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## 2 EARTHWORKS

### 2.01 SCOPE

The works covered by this Section of the Specification comprise the formation by cutting or filling of the earthworks for roadways, paths, open drains and all incidental works other than underground services. Requirements are also laid down for the clearing and grubbing of vegetation, removal of existing structures, stripping and stockpiling of topsoil and for the final trimming and finishing of surfaces for various purposes.

Ancillary works, such as temporary drainage and soil conservation measures are also specified for the protection of permanent works during construction and the prevention of damage to the site and adjacent areas as a result of soil erosion.

### 2.02 STANDARDS

Work carried out and testing performed under this Section of the Specification shall comply with the requirements of the following Standards to the extent that they are relevant and not overridden by the Specification.

#### **Australian Standards**

|               |  |
|---------------|--|
| AS 1289       | Methods of Testing Soils for Engineering Purposes including:   |
| AS 1289.6.1.1 | Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen. |
| AS 1289.3.3.1 | Calculation of the plasticity index of a soil.   |
| AS 1289.5.1.1 | Determination of the dry density/moisture content relation of a soil using standard compactive effort.         |
| AS 1289.5.4.1 | Compaction control test - Dry density ratio, moisture variation and moisture ratio.                            |
| AS 1289.5.7.1 | Compaction Control Test (Rapid Method).  |
| AS 2187       | Explosives, Storage, transport and use   |
| AS 2189       | Explosives Glossary of Terms   |
| AS 1348       | Road & Traffic Engineering -Glossary of Terms  |

#### **Legislation**

Dangerous Goods Act 1975

Dangerous Goods Regulations 1978

Occupational Health and Safety (Certification of Plant Users & Operators) Regulations 2000 (Dated 15 Nov 2000)

Occupational Health and Safety Act 1989

Scaffolding & Lifts Regulations 1950

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**Other References**

AUSTROADS Explosives in Roadworks, User's Guide - 1982.

Terms used to describe the various elements of pavement structure in this Section are in accordance with the definitions prescribed in AS1348, "Glossary of Terms Used in Road Engineering".

A Testing Authority shall be employed by the Contractor to carry out all testing. The Authority shall hold a current NATA (National Association of Testing Authorities) Registration for the relevant tests, and a copy of results shall be forwarded to the Superintendent without delay.

## 2.03 PROTECTION OF THE WORKS

### 2.03.1 General

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

The Contractor requires an Environment Protection Agreement or an Authorisation with the Environment Management Authority for all construction or building activities on a site more than 0.3 hectare and must be obtained prior to commencement of work.

No extensions of time will be granted or allowed relative to any delay with obtaining of the necessary Agreement and other approvals unless it is shown to the satisfaction of the Superintendent that all necessary steps have been taken on time by the Contractor.

Where the Contract documents include a suggested Sediment and Erosion Control Concept Plan, the Contractor is still responsible for the adequacy of those arrangements. The Contractor may choose to adopt those concept arrangements as the basis for applying for approval, or alternatively the Contractor may propose his own measures as the basis for approval.

Prior to commencement of work the Contractor must provide two copies of the Sediment and Erosion control measures plan to Environment ACT – Water Unit for approval. Two copies of the endorsed as approved drawing(s) shall be provided to the Superintendent.

In addition to those erosion and sediment control measures suggested in the Contract documents and the Sediment and Erosion Control Measures Plan the Contractor shall generally plan and manage the works to minimise erosion on the site.

It is expected that control measures may include the following

**(i) Control over surface run-off by:**

- construction of interception drains to divert run-off from undisturbed areas around the works area
- installation of temporary drains
- early stabilisation of floodways
- use of straw bales, silt fences, swales, contour ploughing or rip dozer cleat impressions, spreader banks.

**(ii) Limit movement of vehicles and equipment to:**

- a single approved stabilised construction entrance
- prepared parking areas by the construction of temporary fencing.

**(iii) Minimise the area exposed by:**

- staging of clearing operations
- progressive stabilisation of the works as completed
- provision of temporary grassing
- contour ploughing to disturbed areas.

**(iv) Construction of sediment control measures such as:**

- sediment retention ponds,
- sediment basins
- sediment traps (various types)
- silt fences
- buffer zones

Refer to "Erosion and Sediment Control During Land Development – Environment ACT -" for details.

Where the approved control measures include sediment retention ponds, and notwithstanding the requirements arising elsewhere in the Contract documents or from Environment ACT and, then:

- (a) The ponds shall be kept empty of water for the longest practical duration. During periods of high in-flow of water and sediment, causing overtopping over the pond spillway, the Contractor shall regularly test the quality of the waters being released and treat the water with chemicals as and when necessary in order to achieve a water quality for the released water complying with the above legislation and licence and to maintain sufficient residual gypsum or an acceptable chemical in solution to sustain treatment of subsequent inflow. When there is an inflow which is insufficient to cause overtopping over the pond spillway, then the water is to be treated as necessary and emptied within three days of the inflow occurring.
- (b) The Contractor shall remove and dispose of accumulations of materials from the ponds as often as is necessary to maintain their interception capacity to at least ninety percent (90%) of the design volume of the pond.
- (c) The Contractor shall develop and implement procedures and a programme and provide all necessary equipment, materials and labour to carry out water testing; calibration test; dosing with chemicals; and the controlled release of waters so as to comply with the requirements of the legislation and licence. The testing procedure shall be developed using a turbidity meter which shall be calibrated with a series of test results on water samples with a range of Non-Filterable Residue levels. The Contractor shall arrange laboratory tests for Non-Filterable Residue and obtain advice on dosage rates ensuring that the pH is within acceptable limits, and then if possible develop a simple field correlation technique for assessing the suitability of the water for release. Dosing can be carried out using an acceptable chemical such as gypsum, using a simple slurry mixing and spreading technique designed to achieve acceptable water quality. Gypsum is preferred because it does not change the pH and unless there are problems in effectiveness it shall be the chemical used.

Unless specified elsewhere within the Contract, or directed otherwise by the Superintendent, then the sediment and erosion quality control measures will be provided, operated and managed, maintained or replaced as necessary for the period of the contract, including the consolidation period and/or the Defects Liability Period as required to fulfil the requirements of the Pollution Control Act.

**2.03.2 Protection of Earthworks**

Protect earthworks and in particular road formations from the effects of erosion and deposition. Grade earthworks and particularly subgrades to drain at all stages without ponding. Where run-off must cross the

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formation, ensure that the stream is a broad sheet flow which crosses roughly at right angles to the alignment and minimises the likelihood of subgrade softening.

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.

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.

### **2.03.3 Stockpiles**

Where locations are not nominated in the documents, place stockpiles to minimise effects on site and adjacent areas. Keep clear of tops of slopes to avoid causing instability.

Locate stockpiles clear of natural drainage lines and provide temporary drainage as necessary.

Stockpile material is to be placed to avoid damage to existing flora etc. Where directed by the Superintendent stockpiles shall be temporarily grassed.

### **2.03.4 Protection of Completed Earthworks**

In areas where earthworks, including open drains, have been completed and no further treatment is specified other than topsoiling and grassing or hydroseeding, then the topsoiling and seeding shall be carried out as specified at the earliest practicable date.

Areas of exposed completed earthworks shall, if directed, be stabilised using temporary grassing, within 28 days of formation.

### **2.03.5 Reinstatement**

Fill temporary drains and remove structures when no longer required. Filling shall

be placed and compacted as specified later in this Section. Reinstatement surfaces (including areas formerly occupied by stockpiles) as follows:

- within the area of the permanent works finish as specified;
- areas outside the permanent works which were formerly developed in any way shall be reinstated to their condition at commencement of the Contract;
- undeveloped areas outside the permanent works shall be reinstated as specified for "Dryland Grassing".

## **2.04 CLEARING AND GRUBBING**

### **2.04.1 General**

Unless otherwise specified, remove all vegetation, logs, stumps, boulders, roots, scrub, debris and dumped material and items within the limits of clearing. Demolish and dispose of any minor man-made structures (such as fences and livestock yards), all rubbish and other materials that are unsuitable for use in the Works. Grass and topsoil shall not be removed as part of this initial clearing.

In advance of clearing and grubbing operations, effective erosion and sedimentation control measures shall be implemented in accordance with this Specification.

All trees and stumps, on or within the limits of clearing, unable to be felled and removed by the clearing methods used by the Contractor shall be removed by grubbing. Grub out stumps and roots over 75mm diameter to a minimum depth of -0.5m below the natural surface or 1.5m below the finished surface level, whichever is the lower. Backfill grub holes with suitable spoil from excavations compacted in layers to the density of the surrounding undisturbed soil.

The Contractor shall take all measures to prevent damage to existing underground and overhead utility services.

Every precaution shall be taken to prevent timber from falling on private property and the Contractor shall dispose of any timber so fallen or produce the written consent of the owner to its remaining there. The cost of disposal of such fallen timber shall be borne by the Contractor. Prior to entering private property, the Contractor shall obtain consent from the Superintendent and the property owner.

Damage of any kind, including damage to trees and fencing occurring during clearing operations shall be made good by the Contractor. The cost of repair of such damage shall be borne by the Contractor.

Limits of clearing are defined as lines one metre outside the intersections of excavation or embankment slopes with the natural surface or the outside limits of slope rounding together with any other limits detailed. For services trenches outside the general limits of clearing, limit of clearing is defined as trench width plus one (1) metre either side of the trench. The Contractor shall ensure that only the absolute minimum necessary for construction is cleared.

### Hold Point 2.1

|                        |   |
|------------------------|---|
| Process Held:          | Clearing operations within any given area.  |
| Submission Details:    | At least seven (7) working days prior to commencement of clearing the Contractor shall give notice of intention to commence clearing operations within any given area |
| Release of Hold Point: | The Superintendent will mark or indicate to the Contractor the trees that are to be retained, prior to authorising the release of the Hold Point.                     |

## 2.04.2 Care of Trees

Protect trees marked to be retained by means of fence Type "T" as specified in Clause 8.04. Fences normally shall be located no closer to the tree than the edge of the canopy unless specified otherwise.

Vehicles and plant shall not be parked under existing tree canopies. Refuelling and storage of chemicals and fuel shall not be permitted beneath existing tree canopies.

If plant operation close to trees to remain is unavoidable, lash pine offcuts upright around the trunks in lieu of fencing. Offcuts shall be 1.5m high and spaced at no more than 100mm around trunks. Lower ends shall touch the ground. Sawn faces shall be outermost and painted white. The Superintendent may direct that levels be adjusted in the vicinity of trees to minimise the effects of excavation or filling.

Work within three (3) metres of trees to be protected shall be carried out by hand to avoid damage by equipment. Cut roots neatly in the line of the work before commencing machine excavation. All cut surfaces shall be coated with a suitable bitumen based paint. Roots that are greater than 30mm diameter measured at a distance of three (3) metres from the tree trunk shall not be cut without prior approval from the Superintendent.

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If any tree is damaged during the course of the work, the Superintendent may direct the Contractor to effect repairs or remove and replace the tree. Alternatively, the Superintendent may make arrangements for repair or replacement at the Contractor's expense. Damage to trees shall also include damage to bark and root systems.

The Contractor shall plan all operations to ensure that there is no damage to any trees outside the limits of clearing specified or directed by the Superintendent. No growing trees shall be destroyed or damaged by the Contractor other than those specified and those indicated by the Superintendent.

Where branches intrude on the working area, any necessary trimming shall be carried out by a tree surgeon approved by the Superintendent.

### **2.04.3 Disposal of Material**

Unless otherwise specified, all materials cleared and grubbed in accordance with this Specification shall become the property of the Contractor and shall be removed from the site and legally disposed of.

Unless otherwise specified elsewhere, disposal of timber and other combustible materials by burning shall not be permitted. Where permitted, the Contractor shall comply with all Statutory requirements applicable to burning off, and any such burning off shall be carried out in such a manner that no damage is done to any trees outside the limits of clearing. Smoke resulting from such burning off shall not cause a traffic hazard or a nuisance to adjacent landholders.

### **2.04.4 Chipping of Cleared Vegetation**

The Contractor shall recycle in accordance with ACT No-Waste guidelines, or mulch for use on site.

The Contractor may produce a wood-chip mulch derived from crowns of trees and branches of shrubs cleared under this Specification. The wood-chip mulch produced shall be stockpiled for subsequent use in accordance with the Section 9 of this Specification or for use at other locations as appropriate

The wood-chip mulch shall be produced from branches having a maximum diameter of 100 millimetres and the chipped material produced shall not have two orthogonal dimensions exceeding 75mm and 50mm.

## **2.05 EXCAVATION**

### **2.05.1 General**

Excavate to conform to the lines, grades, cross sections and dimensions shown on the drawings. The Superintendent may order the removal of any soft spots, debris or organic material exposed when excavated areas have been trimmed to finished formation levels. Remove all rocks and boulders which protrude above finished surfaces of subgrades.

Except as specified in Clause 2.07.2, excavation below finished formation levels shall be made good as specified for filling.

Separate the best granular materials from excavations for use in the upper layers or fill subgrades.

Should the Contractor propose to claim payment for adjustment to quantities of excavation due to the inaccuracy of the surface levels shown on the drawings or in the ground model supplied by the Superintendent, he shall, prior to any disturbance of the existing surface, notify the Superintendent. Failure to notify the Superintendent will mean that the levels shown on the drawings or in the ground model supplied by the Superintendent will be taken to be correct. If the subsequent check survey reveals the survey shown on the drawings to be correct, then the Contractor shall bear the cost of the check survey.

**Hold Point 2.2**

|                        |  |
|------------------------|--|
| Process Held:          | Earthworks operations within any given area.   |
| Submission Details:    | At least seven (7) working days prior to commencement of earthworks operations in any given area, if the Contractor considers areas of the ground survey shown on the drawings to be inaccurate, the Contractor shall give notice of intention to commence earthworks operations within that area. |
| Release of Hold Point: | The Superintendent will check the survey of the area in question, prior to authorising the release of the Hold Point.  |

Rock outcrops worthy of retention as landscape features shall be preserved as directed on site. Provide for the protection of rock outcrops where detailed to avoid damage, staining and scarring. Rock surfaces shall be left clean and free of spilled soil or debris. During construction and as directed, rock surfaces shall be covered with soil to a depth of approximately 300mm and washed off at the conclusion of construction work.

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.

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

- (a) Spoil it, or
- (b) Use it for the Contractor's own purposes, or
- (c) Use it as a source of pavement materials, or
- (d) 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 Clause 2.06.2. The cost of making good such deficiency of material shall be borne by the Contractor.

**2.05.2 Stripping and Stockpiling of Topsoil**

Prior to the commencement of earthworks topsoil is to be stripped within the limits of the earthworks. In particular topsoil is to be stripped from any areas to be covered by paving, structures or fill. Also strip topsoil within the limits of clearing for underground services beyond the limit of earthworks. Unless otherwise directed, the depth of stripping shall be to the bottom of the grassroots zone. Grass shall be stripped together with topsoil. Avoid contamination by any other material. Unless otherwise specified soils shall not be stripped from around existing trees closer than a distance equal to twice the radius of the trees crown measured from the trunk.

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.



**Hold Point 2.3**

|                        |   |
|------------------------|---|
| Process Held:          | Stockpiling at any site not shown on the drawings.  |
| Submission Details:    | At least three (3) working days before stockpiling is due to commence the Contractor shall submit details of the location of proposed stockpile sites specifying the maximum dimensions of the proposed stockpile and proposed protective measures. |
| Release of Hold Point: | The Superintendent will review the submission, prior to authorising the release of the Hold Point.  |

Any clearing and grubbing required for these sites shall be carried out in accordance with the Clause 2.04 of this Specification. Temporary erosion and sedimentation control measures shall be taken in accordance with specified requirements.

Topsoil stockpiles shall not exceed 2.5m in height and the maximum batter slope shall not exceed 2:1. If to remain unused for more than four (4) weeks, topsoil stockpiles shall be sown as specified for "Temporary Grassing". Restoration of stockpile sites following completion of the work shall be carried out in accordance with the Section 9 of this Specification.

**2.05.3 Use of Explosives****(i) General**

Storage, transport and handling of explosives shall comply with the requirements of AS 2187, parts 1 and 2. On-site magazines shall comply with AS 2187. The Contractor's attention is drawn to the AUSTROADS publication "Explosives in Roadworks, Users Guide - 1982". This document supplements the rules contained in the Australian Standards and prescribes practices and precautions in the use of explosives in roadworks. Adopt these practices to the extent that they are consistent with the requirements of local legislation. Take particular note of the requirements of Sections 4, 5, 7, 9, 11, 12 and 14.

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.

Structures shall include public utilities. The survey shall include all structures within 500m 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.

Drilling and blasting operations shall not commence without the approval of the Superintendent. The Contractor shall give notice of intention to commence drilling for blasting. The Contractor shall provide details of proposed drilling, blasting and excavation techniques including proposed maximum instantaneous charge, quantity and type of explosive, blasting patterns, methods to limit noise and vibration, pre-splitting details and condition survey details of rockbatters. In the event of rejection of a proposal it shall be revised and resubmitted.

**Hold Point 2.4**

|                        |   |
|------------------------|---|
| Process Held:          | Drilling and blasting operations.   |
| Submission Details:    | At least five (5) working days before proposed drilling and blasting is due to commence the Contractor shall submit details of proposed drilling, and blasting techniques and a condition survey. |
| Release of Hold Point: | The Superintendent will review the submission, prior to authorising the release of the Hold Point.  |

During the blasting operations, erect signs as specified in Section 1 of this Specification. Sound audible warnings as specified in AS 2187.

Blasting in the vicinity of public utilities shall be subject to any limitations imposed by controlling authorities. Special or unusual limitations are noted on the drawings or in the Contract. Obtain clearance from the Superintendent before blasting within 15m of any public utility.

Written notice shall be given to the occupants or their representative of residential or business premises located within a 1km radius of the blasting site. The notice shall include time of blasting, frequency, duration, purpose, precautions being taken to prevent property damage and contact details of the Contractor for enquiry. Provide reports of all enquiries and action taken to the Superintendent.

Ground vibration caused by blasting shall not exceed the values of peak particle velocity listed in Table 2.1.

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**Table 2.1**

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

The requirements of this clause and the fact that the Superintendent may have approved blasting proposals shall not relieve the Contractor of the responsibility to plan and conduct blasting operations safely and with a minimum of inconvenience to the public. The Superintendent may monitor vibrations resulting from blasting as a check on compliance with code requirements. Provide copies of blasting records to the Superintendent.

No person shall, receive explosives unless that person is authorised by or under the *Dangerous Goods Act 1975*. Any person intending to use explosives in the ACT must first be the holder of a "Shotfirer's Permit," issued under the *Dangerous Goods Regulations 1978*. That person must then obtain a "Permit to Use Explosives" under the *Occupational Health & Safety Regulations*. Application for a "Permit to Use Explosives" should be made to the Registrar under the *Occupational Health and Safety Act*. Application must be made at least 14 working days prior to the commencement of any work involving the use of explosives. The application must be accompanied by a "Blast Plan" containing all of the information

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requested in the application form. Application forms are available from ACT WorkCover. To contact ACT WorkCover please dial (02) 6205 0200 or send your inquiry via e-mail to [www.workcover@act.gov.au](mailto:www.workcover@act.gov.au)

Storage of explosives shall be strictly observed and be in accordance with Part III of *Dangerous Goods Act 1975*; Part V (Keeping of Dangerous Goods) of the *Dangerous Goods Regulations 1978* (the "Regulations"). Any person who is transporting, handling and keeping explosives must comply with Part III of the *Dangerous Goods Act 1975*; Parts III, V and VI of the Regulations.

#### **(ii) Blasting Records**

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

#### **(iii) Control of Air Blast Over-Pressure**

Where a noise sensitive location exists within 1km of the blasting site, the Contractor's shall control air blast over-pressure. 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 per cent of the total number of blasts may exceed this value provided a level of 120 decibels is not exceeded at any time.

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 Specification. 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.

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.

#### **(iv) Control of Ground Vibration**

The Contractor shall arrange for the monitoring of ground vibrations to ensure compliance with the peak particle velocity limits shown in Table 2.1. 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 Specification. 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.

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.

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:

$$MIC = 0.5 \left[ \frac{D}{\left[ \frac{PPV}{1140} \right]^{-0.625}} \right]^2$$

- 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 2.1

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

$$\text{Scaled Distance} = \frac{D}{\sqrt{MIC}}$$

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

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.

#### 2.05.4 Disposal of Surplus Spoil

Unless otherwise specified, surplus material from excavations may be disposed of on site by:

- (a) uniform widening of embankments; or
- (b) uniform flattening of fill batters; or
- (c) uniform filling of selected areas within the road reserve.

If not already cleared, dumping sites shall be cleared and grubbed to the extent necessary before any material is deposited. Strip topsoil as specified in Clause 2.05.2 and set aside for later respreading over the dumped spoil.

Unless other treatments are specified, respread topsoil on completion of dumping and grass as specified for "Dryland Grassing".

In the event that suitable disposal areas are not available on site, the material shall be carted to dumping locations nominated by the Superintendent.

Spoil transported to off-site dumps shall be placed in stockpiles within the cleared areas. Level off heaps as necessary to allow access for vehicles to dump on top of previously placed material and to present a neat appearance on completion.

### **Hold Point 2.5**

|                        |   |
|------------------------|---|
| Process Held:          | Commencement of spoiling operations.  |
| Submission Details:    | At least three (3) working days before spoiling is proposed to commence the Contractor shall submit a plan or advice on the proposed spoil areas. |
| Release of Hold Point: | The Superintendent will consider the plan / advice prior to authorising the release of the Hold Point   |

### **2.05.5 Ripping of Access Tracks**

Existing access tracks shall be ripped to a minimum depth of 300mm. All cultivations to be parallel to the final contours. Remove stones larger than 50mm from the surface after ripping.

Omit ripping where rock outcrops are evident or where material cannot be dislodged by a ripper mounted on a tractor of comparable performance to a Caterpillar D6.

### **2.05.6 Unsuitable Material**

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. Unsuitable material also includes material in cuttings which the Superintendent deems to be unsuitable for embankment construction.

Such material shall be excavated to the extent directed by the Superintendent. Material removed as unsuitable shall be incorporated in to the works in accordance with Clause 2.05.4 above or removed from site, as directed by the Superintendent.

The unsuitable material which is removed from below fill embankments greater than 1.0m deep or the face of cuttings shall be replaced with fill material and compacted in accordance with the requirements of Clause 2.06.

Unsuitable material which is removed from the floor of cuttings or below fill embankments less than 1.0m deep shall be treated as unsuitable subgrade material and replaced and compacted in accordance with the requirements of Clause 2.07.6.

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

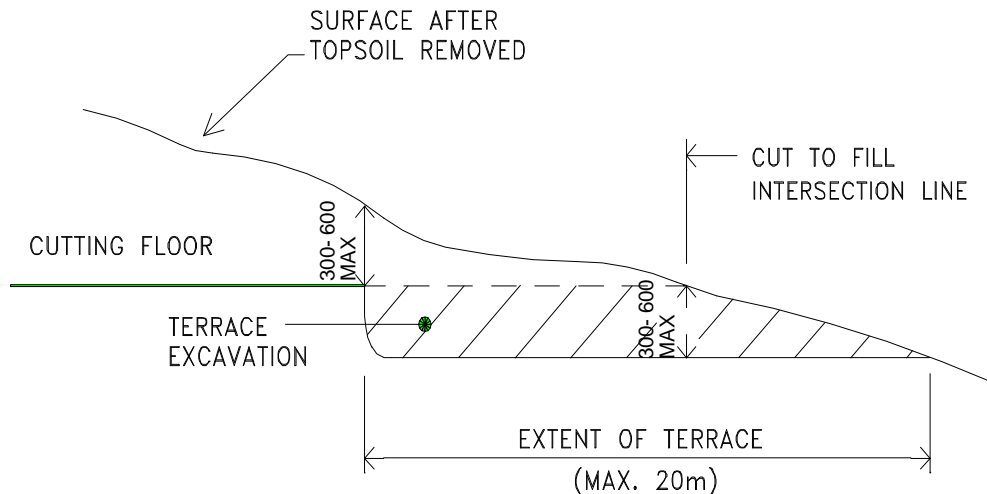
### **2.05.7 Transition from Cut to Fill**

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 pavement.

Following excavation to the cutting floor, a terrace shall be excavated for the width of the pavement to a depth of 600mm below and parallel to the cutting floor, as shown in Figure 2.1.

The terrace shall extend into the cut to the point where the cutting floor is 600mm below the original stripped surface, or a distance of 20 metres, whichever is the lesser.

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.



**Figure 2.1 - Treatment at Intersection Line between Cutting and Embankment**

## 2.06 FILLING

### 2.06.1 General

Place and compact filling to conform to the lines, grades, cross-sections and dimensions shown on the drawings. Allow for the thickness of materials which will be placed in subsequent operations.

Before filling commences the Contractor shall make available for inspection, by the Superintendent, the foundation of the embankment. The Superintendent may order the removal of any soft spots, debris, organic material, or other unsuitable material exposed when the nominal depth of topsoil has been stripped. This additional stripping may extend to a depth of 300mm below the general depth of stripping. The Superintendent may also direct the removal and replacement of such unsuitable material in accordance with Clause 2.05.6..

#### **Hold Point 2.6**

|                        |  |
|------------------------|--|
| Process Held:          | Commencement of filling operations.  |
| Submission Details:    | At least three (3) working days before filling is due to commence the Contractor shall present prepared foundation and written advice that filling is about to commence. |
| Release of Hold Point: | The Superintendent will inspect the foundation and order the removal of any unsuitable material, prior to authorising the release of the Hold Point                      |

Foundations of shallow embankments which are of a depth less than 1.0 metre from the top of pavement to natural surface shall be inspected and tested to determine if the material meets road subgrade requirements. Material in the foundations for shallow embankments which does not meet the requirements for road subgrade shall be deemed unsuitable in accordance with Clause 2.07 and shall be replaced by material of the specified quality.

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 200mm, adjusting the moisture content of the loosened material and compacting as specified in Clause 2.07. The Contractor shall use equipment and techniques to minimise surface heaving or other foundation damage.

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 200mm as specified in Clause 2.06.5.

In areas of fill which are to be topsoiled, use the loamier of the available materials in the top 150mm below the topsoil. The material shall be free of particles greater than 75 mm.

If directed, make rollers available for the test rolling of stripped surfaces.

Where fills are to be constructed on hillsides or against existing fills, slopes which are steeper than 1:10 shall be benched and roughened across the slope to allow placement of filling in layers and to prevent slip failures at the interface.

Provide for the drainage of benches during construction.

### **2.06.2 Materials**

Unless otherwise specified or directed the materials used for filling shall be obtained from cuttings. The Contractor will be required to manage and sort the materials so obtained from cuttings to ensure that the best available material, that is the most granular and least plastic is available for use in road embankments and that any loam material obtained from cutting is used for general fill the top layers of which are to be grassed.

Material used in the top 150mm below subgrades shall be free of particles larger than 75mm, material used in the top 600mm below subgrades shall be free of particles larger than 150mm and material used in the top 1 m below subgrades shall be free of particles larger than 300mm. Elsewhere rock material shall be broken down to less than 600mm unless otherwise permitted.

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.

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

After compaction, embankment material in the subgrade zone(s) below the pavement material (select material layer or subbase layer, where there is no select material layer) shall conform to the requirements of Clause 2.07.4.

The Superintendent may direct that material unsuitable for road embankments be used elsewhere on site or run to spoil. If this should result in a deficiency of material available for filling, then additional material shall be obtained as specified in Clause 2.06.3.

### **2.06.3 Borrow**

Borrow pits will not be permitted on site unless prior written approval is obtained from the Superintendent. In seeking such approval the Contractor shall provide adequate information on the proposed borrow pits including size, location and reinstatement.

---

The Superintendent may approve the winning of additional material on site by:

- (a) uniform widening of cuttings; or
- (b) uniform flattening of cut batters; or
- (c) uniform grading of selected areas within the site

Borrowing from external sources will not be permitted where suitable material is available on site. Where borrow from external sources is proposed in the design, borrow areas are detailed. Alternatively, the Contractor may elect to supply material obtained from his own sources. In all cases, obtain necessary permits before commencing borrowing operations.

Where material is obtained from borrow pits the pit area shall first be cleared and stripped of topsoil. On completion of winning operations, grade the pit to remove abrupt changes of slope or level, respread topsoil and grass as specified for "Dryland Grassing". Provide drainage and erosion protection as necessary. Pits shall be free draining.

#### **2.06.4 Compaction**

Place and compact filling in uniform layers of thickness appropriate to the nature of material and the compaction equipment being used. Layers shall extend for the full width of embankments and shall be placed such that they are parallel to the finished surface. In earth fills the maximum layer thickness generally shall be 150mm compacted. However, greater thicknesses will be permitted subject to the ability of compaction equipment to achieve specified densities. No layer shall be less than 100mm thick compacted. Each layer shall be compacted to the appropriate density prescribed in Table 2. 2. Where area is to be planted or grassed, the top 500mm is to be compacted to a level not exceeding 85% of the modified maximum dry density.

During compaction maintain moisture content of fill in the range  $OMC \pm 2\%$  by drying or the addition of moisture as appropriate. Water spraying equipment used for this purpose shall be capable of distributing water uniformly in controlled quantities over uniform lane widths. Mix mechanically to ensure uniform distribution of moisture before commencing rolling.

Where clay is used as filling it shall be taken directly from the excavation to the fill site, placed and compacted without delay to prevent drying beyond the specified limit. If clay, when excavated, has a moisture content less than the specified minimum, the Contractor shall undertake one or more of the following actions:

- prior to winning and loading or after placement in the fill the material be pulverised by a suitable mechanical stabilising machine, wetted as necessary and mixed thoroughly to a uniform moisture content within the specified limits.
- the material be stockpiled and watered as necessary until it has reached a uniform moisture content within the specified limits.
- part or all of such material be declared unsuitable for use as filling and run to spoil.

In areas inaccessible to rollers normally considered appropriate to achieve the specified compaction, compaction shall be carried out using smaller rollers or suitable mechanical tampers. Reduce layer thicknesses as necessary to ensure the achievement of specified densities.

#### **2.06.5 Backfilling at Structures**

Unless otherwise permitted, no filling shall be placed against concrete bridge abutments, wing walls or retaining walls within fourteen days of casting. Strut walls as necessary to prevent movement during placing and compaction.

Place and compact filling over and around pipes, culverts, bridges and other structures so as to avoid unbalanced loading or movement.



Unless otherwise detailed, the abutments and wings of bridges shall be filled as follows :

- Where the gap between the structure and undisturbed ground is less than 900mm, backfill with subbase material complying with Clause 4.03.2(ii).
- Where the gap between the structure and undisturbed ground exceeds 900mm but is less than 2m, backfill with select material as defined in Clause 4.03.2 (iii).
- Where the gap between the structure and the undisturbed ground exceeds 2m, backfill the zone within 2m of the structure with select material as defined in Clause 4.03.2 (iii) and backfill in the zone beyond 2m of the structure with general fill complying with Clause 2.06.2.

Unless otherwise detailed, material within 300mm of weepholes shall be coarse filter medium complying with Clause 3.06. 1.

## 2.07 SUBGRADE PREPARATION

### 2.07.1 Subgrade Levels

The Contractor shall notify the Superintendent when earthworks have progressed to a stage where the nature of subgrade material can be assessed. The Superintendent may order the removal of unsuitable material or other treatments including variations in pavement thickness to allow for the subgrade materials actually encountered.

#### Hold Point 2.7

|                        |   |
|------------------------|---|
| Process Held:          | Final preparation of subgrade in accordance with Clause 2.07  |
| Submission Details:    | At least one (1) working day prior to reaching subgrade level the Contractor shall provide notification that subgrade level will be reached .                 |
| Release of Hold Point: | <i>The Superintendent will inspect the subgrade and may direct removal of unsuitable or further action prior to authorising the release of the Hold Point</i> |

### 2.07.2 Cut Subgrade

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

The CBR of the material in the floors of cuttings shall be determined by Test Method AS 1289.6.1.1.

All material remaining in the floor shall then be ripped or loosened to a minimum depth of 150 mm below the designed floor level for the width of the pavement to 150mm behind kerb or as shown on the Drawings. The maximum dimension of particles in the ripped or loosened zone shall not exceed 100 mm after recompaction.

**Hold Point 2.8***Process Held:**Recompaction of floors of cuttings.**Submission Details:**At least one (1) working day prior CBR results of material in the floors of cuttings and notification that the floor has been ripped and compacted .**Release of Hold Point:**The Superintendent will consider the submitted test results, inspect the excavated floor and may direct further action prior to authorising the release of the Hold Point*

The ripped or loosened material, or replaced or treated material shall be recompacted in accordance with Clause 2.06.4. No account shall be taken of the volume involved in loosening when measuring the volume of excavations except that where material has been declared unsuitable.

After recompaction, the floors of cuttings shall be trimmed parallel with the finished wearing surface so that their levels do not vary from the designed floor levels by more than the tolerances specified in Clause 2.09.2.

Trim cut subgrade in earth to an even surface free of loose material and compact as specified in Clause 2.06.4 to the density prescribed in Table 2. 2. Excavation below design levels by less than 100mm other than that made for the purpose of removing roots and boulders or replacement of unstable material shall not be backfilled but made good by increasing the thickness of the lowest pavement layer. Grade depressions to drain to the edge of formation, or tyne, rip, top-up and re-compact.

**2.07.3 Rock Subgrade**

Remove all loose rock from the surface.

Treat the rock surface so that water cannot accumulate at any point. This shall be achieved by constructing subgrade drains to connect depressions to the stormwater system or to longitudinal subsoil drains. Subgrade drains shall be at least 150mm wide and shall be cleared of all earth and debris. Backfill depressions and subgrade drains with coarse filter medium complying with Clause 3.06.1.

**2.07.4 Fill Subgrade**

Trim subgrade to an even surface free of loose material to the tolerances specified in Clause 2.09.2.

After compaction, embankment material in the subgrade zone(s) below the underside of pavement (select material layer or subbase layer, where there is no select material layer) shall have a CBR value not less than that quoted on the drawings for the depth(s) specified on the drawings (or where not quoted on the drawings shall have a CBR value of not less than 3 for a depth of not less than 1m). For the purpose of this Clause, the CBR value of the material shall be determined by Test Method AS 1289.6.1.1.

**2.07.5 Clay Subgrade**

Subgrade comprising clay soils of medium to high (CL/CH) and high (CH) plasticity need to be retained moist within the range of -1% to +3% of standard optimum moisture content. To prevent drying out and to limit possible surface heave, immediately after compaction the subgrade should be covered by the first select fill or pavement layer.

### 2.07.6 Unsuitable Subgrade Materials

Unsuitable and sensitive materials such as silt or organic matter shall be removed from cut subgrades to the extent directed by the Superintendent. Soft clay normally will not be regarded as being unsuitable material.

Holes so formed shall be backfilled with selected fill from excavations, or imported material. Both shall comply with the following requirements:

- Maximum size 75mm
- A soaked California Bearing Ratio (CBR) of not less than that shown on the drawings (or where not quoted on the drawings shall have a CBR value of not less than 3). , the CBR value of the material shall be determined by Test Method AS 1289.6.1.1.

Backfill material shall be compacted to the density specified in Table 2.2.

### 2.07.7 Subgrades Affected by Moisture

When a sub-grade is unable to support construction equipment, or it is not possible to compact overlying pavement, only because of subgrade moisture content, then one or more of the following alternative actions may be taken:

- (a) allow the subgrade to dry to a moisture which will allow compaction and the placement of pavement material;
- (b) scarify the subgrade to a minimum depth of 150mm and work as necessary to accelerate drying. Recompact as specified when moisture content approximates optimum;
- (c) excavate the soft material and place and compact selected materials to the standard specified in Clause 2.07.6.

The approach to be adopted shall be at the Contractor's discretion and expense. No extensions of time will be granted in respect of any delay due to wet sub-grade unless it is demonstrated to the satisfaction of the Superintendent that the sub-grade moisture content is due to other than the Contractor's work practices.

## 2.08 TRIMMING AND FINISHING OF SURFACES

Unless otherwise specified, all areas within the limits of clearing and outside the limits of earthworks shall be graded to an even surface. Trim ridges and fill depressions as necessary to produce a surface which will drain freely and is suitable for the operation of tractor mounted mowers.

Trim batters in cut and fill to shapes shown on drawings. Cut and fill batters are to be trimmed to the tolerances specified in Clause 2.09.2 unless otherwise directed by the Superintendent.

## 2.09 CONFORMANCE CRITERIA

### 2.09.1 Compaction Conformance

Compaction conformance requirements for work carried out under this Section of the Specification are itemised in Table 2.2.

Table 2.2

| Item   | Compaction Requirement  |
|--|---|
| 1. Backfilling of grub holes   | Density of surrounding undisturbed soil.  |
| 2. Replacement of unsuitable material in cuttings other than subgrades     | As for Item 1   |
| 3. Replacement of over excavation other than as provided for by Cl. 2.07.2 | As for Item 4 or 5 as relevant.   |
| 4. General fill and foundation of embankments.                             | 90% of modified maximum dry density   |
| 5. Top 1.0m of road embankments  | 95% of modified maximum dry density.  |
| 6. Backfill within 2m of structures  | 95% of modified maximum dry density in roadways<br>90% of modified maximum dry density in other areas |
| 7. Replacement of unsuitable subgrade material                             | 95% of modified maximum dry density.  |
| 8. Cut subgrade in granular soils and clay soils having soaked CBR > 3     | 95% of modified maximum dry density.  |
| 9. Cut Subgrade in clay soils having a soaked CBR < 3 or = to 3            | 90% of modified maximum dry density (i)   |
| 10. Foundation of shallow embankments                                      | 95% of modified maximum dry density.  |

*Notes on Table 2.2*

(i) *Moisture content to be in the range of -1 % to +3 % of the optimum moisture content*

Each successive layer shall not be commenced until the underlying layer has proved to be conforming following inspection and/or testing.

The Superintendent may relax compaction requirements in the lower layers of deep embankments constructed over soft ground. This relaxation will be allowed only in the first 600mm of fill.

The Superintendent may request proof rolling to determine the adequacy of the compactive effort.

### 2.09.2 Tolerances

On completion of cutting, filling and all incidental operations and before the placement of covering materials, finished surfaces shall conform to the tolerances in level and shape itemised in Table 2.3.

Table 2.3

| Item                            | Tolerance  |
|---------------------------------|--|
| 1. Cut subgrade in earth        | Level : + 25mm -Unspecified.<br>Straightness: 20mm maximum departure from 3m straightedge both ways          |
| 2. Cut subgrade in rock         | Level : + 25mm - Unspecified<br>Straightness : Unspecified.  |
| 3. Fill subgrade                | Level : + 25mm -Unspecified .<br>Straightness: 20mm maximum departure from 3m straightedge both ways.        |
| 4. Unpaved areas in cut or fill | Level $\pm$ 10mm in highway verges<br>Level $\pm$ 50mm in subdivision verges<br>Level $\pm$ 150mm in batters |
| 5. Rock batters                 | Level : $\pm$ 300mm  |

### 2.09.3 Sampling and Testing

All laboratory testing of work carried out under this Section of the Specification shall be performed in accordance with procedures specified herein.

Work under this Specification shall be subdivided into lots or discrete work areas. The Superintendent shall have the right to reject a lot which is visually non-homogeneous and/or non-representative.

The specified testing shall be taken at the random test locations established in each lot in accordance with the specified minimum testing frequency in Clause 2.09.4. Prior to testing the Contractor shall work the lot to ensure uniform moisture content and compaction of all material within the lot.

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

The compaction requirements specified in Table 2.1 are minimum requirements. When density tests are carried out on a lot, the number of results falling below the specified value shall not exceed the limits set out in Table 2.4.

**Table 2.4**

| Number of Tests per Lot | Max. results 0-2% below | Max. results more 1-2% below | Max. results more than 2% below |
|-------------------------|-------------------------|------------------------------|---------------------------------|
| 1-2                     | Nil                     | Nil                          | Nil                             |
| 3-5                     | 1                       | 1                            | Nil                             |
| 6-10                    | 2                       | 1                            | Nil                             |
| 10                      | 20%                     | 10%                          | Nil                             |

Relative density test and the establishment of a reference density shall be carried out in accordance with AS 1289 .5.4.1.

#### 2.09.4 Frequency of Testing

The frequency of testing shall be appropriate to verify conformity and to provide confidence against subsidence. Where no minimum frequency of inspection or testing is stated, the Contractor shall nominate appropriate frequencies in their Inspection and Test Plan(s), unless otherwise approved by the Superintendent.

The Contractor shall include in the management review of the Quality System, a review of the appropriateness of the frequency of testing nominated in the Inspection and Test Plan(s). Such review shall take into account the frequency of nonconformity detected, including nonconformities remedied by simple reworking.

**Table 2.5**

| Clause                                  | Characteristic Analysed  | Test Method                     | Minimum Frequency Of Testing   |
|---|--|---------------------------------|--|
| 2.06.1; 2.06.4;<br>2.09.1;<br>Table 2.2 | Compaction and moisture content of general fill material   | AS 1289.5.2.1;<br>AS 1289.5.4.1 | Not less than:<br><br>Three (3) tests per lot<br><br>One (1) per layer<br><br>One (1) test per 500 m3<br><br>* maximum of three (3) tests in total               |
| 2.06.5; 2.09.1;<br>Table 2.2            | Compaction and moisture content of backfill to structures; replacement of unsuitable subgrade; replacement of unsuitable foundation or other confined operations | AS 1289.5.2.1;<br>AS 1289.5.4.1 | Not less than:<br><br>One (1) test per lot<br><br>One (1) test per 200 m3 distributed evenly trough-out full depth and area<br><br>One (1) test every two layers |

| Clause   | Characteristic Analysed  | Test Method                     | Minimum Frequency Of Testing   |
|--|--|---------------------------------|--|
| 2.06.1; 2.06.4;<br>2.07.2; 2.07.6;<br>2.09.1;<br>Table 2.2 | Compaction and moisture content of top layer of fill (subgrade); cut subgrade and foundation of shallow fill | AS 1289.5.2.1;<br>AS 1289.5.4.1 | Not less than:<br><br>Three (3) tests per lot<br><br>One (1) test per 500 m <sup>2</sup><br><br>- One (1) test per 50 linear metres        |
| 2.06.1; 2.06.4;<br>2.07.2; 2.07.6;<br>2.09.1;<br>Table 2.2 | Compaction and moisture content of foundation for fill embankments other than shallow fill embankments       | AS 1289.5.2.1;<br>AS 1289.5.4.1 | Not less than:<br><br>Three (3) tests per lot<br><br>One (1) test per 2000 m <sup>2</sup><br><br>One (1) test per 200 linear metres        |
| 2.06.2; 2.07.2;<br>2.07.4; 2.07.6                          | Material properties (CBR and Sieve Size) fill and cut subgrade and foundations of shallow embankments        | AS 1289.6.1.1<br><br>AS Sieve   | Not less than:<br><br>One per 1000 m <sup>2</sup><br><br>One (1) test per lot  |
| 2.05.1; 2.06.1;<br>2.08, 2.09.3;<br>Table 2.3              | Level tolerances of cut and fill batters   | Level                           | One (1) full cross section per 50m length. Provide levels at all changes in grade and at intermediate points no more than 5m apart.        |
| 2.05.1; 2.06.1;<br>2.08, 2.09.3;<br>Table 2.3              | Straight edge on subdivision verges  | 3m Straight Edge                | One (1) location on the left hand and one (1) on the right hand side verges every 100m apart.  |
| 2.07.2; 2.07.4;<br>2.09.3;<br>Table 2.3                    | Level tolerances of cut subgrade and fill subgrade   | Level                           | One (1) full cross section per 20m linear length. Provide levels at all changes in grade and at intermediate points no more than 3m apart. |
| 2.07.2; 2.07.4;<br>2.09.3;<br>Table 2.3                    | Straight edge on cut and fill batters  | 3m Straight Edge                | At one(1) location to the left and right of the centreline every 50m apart. Both perpendicular and parallel to the centreline.             |

\* for deep fills where one test per layer will adversely affect duration of the activity, the Superintendent may relax this requirement. Recommended relaxation is to limit the number of tests to 3 per fill.

## 2.09.5 Nonconforming Work

### (i) General

A nonconformance report shall be submitted to the Superintendent for any nonconformance detected. Work shall not proceed on any nonconforming item until the Superintendent has approved the disposition for the nonconformance.

**(ii) Nonconforming Compaction**

Where a lot is nonconforming for compaction on the basis of inspection or test results, further compactive effort shall be applied to the lot or nominated parts of the lot until the specified standard is achieved. Scarify the area for the full depth of the layer and add water as necessary. Mix mechanically to ensure uniform distribution of moisture before commencing rolling.

**2.10 MEASUREMENT AND PAYMENT**

Payment shall be made for all activities associated with completing the work detailed in this Specification in accordance with Pay Items *204P1; 205P1-P4; 206P1-P2; and 207P1-P3 inclusive*.

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

The Contractor shall allow in the pay items generally for the costs associated with all testing required to prove conformance of the works as specified.

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

**Pay Item 204P1 Clearing and Grubbing**

The unit of measurement will be the hectare of plan area bounded by the limits of clearing specified in Clause 2.04.

This pay item shall include all works associated with clearing and grubbing.

**Pay Item 205P1 Removal and Stockpiling of Topsoil**

The unit of measurement shall be cubic metre measured in stockpile.

The volume shall be determined by calculation using the End Area method.

This pay item shall include all activities associated with stripping topsoil, carting and placing into stockpile, then stabilising and trimming the stockpiles.

**Pay Item 205P2 General Earthworks**

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

This pay item shall be an average rate to cover all types of material encountered during excavation including earth, rock and topsoil.

This pay item 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, and trimming of batters except that:

- the extra costs of removal of material to spoil off site shall be paid under Pay Item 205P3
- the costs of excavating unsuitable material and incorporating into the work or hauling from site shall be paid under Pay Item 205P4
- importation of material for general fill shall be paid under Pay Item 206P1
- extra costs for the replacement of unsuitable with general fill shall be paid under Pay Item 206P2
- the costs of preparation of fill subgrade shall be paid under Pay Item 207P1



- the costs of preparation of cut subgrade shall be paid under Pay Item 207P2
- extra costs for the replacement of unsuitable with select fill suitable for subgrades shall be paid under Pay Item 207P3
- extra costs in processing select material for use as part of the pavement shall be paid under Pay Item 403P3.

The base of the excavation shall be the designed floor level in accordance with the drawings and no account shall be taken of level tolerances.

The volume of earthworks in cuttings shall be determined by calculation using the End Area Method.

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.

### **Pay Item 205P3                      Disposal of Spoil Material Off Site**

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

This pay item is the extra over amount for the disposal of excess material off site, in the event that it can not be disposed of on site in accordance with Clause 2.05.4.

### **Pay Item 205P4                      Unsuitable Material**

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 Clause 2.05.6 and 2.07.6

This pay item shall include all operations involved in the excavation, drying out, haulage, compaction or other activity required for the re-incorporation of unsuitable material at an alternative location within the Works or for its disposal as spoil.

The volume shall be determined by measurement or survey and calculation. 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 quantity ranges shown in the Contract are provisional quantities.

### **Pay Item 206P1                      Imported Fill**

The unit of measurement shall be the compacted volume of imported fill in cubic metres measured in place. The volume shall be determined by calculation from survey.

This pay item shall include all activities associated with supply and placing of imported fill in embankments.

This pay item shall include all activities associated with the excavation of material from the borrow site and the construction of embankments, the haulage of material and any pretreatment such as breaking down or blending material or drying out material containing excess moisture.

Payment shall not be made for excess widening of embankments or wastage by the Contractor.

**Pay Item 206P2 Replacement of Unsuitable with General Fill**

The unit of measurement shall be the compacted volume of imported fill in cubic metres measured in place. The volume shall be determined by calculation from survey.

This pay item is the extra over amount above the rate for general fill for the replacement and compaction of general fill after the removal of unsuitable in accordance with Clause 2.05.6.

**Pay Item 207P1 Preparation of Fill Subgrade**

The unit of measurement shall be the square metre of subgrade measured to the edge of the overlying pavement or select material layer unless otherwise shown on the drawings.

This pay item shall include all activities associated with trimming compaction and conformance testing of fill subgrade in accordance with Clause 2.07.

**Pay Item 207P2 Preparation of Cut Subgrade**

The unit of measurement shall be the square metre of subgrade measured to the edge of the overlying pavement or select material layer unless otherwise shown on the drawings.

This pay item shall include all activities associated with ripping, re-compaction, trimming and conformance testing of cut subgrade in accordance with Clause 2.07.

**Pay Item 207P3 Replacement of Unsuitable with Select Fill Suitable for Subgrades**

The unit of measurement shall be the compacted volume of imported fill in cubic metres measured in place. The volume shall be determined by calculation from survey.

This pay item is the extra over amount above the rate for general fill for the placement and compaction of select fill material suitable for subgrade after the removal of unsuitable in accordance with Clause 2.07.6.

**2.11 SCHEDULE OF HOLD POINTS**

| Hold point | Clause | Description   |
|------------|--------|---|
| 2.1        | 2.04.1 | Clearing Operations – care of Trees   |
| 2.2        | 2.05.1 | Earthworks Operations - Survey  |
| 2.3        | 2.05.2 | Stockpiling of Topsoil – Approval of Sites                                  |
| 2.4        | 2.05.3 | Drill and Blast Operations – Approval of Operations                         |
| 2.5        | 2.05.4 | Spoil Areas – Approval of sites   |
| 2.6        | 2.06.1 | Filling Operations – Foundation Inspection                                  |
| 2.7        | 2.07.1 | Subgrade Levels - Inspection  |
| 2.8        | 2.07.1 | Re-compaction of Subgrade in Floors of Cuttings – Submit Test (CBR) Results |