



Muswellbrook Shire Council

CONSTRUCTION SPECIFICATION

AUS-SPEC (Cot 09)

1112 Earthworks (Roadways)

Version 01

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
0	No amendment has been made	all	Nil		14 June 2012

Contents

1112	EARTHthworks (Roadways)	1
1	General	1
1.1	Responsibilities	1
1.2	Cross references	1
1.3	Referenced documents	1
1.4	Standard	2
1.5	Interpretations	2
1.6	Submissions	2
1.7	Inspection	2
2	Pre-construction planning	4
2.1	Programming	4
2.2	Natural surface	4
3	Materials	4
3.1	Material characteristics	4
4	Execution	5
4.1	Establishment	5
4.2	Removal of topsoil	5
4.3	Cuttings	6
4.4	Batters	7
4.5	Transition from cut to fill	8
4.6	Unsuitable material	8
4.7	Embankments	9
4.8	Placing fill	11
4.9	Selected material zone	12
4.10	Fill adjacent to structures	12
4.11	Spoil	13
4.12	Borrow	14
4.13	Compaction and moisture requirements	14
4.14	Furniture and services	16
5	Limits and tolerances	16
6	Measurement and payment	17
6.1	Measurement	17
6.2	Pay items	17
7	Annexure A	20
7.1	Earthworks information	20
8	Annexure B - Blasting	20
8.1	General	21
8.2	Blasting records	23
8.3	Control of air blast over-pressure	23
8.4	Control of ground vibration	23

1112 EARTHWORKS (ROADWAYS)

1 GENERAL**1.1 RESPONSIBILITIES****Objectives**

General: Provide Earthworks for roadways.

Performance

Requirements: Conform to this worksection, the Drawings and Standards as directed and approved.

Selections: As documented.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following:

- 0152 *Schedule of rates – supply projects.*
- 0161 *Quality (Construction) or 0167 Integrated management.*
- 0179 *General requirements (Construction).*
- 0257 *Landscape – roadways and street trees.*
- 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.*

1.3 REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

Standards

AS 1289	Methods of testing soils for engineering purposes.
AS 1289.3.3.1-2009	Soil classification tests—Calculation of the plasticity index of a soil.
AS 1289.5.1.1-2003	Soil compaction and density tests—Determination of the dry density or moisture content relation of a soil using standard compactive effort.
AS 1289.5.4.1-2007	Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio.
AS 1289.5.7.1-2006	Soil compaction and density tests—Compaction control test—Hilf density ratio and Hilf moisture variation.
AS 1289.6.1.1-1998	Soil strength and consolidation tests—Determination of the California Bearing Ratio of a soil—Standard laboratory method for a remoulded specimen.
AS 2187	Explosives—Storage, transport and use.
AS 2187.1-1998	Storage.
AS 2187.2-2006	Use of explosives.
BS 6472	Guide to evaluation of human exposure to vibration in buildings
BS 6472.1-2008	Vibration sources other than blasting

Other publications**AUSTROADS**

CMPC-09	Explosives in Roadworks, Users Guide 1982
AGPT04I-2009	<i>Guide to Pavement Technology Part 4T: Earthwork Materials.</i>
<i>Department of Environment and conservation: Noise guide for local Government 2004.</i>	

Department of Transport and Regional Services (DOTARS) Australian Code for the Transport of Explosives by Road and Rail 2000

1.4 STANDARD

General

Soil testing: To AS 1289 (Various).

1.5 INTERPRETATIONS

Definitions

General: For the purposes of this worksection the definitions given below apply.

- Open drains: All drains other than pipe and box culverts and include catch drains, channels (gutters) and kerbs and channels (gutters).
- Selected material zone: The top part of the Upper zone of formation in which material of a specified higher quality is required.
- Topsoil: The surface soil reasonably free from subsoil, refuse, clay lumps, stones and timber fragments.
- Unsuitable material: Material with properties outside the values set out in **Annexure A** and as determined as unsuitable by the Superintendent.

1.6 SUBMISSIONS

Acceptance criteria

General: All submissions will be subject to the approval of the Superintendent.

Approvals

- Planning approval for spoil and borrow.
- Permits for access to spoil and borrow locations.

Documents

- Drawings: Work as Executed Drawings.
- Calculations: Survey records, cut and fill calculations.
- Execution details: As documented. Refer to **HOLD POINTS, WITNESS POINTS**.

Technical data:

- CBR tests.
- Proof rolling and deflection monitoring.
- Compaction tests.

Materials:

- Select materials.
- Synthetic membrane.

1.7 INSPECTION

Notice

General: Give notice so that the inspection may be made of the following:

Summary of HOLD POINTS

Clause/subclause	Requirement	Notice for inspection	Release by
EXECUTION			
Establishment - Protection of earthworks	Replace and/or dry out wet material to minimise any consequent delays to the operations	1 working day prior to next activity	Superintendent
Establishment - Stockpile sites	Approval to use of any stockpile site not shown on the Drawings	3 working days before stockpiling	Superintendent
Removal of topsoil - Survey	Schedule of surface levels	3 working days before removal	Superintendent

Cuttings - Ripping floors of cuttings	Submit ripped or loosened material for inspection	Before recompaction commences	Superintendent
Cuttings - Compacting floors of cuttings	Inspection of compacted cutting floor	Prior to placing any subsequent layers over the completed cutting floor	Superintendent
Batter - Variation for batter slopes	Superintendent to order variation if a batter slope is redetermined after completion	Progressive	Superintendent
Unsuitable material - Floor inspection	Re-present the floor of the excavation after the removal of unsuitable material	Prior to backfilling with replacement material	Superintendent
Embankments - Foundations	Inspection of the embankment foundation area.	1 working day prior to next activity	Superintendent
Embankments - Bridging layer	Inspection and direction for bridging layer where required	3 working days before proceeding	Superintendent
Placing fill - Trimming tops of embankments	Inspection of the completed surface to receive subsequent pavement layers	Prior to placing any subsequent pavement layers	Superintendent
Selected material zone - Inspection	Inspection of the completed select material zone surface prior to placing any subsequent pavement layers	1 working day before proceeding	Superintendent
Fill adjacent to structures - Treatment at weepholes	Proposal to use synthetic membrane	3 working days before proposed use	Superintendent
Compaction and moisture requirements - Deflection monitoring or proof rolling	Present the completed work for deflection monitoring or proof rolling	2 working days before next activity	Superintendent

Summary of WITNESS POINTS – On-site activities

Clause/subclause	Requirement	Notice for inspection
PRE-CONSTRUCTION PLANNING		
Natural surface - Contractor's survey system	Survey method and results, including any discrepancies	At least 7 days notice
EXECUTION		
Removal of topsoil - Program	Inspect cleared site prior to removal of topsoil	3 working days prior to removal
Cuttings - Floors of cuttings	Floors to be no more than 50 mm above or below the designed floor and provide suitable support	1 working day before next activity
Batters - Excavation beyond the batter line	Minor change in the general slope of the batter to suit the site conditions	1 working day before next activity
Transition from cut to fill - Terrace	Excavate a terrace for the width of the selected material zone to a depth of 900 mm below and	1 working day before excavating terrace

	parallel to the cutting floor.	
Unsuitable material - General	Material deemed unsuitable for embankment or pavement support in its present position	Progressive
Embankments - Bridging layer	Supply and place bridging layer	1 working day prior to importing material
Placing fill - Rock pieces	Modify grading of fill material to achieve compaction	Progressive
Fill adjacent to structures - General	Concrete strength required for early filling to structures	3 working days prior to fill placement
Spoil – Haulage disposal	Obtain planning approval and any permits	3 working days before commencing activity
Borrow - Requirement	Obtain planning approval and any permits	3 working days before commencing activity

2 PRE-CONSTRUCTION PLANNING

2.1 PROGRAMMING

Management

Resources: Provide planning resources to allocate plant and personnel for the contract period.

Quality: Program the work to meet the constraints of **HOLD POINTS, WITNESS POINTS**.

2.2 NATURAL SURFACE

Contractor's survey system

Approval: Submit details of the Contractor's proposed survey system for approval within 14 days of possession of site being granted and prior to commencement of clearing and grubbing or earthworks.

Verification: The contractor may receive verified ground models prior to commencement of Contract. They will be in the form of computer generated road design data files in the format of the approved software.

Verification alternative: The Contractor may verify the accuracy of the model by field surveys.

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

Survey: Submit survey verifying existing ground profile. This is a **WITNESS POINT**.

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

3 MATERIALS

3.1 MATERIAL CHARACTERISTICS

Assumptions

Quality and quantity: The Contractor is responsible for any assumptions made for the material or the quantity. This may include:

- Nature and types of the materials encountered in excavations.
- 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

Embankment material: Use material from excavations if acceptable for embankments.

Deficiency: If a deficiency of material for embankment construction is created by the Contractor electing to use the material for other purposes, make good that deficiency from sources of material meeting the quality requirements specified in **Benching in cuttings**.

Costs: The costs of making good deficiency to be borne by the Contractor.

4 EXECUTION

4.1 ESTABLISHMENT

Protection of earthworks

Erosion and sedimentation control: Install effective erosion and sedimentation control measures to *1102 Control of erosion and sedimentation* prior to commencing earthworks and maintain these control measures for the duration of the contract.

Drainage of working areas: Maintain drainage of all working areas 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, take adequate precautions to minimise ingress of surface water into the groundwater table.

Wet weather precautions: If rain is likely or if work is not proposed to continue in a working area on the following day, take precautions to minimise ingress of any excess water into earthworks material.

Loose material: Seal off ripped material remaining in cuttings and material placed on embankments by compaction to provide a smooth tight surface.

Wet material: If in-situ or stockpiled material becomes excessively wet as a result of the Contractor not providing adequate protection of earthworks, replace and/or dry out the material to minimise any consequent delays to the operations. This is a **HOLD POINT**.

Cost: Borne by the Contractor.

Batter indicators

Timing: Establish batter indicator boards and pegs before earthworks operations commence and after survey controls are in place.

Indicators: Locate indicators as follows:

- Horizontal: Generally 25 m intervals, at each cross section shown on the Drawings, or at each change in the slope of the batter, whichever is the lesser.
- Verified interval to not be more than 5 m height.

Information on the indicator: Clearly mark the chainage/station, offset from control line and slope distance to finished surface level.

Retention and removal of pegs: Maintain all pegs and batter indicators in their correct positions. Remove them on completion of the contract or separable part.

Additional pegs: Additional pegs and indicators may be required to suit the Contractor. Do not paint these with the same colours used for the specified setting out pegs and stakes.

Transitions cuttings/embankments: Mark with clearly labelled stakes in accordance with **Transition from cut to fill** and **Foundations for embankments** the position and extent of all transitions from cuttings to embankments and foundations for shallow embankments.

Stockpile sites

Additional stockpile sites: Obtain approval to use any stockpile site not shown on the Drawings. State the maximum dimensions of the proposed stockpile. This is a **HOLD POINT**.

Clearing and grubbing: To *1111 Clearing and grubbing*.

Temporary erosion and sedimentation control measures: To *1102 Control of erosion and sedimentation*.

Restoration: To *0257 Landscape – roadways and street trees* following completion of the work.

4.2 REMOVAL OF TOPSOIL

Program

Timing: Commence removal of topsoil 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 to *1102 Control of erosion and sedimentation* and *1111 Clearing and grubbing*.

This is a **WITNESS POINT**.

Extent of work

General: Remove topsoil throughout the length of the Work and stockpile separately clear of the work. Take care to avoid contamination by other materials.

Cuttings: Remove topsoil to a depth quoted in **Annexure A** or as directed.

Embankments: Remove topsoil over the base of embankments up to the depth below the natural surface quoted in **Annexure A**, or as directed.

Shallow embankments: If the height of embankment from natural surface to underside of pavement is less than two metres, remove topsoil which is deeper than the depth quoted in **Annexure A** to its full depth as directed.

Survey

Earthwork volumes: Provide earthwork volumes if payment is on a 'Schedule of Rates' basis unless alternative arrangements have been made. After removing the topsoil, determine the surface levels in each cutting and embankment at sufficient locations to calculate the volume of excavation for general earthworks and the volume of compacted fill. This is a **HOLD POINT**.

Stockpiles

Height and batter: Conform to the following:

- Maximum height: 2.5 m.
- Maximum batter slope: 2 Horiz : 1 Vert.

Trim: To a simple shape.

Erosion control

Stabilisation: Track roll or stabilise by other approved means to minimise erosion.

Seeding: Where seeding of stockpiles is recommended, conform to *0257 Landscape – roadways and street trees*.

4.3 CUTTINGS

Acceptable material

Cut: Construction of cuttings includes 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.

Preparation: Loosen and break down materials encountered in cuttings so that they are acceptable for incorporation in the Works.

Acceptable material: Refer to **Unsuitable material** and **Embankment construction and Embankment material**.

Benching in cuttings

Benches: Cut batters to be benched at locations and widths shown on the Drawings notwithstanding the tolerances permitted under **Batter tolerances**.

Bench maintenance: Remove loose stones and boulders regularly throughout the Contract period.

Variable material

Excavation methods: If material of variable quality or moisture content is encountered after topsoil has been removed, adjust excavation methods to ensure blending of the materials, to obtain material meeting the requirements of **Embankment material**.

Floors of cuttings

Excavation level: Excavate the floors of cuttings, parallel to the designed grade line, to a designed floor level at the underside of the selected material zone or where there is no selected material zone, to the underside of the pavement subbase.

Tolerance: Trim the floors to a level ± 50 mm to the designed floor level.

Unsuitable material: Remove as set out in **Unsuitable material**. This is a **WITNESS POINT**.

CBR testing: Prior to ripping the cutting floor, determine the CBR to AS 1289.6.1.1 of the material in the floor. Sufficient tests to be taken to represent all the various materials which may exist in the cutting floor. A direction will be given if material in the floors of cuttings has a CBR value less than the value quoted in **Annexure A**.

Ripping floors of cuttings

Loosen: Rip material of 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 not to exceed 150 mm.

Inspection: Submit ripped or loosened material for inspection before re-compaction commences. This is a **HOLD POINT**.

Compacting floors of cuttings

Compaction: Re-compact ripped or loosened material to conform with **Compaction and moisture requirements**. No account to be taken of the volume involved in loosening when measuring the volume of excavations.

Trim: After re-compaction, re-trim the floors of cuttings parallel with the finished wearing surface.

Tolerances: Refer to **Annexure A**.

Inspection: Prior to placing subsequent layers over the completed cutting floor, present the completed surface for inspection. Verify as part of the quality system that the completed surface has achieved full conformance with all respects of this worksection. This is a **HOLD POINT**.

4.4 BATTERS**Batter slopes**

Profile: Provide batter slopes as shown on the Drawings or directed on the basis of site inspection and investigation during the excavation.

Tops of cuttings: Neatly round tops of cutting to the dimensions shown on the Drawings.

Cutting batters: Batters for cuttings to be even and without undulations in the general plane of the batter except that batters may require progressive flattening at the ends of cuttings due to the presence of less stable material.

Unstable material: Clean cut faces of loose or unstable material progressively as the excavation proceeds.

Batter tolerances: The tolerances for the excavation of batters are given in **Excavation tolerances for batters table**.

Excavation tolerances for batters table

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
Note: Tolerances are measured normal to the batter surface with (+) measured towards the roadway.		

Variation for batter slopes

Instruction: A variation to the Contract will be issued where batter slope of any section of a cutting after it has been completed to conform with this Clause is changed. The Contractor will require to reset out, remove additional material and retrim the batter. This is a **HOLD POINT**.

Costs: The costs of changing the batter slopes will be paid as a variation to the Contract.

Excavation beyond batter line

Corrective measures: Submit details of the material and/or methods proposed to restore the specified slope and stability of the batter. This is a **WITNESS POINT**.

Minor over excavation: Minor change in the general slope of the batter to suit the site conditions may be approved, however, this does not constitute a variation for batter slopes.

Batters steeper than 1:1: A direction to restore batter slopes may be given 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 batter will be required to be restored to the average batter slope using randomly mortared stone.

Restoration material:

- Stone: Similar to the sound rock in the cutting and the
- Mortar: Coloured to match the colour of the rock.

Cost: Borne by the Contractor.

4.5 TRANSITION FROM CUT TO FILL

Intersection line

Survey: Mark the position of the intersection line between cutting and embankment occurring at the underside of the selected material zone or pavement subbase, after the removal of topsoil and before the excavation of any cutting commences.

Terrace

Construction: Following excavation to the cutting floor, excavate a terrace 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 Transition from cut to fill**, unless otherwise approved. This is a **WITNESS POINT**.

Extent of terrace: Extend 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 material: Incorporate the material excavated in the embankments or dispose as directed.

Quantities: Material incorporated in embankments to be included in the excavated volume for **Pay item 1112.2** and spoil to be included in the excavated volume of **Pay item 1112.3**.

Quality and compaction: The material placed above the terrace to satisfy the requirements of **Embankment material** and be compacted to conform with **Compaction and moisture requirements**.

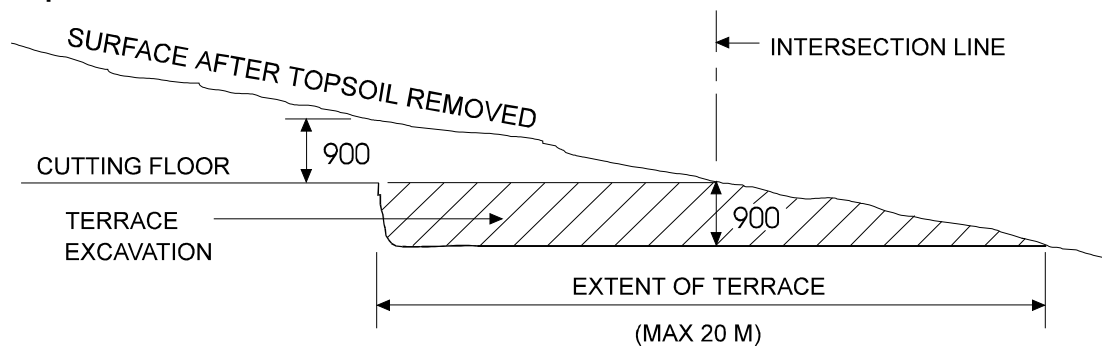


Figure - Transition from cut to fill

4.6 UNSUITABLE MATERIAL

General

Location: Unsuitable material is that occurring below the designed floor level of cuttings and below the nominated depth for stripping topsoil beneath embankments.

Unsuitable: As directed, material unsuitable for embankment or pavement support in its present position. This is a **WITNESS POINT**.

Extent of excavation

Removal: Excavate unsuitable material to the extent as directed. Dispose of removed material as directed and do not use in the work.

Floor inspection

Extent: After removal of the unsuitable material, and prior to backfilling with the replacement material, present the floor of the excavation for inspection. This will determine whether a sufficient depth of unsuitable material has been removed. This is a **HOLD POINT**.

Compaction: To conform with **Compaction and moisture requirements**, prior to replacing material

Replacement material

Quality: Replace unsuitable material with material from cuttings, or with material borrowed in to conform with **Borrow**, of the quality specified in **Embankment material**.

Status: Replacement material is deemed to form part of embankment construction.

Construction: Place to conform with **Placing fill for embankment construction** and to conform with **Compaction and moisture requirements**.

Resultant unsuitable material

Costs: All costs associated with reworking or replacing any material deemed to have become unsuitable because of inappropriate construction activities to be borne by the Contractor.

4.7 EMBANKMENTS

Embankment construction

Scope: Embankment construction includes:

- All operations associated with the preparation of the foundation areas on which fill material is to be placed, and the placing and compacting of approved material within areas from which unsuitable material has been removed.
- The placing and compacting of fill material and of materials of specified quality in nominated zones throughout the Works.
- All other activities required to produce embankments as specified to the alignment, grading and dimensions shown on the Drawings.
- Pre-treatment, such as breaking down or blending material or drying out material containing excess moisture.

Embankment material

Source and quality: Obtain the material for embankment construction from the cuttings within the Works to conform with **Benching in cuttings**, and supplement by borrow to conform with **Borrow** and from other sources as approved if necessary.

Quality: Free of tree stumps and roots, clay, topsoil, steel, organic material and other contaminants and suitable to be compacted to conform with **Compaction and moisture requirements**.

Availability: Program the work 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.

Foundations

Timing: Make the embankment foundation area available for inspection by the Superintendent following removal of topsoil. This is a **HOLD POINT**.

Unsuitable material: If any underlying material is unsuitable remove and replace the material to conform with **Unsuitable material**.

Preparation: Grade and level the general area, adjust the moisture content where necessary and compact the top 200 mm as specified in **Compaction and moisture requirements**.

Foundations for shallow embankments

Type: Shallow embankments are those embankments of a depth less than 1.5 metres from the top of pavement to natural surface.

Quantity: Survey and calculate the extent of the area of shallow embankments after removal of topsoil.

Preparation: Loosen the material exposed to a depth of 200 mm, adjust the moisture content of the loosened material and compact as specified in **Compaction and moisture requirements**, after removing topsoil and unsuitable material.

Foundation damage: Use suitable equipment and techniques to minimise surface heaving or other foundation damage.

Bridging layer

Status: If a bridging layer has been specified as a foundation treatment in the Contract documents, supply and place it as part of **Pay item 1112.2**.

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

Method: End-dump the granular material and spread in a single layer in sufficient depth to allow the passage of earthmoving equipment with minimal surface heaving. The compaction requirements of **Compaction and moisture requirements** not to apply to the bridging layer.

Status: If it is necessary to import suitable material from off site and if no suitable borrow source is available as provided in **Natural surface and earthworks materials**, the supply and placing of the bridging layer may be treated as a Variation to the Contract. This is a **WITNESS POINT**.

Seepage from foundations: A bridging layer may also be employed, subject to approval, 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**. This is a **HOLD POINT**.

Unacceptable location: If its proximity to the pavement is likely to affect the pavement design.

Working platform: As an alternative to a bridging layer, approval of a working platform created by the chemical stabilisation of in situ material to conform with *1113 Stabilisation* may be required.

Hillside embankments

Criteria: If embankments are constructed on or against any natural slopes or the batters of existing embankments, and if the existing slope or batter is steeper than 4 Horizontal to 1 Vertical in any direction.

Terrace: Extent and method as follows:

- Cut horizontal terraces over the whole area to be covered by new filling.
- Step the existing slope or batter in successive terraces, each at least 1 metre in width, and cut the terraces progressively as the embankment is placed.
- Coincide terraces with natural discontinuities wherever possible.
- Provide subsoil drainage if required.
- Compact excavated material as part of the new embankment material.

Excavated volume: No account to be taken of the material removed in terracing when determining the excavated volume for **Pay item 1112.2**.

Batter slopes

Design criteria: The batter slopes shown on the Drawings represent the estimated requirements for the expected types of materials.

Redetermination: Batter slopes may be changed as directed following further assessment of the materials encountered on site.

Slope: When completed, the average planes of the batters of embankments are to conform to those shown on the Drawings or as directed.

Tolerance: Conform to the following:

- For a vertical distance to 1 m below the shoulder, no point on the completed batter to 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 to vary from the specified slope line by more than 300 mm when measured at right angles to the slope.
- In no case is the edge of the formation at the underside of the pavement to be nearer to the roadway than shown on the Drawings and the batter slope at no point be steeper than the specified slope.

Slope undulations: Avoid and remove undulations in the general plane of the batter.

Slope redetermination: A direction to change the slope of any section of an embankment batter that has been completed to conform with this Clause, will constitute a Variation to the contract. The Contractor will require to reset out and remove or add fill material and retrim the batter.

Batter slope for median areas

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

Batter tolerances:

- For a horizontal distance of 2 m from the edge of the shoulder, no point on the completed batter to 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 to 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 to be graded so as not to pond water.

Rock facing of embankments

Type: Embankment batters, including embankments at bridge abutments, to be faced with clean, hard, durable rock.

Location: Where shown on the Drawings.

Rock placement: Exercise extreme caution whilst placing the rock facing as follows:

- Where embankment material is placed above other roads in use, place the outer rock layer in such a manner as to prevent movement down the batter or onto the roadway.
- Ensure that, under no circumstances, any rock can be dislodged and roll onto any adjacent roadway or track in use.
- Provide traffic control procedures to ensure safe passage of vehicles and pedestrians.

Mechanical interlock: Build up the rock facing in layers ahead of each layer of filling. Place rock by hand or plant in such a manner that its least dimension is vertical and that mechanical interlock between the larger stones occurs.

Excess fine material: Remove rock facing that has an excess of fine material surrounding it, together with the fine material, and replace rocks.

Rock supply: Adjust working methods and program the work so as to obtain hard and durable rock of the specified dimensions as it is required.

Graded filter: Fill the space between larger batter rocks 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. Remove fine material from the outside of the rocks on the face of the batter.

Leaching: Where shown on the Drawings, as directed, an appropriate geotextile may be used to prevent the leaching out of fines from the fill material.

4.8 PLACING FILL

General

Uniformity of material: Select the methods of excavation, transport, depositing and spreading of the fill material so as to ensure that the placed material is uniformly mixed.

Embankment stability: Construct the embankment and adequately stabilise using the compaction of the fine material embedding the large rock pieces rather than mechanical interlock of the rock pieces. Compact fine material to meet the requirements of **Compaction and moisture requirements**.

Sources of material and processing: Determine suitable sources of material and any processing to satisfy these quality requirements.

Layer thickness

Placement: Place layers parallel to the grade line and compact to conform with **Compaction and moisture requirements**.

Description: Uniform compacted layers of thickness not exceeding 200 mm

Large rock: Approval required to increase thickness where more than 25% by volume of the filling consists of rock with any dimension larger than 150 mm.

Direction: Approval required to increase in the compacted layer thickness to 300 mm, provided that the relative compaction specified in **Compaction and moisture requirements** is attained.

Rock pieces

Maximum size: Less than two-thirds of the approved compacted layer thickness measured in any direction. Reduce any larger rock pieces in size for incorporation in the embankment layers.

Grading of fill material: Break down rock material and evenly distribute it through the fill material, and place sufficient fine material around the larger material as it is deposited to fill the voids and produce a dense, compact embankment.

Insufficient fine material: If deemed insufficient fine material is present to fill the voids, obtain additional fine material from other places in the work or change the method of winning fill material. This is a **WITNESS POINT**.

Stony patches

Insufficient fine material: Rework stony patches having insufficient fine material to fill the voids, with additional fine material blended in to achieve a dense, compact layer.

Cost: The cost of any reworking to be borne by the Contractor.

Equipment selection for placement: In placing embankment layers, use suitable equipment and techniques to avoid surface heaving or other damage to the foundations and underlying embankment layers.

CBR value

Value: Compacted embankment material in the selected material zone and below (or subbase layer, where no selected material zone) to have a CBR value not less than that quoted for the depth(s) specified in **Annexure A**.

Test method: The CBR value of the material to be determined by Test Method AS 1289.6.1.1

Trimming tops of embankments

Embankment: Trim the top of embankments 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.

Compaction: Compact the tops of embankments at these levels to meet the requirements of **Compaction and moisture requirements**.

Tolerances: Trim to maximum 10 mm above or 40 mm below the levels as calculated above.

Inspection: Present the completed surface for inspection before placing any subsequent pavement layers over the completed top of embankment filling. Verify as part of the quality system that the completed surface has achieved full conformance with all respects of this worksection. This is a **HOLD POINT**.

4.9 SELECTED MATERIAL ZONE

Site won selected material

Quality: Conform to the following:

- Free from stones larger than 100 mm maximum dimension and have no less than 50% passing the 19 mm sieve.
- Have a CBR value not less than that specified in **Annexure A** for the fraction passing 19 mm AS sieve.
- Plasticity Index of 15 maximum.

Stabilisation: If chemical stabilisation is specified these requirements must apply to the selected material immediately prior to incorporating the stabilising agent.

Winning material: Obtain the selected material from cuttings excavated under the Contract or from borrow areas as specified in **Borrow**.

Working methods: Use working methods to yield material that conforms to the requirements of this Clause, and break down oversize rock if required.

Conservation of material

Stockpiles: If the material is not placed directly in the selected material zone, stockpile it at approved locations for future use until at least sufficient material is reserved to complete the selected material zone over the whole work.

Extra material: If suitable available material has not been conserved provide material of equivalent quality.

Costs: If extra material is required, the cost to provide is to be borne by the Contractor.

Placing and compaction

Layers: Place and compact in layers with the compacted thickness of each layer not exceeding 150 mm, homogeneous and free from patches containing segregated stone or excess fines. Refer to **Compaction and moisture requirements**.

Non-complying material: Exclude all non-complying material from all areas.

Top of the selected material zone: Compact and trim 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

Timing: Present the completed surface for inspection prior to placing any subsequent pavement layers over the completed select material zone surface.

Conformance: Verify as part of the quality system that the completed surface has achieved full conformance with all respects of this worksection. This action is a **HOLD POINT**.

4.10 FILL ADJACENT TO STRUCTURES

General

Payment: Supply and placement of fill adjacent to structures is deemed to be part of **Pay item 1112.2**.

Structure types: Structures include bridges, precast and cast-in-place box culverts and retaining walls.

Cross references: Fill adjacent to other culverts and drainage structures to be provided to conform with *1351 Stormwater drainage (Construction)*, *1352 Pipe drainage*, *1353 Precast box culverts* and *1354 Drainage structures*.

Time of placement: Do not place fill against structures, retaining walls, headwalls or wing walls within 21 days after placing of the concrete.

Approval required: To decrease the lag time the walls may be supported by struts, or the Contractor can demonstrate that 85% of the design strength of the concrete has been achieved. This includes concrete in bridge decks and fill placement that impacts the position, stability and serviceability of bridge deck member bearings. This is a **WITNESS POINT**.

Treatment at weepholes

Gravel: Provide drainage adjacent to weepholes by a layer of broken stone or river gravel consisting of clean, hard, durable particles graded from 50 mm to 10 mm as follows:

- The maximum particle dimension not to exceed 50 mm,
- No more than 5 % by mass to pass the 9.5 mm AS sieve.

Extent: Continuous in the line of the weepholes, extend at least 300 mm horizontally into the fill and extend from 200 below to at least 450 mm vertically above the level of the weepholes, where practicable.

Synthetic membrane: Alternatively, provide a synthetic membrane of equivalent drainage characteristics at no extra cost. Store and install in accordance with Manufacturer's instructions. The use of a synthetic membrane is subject to approval. This is a **HOLD POINT**.

Selected backfill

Location: Place selected backfill adjacent to structures to conform with **Selected backfill width and height table**.

Material: Selected backfill to 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.

Selected backfill width and height table

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: Place the selected backfill in layers, with a maximum compacted thickness of 150 mm simultaneously on both sides of box culverts and other drainage structures to avoid differential loading. Start compaction at the wall and proceed away from it, meeting the requirements of **Compaction and moisture requirements**.

Horizontal terraces: Cut the existing embankment slope behind the structure in the form of successive horizontal terraces, each terrace being at least 1 m in width, and the selected backfill placed to conform with **Placing fill for embankment construction**.

Spill through abutments: Do not dump rocks against the columns or retaining walls, build up evenly by individual placement around or against such structures.

Framed structures: For embankments at both ends of the structure, bring up backfill at both ends simultaneously, keeping the difference between the levels of the embankments less than 500 mm.

4.11 SPOIL**General**

Spoil: The surplus material from excavations under the Contract that is not required to complete the Works as specified or material from excavations under the Contract whose quality is deemed to be unacceptable for incorporation in the Works.

Incorporation in the works

Embankments: The Superintendent may direct flatter batter slopes or uniform widening on embankments that have not been commenced. The surface shaped to provide a tidy appearance and effective drainage.

Surplus material: Spread and compact the surplus material as specified in **Placing fill for embankment construction** and **Compaction and moisture requirements** for material in embankments.

Haulage disposal

Planning approval: Obtain planning approval and bear all costs in obtaining such approval by Council's Town Planning Manager, if handling of spoil is involved. This is a **WITNESS POINT**.

Method: Dispose of spoil in a manner and at approved locations. Compact spoil as specified in **Compaction and moisture requirements** for material in embankments.

Payment

Haulage: Disposal of spoil as follows:

- Up to five kilometres from the point of excavation to be included in **Pay item 1112.2**.
- If haulage exceeds five kilometres, payment to be made at the rate nominated in **Annexure A** for haulage of spoil.

4.12 BORROW

Requirement

Criteria: Unless provided by the Contract, borrow will only be authorised for:

- Constructing cuttings and embankments to the batter slopes as directed.
- Providing materials of the quality specified.
- When there is an overall deficiency in either the quantity or the quality of material required to complete the works.

Wastage: Borrow will not be authorised for excess widening of embankments or wastage of quality material by the Contractor.

Material quality: As approved and to conform with **Embankment material, Rock facing of embankments, or Fill adjacent to structures**.

Permits: Obtain approval by Council's Town Planning Manager and any permits required for entry on land and pay any royalty for such borrow material. This is a **WITNESS POINT**.

Authorities: Comply with any requirements of the Local Council, land owners, and the State and Territory environmental planning legislation, livestock protection boards and soil conservation services, as appropriate.

Borrow sites

Location: Ensure the edges are no closer than 3 m from any fence line, road reserve boundary or edge of excavation or embankment and provide adequate clearance for the construction of catch drains.

Borrow site location: As approved by the Superintendent.

Drainage: Provide drainage outlets acceptable to the Superintendent.

Batter slopes:

- Not steeper than 4 H: 1 V.
- To be left in a tidy and safe condition.

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

Restoration: Restore borrow sites to *0257 Landscape – roadways and street trees*.

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

Payment

Borrow: Payment to be made to the Contractor as follows:

- Within the specified working area is deemed to be part of **Pay item 1112.2**.
- If the Superintendent accepts that borrow must to be obtained from locations outside the specified working area for the Works, such work to be treated as a Variation to the Contract.

Haulage: If haulage exceeds five kilometres, payment to be made at the rate nominated in **Annexure A** for haulage of borrow.

4.13 COMPACTION AND MOISTURE REQUIREMENTS

Trimming and compaction

Sequence: Compact all layers uniformly to not less than the relative compaction specified before the next layer is commenced.

Trimming: Trim each layer of material prior to and during compaction to avoid bridging over low areas and to present a smooth surface at the top of each layer.

92% Compaction

Requirements: Compact the following areas to provide a relative compaction, not less than 92% determined by AS 1289.5.7.1 or AS 1289.5.4.1 for modified compactive effort to the following:

- 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: Stockpile unsuitable material as directed by the Superintendent and compact by track rolling.

97% Compaction

Requirements: Compact the following areas 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 to the following:

- Foundations for shallow embankments.
- The whole area on the floor of cuttings.
- Each upper zone 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: Cut the prepared subgrade to a depth below natural surface of less than 0.5 metres where the vertical alignment design is such that a substantial portion of the road is required to be built at or close to the natural surface.

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

Cut-fill transition

Requirement: Approval is required when shallow cutting conditions occur, the specified 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

Requirement: Proof roll as directed in **Annexure A** sections where ripping or loosening of the cutting floor is not required.

Locations: Proof rolling to conform with **Deflection monitoring or proof rolling**.

Moisture content

Compaction timing: Adjust the moisture content of the material at the time of compaction to permit the specified compaction to be attained at a moisture content which 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.

- Wet material: Do not compact material that has become wetted up after placement until it has dried out so that the moisture content is within this range.
- Aeration: The drying process may be assisted by aeration, or where approved, by the use of hydrated or quick lime at the Contractor's cost.
- Drying: Alternatively the Contractor may transport the wet material to a stockpile site for drying out and later use as fill material at the Contractor's cost.
- Dry material: If the material is too dry for compaction as specified, add water. Apply water uniformly and thoroughly mix with the material until a homogeneous mixture is obtained.

Costs: Borne by the Contractor.

Compaction

Extent: Undertake compaction 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.

Rain damage: Complete compaction promptly to minimise the possibility of rain damage.

Compaction and moisture tests

Test locations: Determine sampling locations for testing as described in *0161 Quality – Construction*.

Preparation: Prepare the area at the determined locations for specified compaction and moisture tests.

Moisture content: Prior to testing, work the lot to ensure uniform moisture content and compaction of all material within the lot.

Test representation: The test/s then taken are to be considered to represent the total volume of material placed within the lot.

Further testing: If the material which is present has not achieved uniformity required by this Clause or **Placing fill for embankment construction**, further testing may be directed. The Superintendent to nominate the area to be 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 to be borne by the Contractor. Perform remedial work as necessary to achieve conformance to the requirements of **Compaction and moisture requirements**.

Deflection monitoring or proof rolling

Presentation for testing: Present the work available in lots, for the Superintendent to carry out deflection monitoring or proof rolling. Further compact as directed due to results of proof rolling. This is a **HOLD POINT**.

Timing: Following completion of the formation to the underside of the selected material zone and completion of the selected material zone.

Size: A continuous length of formation of at least 300 m, or lesser length as approved, and a single carriageway width which is generally homogeneous with respect to material and appearance.

Boundaries: Identify the boundaries of each lot with stakes clearly labelled to the satisfaction of the Superintendent.

Costs: The cost of preparing the surface for deflection monitoring or proof rolling is included in the rate for **Pay item 1112.2**.

4.14 FURNITURE AND SERVICES**Widening of formation**

General: Widen road shoulders and formation to accommodate footpaths, guard fence, streetlight plinths, emergency telephone bays and vehicle standing areas as shown on the Drawings.

5 LIMITS AND TOLERANCES**Application**

Summary: The limits and tolerances applicable to this worksection are summarised in **Summary of limits and tolerances table**.

Summary of limits and tolerances table

Activity	Location or timing	Limits/Tolerances	Worksection clause/subclause
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	Batters/ Excavation tolerances for batters
	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	Embankments/ Batter slopes
	More than 1 m below shoulder	± 300 mm	Embankments/ Batter slopes

Activity	Location or timing	Limits/Tolerances	Worksection clause/subclause
-Median Areas	2 m from edge of shoulder	± 50 mm	Embankments/ Batter slopes for median areas
	More than 2 m from edge of shoulder	± 100 mm	
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	Placing fill/Trimming tops of embankments
-Selected material	Rock Quality	Minimum CBR value as per Annexure A	Selected material zone/Site won selected material
-Selected backfill	Adjacent to structures	Plasticity Index 2 to 12	Fill adjacent to structures/ 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.			

6 MEASUREMENT AND PAYMENT

6.1 MEASUREMENT

General

Payments made to the Schedule of Rates: To *0152 Schedule of rates – projects*, this worksection, the drawings and Pay items **1112.1 to 1112.6** inclusive.

Lump Sum prices: Not acceptable.

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

Methodology

The following methodology will be applied for measurement and payment:

- 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 *0257 Landscape – roadways and street trees*.
- 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*.

6.2 PAY ITEMS

Pay items	Unit of measurement/Collection method	Schedule rate scope
1112.1 Removal and stockpiling of topsoil	m ³ excavated The volume to be the sum of: - The volume removed from cuttings calculated by multiplying the area of cutting to be stripped as	- All costs associated with all activities associated with stripping topsoil, carting and placing into stockpile, then stabilising and trimming the stockpiles.

Pay items	Unit of measurement/Collection method	Schedule rate scope
	<p>calculated from the plans of natural surface or accepted Ground Model by the depth of topsoil directed to be removed by the Superintendent, plus;</p> <ul style="list-style-type: none"> - 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. 	
1112.2 General earthworks	<p>m³ measured as volume.</p> <p>The volume of earthworks in cuttings to 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 is deducted the volume of topsoil as calculated under Pay item 1112.1. No account to be taken of the allowable batter tolerances or stepping of batters for topsoiling.</p>	<p>The schedule rate for this Pay Item to 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. All costs associated with 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:</p> <ul style="list-style-type: none"> - removal of unsuitable material to spoil to be paid under Pay item 1112.3; - extra costs in processing selected material to be paid under Pay item 1112.4; - overhaul of spoil or borrow to be paid under Pay items 1112.5 and 1112.6 respectively. <p>The base of the excavation to be the designed floor level in accordance with Treatment of floors of cuttings and no account to be taken of level tolerances.</p> <p>Where unsuitable material from the foundations of shallow cuttings or material from cut to fill transitions is excavated and placed into embankments the volume to 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.</p>

Pay items	Unit of measurement/Collection method	Schedule rate scope
1112.3 Unsuitable material to spoil	m ³ measured as volume of excavation	<p>This Pay item refers only to unsuitable material as defined in Unsuitable material which is removed to spoil stockpile.</p> <p>If the material is such that the volume of excavation cannot be measured, the Superintendent will determine the conversion factors to be applied to the loose volumes measured in haulage units or to the measured stockpile volumes.</p> <p>All costs associated with 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.</p> <p>When this Pay item provides for ranges of provisional quantities, the rates are to be applied successively, but not cumulatively, as the volume of unsuitable material increases from one provisional quantity range to the next higher range.</p> <p>Each rate to 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.</p>
1112.4 Selected material	<p>m³ measured as embankment volume in place in the selected material zone.</p> <p>The volume to be determined by multiplying the theoretical plan area of the top of the selected material zone with its nominated thickness.</p>	<p>All costs associated with 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.</p> <p>The width and depth to be taken as shown on the Drawings or as directed by the Superintendent. No account is to be taken of level tolerances.</p>
1112.5 Haulage of spoil	Per bank m ³ for each kilometre or part thereof in excess of five kilometres.	Where an approved location for spoil disposal is more than five kilometres by road from the point of excavation of material being spoiled, payment to be made for haulage at the rate nominated in Annexure A and include all costs associated with this activity.
1112.6 Haulage of borrow	Per bank m ³ for each kilometre or part thereof in excess of five kilometres.	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 to be made for haulage at the rate nominated in Annexure A and include all costs associated with this activity.

7 ANNEXURE A

7.1 EARTHWORKS INFORMATION

Worksection clause/subclause	Description	Value			
Removal of topsoil/ Extent of work	The depth below natural surface up to which the removal and measurement of top soil shall apply:				
	-Cutting areas	_____mm			
	-Embankment areas	_____mm			
Cuttings /Floors of cuttings	Minimum CBR value in cutting floors used for design of pavement	_____%			
Cuttings/ Compacting floors of cuttings	Construction tolerances, of the designated grade and crossfall, for floors of cuttings after recompaction	+ _____mm - _____mm			
Embankments /Foundations for embankments	Requirements of material in foundations for shallow embankments:				
	-Moisture Content within the range of _____% to _____% of optimum.				
Selected material/Site won selected material	Upper Zones of Formation & Selected Material Zone				
	Material within each zone to have a CBR value of not less than that given in the table below under the nominated test conditions.				
	Location	Minimum CBR Value	Depth	Nominated Soaking Period (Days)	
	-Selected Material Zone				
	-Material below Selected Material Zone to 1.5 m from top of pavement.				
Selected material zone/ Placing and compaction	Construction tolerances for Selected Material Zone are: -designed grade and -cross fall	+ _____mm + _____mm			
Spoil/ Payment	Haulage of spoil under Pay item 1112.5 to be payable at the rate of \$_____ per bank cubic metre per kilometre in excess of 5 km.				
Borrow/ Payment	Haulage of borrow under Pay item 1112.6 to be payable at the rate of \$_____ per bank cubic metre per kilometre in excess of 5 km.				
Compaction and moisture requirements/ Proof rolling	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 requirements/ Moisture content	Moisture Content of material placed in embankments:				
	-Material in upper zones of formation within the range of ____% to ____% of optimum				
	-All other embankment material within the range of ____% to ____% of optimum				

8 ANNEXURE B - BLASTING

Summary of HOLD POINTS

Item/Clause title	Requirement	Notice for inspection	Release by
General			

Item/Clause title	Requirement	Notice for inspection	Release by
Pre-blast survey	Determine and record the existing condition of all structures	7 days before the start of blasting operations	Superintendent
Survey report	Advise Superintendent of blasting charge details and adequacy of survey	3 days before the start of blasting	Superintendent
Proposed blasting procedure	Written details of the proposed blasting procedure including proposed measures to limit noise and damage	Before the start of blasting operations - progressive	Superintendent
Control of air blast over-pressure			
Excessive air blast over-pressure	Suspend further blasting work and submit proposals of additional steps and precautions to avoid recurrence	24 hours prior to next activity	Superintendent

Summary of WITNESS POINTS – On site activities

Item/Clause title	Requirement	Notice for inspection
General		
Licences	Obtain all necessary licences and comply with all Government and Council regulations.	7 days before initiating blasting
Blasting records		
Recording procedure	Prepare records as holes are loaded and signed by the Powderman	On the day of the blast
Advice to residents	Report any special condition affecting any resident	Progressive – 24 hours prior to blasting
Control of ground vibration		
Monitoring vibrations	Design may be adjusted provided that further ground vibration monitoring is done and it is demonstrated that peak particle velocity limits are not exceeded	24 hours before next activity

8.1 GENERAL

Licences

Requirement: When explosives are permitted to be used by the Superintendent, and the Contractor wishes to undertake blasting, obtain all necessary licences from the appropriate authorities, and 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 2187.1 and AS 2187.2.

Conform to the following:

- The transport of explosives to be in accordance with the *Australian Code for the Transport of Explosives by Road and Rail*. This is a **WITNESS POINT**.
- Comply with the requirements of the Environment Protection Authority (EPA).
- The Contractor to be liable for any accident, damage or injury to any person, property or thing, resulting from the use of explosives.

Pre-blast survey

Requirement: Before the start of blasting operations, conduct a survey in the presence of the Superintendent to determine and record the existing condition of all structures likely to be affected by any blast. This is a **HOLD POINT**.

Extent of survey: The survey to include all structures (including utility services) within 500 m of any blast and 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.

Survey report

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

Maximum instantaneous charge: Submit for approval the 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. This is a **HOLD POINT**.

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

Costs: Survey costs to be borne by the Contractor.

Proposed blasting procedure

Written submission: Before each blasting operation, submit written details of the proposed blasting procedure including:

- The quantity and type of explosive to be detonated
- The blasting pattern to be used
- Measures proposed to limit noise
- To ensure that vibration from blasting does not adversely affect nearby structures.

This action is a **HOLD POINT**.

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

Limits on vibration: To AS 6472.1.

Ground vibration: Ground vibration caused by blasting not to exceed the values of peak particle velocity listed in the **Limiting peak particle velocity table**.

Limiting peak particle velocity table

Point of Potential Damage (within 1 km of blasting site)	Peak Particle Velocity
Completed and cured bridge structures or sub-structures (e.g. 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

Procedure: Advise all residents within a radius of 1 km, by letter drop before blasting operations commence. Details to include the likely times, frequency and duration of blasting and precautions being taken to ensure that damage to property will not result. Ensure residents acknowledge receipt of this advice. Report any special condition or approval requirement affecting any resident to the Superintendent. This is a **WITNESS POINT**.

Time limits: Unless otherwise approved, blasting operations to 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, take precautions to ensure the safety of persons and animals and the road to be closed to traffic and the appropriate signs erected in accordance with *1101 Control of traffic*.

Warning procedure: A standard warning procedure such as that given in the AUSTROADS CMPC-09 *Explosives in Roadworks, Users Guide 1982*, to be established and observed at all times.

Presplitting

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

8.2 BLASTING RECORDS

Records to be kept

Requirement: 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.

Recording procedure

Methodology: Prepare the records as holes are loaded and signed by the Powderman. Provide a copy to the Superintendent on the day of the blast. This is a **WITNESS POINT**.

8.3 CONTROL OF AIR BLAST OVER-PRESSURE

Proximity to noise sensitive locations

Application: This Clause only applies 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 Environmental criteria for road traffic noise for the reduction of air blast over-pressure.

Noise limitations: Limit the noise emanating from blasting operations to 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

Procedure: Conform to the following:

- Arrange for the monitoring of air blast over-pressure to ensure compliance with the specified limits.
- All monitoring to be carried out by personnel possessing current NATA registration.
- Report all test results on NATA endorsed test certificates which include a clear statement as to compliance or non-compliance with the requirements of this worksection.
- In general, establish a monitoring location near the perimeter of the noise sensitive location at the point closest to the maximum charge.
- Submit a copy of the monitoring record to the Superintendent.

Excessive air blast over-pressure

Procedure: In the event that the measured air blast over-pressure exceeds the specified limits, suspend further blasting work and submit proposals detailing any additional steps and precautions that will be taken to ensure that for any future blast, the limiting over-pressure will not be exceeded. This is a **HOLD POINT**.

8.4 CONTROL OF GROUND VIBRATION

Monitoring vibrations

Requirement: Arrange for the monitoring of ground vibrations to ensure compliance with the peak particle velocity limits shown in the **Limiting peak particle velocity table**. All monitoring to be carried out by personnel possessing current NATA registration for such monitoring.

Total results: Report all test results on NATA endorsed test certificates to include a clear statement as to compliance or non-compliance with the requirements of this Part of the worksection.

Monitoring locations: In general, establish a monitoring location near the perimeter of the structure or building at the point closest to the maximum charge.

Record: Submit a copy of the monitoring record to the Superintendent.

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

Maximum Instantaneous Charge: For the first blast, set up monitors at not less than five points at varying distances away from the blasting site. The Maximum Instantaneous Charge for the first blast is not to exceed that calculated and certified by an approved explosives specialist. Submit a calculated relationship for Maximum Instantaneous Charge to AS 2187.2, and for future blasting, ground vibration as vector peak particle velocity.

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. This is a **WITNESS POINT**.

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