ACT Government

BULK EARTHWORKS 02B

MUNICIPAL INFRASTRUCTURE TECHNICAL SPECIFICATION

02 - EARTHWORKS

Transport Canberra and City Services

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1 BULK EARTHWORKS

1.1 General

1.1.1 Responsibilities

1.1.1.1 Objectives

Requirement:

- Provide for the stripping and stockpiling of topsoil and for the final trimming and finishing of surfaces of various purposes to allow site works for roadwork and block construction to conform to drawings as documented.
- Provide for the formation by cutting or filling of the earthworks for roadways, bridges, paths, open drains, residential, commercial and industrial blocks, landscaped areas and all incidental works other than underground services, as documented.

1.1.2 Cross references

1.1.2.1 General

The following documents are related to this Specification.

1.1.2.2 Commonwealth Legislation

Aboriginal and Torres Strait Islander Heritage Protection Act

Australian Capital Territory Planning and Land Management Act

Disability Discrimination Act

Environment Protection and Biodiversity Conservation Act

1.1.2.3 ACT Legislation

Environment Protection Act

Heritage Act

Lakes Act

Nature Conservation Act

Pest Plants and Animals Act

Public Unleased Land Act

Tree Protection Act

Water Resources Act

Waste Minimisation Act

Work Health and Safety Act

1.1.2.4 Specifications

General: The following Specifications are related to this standard:

MITS 00	Preliminaries
MITS 01	Roadwork
MITS 03	Underground services
MITS 04	Flexible pavement construction
MITS 09	Landscape
MITS 16	WSUD

1.1.2.5 Design Standards

MIS 02	Earthworks and site grading
MIS 03	Pavement design
MIS 08	Stormwater

1.1.2.6 TCCS reference documents

General: The following TCCS reference documents are related to this Specification:

Reference Document 4	Protection of public landscape assets
Reference Document 6	Design Acceptance submissions
Reference Document 7	Operational acceptance submissions
Reference Document 8	Works as executed quality records
Reference Document 9	Final Acceptance submissions
Reference Document 10	Landscape consolidation
Reference Document 11	Drafting Standard for Civil and Landscape works

1.1.3 Referenced documents

General: The following documents are incorporated into this Specification by reference.

1.1.3.1 Standards

Australian standards

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

AS 2187.2 Use of explosives

AS 3798 Guideline on earthworks for commercial & residential developments

1.1.3.2 Other publications

BS 6472 Guide to evaluation of human exposure to vibration in buildings

BS 6472-1 Vibration sources other than blasting

Workplace Relations Ministers' Council (WRMC)

Australian Code for the Transport of Explosives by Road and Rail

EPA reference documents

ACT EPA Environment Protection Guidelines for Construction and Land Development in the ACT.

1.1.4 Standard

1.1.4.1 General

Soil testing: To *AS 1289 (Various).*

Proprietary products: To *TCCS Products previously considered for use list*

1.1.5 Interpretation

1.1.5.1 Abbreviations

General: For the purposes of this Specification the following abbreviation applies:

BRU: Beneficial Reuse.

CBR: California Bearing Ratio.

CEMP: Construction Environmental Management Plan.

CMP: Conservation Management Plan.EPA: ACT Environment Protection Authority, ACT Government, and its successors.

EPBC Act: Environment Protection and Biodiversity Conservation Act

ESCP: Erosion and Sediment Control Plan.

GITA: Geotechnical Inspection & Testing Authority.

LMPP: Landscape Management and Protection Plan.

NATA: National Association of Testing Authorities.

PACS: Parks and City Services, ACT Government, and its successors.

RAP: Remedial Action Plan.

RMS: NSW Roads and Maritime Services, NSW Government and its successors.

Site Auditor: Contaminated land auditor as defined in the Environment Protection Act.

TCCS: Territory and Municipal Services, ACT Government, and its successors.

VENM: Virgin Excavated Natural Material.

1.1.5.2 Definitions

General: For the purpose of this Specification, the definitions of terms used to define the components of the road reserve are in conformance with *AS 1348, Glossary of Austroads Terms* and *AGRD03,* the definitions given below also apply:

BRU: Beneficial Reuse, Material that contains a level of contamination that has been assessed by the EPA and found to be suitable for a particular land use.

Contamination: Material that contains a level of contamination that would be considered by the EPA as unsuitable for a particular land use.

Controlled Fill: VENM that has been classified as unsuitable material and subsequently blended with a higher quality material under geotechnical supervision to produce an approved fill material with a site classification equivalent to or better than the natural soil profile, in land development.

Field working period: Time period from addition of mixing water until completion of compaction.

Modified material: Granular materials to which small amounts of stabilising agent have been added to improve their performance without causing a significant increase in structural stiffness.

Select Material: VENM or approved BRU material that conforms to the specified quality requirements and is placed within the selected Material Zone, in road projects.

Selected material zone: The top part of the Upper zone of formation in which material of a specified higher quality is required.

Subbase: The material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required over the subgrade, or to prevent intrusion of the subgrade into the base, or to provide a working platform.

Subgrade: The subgrage or upper zone of formation includes the selected material zone.

Topsoil: The surface soil free from subsoil, refuse, clay lumps, stones and timber fragments and capable of growing and supporting vegetation.

Upper zone of formation: The upper zone of formation includes the selected material zone and is at the top of the formation. Refer to the **Embankment nomenclature figure.**

Unbound material: A granular material with no significant capacity to resist tensile stresses.

Unexpected find: The finding of site conditions that are not expected, such as the presence of undocumented waste, odorous or stained soil, asbestos, structures such as underground storage tanks, slabs or any contaminated or suspect material.

Unsuitable material: Material that is unsuitable for fill or pavement support and with properties set out in Unsuitable material as determined as unsuitable by the Authorised Person.

VENM: Virgin excavated material (e.g. clay, gravel, sand, soil and rock) that is not mixed with any other waste and that has been excavated from areas that are not contaminated. VENM is a classification for excavated natural materials that must be approved by the EPA.

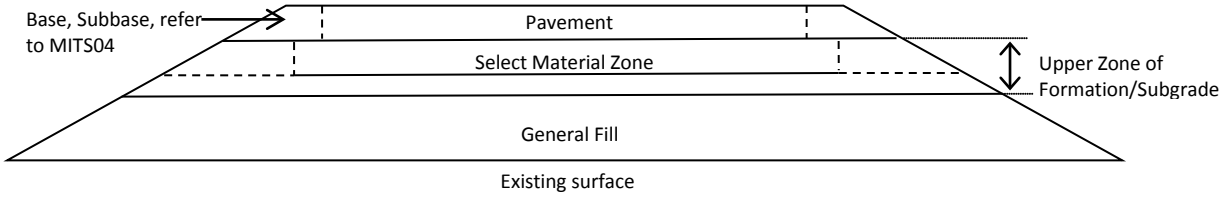

Figure 2B-1 Embankment nomenclature figure

1.1.6 Submissions

1.1.6.1 Documents

Prepare the following:

- VENM Certification: For imported materials.
- Source and conformance verification of selected materials.

Controlled Fill: Where controlled filling is proposed, nominate the Geotechnical Consultant engaged to monitor and endorse the controlled fill at least 3 working days prior to the commencement of earthworks.

This is a **HOLD POINT**.

1.1.7 Hold points and witness points

1.1.7.1 Notice

General: Give written notice to the Authorised person so that the documented inspection and submissions may be made to the **Hold point table** and the **Witness point table.**

Table 2B-1 Hold point table

Item	Clause title	Requirement	Notice for Inspection	Release by
General				
2B.1	Submissions - Documents	Provide advice as to the Geotechnical Consultant engaged to monitor / endorse the Controlled Fill.	At least 3 working days notice prior to commencement of earthworks.	Authorised Person
Materials				
2B.2	Contaminated material and wastes - Excavating contaminated material	Provide EPA or Site Auditor endorsed RAP for the excavation and disposal of contaminated material	3 working days prior to commencement of excavation	Authorised Person
2B.3	Contaminated material and wastes - Unexpected finds	Provide approval from relevant authority for work to recommence within isolated area.	1 working day prior to work recommencing in affected area.	Authorised Person
Execution				
2B.4	Site establishment - Excavation method	Provide details of special procedures for design and execution of blasting to meet all statutory and environmental requirements and the requirements of Appendix B in this Specification.	At least 10 working days prior to commencement of blasting	Authorised Person

Item	Clause title	Requirement	Notice for Inspection	Release by
2B.5	Removal of topsoil - Survey	Provide a detailed topographic survey of the stripped surface.	Within 10 working days after removing the topsoil and 3 working days prior to commencing bulk earthworks	Authorised Person
2B.6	Cuttings - Ripping floors of cuttings	Submit ripped or loosened material for inspection	1 working day before re-compaction commences	Authorised Person
2B.7	Cuttings - Compacting floors of cuttings	Inspection of compacted cutting floor	Prior to placing any subsequent layers over the completed cutting floor	Authorised Person
2B.8	Unsuitable material - Floor inspection	Present the floor of the excavation after the removal of unsuitable material	Prior to backfilling with replacement material	Authorised Person
2B.9	General fill - Foundations	Inspection of the fill foundation area after removal of topsoil.	Prior to filling	Authorised Person
2B.10	Placing fill - Trimming top fill areas	Inspection of the completed surface to receive subsequent layers	Prior to placing any subsequent pavement layers	Authorised Person
2B.11	Selected Material Zone - Inspection	Inspection of the completed Selected Material Zone surface prior to placing any subsequent pavement layers	Prior to placing any subsequent pavement layers	Authorised Person
2B.12	Select Material – Select material pre-treatment	Contractor to specify source and provide conformance report to the Authorised Person	Prior to placing any subsequent layers	Authorised Person
2B.13	Fill adjacent to structures - Treatment at weepholes	Proposal to use synthetic membrane geotextile	3 working days before proposed use	Authorised Person
2B.14	Borrow - Imported Material	Contractor to provide conformance report to the Authorised Person	1 working day before importation of the material.	Authorised Person

Table 2B-2 Witness point table

Item	Clause title	Requirement	Notice for Inspection
Execution			
2B.1	Removal of topsoil - Program	Inspect cleared site prior to removal of topsoil	1 working day prior to removal
2B.2	Cuttings - Floors of cuttings	Floors to be no more than +0mm or -150mm above or below the designed floor and provide suitable support	1 working day before next activity
2B.3	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
2B.4	Transition from cut to fill - Terrace	Excavate a terrace for the width of the selected material zone to a depth of 600 mm below and parallel to the cutting floor.	1 working day before excavating terrace
2B.5	Unsuitable material - General	Material deemed unsuitable for fill or pavement support in its present position.	Progressive
2B.6	Placing fill - Insufficient fine material	Modify grading of fill material to achieve compaction	Progressive
2B.7	Fill adjacent to structures - General	Concrete strength required for early filling to structures	1 working day prior to fill placement
2B.8	Compaction and moisture requirements - test rolling	Present the completed work for test rolling	2 working days before next activity

1.2 Pre-construction planning

1.2.1 Management of stockpiles

General: Manage soil stockpiles as follows:

- Minimise the number of stockpiles, and the area and the time stockpiles are exposed.
- Stockpile topsoil separately from other excavated material.
- Locate stockpiles away from drainage lines, at least 10m away from natural waterways and where they will be least susceptible to wind erosion. Place material to avoid damage to existing flora, root zones of trees and other areas noted for protection.
- Manage weeds in soil stockpiles to minimise seed generation.
- Construct with slopes no greater than 2:1 for heights up to 2.5m. Where stockpiles are greater than 2.5m in height, slopes may be reduced to 1:1 subject to the stockpile material contractors work methods and site safety considerations.
- Stabilise stockpiles and batters that will remain bare for more than 28 days by covering with mulch, anchored fabrics or seeding with sterile grass to *MITS09 Landscape.*
- Where stockpiles and batters will be required for less than 28 days, establish sediment controls around unstabilised stockpiles and batters.
- Suppress dust on stockpiles and batters, as required by the EPA.

1.3 Materials

1.3.1 Contaminated material and wastes

1.3.1.1 Excavating contaminated material

Contamination: Excavate and dispose of all contaminated material in accordance with the requirements of the EPA or Site Auditor endorsed RAP. Provide evidence to the Authorised Person of approval from the EPA or Site Auditor for the excavation and disposal at least 3 working days prior to commencement of excavation.

This is a **HOLD POINT**.

1.3.1.2 Unexpected finds

Unexpected finds: To the Contractor's unexpected finds protocol as documented within the CEMP. In the event of an unexpected find, the Authorised Person must be notified and an area isolated. Work shall not recommence in this area without approval from the relevant authority and the Authorised Person.

This is a **HOLD POINT**.

1.4 Execution

1.4.1 Provision for traffic

1.4.1.1 General

Requirement: Conform to *MITS 01 Traffic Management.*

1.4.2 Site establishment

1.4.2.1 Survey

Requirement: Confirm site surface and benchmarks with the Contractor's verification base survey. Conform to *MITS 00 Preliminaries.*

1.4.2.2 Excavation method

Blasting: Provide details of special procedures for design and execution of blasting to meet all statutory and environmental requirements and in accordance with **Annexure B - Blasting.**

This is a **HOLD POINT**.

1.4.2.3 Protection of earthworks

Erosion and sedimentation control: Install effective erosion and sedimentation control measures to *MITS 00C 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 make sure run-off of water without ponding, except where ponding forms part of an approved erosion and sedimentation control system.

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 by compaction to provide a smooth tight surface.

Wet material: If insitu 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.

1.4.2.4 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 and provide an approved ESCP to *MITS 00C Control of Erosion and Sedimentation* for the proposed location.

Clearing and grubbing: To MITS 02A Clearing and grubbing.

Temporary erosion and sedimentation control measures: To *MITS 00C Control of Erosion and Sedimentation.*

Restoration: To *MITS 09 Landscape* following completion of the work.

1.4.3 Removal of topsoil

1.4.3.1 Program

Timing: The Contractor shall not commence removal of topsoil until after approved erosion and sedimentation controls have been implemented to *MITS 00C Control of Erosion and Sedimentation* and clearing, grubbing and disposal of materials have been completed on that section of the works to *MITS 02A Clearing and grubbing.*

This is a **WITNESS POINT**.

1.4.3.2 Extent of work

General: Progressively remove topsoil throughout the extent of the works in accordance with the staging of the works. Include areas to be covered by paving, structures or fill and stockpile separately clear of the work. Avoid contamination by other materials. Also strip topsoil within the limits of clearing for underground services beyond the limit of earthworks. Grass shall be stripped together with topsoil.

Trees: Unless otherwise specified soils shall not be stripped from around existing trees inside the Tree Protection Zone.

1.4.3.3 Survey

Topsoil volumes: Within 10 working days after removing topsoil for the next construction stage, provide the Authorised Person with a survey of the stockpiles and a detailed topographic survey of the stripped surface at sufficient locations to calculate the volume of excavation for general earthworks.

This is a **HOLD POINT**.

1.4.3.4 Topsoil stockpiles

Height and batter: Conform to the following:

- Maximum height: 2.5m.
- Maximum batter slope: 2 H:1 V.

Stabilisation: Stabilise, without damaging soil biology, to minimise erosion.`

1.4.3.5 Topsoil management

Screening/testing of topsoil quality: *To MITS 09A Topsoil*.

1.4.4 Cuttings

1.4.4.1 Acceptable material

Cut: Construction of cuttings includes all operations associated with the excavation of all types of material within the limits of the works 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, General fill, Placing fill, Controlled Fill and Select material.

1.4.4.2 Benching in cuttings

Benches: Cut batters to be benched at locations and widths shown on the Drawings or as required to undertake earthworks notwithstanding the tolerances permitted under **Batters.**

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

1.4.4.3 Cuttings affected by moisture

Wet material: When a subgrade is unable to support construction equipment, or it is not possible to compact overlying pavement, only because of subgrade moisture content, the contractor shall adopt one or more of the following actions:

- Allow the subgrade to dry to a moisture level which will allow compaction and the placement of pavement material.
- Scarify the subgrade to a minimum depth of 150mm and work as necessary to accelerate drying. Re-compact as specified when moisture content approximates optimum.
- Excavate the soft material and place and compact selected materials to the standard specified in this Specification.

1.4.4.4 Variable material

Excavation methods: If material of variable quality or moisture content is encountered after topsoil has been removed, adjust excavation methods to obtain an acceptable material meeting the requirements of **General fill**

1.4.4.5 Cuttings in rock

Dimensions: Comply with the Drawings or seek direction from the Authorised Person in consultation with a geotechnical engineer as required.

Subgrade Drains: Excavate cuttings in rock 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 to *MITS 03 Underground Services.*

1.4.4.6 Cuttings in medium to high clays

Moisture content: Cuttings comprising clay soils of medium to high (CL/CH) and high (CH) plasticity need to be retained moist within the range of –2% to +2% of standard optimum moisture content. To prevent drying out and to limit possible surface heave, immediately after compaction the cutting floor shall be covered by the first select fill layer.

1.4.4.7 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, excavate the floor of cuttings to the underside of the pavement subbase, or to the underside of controlled fill as determined by the Authorised Person in consultation with the nominated Geotechnical Engineer.

Tolerance: Trim the floors to a level +0mm to -150mm to the designed floor level. Remove all loose material.

Unsuitable material: Remove as set out in **Unsuitable material.**

This is a **WITNESS POINT**.

CBR testing: Prior to ripping the cutting floor beneath road pavements, 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 as directed by the nominated Geotechnical Engineer. The Authorised Person will provide additional directions if material in the floors of cuttings has a CBR value less than the Drawings.

1.4.4.8 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 shall not exceed 150mm.

Controlled fill: Where directed by the Geotechnical Engineer, rip material of the floor beneath controlled fill on blocks to a minimum depth of 200mm below the designed floor level for the extent of the controlled fill placement.

Ripping refusal limits: Where the floor of cuttings are unable to be ripped with a D8 Dozer or with a 30t excavator and tyne (or equivalent) propose alternative methods for compensation of floors for the Authorised Persons approval.

Rock: Rock in the floor of cuttings does not require ripping unless directed.

Inspection: Submit ripped or loosened material for inspection before re-compaction commences.

This is a **HOLD POINT**.

1.4.4.9 Compacting floors of cuttings

Compaction: Re-compact ripped or loosened material to conform to **Compaction and moisture requirements.**

Trim: After re-compaction, re-trim the floors of cuttings parallel with the finished wearing surface beneath pavements, footpaths and paving.

Tolerances: +25mm.

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 specification.

This is a **HOLD POINT**.

1.4.4.10 Earthworks for water quality ponds

Permanent ponds: Construct earthworks according to the Drawings, this Specification, geotechnical design, and *MITS 16 WSUD Features.*

Temporary ponds: To *MITS 00C Control of Erosion and Sedimentation*.

1.4.5 Batters

1.4.5.1 Batter slopes

Profile: Provide batter slopes as shown on the Drawings or as directed by the Authorised Person 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 shall 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 the **Excavation tolerances for batters table.**

Table 2B-3 Excavation tolerances for batters table

Location (as detailed on Drawings)	Tolerance (mm)	
	Slope 1:1 or flatter	Steeper than 1:1
Rock batters	Level +/- 200mm	Level + 200mm
Earth batters	Level: +/- 150mm Line: 20mm max departure over 3metre straightedge both ways	N/A
Toe of batter and level of table drain	+ 0mm / -100mm	+0mm / -150mm
Verges in subdivisions	+/-50mm	+/-50mm

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

1.4.5.2 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**.

Batters steeper than 1:1 in rock: A direction to restore batter slopes may be given if any section of the batter 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 pitching or shotcrete. Refer to *MITS 06A Concrete kerbs, footpaths and minor works.*

1.4.6 Transition from cut to fill

1.4.6.1 Intersection line

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

1.4.6.2 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 600mm below and parallel to the cutting floor, as shown in the **Transition from cut to fill figure**, unless otherwise approved.

This is a **WITNESS POINT**.

Extent of terrace: Extend 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.

Excavated material: Incorporate the material excavated in fill areas or dispose of as directed.

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

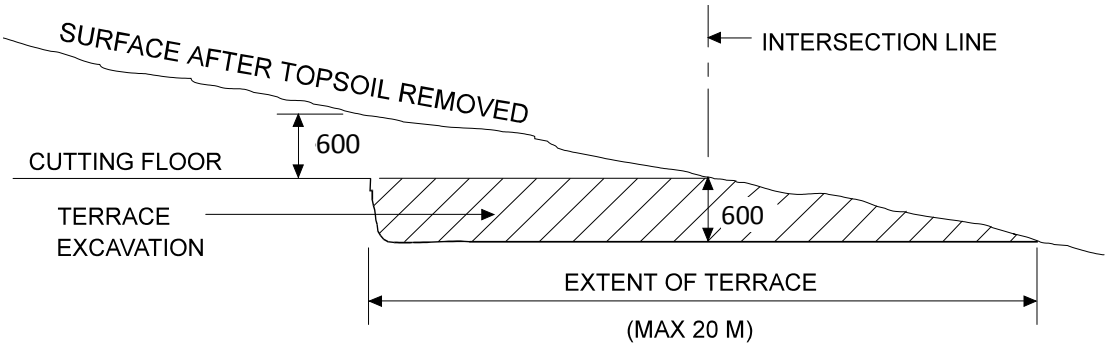

Figure 2B-2 Transition from cut to fill

1.4.7 Unsuitable material

1.4.7.1 General

Quality: Unsuitable material shall include materials which have the following properties:

- Contains deleterious materials such as organic matter, silts and/or demolition or waste material; or
- CBR value less than 2% at 100% SDD (*AS 1289.5.1.1*); or
- High plasticity clays (i.e. liquid limit > 50%) or;
- Rutts excessively, yields or shows signs of instability and is unsuitable for fill or pavement support.

Wet material: Material that is affected by moisture but would otherwise meet the requirement of the specification is not considered to be unsuitable. It is the Contractors responsibility to condition, dry, or replace Wet Material. Refer to **Cuttings.**

Removal: Excavate Unsuitable Material to the extent directed by the Authorised Person. The Authorised Person shall apply discretion when providing direction in relation to this clause in order to achieve the best outcome for the project.

This is a **WITNESS POINT**.

1.4.7.2 Incorporation into the works

Scope: Material removed as unsuitable may be incorporated in to the works with the agreement of the Authorised Person by the following actions:

- Stabilisation of the material to *MITS 02C Stabilisation*; or
- Uniform widening of embankments; or
- Uniform flattening of fill batters; or
- Uniform filling of selected areas as shown on the Drawings.

Where material cannot be incorporated into the works, seek authorisation from the Authorised Person, to remove it from site.

1.4.7.3 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 to **Compaction and moisture requirements**, prior to replacing material.

1.4.7.4 Replacement material

Construction: Place to conform to **Placing fill** and to conform to **Compaction and moisture requirements**.

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

Status: Replacement material is deemed to form part of General Fill.

Resultant unsuitable material: Rework or replace any material deemed to have become unsuitable because of inappropriate construction activities.

1.4.8 General fill

1.4.8.1 Fill construction

Scope: Fill 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 earthworks 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.

1.4.8.2 Fill material

Source and quality: Obtain the material for fill construction from the cuttings within the works to conform to **Cuttings**, and supplement with borrow to conform to **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 to **Compaction and moisture requirements**. 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 1m below sugrades shall be free of particles larger than 300mm. Elsewhere rock material shall be broken down to less than 600mm unless the Authorised Person approves otherwise.

Availability: Program the work so that material of the quality specified in **Placing fill** and **Selected material zone** for the upper zones of the formation is available when required.

1.4.8.3 Foundations

Timing: Make the fill area available for inspection by the Authorised Person following the removal of topsoil.

This is a **HOLD POINT**.

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

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

1.4.8.4 Foundations for shallow fill

Type: Shallow fill is a general fill to 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 fill after removal of topsoil.

Preparation: Loosen the material exposed to a depth of 200mm, 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.

1.4.8.5 Bridging layer

General: If a bridging layer is required the Contractor shall submit a site specific proposal to the Authorised Person for approval.

1.4.8.6 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 4H:1V 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 shown on the Drawings.
- Compact excavated material as part of the new embankment material.

1.4.8.7 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 are to conform to those shown on the Drawings or as directed.

Tolerance: Conform to the following:

- Batters to be no steeper than indicated on the Drawings (+0 mm);
- Batters verges in green field subdivisions to vary from the design slope line by no more than 150mm when measured at right angles to the slope line.
- Batters other than verges in Greenfield subdivisions to be no flatter than 100mm when measured at right angles to the slope line at any point from line / slope / general plane of the batter detailed on the Drawings unless agreed or directed by the Authorised Person

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 to this Clause, will constitute a Variation to the contract. The Contractor shall reset out and remove or add fill material and re-trim the batter.

1.4.8.8 Batter slope for median and verge areas

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

Batter tolerances:

- From the edge of the shoulder or top of kerb, no point on the completed batter to vary from the specified slope line by more than +/-50mm when measured at right angles to the slope line after compaction.
- Free draining: The medians and verges are to be graded so as not to pond water.

1.4.9 Placing fill

1.4.9.1 General

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

Fill stability: Construct the fill and stabilise by compaction of the fine material embedding the rock pieces. Compact to meet the requirements of **Compaction and moisture requirements.**

1.4.9.2 Layer thickness

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

Description: Uniform compacted layers of thickness not exceeding 300mm.

Large rock: Approval required to increase thickness where more than 25% by volume of the filling consists of rock with any dimension larger than 150mm. Use of large rock will only be given for embankment / fill construction beneath roads and in open space/parks and not in controlled fill on blocks.

Direction: Seek approval from the Authorised Person to increase the compacted layer thickness greater than 300mm, provided that the relative compaction specified in **Compaction and moisture requirements** is attained.

1.4.9.3 Rock pieces

Maximum size: For areas of controlled fill in blocks as per **Controlled fill** otherwise, 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 fill 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 achieve the specified compaction of each layer and produce a dense, compact fill.

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

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**.

1.4.9.4 CBR value

Value: Compacted fill 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 the Drawings. The CBR value is to be of the material insitu after compaction.

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

1.4.9.5 Trimming tops of fill areas

Fill: Trim the top of fill areas 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.**

Road pavement tolerances: Trim to maximum 10mm above or 40mm below the levels as calculated above.

Land development tolerances: Trim to maximum ±100mm the levels as calculated above.

Inspection: Present the completed surface for inspection before placing any subsequent pavement layers over the completed top of filling. Verify as part of the quality system that the completed surface has achieved full conformance with all respects of this specification.

This is a **HOLD POINT**.

1.4.10 Controlled fill

1.4.10.1 Introduction

General: For controlled filling on blocks, a site classification equivalent or better than the site classification for the natural soil profile is required. Subject to geotechnical engineering advice, the upper layer of soil underlying the root zone that is otherwise unsuitable for engineering applications can be blended to produce an approved material, used for topsoil, placed in verges, in landscaped mounds or other non-structural applications.

1.4.10.2 Materials

Material: VENM unless approval from the EPA has been obtained for alternative material.

Material properties: In addition to the requirements for fill elsewhere in this specification, controlled fill material shall conform to the following:

- Particle size: Well graded; less than 75 mm with a maximum size of 150 mm in any dimension permissible. Maximum 15% of material between 75 – 150 mm may be considered acceptable with inspection by a suitably qualified engineer to confirm adequacy.
- Maximum depth of filling less than 1.0m: Liquid limit less than 50% and preferably less than 35% and suitable for use as controlled filling.
- Maximum depth of filling less than 2.3m: Liquid limit in the upper 1m less than 50% and preferably less than 35%. Liquid limit of the material below 1m less than 50%. All material must be suitable for use as controlled filling.
- Maximum depth of filling greater than 2.3m: Liquid limit in the upper 1m less than 50% and preferably less than 35%. Liquid limit of the material 1-2.3m less than 50%. Below 2.3m no restrictions. All material must be suitable for use as controlled filling.
- Where material does not meet plasticity specification, reassessment can be considered based on particle size distribution.

Class M sites: Where the existing site classification is Class M (moderately reactive clay or silt site) the controlled fill shall exclude organic soils, topsoil, severely root affected subsoils and peat, excessively wet or dry soils, silts or other soils with deleterious engineering properties and wood, metal, plastics and other foreign or deleterious substances.

Class H and P sites: Where the existing site classification is equivalent to Class H (highly reactive clay sites) or Class P (uncontrolled filled sites), additional earthworks involving over excavation and replacement with controlled filling with the above specified material may be required subject to direction from the Authorised Person.

Excess material: To be removed from site in accordance with the requirements of this Specification.

1.4.10.3 Placement and reporting

General: Where Controlled Fill is designated by the Contract for residential and commercial developments, the Contractor shall place and test the fill to a Level 1 standard in accordance with *AS 3798*. The minimum compaction shall be:

- Standard density / relative compaction of 95% for single residential allotments
- Standard density / relative compaction of 98% for commercial allotments including multi-unit residential sites and industrial sites.

Survey: The Contractor shall maintain comprehensive records of the exact location, depth and extent of fill. Provide surveyed surface level and profiles prior to and after filling for the areas concerned.

1.4.11 Selected material zone

1.4.11.1 Site won Select Material

Quality: Select material is to conform with the requirements of **Select Material**.

Stabilisation: If chemical stabilisation is specified these requirements must apply to the Select Material immediately prior to incorporating the stabilising agent. Stabilisation to *MITS 02C Stabilisation.*

Winning material: Obtain the Select 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.

1.4.11.2 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 lot.

Extra material: If suitable available material has not been conserved, provide material to meet this specification and the Design.

1.4.11.3 Imported Select Materials

General: Where material cannot be obtained from site, import VENM materials complying with the requirements of this Specification.

1.4.11.4 Placing and compaction

Layers: Place and compact in layers with the compacted thickness of each layer not exceeding 200mm, homogeneous and free from patches containing segregated stone or excess fines. Refer to **Compaction and moisture requirements**.

Direction: Seek approval from the Authorised Person to increase the compacted layer thickness greater than 200mm, provided that the relative compaction specified in **Compaction and moisture requirements** is attained.

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 or finished surface levels adopted.

Tolerance: +25mm.

1.4.11.5 Inspection

Timing: Present the completed surface for inspection prior to placing any subsequent pavement layers over the completed Selected Material Zone surface.

Conformance: Verify as part of the quality system that the completed surface has achieved full conformance with all respects of this Specification.

This action is a **HOLD POINT**.

1.4.12 Select material

1.4.12.1 General

Quality: Select Material shall be crushed rock, natural gravels, recycled building material or suitable soils, and the materials shall be free of clay lumps, organic matter and deleterious substances.

Classification: Select Material is designated as defined types as follows:

- CBR15 Select Material with minimum CBR of 15%
- CBR12 Select Material with minimum CBR of 12%
- CBR10 Select Material with minimum CBR of 10%
- CBR8 Select Material with minimum CBR of 8%

The CBR value refers to the CBR of the material in situ after compaction. The Contractor is to make due allowance for any reduction in the material CBR value during winning, transport, placement and compaction. The Authorised Person may undertake audit testing of the material after compaction and if the CBR value is below that specified the Contractor shall remove and replace the material at its cost. No extension of time will be given in such circumstances.

Imported recycled material: Recycled building material is not acceptable within current or future residential blocks.

BRU for use in other projects shall be certified by the EPA as appropriate for the land use application according to EPA requirements. Foreign materials shall be limited to the amounts expressed as a maximum percentage by mass to in accordance with *RMS Test method T276* to the **Limits of foreign material in recycled materials table.**

Onsite borrow: material sourced from within the site may be used as Select Material provided foreign materials are limited to the amounts expressed as a maximum percentage by mass to in accordance with *RMS Test method T276* to the **Limits of foreign material in recycled materials table.**

Table 2B-4 Limits of foreign material in recycled material table

	Foreign materials	Maximum percentage by mass
1	Non compressible high density materials such as mortar, metal, glass, asphalt, ceramics and slag	5%
2	Low density or crushable materials such as plastic film, brick, plaster, clay lumps and other friable material	<0.1%
3	Compressible or compostable material such as rubber, lumps of plastic, wood or other vegetable matter	<0.1%

1.4.12.2 Select Material properties

The select material shall have a maximum particle size not exceeding 75mm, must not have a Unified Soil Classification of ML, MH or CH, and shall be in accordance with the **Select Material properties table**.

Table 2B-5 Select Material properties table

Test Method	Description	Select Material Requirements[iv]			
		Type CBR15	Type CBR12	Type CBR10	Type CBR8
AS1289.3.1.1	Liquid Limit	max 40	max 40	max 40	max 45
AS1289.3.4.1	Linear Shrinkage	max 7	max 8	max 8	max 9
AS 1289.3.6.1	Passing 0.075mm sieve	max 45	max 45	max 50	-
AS 1289.3.6.1	Plasticity Index % Pass 0.425mm sieve	max 900	max 1000	max 1200	max 1500
AS1289.6.1.1	% Swell in CBR test [i] [ii]	max 1.0x	max 1.3	max 1.6	max 2.0
AS1289.6.1.1	4 day Soaked CBR (100% ±1% Standard Compaction)[i][ii][iii]	min 15	min 12	min 10	min 8

Notes
(i) Moisture content for CBR tests are to be 100% ±2%
(ii) The surcharge mass to be applied during soaking and testing of the test specimen shall be 4.5kg.
(iii) The period of soaking will be 4 days or until swelling movements have ceased, whichever is longer.

1.4.12.3 Select Material pre-treatment

Pre-treatment: Select Material other than recycled building material shall be pre-treated prior to testing. Pre-treatment of samples shall be carried out in accordance with the requirements of the **Select Material properties table** and as detailed below.

Methodology: Pre-treatment shall comprise cycles of Standard compaction in accordance with *AS 1289.5.1.1* using the size of mould and associated compactive effort applicable to the size and grading of the sample. The sample shall be conditioned to a moisture content between 90% and 110% of the optimum moisture content for pre-treatment. Fragments larger than 53mm in size shall be initially broken down to a size less than this value. Pre-treatment must be carried out on all materials for use in tests prescribed in the **Select Material properties table**. Pre-treatment is in addition to any compaction required for those tests. The pre-treatment, if any, must be shown on all test reports.

For fine grained and medium grained soils, as defined in *AS 1289.0*, pre-treatment shall be followed by the following:

- Materials retained on the 19mm sieve shall be replaced by an equal proportion by mass of materials passing the 19 sieve and retained on the 4.75mm sieve.
- The percentage by mass of materials retained on the 19mm sieve and the fact that it was replaced should be included in all test reports.

Table 2B-6 Pre-treatment for CBR tests table

Sample Origin	Sampling Location	Pre-treatment
Excavated sedimentary rock	Compacted in-place materials	1 cycle of Standard compaction
	All other locations	3 cycles of Standard compaction
All other sources	Compacted in-place materials	No pre-treatment required
	All other locations	1 cycle of Standard compaction

Submission: The Contractor shall supply conformance and source details to the above requirements. Should the source or quality of the material change further conformance details shall be supplied to the Authorised Person prior to placement of the material.

This is a **HOLD POINT**.

Alternative: If the Contractor elects to place Select Material prior to completion of conformance testing they shall do so at their own risk. Conformance details shall be supplied to the Authorised Person no later than 7 working days after placement.

This is a **HOLD POINT**.

1.4.13 Fill adjacent to structures

1.4.13.1 General

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 to *MITS 03 Underground services.*

Time of placement: Do not place fill against structures, retaining walls, headwalls or wing walls refer to structural design.

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**.

1.4.13.2 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 50mm to 10mm as follows:

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

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

Geotextile membrane: Alternatively, provide a geotextile membrane of equivalent drainage characteristics at no extra cost. Store and install in accordance with Manufacturer's instructions. The use of geotextile is subject to approval by the Authorised Person.

This is a **HOLD POINT.**

1.4.13.3 Selected backfill

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

Material: Selected backfill to consist of a granular material having a maximum dimension not exceeding 50mm and a Plasticity Index, determined by *AS 1289.3.3.1*, neither less than 2 nor more than 12.

Table 2B-7 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 150mm 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 slope behind the structure in the form of successive horizontal terraces, each terrace being at least 1m in width, and the selected backfill placed to conform to **Placing fill.**

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 500mm.

1.4.14 Spoil

1.4.14.1 General

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

1.4.14.2 Incorporation in the works

Fill batters: The Authorised Person may direct flatter batter slopes or uniform widening on batters that have not been commenced. The surface must be shaped to provide a tidy appearance and effective drainage.

Surplus material: Spread and compact the surplus material when directed by the Authorised Person as specified in **Placing fill** and **Compaction and moisture requirements** for fill material.

1.4.14.3 Disposal of spoil

Where excess material is to be removed from site and stockpiled for a future stage of a project, road works, or subdivision, the stockpile location is to be nominated on the Drawings. The Contractor is responsible for management of disposal of the material and the stockpile, including hauling, placement erosion and sedimentation control measures etc.

Where excess material is not required for future stages of the project the Contractor is required to dispose of the material legally in accordance with CEMP and EPA requirements. The Contractor is required to provide the Authorised Person of records of where the material was disposed.

1.4.15 Borrow

1.4.15.1 Imported material

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

- Constructing cuttings and fill batters 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.

Imported material source: As approved by the Authorised Person.

Material quality: As approved and to conform to **Select material**. Provide the Authorised Person with verification of the source and suitability of the material 1 working day prior to importation of material.

This is a **HOLD POINT.**

Authorities: Comply with all legislation and any requirements of the EPA and the contractor's Environmental Authorisation. Notify the EPA of all imported soil accepted onsite.

Wastage: Imported material will not be authorised for excess widening of fill batters or wastage of quality material by the Contractor.

1.4.15.2 On site borrow

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

Site preparation and restoration: For onsite borrow within the defined working area for the works as specified, site preparation to be in accordance with *MITS 00C Control of Erosion and Sedimentation*, *MITS 02A Clearing and grubbing* and the approved ESCP and **Removal of topsoil**.

Restoration: Restore onsite borrow sites to *MITS 09 Landscape.*

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

Batter slopes:

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

1.4.16 Compaction and moisture requirements

1.4.16.1 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.

1.4.16.2 95% Compaction

Requirements: Compact the following areas to provide a relative compaction, not less than 95% determined by *AS 1289.5.7.1* or *AS 1289.5.4.1* for standard compactive effort to the following:

- Each layer of material replacing unsuitable material as detailed in **Unsuitable material**.
- Each layer of fill material placed, 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 Authorised Person and compact by track rolling.

1.4.16.3 98% Compaction

Requirements: Compact the following areas to provide a relative compaction of not less than 98% as determined by *AS 1289.5.7.1* or *AS 1289.5.4.1* for standard compactive effort to the following:

- Foundations for shallow embankments less than 1.5 metres high.
- The whole area on the floor of cuttings.
- Each upper zone layer of the fill 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** in each layer within 1.5 metres from the top of the pavement.

1.4.16.4 100% Compaction

Requirements: Compact the following areas to provide a relative compaction of 100% ±1% as determined by *AS 1289.5.7.1* or *AS 1289.5.4.1* for standard compactive effort to the following:

- Each layer of the selected material zone as specified in **Selected material zone**.
- Spill through bridge embankment zones.

1.4.16.5 Shallow cutting

Location: 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, cut the prepared subgrade to a depth below natural surface of not less than 0.5 metres.

Treatment: Treat the floor of shallow cutting as specified in **Cuttings** and **Transition from cut to fill** and compact to provide a relative compaction of not less than 98% for a depth of 200mm determined by *AS 1289.5.7.1* or *AS 1289.5.4.1*, for standard compactive effort.

1.4.16.6 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 600mm to 300mm.

1.4.16.7 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 -1% to +3% 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.

1.4.16.8 Compaction

Extent: Undertake compaction to obtain the specified relative compaction for the full depth of each layer in fill 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.

Repair: Loosen, recondition and re-compact rain damaged surfaces before placing another layer of material.

1.4.16.9 Compaction and moisture tests

Test locations: Determine sampling locations for testing as described in *MITS 00 Preliminaries*.

Preparation: Prepare the area at the determined locations for specified compaction and moisture tests as required by the testing authority. Additional compaction or wetting of test locations is not permitted.

Moisture content: Prior to testing, work the lot to make sure 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, further testing may be directed. The Authorised Person will nominate the area to be represented by the additional testing.

Material not conforming: If such testing confirms that material not conforming to the specification is present, perform remedial work as necessary to achieve conformance to the requirements of **Compaction and moisture requirements.**

1.4.16.10 Test rolling

Requirement: Test roll sections where ripping or loosening of the cutting floor where directed by the Authorised Person.

Locations: Test roll all road subgrades, finished surface of selected fill and areas for the placement of controlled fill prior to placement of overlying materials.

Presentation for testing: Present the work available in lots, for the Authorised Person to carry out test rolling in accordance with AS 3798. Further compact as directed due to results of test rolling.

This is a **WITNESS 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 300m, 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 Authorised Person.

Failure of test rolling: Should the embankment or cutting presented as ready for test rolling fail the test roll the Contractor shall undertake whatever work is required to rectify the cause of the failure. The Authorised Person may require the area to undergo a further test rolling. The cost of the rectification works and additional test rolling shall be borne by the Contractor.

1.4.17 Trimming and finishing of surfaces

Requirement: 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 within a maximum grade of 1 in 4. Trim batters in cut and fill to shapes shown on Drawings. Cut and fill batters are to be trimmed to the tolerances specified in **Batters** unless otherwise directed by the Authorised Person.

Subgrade test pits: Where test pits shown in the Principal's Geotechnical Investigation Report, available from the Authorised Person, have been excavated under road pavements, backfill to underside of road pavement materials with selected fill (complying with **Select material** compacted to 98% of standard compactive effort.

1.4.18 Geotextiles

General: Geotextile is to be installed where detailed and specified in the Drawings or as directed by the Authorised Person. Geotextile shall be used as a separation or filtration layer within earthworks.

Supply and construction: To RMS R63 Geotextiles (Separation and Filtration).

1.5 Completion

1.5.1 Submissions

Work as Executed Records: To *MITS 00B Quality Requirements*.

Controlled Fill Report: Where applicable, submit a Controlled fill report prepared by a Geotechnical Consultant.

Block Classifications: Where applicable, submit Block Classifications prepared by a Geotechnical Consultant.

Blasting: Where applicable, provide details as outlined in **Annexure B – blasting**. Provide all applicable documentation.

2 MEASUREMENT AND PAYMENT

2.1 Measurement

2.1.1.1 General

Payments made to the Bill of Quantities: To *MITS 00A General Requirements*, this Specification, the Drawings and **Pay items.**

2.1.1.2 Methodology

The following methodology will be applied for measurement and payment:

- Allow for all work, materials, testing and quality assurance requirements in each Pay Item.
- Control measures for erosion and sedimentation are measured and paid in accordance with *MITS 00C Control of Erosion and Sedimentation.*
- Clearing and grubbing of stockpile sites and borrow areas is measured and paid in accordance with *MITS 02A Clearing and grubbing.*
- Seeding and restoration of stockpile sites and borrow areas is measured and paid in accordance with *MITS 09 Landscape.*
- Traffic control for blasting operations is measured and paid in accordance with *MITS 01 Traffic Management.*
- Fill adjacent to culverts and drainage structures is measured and paid in accordance with *MITS 03 Underground services.*
- Working platforms created by chemical stabilisation are measured and paid in accordance with *MITS 00C Control of Erosion and Sedimentation.*
- Potholing for underground service identification is measured and paid in *MITS 00A General Requirements.*
- The volume of material involved in ripping or loosening will not be considered when measuring the volume of excavations.
- All activities associated with preparing the surface for deflection monitoring or test rolling is included in the **Pay item for General Fill**.
- All costs associated with reworking or replacing any material that the Authorised Person deems to have become unsuitable because of inappropriate construction activities shall be borne by the Contractor.

2.2 Pay items

Table 2B-8 Pay items table

Item No	Pay items	Unit of measurement	Schedule of rates scope
2B.1	Topsoil stripping	Bank m^3 measured in situ from the natural surface after clearing and grubbing to the stripped surface	All activities associated with stripping topsoil including sorting, stockpiling, trimming of stockpiles and management of the stockpile until the material is reused or removed or for the duration of the contract.
2B.2	Cut	This shall be an average rate to cover all types of material encountered during excavation including earth and rock. All activities associated with the excavation of material, temporary stockpiling, sorting, haulage to the fill site or to stockpile for disposal, any pre-treatment such as breaking down, blending or drying out material containing excess moisture, trimming of cut batters and management of cut stockpiles until the material is reused or removed. Separate pay items shall be used for each source.	
2B.2.1	Within project site	Bank m^3 measured in situ from the stripped surface to the subgrade surface	This pay item shall be used for in situ cut material within the project site.
2B.2.2	From external areas nominated by the Principal	Bank m^3 measured in situ from the stripped surface to the final excavated surface	This pay item shall be used for in situ cut material from external areas nominated by the Principal. This pay item shall include all activities associated with management of the borrow pit including the design and provision of erosion and sediment control measures, clearing and grubbing. A separate pay item shall be included in the Contract for each source.
2B.2.3	From stockpiles nominated by the Principal	m^3 measured in stockpile at the borrow site. This pay item shall be used for cut material from stockpiles nominated by the Principal.	This pay item shall include all activities associated with stockpile management, including design and provision of erosion and sediment control measures.
2B.3	Unsuitable Material	Bank m^3 measured in situ from the subgrade surface to the final excavated surface	This pay item refers only to unsuitable material as directed by the Authorised Person. 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 stockpiling for its disposal as spoil.

Item No	Pay items	Unit of measurement	Schedule of rates scope
2B.4	Non-mechanical excavation	Bank m^3 measured in situ for the volume requiring non-mechanical excavation	All activities extra over Cut associated with non-mechanical excavation of all types of material encountered during excavation including earth, rock and topsoil. This pay item shall include all activities associated with air or water excavation, cutting and treating tree roots, disposal of slurry and hand excavation within the limits of the contract as shown on the Drawings.
2B.5	General fill	Compacted m^3 measured in situ from the stripped surface to the subgrade surface	All activities associated with the construction of fill areas including compaction, blending and crushing of material or drying out material containing excess moisture, and trimming of fill batters.
2B.6	Controlled fill	Compacted m^3 measured in situ from the stripped surface to the subgrade surface	This pay item is the extra over General fill for all activities associated with selection, placement and compaction of materials as Controlled fill on blocks or other areas specified for Controlled fill. This includes the engagement of a Geotechnical Inspection & Testing Authority for inspection, survey of sub grade and final surface, calculations, testing & reporting specified.
2B.7	Imported Fill	Compacted m^3 measured in situ from the subgrade surface to the final excavated surface	All activities extra over General fill associated with the supply of imported material from the Contractor's own sources. A separate pay item shall be included in the Contract for each source and material type.
2B.8	Preparation of cut and fill subgrades	m^2 based on the pavement area as shown on the Contract Drawings measured to 75mm behind the back of kerb	All activities associated with the preparation of cut and fill sub grades including ripping, re-compaction, trimming and compaction.
2B.9	Preparation of controlled fill subgrades	m^2 based on the area determined on site by the Geotechnical Engineer	All activities associated with the preparation of controlled fill sub grades including ripping, re-compaction, trimming and compaction where directed by the Geotechnical Engineer.

Item No	Pay items	Unit of measurement	Schedule of rates scope
2B.10	Replacement of Unsuitable Material with Selected material	Compacted m^3 measured in situ from the subgrade surface to the final excavated surface	All activities associated with replacing the removed unsuitable material with Selected material. This pay item shall include selection, supply, haulage, any pre-treatment, placement, compaction of Selected material at the specified moisture content and trimming of fill batters. A separate pay item shall be included in the Contract for each selected material type. 2B.10.1 CBR ≥15 2B.10.2 CBR ≥12 2B.10.3 CBR ≥10 2B.10.4 CBR ≥8 2B.10.5 Trench foundations
2B.11	Replacement of Unsuitable Material with General Fill	Compacted m^3 measured in situ from the subgrade surface to the final excavated surface	All activities associated with replacing the removed unsuitable material with General Fill. This pay item shall include selection, supply, haulage, any pre-treatment, placement, compaction of General Fill at the specified moisture content and trimming of fill batters.
2B.12	Stockpile material on site for the Principal's use	m^3 measured in stockpile	All activities extra over Cut to stockpile site material including topsoil and clean fill at the location specified or on site as directed by the Authorised Person for the Principal's use until the material is reused or removed .or for the duration of the contract. This pay item shall include all activities associated with stockpile management, including design and provision of erosion and sediment control measures.
2B.13	Disposal of spoil material off site	m^3 measured in stockpile or bank m^3 measured from the stripped surface to the final excavated surface where material is not stockpiled	All activities associated with the disposal of all excess Cut, unsuitable material, rocks and topsoil from all sources including general earthworks, trenching and other excavations that is directed to be disposed of by the Authorised Person. This pay item shall include the loading of spoil onto trucks, haulage, recycling or disposal fees and compliance with any regulatory requirements.

ANNEXURE A - EARTHWORKS CALCULATION WORKSHEET

Earthworks calculation

Design: Provide the following information at the time of tender.

Construction: Complete the following information based on survey measurements.

Table 2B-9 Earthworks calculation worksheet

Item	Description	Quantity		Pay Item References/ Calculation notes
Topsoil stripping	• Area 1	mm	bcm	
	• Area 2	mm	bcm	
	Estimate of topsoil quantities		**bcm**	2B.1
Cut	• Within site		bcm	2B.2.1
	e/o: Non-mechanical		*(bcm)*	*e/o:* 2B.4
	• External to site		bcm	2B.2.2
	• In stockpile		cm	2B.2.3
	• Terracing at transitions		bcm	Estimate if not modelled, paid under 2B.2.1
	• Trench spoil		bcm	Estimate if not modelled, included within MITS03 items
	• Paths, driveways, footings		bcm	Estimate if not modelled, included within MITS06 items
	• Additional areas		bcm	Included within relevant items
	• Unsuitable material		bcm	2B.3
	Estimate of cut quantities		**bcm**	**(1)**
Fill	• Selected material from cut		cm	
	• Selected material from import		cm	
	Replacement of unsuitable		**cm**	**2B.9** Compare with 2B.3
	• General fill from cut		cm	
	• General fill from import		cm	
	General fill		**cm**	**2B.5**
	e/o: Imported fill		*(cm)*	2B.7
	e/o: Controlled fill		*(cm)*	2B.6
	Estimate of fill quantities		**cm**	**2B.5 + 2B.9 = (2)**
Spoil	• Stockpile/disposal onsite		cm	2B.10
	• Disposal offsite		cm	2B.11 Compare with 2B.3
	Estimate of spoil quantities		**cm**	Compare with **= (1)-(2)**

Calculation notes

General

Extra Over items: Measured within the parent item and thus not recounted within overall totals for cut and fill.

Topsoil stripping

Topsoil: Depth of topsoil shall be estimated from available information such as geotechnical investigations. Where possible, adopt different depths based on site topography and conditions.

Cut

Cut from within site: Measured from the stripped surface to the subgrade, commonly referred to as the boxing level. Boxing is the reduced level of the design surface excluding all surface finishes. For example, the underside of all pavements, the underside of topsoil in verges (generally 100mm), the underside of topsoil in blocks (generally 200mm), the underside of foundations and the underside of garden beds.

Unsuitable material: Make provision for appropriate corresponding value for Replacement of Unsuitable.

Trench spoil: Theoretical calculation of spoil due to the trench configuration considering bench and batter, pipe size, bedding and haunch material and backfill under paths, roads and driveways. All trenches shall be included within this calculation including subsoil drainage and service conduits.

Additional areas: Includes areas not modelled within the boxing tin such as retaining walls, floodways, special structures, ponds, playgrounds etc.

Fill

Fill: Measured from the stripped surface to the subgrade, commonly referred to as the boxing level.

ANNEXURE B - BLASTING

Table 2B-10 Blasting Hold point table

Item	Clause title	Requirement	Notice for inspection	Release by
Annexure B				
2B.15	General - Licences	Obtain blasting permit from WorkSafe ACT	7 days before initiating blasting	Authorised Person
2B.16	General - Proposed blasting procedure	Submission of written details of the proposed blasting procedure		Authorised Person

General

Licences

General: When explosives are permitted to be used by the Authorised Person, and the Contractor wishes to undertake blasting, obtain all necessary licences from the appropriate authorities, and comply with all Government and *WorkSafe ACT 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.*

Blasting Permit: Obtain a Blasting Permit for the works from WorkSafe ACT.

This is a **HOLD POINT.**

The Contractor's attention is drawn to the Austroads publication "*Explosives in Roadworks, Users Guide*". This document supplements the rules contained in the Australian Standards and prescribes practices and precautions in the use of explosives in road works. 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.

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*
- Comply with the requirements of *WorkSafe ACT*
- Comply with the requirements of the *Dangerous Substances Act*
- Comply with the requirements of the *Dangerous Substances Regulations*
- 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 Authorised Person to determine and record the existing condition of all structures likely to be affected by any blast.

Extent of survey: Survey all structures (including utility services) with proximity to the blast as determined by the site geotechnical report and as directed by the Blast Permit.

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 Authorised Person before blasting commences.

Provide copy of written approval from relevant services providers / authorities if blasting in the within 15m of any of public utilities. Any such blasting shall be subject to limitations imposed by controlling authorities. Comply with special or unusual limitations noted on the Drawings or included in the Contract.

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.

Blast monitoring: Amend survey where required due to the outcome of blast monitoring.

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,
- Proposed drilling, blasting and excavation techniques
- Measures proposed to limit noise and vibration.
- Pre-splitting details.
- To make sure 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 Licences.

Limits on vibration: To *BS 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**.

Table 2B-11 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: Consult with the EPA on the requirement for public consultation.

Time limits: Unless otherwise approved, blasting operations to be confined to the periods Mondays to Fridays (excluding public holidays), 8:30am to 5:00pm.

Safety precautions: When blasting operations are being carried out, take precautions to make sure the safety of persons and animals and the road to be closed to traffic and the appropriate signs erected in accordance with *MITS 01 Traffic Management.*

Warning procedure: Establish and observe standard warning procedures (signs and audible warnings) at all times to *AS 2187.2.*

Pre-splitting

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

Blasting records

Records to be kept

Requirement: Maintain accurate records of each blast in accordance with the *WorkSafe ACT blasting checklist* and the Contractor's Blasting Permit.

Control of air blast over-pressure

Proximity to noise sensitive locations

Application: This Clause only applies where a noise sensitive location exists within 1km of the blasting site.

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 *Worksafe ACT requirements.*

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 make sure that for any future blast, the limiting over-pressure will not be exceeded.

Control of ground vibration

Monitoring vibrations

Requirement: Arrange for the monitoring of ground vibrations to make sure of compliance with the peak particle velocity limits shown in the **Limiting peak particle velocity table**. All monitoring is to be carried out by personnel approved by *WorkSafe ACT* for such monitoring.

Total results: Report all test results on test certificates that include a clear statement as to compliance or non-compliance with the requirements of this part of the specification and the Contractor's Blasting Permit.

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 Authorised Person.

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 re-determined to demonstrate that peak particle velocity limits are not exceeded.

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

ACT Government

Transport Canberra and City Services

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