

Municipal Infrastructure Technical Specification 02B

Bulk Earthworks

Edition 1 Revision 1
September 2026

ACT Government

Machinery of Government changes: On 1 July 2025, administrative arrangements were made to establish the City and Environment Directorate (CED). As of the date of publication of this document, the transition from Transport Canberra and City Services (TCCS) to CED, including updates to internal organisational structure, are yet to be finalised. References in this document to the organisation TCCS are to mean CED.

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	All	Cross reference links updated		
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	–	Acknowledgement of Country added		
	All	General amendments to align with layout and structure of Municipal Infrastructure Technical Specifications documents, that are non-technical in nature		
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Edition/Revision number	Clause number	Description of revision	Authorised by	Date
	1.1.5.2	Pavement and earthworks definitions and nomenclature updated, including removal of Upper Zone of Formation		
	1.1.7.1	Hold point and Witness point requirements updated. Refer to individual clauses for specific changes.		
	1.4.4.5	Requirements for cuttings in rock amended		
	1.4.4.6	Moisture content requirements amended		
	1.4.4.7	Requirements added for use of natural in situ material in place of Select Material		
	1.4.4.8	CBR testing and treatment requirements added for floor of cutting, including a new Hold point		
	1.4.4.8.1	Requirements added for amendments to pavement design during construction		
	1.4.4.8.2	Pre-treatment requirements added for floor of cutting material before CBR testing		
	1.4.4.10	Proof rolling requirements added for floor of cutting at design subgrade level		
	1.4.7	Unsuitable material criteria, testing, removal and Hold point requirements updated		
	1.4.7.2	Proof rolling reference added for replacement of unsuitable material		
	1.4.8.2	Upper Zone of Formation replaced with earthworks formation		
	1.4.9.4	CBR testing and treatment requirements updated for fill at design subgrade level		
	1.4.9.4.1	Requirements added for pavement design amendments based on construction-phase CBR testing of fill		
	1.4.9.4.2	Pre-treatment requirements added for fill material before CBR testing		
	1.4.9.5	Proof rolling requirements added for the final General Fill layer		
	1.4.11.2	Requirements added for natural in situ material used in place of Select Material		

Edition/Revision number	Clause number	Description of revision	Authorised by	Date
	1.4.11.2.1	Requirements added for rock encountered in the Selected Material Zone		
	1.4.11.5	Material conformity testing requirements added for Select Material		
	1.4.11.7	Proof rolling requirements added for the top of the Selected Material Zone		
	1.4.12.1	Select Material classifications and CBR requirements updated		
	1.4.12.2	Material property requirements updated for CBR8 and CBR10 Select Material		
	1.4.12.3	Material property requirements added for CBR15 and CBR30 Select Material		
	1.4.12.4	Select Material pre-treatment and conformity testing requirements updated		
	1.4.13.1	Backfilling requirements adjacent to concrete structures updated, including early placement Hold point		
	1.4.16.3	Reference to upper zone layer of fill removed		
	1.4.16.4	Compaction requirement updated to 100% for CBR8 and CBR10 Select Material		
	1.4.16.5	Compaction requirement of 102% added for CBR15 and CBR30 Select Material		
	1.4.16.8	Moisture content limits updated for subgrades and Select Material		
	1.4.17	Proof rolling terminology, methods, equipment, acceptance criteria and Hold points updated		
	1.4.18	Reinstatement requirements updated for Principal subgrade test pits		
	2.1.2	Pay item measurement requirements updated for proof rolling		
	2.2	Pay items updated for Select Material and revised earthworks definitions		
	Annexure A	Calculation notes updated to align with revised earthworks definitions		

Acknowledgement of Country

City and Environment Directorate (CED) acknowledges that Aboriginal people are the Traditional Owners of Australia. We acknowledge and pay respect to the Ngunnawal people as the custodians of the land and waters that we live and thrive on today and recognise any other people or families with connection to the lands of the ACT and region.

CED acknowledges that Canberra's cultural and natural heritage was maintained by the Traditional Custodians for many generations before colonial settlement on Australian soil. Aboriginal people's management of the land preserved the natural balance of local plants and animals. This knowledge of the environment in which we live is critical to the protection and restoration of our land today.

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1 Bulk earthworks

1.1 General

1.1.1 Responsibilities

1.1.1.1 Objectives

Requirement:

(a) 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.

(b) 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

General: The following documents are related to this Specification. The latest version of the documents is to be adopted.

1.1.2.1 Commonwealth Legislation

Aboriginal and Torres Strait Islander Heritage Protection Act (Cth)
Australian Capital Territory (Planning and Land Management) Act (Cth)
Disability Discrimination Act (Cth)
Environment Protection and Biodiversity Conservation Act (Cth)

1.1.2.2 ACT Legislation

Dangerous Substances Act (ACT)
Environment Protection Act (ACT)
Heritage Act (ACT)
Lakes Act (ACT)
Nature Conservation Act (ACT)
Pest Plants and Animals Act (ACT)
Public Unleased Land Act (ACT)
Urban Forest Act (ACT)
Water Resources Act (ACT)
Waste Management and Resource Recovery Act (ACT)
Work Health and Safety Act (ACT)

1.1.2.3 Technical Specifications

Requirement: The following Technical Specifications must be conformed to:

MITS 00 Preliminaries
MITS 01 Traffic Management
MITS 02 Earthworks
MITS 03 Underground Services
MITS 04 Flexible Pavements
MITS 06 Concrete Kerbs, Footpaths and Minor Works
MITS 09 Landscape
MITS 16 Stormwater

The full list of Technical Specifications can be accessed via the TCCS website.

1.1.2.4 Design Standards

General: The following Design Standards are related to this Specification:

MIS 02 Earthworks and Site Grading
MIS 03 Pavement Design
MIS 08 Stormwater

The full list of Design Standards can be accessed via the TCCS website.

1.1.2.5 TCCS Reference Documents

General: The following TCCS Reference Documents are related to this Specification:

Reference Document 4	Landscape Management and Protection Plans
Reference Document 6	Requirements for Design Acceptance Submissions
Reference Document 6A	Requirements for Design Acceptance Submissions for Infill Developments
Reference Document 7	Requirements for Operational Acceptance Submission for Hard Public Infrastructure Works
Reference Document 8	Requirements for Works as Executed Records
Reference Document 9	Requirements for Final Acceptance Submission for Hard Landscape Assets and Civil Works
Reference Document 10	Requirements for Soft Landscape Consolidation and Handover
Reference Document 11	Drafting Requirements for Ref 11 Summary Drawings

The full list of TCCS Reference Documents can be accessed via the TCCS website.

1.1.3 Referenced documents[1]

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

1.1.3.1 Australian Standards

AS 1289	Methods of testing soils for engineering purposes (Set)
AS 1289.0	Methods of testing soils for engineering purposes: Part 0: Definitions and general requirements
AS 1289.3.1.1	Methods of testing soils for engineering purposes: Method 3.1.1: Soil classification tests – Determination of the liquid limit of a soil – Four point Casagrande method
AS 1289.3.3.1	Methods of testing soils for engineering purposes: Method 3.3.1: Soil classification tests – Calculation of the plasticity index of a soil
AS 1289.3.4.1	Methods of testing soils for engineering purposes: Method 3.4.1: Soil classification tests – Determination of the linear shrinkage of a soil – Standard method
AS 1289.3.6.1	Methods of testing soils for engineering purposes: Method 3.6.1: Soil classification tests – Determination of the particle size distribution of a soil – Standard method of analysis by sieving
AS 1289.5.1.1	Methods of testing soils for engineering purposes: Method 5.1.1: Soil compaction and density tests – Determination of the dry density/moisture content relation of a soil using standard compactive effort
AS 1289.5.4.1	Methods of testing soils for engineering purposes: Method 5.4.1: Soil compaction and density tests – Compaction control test – Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	Methods of testing soils for engineering purposes: Method 5.7.1: Soil compaction and density tests – Compaction control test – Hilf density ratio and Hilf moisture variation (rapid method)
AS 1289.6.1.1	Methods of testing soils for engineering purposes: Method 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 (Set)
AS 2187.1	Explosives – Storage, transport and use: Part 1: Storage
AS 2187.2	Explosives – Storage and use: Part 2: Use of explosives
AS 3798	Guidelines on earthworks for commercial and residential developments

1.1.3.2 TfNSW Specifications

TfNSW Specification 3071	Selected Material for Earthworks
TfNSW Specification R44	Earthworks
TfNSW Specification R63	Geotextiles (Separation and Filtration)

1.1.3.3 TfNSW Test Methods

TfNSW T102	Pre-treatment of road construction materials by repeated compaction
TfNSW T106	Coarse particle size distribution of road construction materials (by washing)
TfNSW T109	Plastic limit and plasticity index of road construction materials

[1] Not all the documents are specifically referenced in the body of this Specification. However, they may be relied upon depending on the nature of the Works.

TfNSW T117 California bearing ratio of remoulded specimens of road construction material
TfNSW T276 Foreign materials content of recycled crushed concrete

1.1.3.4 Other publications

Austroads

AGRD03 Guide to Road Design Part 3: Geometric Design
AP-C87 Austroads Glossary of Terms
ATM-440 Proof Rolling

British Standards Institution

BS 6472 Guide to evaluation of human exposure to vibration in buildings (Set)
BS 6472-1 Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting
BS 6472-2 Guide to evaluation of human exposure to vibration in buildings – Blast-induced vibration

Other publications

Workplace Relations Ministers' Council (WRMC) communiques
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 Standards

1.1.4.1 General

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

Proprietary products: Email CED.RoadStandards@act.gov.au for advice on proprietary products.

1.1.5 Interpretation

1.1.5.1 Abbreviations

General: For the purposes of this Specification, the following abbreviations apply:

ACT Australian Capital Territory
AS Australian Standard
BRU Beneficial Reuse
CBR California Bearing Ratio
CED City and Environment Directorate
CEMP Construction Environmental Management Plan
EPA ACT Environment Protection Authority, ACT Government, and its successors
ESCP Erosion and Sediment Control Plan

MIC	Maximum Instantaneous Charge
MIS	Municipal Infrastructure Standard
MITS	Municipal Infrastructure Technical Specification
PAP	Principal's Authorised Person
RAP	Remedial Action Plan
SDD	Standard Dry Density
TCCS	Transport Canberra and City Services, ACT Government, and its successors (including City and Environment Directorate)
TfNSW	Transport for NSW (formerly Roads and Maritime Services, RMS)
VENM	Virgin Excavated Natural Material

1.1.5.2 Definitions

General: For the purposes of this Specification, the definitions of terms used to define the components of the road reserve are in conformance with *AP-C87* and *AGRD03.* The definitions given below also apply:

Authorised Person: The Authorised Person is the person or body responsible for administering the Works Contract and has the same meaning as Contract Administrator, Principal's representative, Principal's Authorised Person (PAP), Superintendent or equivalent. The powers, duties and authorities of the Authorised Person are covered in the Contract.

Beneficial reuse (BRU): Material that contains a level of contamination that has been assessed by the Environment Protection Authority (EPA) and found to be suitable for a particular land use.

Collector Roads: Collector Roads comprise Minor Collector Roads, Major Collector Roads and any lesser category road directly connecting two such roads so as to form a continuation of the Minor or Major Collector Roads.

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

Contract: The agreement between the Principal and the Contractor.

Contractor: The person bound to execute the work under the Contract.

Controlled Fill: Virgin excavated natural material (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.

Design subgrade level: The design subgrade level is the underside of the Selected Material Zone and corresponds to the finished surface level of the subgrade materials. Where a pavement design contains no Selected Material Zone, it is the underside of the lowest material layer constructed to *MITS 04 Flexible Pavements* (typically the subbase). Refer to **Figure 2B-1** and **Figure 2B-2**.

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.

Pavement: The portion of a carriageway placed above the Selected Material Zone constructed to *MITS 04 Flexible Pavements* for the support of, and to form a running surface for, vehicular traffic. Where the pavement design consists of no Selected Material Zone, it is the portion of a carriageway placed above the design subgrade level. Refer to **Figure 2B-1** and **Figure 2B-2**.

Principal: Principal has the same meaning as Owner, Client and Proprietor and is the party to whom the Contractor is legally bound to construct the Works. The primary obligation of the Principal is to make payments to the Contractor.

Select Material: VENM or approved BRU material that conforms to the specified quality requirements of **Clause 1.4.12** and is placed within the Selected Material Zone, in road projects.

Selected Material Zone: The top part of earthworks formation in which material of a specified higher quality is required to be placed in accordance with the requirements of **Clause 1.4.11** and **Clause 1.4.12**. Refer to **Figure 2B-1** and **Figure 2B-2**.

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

Subbase: The material laid above the Selected Material Zone but below the base either for the purpose of making up additional pavement thickness required over the Selected Material Zone, or to prevent intrusion of the earthworks formation material into the base, or to provide a working platform. This material is constructed to *MITS 04 Flexible Pavements*. Refer to **Figure 2B-1** and **Figure 2B-2**.

Subgrade: The material directly below the underside of the Selected Material Zone or the design subgrade level. For embankments, this is considered to be the General Fill material and embankment foundation, up to a depth of 1 metre below the design subgrade level. For cuttings, this is considered to be the natural in situ material up to a depth of 1 metre below the design subgrade level / floor of cutting. Refer to **Figure 2B-1** and **Figure 2B-2**.

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

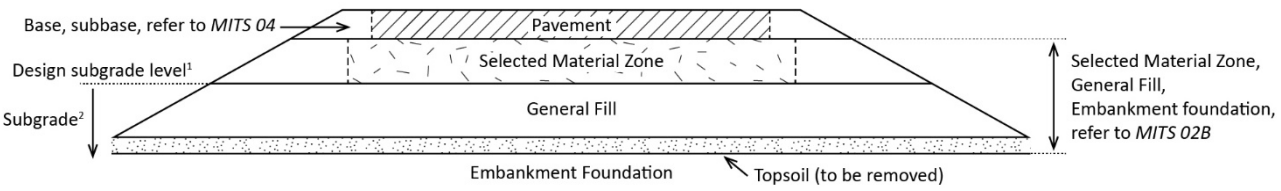
Unbound material: A granular material with no significant capacity to resist tensile stresses.

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 **Clause 1.4.7** as determined as unsuitable by the Authorised Person.

Virgin excavated natural material (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.

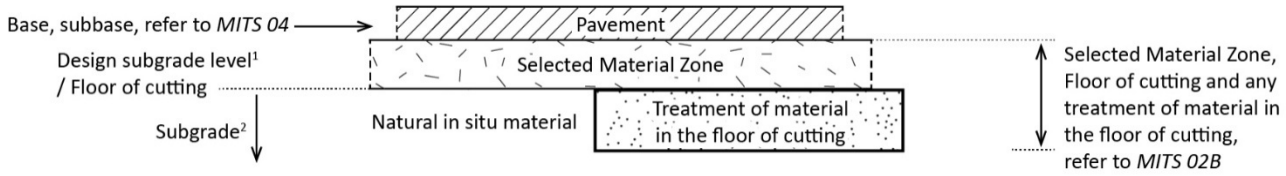
Works: The scope of works to be executed by the Contractor in accordance with the Contract.



[1] The design subgrade level is the underside of the Selected Material Zone. Where a pavement design contains no Select Material Zone, it is the underside of the subbase.

[2] The subgrade is generally considered to be the material below the design subgrade level to a depth of up to 1 m below the design subgrade level.

Figure 2B-1 Embankment nomenclature



[1] The design subgrade level is the underside of the Selected Material Zone. Where a pavement design contains no Select Material Zone, it is the underside of the subbase.

[2] The subgrade is generally considered to be the material below the design subgrade level to a depth of up to 1 m below the design subgrade level.

Figure 2B-2 Cutting nomenclature

1.1.6 Submissions

1.1.6.1 Documents

Prepare the following:

(a) VENM certification: For imported materials.

(b) 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 (HP2B.1)**.

1.1.7 Hold points and Witness points

1.1.7.1 Notice

General: Give written notice to the Authorised Person for Hold points and Witness points in accordance with **Table 2B-1** and **Table 2B-2** respectively.

Table 2B-1 Hold points

Item	Clause	Requirement	Notice for inspection	Release by
General				
HP2B.1	1.1.6.1 – 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				
HP2B.2	1.3.1.1 – Contaminated material and wastes – Excavating contaminated material	Provide an Environment Protection Authority (EPA) or Site Auditor endorsed Remedial Action Plan (RAP) for the excavation and disposal of contaminated material	3 working days prior to commencement of excavation	Authorised Person

Item	Clause	Requirement	Notice for inspection	Release by
HP2B.3	1.3.1.2 – 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				
HP2B.4	1.4.2.2 – 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 **Annexure B** in this Specification	At least 10 working days prior to commencement of blasting	Authorised Person
HP2B.5	1.4.3.3 – 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
HP2B.6	1.4.4.8 – Cuttings – CBR testing of floor of cutting	Submit CBR test results (including evidence of pre-treatment conformity if required) and seek direction where CBR test results are non-conforming	1 working day before next activity or 5 working days before any stabilisation of floor of cuttings is to commence	Authorised Person
HP2B.7	1.4.4.9 – Cuttings – Ripping floors of cuttings	Submit ripped or loosened material for inspection	1 working day before re-compaction commences	Authorised Person
HP2B.8	1.4.4.10 – Cuttings – Compacting floors of cuttings	Inspection of compacted cutting floor	Prior to placing any subsequent layers over the completed cutting floor	Authorised Person
HP2B.9	1.4.7.1 – Unsuitable material – General (extent of removal of unsuitable material)	Submit advice from geotechnical engineer and seek direction on extent of removal of unsuitable material	1 working day prior to removal of unsuitable material	Authorised Person
HP2B.10	1.4.7.3 – Unsuitable material – Floor inspection	Present the floor of the excavation after the removal of unsuitable material	Prior to backfilling with replacement material	Authorised Person
HP2B.11	1.4.8.3 – General Fill – Foundations	Inspection of the fill foundation area after removal of topsoil	Prior to filling	Authorised Person

Item	Clause	Requirement	Notice for inspection	Release by
HP2B.12	1.4.9.4 – Placing fill – CBR value	Submit CBR test results (including evidence of pre-treatment conformity if required) and seek direction where CBR test results are non-conforming	1 working day before next activity or 5 working days before any stabilisation of material is to commence	Authorised Person
HP2B.13	1.4.9.5 – Placing fill – Trimming tops of fill areas	Inspection of the completed surface to receive subsequent layers	Prior to placing any subsequent pavement layers	Authorised Person
HP2B.14	1.4.11.2.1 – Encountering rock in the Selected Material Zone	Submit all test results and all advice and redesigns by the geotechnical engineer and pavement designer	3 working days before proceeding with treatment works of the natural in situ rock material	Authorised Person
HP2B.15	1.4.11.5 – Selected Material Zone – Material conformity testing	Submit Select Material property test results (including evidence of pre-treatment conformity if required)	1 working day before next activity	Authorised Person
HP2B.16	1.4.11.8 – 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
HP2B.17	1.4.13.1 – Fill adjacent to structures – General	Submit concrete compressive strength test results or strut support system design prior to early placement of fill against structures	1 working day prior to fill placement	Authorised Person
HP2B.18	1.4.13.2 – Fill adjacent to structures – Treatment at weepholes	Proposal to use synthetic membrane geotextile	3 working days before proposed use	Authorised Person
HP2B.19	1.4.15.1 – Borrow – Imported material	Contractor to provide conformance report to the Authorised Person	1 working day before importation of the material	Authorised Person
HP2B.20	1.4.17 – Proof rolling	Present the completed subgrade and completed top of SMZ for inspection of proof rolling by Authorised Person	1 working day prior to proof roll	Authorised Person

Table 2B-2 Witness points

Item	Clause	Requirement	Notice for inspection
Execution			
WP2B.1	1.4.3.1 – Removal of topsoil – Program	Inspect cleared site prior to removal of topsoil	1 working day prior to removal
WP2B.2	1.4.4.7 – Cuttings – Floors of cuttings	Floors to be no more than +0 mm or −150 mm above or below the designed floor and provide suitable support	1 working day before next activity
WP2B.3	1.4.5.2 – Batters – Excavation beyond batter line	Minor change in the general slope of the batter to suit the site conditions	1 working day before next activity
WP2B.4	1.4.6.2 – 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
WP2B.5	1.4.9.3 – Placing fill – Insufficient fine material	Modify grading of fill material to achieve compaction	Progressive

1.2 Pre-construction planning

1.2.1 Management of stockpiles

General: Manage soil stockpiles as follows:

(a) Minimise the number of stockpiles, and the area and the time stockpiles are exposed.

(b) Stockpile topsoil separately from other excavated material.

(c) Locate stockpiles away from drainage lines, at least 10 m 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.

(d) Manage weeds in soil stockpiles to minimise seed generation.

(e) Construct with slopes no greater than 2:1 for heights up to 2.5 m. Where stockpiles are greater than 2.5 m in height, slopes may be reduced to 1:1 subject to the stockpile material, Contractor's work methods and site safety considerations.

(f) 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 *MITS 09 Landscape*.

(g) Where stockpiles and batters will be required for less than 28 days, establish sediment controls around unstabilised stockpiles and batters.

(h) 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 Remedial Action Plan (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 (HP2B.2)**.

1.3.1.2 Unexpected finds

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

This is a **HOLD POINT (HP2B.3)**.

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**.

This is a **HOLD POINT (HP2B.4)**.

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 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.

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 Erosion and Sediment Control Plan (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 (WP2B.1)**.

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 (HP2B.5)**.

1.4.3.4 Topsoil stockpiles

Height and batter: Conform to the following:

(a) Maximum height: 2.5 m.

(b) Maximum batter slope: 2H:1V.

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 **Clause 1.4.7**, **Clause 1.4.8**, **Clause 1.4.9**, **Clause 1.4.10** and **Clause 1.4.12**.

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 **Clause 1.4.5**.

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:

(a) Allow the subgrade to dry to a moisture level which will allow compaction and the placement of pavement material.

(b) Scarify the subgrade to a minimum depth of 150 mm and work as necessary to accelerate drying. Re-compact as specified when moisture content approximates optimum.

(c) 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 **Clause 1.4.8**.

1.4.4.5 Cuttings in rock

Requirements: Comply with the drawings. Where the drawings do not acknowledge rock in the floor of cutting or do not specify any drainage mats or subsoil drains to address groundwater in rock, seek direction from the Authorised Person in consultation with a geotechnical engineer. The Authorised Person and geotechnical engineer may apply discretion and may direct that the pavement design be submitted to the pavement designer to amend the pavement design to address potential groundwater in rock (e.g. provision of additional drainage mats or subsoil drains).

Subgrade drains: Comply with the drawings. If drainage mats or subsoil drains to address groundwater in rock are not shown on the drawings, 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 specified in **Clause 1.4.16.8(a)**. 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. Where there is no Selected Material Zone specified on the drawings, 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.

Use of natural in situ material as replacement for Select Material: Use of natural in situ material as Select Material, by adoption of a subgrade floor of cutting level above the design subgrade level shown in the drawings, must be done in accordance with the requirements of **Clause 1.4.11.2**. This practice is only acceptable for local access streets and Collector Roads.

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

Unsuitable material: Remove as set out in **Clause 1.4.7**.

This is a **WITNESS POINT (WP2B.2)**.

1.4.4.8 CBR testing of floor of cutting

Pre-treatment prior to CBR testing: If CBR (California Bearing Ratio) testing is to be undertaken prior to compaction of the floor of cutting, carry out pre-treatment of material in the floor of cutting in accordance with **Clause 1.4.4.8.2** prior to CBR testing.

CBR testing: Prior to ripping the cutting floor beneath road pavements, determine the CBR of the material in the floor at the minimum test frequency specified in *MITS 00B Quality Construction*, *Sub-annexure C1*. If the CBR of the material in the floor is less than the nominated design subgrade CBR specified in the drawings, one of the treatment options below must be undertaken as directed by the Authorised Person:

(a) Treat as unsuitable material, and remove and replace the material in accordance with **Clause 1.4.7**

(b) In situ stabilise the material to *MITS 02C Stabilisation* as agreed with the Authorised Person.

Test method: The CBR value of the material to be determined by test method *AS 1289.6.1.1*. Unless otherwise specified on the drawings, testing shall be 4-day soaked CBR test.

This is a **HOLD POINT (HP2B.6)**.

1.4.4.8.1 Amendments to pavement design during construction

Amendments to the pavement design during construction: CBR testing of natural in situ material during construction is not to be undertaken to adopt a thinner pavement profile design based on an amended higher design CBR value, unless an amendment to the pavement design is approved and certified by the pavement designer and the geotechnical engineer engaged as part of design in accordance with the requirements of *MIS 03 Pavement Design, Section 2.2.3*.

Multiple pavement profile designs per road or region: Where the pavement design consists of multiple nominated design subgrade CBR values, with the intention that construction phase CBR testing of natural in situ material is to be used to determine which pavement profile design is to be adopted for construction, then the requirements for amendments to the pavement design during construction in *MIS 03 Pavement Design, Section 2.2.3* must be complied with.

1.4.4.8.2 Pre-treatment of material in the floor of cutting

Pre-treatment: Material in the floor of cutting that is to be tested for CBR prior to compaction shall be pre-treated prior to CBR testing. Pre-treatment of samples shall be carried out in accordance with *TfNSW Test Method T102* and the requirements of **Table 2B-3**.

Table 2B-3 Pre-treatment prior to CBR tests for material in the floor of cutting

Sample origin	Sampling location	Pre-treatment
Sedimentary rock (or other rocks deemed to break down on compaction as agreed with the Authorised Person)	Material has already been compacted in-place	No pre-treatment required
	Prior to compacting material – either from future cut area(s) or stockpile	3 cycles of Standard Compaction as per *TfNSW T102* (repeated compaction)
All other sources and all fine grained soils	Material has already been compacted in-place	No pre-treatment required
	Prior to compacting material – either from future cut area(s) or stockpile	No pre-treatment required

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.

To be submitted as part of **HOLD POINT (HP2B.6)**.

1.4.4.9 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 150 mm.

Controlled Fill: Where directed by the geotechnical engineer, rip material of the floor beneath Controlled Fill on blocks to a minimum depth of 200 mm below the designed floor level for the extent of the Controlled Fill placement.

Ripping refusal limits: Where the floor of cuttings is unable to be ripped with a D8 Dozer or with a 30-tonne excavator and tyne (or equivalent), propose alternative methods for compensation of floors for the Authorised Person's 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 (HP2B.7)**.

1.4.4.10 Compacting and proof rolling floors of cuttings

Compaction: Re-compact ripped or loosened material to conform to **Clause 1.4.16**.

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

Tolerances: +25 mm.

Proof rolling: Proof roll the compacted floor of cutting (where the surface is at the design subgrade level) in accordance with **Clause 1.4.17** prior to placement of overlying materials.

Proof roll Hold point: Refer to **Clause 1.4.17** for the Hold point which applies to testing rolling the floor of cutting (**HOLD POINT (HP2B.20)**).

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 in all respects with this Specification.

This is a **HOLD POINT (HP2B.8)**.

1.4.4.11 Earthworks for water quality ponds

Permanent ponds: Construct earthworks according to the drawings, this Specification, geotechnical design and *MITS 16 Stormwater.*

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, based on site inspection and investigation during the excavation.

Tops of cuttings: Neatly round tops of cuttings 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 **Table 2B-4**.

Table 2B-4 Excavation tolerances for batters

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

Tolerances are measured normal to the batter surface with (+) measured towards the roadway or 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 (WP2B.3)**.

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 and Open Drains*.

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 600 mm below and parallel to the cutting floor, as shown in the **Figure 2B-3**, unless otherwise approved.

This is a **WITNESS POINT (WP2B.4)**.

Extent of terrace: Extend the cut to the point where the cutting floor is 600 mm below the original stripped surface, or a distance of 20 m, 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 **Clause 1.4.16**.

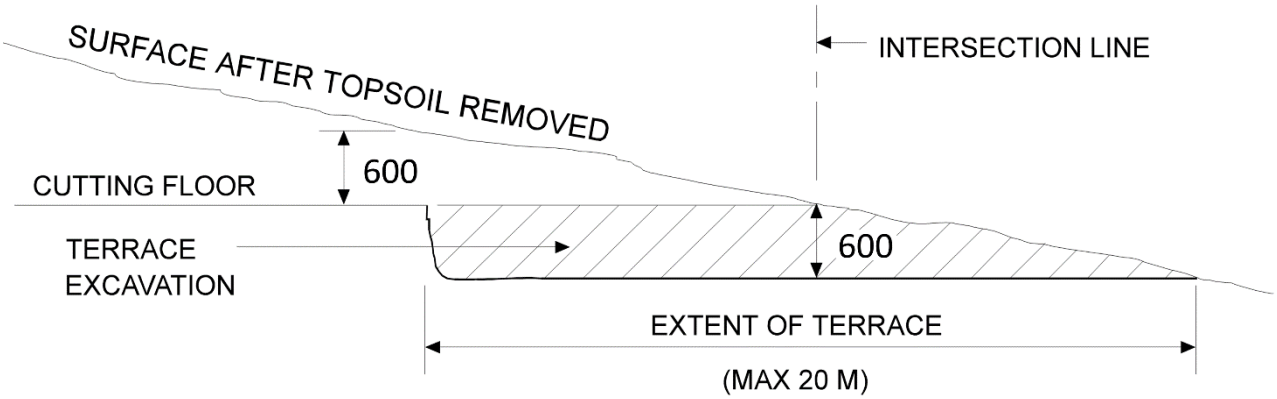


Figure 2B-3 Transition from cut to fill

1.4.7 Unsuitable material

1.4.7.1 General

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

(a) Contains deleterious materials such as organic matter, silts and/or demolition or waste material; or

(b) CBR value less than 2% at 100% SDD (*AS 1289.5.1.1*); or

(c) High plasticity clays (i.e. Liquid Limit > 65%)*; or

(d) Rutts excessively, yields or shows signs of instability and/or is unsuitable for fill or pavement support.

* If the material appears to be unsuitable high plasticity clay but passes the CBR test requirements, the Authorised Person may request the Contractor undertake Atterberg Limits laboratory testing to *AS 1289.3.1.1* to verify the liquid limit requirement.

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 Contractor's responsibility to condition, dry or replace wet material. Refer to **Clause 1.4.4**.

Extent of removal: Seek advice from a geotechnical engineer as to the appropriate extent of excavation of unsuitable material and submit this advice to the Authorised Person for consideration. Excavate unsuitable material to the extent directed by the Authorised Person. The Authorised Person shall apply discretion, and

may direct greater extent of removal of unsuitable material in comparison to that advised by the geotechnical engineer.

This is a **HOLD POINT (HP2B.9)**.

1.4.7.2 Incorporation into the Works

Scope: Material removed as unsuitable may be incorporated into the Works with the agreement of the Authorised Person by the following actions:

(a) Stabilisation of the material to *MITS 02C Stabilisation*; or

(b) Uniform widening of embankments; or

(c) Uniform flattening of fill batters; or

(d) 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 (HP2B.10)**.

Compaction: To conform to **Clause 1.4.16**, prior to replacing material.

1.4.7.4 Replacement material

Construction: Place to conform to **Clause 1.4.9** and to conform to **Clause 1.4.16** and **Clause 1.4.17**.

Quality: Replace unsuitable material with material from cuttings, or with material borrowed in, to conform to **Clause 1.4.15**, of the quality specified in **Clause 1.4.8**.

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:

(a) 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.

(b) The placing and compacting of fill material and of materials of specified quality in nominated zones throughout the Works.

(c) All other activities required to produce earthworks as specified to the alignment, grading and dimensions shown on the drawings.

(d) 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 **Clause 1.4.4**, and supplement with borrow to conform to **Clause 1.4.15**, 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 **Clause 1.4.16**. Material used in the top 150 mm below subgrade shall be free of particles larger than 75 mm, material used in the top 600 mm below subgrade shall be free of particles larger than 150 mm and material used in the top 1 m below subgrade shall be free of particles larger than 300 mm. Elsewhere rock material shall be broken down to less than 600 mm unless the Authorised Person approves otherwise.

Availability: Program the work so that material of the quality specified in **Clause 1.4.9** and **Clause 1.4.11** for the earthworks 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 (HP2B.11)**.

Unsuitable material: If any underlying material is unsuitable, stabilise or remove and replace the material to conform to **Clause 1.4.7**.

Preparation: Grade and level the general area, adjust the moisture content where necessary and compact the top 200 mm as specified in **Clause 1.4.16**.

1.4.8.4 Foundations for shallow fill

Type: Shallow fill is a General Fill to a depth less than 1.5 m 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 200 mm, adjust the moisture content of the loosened material and compact as specified in **Clause 1.4.16**, 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 4 H:1 V in any direction.

Terrace: Extent and method as follows:

(a) Cut horizontal terraces over the whole area to be covered by new filling.

(b) Step the existing slope or batter in successive terraces, each at least 1 m in width and cut the terraces progressively as the embankment is placed.

(c) Coincide terraces with natural discontinuities wherever possible.

(d) Provide subsoil drainage if shown on the drawings.

(e) 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:

(a) Batters to be no steeper than indicated on the drawings (+0 mm).

(b) Batter verges in greenfield subdivisions to vary from the design slope line by no more than 150 mm when measured at right angles to the slope line.

(c) Batters other than verges in greenfield subdivisions to be no flatter than 100 mm 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:

(a) 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 ±50 mm when measured at right angles to the slope line after compaction.

(b) 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 **Clause 1.4.16**.

1.4.9.2 Layer thickness

Placement: Place layers parallel to the grade line and compact to conform to **Clause 1.4.16**.

Description: Uniform compacted layers of thickness not exceeding 300 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. Use of large rock will only be permitted 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 300 mm, provided that the relative compaction specified in **Clause 1.4.16** is attained.

1.4.9.3 Rock pieces

Maximum size: For areas of Controlled Fill in blocks as per **Clause 1.4.10** 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 (WP2B.5)**.

1.4.9.4 CBR value

Pre-treatment prior to CBR testing: If CBR testing is to be undertaken prior to compaction of the fill material, carry out pre-treatment of fill material in accordance with **Clause 1.4.9.4.2** prior to CBR testing.

CBR testing: For fill material that is placed to the design subgrade level, determine the CBR of the material at the minimum test frequency specified in *MITS 00B Quality Construction, Sub-annexure C1*. The CBR value is to be of the fill material at design subgrade level after placement of the material to design subgrade level. If the CBR of the fill material is less than the nominated design subgrade CBR specified in the drawings, one of the treatment options below must be undertaken as directed by the Authorised Person:

(a) Treat as unsuitable material, and remove and replace the material in accordance with **Clause 1.4.7**.

(b) In situ stabilise the material to *MITS 02C Stabilisation* as agreed with the Authorised Person.

Test method: The CBR value of the material to be determined by test method *AS 1289.6.1.1*. Unless otherwise specified on the drawings, testing shall be 4-day soaked CBR test.

This is a **HOLD POINT (HP2B.12).**

1.4.9.4.1 Amendments to pavement design during construction

Amendments to the pavement design during construction: CBR testing of general fill during construction is not to be undertaken to adopt a thinner pavement profile design based on an amended higher design CBR value, unless an amendment to the pavement design is approved and certified by the pavement designer and the geotechnical engineer engaged as part of design in accordance with the requirements of *MIS 03 Pavement Design, Section 2.2.3*.

Multiple pavement profile designs per road or region: Where the pavement design consists of multiple nominated design subgrade CBR values, with the intention that construction phase CBR testing of general fill is to be used to determine which pavement profile design is to be adopted for construction, then the requirements for amendments to the pavement design during construction in *MIS 03 Pavement Design, Section 2.2.3* must be complied with.

1.4.9.4.2 Pre-treatment of fill material

Pre-treatment: Fill material that is to be tested for CBR prior to compaction shall be pre-treated prior to CBR testing. Pre-treatment of samples shall be carried out in accordance with *TfNSW Test Method T102* and the requirements of **Table 2B-5**.

Table 2B-5 Pre-treatment prior to CBR tests for fill material

Sample origin	Sampling location	Pre-treatment
Excavated or stockpiled sedimentary rock (or other rocks deemed to breakdown on compaction as agreed with the Authorised Person)	Material has already been compacted in-place	No pre-treatment required
	Prior to compacting material – either from future cut area(s) or stockpile	3 cycles of Standard Compaction as per *TfNSW T102* (repeated compaction)
All other sources and all fine grained soils	Material has already been compacted in-place	No pre-treatment required
	Prior to compacting material – either from future cut area(s) or stockpile	No pre-treatment required

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.

To be submitted as part of **HOLD POINT (HP2B.12)**.

1.4.9.5 Trimming, compacting and proof rolling 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 **Clause 1.4.16**.

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

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

Proof rolling: Proof roll the compacted top of fill material (where the surface is at the design subgrade level) in accordance with **Clause 1.4.17** prior to placement of overlying materials.

Proof roll Hold point: Refer to **Clause 1.4.17** for the Hold point which applies to proof rolling the top of fill material (**HOLD POINT (HP2B.20)**).

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 in all respects with this Specification.

This is a **HOLD POINT (HP2B.13)**.

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:

(a) 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.

(b) Maximum depth of filling less than 1 m: Liquid Limit less than 50% and preferably less than 35% and suitable for use as controlled filling.

(c) Maximum depth of filling less than 2.3 m: Liquid Limit in the upper 1 m less than 50% and preferably less than 35%. Liquid Limit of the material below 1 m less than 50%. All material must be suitable for use as controlled filling.

(d) Maximum depth of filling greater than 2.3 m: Liquid Limit in the upper 1 m less than 50% and preferably less than 35%. Liquid Limit of the material 1–2.3 m less than 50%. Below 2.3 m no restrictions. All material must be suitable for use as controlled filling.

(e) 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 Class 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:

(a) standard density / relative compaction of 95% for single residential allotments.

(b) 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 **Clause 1.4.12**.

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 **Clause 1.4.15**.

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 Use of natural in situ material as replacement for Select Material

Exclusions: This use of natural in situ material as Select Material is not permitted where the pavement design includes a Selected Material Zone consisting of CBR15 Select Material or CBR30 Select Material.

Requirements: The use of natural in situ material as Select Material, by adoption of a subgrade floor of cutting level above the design subgrade level shown in the drawings, is only permitted for local access streets and Collector Roads where the pavement design consists of CBR8 Select Material or CBR10 Select Material in the Select Material Zone, and if agreed by the Authorised Person. If agreed by the Authorised Person, this practice must be undertaken in accordance with the following requirements, and as depicted in **Figure 2B-4(a)** and **Figure 2B-4(b)**:

(a) For Collector Roads, the subgrade floor of cutting level shall be no more than 150 mm above the design subgrade level shown on the drawings (the thickness of natural in situ material above the design subgrade level shown on the drawings must not exceed 150 mm).

(b) For local access roads, the subgrade floor of cutting level above the design subgrade level shown on the drawings shall not exceed the design thickness of the Selected Material Zone shown on the drawings (the thickness of natural in situ material above the design subgrade level shown on the drawings must not exceed the design thickness of the Selected Material Zone).

(c) The natural in situ materials above the design subgrade level shown on the drawings must meet the material requirements of **Clause 1.4.12** and pre-treatment and material conformity testing of the natural in situ material must be undertaken in accordance with **Clause 1.4.11.5**. The Hold point **(HP2B.15)** in **Clause 1.4.11.5** is to be adhered to.

(d) The natural in situ material must be ripped before compaction to the full thickness of the design Selected Material Zone as shown on the drawings or 200 mm depth, whichever is greater, and compacted as per **Clause 1.4.11.6**.

(e) Proof rolling requirements of **Clause 1.4.11.7** apply, including Hold point **HP2B.20**.

(f) Inspection requirements of **Clause 1.4.11.8** apply, including Hold point **HP2B.16**.

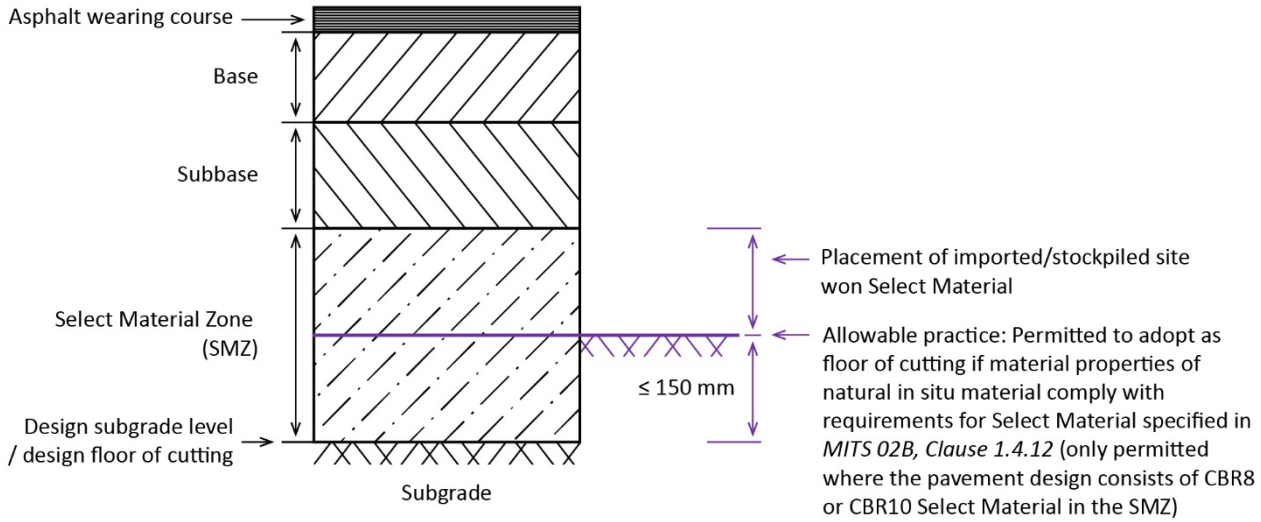


Figure 2B-4(a) Allowable practice for the use of natural in situ material as replacement for Select Material (Collector Roads)

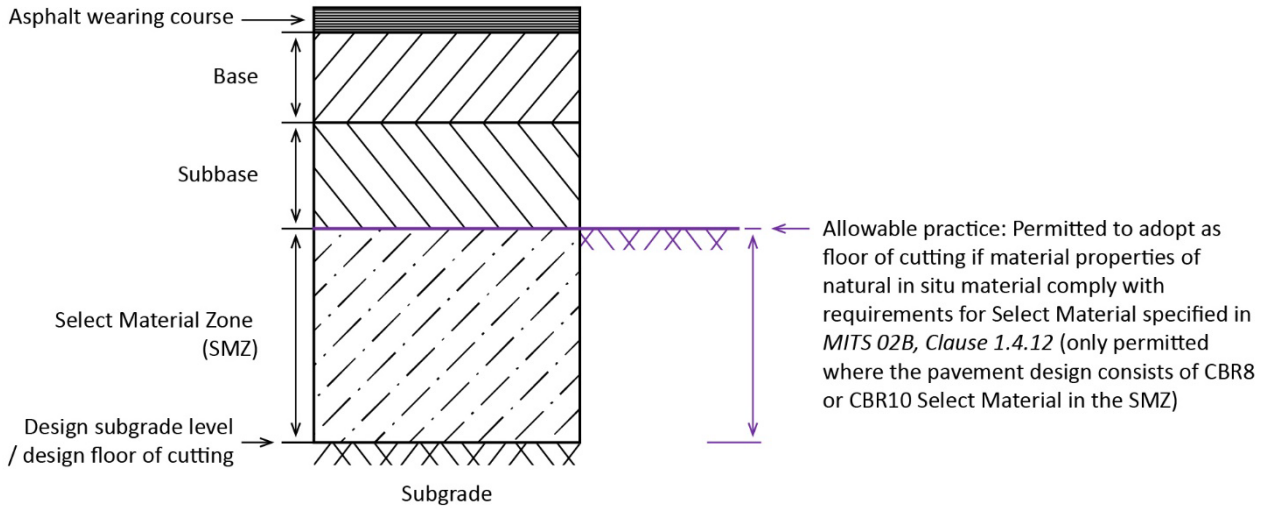


Figure 2B-4(b) Allowable practice for the use of natural in situ material as replacement for Select Material (local access roads)

1.4.11.2.1 Encountering rock in the Selected Material Zone

Requirements: Where rock material (e.g. partly weathered rock) is encountered on site within the Selected Material Zone, it is acceptable to raise the subgrade floor of cutting level to above the design subgrade level shown in the drawings if the following requirements are complied with:

(a) The natural in situ rock material above the design subgrade level shown on the drawings must meet the material requirements of **Clause 1.4.12**, and pre-treatment and material conformity testing of the natural in situ rock material to the full depth of the Selected Material Zone must be undertaken in accordance with **Clause 1.4.11.5**.

(b) Submit pre-treatment and material property test results for the natural in situ rock material to be used in the Selected Material Zone to a geotechnical engineer, and seek advice from the geotechnical engineer that the natural in situ rock material achieves the design requirements for the Selected Material Zone layer. Additional forms of testing may be required at the discretion of the geotechnical engineer.

(c) Submit all test results and geotechnical advice to the pavement designer and request approval and certification of the original design or any redesign by the pavement designer.

(d) The geotechnical engineer and pavement designer are to assess subsurface drainage design treatments to address subsurface permeability (e.g. provision of additional drainage mats or subsoil drains).

Submission: Submit documentary evidence of compliance with the requirements of **Clause 1.4.11.2.1(a)** to **Clause 1.4.11.2.1(d)** to the Authorised Person, including submission of geotechnical advice and pavement redesign, for approval prior to proceeding with the Works.

This is a **HOLD POINT (HP2B.14)**.

Amended design: Adhere to any advice and design changes as directed by the geotechnical engineer and the pavement designer.

1.4.11.3 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 the requirements of this Specification and the design.

1.4.11.4 Imported Select Materials

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

1.4.11.5 Material conformity testing

Pre-treatment prior to material conformity testing: Where required, carry out pre-treatment of Select Material prior to material conformity testing in accordance with **Clause 1.4.12.4**.

Material conformity testing: Prior to placement of Select Material in the Selected Material Zone, carry out testing of material properties in accordance with the requirements of **Clause 1.4.12.2** or **Clause 1.4.12.3**, to the minimum test frequency specified in *MITS 00B Quality Construction, Sub-annexure C1*.

This is a **HOLD POINT (HP2B.15)**.

1.4.11.6 Placing and compaction

Layers: Place and compact in layers with the compacted thickness of each layer not exceeding 200 mm, homogeneous and free from patches containing segregated stone or excess fines. Refer to **Clause 1.4.16**.

Direction: Seek approval from the Authorised Person to increase the compacted layer thickness greater than 200 mm, provided that the relative compaction specified in **Clause 1.4.16** 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: +0mm −25 mm.

1.4.11.7 Proof rolling

Proof rolling: Proof roll the top of Selected Material Zone in accordance with **Clause 1.4.17** prior to placement of overlying materials.

Proof roll Hold point: Refer to **Clause 1.4.17** for the Hold point which applies to testing rolling the top of Selected Material Zone (**HOLD POINT (HP2B.20)**).

1.4.11.8 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 in all respects with this Specification.

This action is a **HOLD POINT (HP2B.16)**.

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:

(a) CBR30 Select Material with minimum CBR of 30%

(b) CBR15 Select Material with minimum CBR of 15%

(c) CBR10 Select Material with minimum CBR of 10%

(d) CBR8 Select Material with minimum CBR of 8%.

The CBR value refers to the CBR of the material in situ after compaction or after pre-treatment in accordance with **Clause 1.4.12.4**. 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) specified in **Table 2B-6** in accordance with *TfNSW Test Method T276*.

On-site 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) specified in **Table 2B-6** in accordance with *TfNSW Test Method T276*.

Table 2B-6 Limits of foreign material in recycled material

	Foreign materials	Maximum percentage by mass
1	Noncompressible 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 (CBR8 and CBR10)

The Select Material with classifications CBR8 and CBR10 shall have a maximum particle size not exceeding 75 mm, must not have a Unified Soil Classification of ML, MH or CH, and shall be in accordance with **Table 2B-7**.

Table 2B-7 Select Material properties (CBR8 and CBR10)

Test method	Description	Select Material requirements	
		Type CBR10	Type CBR8
AS 1289.3.1.1	Liquid Limit	max 40	max 45
AS 1289.3.6.1	Passing 0.075 mm sieve	max 40%	max 40%
AS 1289.3.3.1	Plasticity Index	max 25	max 25
AS 1289.6.1.1	4 day Soaked CBR (100% ±1% Standard Compaction)[(i)][(ii)][(iii)]	min 10	min 8

[(i)] Moisture content for CBR tests is to be 100% ±2%

[(ii)] The surcharge mass to be applied during soaking and testing of the test specimen shall be 4.5 kg

[(iii)] The period of soaking will be 4 days or until swelling movements have ceased, whichever is longer

1.4.12.3 Select Material properties (CBR15 and CBR30)

Guidance: The Select Material with classifications CBR15 and CBR30 are equivalent to *TfNSW Specification R44* requirements for Selected Material in the lower Selected Material Zone and Select Material in the upper Selected Material Zone, respectively, except the CBR requirements have been adjusted to account for the fact that *TfNSW Specification R44* adopts characteristic CBR whereas this Specification adopts minimum CBR.

Requirements – site won Select Material: Site won Select Material with classifications CBR15 and CBR30 shall have a maximum particle size not exceeding 53 mm, and shall be in accordance with **Table 2B-8**.

Requirements – imported Select Material: Imported Select Material with classifications CBR15 and CBR30 shall have a maximum particle size not exceeding 53 mm, and shall comply with *TfNSW Specification 3071*, except for the following amendments:

(a) CBR30 Select Material is to have a minimum CBR of 30 in accordance with **Table 2B-8**. The characteristic CBR requirement of 33 in *TfNSW Specification 3071, Table 3071.2* does not apply.

(b) CBR15 Select Material is to have a minimum CBR of 15 in accordance with **Table 2B-8**. The characteristic CBR requirement of 19 in *TfNSW Specification 3071, Table 3071.2* does not apply.

(c) Imported CBR15 and CBR30 Select Material must comply with the particle size distribution requirements of *TfNSW Specification 3071, Table 3071.1* or the alternative particle size distribution requirements of **Table 2B-9**.

Table 2B-8 Select Material properties (CBR15 and CBR30)

Test method	Description	Select Material requirements	
		Type CBR30	Type CBR15
AS 1289.3.6.1 or *TfNSW T106*	Passing 19 mm sieve	min 50%	min 50%
AS 1289.3.6.1 or *TfNSW T106*	Passing 2.36 mm sieve	min 30%	min 30%
AS 1289.3.3.1 or *TfNSW T109*	Plasticity Index	max 15	max 15
AS 1289.6.1.1 or *TfNSW T117*	4 day Soaked CBR (100% ±1% Standard Compaction) [(i)] [(ii)] [(iii)]	min 30	min 15

[(i)] Moisture content for CBR tests is to be 100% ±2%

[(ii)] The surcharge mass to be applied during soaking and testing of the test specimen shall be 4.5 kg

[(iii)] The period of soaking will be 4 days or until swelling movements have ceased, whichever is longer

Table 2B-9 Alternative particle size distribution for imported CBR15 and CBR30 Select Material

AS sieve	% passing (by mass)[(i)]
53 mm	100
37.5 mm	95–100
19.0 mm	65–95
6.7 mm	40–80
2.36 mm	30–70

[(i)] Determined using *TfNSW Test Method T106*, after pretreatment specified in *TfNSW Specification 3071, Annexure 3071/A2*

1.4.12.4 Select Material pre-treatment

Pre-treatment: Select Material other than recycled building material shall be pre-treated prior to material conformity testing. Pre-treatment of samples shall be carried out in accordance with *TfNSW Test Method T102* and the requirements of **Table 2B-7**.

Table 2B-10 Pre-treatment prior to material conformity testing for Select Material

Sample origin	Sampling location	Pre-treatment
Excavated or stockpiled sedimentary rock (or other rocks deemed to breakdown on compaction as agreed with the Authorised Person)	Material has already been compacted in-place	No pre-treatment required
	Prior to compacting material – either from future cut area(s) or stockpile	3 cycles of Standard Compaction as per *TfNSW T102* (repeated compaction)
All other sources	Material has already been compacted in-place	No pre-treatment required
	Prior to compacting material – either from future cut area(s) or stockpile	No pre-treatment required

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.

To be submitted as part of **HOLD POINT (HP2B.15)**.

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*.

Timing of placement: Unless otherwise specified in the structural design, do not place fill against structures until:

(a) 28 days after placing of concrete for concrete earth retaining structures (e.g. cantilever retaining walls, wing walls and conventional bridge abutments); or

(b) 28 days after placing of concrete for the earth retaining component of concrete frame structures, and the compressive strength of the concrete in the bridge deck (or horizontal connecting slab) must be at least 75% of the specified minimum 28-day concrete compressive strength. This requirement applies to concrete frame structures, such as integral and semi-integral bridge abutments.

Approval required for early placement of fill: To decrease the lag time, the Contractor can commence placement of fill material adjacent to structures earlier than the nominated times specified in **Clause 1.4.13.1** if the following is adopted:

(d) The walls are supported by struts to the satisfaction of the Authorised Person; or

(e) 100% of the design compressive strength has been achieved for concrete earth retaining structures (e.g. cantilever retaining walls, wing walls and conventional bridge abutments), but no earlier than 14 days after concrete placement; or

(f) 100% of the design compressive strength has been achieved for the earth retaining component of concrete frame structures, and the compressive strength of the concrete in the bridge deck (or horizontal connecting slab) has achieved at least 75% of the specified minimum 28-day concrete compressive strength. This requirement applies to concrete frame structures, such as integral and semi-integral bridge abutments.

This includes fill placement that impacts the position, stability and serviceability of bridge deck member bearings.

Submission to Authorised Person: Submit compressive strength test results or temporary design of strut support system to the Authorised Person for approval prior to early placement of fill.

This is a **HOLD POINT (HP2B.17)**.

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 50 mm to 10 mm as follows:

(a) The maximum particle dimension not to exceed 50 mm.

(b) 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 mm below to at least 450 mm 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 (HP2B.18)**.

1.4.13.3 Selected backfill

Location: Place selected backfill adjacent to structures to conform to **Table 2B-11**.

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.

Table 2B-11 Selected backfill width and height

Structure type	Selected backfill width	Height
Bridge abutments	2 m	H
Cast-in-place box culverts	H/3	H + 300 mm
Corrugated steel pipes and arches	0.5 m	H + 500 mm
Retaining walls	H/3	H

Where H = height of structure

Placement: 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 **Clause 1.4.16**.

Horizontal terraces: Cut the existing 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 to **Clause 1.4.9**.

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.

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, 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 **Clause 1.4.9** and **Clause 1.4.16** 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, roadworks, 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 with 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:

(a) constructing cuttings and fill batters as directed.

(b) providing materials of the quality specified.

(c) 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 **Clause 1.4.12**. 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 (HP2B.19)**.

Authorities: Comply with all legislation, any requirements of the EPA and the Contractor's Environmental Authorisation. Notify the EPA of all imported soil accepted on site.

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 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.

Site preparation and restoration: For on-site 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*, the approved ESCP and **Clause 1.4.3**.

Restoration: Restore on-site borrow sites to *MITS 09 Landscape*.

Widening of cutting: If borrow material is obtained by uniformly widening a cutting, apply the requirements of **Clause 1.4.5** and **Clause 1.4.4** to the redetermination of batter slopes, the trimming of batters and the compaction of floors of cuttings respectively.

Batter slopes:

(a) Not steeper than 4 H:1 V.

(b) 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:

(a) Each layer of material replacing unsuitable material as detailed in **Clause 1.4.7**.

(b) Each layer of fill material placed, up to 1.5 m from the top of the pavement.

(c) Fill placed adjacent to structures up to 1.5 m from the top of the pavement.

(d) Material in unsealed verges and within medians up to the level at which topsoil is placed.

(e) Spoil (excluding unsuitable material).

(f) 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:

(a) Foundations for shallow embankments less than 1.5 m high.

(b) The whole area on the floor of cuttings.

(c) Each layer of the fill within 1.5 m from the top of the pavement.

(d) 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.

(e) The fill material placed adjacent to structures as specified in **Clause 1.4.13** in each layer within 1.5 m 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:

(a) Each layer of the Selected Material Zone as specified in **Clause 1.4.11** (for CBR8 and CBR10 Select Material layers only).

(b) Spill through bridge embankment zones.

1.4.16.5 102% compaction

Requirements: Compact the following areas to provide a relative compaction of 102% ±1% as determined by *AS 1289.5.7.1* or *AS 1289.5.4.1* for standard compactive effort to the following:

(a) Each layer of the Selected Material Zone as specified in **Clause 1.4.11** (for CBR15 and CBR30 Select Material layers only)

1.4.16.6 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 the natural surface of not less than 0.5 m.

Treatment: Treat the floor of shallow cutting as specified in **Clause 1.4.4** and **Clause 1.4.6** and compact to provide a relative compaction of not less than 98% for a depth of 200 mm determined by *AS 1289.5.7.1* or *AS 1289.5.4.1*, for standard compactive effort.

1.4.16.7 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 600 mm to 300 mm.

1.4.16.8 Moisture content

Moisture content: Determine the field moisture content of the material at the time of compaction to permit the specified compaction to be attained. The field moisture content shall be within the following moisture ranges as determined by *AS 1289.5.1.1* or *AS 1289.5.7.1:*

(a) For General Fill, Controlled Fill and floor of cuttings: 80% to 110% of OMC.

(b) For Select Material in the Selected Material Zone: 60% to 90% of OMC.

The moisture range is expressed as the ratio of field moisture content to Optimum Moisture Content (OMC) at standard compactive effort and is reported to the nearest 1%.

Timing of compaction: Adhere to the following:

(c) 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.

(d) 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.

(e) 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.

(f) 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.

1.4.16.9 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.

1.4.16.10 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 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 **Clause 1.4.9**, 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 **Clause 1.4.16**.

1.4.17 Proof rolling

Requirement: Proof roll the following completed earthworks layers in accordance with *Austroads ATM-440* prior to placement of overlying materials:

(a) For embankments, proof roll the compacted top of fill material at the design subgrade level.

(b) For cuttings, proof roll the compacted floor of cutting at the design subgrade level.

(c) Proof roll the top of Selected Material Zone.

Fill material layers below the design subgrade level: Fill material layers placed at a depth of up to 1 m below the design subgrade level must be capable of withstanding proof rolling to verify their stability. Proof rolling of fill material layers where the surface is below design subgrade level is only required where directed by the Authorised Person.

Equipment: Proof rolling shall be undertaken using the equipment specified in *Austroads ATM-440*. The use of a steel drum roller is not permitted for proof rolling.

Extent of proof rolling: The proof rolling pattern must cover the full width and length of each Lot and be in accordance with the rolling pattern and procedure requirements outlined in *Austroads ATM-440*, unless otherwise agreed with the Authorised Person.

Boundaries: Show the boundaries on the proof rolling plan in accordance with *Austroads ATM-440* or identify the boundaries of each lot on site with stakes clearly labelled to the satisfaction of the Authorised Person.

Presentation for testing: Present the work available in lots, for the Authorised Person to inspect proof rolling in accordance with *Austroads ATM-440*. Further compact as directed due to results of proof rolling.

Conformity: The surfaces when proof rolled must not exhibit visible deformation, rutting, or yielding and/or show signs of distress or instability.

Failure of proof rolling: Should the embankment, cutting or top of SMZ presented as ready for proof rolling fail the proof 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 further proof rolling. The cost of the rectification works and additional proof rolling shall be borne by the Contractor.

This is a **HOLD POINT (HP2B.20)**.

1.4.18 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 **Clause 1.4.5** 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, re-excavate (if required) and backfill to underside of road pavement materials with selected fill (complying with **Clause 1.4.12** compacted to 98% of standard compactive effort).

1.4.19 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 *TfNSW Specification R63*.

1.5 Completion

1.5.1 Submissions

Works as Executed Records: To *MITS 00B Quality Construction*.

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**. Provide all applicable documentation.

2 Measurement and payment

2.1 Measurement

2.1.1 General

Payments made to the Bill of Quantities: To *MITS 00A General Requirements*, this Specification, the drawings and **Clause 2.2**.

2.1.2 Methodology

The following methodology will be applied for measurement and payment:

(a) Allow for all work, materials, testing and quality assurance requirements in each Pay item.

(b) Control measures for erosion and sedimentation are measured and paid in accordance with *MITS 00C Control of Erosion and Sedimentation*.

(c) Clearing and grubbing of stockpile sites and borrow areas is measured and paid in accordance with *MITS 02A Clearing and Grubbing*.

(d) Seeding and restoration of stockpile sites and borrow areas is measured and paid in accordance with *MITS 09 Landscape*.

(e) Traffic control for blasting operations is measured and paid in accordance with *MITS 01 Traffic Management*.

(f) Fill adjacent to culverts and drainage structures is measured and paid in accordance with *MITS 03 Underground Services*.

(g) Working platforms created by chemical stabilisation are measured and paid in accordance with *MITS 00C Control of Erosion and Sedimentation*.

(h) Potholing for underground service identification is measured and paid in accordance with *MITS 00A General Requirements*.

(i) The volume of material involved in ripping or loosening will not be considered when measuring the volume of excavations.

(j) All activities associated with preparing the surface for deflection monitoring or proof rolling is included in the **Pay items** for **General Fill, Preparation of cut and fill subgrades**, **Preparation of Controlled Fill subgrade**, **Replacement of unsuitable material with selected material**, and **Select Material**.

(k) 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-12 Pay items

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 (after removal of topsoil) to the floor of cutting.	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 (after removal of topsoil) 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, and 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 (after removal of topsoil) to the top of General Fill earthworks formation.	All activities associated with the construction of fill areas, including pre-treatment, testing, compaction, proof rolling, 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 (after removal of topsoil) to the top of Controlled Fill earthworks formation.	This Pay item is the extra over General Fill for all activities associated with selection, placement, pre-treatment, testing and compaction of materials as Controlled Fill on blocks or other areas specified for Controlled Fill. This includes the engagement of a Geotechnical Inspection and Testing Authority for inspection, survey of surface level prior to placement of Controlled Fill and of final surface after placement of Controlled Fill, calculations, testing and reporting specified.
2B.7	Imported fill	Compacted m^3 measured in situ from the stripped surface (after removal of topsoil) 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 75 mm behind the back of kerb.	All activities associated with the preparation of cut and fill subgrades, including ripping, re-compaction, trimming, compaction and proof rolling.
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 subgrades, including ripping, re-compaction, trimming, compaction, and proof rolling 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, proof rolling and trimming of fill batters. A separate Pay item shall be included in the Contract for each selected material type: 2B.10.1 CBR ≥ 30 2B.10.2 CBR ≥ 15 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, testing, placement, compaction of General Fill at the specified moisture content and trimming of fill batters.
2B.12	Select Material	Compacted m^3 measured in situ from subgrade surface to top of Selected Material Zone.	All activities associated with placement of Select Material in the Selected Material Zone. This Pay item shall include selection, supply, haulage, any pre-treatment, testing, placement, compaction of selected material at the specified moisture content, proof rolling and trimming of fill batters. A separate Pay item shall be included in the Contract for each selected material type: 2B.10.1 CBR ≥ 30 2B.10.2 CBR ≥ 15 2B.10.3 CBR ≥ 10 2B.10.4 CBR ≥ 8 2B.10.5 Trench foundations
2B.13	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.

Item No	Pay items	Unit of measurement	Schedule of rates scope
2B.14	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-13 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 *MITS 03* items
	Paths, driveways, footings		bcm	Estimate if not modelled, included within *MITS 06* 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 material		**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 on site		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 (after stripping of topsoil) to the floor of cutting, 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 100 mm), the underside of topsoil in blocks (generally 200 mm), the underside of foundations and the underside of garden beds.

Unsuitable material: Make provision for appropriate corresponding value for replacement of unsuitable material.

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 (after stripping of topsoil) to the top of earthworks fill formation (or top of subgrade or subgrade surface), commonly referred to as the boxing level.

Annexure B – Blasting

Table 2B-34 Blasting Hold points

Item	Clause title	Requirement	Notice for inspection	Release by
Annexure B				
HP2B.21	General – Licences	Obtain blasting permit from WorkSafe ACT	7 days before initiating blasting	Authorised Person
HP2B.22	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 (HP2B.21)**.

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 roadworks. Adopt these practices to the extent that they are consistent with the requirements of local legislation. Take particular note of the requirements of Sections 4, 5, 7, 9, 11, 12 and 14.

Conform to the following:

(a) The transport of explosives to be in accordance with the *Australian Code for the Transport of Explosives by Road and Rail*.

(b) Comply with the requirements of WorkSafe ACT.

(c) Comply with the requirements of the *Dangerous Substances Act*.

(d) Comply with the requirements of the *Dangerous Substances (General) Regulation*.

(e) 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 a copy of the written approval from relevant services providers or authorities if blasting is within 15 m of any 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 (MIC): Submit for approval the MIC and the Contractor's validation of the adequacy of the proposed structural survey at least 3 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:

(a) the quantity and type of explosive to be detonated

(b) the blasting pattern to be used

(c) proposed drilling, blasting and excavation techniques

(d) measures proposed to limit noise and vibration

(e) pre-splitting details

(f) measures to ensure that vibration from blasting does not adversely affect nearby structures.

This is a **HOLD POINT (HP2B.22)**.

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.*

Ground vibration: Ground vibration caused by blasting not to exceed the values of peak particle velocity listed in **Table 2B-15**.

Table 2B-4 Limiting peak particle velocity

Point of potential damage (within 1 km of blasting site)	Peak particle velocity
Completed and cured bridge structures or sub-structures (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 are to be confined to the period Monday to Friday (excluding public holidays), 8:30 am to 5:00 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 *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 750 mm 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 overpressure

Proximity to noise sensitive locations

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

Noise limitations: Limit the noise emanating from blasting operations to an overpressure 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 overpressure

Procedure: Conform to Worksafe ACT requirements.

Excessive air blast overpressure

Procedure: In the event that the measured air blast overpressure 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 overpressure will not be exceeded.

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 **Table 2B-15**. 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 **Annexure B** 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 (MIC): For the first blast, set up monitors at not less than five points at varying distances away from the blasting site. The MIC for the first blast is not to exceed that calculated and certified by an approved explosives specialist. Submit a calculated relationship for MIC 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 requested.