shoulder, no point on the completed batter shall vary from the specified slope line by more than 300 mm when measured at right angles to the slope.

However, in no case shall the edge of the formation at the underside of the pavement be nearer to the roadway than shown on the Drawings.

Slope undulations

Undulations in the general plane of the batter shall not be permitted.

Slope redetermination

Where the Superintendent redetermines the slope of any section of an embankment batter which has been completed in accordance with this Clause the Superintendent shall order a Variation to the contract for the resetting out and removal or addition of fill material and retrimming of the batter.

7.7 ROCK FACING OF EMBANKMENTS**Location**

Where shown on the Drawings, embankment batters (including embankments at bridge abutments) shall be provided with a facing of clean, hard, durable rock.

Mechanical interlock

The rock facing shall be built up in layers ahead of each layer of filling. Rock may be placed by hand or plant but shall be placed in such a manner that its least dimension is vertical and that mechanical interlock between the larger stones occurs.

Any rock deposited in the rock facing which has an excess of fine material surrounding it shall be removed together with the excess fine material and replaced.

Graded filter

The Contractor shall adjust its working methods and programme the work so as to obtain hard and durable rock of the specified dimensions as it is required.

The space between larger batter rocks shall be filled with progressively smaller rocks to form a 'graded filter' which prevents the leaching out of fines from the fill material but which does not overfill the voids between larger rocks, or cause the larger rocks to lose contact with one another.

Fine material shall not cover the outside of the rocks on the face of the batter.

Geotextile

Where shown on the Drawings, or approved by the Superintendent, an appropriate geotextile may be used to prevent the leaching out of fines from the fill material.

Caution in placement

The Contractor shall exercise extreme caution whilst placing the rock facing.

Where embankment material is placed above other roads in use the outer rock layer shall be placed in such a manner as to prevent spillage down the batter and onto the roadway.

The Contractor shall ensure that, under no circumstances, could any rock be dislodged and roll onto any adjacent roadway or track in use.

7.8 TRIMMING TOPS OF EMBANKMENTS**Levels**

The tops of embankments shall be trimmed parallel to the designed grade line at levels equal to the finished surface level less the thicknesses of pavement courses and the selected material zone if applicable.

Tolerances

The tops of embankments at these levels shall be compacted to meet the requirements of **Compaction and moisture requirements** and trimmed so that they do not vary more than 10 mm above or 40 mm below the levels as calculated above.

Prior to placing any subsequent pavement layers

Prior to placing any subsequent pavement layers over the completed top of embankment filling, the Contractor shall present the completed surface to the Superintendent for inspection.

The Contractor shall verify as part of the quality system that the completed surface has achieved full conformance with all respects of this worksection.

This action constitutes a HOLD POINT.

The Superintendent's approval of the completed top of the embankment is required prior to the release of the hold point.

7.9 SELECTED MATERIAL ZONE**Dimension and quality**

A selected material zone may be indicated on the Drawings as a zone below the subbase layer and the following quality requirements:

- It shall be free from stone larger than 100 mm maximum dimension,
- The fraction passing 19.0 mm AS sieve shall have a CBR value of not less than that quoted in Annexure A.

When chemical stabilisation is specified these requirements shall apply to the selected material immediately prior to incorporating the stabilising agent.

Winning material

The selected material shall be obtained from cuttings excavated under the Contract or from borrow areas as specified in **Borrow**.

If necessary, the Contractor shall use working methods to yield material for the selected material zone by breaking down oversize rock or by other means, including processing through a crusher, to ensure that the resulting material conforms to the requirements of this Clause.

Selection of material

The Contractor shall ensure that any material encountered of the quality specified for the selected material zone shall be either placed directly in the selected material zone or stockpiled at locations approved by the Superintendent for future use by the Contractor in the selected material zone until at least sufficient material is reserved to complete the selected material zone over the whole work.

Should the Contractor fail to conserve material of the specified quality, the Superintendent may direct that material of equivalent quality be provided. The cost of providing such extra material shall be borne by the Contractor.

Cost of handling

The Contractor shall have no right to monetary compensation or a claim for damages in respect of any loss the Contractor may claim to have suffered by reason of the Contractor's failure to reserve sufficient selected material or by reason of stockpiling material for the selected material zone.

Placing and compaction of layers

The selected material zone shall be placed and compacted in layers with the compacted thickness of each layer not exceeding 150 mm. Compaction shall be as specified in **Compaction and moisture requirements**.

Homogeneous layers

After placement the selected material shall be homogeneous and free from patches containing segregated stone or excess fines.

There shall be no areas containing material which does not comply with the specified requirements of this Clause.

Compact and trim

The top of the selected material zone shall be compacted and trimmed parallel with the designed grade line at a level equal to the finished surface level minus the thickness of pavement layers adopted. The tolerances for the trimmed levels are given in Annexure A.

Inspection prior to placing any subsequent pavement layers

Prior to placing any subsequent pavement layers over the completed select material zone surface, the Contractor shall present the completed surface to the Superintendent for inspection.

The Contractor shall verify as part of the quality system that the completed surface has achieved full conformance with all respects of this worksection.

This action constitutes a HOLD POINT.

The Superintendent's approval to the compacted and trimmed top of selected material zone is required prior to the release of the hold point.

7.10 FILL ADJACENT TO STRUCTURES

Payment

Supply and placement of fill adjacent to structures shall be deemed to be part of General Earthworks.

Structure types

Structures shall include bridges, precast and cast-in-place box culverts and retaining walls.

Fill adjacent to other culverts and drainage structures shall be provided in accordance with *1351 Stormwater drainage (Construction)*, *1352 Pipe drainage*, *1353 Precast box culverts* and *1354 Drainage structures*.

Time of placement

No filling shall be placed against structures, retaining walls, headwalls or wingwalls within 21 days after placing of the concrete, unless the walls are effectively supported by struts to the satisfaction of the Superintendent, or when the Contractor can demonstrate that 85% of the design strength of the concrete has been achieved.

7.11 TREATMENT AT WEEPHOLES

Grading

Drainage adjacent to weepholes shall be provided by either a layer of broken stone or river gravel consisting of clean, hard, durable particles graded from 50 mm to 10 mm such that:

- The maximum particle dimension shall not exceed 50 mm,
- No more than 5 per cent by mass shall pass the 9.5 mm A.S. sieve.

Extent

The broken stone or river gravel shall be continuous in the line of the weepholes, extend at least 300 mm horizontally into the fill and extend at least 450 mm vertically above the level of the weepholes.

Synthetic membrane

Alternatively the Contractor may provide a synthetic membrane of equivalent drainage characteristics at no extra cost to the Principal.

It shall be stored and installed in accordance with Manufacturer's instructions.

The use of a synthetic membrane shall be subject to the Superintendent's approval.

7.12 SELECTED BACKFILL

Selected backfill shall be placed adjacent to structures in accordance with Table 7.1.

The selected backfill shall consist of a granular material having a maximum dimension not exceeding 50 mm and a Plasticity Index, determined by AS 1289.3.3.1, neither less than 2 nor more than 12.

Table 7.1 Selected backfill, width and height

Structure type	Selected backfill	
	Width	Height
Bridge abutments	2 m	H
Cast-in-place box culverts	H/3	H + 300 mm
Corrugated steel pipes and arches	0.5 m	H + 500 mm
Retaining walls	H/3	H
Where H = height of structure)		

Placement in layers

The selected backfill shall be placed in layers, with a maximum compacted thickness of 150 mm. Layers shall be placed simultaneously on both sides of box culverts and other drainage structures to avoid differential loading. Compaction shall start at the wall and proceed away from it, and shall meet the requirements of **Compaction and moisture requirements**.

Horizontal terraces

The existing embankment slope behind the structure shall be cut in the form of successive horizontal terraces, each terrace being at least 1 m in width, and the selected backfill shall be placed in accordance with **Placing fill for embankment construction**.

Time of placement against structures, etc.

No selected backfilling shall be placed against structures, retaining walls, headwalls or wingwalls within 21 days after placing of the concrete, unless the walls are effectively supported by struts to the satisfaction of the Superintendent, or when the Contractor can demonstrate that 85% of the design strength of the concrete has been achieved.

Where a bridge deck is being concreted adjacent to an abutment, no filling shall be placed against the abutment within 21 days after placing concrete in the bridge deck, unless approved by the Superintendent.

Spill through abutments

In the case of spill-through abutments, rocks shall not be dumped against the columns or retaining walls but shall be built up evenly by individual placement around or against such structures.

Framed structures

In the case of framed structures, embankments at both ends of the structure shall be brought up simultaneously, the difference between the levels of the embankments at the respective abutments, shall not exceed 500 mm.

7.13 SPOIL**Definition**

Spoil is surplus material from excavations under the Contract which is not required to complete the Works as specified or material from excavations under the Contract whose quality the Superintendent deems to be unacceptable for incorporation in the Works.

Acquisition of planning approval where necessary

The Contractor shall bear all costs associated with the acquisition of planning approval by Council's Town Planning Manager should this be determined as necessary by the Superintendent.

Use in embankments

Where there is surplus material the Superintendent may direct that flatter batter slopes be provided on embankments which have not been commenced, and/or direct that the excess material be used in the uniform widening of embankments, the surface of which shall be shaped so as to provide a tidy appearance and effective drainage.

The surplus material shall be spread and compacted as specified in **Placing fill for embankment construction** and **Compaction and moisture requirements** for material in embankments.

Disposal of spoil

Alternatively, spoil shall be disposed of in the manner and at locations approved by the Superintendent. Surplus material so deposited shall be compacted as specified in **Compaction and moisture requirements** for material in embankments or to such lesser extent as may be approved by the Superintendent.

Disposal of spoil up to five kilometres from the point of excavation shall be deemed to be included in General Earthworks.

Where haulage exceeds five kilometres, payment shall be made at the rate nominated in Annexure A for haulage of spoil.

7.14 BORROW**Borrow to be authorised**

Unless provided by the Contract, borrow will only be authorised by the Superintendent if, in constructing cuttings and embankments to the batter slopes specified or directed by the Superintendent or in providing materials of the quality specified, and not by reason of excess widening of embankments or wastage by the Contractor of material of the quality specified in **Embankment material**, **Rock facing of embankments**, **Trimming tops of embankments** or **Fill adjacent to structures**, there is an overall deficiency in either the quantity or the quality of material required to complete the Works.

Borrow site characteristics

Where borrow material is required to complete the Works as specified, the location of borrow sites shall be as approved by the Superintendent, and the quality of material shall be acceptable to the Superintendent in accordance with **Embankment material**, **Rock facing of embankments**, or **Fill adjacent to structures**, as appropriate.

Planning approval

The Contractor shall bear all costs associated with the acquisition of Planning approval by Council's Town Planning Manager should this be determined as necessary by the Superintendent.

The edges of borrow sites shall be no closer than 3 m from any fence line, road reserve boundary or edge of excavation or embankment.

Adequate clearance shall be provided for the construction of catch drains.

Borrow sites shall have drainage outlets acceptable to the Superintendent, cut batter slopes not steeper than 4 h to 1 v, and shall be left by the Contractor in a tidy and safe condition.

Site preparation and restoration

For borrow within the defined working area for the Works as specified, site preparation shall be in accordance with 1111 *Clearing and grubbing* and **Removal of topsoil**.

Restoration of borrow sites shall be carried out in accordance with 0250 *Open space – landscaping*.

Widening of cutting

If borrow material is obtained by uniformly widening a cutting, the requirements of **Excavation**, **Batter tolerances** and **Treatment of floors of cuttings** as to the redetermination of batter slopes, the trimming of batters and the compaction of floors of cuttings respectively shall apply to the borrow area.

Payment

Borrow from within the specified working area shall be deemed to be part of General Earthworks except that additional payment for haulage will be made at the rate nominated in Annexure A for haulage of borrow where the authorised borrow sites are more than five kilometres from the point of delivery.

Borrow obtained from locations outside the specified working area

If the Superintendent accepts that borrow must to be obtained from locations outside the specified working area for the Works, such work shall be treated as a Variation to the Contract.

The Contractor shall be responsible for obtaining any permits required for entry on land and for the payment of any royalty for such borrow material.

The Contractor shall also comply with any requirements of the Environmental Planning and Assessment Act, the Local Council, land owners, the Rural Lands Protection Board and the NSW Soil Conservation Service, as appropriate.

8 COMPACTION AND QUALITY CONTROL

8.1 COMPACTION AND MOISTURE REQUIREMENTS

Trimming and compaction

In areas listed below, all layers shall be uniformly compacted to not less than the relative compaction specified before the next layer is commenced.

Each layer of material shall be trimmed prior to and during compaction to avoid bridging over low areas.

A smooth surface shall be presented at the top of each layer.

92% Compaction requirements

The following areas shall be compacted to provide a relative compaction, determined by AS 1289.5.7.1 or AS 1289.5.4.1 for modified compactive effort, of not less than 92%:

- Each layer of material replacing unsuitable material as detailed in **Unsuitable material**.
- Each layer of material placed in embankments, up to 1.5 metres from the top of the pavement.
- Fill placed adjacent to structures up to 1.5 metres from the top of pavement.
- Material in unsealed verges and within medians up to the level at which topsoil is placed.
- Spoil (excluding unsuitable material).
- All other areas except those where higher relative compaction is specified.

Unsuitable material

Unsuitable material shall be stockpiled as directed by the Superintendent and compacted by track rolling.

97% Compaction requirements

The following areas shall be compacted to provide a relative compaction of not less than 97% as determined by AS 1289.5.7.1 or AS 1289.5.4.1 for modified compactive effort:

- Foundations for shallow embankments.
- The whole area on the floor of cuttings.
- Each layer of the embankment within 1.5 metres from the top of pavement.
- Each layer of the selected material zone as specified in **Selected material zone**.
- Any areas of material of specified quality which may be shown on the Drawings or specified elsewhere behind kerbs and/or gutters or adjacent to rigid pavements.
- The fill material placed adjacent to structures as specified in **Fill adjacent to structures** and **Selected backfill** in each layer within 1.5 metres from the top of the pavement.

Shallow cutting definition

Where the vertical alignment design is such that a substantial portion of the road is required to be built at or close to natural surface, the prepared subgrade shall be considered to be in shallow cutting.

Shallow cutting is defined as cutting to a depth below natural surface of less than 0.5 metres.

The floor of shallow cutting shall be treated as specified in **Treatment of floors of cuttings** and **Transition from cut to fill** and shall be compacted to provide a relative compaction determined by AS 1289.5.7.1 or AS 1289.5.4.1, for modified compactive effort, of not less than 97% for a depth of 200 mm.

Cut-fill transition

When shallow cutting conditions occur and with written approval of the Superintendent the requirements specified for transition from cut to fill (**Transition from cut to fill**) may be modified such that the depth of terrace excavation at the transition from cut to fill is reduced from 900 mm to 250 mm.

Proof rolling

Sections of the works where the ripping or loosening of the cutting floor is not required and/or where provision of 'proof-rolling' to the Superintendent's satisfaction is required are indicated in Annexure A. Proof rolling shall be in accordance with **Deflection monitoring or proof rolling**.

Moisture content and wetting and drying

At the time of compaction the moisture content of the material shall be adjusted so as to permit the specified compaction to be attained at a moisture content which, unless otherwise approved by the Superintendent, is within the range set out in Annexure A of the optimum moisture content as determined by AS 1289.5.1.1 or AS 1289.5.7.1.

Material which becomes wetted up after placement shall not be compacted until it has dried out so that the moisture content is within this range.

The drying process may be assisted by aeration, or where approved by the Superintendent, by the use of hydrated or quick lime at the Contractor's cost.

Alternatively the Contractor may transport the wet material to a stockpile site for drying out and later use as fill material.

The cost of transport to stockpile for drying out and later use shall be borne by the Contractor.

If there is insufficient moisture in the material for it to be compacted as specified, water shall be added. The added water shall be applied uniformly and thoroughly mixed with the material until a homogeneous mixture is obtained.

The costs of such wetting or drying the material to be compacted shall be borne by the Contractor.

Prompt compaction

Compaction shall be undertaken to obtain the specified relative compaction for the full depth of each layer in embankments and for the full width of the formation over the entire length of the work.

Compaction shall be completed promptly to minimise the possibility of rain damage.

Moisture content above optimum

Any material placed by the Contractor that has attained the specified relative compaction but subsequently becomes wetted up so that the moisture content is greater than the apparent optimum, determined by AS 1289.5.7.1, shall be dried out and uniformly recompacted to the required relative compaction in accordance with this Clause before the next layer of material is placed.

Alternatively, the Contractor may remove the layer of wetted material to a stockpile site for drying and later re-use.

The cost of the removal to stockpile, drying out and reincorporation of the wet material shall be borne by the Contractor.

8.2 PROCEDURES FOR DETERMINING TEST LOCATIONS**Test locations**

Sampling locations for testing shall be determined as described in *0165 Quality systems and control (Construction)*.

Contractor to prepare area

The specified compaction and moisture tests shall be taken at the determined locations.

Prior to testing the Contractor shall work the lot to ensure uniform moisture content and compaction of all material within the lot.

Test representation

The test/s then taken shall be considered to represent the total volume of material placed within the lot.

Further testing

Where the Superintendent considers that the material which is present has not achieved uniformity required by this Clause or **Placing fill for embankment construction**, the Superintendent may take or direct further testing.

The Superintendent shall nominate the area represented by the additional testing.

Material not conforming

If such testing confirms that material not conforming to the worksection is present, the cost of such tests shall be borne by the Contractor.

The Contractor shall carry out remedial work as necessary to achieve conformance to the requirements of **Compaction and moisture requirements**.

8.3 DEFLECTION MONITORING OR PROOF ROLLING

Formation presented for testing

Following completion of the formation to the underside of the selected material zone in accordance with **Foundations for embankments** and **Placing fill for embankment construction**, and completion of the selected material zone in accordance with **Selected material zone**, the Contractor shall make the work available in lots, for the Superintendent to carry out deflection monitoring or proof rolling

This action constitutes a **HOLD POINT**.

The Superintendent's approval to the completed formation following deflection monitoring or proof rolling is required prior to the release of the hold point.

Lot size

A lot for deflection testing shall consist of a continuous length of formation of at least 300 m, or lesser length as approved by the Superintendent, and a single carriageway width which is generally homogeneous with respect to material and appearance.

The Contractor shall identify the boundaries of each lot with stakes clearly labelled to the satisfaction of the Superintendent.

The cost of preparing the surface for deflection monitoring or proof rolling is deemed to be included in the rate for General Earthworks.

8.4 WIDENING OF FORMATION FOR FURNITURE AND SERVICES

Road shoulders and formation shall be widened to accommodate footpaths, guardfence, streetlight plinths, emergency telephone bays and vehicle standing areas as shown on the Drawings.

8.5 MEDIAN AREAS

Batter slope

The batter slopes for median areas shall conform to those shown on the Drawings and undulations in the general plane of the batter slope shall not be permitted.

Batter tolerances

For a horizontal distance of 2 m from the edge of the shoulder, no point on the completed batter shall vary from the specified slope line by more than 50 mm when measured at right angles to the slope line within 24 hours after compaction.

At distances greater than 2 m horizontally from the edge of the shoulder, no point on the completed batter shall vary from the specified slope line by more than 100 mm when measured at right angles to the slope line within 24 hours after compaction.

Free draining

The medians shall be graded so as not to pond water.

9 LIMITS AND TOLERANCES

The limits and tolerances applicable to this worksection are summarised in Table 9.1.

Table 9.1 Summary of limits and tolerances

Activity	Frequency	Limits/Tolerances	Worksection Clause Reference
Batter slopes			
-Excavation	At toe of batter and level of table drain	Batter $\leq 1:1$, +0, -150 mm Batter $> 1:1$, +0, -200 mm	Batter tolerances (Cuttings) and Table 4.1
	2 m above table drain and higher	Batter $\leq 1:1$, ± 300 mm Batter $> 1:1$, +300, -600 mm	
	Between level of table drain and 2 m above table drain	Pro-rata basis	
-Embankment	1 m below shoulder	± 150 mm	Slope tolerances

Activity	Frequency	Limits/Tolerances	Worksection Clause Reference
	At +1 m below shoulder	± 300 mm	Slope tolerances
-Median Areas	At 2 m from edge of shoulder	± 50 mm	Slope tolerances (Compaction and quality control)
	At distances greater than 2 m from edge of shoulder	± 100 mm	
Floors			
-Floor of cutting	As completed	Annexure A	Treatment of floors of cuttings
Tops of Embankments			
-Trimming tops of Embankments	At completion of embankment construction	Parallel to the designed grade line, +10 mm or –40 mm of the levels specified	Trimming tops of embankments
-Selected material	As completed	Annexure A	Selected material zone
-Selected backfill	Adjacent to structures	Plasticity Index >2, <12	Selected backfill
Plus (+) is towards the roadway/surface and minus (–) is away from the roadway/surface. Tolerances are measured at right angles to the slope line.			

10 MEASUREMENT AND PAYMENT

10.1 GENERAL

Payment shall be made for all the activities associated with completing the work detailed in this worksection on a schedule of rates basis in accordance with Pay Items 1112.1 to 1112.6 inclusive.

A lump sum price for any of these items shall not be accepted.

If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

Control measures for erosion and sedimentation are measured and paid in accordance with 1102 *Control of erosion and sedimentation*.

Clearing and grubbing of stockpile sites and borrow areas is measured and paid in accordance with 1111 *Clearing and grubbing*.

Seeding and restoration of stockpile sites and borrow areas is measured and paid in accordance with 0250 *Open space – landscaping*.

Traffic control for blasting operations is measured and paid in accordance with 1101 *Control of traffic*.

Fill adjacent to culverts, other than box culverts, and drainage structures is measured and paid in accordance with 1351 *Stormwater drainage (Construction)*, 1352 *Pipe drainage*.

Selected backfilling to box culverts is measured and paid in accordance with 1353 *Precast box culverts*.

Working platforms created by chemical stabilisation are measured and paid in accordance with 1113 *Stabilisation*.

10.2 PAY ITEMS

C0202.1 Removal and stockpiling of topsoil

The unit of measurement shall be cubic metre as bank volume.

The volume shall be the sum of:

The volume removed from cuttings calculated by multiplying the area of cutting to be stripped as calculated from the plans of natural surface or accepted Ground Model by the depth of topsoil directed to be removed by the Superintendent, plus;

The volume removed from under embankments calculated by multiplying the area to be stripped as calculated from the plans of natural surface or accepted Ground Model by the depth of topsoil stripping as nominated in Annexure A, plus;

The additional volume of topsoil removed from shallow embankments below the depth nominated in Annexure A and calculated on the basis of plan area multiplied by the directed depth of excavation, or as directed.

The schedule rate under this Pay Item includes all activities associated with stripping topsoil, carting and placing into stockpile, then stabilising and trimming the stockpiles.

1112.2 General earthworks

The unit of measurement shall be the cubic metre measured as bank volume of excavation.

The schedule rate for this Pay Item shall be an average rate to cover all types of material encountered during excavation and placed in embankments or spoil stockpiles, including both earth and rock.

Payment for General Earthworks shall include all activities associated with the excavation of material and the construction of embankments, stockpiling of spoil, the haulage of material and any pretreatment such as breaking down or blending material or drying out material containing excess moisture, except that:

- removal of unsuitable material to spoil shall be paid under Pay Item 1112.3;
- extra costs in processing selected material shall be paid under Pay Item 1112.4;
- overhaul of spoil or borrow shall be paid under Pay Items 1112.5 and 1112.6 respectively.

The base of the excavation shall be the designed floor level in accordance with **Treatment of floors of cuttings** and no account shall be taken of level tolerances.

The volume of earthworks in cuttings shall be determined by the surface to surface triangulation method, calculating the volume between the plans of natural surface or accepted Ground Model, the designed batter lines and the base of the excavation; from which shall be deducted the volume of topsoil as calculated under Pay Item 1112.1. No account shall be taken of the allowable batter tolerances or stepping of batters for topsoiling.

Where unsuitable material from the foundations of shallow cuttings or material from cut to fill transitions is excavated and placed into embankments the volume shall be calculated from joint surveys carried out immediately prior to, and after subsequent removal of the unsuitable material, or by other methods which may be approved by the Superintendent.

1112.3 Unsuitable material to spoil

The unit of measurement shall be the cubic metre measured as bank volume of excavation.

This pay item refers only to unsuitable material as defined in **Unsuitable material** which is removed to spoil stockpile.

If the material is such that the bank volume of excavation cannot be measured, the Superintendent shall determine the conversion factors to be applied to the loose volumes measured in haulage units or to the measured stockpile volumes.

The schedule rate(s) under this Pay Item shall include all operations involved in the excavation, haulage, drying out, compaction or other activity required under **Unsuitable material** for its disposal as spoil in accordance with **Spoil**.

When this Pay Item provides for ranges of provisional quantities, the rates shall be applied successively, but not cumulatively, as the volume of unsuitable material increases from one provisional quantity range to the next higher range.

Each rate shall be applied as the sole payment due for all unsuitable material removed within each quantity range, irrespective of the nature or quantity of the material removed.

1112.4 Selected material

The unit of measurement shall be the cubic metre measured as embankment volume in place in the selected material zone. The volume shall be determined by multiplying the theoretical plan area of the top of the selected material zone with its nominated thickness.

This pay item covers any extra costs involved in stockpiling, processing, placing, compaction and trimming of material, including surface preparation for deflection monitoring in the selected material zone over and above those costs allowed for under Pay Item 1112.2.

The width and depth shall be taken as shown on the Drawings or as directed by the Superintendent. No account shall be taken of level tolerances.

1112.5 Haulage of spoil

Where an approved location for spoil disposal is more than five kilometres by road from the point of excavation of material being spoiled, payment shall be made for haulage at the rate nominated in Annexure A per bank cubic metre for each kilometre or part thereof in excess of five kilometres.

1112.6 Haulage of borrow

Where an authorised borrow site that was not nominated in the Contract, is more than five kilometres by road from the point of delivery of borrow material to the Works, payment shall be made for haulage at the rate nominated in Annexure A per bank cubic metre for each kilometre or part thereof in excess of five kilometres.

11 11 ANNEXURE A**11.1 EARTHWORKS INFORMATION**

Worksection Clause reference	Description	Value	
Removal of topsoil	The depth below natural surface up to which the removal and measurement of top soil shall apply:		
	-Cutting areas	_____ mm	
	-Embankment areas	_____ mm	
Treatment of floors of cuttings	Minimum CBR value in cutting floors used for design of pavement	_____ %	
	Construction tolerances, of the designated grade and crossfall, for floors of cuttings after recompaction	+ _____ mm - _____ mm	
Foundations for embankments	Requirements of material in foundations for shallow embankments:		
	-Moisture Content within the range of _____% to _____% of optimum.		
Placing fill for embankment construction, Selected material zone	Upper Zones of Formation (7.5) & Selected Material Zone (7.9)		
	Material within each zone shall have a CBR value of not less than that given in the table below under the nominated test conditions.		
	Location	Minimum CBR Value	Depth
	-Selected Material Zone		Nominated Soaking Period (Days)
	-Material below Selected Material Zone to 1.5 m from top of pavement.		
Selected material zone	Construction tolerances for Selected Material Zone are:		
	-designed grade and -cross fall	+ _____ mm + _____ mm	
Spoil	Haulage of spoil under Pay Item C0202.5 shall be payable at the rate of \$ _____ per bank cubic metre per kilometre in excess of 5 km.		
Borrow	Haulage of borrow under Pay Item C0202.6 shall be payable at the rate of \$ _____ per bank cubic metre per kilometre in excess of 5 km.		
Compaction and moisture requirements	Shallow cuttings		
	-Sections of work nominated to be in shallow cutting:		
	-Ripping or loosening [is / is not] required in shallow cutting.		
	-Proof rolling of subgrade [is / is not] required.		
Compaction and moisture	Moisture Content of material placed in embankments:		
	-Material in upper zones of formation within the range of ____% to ____% of optimum		

Worksection Clause reference	Description	Value
requirements	-All other embankment material within the range of ___% to ___% of optimum	