

# TRANSPORT FOR NSW (TfNSW)

## QA SPECIFICATION R44

### EARTHWORKS

#### NOTICE

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#### REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 4/Rev 0	Global	Content reorganised and reworded to improve clarity.	GM, IC	14.02.13
	Global	Term “drainage blanket” changed to “drainage layer”.		
	1.4	Definitions added for: “Capping layer”, “Drainage layer”, “Floor of cutting”, “Select Fill”, “Verge material”.		
		Fig 2(a), and Fig 2(b) (previously Fig 3), redrawn.		
	1.5	“Earthworks Plan”, previously clause 1.7. Earthworks Plan requirements consolidated. Additional item inserted on procedures to prevent damage to adjacent structures from earthworks activities.		
	1.6.2, Annex A1	“MX software” replaced by “standard RMS CADD software”.		
	1.7	“Protection of Earthworks”, previously clause 1.5.		
	2.1	Additional sub-clause added that imported material not to be placed until all available suitable material has been used up.		
	2.3	“Topsoil”, previously clause 2.7.		
	2.3.2(d)	Seeding of topsoil stockpiles clarified to be with a sterile cover crop.		
2.6	“Stockpile Sites”, previously clause 2.3.			
2.7	“Borrow Sites”, previously clause 2.6.			

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 4/Rev 0 (cont'd)	2.8.1	<p>“or borrow sources” added in 1<sup>st</sup> para.</p> <p>“shale” deleted as example of material susceptible to breakdown or weathering.</p>		
	2.8.3.1	Required properties of material which are subject to further modification clarified.		
	2.8.4.1	Statement on chemical stabilisation of verge material deleted.		
	2.8.4.2	Last paragraph of clause deleted.		
	3.1	Clause edited and reworded to clarify intent.		
	3.2	Clause edited and reworded to clarify intent. Superfluous statements deleted.		
		Figs 3(a), 3(b), 3(c), 3(d) and 3(e) (previously Fig 4(a), etc) redrawn.		
		Table title inserted for table of drainage layer material properties.		
	3.3	Heading title changed.		
		Fig 4 (previously Fig 4(f)) redrawn; title and captions changed to clarify intent.		
	3.4	Clause edited and reworded to clarify intent.		
		Figs 5(a) to 5(e) redrawn.		
		Foundation Treatment types for cuttings, C2 to C5, re-numbered to be consistent with those for embankments.		
	3.4.5	Table of drainage layer material properties deleted, replaced by cross reference to Table 2 in clause 3.2.5.		
	3.5	Heading title changed.		
3.5.1	Previously clause 5.1.3.			
	Clause reworded to simplify concept of Shallow Embankment.			
	Sub-clause added permitting excavation to a lesser depth than that specified for shallow embankment.			
3.5.2	New Fig 6(a) for Shallow Embankment added.			
	Previously clause 3.5.			
	Clause reworded to simplify concept of Cut/Fill Transition treatment.			
4.3	Fig 6(b) (previously Fig 6), showing Cut/Fill Transition treatment, redrawn.			
	Previously clause 4.2.1. Heading title changed.			

<b>Ed/Rev Number</b>	<b>Clause Number</b>	<b>Description of Revision</b>	<b>Authorised By</b>	<b>Date</b>
Ed 4/Rev 0 (cont'd)	4.4	Previously clause 4.3.		
	4.5	Previously clause 4.4.		
	4.6	New clause titled "Pre-splitting or Line Drilling"; previously part of clause 4.5.2.		
	4.7	Previously clause 4.5; previous sub-clauses 4.5.1 to 4.5.3 correspondingly renumbered.		
	4.7.1	Clarification added that cost of Building Condition inspection to be responsibility of contractor if no pay item provided in G36.		
	4.7.2	Previously clause 4.5.2.  Heading re-titled "Pre-splitting or Line Drilling Prior to Blasting".		
	5.1	Clause reorganised and reworded.		
	5.2	Previously clause 5.1.1.  Table title inserted for table of layer thickness and material properties in earth fill embankments.		
	5.2.1	Previously clause 5.1.1.1.  Fig 7 amended.  Material property requirements for fill at spill through abutment changed.  Maximum layer thickness increased to 300 mm.		
	5.3	Previously clause 5.1.2; previous sub-clauses 5.1.2.1 to 5.1.2.5 correspondingly renumbered.		
	5.3.2	Maximum dimension of rockfill material reduced to 300 mm.  Table title inserted for table of rock fill material properties.		
	5.3.3	Table title inserted for table of capping layer material properties.		
	5.4	Previously clause 5.2.  Embankment batter tolerances now shown in new Table 8.		
	5.5	Previously clause 5.3.  Restriction on placing rock facing higher than 1.5m below Designed Finish Level deleted.  Superfluous statement on provision of drainage layer deleted.		

<b>Ed/Rev Number</b>	<b>Clause Number</b>	<b>Description of Revision</b>	<b>Authorised By</b>	<b>Date</b>
Ed 4/Rev 0 (cont'd)	5.6	Previously clause 5.4. Fill adjacent to structures explicitly referred to as "Select Fill".		
	7.4	Characteristic deflection formula moved to this clause from Annexure.		
	Annex A	Notes to Tender Documenter (within boxed text) amended.		
	Annex A1	Table on survey requirements amended.		
	Annex A2	Previously Annex A4. Topsoil requirements moved to this Annex from previous Annex 3.		
	Annex A3	Material properties for earth fill at spill through abutments amended.		
		Previously Annex A7; retitled "Foundation Treatment".		
	Annex A4	Thickness requirement added for Type E5 Foundation Treatment "Drainage Layer". Combining previous Annex A3 and A6, and retitled.		
	Annex A6	Previously Annex A2.		
	Annex B	Pay Item P2: clarification to parts (a), (c) and (g); previous part (i) on placing and compaction of verge material deleted.		
Annex L	Previous clause 8 transferred to this Annexure.			
Ed 4/Rev 1	Global	"OEH" changed to "EPA".	GM, IC	15.04.13
	1.4	Definition of "Designed Floor Level" changed.		
	2.7.3	Names of government departments updated.		
	2.8.2	Maximum size of UZF other than SMZ material fixed at 100 mm, regardless of whether safety barriers, etc are to be installed.		
	2.8.5	New clause on spilled through bridge abutment fill material added.		
	3.2	Minor editing of Hold Point.		
	3.2.5, 3.4.5	Superfluous statement that drainage layer material must not contain clay fines or silt deleted.		
	3.2.5	Table 2 reworded.		
	3.3	Requirement for terraces to coincide with natural discontinuities deleted.		

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
	3.4.5  3.5.2  5.2.1  5.3.2  5.3.3  5.5  7.5.1  7.5.2  Annex A2.2  Annex A4  Annex A6 footnote (1)	Statement on placing of geotextile around drainage layer moved from item (d) to within item (c).  Plan view for Fig 6(b) added.  Clause on spilled through bridge abutment fill material requirements replaced by reference to clause 2.8.5.  Rock fill material property requirements moved to Table 6.  Apparent inconsistency for capping layer material property requirements clarified. Rock fill material property requirements moved to Table 7.  Requirement for graded filter layer deleted. Statement regarding wave action, etc deleted.  Table 12 on level tolerances reworded.  Clause reworded to clarify intent.  Item descriptions changed to improve clarity. Column titled “Test Condition” deleted and replaced by footnote. Footnotes reworded and rearranged.  Reinstated item for deduction for level nonconformity where overlying layer is not part of Contract.  Statement on $v_p$ amended.		
Ed 5/Rev 0	Global    1.1  1.2  1.4	Clauses rearranged and reworded to improve clarity.  References to G35 and G39 deleted.  Term “compaction routine” replaced with “compaction procedure”.  Heading title changed to “Scope”. Individual clauses edited.  Heading title changed to “Earthworks Process”.  Definitions of: <ul style="list-style-type: none"> <li>• “Bridging layer”, “Site won material”, “Steel furnace slag” added;</li> <li>• “Imported material”, “Spoil”, “Structural Treatment”, “Unsuitable material”, “Upper Zone of Formation”, “Working Platform” amended;</li> <li>• “Limit of Works” deleted.</li> </ul>	GM, CPS	18.09.14

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 5/Rev 0 (cont'd)	1.5	Headings added to form new sub-clauses 1.5.1 and 1.5.2. Earthworks Plan requirements edited for clarity.		
	1.6.2	Previous clauses 1.6.2 and 1.6.3 on survey reworded and combined together under clause 1.6.2.		
	2.1, 2.2	Individual sub-clauses rearranged between the two clauses.  Last paragraph of clause 2.2 (repeat of clause 1.5.1 item (d)) deleted.		
	2.3.2	Maximum height of topsoil stockpiles reduced to 2 m.		
	2.4	Headings added to form new sub-clauses 2.4.1 to 2.4.5.		
	2.5.1	“Limit of Works” replaced by “Site”.  Period of notice to Principal before use of spoil locations outside the Site changed from “7 days” to “5 working days”.		
	2.5.2	Clarification on payment for contaminated material added.		
	2.6	Clauses rearranged and rewritten to improve clarity.		
	2.7.1, 2.7.2	Requirements applicable only to specified borrow areas moved from clause 2.7.1 “General” to clause 2.7.2 “Nominated Borrow Areas”.		
	2.7.3	POEO Act added as a statutory requirement for compliance.  Lead time for submission of copies of approvals and consents to Principal before commencing work at contractor arranged borrow areas changed from “10 days” to “5 working days”.  Statement added that material brought on to site from contractor arranged borrow areas must comply with conditions attached to EPA resource recovery exemptions.		
	2.8	Heading title expanded to include spill through abutment zone material.		
	2.8.1	Heading added to form new sub-clause 2.8.1. Subsequent sub-clauses renumbered.		
	2.8.2	Previously sub-clause 2.8.1.  Clause reworded to delete option of mandating Upper Zone Material etc, to be imported.		

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 5/Rev 0 (cont'd)	2.8.2	Statement added to prohibit use of steel furnace slag aggregates in UZF, verges and spill through bridge abutment zones.		
	2.8.3	New sub-clause titled “Sampling and Testing”, combining existing requirements on sampling and testing of material in stockpiles with that from sub-clauses 6.1.2 and 6.2.  Subsequent sub-clauses renumbered.		
	2.8.5.1	Statement on modification of Selected Material reworded to clarify the intent.		
	2.8.6	CBR values for conformity for verge material in stockpiles changed to characteristic values.		
	3.2	Clarification note added on damage caused to foundation by earthworks plant after foundation treatment.		
	3.2	Individual clauses for each of the treatment types rewritten to improve clarity.  Statement added that foundation treatment required in medians if so specified in Annex A6.  Applicable Pay Item for each type of treatment added.		
	3.2.2	Figure 3(b) – dimension arrow changed to between top of bridging layer and underside of SMZ. Clause changed to suit.  Statement added that Principal may require trial section for bridging layer.  Pay Item reference changed.		
	3.2.5	Minimum distance between top of Type E5 drainage layer and underside of SMZ added. Dimension arrow and accompanying note for the same added to Figure 3(e).  Use of steel furnace slag aggregates in drainage layer prohibited.  Specified strength class and filtration class of geotextile changed to “complying with R63”.		
	3.2.6	New Type E6 earth fill embankment foundation treatment added.  “Other Treatments” now clause 3.2.7.		
	3.3	Heading title changed to indicate more clearly scope of clause.		

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Ed 5/Rev 0 (cont'd)	3.4	Clarification on level for excavation, whether Designed Floor Level or Foundation Level.  Statement added that samples for CBR and PI tests may be obtained from test pits prior to reaching required excavation level.		
	3.4	Statement added that foundation treatment required in medians if so specified in Annex A6.		
	3.4.1 to 3.4.5	Individual clauses for each of the treatment types rewritten to improve clarity.  Applicable Pay Item for each type of treatment added.		
	3.4.1	Maximum depth of ripping in Type C1 treatment limited to 400 mm added.  Figure 5(a) – “Foundation Level” deleted (not relevant).		
	3.4.2	Statement added to determine CBR and PI values of material in cutting floor for Type C2 treatment only where directed by the Principal.  Requirement in Type C2 treatment to “loosen and recompact” floor of cutting changed to “compact with not less than 6 passes of vibrating roller”.		
	3.4.5	Specified strength class and filtration class of geotextile changed to “meeting the requirements of R63”.  Use of steel furnace slag aggregates in drainage layer prohibited.		
	3.5.2	Statement added that cut/fill transition treatment required in medians if so specified in Annex A6.  Figure 6(b) – extent of shallow embankment corrected.		
	4.1	Individual clauses rearranged. Headings added to form new sub-clauses 4.1.1 to 4.1.3, incorporating the contents of previous clause 4.2.  Subsequent clauses renumbered.		
	4.3	Text in Table 3 reworded to improve clarity.  Footnote added that bench widths must not be less than that shown on Drawings.		
	4.5	Headings added to form new sub-clauses 4.5.1 and 4.5.3.		



Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 5/Rev 0 (cont'd)	4.5.1	Requirement that line drilling boreholes must be straight, parallel and in designed plane of batter added.		
	4.5.3	Clause moved here from previous clause 4.7.2.  Statement added that burden blasting must not damage batter face.		
	4.6.1	Statement added that Hold Point in G36 for submission of Vibration and Airblast Management Sub-Plan and Building Condition Inspection Reports applies.  Process held in Hold Point changed to “start of each blast”. Submission details amended.		
	4.6.1	Notification of blasting extended to include “any other relevant parties”.  Clarification of payment for Building Condition Reports added.		
	4.6.3, 4.6.4	Clauses on control of airblast and ground vibration previously located at back of specification moved to follow immediately clause 4.6.2.		
	4.6.3	Requirement to comply with criteria in ANZECC to minimise annoyance due to blasting deleted (duplicate clause in G36).  Statement that verification of compliance with ANZECC criteria to be in accordance with AS 2187.2 Appendix J, moved to G36.  “recognised testing facility” changed to “NATA accredited testing facility or manufacturer’s facility approved by the Principal”.		
	4.6.3, 4.6.4	Monitoring to be carried out by NATA accredited personnel deleted, as NATA does not accredit personnel.		
	5.1	Individual clauses rearranged. Headings added to form new sub-clauses 5.1.1 to 5.1.3.		
	5.2	Individual clauses rearranged. Headings added to form new sub-clauses 5.2.1 and 5.2.2. Previous clause 5.2.1 becomes 5.2.3.		
	5.2.3	Figure 7: dimension of bench width and notes to figure added.		
	5.3	Individual clauses rearranged; headings added to form new sub-clauses or replace existing sub-clauses.		

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date	
Ed 5/Rev 0 (cont'd)	5.3	Previous sub-clause 5.3.4 on minimum thickness of Select Fill within rock fill embankments moved to B30 and R11.			
	5.3.2	Requirement added for geotextile to be placed over foundation area prior to placing rock fill where shown on Drawings or directed by the Principal.			
	5.3.2	Requirement to hand place rock around columns or retaining wall moved here from sub-clause 5.2.3 (previously sub-clause 5.2.1).			
	5.3.4	Heading title changed.			Thickness requirement for rock capping layer moved to Annex A4.
					Table 7 – Percentage passing 19.0 mm sieve limits increased to “0 – 15%”.
					Requirement for geotextile as separation between rock capping layer and overlying earth fill added.
					Minimum distance between top of capping layer and bottom of SMZ decreased to 400 mm and 800 mm.
	5.3.5	Previous sub-clause deleted, and requirements moved to sub-clauses 5.3.2 and 5.3.4 and B30.			
	5.4	Heading title changed. Text in Table 8 reworded to improve clarity.			
	5.5	Individual clauses rearranged. Headings added to form new sub-clauses 5.5.1 to 5.5.4.			
	5.5.3	Requirement for geotextile as separation between earth fill and rock facing added.			
	5.6	Heading title changed.			Select Fill against structures to be in accordance with the Drawings in the first instance, otherwise to be in accordance with B30, R11 and R58/R59 as appropriate.
					“Bridge structures” replaced by “retaining walls and bridge abutments”.
6.1.1	Statement added that UZF layer required in medians if so specified in Annex A6.				

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 5/Rev 0 (cont'd)	6.1.2	Requirement for Selected Material to be stockpiled and tested moved to clause 2.8.3. Previous Table 10 on sampling frequency for stockpiled Selected Material moved to Annex L.		
	7.2, 7.3, 7.4	Heading titles changed to more accurately reflect the content.		
	7.3	New clause titled “Sampling and Testing for Compaction Conformity”, incorporating parts of previous sub-clauses 7.2.1 and 7.2.2. Headings added to form sub-clauses 7.3.1 to 7.3.7.		
	7.3.3	Clause on applicable test methods for field density rewritten to clarify requirements.		
	7.4	New clause titled “Earth Fill Compaction Conformity Criteria” incorporating parts of previous sub-clauses 7.2.1 and 7.2.3.  Table 10 location details amended to clarify requirements.		
	7.5	Previously clause 7.3; title changed to “Rock Fill Placing Conformity”.		
	7.6	Previously clause 7.4 “Deflection Testing”.		
	7.6.1	Clarified that proof rolling to be carried out only when directed.		
	7.6.2	Deflection testing by Benkelman Beam may be delayed due to adverse weather condition added.		
	7.7	Previously clause 7.5 “Level Control”.		
	7.7.1	Level tolerances in Table 11 changed.		
	7.7.2	Clarified volume to which deduction for out of tolerance is applied.		
	Annex A	Notes to guide Tender Documenter differentiated from notes to clarify details in table.		
	Annex A1	Table edited. Survey of surface after placing of imported material added to table.		
	Annex A2.1	Table edited.		
	Annex A2.2	Table column heading titles changed.  CBR requirement for Selected Material and verge material increased to allow for change from minimum value to characteristic value.  PI lower limit of 6 added for spill through bridge abutment fill material at waterway crossings.		

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 5/Rev 0 (cont'd)	<p data-bbox="320 210 469 241">Annex A2.2</p> <p data-bbox="320 297 448 329">Annex A3</p> <p data-bbox="320 620 448 651">Annex A4</p> <p data-bbox="320 672 448 703">Annex A6</p> <p data-bbox="320 875 432 907">Annex B</p>	<p data-bbox="512 210 979 277">Note (4) to table amended to clarify application rate requirement for binder.</p> <p data-bbox="512 297 1051 432">Minimum distance from top of bridging layer to underside of SMZ increased to 900 mm. Tolerances added to thickness of bridging layer.</p> <p data-bbox="512 452 1054 519">Minimum distance from top of drainage layer to underside of SMZ added.</p> <p data-bbox="512 539 1018 607">Minimum distance and thicknesses associated with Treatment Type E6 added.</p> <p data-bbox="512 627 979 658">Thickness of rock capping layer added.</p> <p data-bbox="512 678 1026 768">New annexure for specifying whether foundation treatments/structural treatments required in medians</p> <p data-bbox="512 788 1032 855">Previous Annex 6 on blasting now becomes Annex 7.</p> <p data-bbox="512 875 1042 965">Statement added that rates must include cost of testing, where not paid under Primary Testing.</p> <p data-bbox="512 985 1011 1052">Pay item descriptions changed to improve clarity.</p> <p data-bbox="512 1072 1023 1184">Pay item P1.1 – clarification added that payment for placing of topsoil for revegetation purposes is made under R178.</p> <p data-bbox="512 1205 1011 1339">Pay item P1.2 – note added that if bank volume cannot be measured, the Principal will determine conversion factor for loose volumes.</p> <p data-bbox="512 1359 1043 1494">Pay item P2 “General Earthworks (Cut/Fill)” - method of determining excavation volume reworded to improve clarity; - scope clarified.</p> <p data-bbox="512 1514 1019 1581">Pay item P3 – inclusions and exclusions in rate amended.</p> <p data-bbox="512 1601 952 1668">Pay item P5 – “Limit of Works area” changed to “Site”.</p> <p data-bbox="512 1688 1011 1845">Pay item P6 – notes added that if bank volume cannot be measured, the Principal will determine conversion factor for loose volumes, and rate must include cost of classification of waste material.</p> <p data-bbox="512 1865 987 1933">Pay item P7 – individual sub-pay item descriptions changed to improve clarity.</p>		

<b>Ed/Rev Number</b>	<b>Clause Number</b>	<b>Description of Revision</b>	<b>Authorised By</b>	<b>Date</b>
Ed 5/Rev 0 (cont'd)	Annex B	<p>Previous pay item P7.1 (for both Types E1 and C1) separated into pay items P7.1 (for Type E1) and P7.2 (for Type C1).</p> <p>Previous pay item P7.2 (for Type E2) now becomes pay item P7.3. Unit of measurement for pay item P7.3(b) for imported material changed from “tonnes” to “cubic metres”. Rate to allow for extra material required due to penetration into underlying surface. Clarification added that geotextile is paid under P7.5(a).</p> <p>New pay item P7.4 (for Type C2) added. Unit of measurement for pay item P7.4(b) for imported material changed from “tonnes” to “cubic metres”.</p> <p>Previous pay item P7.4 (for both Types E5 and C5) separated into pay items P7.6 (for Type E5) and P7.7 (for Type C5). Unit of measurement for pay item P7.3(b) for imported material changed from “tonnes” to “cubic metres”. Rate to allow for extra material required due to penetration into underlying surface. Clarification added that geotextile is paid under P7.5(a).</p> <p>New pay item P7.8 for Type E6 added.</p>		
	Annex C1	Descriptions in Schedule of Hold Points amended.		
	Annex C3	Schedule of Identified Records items amended.		
	Annex L	<p>Title expanded to include “work activities”.</p> <p>Individual items within table rearranged to more closely reflect work sequence.</p> <p>Table L.2 moved here from previous clause 6.1.2.</p>		
	Annex M	Referenced documents updated.		
Ed 5/Rev 1	Global	References to “Roads and Maritime Services” or “RMS” changed to “Transport for NSW” or “TfNSW” respectively.	DCS	22.06.20





# EARTHWORKS

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## FOREWORD

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### REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW R44 Edition 5 Revision 0.

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

### PROJECT SPECIFIC CHANGES

Any project specific changes are indicated in the following manner:

- (a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. ***Additional Text***.
- (b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.



# **TfNSW QA SPECIFICATION R44**

## **EARTHWORKS**

### **1 GENERAL**

#### **1.1 SCOPE**

This Specification sets out the requirements for earthworks for roadworks, which aims to create a stable formation suitable for a pavement to be constructed upon, using materials from within the site or, if suitable materials are not available from within the site, using suitable materials from offsite.

The earthwork formation is constructed by the controlled excavation, selection and placement of materials, and the use of Foundation Treatments and Structural Treatments, to achieve the best possible support for the road pavement.

Earthworks is carried out in conjunction with other work such as surface and subsurface drainage works and environmental control measures.

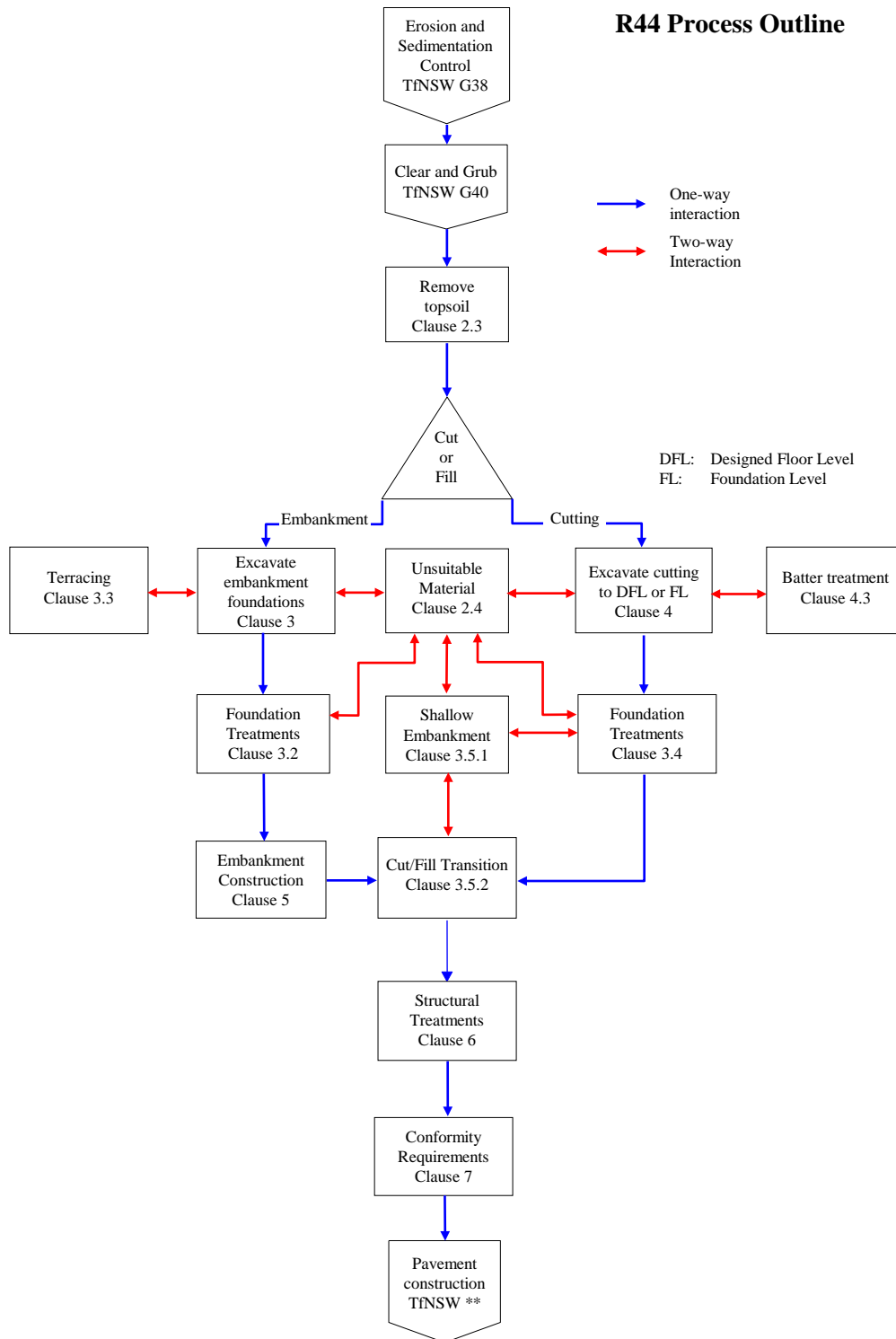
## 1.2 EARTHWORKS PROCESS

The earthworks process is summarised in Table R44.1.

**Table R44.1 – Summary of Earthworks Process**

Reference	Description
Clause 1	<p><b>General</b></p> <p>Prepare and submit for consideration an EARTHWORKS PLAN and PROJECT QUALITY PLAN. Set out the earthworks by survey, and carry out surveys for process control and determining quantities. Protect the environment and the earthworks by installing and maintaining effective drainage, and control measures for erosion and sedimentation.</p>
Clause 2	<p><b>Materials</b></p> <p>Manage the use of materials from within the Site, stockpile areas, remove and stockpile topsoil, remove, replace or treat any unsuitable material, spoil or borrow, and import materials as necessary.</p>
Clause 3	<p><b>Foundations</b></p> <p>Prepare and compact the floors of cuttings, cut/fill transitions and foundations for embankments, including subsurface drainage, and the use of bridging layers, stabilisation, geotextiles/geogrids, and drainage layers as Foundation Treatments.</p>
Clause 4	<p><b>Cuttings</b></p> <p>Excavate cuttings with specified benches, drainage and batter tolerances. Blasting of rock may be required.</p>
Clause 5	<p><b>Embankments</b></p> <p>Place and compact suitable material to the specified dimensions and batter tolerances, including subsurface drainage and the use of rock facing, Select Fill against structures, stabilisation, and geotextiles/geogrids.</p>
Clause 6	<p><b>Structural Treatments</b></p> <p>Where shown on the Drawings, place and compact Selected Material and verge material of the specified quality over the full length of the earthworks, or provide other geotechnical treatments as required.</p>
Clause 7	<p><b>Conformity Requirements</b></p> <p>Complete the earthworks to the specified quality and tolerances. Undertake all inspection and testing necessary to demonstrate that the quality requirements of this Specification are achieved.</p>

The earthworks process outline by activity sequence is given in Figure R44.1.



**Figure R44.1 – Earthworks Process Outline By Activity Sequence**

**Notes:**

- (a) Notwithstanding that some clearing and grubbing may be necessary before erosion and sedimentation control can commence, staged construction of drainage works including sedimentation control, culverts, catch drains and ancillary activities must generally precede clearing and grubbing activities.
- (b) Pavement construction must be carried out in accordance with the appropriate TfNSW specifications (shown as “TfNSW \*\* ” above) included within the Contract.

### 1.3 STRUCTURE OF SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

#### 1.3.1 Project Specific Information

Details of work specific to this Contract are shown in Annexure R44/A.

#### 1.3.2 Measurement and Payment

The method of measurement and payment is detailed in Annexure R44/B.

#### 1.3.3 Schedules of HOLD POINTS, WITNESS POINTS and Identified Records

The schedules in Annexure R44/C list the **HOLD POINTS** and **WITNESS POINTS** that must be observed. Refer to Specification TfNSW Q for the definitions of **HOLD POINTS** and **WITNESS POINTS**.

The records listed in Annexure R44/C are **Identified Records** for the purposes of TfNSW Q Annexure Q/E.

#### 1.3.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements shown in Clause 1.5 and must be implemented.

#### 1.3.5 Minimum Frequency of Testing

The Inspection and Test Plan must nominate the proposed testing frequency to verify conformity of the item, which must not be less than the frequency specified in Annexure R44/L. Where a minimum frequency is not specified, nominate an appropriate frequency. Frequency of testing must also conform to the requirements of TfNSW Q.

#### 1.3.6 Referenced Documents

Unless specified otherwise or is specifically supplied by the Principal, the applicable issue of a referenced document, is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 2350). For convenience, the full titles are given in Annexure R44/M.

### 1.4 DEFINITIONS

The terms “you” and “your” mean “the Contractor” and “the Contractor’s” respectively.

The following definitions apply to this Specification:

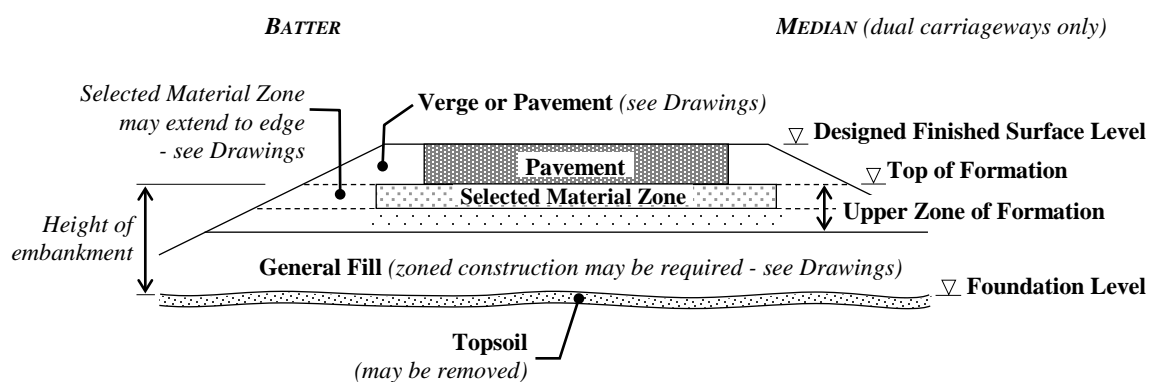
**Borrow site** An area (either within or outside the Site), other than cuttings and specified excavations, from which material may be excavated for use in the Works.



<b>Bridging layer</b>	A layer located at the foundation of the formation in an embankment constructed from granular earth fill material or rock fill material with strong mechanical interlock. The purpose of the bridging layer is to provide a stable platform upon which a conforming earthworks layer can be constructed.
<b>Capping layer</b>	A layer of graded rock material, placed over rock fill as a transition layer between rock fill layers and the overlying earth fill layer(s) in an embankment.
<b>Contaminated material</b>	Material classified as “Special”, “Hazardous” or “Restricted Solid” Waste in accordance with EPA Waste Classification Guidelines.
<b>Cutting</b>	An earth or rock excavation within the Site that is made below an existing surface to create the road formation.
<b>Cut/Fill Transition Zone</b>	An area of special formation treatment where the road formation transitions from a cutting to an embankment, as shown in Figure R44.6(b), and described in Clause 3.5.2.
<b>Designed Floor Level</b>	The level of excavation in a cutting at the underside of the Selected Material Zone.
<b>Drainage layer</b>	A layer located at the foundation of the formation in an embankment or within a cutting, constructed of free draining material with grading as specified in Clauses 3.2.5 and 3.4.5. The purpose of the drainage layer is to provide a pathway for the free drainage of excess water from the foundations of embankments or cuttings. The drainage layer is usually wrapped in geotextile to prevent its contamination or blockage over time from adjacent fine grained material.
<b>Earthworks</b>	The activities covered by this Specification.
<b>Earth fill</b>	Material consisting of fine material and coarse particles distributed throughout the layer filling any voids so that when compacted produces a dense stable embankment.
<b>Embankment</b>	An earth or rock fill structure above an existing and/or excavated surface to create the road formation.
<b>Floor of cutting</b>	The trimmed base of the cutting excavation at either the level of the Designed Floor Level or at the level of the Foundation Level depending on the type of Foundation Treatment.
<b>Formation</b>	The earthworks structure including all Foundation and Structural Treatments on which the road pavement will be constructed.
<b>Foundation Level</b>	The level from which the formation is constructed. This is the level achieved after excavation is undertaken for Foundation Treatments.
<b>Foundation Treatment</b>	A special layer or treatment zone at the base of a formation for the purpose of reinforcing, strengthening or draining the foundation.
<b>General fill</b>	Embankment material other than for Foundation or Structural Treatments.
<b>Imported material</b>	Material obtained from sources other than that generated by excavation in cuttings and other specified excavations within the Site.

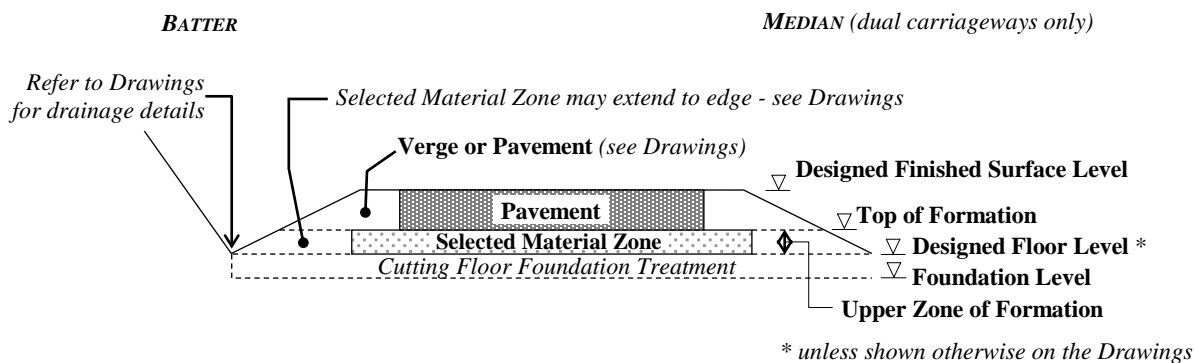
<b>Joint survey</b>	See Specification TfNSW G71. A survey carried out in the presence of, or in conjunction with, the Principal's surveyor.
<b>Road Formation</b>	Same as Formation.
<b>Rock fill</b>	Material composed of hard, sound, durable rock with only a small amount of fine particles, which when placed and compacted produces an embankment deriving its stability from the mechanical interlock of the coarser particles, rather than from the compaction of finer material around the coarser particles.
<b>Roller pass</b>	Compactive effort of a single movement of the roller over all segments of the Lot nominated in the PROJECT QUALITY PLAN.
<b>Select Fill</b>	Fill material of specified quality placed against or adjacent to structures (refer Clause 5.6). This material is different from Selected Material (see below).
<b>Selected Material</b>	Material placed in the Selected Material Zone of the quality specified in Clause 2.8.5 and Annexure R44/A2.2.
<b>Selected Material Zone</b>	The top part of the Upper Zone of Formation consisting of Selected Material – see Figures R44.2 (a) and (b).
<b>Shallow Embankment</b>	A part of an embankment where the height from the Stripped Surface Level to the Top of Formation is less than the height specified in Annexure R44/A4.
<b>Site won material</b>	Material that is obtained from excavations within the Site.
<b>Spoil</b>	Spoil is material from excavations under the Contract which is surplus to that required to complete the Works as specified, and/or material from excavations under the Contract whose quality renders it unacceptable for incorporation in the Works. Spoil includes contaminated material which needs to be disposed of outside the Site.
<b>Steel furnace slag</b>	Steel furnace slag is a waste by-product in the production of steel using the Basic Oxygen Steel (BOS) or Electric Arc Furnace (EAF) processes. Steel furnace slag does not include any bag house dust or air pollution control residues.
<b>Stripped Surface Level</b>	Level of the surface after stripping of topsoil.
<b>Structural Treatment</b>	A special layer or zone within the upper part of the formation for the purpose of strengthening the upper part of the formation.
<b>Topsoil</b>	Topsoil is natural surface soil that may contain organic matter.

<b>Unsuitable material</b>	<p>Unsuitable material is material occurring:</p> <ul style="list-style-type: none"> <li>• for cuttings, below the Designed Floor Level (or below the Foundation Level where excavation to that level is required as part of Foundation Treatment);</li> <li>• for embankments, below the Stripped Surface Level;</li> </ul> <p>which the Principal deems to be unsuitable for embankment or pavement support in its existing condition in accordance with Clause 2.4.</p> <p>It excludes materials excavated to Foundation Level for Foundation Treatment Types C2, C3(II) and C5.</p> <p>The Principal will deem any contaminated material occurring below the Designed Floor Level (or Foundation Level) of cuttings and below the Stripped Surface Level beneath embankments to be unsuitable material if the contaminated material cannot be left in place.</p>
<b>Upper Zone of Formation</b>	<p>The top part of the formation in which materials of a specified higher quality are required, as shown in Figures R44.2 (a) and (b). The Upper Zone of Formation includes the Selected Material Zone. The depth and quality of the materials are specified in Annexure R44/A4 and R44/A2.2 respectively.</p>
<b>Upper Zone Material</b>	<p>Material of specified quality used in the Upper Zone of Formation.</p>
<b>Verge material</b>	<p>Material placed in the zone adjacent to the edge of the pavement which is subjected to occasional traffic from vehicles leaving the pavement, of the quality specified in Annexure R44/A2.2.</p>
<b>Working platform</b>	<p>A layer located at the foundation of the formation in an embankment or within a cutting, constructed by stabilising the insitu material at Foundation Level or using imported stabilised material. The purpose of the working platform is to provide a stable platform upon which a conforming earthworks layer can be constructed.</p>



[See Figures R44.3(a) to (e) for details of Foundation Treatment types for embankments]

**Figure R44.2(a) – Embankment Nomenclature**



[See Figures R44.5(a) to (d) for details of Foundation Treatment types for cuttings]

**Figure R44.2(b) – Cutting Nomenclature**

## 1.5 EARTHWORKS PLAN

### 1.5.1 Plan Requirements

The EARTHWORKS PLAN must address all requirements and constraints imposed by the Specification, the physical conditions at the Site and your proposed methods of working. The EARTHWORKS PLAN must include details of the following:

- (a) All excavations required for the Works, including: Cuttings, Foundation Treatments, Shallow Embankments, Cut to Fill Transitions and trenches (such as that for drainage pipes or utility conduits).
- (b) The types, locations and quantities of all materials required for the Works or to be spoiled, including foundation treatment materials, earth fill, rock fill, spill through bridge abutment zone material, rock for rock facing and capping layers, Upper Zone material (including Selected Material and that at Shallow Embankments and Cut/Fill Transitions), verge material, Select Fill, topsoil, unsuitable material, uncontaminated spoil, contaminated spoil and imported materials.
- (c) The locations and quantities of all materials to be sourced from within the Site and the staging and excavation sequence that ensures that each of the material types listed in item (b) above is available when needed. Locations and quantities must be cross-referenced to the excavations listed under item (a) above.
- (d) A mass haul diagram and/or table detailing the types and quantities of each type of material to be excavated from each cutting or borrow area, and the locations within the Site for placement of the materials.
- (e) Details of the processes for winning, sorting, isolating, processing, blending and placement of the materials listed under Item (b) above, to meet the requirements of this Specification, including maximum particle dimension, grading, durability and other soil properties.
- (f) A preliminary assessment of stockpiling requirements and the quantities that can be placed in nominated stockpile areas, and any additional potential stockpile areas required (refer Clause 2.6).

- (g) Procedures proposed for procuring and managing materials from borrow areas or imported materials where applicable (refer Clause 2.7).
- (h) Preliminary identification of zones of potentially unsuitable material, and the management of their re-incorporation and/or disposal (refer Clause 2.4).
- (i) Where applicable, procedures for the control and incorporation of potentially deleterious materials such as acid sulfate rock and high swelling clays in zoned embankments.
- (j) Procedures proposed for the treatment of foundations in cuttings and embankments (refer Clause 3).
- (k) Procedures to ensure that the specified compaction and moisture content have been achieved over the full depth of each layer and that the specified layer thickness is not exceeded (refer Clauses 5, 6 and 7).
- (l) Procedures for protection of earthworks and dealing with over-wet materials and over-dry materials (refer Clause 1.7).
- (m) Procedures to prevent damage to structures from hammering or ripping during rock excavation, from compaction using vibrating plant, or from blasting.

### **1.5.2 Plan Submission and Updating**

Notwithstanding the staged submission provisions of Specification TfNSW Q, provide the EARTHWORKS PLAN in its entirety with the first stage submission of the PROJECT QUALITY PLAN.

Amend the EARTHWORKS PLAN in accordance with the requirements of Specification TfNSW Q.

Submit to the Principal an updated EARTHWORKS PLAN:

- (a) at intervals not exceeding three months during the currency of the Contract;
- (b) within two weeks of any change of the EARTHWORKS PLAN for any Milestone or for the Works; and
- (c) within two weeks of receipt of the Principal's determination in respect of the earthworks construction, if such determination alters any details in the EARTHWORKS PLAN.

An updated EARTHWORKS PLAN must show:

- (i) the same level of detail as specified for the original EARTHWORKS PLAN;
- (ii) the "as-built" EARTHWORKS PLAN in respect of all work completed up to the date of updating; and
- (iii) reasons for any deviation from the previously submitted EARTHWORKS PLAN, and actions if any, to correct any deviation within your control.

## **1.6 SURVEYING**

### **1.6.1 Setting Out of Earthworks**

Mark on the ground the position and extent of all cuttings and embankments shown on the Drawings, and any cut/fill transitions, using pegs and batter profiles or equivalent, prior to commencement of construction.

Setting out must take into account any formation widening necessary to accommodate the design requirements.

Where this Specification refers to dimensions or setting out relevant to the underside of the Selected Material Zone, and the Drawings do not provide for a Selected Material Zone, adopt the dimensions for setting out relevant to the underside of the pavement.

### **1.6.2 Joint Survey**

Carry out the surveys listed in Annexure R44/A1, for determination of quantities for payment or for process control.

Where specified in Annexure R44/A1 or directed by the Principal, the survey must be carried out as a joint survey in accordance with Specification TfNSW G71.

Where specified in Annexure R44/A1, the Survey Report must include an electronic file in a format suitable for creating accurate models using standard TfNSW CADD software.

## **1.7 PROTECTION OF EARTHWORKS**

Your responsibility for care of the Works includes the protection of earthworks. Specifically:

- (a) Install and maintain effective erosion and sedimentation control measures in accordance with Specifications TfNSW G36 and G38.
- (b) Provide and maintain measures for drainage of the working areas without scouring from the surface run-off. Do not allow water to pond in the working areas resulting in wetting up of the existing pavement or formation or foundation material, except where ponding is off the formation and forms part of a planned erosion and sedimentation control system.
- (c) When rain is likely, or when no work is planned for the following day in a particular area being worked, take precautions to minimise any ingress of water into the earthworks material. Seal off ripped material remaining in cuttings, and material placed on embankments, using a smooth drum roller.
- (d) Should earthworks material become over-wet (above the specified moisture content for compaction), replace and/or dry out the material at your own cost. Refer also to Clauses 2.4 and 7.2.
- (e) Do not allow earthworks material in embankments to dry out to the point where excessive shrinkage occurs, and the surface is pulverised by traffic generating excessive dust.

## **2 EARTHWORKS MATERIALS**

### **2.1 GENERAL**

General earthworks includes excavation in all types of material, both earth and rock, and placing it in embankments or disposing of it in areas other than embankments.

When surplus excavated material from other works under the Contract (such as trenching for drainage pipes or utility conduits) is used in the construction of embankments or backfilling of trenches, the requirements of this Specification also apply to such material.

You are responsible for:

- (a) any of your assumptions made in relation to the nature and types of the materials as encountered in excavations or imported, and the bulking and compaction characteristics of all such materials which are then incorporated in the Works;
- (b) determining suitable sources of material and any processing needed to satisfy the quality requirements;
- (c) the design, and the cost of construction and/or maintenance of all tracks, roads, haul roads, pads and other earthworks structures required for the proper execution of the Works.

## **2.2 MATERIALS MANAGEMENT**

Manage your procurement of materials, whether obtained from sources external to the Site or from nominated sources or from within the Site, to ensure sufficiency of materials of the specified quality.

Unless otherwise specified, do not use imported material in the Works until all material of suitable quality available from the cuttings within the Site has been placed, or has been allocated to be placed, in the formation.

If you cause a deficiency of material for embankment construction and other specified materials, by electing not to use acceptable material from excavations in the embankments or by constructing embankments with dimensions other than those shown on the Drawings or authorised in accordance with Clause 5.4, you must make good that deficiency from sources of material meeting the quality requirements specified in Clause 5.

The cost of making good such deficiency of material will be borne by you.

## **2.3 TOPSOIL**

### **2.3.1 Removal of Topsoil**

Commence removal of topsoil on any section of the Works only after erosion and sedimentation controls have been implemented and clearing, grubbing and removal of cleared materials has been completed on that section of the Works.

Do not remove topsoil in locations where a bridging layer is to be constructed in accordance with Clause 3.2.2, unless directed otherwise by the Principal.

Where specified in Annexure R44/A2.1 or where directed by the Principal, after removal of the topsoil:

- (i) stockpile the topsoil within the Site separately from other materials and clear of the Works for use in revegetation, or
- (ii) stockpile the topsoil as a windrow longitudinally and adjacent to the toe of embankment batter, or
- (iii) spoil the topsoil outside the Site in accordance with Clause 2.5.1; or

- (iv) if the topsoil has been identified as contaminated material, spoil the topsoil in accordance with Clause 2.5.2.

### **2.3.2 Topsoil Stockpiles**

Locate your topsoil stockpiles in accordance with Clause 2.6.

Before stockpiling topsoil, carry out a survey in accordance with Specification TfNSW G71 to determine the surface levels at each stockpile area, at sufficient positions to later determine the volumes of topsoil placed at the location. When shown in Annexure R44/A1, the survey must be a joint survey in accordance with Clause 1.6.

Topsoil stockpiles must:

- (a) be free from subsoil, other excavated materials, contaminated materials, refuse, clay lumps and stones, timber or other rubbish;
- (b) be trimmed to a regular shape to facilitate quantity measurement, and with a height not exceeding 2 m and batter slopes not steeper than 2H:1V;
- (c) have their batters track rolled or stabilised by other means acceptable to the Principal; and
- (d) be seeded with a sterile cover crop in accordance with Specification TfNSW R178, to encourage vegetation cover. Seeding must be carried out progressively within seven days of completion of each 500 m<sup>2</sup> of exposed batter face.

### **2.3.3 Survey after Removal of Topsoil**

After removing the topsoil, determine the surface levels in each cutting and embankment at sufficient locations to determine the volume of excavation for general earthworks and the volume of unsuitable material.

When shown in Annexure R44/A1, the survey must be a joint survey in accordance with Clause 1.6.

## **HOLD POINT**

Process Held:	Any works which will alter the ground surface as surveyed.
Submission Details:	At least three working days before the proposed date for altering the surfaces, submit a Survey Report of the existing surface levels, and a notification that the set out specified in Clause 1.6.1, including set out of the cut/fill intersection point and extent of the Transition Zone as specified in Clause 3.5, have been carried out.
Release of Hold Point:	The Principal will inspect the surfaces and set out, and may direct further action prior to authorising the release of the Hold Point. Further action may include altering the limits of the cut/fill transition.

## **2.4 UNSUITABLE MATERIAL**

### **2.4.1 Identification and Removal of Unsuitable Material**

After the stripping of topsoil covering each embankment foundation, or upon reaching the Designed Floor Level or Foundation Level of cuttings, subsequent earthworks processes are held (refer to Hold Points in Clauses 3.2 and 3.4) to allow inspection of the foundation.



Where unsuitable material (as defined in Clause 1.4) is found, such unsuitable material must be excavated to the extent directed by the Principal.

Promptly notify the Principal of any areas of the foundation or any layer within the formation that rut excessively, yield or show signs of distress or instability.

### **HOLD POINT**

Process Held: Replacement of each Lot of unsuitable material.

Submission Details: Notification that unsuitable material has been removed as directed.

Release of Hold Point: The Principal will inspect the excavation and may direct removal of further material as unsuitable material prior to authorising the release of the Hold Point.

#### **2.4.2 Use or Disposal of Unsuitable Material**

Use any material that has been removed as unsuitable by placing it in embankments in accordance with Clause 5, unless directed to spoil the material in accordance with Clause 2.5.

Remove from the Site any contaminated materials that cannot be treated and re-used within the Works or stockpiled at the Site, and dispose of such material in accordance with Clause 2.5 of this Specification and Specification TfNSW G36.

#### **2.4.3 Replacement of Unsuitable Material**

Replace any material that has been removed as unsuitable material with either:

- (a) suitable material in accordance with Clause 5.1; or
- (b) if directed, with foundation treatments in accordance with Clause 3 or as shown on the Drawings.

#### **2.4.4 Unsuitable Material from Inappropriate Construction Activities**

If you allow any material to become unsuitable because of your inappropriate construction activities, all costs associated with reworking or replacing such unsuitable material must be borne by you.

Examples of inappropriate construction activities include poor surface drainage, restricted or inoperative subsurface drains, contamination, excessive sized construction plant where the imposed load exceeds the material strength, poorly maintained construction plant allowing leakage of oils and water onto the formation, and leaving the surface unsealed allowing moisture ingress during wet weather.

#### **2.4.5 Quantity Measurement of Unsuitable Material**

Before and after removal of unsuitable material, carry out a survey in accordance with Specification TfNSW G71 to determine the surface levels at sufficient locations to later determine the volume of unsuitable material removed. Where shown in Annexure R44/A1, the survey must be a joint survey in accordance with Clause 1.6.

Alternatively, the Principal may agree to determination of volume by manual measurement (with a tape measure or other means) and calculation.

## **2.5 SPOIL**

### **2.5.1 Non-contaminated Materials**

Except for contaminated materials, dispose of spoil generated from the Work under the Contract in the manner and at locations authorised or agreed to by the Principal. Use up all available areas within the Site before proposing alternative locations.

Dispose of non-contaminated material by the following means:

- (a) flatter batter slopes being provided on embankments; or
- (b) uniform widening of embankments; or
- (c) stockpiling within the Site; or
- (d) disposal at an approved location outside the Site.

Embankment widening or batter flattening work is deemed to form part of the embankment construction and must be carried out in accordance with Clause 5. Spread and compact the spoil as specified in Clauses 5 and 7 for material in embankments. Maintain effective drainage for the whole of the embankment.

If you propose to use spoil locations outside the Site, obtain all the necessary approvals and consents, including environmental approvals, and provide copies of them to the Principal at least 5 working days prior to commencing the disposal of material at these off site locations.

Payment for disposal of spoil comprising non-contaminated material within the Site is deemed to be included in the rates generally. Where an approved location for disposal of spoil comprising non-contaminated material is outside the Site, payment for disposal of spoil at the approved location will be made under Pay Item R44P6 or Pay Item R44P1.2.

### **2.5.2 Contaminated Materials**

Contaminated materials must be managed, stockpiled and/or removed from the Site in accordance with TfNSW G36. If disposal methods and sites are not specified, it is your responsibility to determine the method(s) and location(s) for disposal of the contaminated material.

Notify the Principal at least 24 hours prior to excavation of the contaminated material, and removal of any contaminated material from the Site, and provide details of the proposed method and location of disposal.

Payment for excavation and stockpiling of contaminated material on site will be made under Pay Item R44P1.2 or Pay Item R44P2; or where the contaminated material is contained in unsuitable material, under Pay Item R44P4.

Additional payment will be made under Pay Item R44P8 for the identification, treatment, classification in accordance with EPA Waste Classification Guidelines and disposal of the contaminated material at sites legally authorised to accept the contaminated material.

Treatment and disposal of contaminated material caused by your operations will be at no cost to the Principal.

## **2.6 STOCKPILE AREAS**

Locate your stockpiles at the areas nominated in the Drawings or Specifications.

Where no such areas are nominated, or if you propose to locate your stockpiles in areas other than those nominated, submit your proposal with details of the maximum dimensions of the proposed stockpiles, for concurrence by the Principal at least 10 working days before stockpiling is due to commence. Obtain all the necessary approvals and consents, including environmental approvals, and provide copies of them to the Principal.

Set up the stockpiles in a manner that minimises any damage to natural vegetation and trees, maintaining the existing surface drainage and such that the stockpiled material is accessible for carting away at any time.

The Principal will only consider requests for new stockpile areas if all stockpile areas nominated in the Drawings or Specifications have already been allocated for full use.

Carry out any clearing and grubbing for the stockpile areas in accordance with Specification TfNSW G40. Comply with the requirements in Specification TfNSW G38 for placing and managing stockpiles.

Install and maintain appropriate erosion and sedimentation control measures, in accordance with Specification TfNSW G38.

Following completion of the Works, carry out restoration of the stockpile areas in accordance with Specification TfNSW R178.

## **2.7 BORROW AREAS**

### **2.7.1 General**

Detail the selection and quality control of materials obtained from borrow areas in the EARTHWORKS PLAN.

### **2.7.2 Nominated Borrow Areas**

For borrow areas shown in the Drawings or nominated in Annexure R44/A2.1, carry out site preparation in accordance with Clause 2.3.1 of this Specification and Specification TfNSW G40.

The top of the batter from the resulting excavation of the borrow areas must not be closer than 3 m to any existing or proposed fence line, road reserve boundary or edge of excavation or embankment. The slope of cut batters at such borrow areas must be as specified in Annexure R44/A2.1

Provide adequate drainage outlets for the borrow areas.

At Completion, leave the borrow areas in a tidy and safe condition and meeting the requirements of Specification TfNSW G36. Unless otherwise approved by the Principal, carry out restoration of borrow areas in accordance with Specification TfNSW R178.

### **2.7.3 Contractor Arranged Borrow Areas**

For borrow areas arranged by you, obtain any permits required for entry on to the land and for payment of any royalty for such borrow material.

Comply with all statutory requirements including the *Environmental Planning and Assessment Act 1979 (NSW)* and *Protection of the Environment Operations Act 1997 (NSW)*, and any requirements of local Councils, landowners and other relevant stakeholders.

Provide copies of all approvals and consents to the Principal at least 5 working days prior to commencing work at these borrow areas.

Material from such borrow areas brought on to the Site must comply with the conditions attached to the EPA resource recovery exemptions, as applicable.

You are responsible for all costs involved in opening up, maintaining and restoring any borrow areas arranged by you.

## **2.8 MATERIAL IN UPPER ZONE OF FORMATION, VERGES AND SPILL THROUGH BRIDGE ABUTMENTS**

### **2.8.1 General**

The material placed in the Upper Zone of Formation, verges and at spill through bridge abutment must be selected, placed and controlled to meet the specified requirements.

The Upper Zone of Formation in embankments consists of 2 components as shown in Figure R44.2(a). The top component of Upper Zone of Formation is the Selected Material Zone.

### **2.8.2 Material Source**

Obtain Upper Zone Material, verge material and spill through bridge abutment fill material of the specified quality from cuttings or borrow areas within the Site.

Where these materials are not available from cuttings or borrow areas within the Site or in insufficient quantities, obtain them as imported material from the sources nominated in Annexure R44/A2.1, unless otherwise approved by the Principal.

Where the source of imported material is not nominated in Annexure R44/A2.1, obtain them from legally operating quarries or recycling facilities or other sources acceptable to the Principal. Provide the Principal with details of the proposed source locations, quantities and types of material before the imported material is delivered to the Site (refer Clause 6.1.1).

Do not use steel furnace slag aggregates in the Upper Zone of Formation, including the Selected Material Zone (Clause 6.1.2), verges (Clause 6.2), and spill through bridge abutment zones (Clause 5.2.3).

### **2.8.3 Sampling and Testing**

Prior to placement, all material intended for use in the Selected Material Zone and verges must be stockpiled and tested for conformity with the requirements of Clauses 2.8.5 and 2.8.6 respectively and Annexure R44/A2.2. The total mass of each Lot of stockpiled material must not exceed 4000 tonnes.

Sampling frequency must be in accordance with Table R44/L.2 and the characteristic value (Q) of the CBR for each Lot calculated in accordance with Specification TfNSW Q. For the purpose of this calculation, report the individual CBR values to the nearest 1% and the characteristic value (Q) to the nearest 0.1%.

Prior to testing, pre-treat any Upper Zone Material which may be susceptible to breakdown or weathering, by crushing to size, artificial weathering in accordance with Test Method TfNSW T103 and repeated compaction in accordance with Test Method TfNSW T102.

Before placement of material from any source, establish the response of that material to pre-treatment and adopt an appropriate pre-treatment regime for subsequent conformity testing.

## **2.8.4 Upper Zone of Formation Material other than Selected Material**

### **2.8.4.1 Site Won Material**

Material for use in the Upper Zone of Formation, other than Selected Material Zone, must:

- (a) have a CBR value as that stated in Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;
- (b) have a Plasticity Index (PI) value as that stated in Annexure R44/A2.2;
- (c)
  - (i) be free from stone larger than 100 mm maximum particle dimension;
  - (ii) have no less than 50% passing the 19.0 mm AS sieve.

### **2.8.4.2 Imported Material**

Material imported for the Upper Zone of Formation, other than Selected Material Zone, must be from the sources and of the quality specified in Annexure R44/A2.1 and R44/A2.2 respectively, or approved by the Principal.

Clause 2.8.4.1 part (c) for site won material also applies to the imported material.

## **2.8.5 Selected Material**

### **2.8.5.1 Site Won Selected Material**

Material for use in the Selected Material Zone must:

- (a) have a characteristic CBR value as stated in Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;
- (b) have a PI value as stated in Annexure R44/A2.2;
- (c)
  - (i) be free from stone larger than 100 mm maximum particle dimension;
  - (ii) have no less than 50% passing the 19 mm AS sieve.

If the Selected Material conforms to the specified requirements for the lower layer of the Selected Material Zone, but has a CBR value less than that specified for the upper layer of the Selected Material Zone, the Selected Material may be modified with hydrated lime, or other binders approved by the Principal, to make it conforming to the requirements of the upper layer.

### **2.8.5.2 Imported Selected Material**

Material imported for the Selected Material Zone must meet the requirements of Specification TfNSW 3071.

## **2.8.6 Verge Material**

### **2.8.6.1 Site Won Verge Material**

Material for use in the verges must meet the following requirements:

- (a) have a characteristic CBR value as stated in Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;

- (b) have a PI value as stated in Annexure R44/A2.2;
- (c)
  - (i) be free from stone larger than 53 mm maximum particle dimension;
  - (ii) have no less than 50% passing the 19.0 mm AS sieve.

#### **2.8.6.2 Imported Verge Material**

Material imported for the verges must meet the requirements of TfNSW 3071 for Selected Material and must:

- (a) have a characteristic CBR value not less than that specified in Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;
- (b) have a PI value as stated in Annexure R44/A2.2.

#### **2.8.7 Spill Through Bridge Abutment Fill Material**

For both Type ST1 material (at waterway crossings) and Type ST2 material (at overbridges), the fill material must:

- (a) have a CBR value as stated in Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;
- (b) have a PI value as stated in Annexure R44/A2.2;
- (c)
  - (i) be free from stone larger than 53 mm maximum particle dimension;
  - (ii) have no less than 50% passing the 19.0 mm AS sieve.

### **3 FOUNDATIONS**

#### **3.1 GENERAL**

Foundation treatments under embankments are carried out after removal of unsuitable material, or excavating further in Shallow Embankment areas to provide a minimum embankment height (refer to Clause 3.5.1), or where relevant, after terracing of hillside embankment foundations.

Foundation treatments within cuttings are carried out after excavation to the Designed Floor Level, or Foundation Level as appropriate, and removal of unsuitable material.

Taking into account the Site conditions, traffic, access, environmental/climatic conditions and insitu materials, select your equipment and techniques and use them in such a manner that minimises surface heaving or other foundation damage during preparation of the foundation and construction of overlying layers.

Construct other measures (such as trench and foundation drains, constructed in accordance with Specification TfNSW R33) in conjunction with the foundation treatments, as shown on the Drawings, or as authorised or directed by the Principal.

#### **3.2 FOUNDATION TREATMENTS UNDER EMBANKMENTS**

After preparation of the embankment foundation area, present the area for inspection by the Principal prior to placing embankment materials.

## **HOLD POINT**

Process Held:	Treatment of each Lot of embankment foundation.
Submission Details:	<ul style="list-style-type: none"><li>(a) Survey report;</li><li>(b) Notification of completion of clearing operations;</li><li>(c) In areas other than beneath Shallow Embankments, notification that:<ul style="list-style-type: none"><li>(i) topsoil has been removed in accordance with Clause 2.3;</li><li>or</li><li>(ii) grasses have been flattened/mowed if shown on the Drawings or specified;</li></ul></li><li>(d) In areas beneath Shallow Embankments:<ul style="list-style-type: none"><li>(i) notification that topsoil has been removed and surface excavated in accordance with Clause 3.5.1; and</li><li>(ii) CBR and PI test results, if required in accordance with Clause 3.5.1.</li></ul></li></ul>
Release of Hold Point:	The Principal: <ul style="list-style-type: none"><li>(a) will consider the submitted documents;</li><li>(b) may inspect the excavated floor for the embankment foundation; and</li><li>(c) may direct further action prior to authorising the release of the Hold Point. Further action may include removal of unsuitable material in accordance with Clause 2.4, or treatment in accordance with Clause 3.2.</li></ul>

The types of treatments for embankment foundations are listed as follows and depicted in Figures R44.3 (a), (b), (c), (d) and (e) or under Clause 3.2.6:

- Type E1 – Loosen and Recompact
- Type E2 – Bridging Layer
- Type E3 – Working Platform
- Type E4 – Geotextile/Geogrid Layer(s)
- Type E5 – Drainage Layer
- Type E6 – Earth Fill Foundation Treatment

These may be applied individually or in combination, as specified in Annexure R44/A3 or as shown on the Drawings or specified or directed or authorised otherwise by the Principal.

Where specified in Annexure R44/A6, extend the foundation treatment into the medians.

Carry out Type E1 treatment for all embankment foundations, unless specified otherwise in Annexure R44/A3 or shown on the Drawings or directed or authorised by the Principal to carry out other types of treatment.

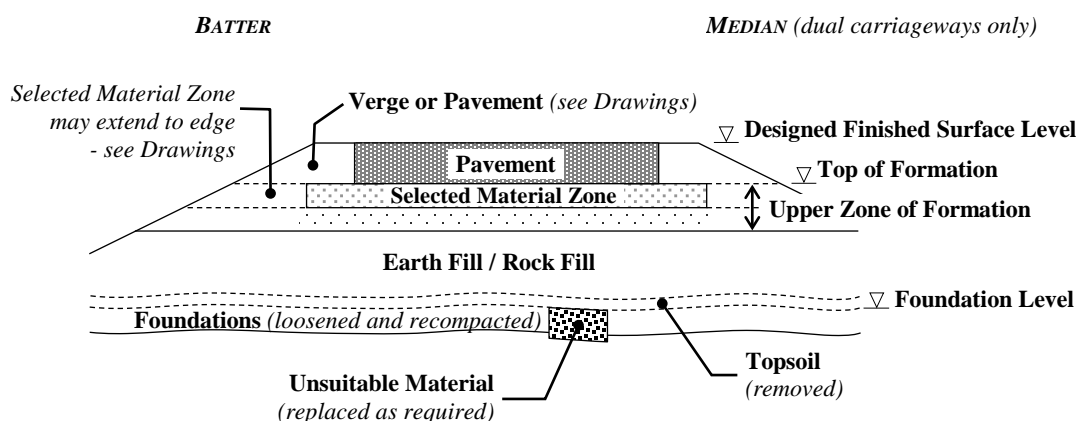
Maintain the embankment foundation after treatment in its conforming condition until embankment construction commences. You will bear the cost of any additional foundation treatments required as a result of damage to the foundations that is caused, or allowed to occur, by you.

Damage in this context includes that arising from using the treated foundation area by earthworks plant for purposes other than the construction of the embankment over the foundation treatment.

### 3.2.1 Treatment Type E1 – Loosen and Recompact

Unless shown otherwise on the Drawings or specified or directed or authorised otherwise by the Principal, treat the foundation area in preparation for embankment construction as described below:

- (a) Remove and replace any unsuitable material present in the foundation in accordance with Clause 2.4;
- (b) Loosen the material in the foundation area by ripping to a depth of between 300 mm to 400 mm;
- (c) Carry out any terracing as required by Clause 3.3;
- (d) Adjust the moisture content of the loosened material and recompact it to the relative compaction specified in Clause 7.



**Figure R44.3(a) – Embankment Foundation Treatment Type E1 – Loosen and Recompact**

The work carried out for this treatment will be paid under Pay Item R44P7.1. No account will be taken of the volume that is loosened during Type E1 treatment when measuring the volume of excavations for payment.

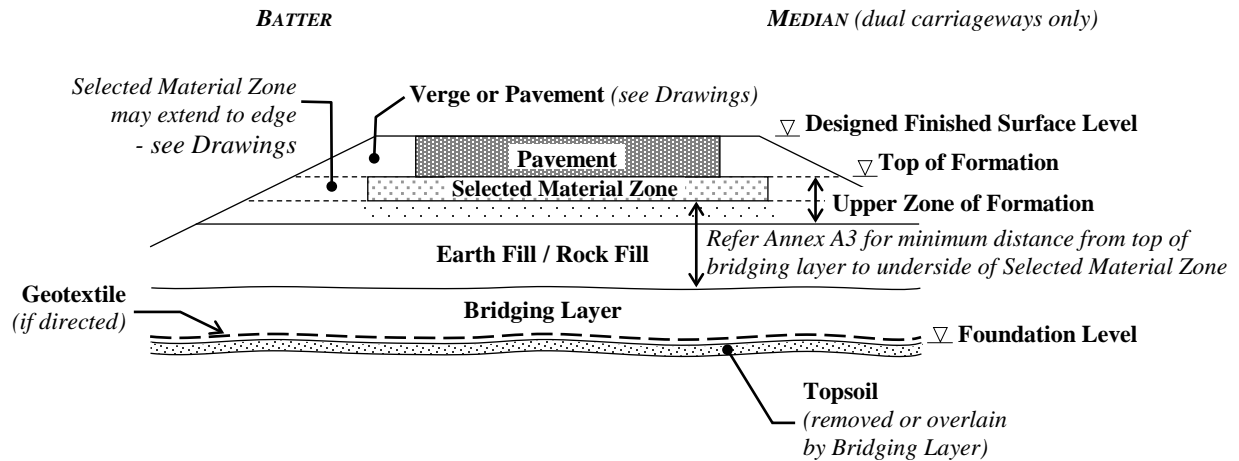
### 3.2.2 Treatment Type E2 – Bridging Layer

Where shown on the Drawings or specified or directed or authorised by the Principal where you can demonstrate that it is impracticable to achieve the degree of compaction specified for the foundation in Clause 7, construct a bridging layer over the embankment foundation area.

The distance from the top of the bridging layer to the underside of the Selected Material Zone must not be less than that stated in Annexure R44/A3.

If specified or directed by the Principal, prior to placing the bridging layer, place a geotextile complying with the quality requirements of Specification TfNSW R63 over the embankment foundation area.





**Figure R44.3(b) – Embankment Foundation Treatment Type E2 – Bridging Layer**

The Principal may require the construction of a trial section of the bridging layer prior to authorising placement of the bridging layer in other areas.

Construct the bridging layer from earth fill material or rock fill material conforming to the requirements of Clauses 5.2.1 or 5.3.1 respectively. If earth fill is used, it must consist of granular material with strong mechanical interlock and low sensitivity to moisture. The bridging layer material must provide a stable platform upon which a conforming earthworks layer can be constructed.

Place the material by end-dumping and spreading it in a single layer to a completed thickness no greater than that specified in Annexure R44/A3 but of sufficient thickness to allow the passage of earthmoving equipment over the bridging layer with minimal surface heaving. The compaction requirements of Clause 7 do not apply to the bridging layer.

The thickness of the bridging layer when completed must not exceed that stated in Annexure R44/A3.

Payment for the bridging layer will be made under Pay Item R44P7.3. Payment for the geotextile where placed will be made under Pay Item R44P7.5(a).

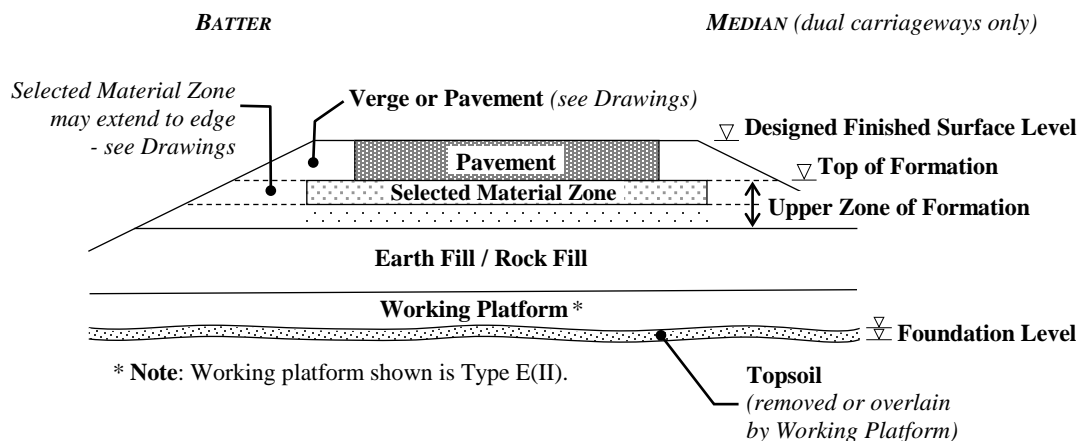
### **3.2.3 Treatment Type E3 – Working Platform**

Where shown on the Drawings or specified or directed or authorised by the Principal, treat the foundation by one of the methods described below to form a Working Platform on which to construct the formation:

- (I) Increase the strength of the insitu material by chemical stabilisation in accordance with Specification TfNSW R50.

The steps to be undertaken are the same as that for Type E1 Treatment in Clause 3.2.1 except that after loosening of the material in the foundation, a stabilising agent is mixed into the loosened material in accordance with Specification TfNSW R50.

- (II) Construct a Working Platform using premixed stabilised material in accordance with Specification TfNSW R50.



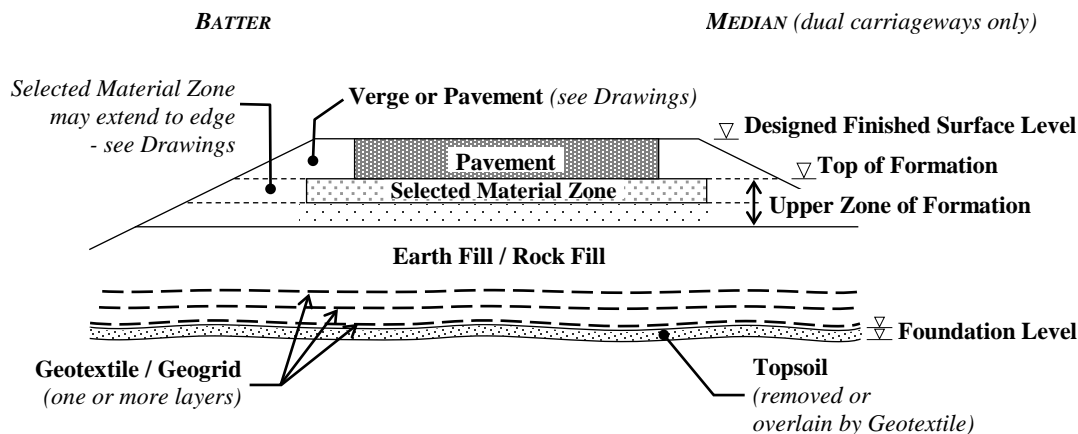
**Figure R44.3(c) – Embankment Foundation Treatment Type E3 – Working Platform**

Payment for the chemical stabilisation of the insitu material will be made under the appropriate Pay Items in Specification TfNSW R50, and payment for imported material will be made under Pay Item R44P3.

**3.2.4 Treatment Type E4 – Geotextile/Geogrid Layer(s)**

Where shown on the Drawings or specified or directed or authorised by the Principal, carry out a Type E4 treatment, consisting of placing a layer (or multiple layers) of geotextile and/or geogrid.

Supply and placement of the geotextile and geogrid will be in accordance with Specifications TfNSW R63 and TfNSW R67 respectively.



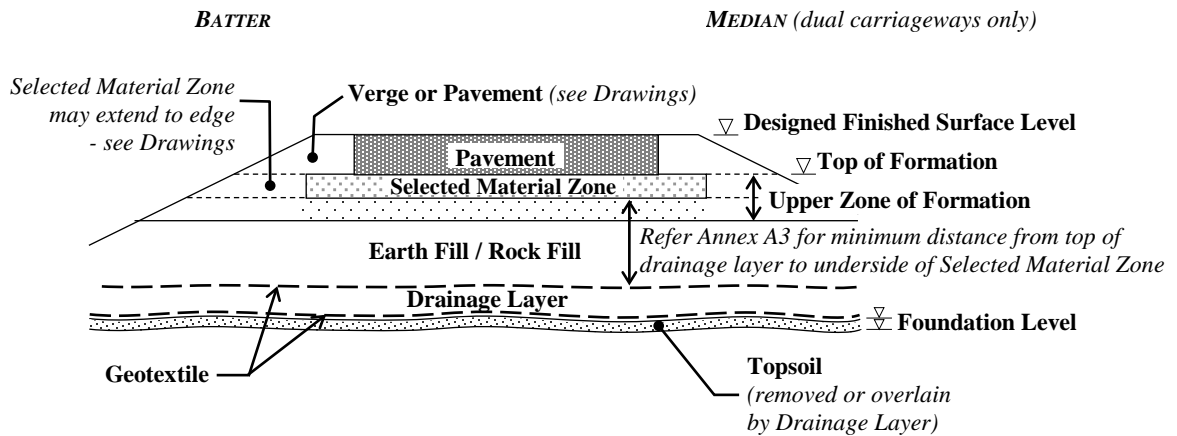
**Figure R44.3(d) – Embankment Foundation Treatment Type E4 – Geotextile/Geogrid Layer(s)**

Payment for the geotextile and geogrid used in the Works will be made under Pay Item R44P7.5.

**3.2.5 Treatment Type E5 – Drainage Layer**

Where shown on the Drawings or specified or directed or authorised by the Principal, treat the embankment foundation by constructing a drainage layer consisting of a rock layer enclosed by geotextile.

The distance between the top of the drainage layer and the underside of the Selected Material Zone must not be less than that stated in Annexure R44/A3.



**Figure R44.3(e) – Embankment Foundation Treatment Type E5 – Drainage Layer**

The material for the drainage layer must meet the properties shown in Table R44.2. Do not use steel furnace slag aggregates in the drainage layer.

**Table R44.2 – Drainage Layer Material Properties**

Property	Requirement
Maximum particle dimension	125 mm
Percentage passing:	
19.0 mm AS sieve	0 – 15%
1.18 mm AS sieve	0 – 5%
75 µm AS sieve	< 0.5% *
Percentage of +19.0 mm fraction with $I_{s(50)} < \text{Annexure R44/A2.2}$	10% (max)
Wet/Dry Strength Variation	Annexure R44/A2.2

\* **Note:** Test only where directed.

Adjust the grading of the drainage layer as necessary within the above limits to ensure that it provides a stable foundation for compaction of the overlying embankment.

Where shown on the Drawings or specified or directed or authorised by the Principal, remove the topsoil layer.

Shape and trim the foundation beneath the drainage layer, to ensure that the drainage layer after placing can drain properly. Maintain a clear drainage path through the layer, particularly at the outer edges of the embankment, and provide outlet/drainage treatment at the ends as shown on the Drawings or directed by the Principal.

Place a geotextile complying with Specification TfNSW R63 over the embankment foundation area, and then place and spread the drainage layer material in such a way as to avoid segregation and to ensure that it is not contaminated with foreign materials. Compact the drainage layer using the nominated compaction procedure developed as specified in Clause 7.5.

Place a geotextile of the same type as that specified in the preceding paragraph over the drainage layer, before placing the embankment fill.

The thickness of the drainage layer when completed must be as stated in Annexure R44/A3.

Payment for the drainage layer will be made under Pay Item R44P7.6. Payment for the geotextile used in the Works will be made under Pay Item R44P7.5(a).

### **3.2.6 Treatment Type E6 - Earth Fill Foundation Treatment Layer**

Where shown on the Drawings or specified or directed or authorised by the Principal, or where you demonstrate that it is impractical to achieve the degree of compaction specified for the foundation in Clause 7, the Principal may approve the placement of an earth fill layer as a foundation treatment.

The distance from the top of this earth fill layer to the underside of the Selected Material Zone must not be less than that stated in Annexure R44/A3.

The material for this earth fill foundation treatment layer must comply with the requirements for earth fill in Clause 5.2.

The Principal may require the construction of a trial section of the earth fill foundation treatment layer prior to authorising the construction of the earth fill foundation treatment layer in other areas.

Compact the layer such that the top 300 mm conforms to the requirements of Clause 7 for foundation treatments for embankments. The moisture content must be within the limits specified in Annexure R44/A5.

The thickness of the earth fill layer when completed must be as stated in Annexure R44/A3.

After compaction, each Lot may be subjected to proof rolling in accordance with Clause 7.6.1. If proof rolling shows that the earth fill foundation treatment layer exhibits excessive deflection, or if subsequent layers cannot be compacted to meet the specified requirements for earth fill, the layer placed for this Foundation Treatment must be removed, and the foundation treatment re-determined by the Principal.

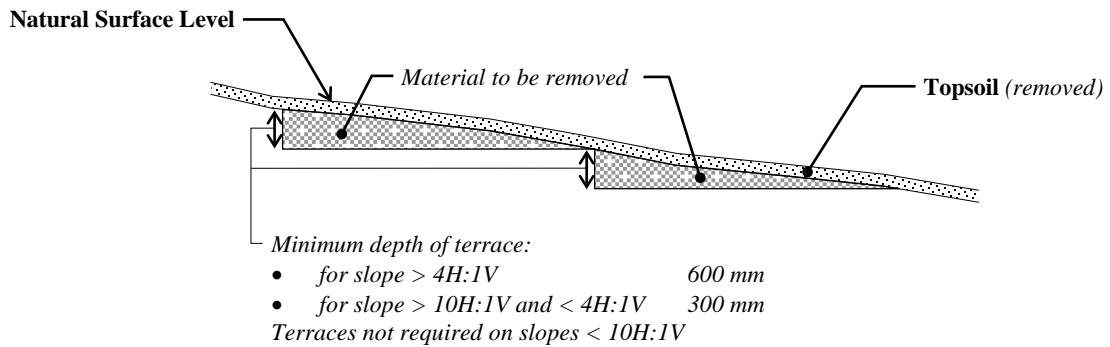
### **3.2.7 Other Treatments**

Adopt other foundation treatments as shown on the Drawings or as directed or agreed by the Principal.

## **3.3 FOUNDATION TREATMENT FOR HILLSIDE EMBANKMENTS – TERRACING**

Where embankments are to be constructed on or against any slopes or batter of existing embankments (including batters resulting from the partial construction of embankments under the Contract), and the existing slope or batter is steeper than 10H:1V in any direction, cut horizontal terraces into such slopes or batters which will be covered by the embankment to be constructed.

Step the existing slope or batter progressively in successive terraces, each at least 1 metre in width as shown in Figure R44.4. Cut the terraces to a minimum depth of 300 mm at the steps except where the existing slope or batter is 4H:1V or steeper, in which case the terraces must be cut to a minimum depth of 600 mm at the steps.



**Figure R44.4 – Hillside Terracing Requirements**

Cut the terraces progressively as the embankment is placed.

Inspect the floor of each terrace in accordance with Clause 2.4 to check for any unsuitable material. Unless directed otherwise by the Principal, incorporate the material thus excavated in embankments in accordance with Clause 5, or dispose of it as spoil in accordance with Clause 2.5.

No account will be taken of the material removed in terracing when determining the general earthworks excavated volume.

### **3.4 FOUNDATION TREATMENTS WITHIN CUTTINGS**

Excavate cuttings to the Designed Floor Level, or to the Foundation Level if Foundation Treatment Types C2, C3(II) or C5 are shown on the Drawings or otherwise specified or directed or authorised by the Principal.

Remove and replace any unsuitable material in accordance with the Clause 2.4.

Prior to carrying out any foundation treatments or placing formation materials, carry out tests to determine the CBR and PI values of the material in the floor of the cutting, using the Test Methods stated in Annexure R44/A2.2, and present the floor for inspection by the Principal.

You may obtain samples for the CBR and PI tests from test pits prior to completion of excavation to the required floor level of the cutting.

**HOLD POINT**

Process Held:	Treatment of each Lot of floors of cuttings.
Submission Details:	<p>(a) Notification of completion of excavation to:</p> <p>(i) Designed Floor Level, or Foundation Level, as appropriate; and</p> <p>(ii) depth specified for Cut/Fill Transition Zone (refer to Clause 3.5);</p> <p>(b) CBR and PI test results.</p> <p>(The submission must be concurrent with the submission for any adjoining Shallow Embankment foundation required by the Hold Point in Clause 3.2.)</p>
Release of Hold Point:	<p>The Principal:</p> <p>(a) will consider the submitted documents;</p> <p>(b) will inspect the floor of the cutting; and</p> <p>(c) may direct further action prior to authorising the release of the Hold Point.</p> <p>Further action may include the removal of unsuitable material in accordance with Clause 2.4; installation of trench drains in accordance with Specification TfNSW R33, or foundation treatments in accordance with this Clause, or changes to the area to be excavated.</p>

The types of treatments for foundations within cuttings are listed as follows and depicted in Figures R44.5 (a), (b), (c) and (d) or under Clause 3.4.4:

- Type C1 – Loosen and Recompact
- Type C2 – Excavation and Backfill
- Type C3 – Working Platform
- Type C4 – Geotextile/Geogrid Layer(s)
- Type C5 – Drainage Layer

These may be applied individually or in combination, as specified in Annexure R44/A3 or as shown on the Drawings or otherwise specified or directed or authorised by the Principal.

Where specified in Annexure R44/A6, extend the foundation treatment into the medians.

Where the CBR and PI values of the material at the Designed Floor Level conform to the requirements of Annexure R44/A2.2, carry out Foundation Treatment Type C1 involving loosening and recompaction of the underlying material.

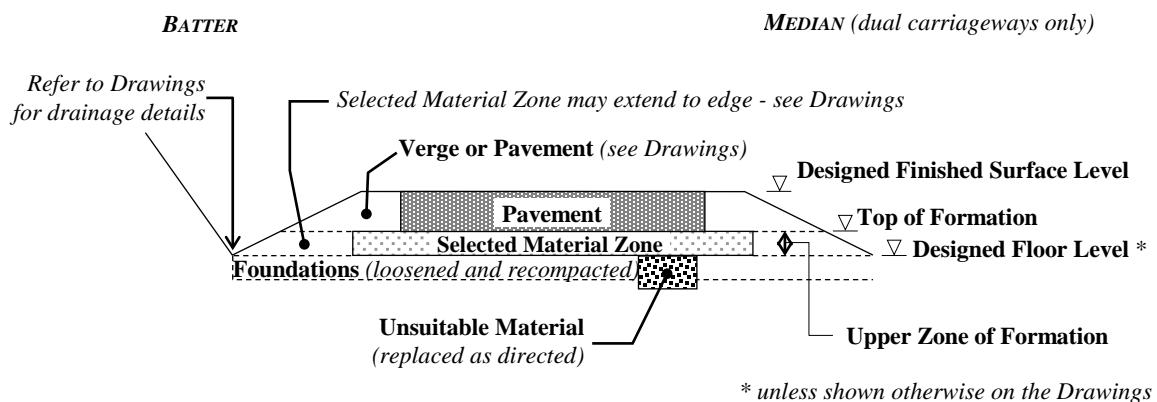
Where the CBR of the material at the Designed Floor Level is less than, or where the PI is greater than, the requirement nominated in Annexure R44/A2.2, remove or modify the material to the appropriate depth in accordance with the directed foundation treatment (Foundation Treatment Types C2 to C5).

Maintain the floor of the cutting in its conforming condition until any subsurface drainage is completed and backfilling and construction of Upper Zone of Formation commences. You will bear the cost of any additional treatment required as a result of damage to the foundations that is caused, or allowed to occur, by you.

**3.4.1 Treatment Type C1 – Loosen and Recompact**

Unless shown otherwise on the Drawings or specified or directed or authorised by the Principal, treat the floors of cuttings as described below:

- (a) After excavation to the Designed Floor Level, trim the surface to conform to the tolerances stated in Clause 7.7.1. Remove and replace any unsuitable material present in accordance with Clause 2.4.
- (b) Loosen the material below the floor of the cutting by ripping to a depth of between 300 mm to 400 mm for the width of the Selected Material Zone as shown on the Drawings, or the width of the pavement layers plus one metre on each side (whichever width is the greater). The maximum particle dimension in the loosened material must not exceed 100 mm.
- (c) Adjust the moisture content of the loosened material and recompact it to the relative compaction specified in Clause 7.
- (d) After recompaction, trim the floor of the cutting to the Designed Floor Level and within the tolerances stated in Clause 7.7.



**Figure R44.5(a) – Cutting Floor Treatment Type C1 – Loosen and Recompact**

As part of the trimming operation, prepare the surface in accordance with Test Method TfNSW T199, for deflection monitoring as required in Clause 7.6.

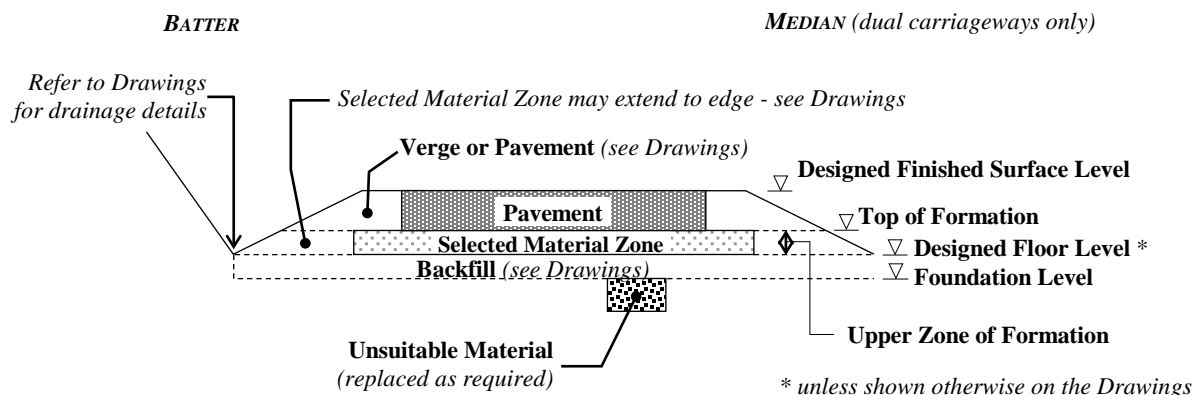
The work carried out for this treatment will be paid under Pay Item R44P7.2. No account will be taken of the volume that is loosened in Type C1 treatment when measuring the volume of excavations for payment.

**3.4.2 Treatment Type C2 – Excavation and Backfill**

Where shown on the Drawings or specified or directed or authorised by the Principal, treat the floors of the cuttings as described below:

- (a) After excavation to the Foundation Level which is parallel to, and at a depth below the Designed Floor Level equal to the nominated thickness of backfill, trim the floor of the cutting to conform to the tolerance stated in Clause 7.7. Remove and replace any unsuitable material present in accordance with Clause 2.4;
- (b) If directed by the Principal, determine the CBR and PI values of the material in the floor of the cutting by the Test Methods stated in Annexure R44/A2.2;

- (c) Compact the material exposed at the floor of the cutting with not less than 6 passes of a vibrating roller;
- (d) Place backfill material meeting the grading requirements of Clause 2.8.4 and Annexure R44/A2.2, and compact in accordance with the requirements for earth fill in Clause 7.4. Trim the compacted backfill to the Designed Floor Level and within the tolerances stated in Clause 7.7.



**Figure R44.5(b) – Cutting Floor Treatment Type C2 – Excavation and Backfill**

The material excavated between the Designed Floor Level and the Foundation Level in Type C2 treatment must be included in the excavated volume for general earthworks and paid under Pay Item R44P2.

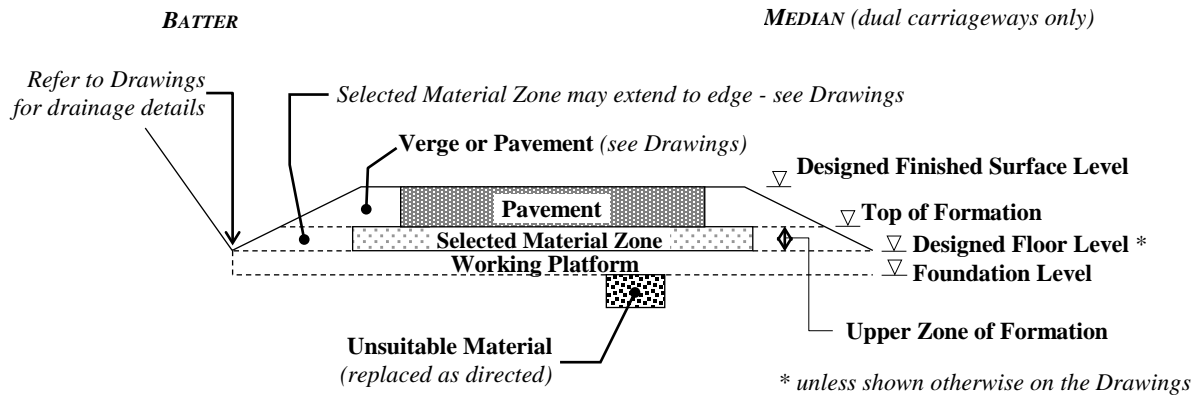
The backfilling under item (d) of this Clause will be paid under Pay Item R44P7.4.

### 3.4.3 Treatment Type C3 – Working Platform

Where shown on the Drawings or specified or directed or authorised by the Principal, treat the floors of the cuttings by one of the methods described below:

- (I) Increase the strength of the insitu material by chemical stabilisation in accordance with Specification TfNSW R50 to form a Working Platform on which to construct the formation.
- The steps to be undertaken are the same as that for Type C1 Treatment in Clause 3.4.1 except that after loosening of the material below the floor of the cutting, a stabilising agent is mixed into the loosened material in accordance with Specification TfNSW R50.
- (II) Where specified in Annexure R44/A2.1 or directed or authorised by the Principal, construct a Working Platform using premixed stabilised material.
- The steps to be undertaken are the same as that for Type C2 Treatment in Clause 3.4.2 except that after compaction of the floor of the cutting, premixed stabilised material in accordance with Specification TfNSW R50 is used as the backfill material.





**Figure R44.5(c) – Cutting Floor Treatment Type C3 – Working Platform**

Payment for chemical stabilisation of the insitu material will be made under the appropriate Pay Items in Specification TfNSW R50, and payment for imported material will be made under Pay Item R44P3.

The material excavated between the Designed Floor Level and the Foundation Level, at the underside of the Working Platform, must be included in the excavated volume for General Earthworks and paid under Pay Item R44P2.

### 3.4.4 Treatment Type C4 – Geotextile/Geogrid Layer(s)

Where shown on the Drawings or specified or directed or authorised by the Principal, carry out a Type C4 treatment, consisting of placing a layer (or multiple layers) of geotextile and/or geogrid on the floor of the cutting.

Supply and placement of the geotextile and geogrid must be in accordance with Specifications TfNSW R63 and/or TfNSW R67 respectively.

Payment for the geotextile and geogrid used in the Works will be made under Pay Item R44P7.5.

### 3.4.5 Treatment Type C5 – Drainage Layer

Where shown on the Drawings or specified or directed or authorised by the Principal, treat the floors of the cuttings as described below:

- (a) After excavation to the Foundation Level which is parallel to, and at a depth below the Designed Floor Level equal to the thickness of the drainage layer, trim the floor of the cutting to within the tolerances stated in Table R44.11 and to the same crossfall as the pavement above to ensure that drainage within the cutting occurs.

Where the horizontal alignment of the road is in crossfall transition, provide a minimum 1% crossfall at the floor of the cutting.

Remove and replace all unsuitable material present in accordance with Clause 2.4.

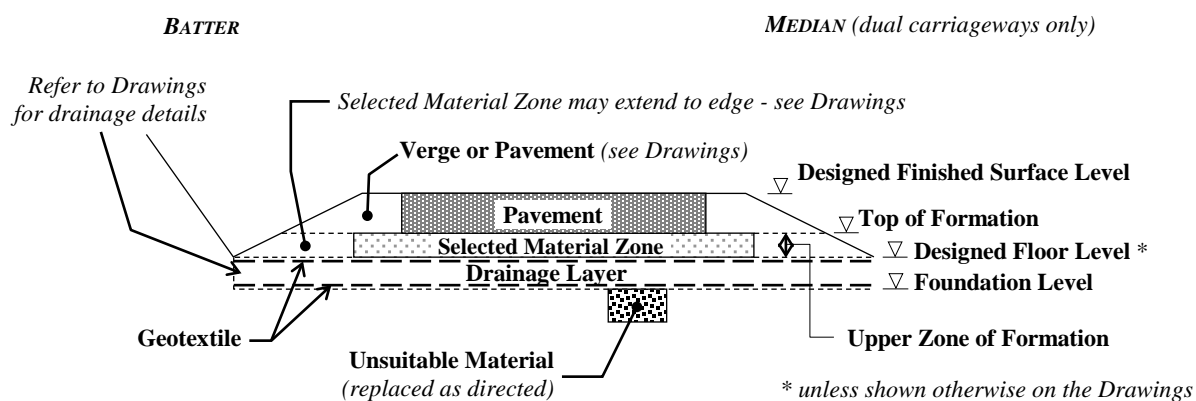
- (b) Compact the material exposed at the floor of the cutting with not less than 6 passes of a vibrating roller.
- (c) Prior to placing the drainage layer, place a geotextile meeting the requirements of Specification TfNSW R63, over the floor of the cutting, except where the cutting is in rock.

- (d) Place material meeting the properties for drainage layer in Table R44.2 over the geotextile, to a minimum layer thickness of 300 mm, avoiding segregation and contamination with foreign materials. Do not use steel furnace slag aggregates in the drainage layer.

Adjust the grading of the drainage layer material as necessary within the limits in Table R44.2 to ensure that it provides a stable foundation for compaction of the overlying Selected Material Zone.

Compact the drainage layer using the nominated compaction procedure developed, as specified in Clause 7.5. After compaction, the upper surface of the drainage layer must be within the tolerances stated in Table R44.11.

- (e) Place a geotextile of the same type as that specified in item (c) above over the top of the drainage layer.
- (f) Provide end outlet/drainage treatment as shown on the Drawings, or directed by the Principal.



**Figure R44.5(d) – Cutting Floor Treatment Type C5 – Drainage Layer**

Payment for the drainage layer will be made under Pay Item R44P7.7. Excavation for the drainage layer will be measured and paid under Pay Item R44P2. Payment for the geotextile will be made under Pay Item R44P7.5(a).

### 3.4.6 Other Treatments

Other foundation treatments may be adopted as shown on the Drawings or as directed or agreed by the Principal.

## 3.5 SHALLOW EMBANKMENT AND CUT/FILL TRANSITION ZONE

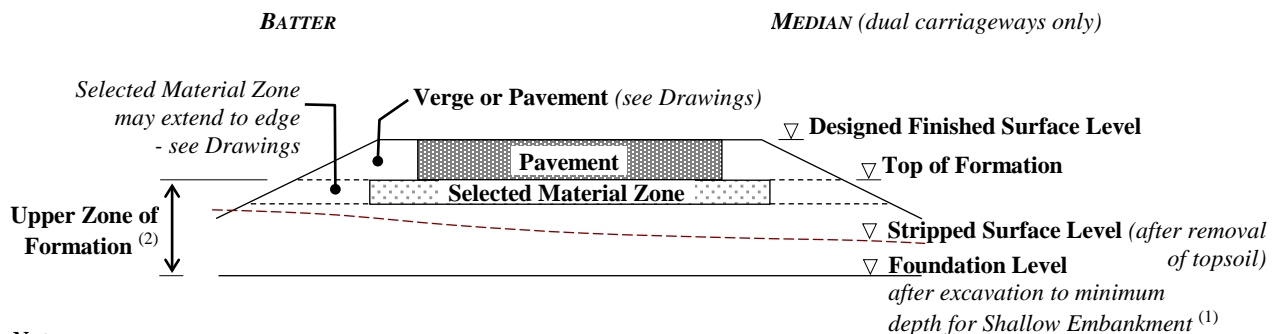
### 3.5.1 Shallow Embankment

Where the height of the embankment is less than that stated in Annexure R44/A4 for a Shallow Embankment, excavate the area further to a depth necessary to achieve the minimum height, unless otherwise shown on the Drawings or directed by the Principal.

You may propose to the Principal a height that is less than the minimum height stated for a Shallow Embankment to reduce the depth of excavation required. Carry out CBR and PI tests on the embankment foundation at this proposed higher level and submit them to the Principal. For this lesser height to be approved by the Principal, the CBR and PI values must comply with those stated in Annexure R44/A2.2.

Observe the Hold Point in Clause 3.2 and carry out embankment foundation treatments in accordance with Clause 3.2, before placing the overlying formation.

The thickness of the Upper Zone of Formation will be that corresponding to “Shallow Embankment” in Annexure R44/A4, and will generally be the entire formation from Foundation Level to Top of Formation, unless shown otherwise in Annexure R44/A4. Fill placed within this zone must comply with that for Upper Zone of Formation.



**Notes:**

- (1) Where the height from Stripped Surface Level to Top of Formation is less than minimum height for Shallow Embankment (refer to Annexure R44/A4), further excavation to achieve the minimum height for Shallow Embankment is required.
- (2) The thickness of the Upper Zone of Formation will be that corresponding to “Shallow Embankment” in Annexure R44/A4, and will generally be the entire formation from Foundation Level to Top of Formation, unless shown otherwise in Annexure R44/A4.

**Figure R44.6(a) – Shallow Embankment Nomenclature**

The volume of material excavated must be included in the measured volume for General Earthworks.

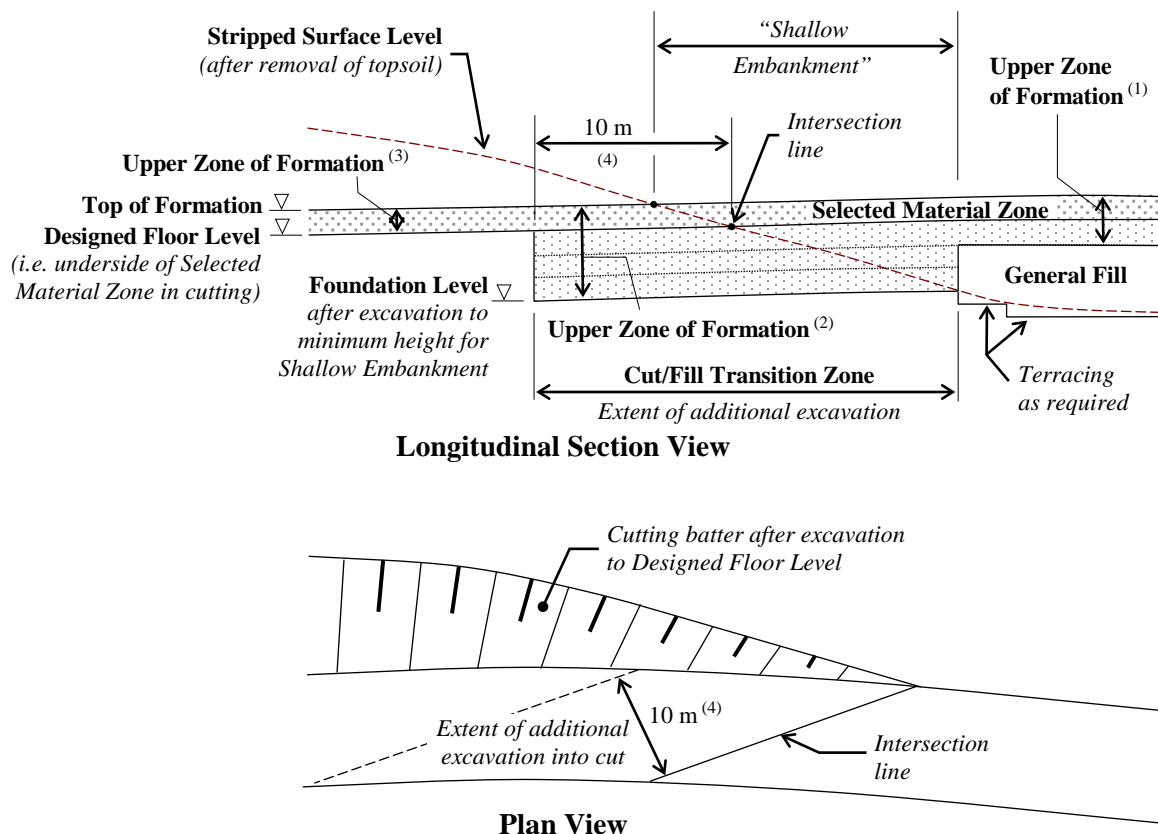
### 3.5.2 Cut/Fill Transition Zone

Following excavation to the Designed Floor Level at the cut/fill transition, within the area classed as Shallow Embankment in accordance with Clause 3.5.1, carry out further excavation, parallel to the cutting floor, below the Designed Floor Level, to a depth necessary to achieve the minimum height specified in Annexure R44/A4 for a Shallow Embankment, as shown in Figure R44.6(b).

This additional excavation must extend into the cut for a distance of 10 m from the line resulting from the intersection of the plane of the Designed Floor Level (i.e. underside of the Selected Material Zone in a cutting) with the plane of the stripped surface, as shown in Figure R44.6(b). The 10 m is measured perpendicular to the line of intersection between the two planes.

Where specified in Annexure R44/A6, extend the cut/fill transition treatment into the medians.

This cut/fill transition treatment must not however extend into the cutting batter.



**Notes:**

- (1) Where the height from the Stripped Surface Level to the Top of Formation is greater than the minimum height for a Shallow Embankment, no further excavation below the Stripped Surface Level, other than terracing, is necessary. The thickness of the Upper Zone of Formation will be that corresponding to “Embankment” in Annexure R44/A4. The fill below the Upper Zone of Formation may be General Fill.
- (2) Where the height from the Stripped Surface Level to the Top of Formation is less than the minimum height for a Shallow Embankment, further excavation to achieve the minimum height for Shallow Embankment is necessary. This excavation extends into the cut for a further 10 m as part of the Cut/Fill Transition Zone. The thickness of the Upper Zone of Formation will be that corresponding to “Cut/Fill Transition Zone” in Annexure R44/A4.
- (3) Beyond the Cut/Fill Transition Zone, the thickness of the Upper Zone of Formation will be that corresponding to “Cutting” in Annexure R44/A4.
- (4) The 10 m is measured perpendicular to the line resulting from the intersection of the plane of the Designed Floor Level with the plane of the stripped surface.

**Figure R44.6(b) – Cut/Fill Transition Treatment**

Within this transition zone, the requirements of Clause 3.5.1 for Shallow Embankment apply.

The volume of material excavated must be included in the measured volume for General Earthworks.

Ensure that the excavation is free-draining by either sloping toward the nearest exit of the cutting at a minimum grade of 1%, or installing a subsurface drain at the lower end of the excavation unless otherwise shown on the Drawings or directed by the Principal. Installation, and payment, of the subsurface drains will be in accordance with Specification TfNSW R33.

## **4 CUTTINGS**

### **4.1 GENERAL**

#### **4.1.1 Scope**

Excavation of cuttings includes:

- (a) excavation of material within the batter limits shown in the Drawings;
- (b) benching or terracing of cut batters;
- (c) cleaning of batter surfaces;
- (d) foundation treatments in accordance with Clause 3.4, beneath Shallow Embankments in accordance with Clause 3.5.1, and cut/fill transition in accordance with Clause 3.5.2.

#### **4.1.2 Material from Excavation**

Loosen and process the excavated materials as required to meet the Specification requirements for incorporation in the Works, in particular Clauses 2, 5.6 and 6 of this Specification.

#### **4.1.3 Cutting Batters**

The batter slopes in cuttings may be re-determined by the Principal, following a site inspection and investigation during excavation.

Batters will generally require progressive flattening at the ends of cuttings owing to the presence of less stable material. Round off the tops of cuttings to the dimensions shown on the Drawings unless otherwise directed.

Except for that resulting from pre-splitting or line drilling boreholes, the surface of batters in the cutting must be free of rills. Treat the face of the batter where such treatment is shown on the Drawings.

Clear the cut faces of any loose or unstable material progressively as the excavation proceeds.

## **4.2 CUTTINGS IN ROCK**

Clean the cut batters in rock with slopes of 1H:1V or steeper, using compressed air, to allow inspection of the batter and assessment of its stability immediately following completion of excavation to the level of each bench. Do not use water jets and air-water jets unless specifically approved by the Principal for specific areas. Remove any loose or unstable blocks which are too large to be removed by the above means, by hand or machine, unless otherwise directed by the Principal.

Clean also the surface of the bench at the top of the batter by compressed air, unless otherwise directed by the Principal.

Continue cleaning until all loose rock and soil material is removed, and all rock and joint surfaces are sufficiently exposed so that the Principal can assess their condition and likely effect on the stability of the batter.

**HOLD POINT**

Process Held:	Excavation below bench level for slopes of 1H:1V or steeper.
Submission Details:	Presentation of cleaned batter and bench/floor surfaces for geotechnical inspection.
Release of Hold Point:	The Principal will inspect the cleaned surfaces and may direct further action prior to authorising the release of the Hold Point. Further action may include additional cleaning (if the condition of the faces cannot, in the opinion of the Principal, be adequately assessed), and stabilisation works, prior to or concurrent with any further work within the cutting.

Following inspection, the Principal may direct additional stabilisation works, including changes to the batter slope.

**4.3 BATTER TOLERANCES IN CUTTINGS**

Batters in cuttings must not have undulations in the general plane of the batter.

Excavation of batters must comply with the tolerances given in Table R44.3.

**Table R44.3 – Excavation Tolerances for Batters in Cuttings**

Location	Tolerance (mm)	
	Slope 1H:1V or flatter	Steeper than 1H:1V
At level of toe of batter	+0 / -150	+0 / -200
Between level of toe of batter and 2 m above toe of batter	interpolate	interpolate
2 m above toe of batter and beyond	+300 / -300	+300 / -600

**Notes:**

- (1) Plus (+) is towards the roadway and minus (-) is away from the roadway. Tolerances are measured perpendicular to the plane of the slope.
- (2) Bench widths must not be less than those shown on the Drawings.

If the batter is over-excavated beyond the tolerance applicable for the batter slope line, or after cleaning the batter is beyond the tolerance applicable, restore the batter to the specified slope and stability to the Principal's satisfaction. Proposals for restoration must take into account long term stability, durability, and consideration of urban design solutions. The cost of restoring or re-forming the batter will be borne by you.

For batters steeper than 1H:1V, if any section of the batter up to a height of 3 m above the toe of batter has been over excavated beyond the tolerance limit specified, the Principal may direct that the batter be re-formed to the average batter slope using randomly mortared stone or other treatments. Where stone is directed, it must be similar to the sound rock in the cutting and the mortar must be coloured to match the colour of the rock.

Alternatively, you may request a minor change in the general slope of the batter for your convenience. If the Principal approves such a change, it will not be regarded as a redetermination of the batter slope under Clause 4.2 and no additional payment will be made. If your request is denied, restore the batter to the specified slope and stability to the satisfaction of Principal.

#### **4.4 BENCHING IN CUTTINGS**

Construct benches at cut batters as shown on the Drawings, to provide drainage and erosion control, to provide geotechnical stability, and to allow access for maintenance purposes. Notwithstanding the tolerances permitted under Clause 4.3, bench widths must not be less than those shown on the Drawings.

The floor of the bench must not vary from levels shown on the Drawings by more than the tolerances shown in Clause 7.7, but the bench must have a crossfall to drain water away from the cut face immediately below the bench. Provide and maintain longitudinal drainage to prevent ponding of water on the benches.

Construct bench drains, where shown on the Drawings, progressively as each batter face is completed. Payment for this work will be made in accordance with TfNSW R11.

Maintain and regularly clean the benches of any loose materials throughout the Contract period. The cost of such maintenance and cleaning of benches is deemed to be included in the rates generally.

#### **4.5 PRE-SPLITTING OR LINE DRILLING**

##### **4.5.1 General**

Use pre-splitting or line drilling to produce a uniform and neat batter surface after excavation. The boreholes used in pre-splitting or line drilling must be straight, parallel and in the designed plane of the batter.

The Principal will give consideration to an alternative method of excavation and preparation of the cut face so as to produce a result equivalent to that produced from pre-splitting or line drilling. Approval to such alternative methods will be granted at the absolute discretion of the Principal, who may require a trial section of the proposed method to be carried out to demonstrate its suitability.

##### **4.5.2 Hole Diameter and Hole Spacing**

Where pre-splitting or line drilling is carried out, the centre-to-centre spacing of drill holes must not exceed the values in Table R44.4.

**Table R44.4 – Hole Diameter and Spacing for Pre-splitting or Line Drilling**

<b>Cut Batter Treatment</b>	<b>Hole Diameter (mm)</b>	<b>Maximum Hole Spacing (mm)</b>
Pre-splitting	38 – 51	450
Pre-splitting	51 – 64	750
Pre-splitting	76 – 89	900
Line Drilling	Up to 51	150
Line Drilling	51 – 76	250

### **4.5.3 Pre-splitting or Line Drilling Prior to Blasting**

Prior to commencing blasting (refer Clause 4.6), batters with gradients 1H:1V or steeper must be pre-split or line drilled to the design batter profile to the spacings shown in Table R44.4 to produce a uniform and neat batter surface after excavation which is acceptable to the Principal.

Such burden blasting must not damage the batter face.

## **4.6 BLASTING**

Clause 4.6 applies only where blasting is permitted under the Contract, as indicated in Annexure R44/A7.

### **4.6.1 General**

Comply with the requirements of Specification TfNSW G36 for ground vibration and airblast.

The Hold Point in Specification TfNSW G36 for the submission of the Vibration and Airblast Management Sub-Plan and the Building Condition Inspection Reports applies prior to the commencement of blasting.

Include in the Vibration and Airblast Management Sub-Plan a detailed procedure to be followed in the event of a misfire of the charges.

Comply with all Government regulations relating to transport, storage, handling and the use of explosives and AS 2187 Parts 1 and 2. Comply also with the requirements of external agencies including, but not limited to, the Environment Protection Authority (EPA) and the WorkCover Authority, and demonstrate compliance.

Prior to commencement of any blasting activities, obtain all necessary approvals and licences from the appropriate authorities.

### **HOLD POINT**

Process Held: Start of each blast.

Submission Details: At least 24 hours prior, submit details of:

- (i) proposed blasting design and estimated vibration and airblast at sensitive receivers; and
- (ii) measures to limit noise and to ensure that vibration from blasting does not adversely affect nearby structures.

Release of Hold Point: The Principal will consider the submitted documents, prior to authorising the release of the Hold Point.

Do not use exposed detonating cord in built-up areas.

When blasting operations are being carried out, take precautions relating to the safety of persons and animals. Close any roads likely to be affected by the blasting to traffic and erect the appropriate signs in accordance with Specification TfNSW G10. Establish a standard warning procedure such as that given in the NAASRA Explosives in Roadworks Users Guide 1982 and observe the procedure at all times.



Implement and maintain a community liaison program during blasting activities to keep the community in the vicinity of the Works informed of any such activities. Provide information on expected levels of vibration or airblast.

For each blast, notify in writing all residents within a radius of 1 km from the location of the proposed blasting, and any other relevant parties, before blasting commences. Notification must include the likely times, frequency and duration of blasting and precautions being taken to ensure that damage to property will not result.

Confine your blasting operations to the weekdays of Mondays to Fridays but excluding public holidays, between the hours of 9 am and 3 pm, unless otherwise approved by the Principal.

Do not detonate a blast prior to the time that has been announced for that blast, unless otherwise approved by the Principal.

Monitor and report the building(s) condition during the blasting operations. If no Pay Item has been provided in Specification TfNSW G36 for the Building Conditions Reports, all costs associated with the inspections and reports will be borne by you.

#### **4.6.2 Blasting Records**

Maintain accurate records of each blast including the details listed below:

- (a) Date, identification number and time of blast;
- (b) Location, number and diameter of blast holes loaded;
- (c) Depth of each drill hole loaded;
- (d) Inclination of drill holes;
- (e) Burden(s) and spacing(s);
- (f) Types and amounts of explosives used;
- (g) Maximum instantaneous charge;
- (h) Initiation Plan;
- (i) Length and type of stemming in each blast hole;
- (j) Ground vibration and noise levels at measuring locations.

The records must be written as the holes are loaded, and must be signed by the shotfirer. Provide a copy of the records to the Principal on the day of the blast.

#### **4.6.3 Control of Airblast**

*Clause 4.6.3 will apply only where a noise sensitive location exists which will be impacted by the blasting.*

The airblast (noise) emanating from blasting operations must not exceed the limits in Annexure R44/A7 at any noise sensitive location, measured at the noise monitoring location nearest to the noise sensitive location. In general, a monitoring location will be sited at the perimeter of the noise sensitive location at the point closest to the maximum charge.

Carry out monitoring of airblast to verify that the specified limits are not exceeded. The equipment used for such monitoring must be calibrated annually by a NATA accredited testing facility or manufacturer's facility approved by the Principal. All readings from the monitoring must be reported on test certificates, which must indicate clearly compliance or non-compliance with the requirements of this Specification. Provide a copy of the monitoring record to the Principal.

In the event that the measured airblast exceeds the specified limits, suspend further blasting work and take additional steps and precautions to ensure that, for any future blast, the limiting airblast must not be exceeded. Do not resume any blasting until details of the additional steps and precautions have been provided to the Principal.

#### **4.6.4 Control of Ground Vibration from Blasting**

*Clause 4.6.4 will apply only where a vibration sensitive location exists which will be impacted by the blasting.*

Carry out monitoring of ground vibrations to verify compliance with the limits stated in Annexure R44/A7. In general, a monitoring location will be sited at the perimeter of the structure or building at the point closest to the maximum charge. The measurement process for determining verification of compliance with the ANZECC criteria must be in accordance with AS 2187.2.

The equipment used for monitoring must be calibrated annually by a NATA accredited testing facility or manufacturer's facility approved by the Principal. All readings from the monitoring must be reported on test certificates, which must indicate clearly compliance or non-compliance with the requirements of this Specification. Provide a copy of the monitoring record to the Principal.

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

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

$$\text{MIC} = 0.5 \left[ \frac{D}{\left[ \frac{p.p.v.}{1140} \right]^{-0.625}} \right]^2$$

where MIC = Maximum Instantaneous Charge, in kilograms

D = Distance in metres from charge to the point of potential damage

p.p.v = limiting peak particle velocity from Annexure R44/A7

For subsequent blasts, the charge weight and other aspects of blast design may be adjusted provided that further ground vibration monitoring is undertaken and the blasting site relationship re-determined to demonstrate that charge weight limits are not exceeded. Make the graphs available to the Principal, if so requested.

## **5 EMBANKMENTS**

### **5.1 GENERAL**

#### **5.1.1 Scope**

Embankment construction includes:

- (a) preparation of foundation areas over which fill material is to be placed as described in Clause 3 and backfilling of excavations undertaken for foundation treatments for both cuttings and embankments;
- (b) placement and compaction of conforming material in areas from which unsuitable material has been removed in accordance with Clause 2.4, and in areas where material below the pavement zone has been removed in Shallow Embankments and cut/fill transitions;
- (c) the placement and compaction of fill material, both general fill and materials of specified quality in nominated zones throughout the Works, including at spill through bridge abutment where subsequent pile foundation works are to be undertaken;

to the alignment, levels, dimensions and grading shown on the Drawings.

#### **5.1.2 Materials for Embankment Construction**

Materials for embankment construction must be free of tree stumps, roots and refuse. The material must be obtained from excavations within the Site and, where authorised by the Principal, may be supplemented with borrowed or imported material in accordance with Clauses 2.7 and 2.8.

Programme and manage the Works as detailed in the EARTHWORKS PLAN (Clauses 1.5 and 2.2) so that material of the quality specified in Clause 2.8 for the Upper Zone of Formation and verges is available when required.

Prior to placement, process those materials which do not meet the requirements of Clauses 5.2 and 5.3 to achieve conformity. Select the methods of excavation, transport, depositing and spreading of the fill material so that the placed material in any Lot is homogeneous.

#### **5.1.3 Embankment Construction**

The batter slopes shown on the Drawings may be re-determined by the Principal depending upon the materials encountered.

Embankment construction (other than for foundation treatments as specified in Clause 3, Upper Zones of Formation and verges) must be in accordance with the requirements of either Clause 5.2 or 5.3, as applicable.

Place fill material for embankment construction in layers parallel to the grade line.

Compact to achieve the relative compaction specified in Clause 7 over the full depth of the layer. Describe in the EARTHWORKS PLAN the method used to verify that the specified compaction has been achieved over the full layer depth and that the layer depth has not been exceeded.

## 5.2 EARTH FILL EMBANKMENTS

### 5.2.1 Earth Fill Material

Earth fill is material not conforming to rock fill requirements (refer Clause 5.3.1).

Earth fill embankments derive their stability from compaction of the fine material around the coarser particles.

Any rock material must be broken down to smaller sized particles and evenly distributed throughout the layer to prevent the formation of voids and to produce a dense compact embankment. To meet this requirement, additional fine material may need to be obtained from other places within the Site or by a change in the method of winning and processing the material.

The particle size limitations and proportion of rock in earth fill material are given in Table R44.5.

**Table R44.5 – Maximum Layer Thickness and Proportion of Rock in Earth Fill Embankments**

Maximum Layer Thickness (mm)	Minimum Quantity Rock (by volume)	Maximum Particle Dimension	% Passing 37.5 mm AS Sieve * (by mass)
300	Not specified	200	> 60%
500	25% > 200 mm	300	> 60%

\* Test Method T106

### 5.2.2 Placing Earth Fill

Place earth fill in layers of thickness (after compaction) not less than 100 mm and not more than that given in Table R44.5.

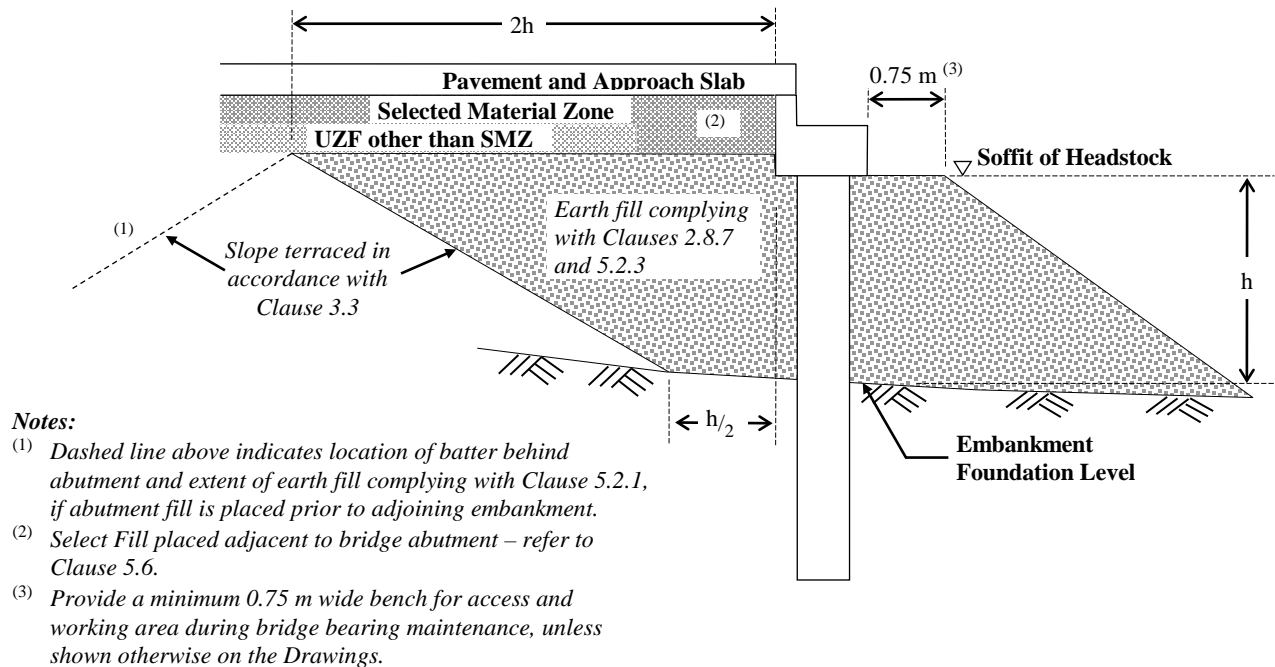
In placing embankment layers, use equipment and techniques to avoid surface heaving or other damage to the foundations and underlying embankment layers.

### 5.2.3 Earth Fill at Spill Through Bridge Abutments

At spill through bridge abutments, place fill material conforming to Clause 2.8.7 within the zone shown in Figure R44.7.

The limits of the zone are detailed as follows. At one end, it forms the exposed sloping part of the spill through embankment. At the other end, at the top, it extends a distance of 2h from the rear face of the bridge abutment headstock; at the bottom at embankment foundation level, it extends a distance of  $h/2$  from this rear face.

(For the purpose of this Clause, the height “h” is the distance between the soffit of the headstock and the embankment foundation level. Where excavation is required for foundation improvement, the height “h” is measured to the base of the excavation.)



**Figure R44.7 – Dimensions of Fill at Spill Through Bridge Abutments**

Prior to placement, the material must be stockpiled, sampled and tested for conformity in accordance with the requirements of Clause 2.8.3.

Each layer must not exceed 300 mm in thickness when compacted and must be compacted to the requirements stated in Table R44.10.

## 5.3 ROCK FILL EMBANKMENTS

### 5.3.1 Rock Fill Material

Rock fill is material composed of hard, sound, durable rock with only a small amount of fine particles, which when placed and compacted in a formation derives its stability from the mechanical interlock of the coarser particles, rather than from the compaction of the finer material around the coarser particles.

Material for rock fill must comply with Table R44.6. The constituent particles must be of uniform strength and soundness.

**Table R44.6 – Rock Fill Material Properties**

<b>Property</b>	<b>Requirement</b>
Maximum particle dimension	300 mm
Percentage passing:	
100 mm AS sieve	0 – 20%
19.0 mm AS sieve	0 – 10%
1.18 mm AS sieve	0 – 5%
Percentage of +100 mm fraction with $I_{s(50)} < \text{Annexure R44/A2.2}$	10% (max)
Wet/Dry Strength Variation	Annexure R44/A2.2

If you elect to construct a rock fill embankment, adjust the working methods employed in the excavation of cuttings so as to produce rock fill material of the grading and rock strength specified. Such working methods must include screening and, if necessary, secondary processing.

Material that does not meet the requirements for rock fill must be broken down further into finer particles, or have additional fines incorporated, and used in earth fill embankments in accordance with Clause 5.2.

### 5.3.2 Placing Rock Fill

Nominate to the Principal the proposed areas of rock fill. Unless shown otherwise on the Drawings, do not place rock fill in areas where earth fill has previously been constructed.

Shape and treat the foundations under rock fills to maintain drainage and to ensure that erosion of the foundation will not occur. Where shown on the Drawings or directed by the Principal, place a geotextile complying with Specification TfNSW R63 over the foundation area prior to placing the rock fill.

Place and spread the rock fill material in such a way as to avoid segregation and to ensure that it is not contaminated with foreign material. The compacted rock fill layer thickness must not exceed 550 mm.

Do not dump rock against the columns or retaining walls but build it up evenly by hand placing around or against such structures.

Compact the rock fill using the nominated compaction procedure, developed as specified in Clause 7.5.

### 5.3.3 Surplus Rock Fill Material

If you elect to construct earth fill in some or all of the nominated rock fill locations, and a surplus of rock, capable of being processed for rock fill, is later found to exist, then treat the surplus by:

- (a) processing the material for use as earth fill; or
- (b) removal of earth fill, and placement of the surplus rock as rock fill, at your cost.

**5.3.4 Rock Capping Layers**

Place a rock capping layer, composed of graded rock fill, immediately above the completed rock fill embankment of completed thickness as specified in Annexure R44/A4.

The material in the rock capping layer must comply with the properties shown in Table R44.7.

**Table R44.7 – Rock Capping Layer Material Properties**

<b>Property</b>	<b>Requirement</b>
Maximum particle dimension	150 mm
Percentage passing:	
19.0 mm AS sieve	0 – 15%
1.18 mm AS sieve	0 – 5%
Percentage of +19.0 mm fraction with $I_{s(50)} < \text{Annexure R44/A2.2}$	10% (max)
Wet/Dry Strength Variation	Annexure R44/A2.2

Place and spread the material for the capping layer in such a way as to avoid segregation and to ensure that it is not contaminated with foreign material. Compact the capping layer using the nominated compaction procedure, developed as specified in Clause 7.5.

Provide a geotextile complying with TfNSW R63 as separation between rock capping layer and any overlying layer of earth fill.

Do not place the rock capping layer within 400 mm of the underside of the Selected Material Zone. Increase this minimum distance to 800 mm, where safety barrier posts, subsurface drainage or services are to be installed.

Payment for geotextiles will be made under Pay Item R44P7.5(a).

**5.4 EMBANKMENT BATTER TOLERANCES**

When completed, the batters of embankments must conform to those shown on the Drawings unless otherwise authorised or re-determined by the Principal.

The tolerances for construction of embankment batters are detailed in Table R44.8.

**Table R44.8 – Tolerances for Embankment Batters**

Location	Tolerance (mm)	
	Slope 1H:1V or flatter	Steeper than 1H:1V
At level of top of formation/underside of pavement	+0 / -150	+0 / -150
Between top of formation and 1 m below top of formation	+150 / -150	+150 / -150
Beyond 1 m below top of formation	+300 / -300	+300 / -300

**Note:** Plus (+) is towards the roadway and minus (-) is away from the roadway. Tolerances are measured perpendicular to the plane of the slope.

Notwithstanding the above, the edge of the formation at the level of the underside of the pavement must not be nearer to the roadway than that shown on the Drawings. Undulations in the general plane of the batter are not acceptable. The completed batter must be free of rills running down the face of the batter.

Promptly remove any loose material on the batters as the work progresses.

Placement of additional material on the existing embankment batters must be carried out in the same manner as that specified for placement of hillside embankments in Clause 3.3.

## 5.5 ROCK FACING TO EMBANKMENTS

### 5.5.1 General

Where shown on the Drawings, provide a rock facing of clean, hard, durable rock over embankment batters (including embankments at bridge structures).

Adjust your method of working and program of work such that sufficient hard and durable rock of the specified dimensions is available when required.

You may elect, with the approval of the Principal, to place surplus rock conforming to Clause 5.5.2 as rock facing.

Place the rock facing outside of the general embankment dimensions.

### 5.5.2 Rock Facing Material

Rock used for rock facing must have a minimum dimension of 500 mm, with Point Load Strength Index ( $I_{s(50)}$ ) as determined by Test Method TfNSW T223, and Wet/Dry Strength Variation meeting the respective requirements stated in Annexure R44/A2.2.

### 5.5.3 Placing Rock Facing

Build up the rock facing in layers just ahead of each layer of fill. Place the rock with its least dimension vertical, and such that mechanical interlock between the larger stones occurs.

Provide a geotextile complying with Specification TfNSW R63 as separation between the earth fill material and the rock facing.



Fill the space between larger rocks in the rock facing and adjacent fill material with progressively smaller rocks to form a graded filter which prevents the leaching out of fines from the fill material but which does not overfill the voids between larger rocks, or cause the larger rocks to lose contact with one another.

Remove any excess of fine material surrounding any rock placed within the rock facing by removing the rock, removing the excess fine material and re-placing the rock.

Exercise extreme caution whilst placing the rock facing. Where embankment material is placed in the formation above other roads in use, place the outer rock layer in such a manner as to prevent spillage down the batter. Implement measures to prevent any rock being dislodged and allowed to roll down on to any adjacent roadway or track in use.

#### **5.5.4 Payment**

Payment for the rock facing and drainage layer will be in accordance with Pay Item R44P2. Payment for the geotextile will be in accordance with Pay Item R44P7.5(a).

### **5.6 SELECT FILL ADJACENT TO STRUCTURES**

#### **5.6.1 General**

Place Select Fill adjacent to structures to the details shown on the Drawings.

Where such details are not shown on the Drawings, place Select Fill adjacent to structures in accordance with Clauses 5.6.2 to 5.6.4.

Outside of the zones of Select Fill material, place fill in accordance with Clauses 5.2 and 6.1.

#### **5.6.2 Retaining Walls and Bridge Abutments**

Place Select Fill adjacent to retaining walls and bridge abutments of the material type and to the extent required in accordance with Specification TfNSW B30.

#### **5.6.3 Culverts and Other Drainage Structures**

Place Select Fill adjacent to culverts and other drainage structures of the material type and to the extent required in accordance with Specification TfNSW R11.

#### **5.6.4 Reinforced Soil Walls**

Place fill for reinforced soil walls of the material type and to the extent required in accordance with Specification TfNSW R58 or TfNSW R59 as applicable.

## 6 STRUCTURAL TREATMENTS

### 6.1 UPPER ZONE OF FORMATION

#### 6.1.1 General

Provide an Upper Zone of Formation, including a Selected Material Zone (see Figures R44.2(a), R44.2(b), R44.6(a) and R44.6(b)), to the thickness specified in Annexure R44/A4 and with materials meeting the quality requirements specified in Clause 2.8.

Unless specified otherwise, do not import material for the Works until all material of suitable quality available from cuttings within the Site has been placed or has been allocated to be placed in the formation.

#### **HOLD POINT**

Process Held:	Delivery of site won material and imported material for the Upper Zone of Formation.
Submission Details:	Proposed source locations, quantities and types of material, and verification of conformity. If imported, verification that all possible sources of the material within the Site have been exhausted or allocated.
Release of Hold Point:	The Principal will examine details and may inspect the source and stockpiles of material prior to authorising the release of the Hold Point.

Before placing imported Upper Zone Material in any formation, carry out a survey in accordance with TfNSW G71 to determine the surface levels at sufficient locations to later determine the volume of compacted imported material placed in the Works. When shown in Annexure R44/A1, the survey must be a joint survey in accordance with Clause 1.6.

Moisture content and compaction must be in accordance with Clause 7.

Where specified in Annexure R44/A6, extend the Upper Zone of Formation layer into the medians.

#### 6.1.2 Selected Material Zone

Provide a Selected Material Zone (see Figures R44.2(a), R44.2(b), R44.6(a) and R44.6(b)) to the thickness specified in Annexure R44/A4. Place and compact each layer of the Selected Material Zone with a compacted thickness not exceeding 150 mm, unless specified otherwise in Annexure R44/A4.

Where specified in Annexure R44/A2.1, the material placed in the upper layer of the Selected Material Zone at any particular location must be from the same source, produced using the same process and exhibit similar properties prior to any chemical modification which may be required, as that placed in the lower layer, at that same location.

**HOLD POINT**

Process Held:	Placement of each Lot of Selected Material Zone.
Submission Details:	Test reports verifying conformity of each Lot of stockpiled material for use in Selected Material Zone.
Release of Hold Point:	The Principal will consider the submitted documents, prior to authorising the release of the Hold Point.

After placement, the Selected Material must be homogeneous and free from patches containing segregated stone or excess fines. The placement methods used must ensure conformity with the requirements of Clause 2.8.5 and Annexure R44/A2.2.

Trim the Selected Material Zone to meet the tolerances shown in Clause 7.7.1. As part of the trimming operation, prepare the surface in accordance with Test Method TfNSW T199, for deflection monitoring as required in Clause 7.6.

**HOLD POINT**

Process Held:	Covering of each Lot of Selected Material Zone.
Submission Details:	Verification of conformity of each Lot of Selected Material Zone placed, with relevant test and survey reports.
Release of Hold Point:	The Principal will consider the submitted documents, prior to authorising the release of the Hold Point.

**6.2 VERGES**

Provide verges as shown on the Drawings, and meeting the material quality requirements specified in Clause 2.8.

Unless otherwise specified, do not place imported material in the Works until all material of suitable quality available from the cuttings within the Site has been placed or has been assigned to be placed in the formation.

**HOLD POINT**

Process Held:	Delivery of site won and imported material for the verges.
Submission Details:	Proposed location, quantities and type of material, and verification of conformity. If imported, verification that all possible sources of the material within the Site have been exhausted.
Release of Hold Point:	The Principal will examine details and may inspect the source and stockpiles of material prior to authorising the release of the Hold Point.

If required, carry out a survey in accordance with Specification TfNSW G71:

- (a) before placing material in any verge to determine the surface levels at sufficient locations to later determine the volume of compacted verge material placed in the Works; and
- (b) before placing imported material to determine the surface levels at sufficient locations to later determine the volume of compacted imported material placed in the Works.

When shown in Annexure R44/A1, the surveys must be a joint survey in accordance with Clause 1.6.

Place and compact the verge material in layers with the compacted thickness of each layer between 100 mm and 200 mm unless otherwise specified in Annexure R44/A4.

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

Moisture content and compaction must be in accordance with Clause 7. You may compact adjacent to a concrete pavement only after at least 10 days after the placement of concrete, or after joint sealing is completed, whichever is the later.

Trim the verge to meet the tolerances shown in Clause 7.7.

### **6.3 OTHER TREATMENTS**

Provide other Structural Treatments where shown on the Drawings, to comply with geotechnical or other design requirements.

## **7 ADDITIONAL CONFORMITY REQUIREMENTS**

### **7.1 GENERAL**

Compact all layers of material placed in the Works uniformly over the full area and depth of the layer to achieve the relative compaction specified before the next layer is commenced. Trim each layer of material prior to and during compaction. Complete the compaction promptly to ensure that moisture content remains conforming and uniform and to minimise the possibility of rain damage.

### **7.2 EARTH FILL MOISTURE CONTENT**

Maintain the moisture content of earth fill, at the time of compaction, within the range specified in Annexure R44/A5 at all locations within the Lot. Adjust the moisture content within that range to enable the specified compaction to be achieved. Address monitoring and adjusting of moisture content in the EARTHWORKS PLAN.

Do not compact material that has been placed with a moisture content greater than that specified in Annexure R44/A5, or has become wetted-up after placement, until it has dried out so that the moisture content is within the specified range. The drying process may be assisted by aeration or, where approved by the Principal, by the use of hydrated lime or quicklime, complying with Specification TfNSW 3211, at your cost.

Alternatively, you may remove the wet material to a stockpile site for drying out and later use as fill material. Any cost of removal to stockpile, for drying out and later use is deemed to be included in the rates generally.

If there is insufficient moisture in the material for it to be compacted as specified, add water. The added water must be applied uniformly and thoroughly mixed with the material until a homogeneous mixture is obtained. The cost of such wetting of the material must be borne by you.

Measure the field moisture content in accordance with Clause 7.3.5.

### **7.3 SAMPLING AND TESTING FOR COMPACTION CONFORMITY**

#### **7.3.1 General**

Ensure that the laboratory acts independently when carrying out sampling and testing, as detailed in TfNSW Q Annexure Q/L Clause L2.

Provide a smooth surface at each sampling location for the purpose of obtaining samples.

#### **7.3.2 Homogeneity**

A Lot must contain only areas of work that are essentially homogeneous. This occurs when material origin and properties, general appearance, moisture condition during compaction, compaction technique, response to compactors, and state of underlying materials are substantially alike.

Areas that fail to meet these conditions must be excluded from the Lot and must be tested separately as one or more additional Lots.

The PROJECT QUALITY PLAN must include procedures to ensure that Lots are inspected for homogeneity in accordance with TfNSW Q Annexure Q/L Clause L1.

#### **7.3.3 Applicable Test Methods for Field Density**

At each sample location selected for determination of relative compaction, carry out a field density test and obtain a sample for laboratory testing to obtain the maximum density and field moisture content.

Carry out field (insitu) density tests in accordance with either Test Methods TfNSW T173 using a nuclear gauge, TfNSW T119 using the sand replacement method, or TfNSW T165 using the fixed volume extractive method. The situations where these test methods are applicable are shown in Table R44.9.

**Table R44.9 – Applicable Test Methods for Determining Field Density and Relative Compaction**

<b>Fill Material Properties</b>	<b>Test Method / Actions</b>
≤ 20% by mass retained on 37.5 mm AS sieve	Either T173 (nuclear gauge) or T119 (sand replacement method)
> 20%, ≤ 40% by mass retained on 37.5 mm AS sieve	T119 (sand replacement method) <sup>(1)</sup>
> 40% by mass retained on 37.5 mm AS sieve	Report only % by mass of oversize material <sup>(2)</sup>
Fine to medium grained cohesionless materials, including one size material or gap graded material	T165 (fixed volume extractive method)

**Notes:**

<sup>(1)</sup> If % by mass retained on 37.5 mm AS sieve is between 20% and 40%, do not use the nuclear gauge method.

<sup>(2)</sup> If % by mass retained on 37.5 mm AS sieve is greater than 40%, do not report the relative compaction as the test result obtained is not valid.

Do not use TfNSW T173 (nuclear gauge) for insitu density tests if the layer thickness exceeds 300 mm.

**7.3.4 Use Only Single Test Method for Particular Lot**

Conduct all tests within a particular Lot using only a single Test Method. Do not combine results obtained using different Test Methods in a statistical calculation to assess conformity of a particular Lot.

**7.3.5 Field Moisture Content**

Determine field moisture content in accordance with Test Methods TfNSW T120, TfNSW T121, or TfNSW T180. Only use TfNSW T121 and TfNSW T180 where results have previously been checked against those of TfNSW T120 for the range of materials being compacted, using Test Method TfNSW T2105.

**7.3.6 Relative Compaction Determination**

Irrespective of the Test Method used to determine the insitu density, determine also the proportion and density of oversize material retained on the 37.5 mm AS sieve in the sample, for adjustment of the laboratory maximum density, in accordance with the procedure described in Test Method TfNSW T105 Appendix A Part A.5.

Determine the laboratory maximum density using Test Methods TfNSW T111, TfNSW T112, TfNSW T162, TfNSW T164 or TfNSW T166, as appropriate.

Calculate the relative compaction using Test Method TfNSW T166.

**7.3.7 Repair of Test Holes**

Repair test holes using freshly mixed material of the same type as used in the surrounding earthworks layer. Compact the repair material to a degree equal to that of the surrounding earthworks layer. Detail in the PROJECT QUALITY PLAN the method of repairing the test holes.

**7.4 COMPACTION CONFORMITY**

Determine the characteristic value of relative compaction in accordance with Specification TfNSW Q. Round off the relative compaction value and the characteristic relative compaction value to the nearest 0.1%.

Conformity of a Lot is achieved if the lower limit of the characteristic value of relative compaction of that Lot is not less than that specified in Table R44.10.

**Table R44.10 – Lower Limit for Characteristic Values of Relative Compaction**

Location of Material	Lower Limit of Characteristic Value of Relative Compaction
Earth mounds Spoil	90.0%
Each layer of material replacing unsuitable material under embankments. Foundation treatments for embankments (except Type E2 bridging layer and Type E5 drainage layer).	95.0%
Each layer of material replacing unsuitable material in cuttings. Foundation treatments in cuttings. Each layer of material placed in formations up to the underside of the Selected Material Zone, including that in Shallow Embankments and Cut/Fill Transition Zone. Material in verges or within medians up to the level at which topsoil is placed. Other areas not specifically mentioned herein.	98.0%
Material placed in the spill through bridge abutment zone, as specified in Clause 5.2.3.	100.0%
Each layer of the Selected Material Zone.	102.0%

**7.5 ROCK FILL PLACING CONFORMITY**

Conformity of rock fill placing is based on compliance with the nominated compaction procedure, verified in accordance with this Clause and proof rolling in accordance with Clause 7.6.1.

Through construction and testing of some trial sections, develop a materials grading, mixing, watering and rolling procedure and nominate the verified procedure to the Principal. The compaction procedure must include at least one vibrating roller. If the procedure includes insitu modification (e.g. with a grid roller or similar), then verify the after-compaction grading of the material.

**WITNESS POINT**

Process Witnessed:	Construction of each trial section of rock fill.
Submission Details:	Notification of the place, date and time of construction of the trial section, at least 3 working days prior to commencement, with details of: <ul style="list-style-type: none"> <li>(i) Test results of all previous trial sections;</li> <li>(ii) Material type(s) and specifications, including moisture conditioning prior to and during rolling;</li> <li>(iii) Plant types and specifications;</li> <li>(iv) Number of roller passes;</li> <li>(v) Maximum and minimum roller speed and frequency of vibration;</li> <li>(vi) In-process testing regime and proof that there is no remaining internal settlement and proof that embankment stability exists.</li> </ul>

The length of a trial section must not exceed 50 m, and the width must be greater than or equal to 2 times the maximum roller drum width. Do not construct trial sections within 1.5 m of the bottom of the Selected Material Zone.

Verification of a compaction procedure will be based on results from two (2) successive trial sections. Two contiguous trial sections, constructed over the same time period in a continuous operation, is not considered as two successive trial sections.

**HOLD POINT**

Process Held:	Construction of remaining sections of rock fill.
Submission Details:	Verification, including test results, of conformity of each trial section including details of the proposed compaction procedure, any test results and survey reports.
Release of Hold Point:	The Principal will consider the submitted documents, prior to authorising the release of the Hold Point.

Where in-process testing of the compaction procedure reveals nonconforming results, cease all placing and compaction, and redevelop the procedure using new trial sections in accordance with the above, or break down and/or sort rock material to achieve an earth fill in accordance with Clause 5.2.

The above Hold Point applies to the redeveloped procedure prior to recommencement of placement and compaction operations.

All costs associated with the development and nomination and verification of the compaction procedure, and the utilisation of the nominated compaction procedure on rock fill layers is deemed to be included in the rate for General Earthworks.



## **7.6 DEFLECTION TESTING**

### **7.6.1 Proof Rolling**

All embankment Lots, and all other surfaces within 1.5 m of the underside of the Selected Material Zone, must be capable of withstanding proof rolling to verify their stability.

Where directed by the Principal, carry out proof rolling in accordance with Test Method TfNSW T198 of embankment Lots and other surfaces within 1.5 m of the underside of the Selected Material Zone. The proof rolled surfaces must not exhibit visible deformation, rutting, or yielding and/or show signs of distress or instability.

#### **WITNESS POINT**

Process to be Witnessed: Proof rolling of any embankment fill layer, or any other surface within 1.5 m of the underside of the Selected Material Zone.

Submission Details: At least 1 working day prior to the proof rolling, notify the Principal and provide verification that the subject layer or surface conforms in all respects except for proof rolling.

The moisture content of the compacted material being proof rolled must be within the range specified in Annexure R44/A5. Proof roll each layer immediately following compaction. For the purpose of deflection testing by proof rolling, take the testing paths along the full width and length of each Lot.

If further proof rolling is required at a later date, the layer must be re-conditioned such that the moisture content is within the range specified in Annexure R44/A5, re-verified as conforming for density and survey requirements of this Specification, and given not less than eight (8) passes with the roller to be subsequently used for the proof rolling operation.

### **7.6.2 Benkelman Beam**

Where specified in Annexure R44/A4, conduct deflection testing using the Benkelman Beam in accordance with Test Method TfNSW T199 of the following surfaces:

- (a) underside of the Selected Material Zone;
- (b) top of the Selected Material Zone.

Where no Selected Material Zone is specified, conduct deflection testing of the formation at the level of the underside of pavement. Benkelman Beam testing of the underside of the Selected Material Zone is not required if a drainage layer lies immediately below the Selected Material Zone.

Carry out deflection testing by Benkelman Beam within 3 days of compaction of the material, or such longer period as approved by the Principal due to adverse weather conditions.

Where the required characteristic deflection does not exceed 1.2 mm, the standard deviation of the Lot must not exceed 0.2 mm. If the required characteristic deflection exceeds 1.2 mm, the coefficient of variation of the Lot must not exceed 25%.

For the purpose of deflection testing with the Benkelman Beam, a Lot must consist of a continuous length of formation and of at least a single carriageway width that is generally homogeneous with respect to material and appearance. Mark the boundaries of each Lot such that they are clearly identifiable in the field.

Obtain the characteristic deflection for each Lot from the equation:

$$CD = u + f \cdot \sigma$$

- where CD = characteristic deflection  
u = average maximum deflection  
f = value as shown in Annexure R44/A4  
 $\sigma$  = standard deviation

Where the characteristic deflection exceeds the value in Annexure R44/A4, re-examine the Lot boundaries, re-check the Lot for homogeneity, and subsequently re-nominate the Lot (or parts thereof) for further testing.

**WITNESS POINT** (when Benkelman Beam Testing is specified)

Process to be Witnessed: Benkelman Beam testing of the surface under the first layer of pavement.

Submission Details: At least 1 working day prior, notify the Principal of the time, date and location of Benkelman Beam testing and results of proof rolling.

**HOLD POINT**

Process Held: Placing each Lot of Selected Material Zone, or each Lot of pavement where there is no Selected Material Zone.

Submission Details: At least 3 working days prior, submit deflection test results, Survey Report of the finished surface and verification of conformity of each Lot of formation.

Release of Hold Point: The Principal will consider the submitted documents, and where the characteristic deflection exceeds the value in Annexure R44/A4 or the standard deviation exceeds 0.2 mm when the characteristic deflection is less than 1.2 mm, corrective action by you is required. The Principal may direct further action prior to authorising the release of the Hold Point.

**7.7 LEVEL CONTROL**

**7.7.1 Tolerances**

Finish the surface levels of the floors of cuttings, transitions, earthworks layers and zones, and verges to the design surface levels less the nominated thicknesses of the relevant overlying courses and zones to within the tolerances detailed in Table R44.11.

**Table R44.11 – Level Control - Tolerances**

Location	Tolerance
(a) Top of upper 150 mm layer of Selected Material Zone, or top of formation where there is no Selected Material Zone:	
(i) where overlying layer is part of the Contract	+0 mm / -20 mm
(ii) where overlying layer is not part of the Contract	+0 mm / -20 mm
(b) Top of lower layer of Selected Material Zone	+10 mm / -40 mm
(c) Top of formation at underside of Selected Material Zone:	
(i) where underlying layer is a drainage layer in a cutting	+20 mm / -40 mm
(ii) all other cases	+0 mm / -40 mm
(d) Surface of verges	+0 mm / -20 mm
(e) Designed Floor Level in cutting before foundation treatment:	
(i) Type C1 - Loosen and recompact	+10 mm / -40 mm
(ii) Type C3(I) - Working platform - stabilisation of insitu material	+10 mm / -40 mm
(iii) Type C4 - Geotextile and geogrids	+0 mm / -40 mm
(f) Foundation Level in cutting before foundation treatment:	
(i) Type C2 - Excavation and backfill	+10 mm / -40 mm
(ii) Type C3(II) - Working platform - imported stabilised material	+10 mm / -40 mm
(iv) Type C5 - Drainage layer in:	
- rock cutting	+10 mm / -150 mm
- other than rock cutting	+10 mm / -40 mm
(g) Foundation Level at Shallow Embankment and Cut/Fill Transition Zone	+50 mm / -150 mm
(h) Floor of benches in cutting	+50 mm / -50 mm

**Note:** Refer to Clause 1.4 and Figures R44.2(a) and (b) for definitions of "Designed Floor Level" and "Foundation Level".

### 7.7.2 Areas Below Level Tolerances

Where the overlying layer is not part of the Contract, and the finished surface level of the top of the Selected Material Zone is not higher than the upper limit of the tolerance shown in Table R44.11 (+0 mm), but is lower than the lower limit of the tolerance (-20 mm), the work may be accepted by the Principal, under the following conditions:

- (a) Deductions applied at the rate shown in Annexure R44/A4 for the volume that is outside the lower limit of tolerance (-20 mm);
- (b) Acceptance by the Principal of your method for determining the volume referred to in item (a) above by survey and calculation, and the calculated volumes.

### 7.7.3 Median Areas

The batter slopes for median areas must comply with those shown on the Drawings and undulations in the general plane of the batter slope will not be permitted outside of the following tolerances.

For a horizontal distance of up to 2 m from the edge of the shoulder (except areas where verges are required), no point on the completed batter may vary from the specified slope line by more than 35 mm when measured at right angles to the slope line. At distances greater than 2 m horizontally from the edge of the shoulder, no point on the completed batter may vary from the specified slope line by more than 75 mm when measured at right angles to the slope line.

Notwithstanding the tolerance of construction above, slope the surface of the medians so as not to pond water.

**ANNEXURE R44/A – PROJECT SPECIFIC INFORMATION****A1 SURVEY**

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text after completing Annexure R44/A1)*

*Consult TfNSW Survey Section whether TfNSW survey resources are available for undertaking the joint surveys shown in the table below, and amend the table accordingly.*

*Where “Yes / No” options are shown in the table, delete whichever is not applicable.*

Refer Clause 1.6.

Carry out the surveys listed in the table below. Where specified, the survey must be carried as a joint survey in accordance with TfNSW G71.

Clause	Area To Be Surveyed	Requirement	
		Joint Survey	Model File <sup>(1)</sup>
2.3.2	Surface at each topsoil stockpile location before commencing stockpiling	Yes	Yes / No
2.3.3	Surface after stripping of topsoil	Yes	Yes / No
2.4	Surface before removal of unsuitable material	Yes	Yes / No
2.4	Surface after removal of unsuitable material	Yes	Yes / No
3.4, 7.7.1	Floor of cutting before placing material for foundation treatment or formation	No	Yes / No
4.3, 5.4	Completed cutting and embankment batter surface prior to topsoiling, vegetation or other treatments	No	Yes / No
5.1, 6.1.1	Surface before placing imported material	Yes	Yes / No
5.1, 6.1.1	Surface after placing imported material	Yes	Yes / No
6.1.2	Surface before placing Selected Material	No	Yes / No
6.2	Surface before placing verge material	No	Yes / No
7.7.1	Top of finished formation	No	Yes / No
7.7.3	Finished surface of median	No	Yes / No

**Note:**

<sup>(1)</sup> If this requirement is “Yes”, the survey report must include an electronic file in a format suitable for creating accurate models using standard TfNSW CADD software.

**A2 MATERIALS****A2.1 Sources**

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text after completing Annexure R44/A2)*

*Where “Yes / No” options are shown in the table below, delete whichever is not applicable.*

*Where borrow areas or sources of imported material are to be specified, insert in the table below their locations.*

<b>Clause</b>	<b>Description</b>	<b>Requirement</b>
2.3.1	Topsoil:	
2.3.1 (i)	- stockpile within the Site	Yes / No
2.3.1 (ii)	- stockpile as a windrow	Yes / No
2.3.1 (iii)	- spoil outside the Site	Yes / No
2.3.1 (iv)	- spoil as contaminated material	Yes / No
2.7.2	Borrow areas:	
	- Nominated borrow area locations	
	- Maximum cut batter slope at borrow area	
2.8.2	Sources of imported material for:	
2.8.4.2	- Upper Zone of Formation, other than Selected Material Zone	
2.8.5.2	- Selected Material Zone	
2.8.6.2	- Verge	
5.2, 5.3	- General fill	
3.2.3, 3.4.3	- Working platform for Foundation Treatment Types E3(II) or C3(II)	
6.1.2	Material in both layers of the Selected Material Zone at any location must be from the same source	Yes / No <sup>(1)</sup>

**Note:**

<sup>(1)</sup> If this requirement is “Yes”, the material placed in the upper layer of the Selected Material Zone at any particular location must be from the same source, produced using the same process and exhibit similar properties prior to any chemical modification which may be required, as that placed in the lower layer at that same location.

## A2.2 Properties

Clause	Material Type	Criteria	Test Method	Pre-treatment <sup>(1)</sup>
2.8.4, 3.5	<b>Upper Zone of Formation Material other than Selected Material, including at Shallow Embankment and Cut/Fill Transition Zone:</b>			
	a) CBR <sub>10 day</sub> <sup>(2)</sup>	8 min	T117	T102/T103 <sup>(3)</sup>
	b) Plasticity Index	25 max	T109	T102/T103
2.8.5.1	<b>Site won Selected Material:</b>			
	a) Selected Material Zone, upper 150 mm thick layer CBR <sub>4 day</sub> <sup>(2)</sup> , characteristic value (Q) <sup>(3)</sup>	33 min <sup>(4)</sup>	T117	T102/T103 <sup>(5)</sup>
	b) Selected Material Zone, lower layer CBR <sub>4 day</sub> <sup>(2)</sup> , characteristic value (Q) <sup>(3)</sup>	19 min	T117	T102/T103 <sup>(5)</sup>
	c) Plasticity Index	15 max	T109	T102/T103 <sup>(5)</sup>
2.8.6	<b>Verge material:</b>			
	a) CBR <sub>4 day</sub> <sup>(2)</sup> , characteristic value (Q) <sup>(3)</sup>	19 min	T117	T102/T103 <sup>(5)</sup>
	b) Plasticity Index	6 min, 12 max	T109	T102/T103 <sup>(5)</sup>
2.8.7	<b>Spill through bridge abutment fill material:</b>			
	<b>Type ST1, for waterway crossings</b>			
	a) CBR <sub>10 day</sub> <sup>(2)</sup>	8 min	T117	T102/T103 <sup>(5)</sup>
	b) Plasticity Index	6 min, 15 max	T109	T102/T103 <sup>(5)</sup>
	<b>Type ST2, for overbridges</b>			
	a) CBR <sub>10 day</sub> <sup>(2)</sup>	8 min	T117	T102/T103 <sup>(5)</sup>
	b) Plasticity Index	25 max	T109	T102/T103 <sup>(5)</sup>
3.4	<b>Material in floor of cutting:</b>			
	a) CBR <sub>10 day</sub> <sup>(2)</sup>	8 min	T117	T102/T103 <sup>(5)</sup>
	b) Plasticity Index	25 max	T109	T102/T103 <sup>(5)</sup>
3.5	<b>Material in foundation of Shallow Embankment and Cut/Fill Transition Zone, where depth of excavation less than specified:</b>			
	a) CBR <sub>10 day</sub> <sup>(2)</sup>	8 min	T117	T102/T103 <sup>(5)</sup>
	b) Plasticity Index	25 max	T109	T102/T103 <sup>(5)</sup>
3.4.2	<b>Backfill material for Foundation Treatment Type C2:</b>			
	a) CBR <sub>10 day</sub> <sup>(2)</sup>	8 min	T117	T102/T103 <sup>(5)</sup>
	b) Plasticity Index	25 max	T109	T102/T103 <sup>(5)</sup>
3.2.5, 3.4.5	<b>Material for drainage layer (Foundation Treatment Type E5 and C5):</b>			
	a) Point Load Strength Index I <sub>s(50)</sub>	1 MPa min	T223	NA
	b) Wet/Dry Strength Variation	35% max	T215	T102
5.3.1	<b>Rock fill material:</b>			
	a) Point Load Strength Index I <sub>s(50)</sub>	1 MPa min	T223	NA
	b) Wet/Dry Strength Variation	35% max	T215	T102
5.5	<b>Rock facing material:</b>			
	a) Point Load Strength Index I <sub>s(50)</sub>	1 MPa min	T223	NA
	b) Wet/Dry Strength Variation	35% max	T215	T102

Legend: NA = not applicable    max = maximum    min = minimum

## Notes:

<sup>(1)</sup> Pre-treatment is not required where samples are taken from the compacted formation.

- (2) Compaction for CBR test must be at 100% of MDD under standard compaction.
- (3) When calculating CBR characteristic value, report values calculated to the nearest 1%.
- (4) Refer Clause 2.8.5.1. If the Selected Material conforms to the specified requirements for the lower layer of the Selected Material Zone, but has a CBR value less than that specified for the upper layer of the Selected Material Zone, the Selected Material may be modified with hydrated lime, or other binders approved by the Principal, to make it conform to the specified requirements of the upper layer. A suggested application rate for hydrated lime is 1 to 2% by mass, but the Contractor must by laboratory trials determine the appropriate application rate to be used. The modified material must have a UCS of less than 1.5 MPa, when tested in accordance with TfNSW T131 using 7 days accelerated curing. Do not use binders which are prone to give rise to rapid or uneven strength gain or excessive shrinkage.
- (5) Where pre-treatment is shown as "T102/T103", determine the appropriate pre-treatment regime for the material in accordance with Clause 2.8.3.

### **A3 FOUNDATION TREATMENT**

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text after completing Annexure R44/A3)*

*Review the default values shown in the table below and amend if appropriate, taking into account the geotechnical and the pavement design details for the project.*

*Fill in the missing details as required, and where "Yes / No" options are provided, delete whichever is not applicable.*

<b>Clause</b>	<b>Description</b>	<b>Requirement</b>
3.2.2	<b>Foundation Treatment Type E2 - Bridging Layer</b>	
	- Minimum distance from top of bridging layer to underside of Selected Material Zone	900 mm
	- Completed thickness of bridging layer	800 mm ( $\pm 100$ mm)
3.2.5	<b>Foundation Treatment Type E5 - Drainage Layer</b>	
	- Minimum distance from top of drainage layer to underside of Selected Material Zone	900 mm
	- Completed thickness of drainage layer	300 mm (+100 mm, -0 mm)
3.2.6	<b>Foundation Treatment Type E6 - Earth Fill Foundation Treatment</b>	
	- Minimum distance from top of earth fill foundation treatment layer to underside of Selected Material Zone	900 mm
	- Completed thickness of earth fill foundation treatment layer	500 mm ( $\pm 100$ mm)
3.2, 3.4	<b>Specified Foundation Treatment</b>	
	-	Type: .....
	-	Type: .....

**A4 SHALLOW EMBANKMENT, CUT/FILL TRANSITION ZONE, UPPER ZONE OF FORMATION AND VERGES**

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text after completing Annexure R44/A4)*

*Review the default values shown in the table below and amend if appropriate, taking into account the geotechnical and the pavement design details for the project.*

*Fill in the missing details as required, and where “Yes / No” options are provided, delete whichever is not applicable.*

<b>Clause</b>	<b>Description</b>	<b>Requirement</b>
3.5.1	A Shallow Embankment exists where the height from the Stripped Surface Level to the Top of Formation is less than	1,200 mm
5.3.4	Completed thickness of rock capping layer	300 mm (+100 mm, -0 mm)
6.1	Thickness of Upper Zone of Formation (incorporating Selected Material Zone) for:	
	- Embankment	600 mm
	- Shallow Embankment	1,200 mm
	- Cutting	300 mm
	- Cut/Fill Transition Zone	1,200 mm
6.1.2	Selected Material Zone:	
	- Total thickness	300 mm
6.1.2	Maximum compacted thickness of each layer in the Selected Material Zone	150 mm
6.2	Compacted layer thickness of each layer of verge material	100 mm to 200 mm
7.6.2	Deflection testing with Benkelman Beam at underside and top of Selected Material Zone	Yes / No
	Maximum characteristic deflection (CD) recorded for any Lot must not exceed:	
	- Top of Selected Material Zone	1.0 mm
	- Underside of Selected Material Zone	1.2 mm
	Factor “f” to be used in determining CD	1.65
7.7.2	Where the overlying layer is not part of the Contract, deduction to be applied for the volume that is outside the lower limit of tolerance (-20 mm)	\$/m <sup>3</sup>



**A5 COMPACTION MOISTURE REQUIREMENTS**

Refer Clause 7.2.

<b>Material Description</b> <sup>(1)</sup>	<b>Source / Location</b>	<b>Moisture Range</b> <sup>(2)</sup>
Earthworks material		60 – 90%

**Notes:**

- (1) Material types above are project specific.
- (2) The Moisture Range is expressed as the ratio of Field Moisture Content to Optimum Moisture Content at standard compactive effort and is reported to the nearest 1%.

**A6 FOUNDATION TREATMENT AND STRUCTURAL TREATMENT IN MEDIANS**

Refer Clauses 3.2, 3.4, 3.5.2 and 6.1.1.

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text after completing Annexure A6)*

*State in the table below any foundation treatment and/or structural treatment required in the medians between carriageways.*

*If any foundation treatment is required in the median areas, insert the treatment type required (e.g. E1 to E6, C1 to C5) in the middle column.*

*For Cut/Fill Transition treatment or structural treatment in medians, delete whichever of “Yes / No” option is not applicable.*

<b>Location</b>		<b>Treatment Types Required in Medians</b>		
<b>From Chainage</b>	<b>To Chainage</b>	<b>Foundation Treatment Type</b>	<b>Cut/Fill Transition</b>	<b>UZF (inc SMZ)</b>
			Yes / No	Yes / No
			Yes / No	Yes / No
			Yes / No	Yes / No

**Legend:** UZF = Upper Zone of Formation      SMZ = Selected Material Zone

**A7 BLASTING**

Refer Clause 4.6.

**Blasting permitted under Contract?      Yes / No****Limiting Blast Overpressure and Peak Particle Velocity:**

<b>Point of Potential Damage</b> (within 1 km from the proposed blast site)	<b>Blast Overpressure Level</b> (dB[linear])	<b>Peak Particle Velocity<sup>(1)</sup></b> (mm/s)
Completed and cured bridge structures or substructures (e.g. completed abutment)	–	10 mm/s
Bridgeworks and structural retaining walls under construction	–	10 mm/s
Residential premises, schools, hospitals and other buildings	115 dB <sup>(2)</sup>	5 mm/s <sup>(2)</sup>
Building or monument of historical significance	115 dB	2 mm/s

**Notes:**

<sup>(1)</sup> Peak Particle Velocity is the vector peak particle velocity, defined as the maximum of the resultant vector particle velocity  $v_p$  and is the amplitude of the vector sum of three time-synchronised velocity components directly measured by an instrument.

$v_p$  is determined by the equation  $v_p = \sqrt{(v_x^2 + v_y^2 + v_z^2)}$ ,

where  $v_x$ ,  $v_y$  and  $v_z$  are the synchronized instantaneous velocity components in the x, y and z axes respectively.

<sup>(2)</sup> 5% of readings may exceed 115 dB and 5 mm/s but must not exceed 120 dB and 10 mm/s.

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## **ANNEXURE R44/B – MEASUREMENT AND PAYMENT**

Payment will be made for all costs associated with completing the work detailed in this Specification in accordance with the following Pay Items.

Where no specific pay items are provided for a particular item of work, the costs associated with that item of work are deemed to be included in the rates and prices generally for the Work Under the Contract.

Unless specified otherwise, a lump sum price for any of these items will not be accepted.

The rates include the cost of testing where such costs are not paid under Primary Testing.

### **Pay Item R44P1 - Topsoil**

#### **Pay Item R44P1.1 - Removal and Stockpiling of Non-contaminated Topsoil (Stockpile Volumes)**

The unit of measurement is the “cubic metre”, measured on the stockpile of topsoil, removed and stockpiled in accordance with Clause 2.3. The volume is determined by survey or manual measurement, and calculation.

The rate is an average rate to cover the cost of removal, loading, handling, transporting and stockpiling of all non-contaminated topsoil within the Site.

Payment for placing of topsoil for revegetation purposes is made under the relevant pay item in Specification TfNSW R178.

#### **Pay Item R44P1.2 - Removal and Disposal Off Site of Topsoil (Bank Volumes)**

This pay item applies to both contaminated and non-contaminated topsoil.

The unit of measurement is the “cubic metre”, measured as bank volume of excavation of topsoil removed and disposed of outside the Site in accordance with Clause 2.3.1 items (iii) and (iv). The volume is determined by survey or manual measurement, and calculation.

The rate is an average rate to cover the cost of removal, loading, handling, transporting and disposal of outside the Site of the topsoil, including tipping fees and any other disposal costs.

Where the topsoil is contaminated material and is treated and disposed of outside the Site in accordance with Clause 2.5.2, additional payment is made under Pay Item R44P8.

### **Pay Item R44P2 - General Earthworks (Cut/Fill)**

The unit of measurement is the “cubic metre”, measured as bank volume of excavation.

For the purpose of determining the volume of excavation, the base of the excavation is taken as either the Designed Floor Level for Foundation Treatment Types C1, C3(I) or C4, or the Foundation Level for Treatment Types C2, C3(II) and C5, and Shallow Embankments and Cut/Fill Transition Zones, before the removal of unsuitable material. The top of the excavation is the stripped surface, from the survey carried out in accordance with Clause 2.3.3. The sides of the excavation are taken as either the design cut batters shown on the Drawings, or as determined by the Principal.

When measuring the volume of excavations for payment, no account is taken of the volume arising from:

- (a) level or batter tolerances;
- (b) loosening embankment floor in Foundation Treatment Type E1 (Clause 3.2.1);
- (c) material removed in hillside terracing (Clause 3.3);
- (d) ripping and loosening the floor of the cutting in Foundation Treatment Type C1 (Clause 3.4.1);
- (e) stabilisation of insitu material in Foundation Treatment Type C3(I) (Clause 3.4.3).

The rate is an average rate to cover excavation, placing in embankments or disposal in other than embankments within the Site, for all types of material, including both earth and rock. It includes all costs associated with the following:

- (a) excavation of material in cuttings (including benches, table drains and gutters);
- (b) excavation of material to Foundation Level for Foundation Treatment Types C2, C3(II) and C5;
- (c) excavation of material to Foundation Level for Shallow Embankments;
- (d) placing and compaction of conforming material to replace unsuitable material and contaminated material that has been removed;
- (e) placing and compaction of either earth fill or rock fill material in the formation, and materials of specified quality in the Upper Zone of Formation, other than work paid under Pay Item R44P5;
- (f) placing and compaction of materials of specified quality in Shallow Embankments, Cut/Fill Transition Zones and spill through bridge abutment zones;
- (g) placing and compaction of material of specified quality in reinforced soil block (but see item (x) below);
- (h) placing and compaction of rock capping layers;
- (i) placing of rock facing in embankments;
- (j) trimming to level tolerances;
- (k) rounding of the tops of batters;
- (l) haulage of material and any pre-treatment such as breaking down or blending material for purposes such as rock fill;
- (m) restoring, stabilising or re-forming any over-excavation;
- (n) working General Fill material and Upper Zone Material to bring moisture content of the Lot to within the specified range including drying out material containing excess moisture;
- (o) deflection testing by proof rolling (which is not a scheduled test under Primary Testing);
- (p) addressing any deficiency in sites for stockpiling, including disposal of unsuitable materials and supplying their replacement;
- (q) double handling of materials excavated from the Site that are stored temporarily in stockpiles before being returned for incorporation into the Works due to your construction staging;

except that:

- (i) supply and placing of imported or borrowed General Fill material and Upper Zone Material (other than Selected Material and verge material) is paid under Pay Item R44P3;
- (ii) removal of unsuitable material is paid under Pay Item R44P4;

- (iii) additional cost of disposal of outside the Site of non-contaminated spoil is paid under Pay Item R44P6;
- (iv) additional cost for identification, treatment and disposal of contaminated material is paid under Pay Item R44P8;
- (v) additional cost for placing site won Selected Material is paid under Pay Item R44P5.1;
- (vi) additional cost for placing site won verge material is paid under Pay Item R44P5.3;
- (vii) additional cost for Foundation Treatment Types E1, C1, E2, C2, E4/C4, E5, C5 and E6 is paid under Pay Items R44P7.1 to R44P7.8;
- (viii) additional cost for Foundation Treatment Types E3 and C3, involving chemical stabilisation of insitu material, and imported material is paid under TfNSW R50 and Pay Item R44P3;
- (ix) material from excavations for drainage works (other than that for table drains and gutters) must not be included in the measurement for this Pay Item, as this is paid for under Specification TfNSW R11;
- (x) additional cost for supply and placing of material in reinforced soil block is paid as an “extra over” under Specification TfNSW R58/R59;
- (xi) placing site won Select Fill adjacent to structures is paid under TfNSW B30, R11 and R58/R59;
- (xii) payment for incorporation into embankments of surplus material from other works under the Contract is included in the relevant pay items for excavation in the specifications for those other works.

**Pay Item R44P3 - Imported or Borrowed Material (other than Selected Material, Verge Material and Foundation Treatment Material)**

The unit of measurement is the “cubic metre” of compacted volume of imported or borrowed material, measured in place. The volume is determined by calculation from the Drawings or by survey.

Payment will not be made for excess widening of embankments or wastage by you.

The rate covers all costs associated with supply, haulage, placing, compaction, and trimming to level tolerances, of imported or borrowed material placed in the formation, including any necessary pre-treatment such as breaking down or blending material or drying out material containing excess moisture. It includes the cost of imported or borrowed material for Foundation Treatment C3(II). Stabilisation of the imported material is paid under the relevant pay item in Specification TfNSW R50.

It also includes all costs associated with the opening up of the borrow site, excavation of material from the borrow site, maintenance of the borrow site, and restoration of the borrow site.

It excludes the cost of imported or borrowed material for the following:

- (a) Selected Material (paid under Pay Item R44P5.2);
- (b) Verge material (paid under Pay Item R44P5.4);
- (c) Replacement of unsuitable material (paid under Pay Item R44P2);
- (d) Foundation Treatment Type E2 (paid under Pay Item R44P7.3(b));
- (e) Foundation Treatment Type C2 (paid under Pay Item R44P7.4(b));
- (f) Foundation Treatment Type E5 (paid under Pay Item R44P7.6(b));
- (g) Foundation Treatment Type C5 (paid under Pay Item R44P7.7(b))

- (h) Select Fill adjacent to structures (paid under the relevant pay items in Specifications TfNSW B30 and R11).

**Pay Item R44P4 - Unsuitable Material**

This Pay Item refers only to unsuitable material as defined in Clause 1.4 and described in Clause 2.4.

The unit of measurement is the “cubic metre”, measured as bank volume of excavation.

If the bank volume of excavation cannot be measured, the Principal will determine the conversion factors to be applied to the loose volumes measured in haulage plant or in stockpile volumes in order to calculate the bank volume of excavation for payment.

The rate covers all costs associated with the excavation of unsuitable material, temporary stockpiling, drying out, haulage, compaction or other activity required under Clause 2.4 for the incorporation of unsuitable material in embankments or all activities required for disposal within the Site in accordance with Clause 2.5.1. Placing and compaction of conforming material to replace the unsuitable material removed is paid under Pay Item R44P2.

Where the Principal directs that non-contaminated unsuitable material be disposed of outside the Site, additional payment will be made under Pay Item R44P6.

Where the unsuitable material is contaminated material and requires identification, treatment and disposal of outside the Site, additional payment will be made under Pay Item R44P8.

When the schedule of quantities under Pay Item R44P4 provides for ranges of provisional quantities, the rates are applied successively, but not cumulatively, as the volume of unsuitable material increases from one provisional quantity range to the next higher range.

Each rate is applied for all unsuitable material removed within each quantity range, irrespective of the nature of the material removed.

**Pay Item R44P5 - Selected Material Zone and Verge**

The unit of measurement is the “cubic metre” of compacted volume of the Selected Material Zone and verge.

For the purpose of determining the volume, the width, depth and length are taken as those shown on the Drawings, and no account is taken of the allowable placement tolerances. Where additional areas are directed by the Principal, the volume is determined by survey or manual measurement, and calculation.

The rates cover all costs associated with the identification, winning/purchasing, processing (including blending or modification to meet the CBR and PI requirements), stockpiling (including double handling to suit your construction staging), haulage, placing, compaction and trimming of material in the Selected Material Zone and verge.

Where modification of the material is required for purposes other than only to meet specified CBR requirements (refer Clause 2.8.5.1), payment for the work is made under the relevant pay item in Specification TfNSW R50.

**Pay Item R44P5.1 – Selected Material Zone – Site Won Material**

Where the material is obtained from excavations within the Site, the rate is an “extra over” rate to cover any additional cost over and above those allowed for under Pay Item R44P2.

**Pay Item R44P5.2 – Selected Material Zone – Imported Material**

Where the material is imported from outside the Site, the rate covers all costs (including the cost of any modification required to conform to TfNSW 3071).

**Pay Item R44P5.3 – Verge – Site Won Material**

Where the material is obtained from excavations within the Site, the rate is an “extra over” rate to cover any additional cost over and above those costs allowed for under Pay Item R44P2.

**Pay Item R44P5.4 – Verge – Imported Material**

Where the material is imported from outside the Site, the rate covers all costs (including the cost of any modification required to conform to Specification TfNSW 3071).

**Pay Item R44P6 – Disposal Off Site of Non-contaminated Spoil (other than Topsoil)**

The unit of measurement is the “cubic metre”, measured as bank volume of excavation.

If the bank volume of excavation cannot be measured, the Principal will determine the conversion factors to be applied to the loose volumes measured in haulage plant or in stockpiles in order to calculate the bank volume of excavation for payment.

The rate is an average rate to cover all additional costs associated with the disposal of outside the Site of all types of non-contaminated material, except for topsoil. The rate includes the cost of classification in accordance with EPA Waste Classification Guidelines.

Payment for disposal of non-contaminated topsoil outside the Site is made under Pay Item R44P1.2.

Payment under this Pay Item R44P6 is additional to payment(s) made under R44P2 or R44P4.

**Pay Item R44P7 – Foundation Treatments**

**Pay Item R44P7.1 – Treatment Type E1 – Loosen and Recompact**

The unit of measurement is the “square metre” of area treated.

The area is determined by survey or manual measurement, and calculation. The area measured excludes changes to the design quantities resulting from over-clearing or over-excavation and changes to suit your construction method.

The rate is an average rate to cover the cost of loosening the embankment foundation, terracing, adjusting the moisture content, processing the material to achieve the specified quality requirements, recompaction and trimming as specified. The Pay Item covers costs over and above those allowed for under Pay Item R44P2.

**Pay Item R44P7.2 – Treatment Type C1 – Loosen and Recompact**

The unit of measurement is the “square metre” of area treated.

The area is determined by survey or manual measurement, and calculation. The area measured excludes changes to the design quantities resulting from over-excavation and changes to suit your construction method.

The rate is an average rate to cover the cost of trimming the excavated floor of cutting, loosening the floor of cutting, adjusting the moisture content, processing the material to achieve the specified quality requirements, recompaction and trimming as specified. The Pay Item covers costs over and above those allowed for under Pay Item R44P2.

**Pay Item R44P7.3 – Treatment Type E2 – Bridging Layer**

The unit of measurement is the “cubic metre” of compacted volume, measured in place. The quantity is determined by survey or manual measurement, and calculation.

The measured quantity of bridging layer excludes changes to the design quantities resulting from excess widening of the bridging layer, wastage and changes to suit your construction method.

The rate allows for any bridging layer material that penetrates or settles below the level of the underlying natural surface or stripped surface.

**Pay Item R44P7.3(a) – Treatment Type E2 – Bridging Layer – Site Won Material**

The rate covers all costs associated with the identification, selection, winning, processing (including breaking down), stockpiling (including double handling to suit your construction staging), haulage and placing of site won material in the bridging layer, over and above those costs allowed for under Pay Item R44P2.

**Pay Item R44P7.3(b) – Treatment Type E2 – Bridging Layer – Imported Material**

The rate covers all costs associated with the identification, winning/purchasing, processing (including breaking down), stockpiling (including double handling to suit your construction staging), haulage and placing of imported material in the bridging layer.

Geotextile is measured and paid for under Pay Item R44P7.5(a).

**Pay Item R44P7.4 – Treatment Type C2 – Excavation and Backfill**

The unit of measurement is the “cubic metre” of compacted volume, measured in place.

The volume is determined by calculation using the specified thickness and measured area. The volume excludes quantities resulting from excess widening of the layer, wastage, local depressions, settlement or changes to suit your construction method.

**Pay Item R44P7.4(a) – Treatment Type C2 – Backfill – Site Won Material**

The rate covers all costs associated with the identification, selection, winning, haulage, processing (including breaking down), stockpiling (including double handling to suit your construction staging), haulage, placing, compaction and trimming of site won material in the backfill layer, over and above those costs allowed for under Pay Item R44P2.

**Pay Item R44P7.4(b) – Treatment Type C2 – Backfill – Imported Material**

The rate covers all costs associated with the identification, winning/purchasing, processing (including breaking down), stockpiling (including double handling to suit your construction staging), transportation, placing, compaction and trimming of imported material in the backfill layer.



Excavation to Foundation Level is paid under Pay Item R44P2.

**Pay Item R44P7.5 – Treatment Type E4 and Type C4 – Geotextile and Geogrid**

The unit of measurement is the “square metre” of each type of geotextile or geogrid installed.

The area of geotextile or geogrid is determined using the width and length measured in place. The area measured excludes the additional areas in the laps required to provide a continuous length or width of geotextile or geogrid.

**Pay Item R44P7.5(a) – Geotextile**

**Pay Item R44P7.5(b) – Geogrid**

The rate covers all costs associated with the supply and placing of geotextile and geogrids in earthworks, including use in rock fill, rock facing and foundation treatments.

**Pay Item R44P7.6 – Treatment Type E5 – Drainage Layer**

The unit of measurement is the “cubic metre” of compacted volume, measured in place.

The volume is determined by calculation using the specified thickness and measured area. The volume excludes quantities resulting from excess widening of the layer, wastage, local depressions, settlement, or changes to suit your construction method.

The rate allows for any drainage layer material that penetrates or settles below the level of the underlying natural surface or stripped surface.

**Pay Item R44P7.6(a) – Treatment Type E5 – Drainage Layer – Site Won Material**

The rate covers all costs associated with the identification, selection, winning, haulage, processing (including breaking down), stockpiling (including double handling to suit your construction staging), haulage, placing, compaction and trimming of site won material in the drainage layer, over and above those costs allowed for under Pay Item R44P2.

**Pay Item R44P7.6(b) – Treatment Type E5 – Drainage Layer – Imported Material**

The rate covers all costs associated with the identification, winning/purchasing, processing (including breaking down), stockpiling (including double handling to suit your construction staging), transportation, placing, compaction and trimming of imported material in the drainage layer.

Geotextile is measured and paid for under Pay Item R44P7.5(a).

**Pay Item R44P7.7 – Treatment Type C5 – Drainage Layer**

The unit of measurement is the “cubic metre” of compacted volume, measured in place.

The volume is determined by calculation using the specified thickness and measured area. The volume excludes quantities resulting from excess widening of the layer, wastage, local depressions, settlement, or changes to suit your construction method.

The rate allows for any drainage layer material that penetrates or settles below the level of the underlying natural surface or stripped surface.

**Pay Item R44P7.7(a) – Treatment Type C5 – Drainage Layer – Site Won Material**

The rate covers all costs associated with the identification, selection, winning, haulage, processing (including breaking down), stockpiling (including double handling to suit your construction staging), haulage, placing, compaction and trimming of site won material in the drainage layer, over and above those costs allowed for under Pay Item R44P2.

**Pay Item R44P7.7(b) – Treatment Type C5 – Drainage Layer – Imported Material**

The rate covers all costs associated with the identification, winning/purchasing, processing (including breaking down), stockpiling (including double handling to suit your construction staging), transportation, placing, compaction and trimming of imported material in the drainage layer.

Excavation to Foundation Level for the drainage layer is paid for under Pay Item R44P2.

Geotextile is measured and paid for under Pay Item R44P7.5(a).

**Pay Item R44P7.8 – Treatment Type E6 – Earth Fill Foundation Treatment Layer**

The unit of measurement is the “cubic metre” of compacted volume, measured in place.

The quantity is determined by survey or manual measurement, and calculation. The measured quantity of earth fill foundation treatment layer excludes changes to the design quantities resulting from excess widening of the earth fill foundation treatment layer, wastage and changes to suit your construction method.

The rate covers all costs associated with the identification, selection, winning, processing (including breaking down), stockpiling (including double handling to suit you), haulage, placing, compacting and trimming of site won material in the earth fill foundation treatment layer, over and above those costs allowed for under Pay Item R44P2.

The rate allows for any earth fill foundation treatment material that penetrates or settles below the level of the underlying natural surface or stripped surface.

Geotextile is measured and paid for under Pay Item R44P7.5(a).

**Pay Item R44P8 - Identification, Treatment and Disposal Off Site of Contaminated Material**

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text after customising Pay Item R44P8)*

*Use Pay Item R44P8.1 where the presence of specific types of contaminated materials has been identified during site investigation. Provide separate sub-Pay Items R44P8.1(a), R44P8.1(b), etc for each type of identified contaminated material, with descriptions of the contaminated material.*

*Use Pay Item R44P8.2 for any potential contaminated material which has not been identified at time of tender.*

The rate covers the additional costs of identification, classification in accordance with EPA Waste Classification Guidelines, treatment, loading, haulage and disposal of contaminated material at sites legally authorised to accept the contaminated material, whether the contaminated material is topsoil, general fill or unsuitable material.

Payment under this Pay Item R44P8 is additional to payment made under Pay Items R44P1.2, R44P2 or R44P4 as applicable.

**Pay Item R44P8.1 – Identified Contaminated Material**

The unit of measurement is the “tonne” of disposed material.

The quantity is determined using weighbridge dockets or invoices issued by the disposal facility.

**Pay Item R44P8.2 – Other Contaminated Material**

The Pay Item is a Provisional Sum.

Payment will be made for the costs of the activities required by Clause 2.5.2 for any contaminated material other than those provided in Pay Item R44P8.1 plus the provisional sum margin added in accordance with Clause 55.4 of the General Conditions of Contract.

## **ANNEXURE R44/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS AND IDENTIFIED RECORDS**

Refer to Clause 1.3.3.

### **C1 SCHEDULE OF HOLD POINTS**

<b>Clause</b>	<b>Description</b>
G71 Cl 2.10.1	Notification of joint survey.
2.3.3, G71 Cl 2.10.2	Submission of joint survey results.
2.4	Inspection after removal of unsuitable material and prior to backfilling.
3.2	Presentation of each Lot of embankment foundation after removal of topsoil, and submission of CBR and PI test results of material in foundation, if required.
3.4	Presentation of each Lot of floor of cutting, and submission of CBR and PI test results of material in floor of cutting, if required.
4.2	Presentation of cleaned batter and bench/floor surfaces for geotechnical inspection.
4.6.1, G36 Cl 4.7	Submission of Vibration and Airblast Management Sub-Plan and the Building Condition Inspection Reports.
4.6.1	Submission of blasting details for each blast.
6.1.1	Submission of details of location, quantities, type and verification of conformity of Upper Zone Material (including Selected Material). If imported, verification that all possible sources of material within the Site have been exhausted.
6.1.2	Verification of conformity of stockpiled Selected Material.
6.1.2	Verification of conformity of each Lot of Selected Material Zone placed, with test and survey reports.
6.2	Submission of details of location, quantities, type and verification of conformity of verge material. If imported, verification that all possible sources of material within the Site have been exhausted.
7.5	Verification of conformity of each trial section of rock fill, including submission of compaction procedure, test results and survey reports.
7.6.2	Submission of deflection test results, finished surface levels and verification of conformity of each Lot of Selected Material Zone placed (or pavement where no Selected Material Zone is specified).

### **C2 SCHEDULE OF WITNESS POINTS**

<b>Clause</b>	<b>Description</b>
7.5	Construction of each trial section of rock fill.
7.6.1	Proof rolling of embankment layers and other surfaces within 1.5 m of the underside of

	the Selected Material Zone.
7.6.2	Benkelman Beam testing of Selected Material Zone.

**C3 SCHEDULE OF IDENTIFIED RECORDS**

The records listed below are Identified Records for the purposes of TfNSW Q Annexure Q/E.

<b>Clause</b>	<b>Description of Identified Record</b>
1.5	Earthworks Plan.
2.5	Records of spoil disposal, including their locations, relevant consents and planning and environmental approvals, placement Lot records, and records of contaminated material transport and disposal.
2.7.3	Records of contractor arranged borrow areas, including their locations, relevant consents and planning and environmental approvals, and placement Lot records.
2.8.2	Details of source, location, quantities and type of imported Selected Material.
4.6.1	Details of blasting design and measures to limit noise and ensure that vibration from blasting does not adversely affect nearby structures.
4.6.2	Blasting records.
7.6	Deflection testing results of each Lot of formation.

**ANNEXURES R44/D TO R44/K – (NOT USED)**

## ANNEXURE R44/L – WORK ACTIVITIES, TEST METHODS, MINIMUM FREQUENCY OF TESTING AND ACCEPTANCE CRITERIA

A summary of the work activities, test methods, minimum frequencies of testing and acceptance criteria for control of the earthworks process is given in Table R44/L.1.

**Table R44/L.1 – Control of Earthworks Process**

Work Activity	* clause reference in R44, unless noted otherwise			
	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
<b>1. Project Planning</b>	1.3.4			
Submit EARTHWORKS PLAN	1.5, 2.2			
<b>2. Clearing and Grubbing</b>	2.3.1			
Clearing and grubbing	G40	Inspection	Each section	Complete
<b>3. Erosion and Sedimentation Control</b>	1.7, 2.6, 2.7			
Install and maintain erosion and sedimentation control measures, including at stockpile areas and borrow areas	G36, G38	Inspection	Each section or site	Approved Env Sed Ctrl Plan
<b>4. Setting Out of Earthworks</b>	1.6.1			
Set out position of intersection line between plane of Designed Floor Level and plane of stripped surface	3.5.2	Survey	Each cut/fill transition	Pegs in place
Establish and maintain batter profiles	1.6.1	Survey	Each section	Pegs in place
Remove pegs at completion of work		Inspection	Each section	Pegs removed
<b>5. STOCKPILE AREAS</b>	2.6			
Stockpile areas not nominated by the Principal - obtain the Principal's concurrence at least 10 working days in advance	2.6		Each area	Evidence of approvals and consents
Pre-construction land condition assessment	G36		Each area	G36
Post-construction land condition assessment	G36		Each area	G36
Restore stockpile areas	2.6, G36	Inspection	Each area	G36, R178
<b>6. BORROW AREAS AND IMPORTED MATERIALS</b>	2.7, 2.8, 6			
Contractor arranged borrow areas - advise the Principal at least 10 working days in advance	2.7.3		Each area	Evidence of approvals and consents
Site preparation of Principal nominated borrow areas	2.7.2	Inspection	Each area	2.7.2, G40
Location and shape of batters in Principal nominated borrow areas	2.7.2	Inspection	Each area	2.7.2, R44/A2.1
Restore borrow areas	2.7.2	Inspection	Each area	R178
Delivery of imported materials <b>Hold Point</b>	6.1.1, 6.2	R44/A2.2	Each source	Release of Hold Point
Survey to determine quantity of imported materials placed in the Works	1.6.3, 6.1.1, 6.2	Survey	Each section	Survey report

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* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
<b>7. TOPSOIL</b>	2.3			
<b>7.1 Removal of Topsoil</b>	2.3.1			
Survey of stripped surfaces <b>Hold Point</b>	2.3.3, 1.6	Survey	Each section	Release of Hold Point
<b>7.2 Stockpiling Topsoil</b>				
Survey of stockpile areas prior to stockpiling	2.3.2, 1.6	Survey	Each area	Report
Stockpile height (< 2.0 m) and slope (< 2H:1V)	2.3.2	Measure	Each stockpile	2.3.2
Contents free from foreign material	2.3.2	Inspection	Each stockpile	2.3.2
Seeding of stockpile	2.3.2, R178	Inspection	R178	R178
<b>8. SPOIL</b>	2.5			
<b>8.1 Non-contaminated Materials</b>	2.5.1			
Authorisation for disposal within the Site	2.5.1		Each location	Authorised
Authorisation for disposal of outside the Site	2.5.1		5 working days prior to commencing disposal at each location	Evidence of approvals and authorised
<b>8.2 Contaminated Materials</b>	2.5.2			
Method and location for disposal	2.5.2	Submission	Each source/ location	G36
<i>[Additional details to be inserted by Project Manager as appropriate]</i>				
<b>9. EMBANKMENT FOUNDATIONS</b>	3			
<b>9.1 Preparation of Embankment Foundations</b>	3.2			
Topsoil removal and stripped surface survey - refer item 7.1 of this table				
Additional excavation to achieve minimum height of formation (Shallow Embankment)	3.5.1	Survey	Each section	Report
Test Shallow Embankment foundation, if proposing less than specified minimum height of formation:	3.5.1			
- CBR		R44/A2.2	1000 m <sup>2</sup>	R44/A2.2
- Plasticity Index		R44/A2.2	1000 m <sup>2</sup>	R44/A2.2
Excavated surface survey	1.6.3	Survey	Each section	Report
Preparation of each Lot of embankment foundation <b>Hold Point</b>	3.2	Inspection	Each section	Release of Hold Point
<b>9.2 Unsuitable Material</b>	2.4			
Remove unsuitable material <b>Hold Point</b>	2.4	Inspection	Each Lot	Release of Hold Point
Surface survey after removal of unsuitable material	2.4.5, 1.6	Survey	Each Lot	Report
Replace with suitable material:	2.4	Inspection	Each Lot	Complete
- Relative compaction	7.4	T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	7.2	T120, T121, T180	Q	R44/A5

Work Activity	* clause reference in R44, unless noted otherwise			
	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
<b>9.3 Treatment Type E1 - Loosen and Compact</b>	3.2.1			
Authorisation given	3.2.1		Each section	Authorised
Loosen to specified depth and extent	3.2.1	Inspection	Each section	3.2.1
Compact loosen material:				
- Relative compaction	7.4	T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	7.2	T120, T121, T180	Q	R44/A5
<b>9.4 Treatment Type E2 - Bridging Layer</b>	3.2.2			
Authorisation given	3.2.2		Each section	Authorised
Distance from top of bridging layer to underside of Selected Material Zone	3.2.2	Survey	Each section	R44/A3
Geotextile material suitability	3.2.2, R63	R63	R63	R63
Place geotextile over foundation area	R63	R63	R63	R63 and inspection
Bridging layer material suitability	3.2.2, 5.2.1, 5.3.1	Inspection	Each section	3.2.2, 5.2
Trial section	3.2.2	Inspection	As directed	3.2.2
Place bridging layer – stable platform	3.2.2	Inspection	Each section	3.2.2
Completed thickness	3.2.2	Survey	Each section	R44/A3
<b>9.5 Treatment Type E3(I) - Working Platform by Chemical Stabilisation of Insitu Material</b>	3.2.3			
Authorisation given	3.2.3		Each section	Authorised
Loosen to specified depth and extent	3.2.3	Inspection	Each section	3.2.3
Mix stabilising agent	3.2.3, R50	Inspection	Each section	R50
Recompact stabilised material:	3.2.3			
- Relative compaction	7.4	T111, T119, T162, T166, T173	Q	R50, Table R44.10
- Moisture content	R50	T120, T121, T180	Q	R50
<b>9.6 Treatment Type E3(II) - Working Platform Using Imported Stabilised Material</b>	3.2.3			
Authorisation given	3.2.3		Each section	Authorised
Place and compact imported stabilised material:	3.2.3, R50			
- Relative compaction	7.4	T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	R50	T120, T121, T180	Q	R50
<b>9.7 Treatment Type E4 - Geotextile or Geogrid Layer</b>	3.2.4			
Authorisation given	3.2.4		Each section	Authorised
Geotextile or geogrid material suitability	3.2.4	R63 or R67	R63 or R67	R63 or R67
Place geotextile or geogrid	3.2.4	R63 or R67	R63 or R67	R63 or R67 and inspection
<b>9.8 Treatment Type E5 - Drainage Layer</b>	3.2.5			
Authorisation given	3.2.5		Each section	Authorised



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* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
Distance from top of drainage layer to underside of the Selected Material Zone	3.2.5	Survey	Each section	R44/A3
Drainage layer material suitability:				
- Maximum particle dimension	3.2.5	Inspection/ T280 if required	Q	Table R44.2
- Grading	3.2.5	T201	Q	Table R44.2
- Point Load Strength Index of +19 mm fraction	3.2.5	R44/A2.2	Min 10 per stockpile	R44/A2.2
- Wet/Dry Strength Variation	3.2.5	R44/A2.2	Stockpile	R44/A2.2
Geotextile material suitability	3.2.5, R63	R63	R63	R63
Place geotextile at bottom of drainage layer	R63	Inspection	Each section	R63 and inspection
Place and compact drainage layer - nominated compaction procedure	3.2.5, 7.5	Inspection	Each section	3.2.5, 7.5
Completed thickness	3.2.5	Survey	Each section	R44/A3 and inspection
Place geotextile over completed layer	R63	R63	R63	R63 and inspection
<b>9.9 Treatment Type E6 - Earth Fill Foundation Treatment Layer</b>	3.2.6			
Authorisation given	3.2.6		Each section	Authorised
Distance from top of earth fill foundation treatment layer to underside of the Selected Material Zone	3.2.6	Survey	Each section	R44/A3
Earth fill materials suitability	3.2.6, 5.2	Inspection	Each section	3.2.6
Trial section	3.2.6	Inspection	As directed	3.2.6
Earth fill foundation treatment layer placed:	3.2.6	Inspection	Each section	3.2.6
- Relative compaction of top 300 mm of layer	3.2.6, 7.4	T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content of top 300 mm of layer	3.2.6, 7.2	T120, T121, T180	Q	R44/A5
Completed thickness	3.2.6	Survey	Each section	R44/A3
Proof rolling	7.6.1	T198	As directed	No deformation
<b>9.10 Hillside embankment foundation treatment</b>	3.3	Inspection	Each earthworks Lot	Terraced as per 3.3
<b>10. CUTTINGS</b>	3.4, 4			
<b>10.1 Preparation of Cutting Area</b>				
Topsoil removal and stripped surface survey - refer item 7.1 of this table				
<b>10.2 Excavation</b>	4.1			
Material loosened and broken down to meet requirements for use as:	2.1, 2.2, 4.2	Inspection		
- Earth fill	5.2			
- Rock fill	5.3.1			
- Bridging layer	3.2.2			
- Drainage layer	3.2.5, 3.4.5			
- Rock capping layer	5.3.4			

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
- Rock facing	5.5			
- Spill through bridge abutment fill material	5.2.1			
- Upper Zone Material other than Selected Material	6.1.1			
- Selected Material	6.1.2			
- Verge material	6.2			
- Select Fill adjacent to structures	B30, R11, R58/R59			
Protection of earthworks	1.7	Inspection	Daily	1.7
<b>10.3 Cutting Batters</b>	4.4			
Batters conform to tolerances	4.2, 4.4	Survey	Each batter	Table R44.3
Treat tops and ends of cuttings	4.2	Inspection	Each batter	4.2
Clean down rock cuttings <b>Hold Point</b>	4.2	Inspection	Each batter	Release of Hold Point
Stabilise batters	4.2	As directed	As directed	As directed
Treat batters	4.2	As directed	As directed	As directed
Benches conform to tolerances and drain effectively	4.4	Survey	Each bench	Table R44.11
<b>10.4 Pre-splitting or Line Drilling</b>	4.5			
Select drill hole diameter and spacing	4.5.2	Measure	Each batter	Table R44.4
<b>10.5 Blasting</b>	4.6			
Submit Vibration and Airblast Management Sub-plan and Building Condition Inspection Reports <b>Hold Point</b>	4.6.1, G36			Release of Hold Point
Obtain licences and other regulatory requirements	4.6.1			Evidence of licences
Community liaison program	4.6.1	Monitor		
Pre-splitting of batters with slopes steeper than 1H:1V Drill hole diameter and spacing	4.5.3	Measure	Each blast	Table R44.4
Before each blast – submit details of blasting design and measures to limit noise and vibration <b>Hold Point</b>	4.6.1		Each blast	Release of Hold Point
Control airblast	4.6.3	AS2187.2	Each blast	Annex R44/A7
Control ground vibration	4.6.4	AS2187.2	Each blast	Annex R44/A7
Blasting records	4.6.2		Each blast	Records
<b>10.6 Cut/Fill Transition Zone</b>	3.5.2			
Set out extent of Cut/Fill Transition Zone	3.5.2	Survey	Each transition	
Excavate Cut/Fill Transition Zone	3.5.2	Survey	Each transition	3.5.2, R44/A4
Excavated terraces free-draining	3.5.2	Inspection	Each transition	Drainage achieved
<b>11. FOUNDATION TREATMENTS FOR CUTTINGS</b>	3.4			
<b>11.1 Preparation of Cutting Foundations</b>	3.4			
Excavate to Designed Floor Level or Foundation Level and trim to required tolerances	3.4	Survey	Each section	Table R44.11
Test cutting floor for:	3.4			
- CBR		R44/A2.2	1000 m <sup>2</sup>	R44/A2.2
- Plasticity Index		R44/A2.2	1000 m <sup>2</sup>	R44/A2.2
Preparation of each Lot of cutting foundation <b>Hold Point</b>	3.4		Each section	Release of Hold Point

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* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
<b>11.2 Unsuitable Material</b>	2.4			
Remove unsuitable material <b>Hold Point</b>	2.4	Inspection	Each Lot	Release of Hold Point
Surface survey after removal of unsuitable material	2.4.5, 1.6	Survey	Each Lot	Report
Replace with suitable material:	2.4	Inspection	Each Lot	Complete
- Relative compaction	7.4	T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	7.2	T120, T121, T180	Q	R44/A5
<b>11.3 Treatment Type C1 - Loosen and Recompact</b>	3.4.1			
Authorisation given	3.4.1		Each section	Authorised
Trim floor of cutting to required tolerance	3.4.1, 7.7.1	Survey	Each section	Table R44.11
Ripping depth and extent and maximum particle dimension	3.4.1	Inspection	Each section	3.4.1
Compact loosen material:	3.4.1			
- Relative compaction	7.4	T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	7.2	T120, T121, T180	Q	R44/A5
Trim floor of cutting to required tolerance	3.4.1, 7.7.1	Survey	Each section	Table R44.11
<b>11.4 Treatment Type C2 - Excavation and Backfill</b>	3.4.2			
Authorisation given	3.4.2		Each section	Authorised
Excavate cutting to Foundation Level and trim to required tolerances	3.4.2, 7.7.1	Survey	Each section	Table R44.11
Compact excavated surface – 6 passes of vibrating roller	3.4.2		Each section	Inspection
Backfill material suitability:	3.4.2			
- CBR		R44/A2.2	1000 m <sup>3</sup>	R44/A2.2
- Plasticity Index		R44/A2.2	1000 m <sup>3</sup>	R44/A2.2
Compact backfill:	3.4.2			
- Relative compaction	7.4	T105, T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	7.2	T120, T121, T180	Q	R44/A5
Trim backfill surface to required tolerance	3.4.2, 7.7.1	Survey	Each section	Table R44.11
<b>11.5 Treatment Type C3(l) - Working Platform by Chemical Stabilisation of Insitu Material</b>	3.4.3			
Authorisation given	3.4.3		Each section	Authorised
Trim floor of cutting to required tolerance	3.4.3, 7.7.1	Survey	Each section	Table R44.11
Loosen to specified depth and extent	3.4.3	Inspection	Each section	3.4.3
Mix stabilising agent	3.4.3, R50	Inspection	Each section	R50
Recompact stabilised material:	3.4.3			
- Relative compaction	7.4	T111, T119, T162, T166, T173	Q	R50, Table R44.10
- Moisture content	R50	T120, T121, T180	Q	R50

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
Trim working platform surface to required tolerance	3.4.3, 7.7.1	Survey	Each section	Table R44.11
<b>11.6 Treatment Type C3(II) - Working Platform Using Imported Stabilised Material</b>	3.4.3			
Authorisation given	3.4.3		Each section	Authorised
Excavate to Foundation Level		Survey	Each section	Table R44.11
Compact excavated surface – 6 passes of vibrating roller	3.4.3	Inspection	Each section	Inspection
Place and compact imported stabilised material:	3.4.3, R50			
- Relative compaction	7.4	T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	R50	T120, T121, T180	Q	R50
Trim backfill surface to required tolerance	3.4.2, 7.7.1	Survey	Each section	Table R44.11
<b>11.7 Treatment Type C4 - Geotextile or Geogrid Layer</b>	3.4.4			
Authorisation given	3.4.4		Each section	Authorised
Geotextile or geogrid material suitability	3.4.4	R63, R67	R63, R67	R63, R67
Place geotextile or geogrid	3.4.4	Inspection	R63, R67	R63, R67 and inspection
<b>11.8 Treatment Type C5 - Drainage Layer</b>	3.4.5			
Authorisation given			Each section	Authorised
Excavate cutting to Foundation Level and trim to required tolerances	3.4.5, 7.7.1	Survey	Each section	Table R44.11
Compact excavated surface – 6 passes of vibrating roller	3.4.5		Each section	Inspection
Drainage layer material suitability:				
- Maximum particle dimension	3.4.5	Inspection / T280 if required	Q	Table R44.2
- Grading	3.4.5	T201	Q	Table R44.2
- Point Load Strength Index of +19 mm fraction	3.4.5	T223	Min 10 per stockpile	R44/A2.2
- Wet/Dry Strength Variation	3.4.5	T215	Stockpile	R44/A2.2
Geotextile material suitability	3.4.5, R63	R63	R63	R63
Place geotextile over cutting floor	3.4.5	Inspection	Each section	R63 and inspection
Place and compact drainage layer - nominated compaction procedure	3.4.5, 7.5	Inspection	Each section	3.4.5, 7.5
Trim top of drainage layer to required tolerance	3.4.5, 7.7.1	Survey	G71	Table R44.11
Place geotextile over drainage layer	3.4.5		Each section	3.4.5
<b>11.9 Other Foundation Treatment Types</b>	3.4.6			
<b>12. EMBANKMENTS</b>	5			
<b>12.1 Embankment Material other than Upper Zone Material, verge material, and Type ST1 and ST2 material</b>	2.2, 5			
Earth fill material:	5.2			
- Free from deleterious materials	5.1.2	Inspection	Each Lot	No deleterious material

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
- Maximum particle dimension	5.2.1	Inspection/ T280 if required	Each Lot	Table R44.5
- Grading	5.2.1	T201	Each Lot	Table R44.5
Rock fill material:	5.3			
- Maximum particle dimension	5.3.1	Inspection/ T280 if required.	Each Lot	Table R44.6
- Grading	5.3.1	T201	Each Lot	Table R44.6
- Point Load Strength Index of +100 mm fraction	5.3.1	R44/A2.2	10 per Lot	R44/A2.2
- Wet/Dry Strength Variation	5.3.1	R44/A2.2	Each source	R44/A2.2
Rock capping layer material:	5.3.4			
- Maximum particle dimension	5.3.4	Inspection/ T280 if required.	Each Lot	Table R44.7
- Grading	5.3.4	T201	Each Lot	Table 44.7
- Point Load Strength Index of +19 mm fraction	5.3.4	T223	10 per Lot	R44/A2.2
- Wet/Dry Strength Variation	5.3.4	T215	Each source	R44/A2.2
<b>12.2 Earth Fill Embankment Construction</b>	5.2			
Place earth fill for embankment construction:	5.2, 7.2			
- Lot homogeneity	5.1, 7.3.2	Inspection	Each Lot	5.2
- Layer thickness	5.2.1	Measure	Each Lot	Table R44.5
- Relative compaction	7.4	T105, T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	7.2	T120, T121, T180	Q	R44/A5
Protection of earthworks	1.7	Inspection	Daily	1.7
<b>12.3 Spill Through Bridge Abutment Fill Material (Type ST1 and ST2)</b>	2.8.7			
- CBR	2.8.7	R44/A2.2	Each Lot	R44/A2.2
- Plasticity Index	2.8.7	R44/A2.2	Each Lot	R44/A2.2
- Maximum particle dimension	2.8.7	Inspection/ T280 if required	Each Lot	2.8.7
- Grading	2.8.7	T201	Each Lot	2.8.7
<b>12.4 Spill Through Bridge Abutment Fill Construction</b>	5.2.3			
Place spill through bridge abutment fill material:	5.2.3			
- Width and height of zone	5.2.3	Survey	Each zone	Figure R44.7
- Lot homogeneity	5.1.2, 7.3.2	Inspection	Each Lot	5.1.2, 7.3.2
- Layer thickness	5.2.3	Measure	Each Lot	5.2.3
- Relative compaction	5.2.3, 7.4	T105, T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	5.2.3, 7.2	T120, T121, T180	Q	R44/A5
<b>12.5 Rock Fill Embankment Construction</b>				
Place rock fill for embankment construction:	5.3			

Work Activity	* clause reference in R44, unless noted otherwise			
	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
- Trial section <b>Witness Point / Hold Point</b>	7.5	7.5	Each trial section	Release of Hold Point
- Lot homogeneity	5.1.2, 7.3.2	Inspection	Each Lot	5.1.2, 7.3.2
- Layer thickness	5.3.2	Measure	Each Lot	5.3.2
- Proof rolling <b>Witness Point</b>	7.6.1	T198	As directed	7.6.1
Place rock capping layer over rock fill	5.3.3			
- Trial section <b>Witness Point / Hold Point</b>	7.5	7.3	Each trial section	Release of Hold Point
- Lot homogeneity	5.1.2, 7.3.2	Inspection	Each Lot	5.1.2, 7.3.2
- Layer thickness	5.3.4	Measure	Each Lot	R44/A4
- Distance from top of rock capping layer to underside of Selected Material Zone	5.3.4	Survey	Each Lot	5.3.4
- Proof rolling <b>Witness Point</b>	7.6.1	T198	As directed	7.6.1
Geotextile material suitability	5.3.4	R63	R63	R63
Place geotextile	5.3.4	R63	R63	R63
<b>12.6 Embankment Batters</b>	5.4			
Batters conform to tolerances	5.4	Survey	Each batter	Table R44.8
Remove loose material from batters	5.4	Inspection	Each batter	5.4
Treat batters	5.4	As directed	As directed	As directed
<b>12.7 Rock Facing to Embankments</b>	5.5			
Rock facing material suitability:	5.5.2			
- Minimum dimension	5.5.2	Inspection	Each batter	5.5.2
- Point Load Strength Index	5.5.2	R44/A2.2	10 per batter	R44/A2.2
- Wet/Dry Strength Variation	5.5.2	R44/A2.2	Each source	R44/A2.2
Place rock facing to embankments	5.5.3	Inspection	Each batter	5.5
<b>12.8 Select Fill adjacent to Structures</b>	5.6	B30, R11 or R58/R59	B30, R11 or R58/R59	B30, R11 or R58/R59
<b>13. STRUCTURAL TREATMENTS</b>				
<b>13.1 Upper Zone Material other than Selected Material</b>	2.8.4			
<b>Site won:</b>	2.8.4.1			
- CBR	2.8.4.1	R44/A2.2	Each Lot	R44/A2.2
- Plasticity Index	2.8.4.1	R44/A2.2	Each Lot	R44/A2.2
- Maximum particle dimension	2.8.4.1	Inspection/ T280 if required.	Each Lot	2.8.4.1
- Grading	2.8.4.1	T106	Each Lot	2.8.4.1
<b>Imported:</b>	2.8.4.2			
- CBR	2.8.4.2	R44/A2.2	Each Lot	R44/A2.2
- Plasticity Index	2.8.4.2	R44/A2.2	Each Lot	R44/A2.2
- Maximum particle dimension	2.8.4.1	Inspection/ T280 if required.	Each Lot	2.8.4.1
- Grading	2.8.4.1	T106	Each Lot	2.8.4.1
<b>13.2 Selected Material</b>	2.8.5			
<b>Site won</b>	2.8.5.1			

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
- CBR	2.8.5.1	R44/A2.2	Each Lot	R44/A2.2
- Plasticity Index	2.8.5.1	R44/A2.2	Each Lot	R44/A2.2
- Maximum particle dimension	2.8.5.1	Inspection/ T280 if required.	Each Lot	2.8.5.1
- Grading	2.8.5.1	T106	Each Lot	2.8.5.1
<b>Imported</b>	2.8.5.2	3071	3071	3071
<b>13.3 Verge Material</b>	2.8.6			
<b>Site won</b>	2.8.6.1			
- CBR	2.8.6.1	R44/A2.2	Each Lot	R44/A2.2
- Plasticity Index	2.8.6.1	R44/A2.2	Each Lot	R44/A2.2
- Maximum particle dimension	2.8.6.1	Inspection/ T280 if required.	Each Lot	2.8.6.1
- Grading	2.8.6.1	T106	Each Lot	2.8.6.1
<b>Imported</b>	2.8.6.2	3071	3071	3071 & R44/A2.2
<b>13.4 Placing Material in Upper Zone of Formation other than Selected Material Zone</b>	6.1.1			
Delivery of Upper Zone Material other than Selected Material <b>Hold Point</b>	6.1.1			Release of Hold Point
Place material in Upper Zone of Formation other than Selected Material Zone:				
- Layer thickness	6.1.1	Measure	Each Lot	R44/A4
- Relative compaction	6.1.1, 7.4	T105, T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	6.1.1, 7.2	T120, T121, T180	Q	R44/A5
Trim to required tolerance	6.1.1, 7.7.1	Survey	Each section	Table R44.11
<b>13.5 Placing Material in Selected Material Zone</b>	6.1.2			
Delivery of Selected Material <b>Hold Point</b>	6.1.2			Release of Hold Point
Place material in Selected Material Zone:				
- Layer thickness	6.1.2	Measure	Each Lot	R44/A4
- Relative compaction	6.1.2, 7.4	T105, T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	6.1.2, 7.2	T120, T121, T180	Q	R44/A5
Trim to required tolerance	6.1.2, 7.7.1	Survey	Each section	Table R44.11
Verification of conformity before covering <b>Hold Point</b>	6.1.2	Reports	Each Lot	Release of Hold Point
<b>13.6 Placing Material for Verges</b>	6.2			
Delivery of verge material <b>Hold Point</b>	6.2			Release of Hold Point
- Layer thickness	6.2	Measure	Each Lot	R44/A4

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
- Relative compaction	6.2, 7.4	T105, T111, T119, T162, T166, T173	Q	Table R44.10
- Moisture content	6.2, 7.2	T120, T121, T180	Q	R44/A5
- Trim to required tolerance	6.2, 7.7.1	Survey	Each section	Table R44.11
<b>13.7 Other Treatments</b>	6.3			
<i>[Additional details to be inserted by Project Manager as appropriate]</i>				
<b>14. Deflection Testing</b>	7.6			
Proof rolling of all surfaces within 1.5 m of underside of Selected Material Zone <b>Witness Point</b>	7.6.1	T198	As directed	No deformation
Benkelman Beam testing at underside of the Selected Material Zone <b>Hold Point</b>	7.6.2	T199	R44/A4	7.6.2, R44/A4
Benkelman Beam testing at top of the Selected Material Zone <b>Witness Point / Hold Point</b>	7.6.2	T199	R44/A4	7.6.2, R44/A4
<b>15. Level Control</b>	7.7			
Surface levels of Selected Material Zone, formation at underside of Selected Material Zone, Designed Floor Level and Foundation Level, cut/fill transitions, benches in cuttings, rock fill and verges	7.7.1	Survey	Each section	Table R44.11
Median areas	7.7.3	Survey	Each section	7.7.3

**Table R44/L.2 – Sampling Frequency for Material in Stockpiles**

Total Mass of Lot Represented (tonnes)	1 – 500	501 – 1000	1001 – 2000	2001 – 4000
Minimum Number of Samples per Lot	2	3	4	5



**ANNEXURE R44/M – REFERENCED DOCUMENTS**

Refer to Clause 1.3.6.

**TfNSW Specifications**

TfNSW G10	Traffic Management
TfNSW G36	Environmental Protection
TfNSW G38	Soil and Water Management
TfNSW G40	Clearing and Grubbing
TfNSW G71	Construction Surveys
TfNSW Q	Quality Management System
TfNSW B30	Excavation and Backfill for Bridgeworks
TfNSW R11	Stormwater Drainage
TfNSW R33	Trench Drains
TfNSW R50	Stabilisation of Earthworks
TfNSW R58 or R59	Construction of Reinforced Soil Walls
TfNSW R63	Geotextiles (Separation and Filtration)
TfNSW R67	High Strength Geosynthetic Reinforcement
TfNSW R178	Vegetation
TfNSW 3071	Selected Material for Formation Layers

**TfNSW Test Methods**

TfNSW T102	Pretreatment of Road Construction Materials by Compaction
TfNSW T103	Pretreatment of Road Materials by Artificial Weathering
TfNSW T105	Preparation of Samples for Testing (Soils)
TfNSW T106	Coarse Particle Size Distribution of Road Construction Materials (By Dry Sieving)
TfNSW T109	Plastic Limit and Plasticity Index of Road Construction Materials
TfNSW T111	Dry Density/Moisture Relations of Road Construction Materials (Standard Compaction)
TfNSW T117	California Bearing Ratio of Remoulded Specimens of Road Construction Materials
TfNSW T119	Determination of Density of Road Materials insitu using the Sand Replacement Method
TfNSW T120	Moisture Content of Road Construction Materials (Standard Method)
TfNSW T121	Moisture Content of Road Construction Materials (Sand Bath or Hot Plate Method)
TfNSW T131	Unconfined Compressive Strength of Road Construction Materials (Blended in the Laboratory with Cementitious Binders)

TfNSW T162	Compaction Control Test (Rapid Method)
TfNSW T166	Relative Compaction of Road Construction Materials
TfNSW T173	Field Wet Density of Road Construction Materials (Nuclear Gauge in Direct Transmission Method)
TfNSW T180	Moisture Content of Road Construction Materials (Microwave Oven Method)
TfNSW T198	Proof Rolling Test
TfNSW T199	Deflection Testing of Road Formation
TfNSW T201	Particle Distribution of Aggregates (By Washing)
TfNSW T215	Wet/Dry Strength Variation
TfNSW T223	Point Load Strength of Rock
TfNSW T2105	Correlation of Moisture Content with Standard Method

**Australian Standards**

AS 2187	Parts 1 and 2. Explosives – Storage, transport and use
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**Other References**

- NAASRA Explosives in Roadworks Users Guide 1982
- ANZECC Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration