

TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION R44

EARTHWORKS

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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.		

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Ed 4/Rev 0 (cont'd)	2.8.1	“or borrow sources” added in 1 st para. “shale” deleted as example of material susceptible to breakdown or weathering.		
	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. New Fig 6(a) for Shallow Embankment added.		
	3.5.2	Previously clause 3.5. Clause reworded to simplify concept of cut/fill transition treatment. Fig 6(b) (previously Fig 6), showing cut/fill transition treatment, redrawn.		
	4.3	Previously clause 4.2.1. Heading title changed.		

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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.		

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
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. Material properties for earth fill at spill through abutments amended.		
	Annex A3	Previously Annex A7; retitled "Foundation Treatment". Thickness requirement added for Type E5 Foundation Treatment "Drainage Layer".		
	Annex A4	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.		

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

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.		

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
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 Australian and New Zealand Environment and Conservation Council (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.		
	4.6.6	Simplified version of equation added as alternative.		
	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.		

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	5.3	Individual clauses rearranged; headings added to form new sub-clauses or replace existing sub-clauses.		
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”. Previous clause 5.6.2 for treatment at weepholes moved to B30 and R11.		
	6.1.1	Statement added that UZF layer required in medians if so specified in Annex A6.		

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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.		

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Ed 5/Rev 0 (cont'd)	Annex A2.2	Note (4) to table amended to clarify application rate requirement for binder.		
	Annex A3	Minimum distance from top of bridging layer to underside of SMZ increased to 900 mm. Tolerances added to thickness of bridging layer.		
		Minimum distance from top of drainage layer to underside of SMZ added.		
		Minimum distance and thicknesses associated with Treatment Type E6 added.		
	Annex A4	Thickness of rock capping layer added.		
	Annex A6	New annexure for specifying whether foundation treatments/structural treatments required in medians		
		Previous Annex 6 on blasting now becomes Annex 7.		
	Annex B	Statement added that rates must include cost of testing, where not paid under Primary Testing.		
		Pay item descriptions changed to improve clarity.		
		Pay item P1.1 – clarification added that payment for placing of topsoil for revegetation purposes is made under R178.		
		Pay item P1.2 – note added that if bank volume cannot be measured, the Principal will determine conversion factor for loose volumes.		
		Pay item P2 “General Earthworks (Cut/Fill)” - method of determining excavation volume reworded to improve clarity; - scope clarified.		
		Pay item P3 – inclusions and exclusions in rate amended.		
		Pay item P5 – “Limit of Works area” changed to “Site”.		
		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.		
		Pay item P7 – individual sub-pay item descriptions changed to improve clarity.		

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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
Ed 6/Rev 0	Global	Clauses rearranged and reworded to improve clarity. Some clause rearrangement and rewording without changing the intent or meaning are not recorded in this register.	A/CEI DK	28.06.23
	1.2, 1.3, 1.4	Previous clauses 1.2, 1.3 and 1.4 rearranged to be in same order as other specs. Clauses and Figures re-numbered accordingly.		
	1.3	Definitions reworded.		

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	1.5.1 (n)	Procedures to protect buried structures, utility services infrastructure and culverts from construction traffic added to Earthworks Plan requirements.		
	1.6	Sub-clauses 1.6.1 and 1.6.2 order rearranged.		
	1.6.2	Clause amended to require marking on ground the location and extent of cuttings, embankments and drainage layers.		
	1.8	New clause on protection of environment, incorporating requirement relocated from Clause 1.7.		
	2	Individual clauses under this clause rearranged in different order.		
	2.1	Clause title changed. Previous first two paragraphs, which are superfluous, deleted.		
	2.4	Headings added to form new sub-clauses 2.4.1 to 2.4.3.		
	2.4.2	Requirement to carry out pre-construction land condition assessment of stockpile areas added.		
	2.6.4	Statements on payment for removal of unsuitable material, and replacement with conforming material, added.		
	2.8.1	Drainage layers added to areas where use of steel furnace slag aggregates is prohibited.		
	2.8.3	Clause title changed.		
	2.8.5.1	Site won Selected Material requirements updated to harmonise with revised spec 3071. Reference to Note (5) in Annex A2.2 added.		
	2.8.7	References to Type ST2 material deleted; Type ST1 material becomes simply Type ST material.		
	2.9	New clause on other earthworks materials, cross referencing requirements in other clauses.		
	3	Clauses rearranged, with clauses relating to “cutting” shown before clauses relating to “embankment”. Clauses and Figures re-numbered accordingly.		
	3.2	Exception to requirement to carry out CBR and PI tests for foundations of cuttings added for Treatment Type C5.		
	3.2.3	Treatment Type C3 “working platform” separated into Types C3(I) and C3(II), comprising insitu stabilised and plant mixed stabilised respectively.		

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	3.2.4	Geogrid conformity requirements to R67 clarified.		
	3.3.2	Reminder added that capping layer on top of Treatment Type E2 “rock fill bridging layer” required if bridging layer is overlain by earth fill.		
	3.3.3	Treatment Type E3 “working platform” separated into Types E3(I) and E3(II), comprising insitu stabilised and plant mixed stabilised respectively.		
	3.3.4	Geogrid conformity requirements to R67 clarified.		
	3.3.6	Maximum rock particle size clarified. Pay Item reference added for Treatment Type E6, consistent with the wording for other Treatment Types.		
	3.4	Fig. 5 – required depth of terrace changed to a range.		
	4.1.2	Previous statement under this clause number moved to sub-clause 2.8.2. Clause title changed. Previous 1 st paragraph of sub-clause 4.1.3 moved here and reworded. Remaining clauses moved elsewhere.		
	4.2	Clause title changed. Clause edited to remove superfluous wording. Requirement to clean bench surface at top of batter deleted, as meaning is unclear.		
	4.3	Clause title changed. Previous first two paragraphs and table on cutting batter tolerances moved to under Clause 7.8.		
	4.4	Headings added to form new sub-clauses 4.4.1 to 4.4.3.		
	4.5.2	Note added to Table R44.3.		
	4.6	Headings added to form new sub-clauses 4.6.2 and 4.6.3. Subsequent sub-clauses re-numbered.		
	4.6.1	New title for vibration and airblast sub-plan added.		
	4.6.4	Video recording of blasting event required as part of blasting records.		
	4.6.5, 4.6.6	Wording harmonised between the two sub-clauses.		

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	5.1	Heading added to form new sub-clause 5.1.4.		
	5.1.2	Heading title changed.		
	5.1.3	Reminder to carry out survey before and after placing imported fill material added.		
	5.2.1	Previous 2 nd paragraph incorporated within definition of earth fill material under Clause 1.3.		
		Previous Table 5 on maximum layer thickness and grading of earth fill, replaced by descriptive requirements.		
	5.2.2	Statement added that Principal may authorised increase in layer thickness to 500 mm.		
		Clauses relevant to earth fill placing moved here from previous Clauses 5.2.1, 7.1 and 5.1.3.		
	5.2.3	Clause title changed.		
		Fig.7 – detail of zone immediately adjacent to bridge abutment amended.		
		Requirement to stockpile Type ST and test for conformity before use, deleted as this is inconsistent with Clause 2.8.3.		
	5.4	Previous Clause 5.4 on embankment batter tolerances moved to under Clause 7.8.		
		Subsequent clauses re-numbered accordingly.		
	7.1	Previous Clause 7.1 moved to Clause 5.2.2.		
		Subsequent clauses re-numbered accordingly.		
		Headings added to form new sub-clauses 7.1.1 and 7.1.3. Previous sub-clause 7.3.5 moved here to become sub-clause 7.1.2.		
	7.2.1	Previously sub-clause 7.3.2, with clause title changed.		
	7.2.2	Previously sub-clause 7.3.3, incorporating parts of previous sub-clauses 7.3.1, 7.3.3 and 7.3.4, with clause title changed.		
		Requirement to select sample locations in accordance with spec Q added.		
	7.2.3	Previously sub-clause 7.3.6 on relative compaction determination.		
	7.2.4	Previously Clause 7.4 on compaction conformity.		
	7.3	Previously sub-clause 7.3.7 on repair of test holes.		

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	7.4	Previously Clause 7.5 on rock fill placing. Headings added to form new sub-clauses 7.4.1 to 7.4.3. Witness Point and Hold Point – requirements clarified.		
	7.5, 7.6	Previous clause on deflection testing now split into Clause 7.5 (on proof rolling) and Clause 7.6 (on Benkelman Beam testing).		
	7.5	Clause title changed. Headings added to form new sub-clauses 7.5.2 and 7.5.3.		
	7.5.1, 7.5.2	Proof rolling requirements clarified.		
	7.6	Headings added to form new sub-clauses 7.6.1 to 7.6.5.		
	7.6.1	Requirement to conform to grid sampling pattern in T199, and other requirements, added. Permissible time delay in carrying out Benkelman Beam testing clarified.		
	7.6.3	Minimum width of Lot changed from “a single carriageway” to “a single lane”.		
	7.6.4	Equation for calculating characteristic deflection deleted, as equation is given in referenced T199.		
	7.6.5	Conformity requirements changed.		
	7.7	Clause title changed.		
	7.8.1	New sub-clause on cutting batter dimension tolerances, incorporating parts of previous (sub-)clauses 4.1.3, 4.3 and 5.4.		
	7.8.2	Previously Clause 5.4.		
	7.9.1	Part of previous (sub-)clauses 4.3 and 4.1.3, and Clause 5.4 moved here and modified.		
	7.9.2	Parts of previous Clause 5.4 moved here and modified.		
	7.9.3	Previously sub-clause 7.7.3, on batter surface tolerances in medians, now made applicable to all batter surfaces.		
	Annex A1	New item on survey of surface of existing ground where topsoil not required to be removed, added. Previous separate items on survey before, and after, removal of unsuitable material combined into one item. Previous separate items on survey before, and after, placing imported material combined into one item.		

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
	Annex A2.1	New item for spill through bridge abutment zone added.		
	Annex A2.2	Type ST2 material deleted; Type ST1 material becomes Type ST material. Table notes order rearranged. Notes 1, 2 and 5 requirements clarified.		
	Annex A3	Items added for specifying Treatment Types C3(II) and E3(II).		
	Annex A4	Item added for specifying Benkelman Beam deflection testing at top of verge. Note 1 added to table.		
	Annex A5	Guidance notes within boxed text added.		
	Annex A7	Terminology made consistent with main text.		
	Annex B	Pay Item P1.2 – pay item clarified to apply only to non-contaminated topsoil; EPA waste classification added to part of rate. Pay Item P2 – individual clauses rearranged, and reworded; development and verification of compaction procedure for rock fill added as a cost item. Pay Item R44P3 – replacement of unsuitable material deleted, as it is not relevant. Pay Item R44P7.4 – rate to allow for capping layer over rock fill bridging layer added.		
	Annex C1 & C2	Schedule of Hold Points and Witness Points updated.		
	Annex C3	Schedule of Identified Records updated.		
	Annex D	Planning Documents added.		
	Annex L	Table L.1 – some items in table rearranged and reworded. Testing frequency for rock fill and rock capping material changed.		
	Annex M	Referenced documents updated.		



EARTHWORKS

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VERSION FOR: DATE:

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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 1.

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 outside the Site.

The earthwork formation is constructed by the controlled excavation, selection and placement of the 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 works such as surface and subsurface drainage and environmental control measures.

1.2 STRUCTURE OF SPECIFICATION

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

1.2.1 Project Specific Requirements

Project specific details of work are shown in Annexure R44/A.

1.2.2 Measurement and Payment

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

1.2.3 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.

1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure R44/D and must be implemented.

1.2.5 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.

1.2.6 Referenced Documents

Unless otherwise specified, the applicable issue of a referenced document, other than an TfNSW Specification, 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 1234). For convenience, the full titles are given in Annexure R44/M.

1.3 DEFINITIONS

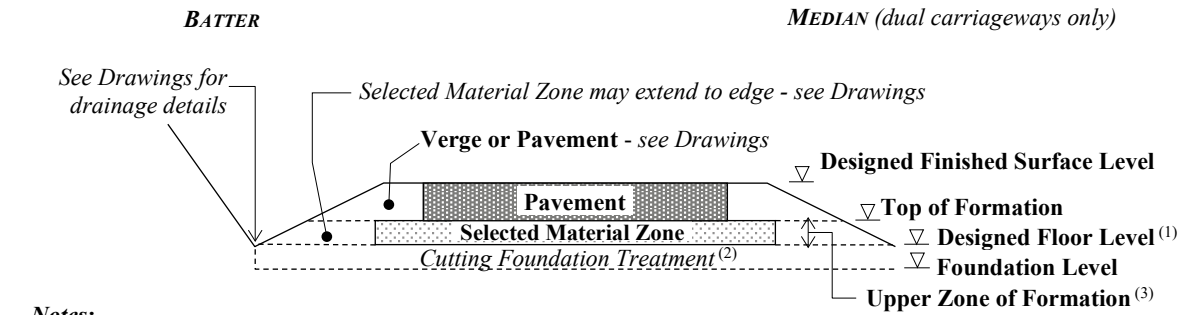
The terms “you” and “your” mean “the Contractor” and “the Contractor’s” respectively.

The following definitions apply to this Specification:

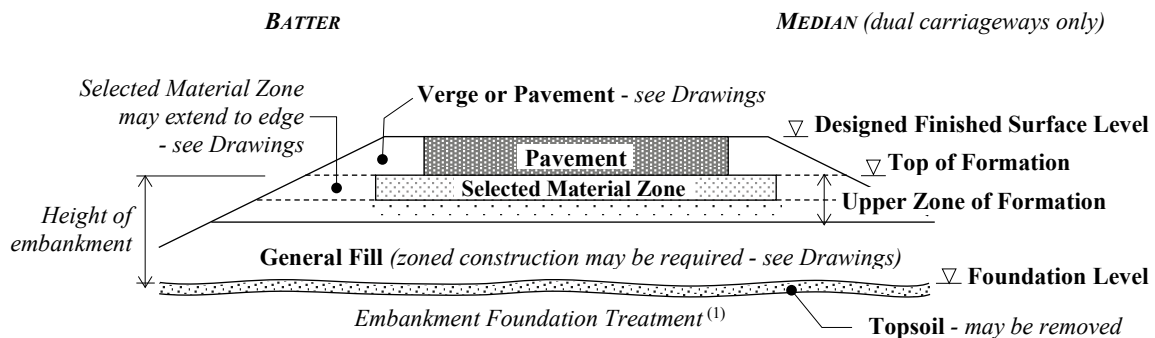
Borrow area	An area (either within or outside the Site), other than cuttings and specified excavations, from which material may be excavated for use in the Works.
Bridging layer	A layer located at the foundation of an embankment constructed from granular earth fill material or rock fill material with strong mechanical interlock. The purpose of the bridging layer is to provide a stable platform upon which a conforming earthworks layer can be constructed.
Capping layer	A layer of graded rock material, placed over rock fill (including rock fill in bridging layers) as a transition layer between rock fill layers and the overlying earth fill layers in an embankment.
Contaminated material	Material classified as “Special”, “Hazardous” or “Restricted Solid” Waste in accordance with EPA Waste Classification Guidelines.
Cutting	An earth or rock excavation within the Site that is made below an existing surface to create the road formation.
Cut/Fill Transition Zone	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.
Designed Floor Level	The level of excavation in a cutting at the underside of the Selected Material Zone.
Drainage layer	A layer located at the foundation of a cutting or an embankment, constructed of free draining material with grading as specified in Clauses 3.2.5 and 3.3.5. The purpose of the drainage layer is to provide a pathway for the free drainage of excess water away from the foundations of cuttings or embankments. The drainage layer is usually wrapped in geotextile to prevent its contamination or blockage over time from adjacent fine grained material.
Earthworks	The activities covered by this Specification.

Earth fill	Material composed of fine and coarse particles, which when placed and compacted produces a dense embankment deriving its stability from the packing of the fine particles around the coarser material.
Embankment	An earth fill or rock fill structure above an existing and/or excavated surface to create the formation.
Floor of cutting	The trimmed base of the cutting excavation, at either the level of the Designed Floor Level or the Foundation Level, depending on the type of Foundation Treatment.
Formation	The earthworks structure including all Foundation and Structural Treatments on which the road pavement will be constructed.
Foundation Level	The level from which the formation is constructed. This is the level achieved after excavation is undertaken for Foundation Treatments.
Foundation Treatment	A special layer or treatment zone at the base of a formation for the purpose of reinforcing, strengthening or draining the foundation.
General fill	Material placed as fill in embankments for other than Foundation or Structural Treatments.
Imported material	Material obtained from sources other than that generated by excavation in cuttings and other specified excavations within the Site.
Joint survey	A survey carried out in the presence of, or in conjunction with, the Principal's surveyor. Refer also to Specification TfNSW G71.
Rock fill	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 packing of the fine particles around the coarser material.
Roller pass	Compactive effort of a single movement (or pass) of the roller over all areas of the Lot nominated in the PROJECT QUALITY PLAN.
Select Fill	Fill material of specified quality placed against or adjacent to structures (refer to Clause 5.5). This material is different from Selected Material (see below).
Selected Material	Material placed in the Selected Material Zone of the quality specified in Clause 2.8.5 and Annexure R44/A2.2.
Selected Material Zone	The top part of the Upper Zone of Formation consisting of Selected Material, as shown in Figures R44.1(a) and R44.1(b).
Shallow Embankment	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.
Site won material	Material that is obtained from excavations within the Site.
Spoil	Material from excavations under the Contract which is surplus to that required to complete the Works, 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.

Steel furnace slag	Material that is a waste by-product from 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.
Stripped Surface Level	Level of the surface after removal (stripping) of topsoil.
Structural Treatment	A special layer or zone within the upper part of the formation for the purpose of strengthening the upper part of the formation.
Topsoil	Natural surface soil which may contain organic matter.
Unsuitable material	<p>Material occurring:</p> <ul style="list-style-type: none"> • in cuttings, below the Designed Floor Level (or below the Foundation Level where excavation to that level is required as part of Foundation Treatment); • in embankments, below the Stripped Surface Level; <p>which is deemed to be unsuitable for embankment or pavement support in its existing condition in accordance with Clause 2.6. 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>
Upper Zone of Formation	The top part of the formation composed of materials of a specified higher quality, as shown in Figures R44.1(a) and R44.1(b). In cuttings, the Upper Zone of Formation comprises only the Selected Material Zone. In embankments, the Upper Zone of Formation comprises two components, with the top component as the Selected Material Zone. The thickness and quality of the materials for the Upper Zone of Formation are specified in Annexure R44/A4 and R44/A2.2 respectively.
Upper Zone material	Material of specified quality used in the Upper Zone of Formation.
Verge material	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.
Working platform	A layer located at the foundation of the formation in an embankment or 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.

**Notes:**

- (1) Unless shown otherwise on the Drawings.
- (2) See Figures R44.3(a) to R44.3(d) for details of cutting foundation treatment types.
- (3) In cuttings, the Upper Zone of Formation comprises only the Selected Material Zone.

Figure R44.1(a) – Cutting Nomenclature**Note:**

- (1) See Figures R44.4(a) to R44.4(e) for details of embankment foundation treatment types.

Figure R44.1(b) – Embankment Nomenclature

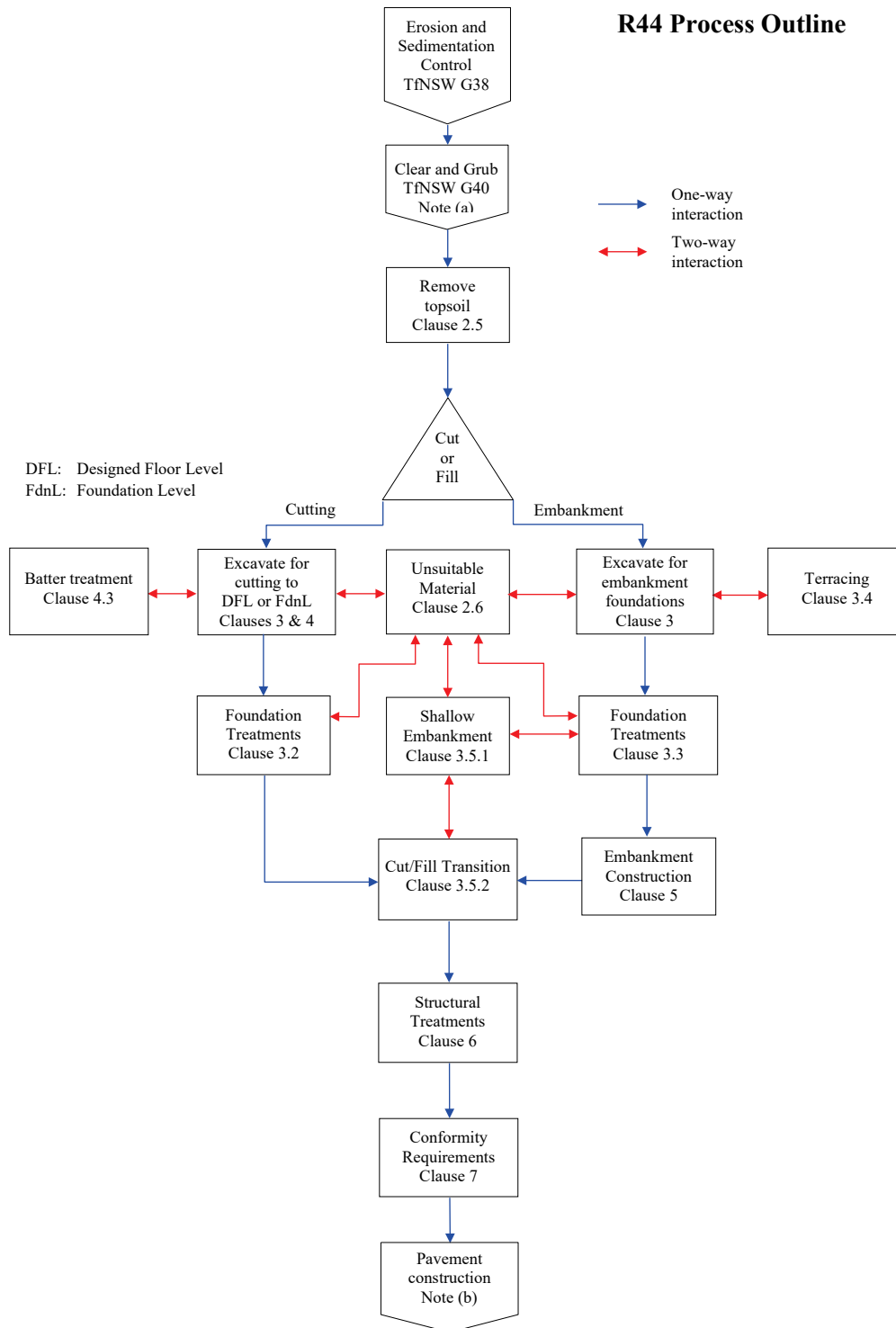
1.4 EARTHWORKS PROCESS

The earthworks process is summarised in Table R44.1.

Table R44.1 – Summary of Earthworks Process

Reference	Description
Clause 1	General 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 earthworks by providing effective drainage. Protect the environment by installing and maintaining erosion and sedimentation control measures.
Clause 2	Materials Manage the use of materials from within the Site and stockpile areas; remove topsoil and place in stockpiles; remove, replace or treat any unsuitable material; dispose of spoil; and borrow and import materials as required.
Clause 3	Foundations Prepare and treat the floors of cuttings, embankments and cut/fill transitions, including the use of bridging layers, working platforms, geotextiles/geogrids and drainage layers as Foundation Treatments.
Clause 4	Cuttings Excavate cuttings to the specified dimensions and batter surface tolerances, including providing benches and drainage. Use blasting of rock where required and permitted.
Clause 5	Embankments Place and compact suitable earth fill or rock fill material to the specified dimensions and batter surface tolerances, including use of geotextiles/geogrids, rock capping and rock facing, and Select Fill against structures.
Clause 6	Structural Treatments Place and compact material of the specified quality for the Upper Zone of Formation (including Selected Material Zone) and verges, or provide other geotechnical treatments as required.
Clause 7	Additional Conformity Requirements 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.

The earthworks process outline by activity sequence is shown in Figure R44.2.

**Figure R44.2 – Earthworks Process Outline By Activity Sequence****Notes:**

- 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.
- Pavement construction to be carried out in accordance with the appropriate TfNSW specifications included within the Contract.

1.5 EARTHWORKS PLAN

1.5.1 Plan Requirements

The EARTHWORKS PLAN must address all requirements and constraints imposed by the specifications, 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/fill transitions, terracing 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 disposed of as spoil, including: foundation treatment materials, earth fill, rock fill and spill through bridge abutment fill material, rock for capping layers and rock facing, Upper Zone material (including Selected Material and that at Shallow Embankments and cut/fill transitions), verge material, Select Fill, topsoil, unsuitable material, non-contaminated 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) Preliminary assessment of stockpiling requirements and the quantities that can be placed in the nominated stockpile areas, and any additional potential stockpile areas required (refer to Clause 2.4).
- (f) Preliminary identification of zones of potentially unsuitable material, and their management for re-incorporation and/or disposal (refer to Clause 2.6).
- (g) 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.
- (h) Procedures for procuring and managing materials from borrow areas, or as imported materials where applicable (refer to Clauses 2.3 and 2.8).
- (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 for the treatment of foundations in cuttings and under embankments (refer to Clause 3).
- (k) Procedures to ensure that the specified moisture content and compaction have been achieved over the full depth of each layer and that the specified layer thickness is not exceeded (refer to Clauses 5, 6 and 7).
- (l) Procedures for protection of earthworks and dealing with over-wet materials and over-dry materials (refer to 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.
- (n) Procedures to protect buried structures, culverts and utility services infrastructure during earthworks placing and from construction traffic as required by Specifications TfNSW R11 and TfNSW G7.

1.5.2 Plan Submission and Updating

Notwithstanding the staged submission provisions of 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 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;
- (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;
- (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 Surveys – General

Carry out all surveys shown as required in Annexure R44/A1 in accordance with Specification TfNSW G71. Where so specified in Annexure R44/A1 or directed by the Principal, carry out the survey as a joint survey.

Obtain the surface levels at sufficient positions when carrying out surveys for the purpose of calculation of earthworks quantities for payment, or for process control or conformity verification.

Where a “Model File” is shown as required in Annexure R44/A1, include with the Survey Report an electronic file of the survey data which is in a format suitable for creating accurate models using standard TfNSW CADD software.

1.6.2 Setting Out

Set out the earthworks prior to commencement of construction by marking on the ground, using pegs and signs, the location and extent of all cuttings and embankments including cut/fill transitions and drainage layers as detailed on the Drawings. Install batter profiles, or provide alternative means, to indicate the slope of embankments or cuttings.

When setting out, 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.

1.7 PROTECTION OF EARTHWORKS

Protect the earthworks by implementing, as a minimum, the following measures:

- (a) 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.
- (b) 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.
- (c) Should earthworks material become over-wet (i.e. above the specified moisture content for compaction), replace and/or dry out the material at your own cost (refer also to Clauses 2.6.5 and 7.1.3).
- (d) 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.

1.8 PROTECTION OF ENVIRONMENT

Prior to commencement of any work which will disturb the natural environment, install erosion and sedimentation control measures in accordance with Specifications TfNSW G36 and TfNSW G38, and maintain them throughout the duration of the Contract.

2 MATERIALS

2.1 CONTRACTOR'S RESPONSIBILITY

You are responsible for:

- (a) any of the assumptions you 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 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 within the Site or from sources located outside the Site or from nominated sources, to ensure sufficiency of materials meeting the specified requirements.

Unless otherwise specified, do not import material for use in the Works until all material meeting the specified requirements which are available from cuttings within the Site has been placed, or has been allocated to be placed, in the formation.

If you cause a deficiency of material suitable for use in embankment construction or materials meeting other specified requirements, 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, make good that deficiency at your own cost using material meeting the specified requirements.

2.3 BORROW AREAS

2.3.1 General

Include details of the method of selection and quality control of materials obtained from borrow areas in the EARTHWORKS PLAN (refer to item (h) in Clause 1.5.1).

2.3.2 Nominated Borrow Areas

For borrow areas shown on the Drawings or nominated in Annexure R44/A2.1, carry out site preparation in accordance with Clause 2.5.1 of this specification and 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 cutting batters at such borrow areas must conform to that 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 TfNSW G36. Unless otherwise approved by the Principal, carry out restoration of borrow areas in accordance with TfNSW R178.

2.3.3 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 five working days prior to commencing work at these borrow areas.

Any material which you bring from borrow areas 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 which are arranged by you.

2.4 STOCKPILE AREAS

2.4.1 Locations

Locate your stockpiles at the areas nominated on 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.

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

2.4.2 Setting Up

Prior to using the areas, carry out a pre-construction land condition assessment of the area as specified in TfNSW G36.

Set up the stockpiles in a manner that minimises any damage to natural vegetation and trees, maintains the existing surface drainage and allows access to the stockpiles for carting away at any time.

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

2.4.3 Restoration

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

2.5 TOPSOIL

2.5.1 Removal of Topsoil

Commence removal of topsoil after completion of clearing and grubbing, and removal of the cleared materials on that section of the Works.

Do not remove topsoil in locations where a bridging layer is to be constructed in accordance with Clause 3.3.2, unless directed otherwise by the Principal.

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

- (a) stockpile the topsoil within the Site separately from other materials and clear of the Works for use in revegetation, or
- (b) stockpile the topsoil as a windrow longitudinally and adjacent to the toe of embankment batter, or
- (c) dispose of the topsoil as spoil outside the Site in accordance with Clause 2.7.1; or
- (d) if the topsoil has been identified as contaminated material, dispose of the topsoil as spoil in accordance with Clause 2.7.2.

2.5.2 Topsoil Stockpiles

Locate your topsoil stockpiles in accordance with Clause 2.4.1.

Before commencing stockpiling of topsoil, carry out a survey of the existing surface at each stockpile area in accordance with Clause 1.6.1, to be able to later determine the volumes of topsoil placed at the location.

Topsoil stockpiles must:

- (a) be free from subsoil, other excavated materials, contaminated materials, clay lumps and stones, timber, refuse 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 cover crop in accordance with Specification TfNSW R178, to encourage vegetation cover. The cover crop must be sterile. Seed the stockpile progressively within seven days of completion of each 500 m² of exposed batter face.

2.5.3 Survey after Removal of Topsoil

After removing the topsoil, carry out a survey of the resulting surface in accordance with Clause 1.6.1 to be able to later determine the volume of excavation for general earthworks, and the volume of unsuitable material.

HOLD POINT

Process Held:	Any works which will alter the ground surface as surveyed.
Submission Details:	Survey Report of existing surface levels, and notification that the set out specified in Clause 1.6.2, including set out of the extent of the Cut/Fill Transition Zone as specified in Clause 3.5.2, have been carried out, at least three working days prior.
Release of Hold Point:	The Principal will consider the submitted documents, 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 Zone.

2.6 UNSUITABLE MATERIAL**2.6.1 Identification and Removal of Unsuitable Material**

Upon reaching the Designed Floor Level or Foundation Level of cuttings, or after stripping of the topsoil covering each embankment foundation, hold any subsequent earthworks processes (refer to Hold Points in Clauses 3.2 and 3.3) to allow inspection of the foundation.

Where unsuitable material (as defined in Clause 1.3) is found, excavate such unsuitable material to the extent directed by the Principal.

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.

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

2.6.2 Replacement of Unsuitable Material

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

- (a) suitable material conforming to Clause 5.2.1; or
- (b) if directed, with foundation treatments in accordance with Clause 3 or as shown on the Drawings.

2.6.3 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 dispose of the material as spoil in accordance with Clause 2.7.

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 2.7 of this specification and TfNSW G36.

2.6.4 Quantity Measurement of Unsuitable Material

Before and after removal of unsuitable material, carry out a survey (if specified as required in Annexure R44/A1) in accordance with Clause 1.6.1 to determine the volume of unsuitable material removed.

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

Payment for the removal of unsuitable material, and its subsequent processing and use or disposal within the Site, will be made under Pay Item R44P4. Payment for placing and compaction of conforming material to replace the unsuitable material removed will be paid under Pay Item R44P2 (site won material) or Pay Item R44P3 (imported material).

2.6.5 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 will be borne by you.

Examples of inappropriate construction activities include poor surface drainage, restricted or inoperative subsurface drains, contamination, excessively 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.

2.7 SPOIL

2.7.1 Non-contaminated Materials

Dispose of spoil comprising non-contaminated material in the manner and at the locations authorised or agreed to by the Principal, by any of the following means, as appropriate:

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

Use up all available areas within the Site for disposal by the above means, before proposing alternative locations.

Construction of flatter batters (item (a) above) or wider embankments (item (b) above) must be carried out in accordance with Clause 5 for embankment construction.

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

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

2.7.2 Contaminated Materials

Manage, stockpile and/or remove from the Site contaminated materials in accordance with TfNSW G36. If disposal methods and locations are not specified, 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 at the Site will be made under Pay Item R44P1.2 or Pay Item R44P2; or where the contaminated material is contained within 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 locations legally authorised to accept the contaminated material.

Treatment and disposal of material contaminated by your operations will be at your own cost.

2.8 UPPER ZONE, VERGE AND SPILL THROUGH BRIDGE ABUTMENT FILL MATERIAL

2.8.1 General

Material placed in the Upper Zone of Formation, verges, and spill through bridge abutment zones (refer to Clause 5.2.3) must conform to the requirements of Clauses 2.8.4 to 2.8.7.

Do not use steel furnace slag aggregates in the Upper Zone of Formation, verges, spill through bridge abutment zones, and cutting and embankment drainage layers.

2.8.2 Material Source

Obtain Upper Zone material, verge material and spill through bridge abutment fill (Type ST) material of the specified quality in the first instance from cuttings or borrow areas within the Site.

Loosen and process the excavated materials from cuttings as required to meet the specified requirements before their incorporation in the Works.

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 (refer also to Clause 2.2).

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 to be supplied and their material properties before the imported material is delivered to the Site (refer also to Clauses 6.1.1 and 6.2, and associated Hold Points).

2.8.3 Stockpiling and Testing

Prior to placement of Selected Material, verge material and Type ST material, place the material in stockpiles and test it for conformity with the requirements of Clauses 2.8.5, 2.8.6 and 2.8.7 respectively and Annexure R44/A2.2. Each Lot of stockpiled material must not exceed 4,000 tonnes in mass.

Sample and test the material at the frequency specified in Table R44/L.2, and calculate the characteristic value (Q) of the CBR for each Lot in accordance with 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%.

Before placing the material in the Works, establish the response of the material to pre-treatment and adopt an appropriate pre-treatment regime for subsequent conformity testing.

For those materials which may be susceptible to breakdown or weathering, pre-treat samples of the material by crushing to size, subjecting to repeated compaction in accordance with Test Method TfNSW T102 or artificial weathering in accordance with Test Method TfNSW T103 (refer to Annexure R44 A2.2).

2.8.4 Upper Zone 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 conforming to Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;
- (b) have a Plasticity Index (PI) value conforming to Annexure R44/A2.2;
- (c)
 - (i) have a maximum particle dimension no greater than 100 mm;
 - (ii) have greater 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 Annexures R44/A2.1 and R44/A2.2 respectively, or approved by the Principal.

Clause 2.8.4.1 item (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 conforming to Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;
- (b) have a PI value conforming to Annexure R44/A2.2;
- (c)
 - (i) have a maximum particle dimension no greater than 53 mm;
 - (ii) have greater than 50% passing the 19 mm AS sieve.
 - (iii) have greater than 30% passing the 2.36 mm AS sieve.
- (d) meet the requirements of Clause 5.3 “Slag and Recycled Materials” of Specification TfNSW 3071, if applicable.

If the site won Selected Material conforms to the specified requirements for the lower layer of the Selected Material Zone, but has a CBR value that is less than that specified for the upper layer of the Selected Material Zone, you may modify the Selected Material by mixing it with hydrated lime, or other binders approved by the Principal, to make it conforming to the specified requirements of the upper layer. (Refer also to Note (5) of the table in Annexure R44/A2.2.)

2.8.5.2 Imported Selected Material

Material imported for the Selected Material Zone must conform to 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 conforming to Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;
- (b) have a PI value conforming to Annexure R44/A2.2;
- (c)
 - (i) have a maximum particle dimension no greater than 53 mm;
 - (ii) have greater than 50% passing the 19.0 mm AS sieve.

2.8.6.2 Imported Verge Material

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

- (a) have a characteristic CBR value conforming to Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;
- (b) have a PI value conforming to Annexure R44/A2.2.

2.8.7 Spill Through Bridge Abutment Fill (Type ST) Material

Type ST material for use at spill through bridge abutments must:

- (a) have a CBR value conforming to Annexure R44/A2.2, for the fraction passing 19.0 mm AS sieve;
- (b) have a PI value conforming to Annexure R44/A2.2;
- (c)
 - (i) have a maximum particle dimension no greater than 53 mm;
 - (ii) have greater than 50% passing the 19.0 mm AS sieve.

2.9 OTHER EARTHWORKS MATERIALS**2.9.1 General**

Obtain fill material for embankment construction in the first instance from cuttings within the Site. Where authorised by the Principal, the site won fill material may be supplemented with borrowed or imported material in accordance with Clause 2.3.

Fill material for embankment construction must be free of tree stumps, roots and refuse.

Loosen and process the excavated materials from cuttings as required to meet the specified requirements before their incorporation in the Works.

If surplus excavated material from other works under the Contract (such as that from trenching for drainage pipes or utility conduits) is used in the construction of embankments or backfilling of trenches, such material must also conform to the specified requirements.

2.9.2 Drainage Layer Material

Material for foundation treatment Types C5 and E5, Drainage Layer, must conform to the properties specified in Table R44.2 in Clause 3.2.5 (and cross referenced in Clause 3.3.5).

2.9.3 Earth Fill and Rock Fill Material

Earth fill and rock fill material must also conform to the requirements of Clauses 5.2.1 and 5.3.1 respectively.

2.9.4 Rock Capping and Rock Facing Material

Rock capping and rock facing material must conform to the requirements of Clauses 5.3.4 and 5.4.2 respectively.

3 FOUNDATIONS**3.1 GENERAL**

Carry out foundation treatments for:

- (a) Cuttings: after excavation to the Designed Floor Level, or Foundation Level as appropriate, and removal of unsuitable material;

- (b) Embankments: 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.

Taking into account the site conditions such as 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 features (such as trench and foundation drains in accordance with Specification TfNSW R33) in conjunction with the foundation treatments, as shown on the Drawings, or as directed or authorised by the Principal.

3.2 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 specified or directed or authorised by the Principal, in accordance with Clause 4.

Remove and replace any unsuitable material in accordance with the Clause 2.6.

Prior to carrying out any foundation treatments within cuttings (except for Treatment Type C5), carry out tests to determine the CBR and PI values of the material in the floor of the cutting, using the Test Methods specified 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: (a) Notification of completion of excavation to:

- (i) Designed Floor Level, or Foundation Level, as appropriate;
- and
- (ii) depth specified for Cut/Fill Transition Zone (refer to Clause 3.5.2).

(b) CBR and PI test results.

(The submission must be concurrent with the submission for any adjoining Shallow Embankment foundation required by the Hold Point in Clause 3.3.)

Release of Hold Point: The Principal will consider the submitted documents, inspect the floor of the cutting and may direct further action prior to authorising the release of the Hold Point.

Further action may include the removal of unsuitable material in accordance with Clause 2.6; installation of trench drains in accordance with TfNSW R33, foundation treatments in accordance with this Clause, or changes to the area to be excavated.

The following types of treatments for foundations within cuttings are depicted in Figures R44.3(a) to R44.3(d) or described under Clause 3.2.4:

- Type C1 – Loosen and Recompect;
- 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 shown on the Drawings or specified or directed or authorised by the Principal.

Where so 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 requirements nominated in Annexure R44/A2.2, remove or modify the material to the appropriate depth in accordance with the directed foundation treatment (i.e. Foundation Treatment Types C2 to C5).

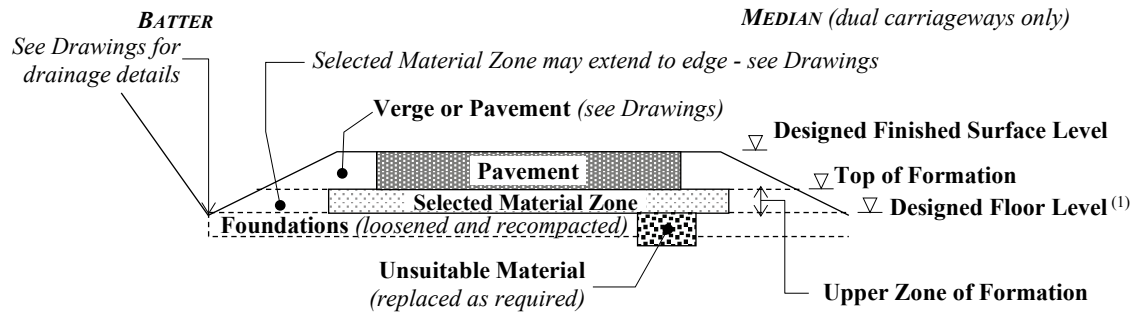
Maintain the floor of the cutting in its conforming condition until you have completed the subsurface drainage and commenced backfilling and construction of Upper Zone of Formation (which, in Cuttings, comprise only the Selected Material Zone). You will bear the cost of any additional treatment required as a result of damage to the foundations that is caused, or allowed to occur, by you.

3.2.1 Treatment Type C1 – Loosen and Recompect

Unless shown otherwise on the Drawings or specified or directed or authorised by the Principal, carry out a Type C1 treatment to the floors of cuttings as follows:

- (a) After excavation to the Designed Floor Level, trim the surface to within the tolerances specified in Clause 7.7.1;
- (b) Remove and replace any unsuitable material present in accordance with Clause 2.6;
- (c) 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;
- (d) Adjust the moisture content of the loosened material as required and recompact it to conform to the relative compaction level specified in Clause 7.2;
- (e) After recompaction, trim the floor of the cutting to the Designed Floor Level and within the tolerances specified in Clause 7.7.

As part of the trimming operation, prepare the surface in accordance with Test Method TfNSW T199, for deflection monitoring as required under Clauses 7.5 and 7.6.



Note:

(1) Unless shown otherwise on the Drawings.

Figure R44.3(a) – Cutting Foundation Treatment Type C1 – Loosen and Recompact

Payment for the Type C1 treatment will be made under Pay Item R44P7.1. Do not include the volume that is loosened (and recompacted) for the Type C1 treatment when measuring the total excavation volume under general earthworks, for payment under Pay Item R44P2.

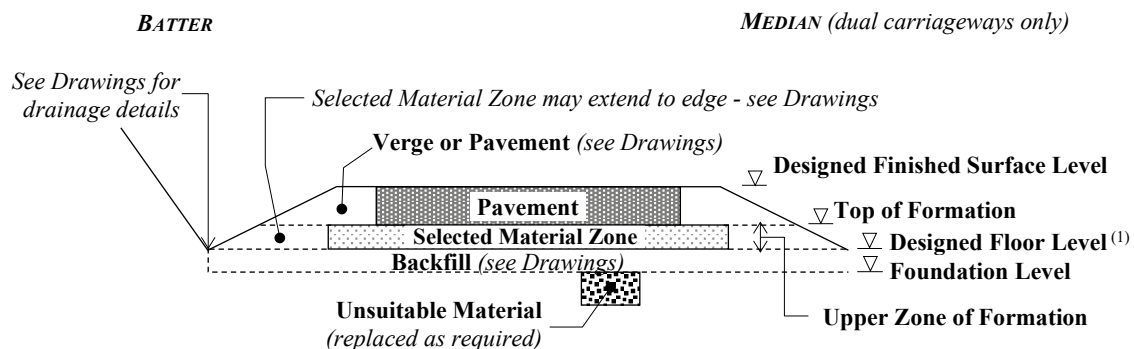
3.2.2 Treatment Type C2 – Excavation and Backfill

Where shown on the Drawings or specified or directed or authorised by the Principal, carry out a Type C2 treatment to the floors of the cuttings as follows:

- (a) After excavation to the Foundation Level which is parallel to, and at a depth below the Designed Floor Level equal to the required thickness of backfill, trim the floor of the cutting to within the tolerances specified in Clause 7.7;

Determine the CBR and PI values of the material in the floor of the cutting by the Test Methods specified in Annexure R44/A2.2;

- (b) Remove and replace any unsuitable material present in accordance with Clause 2.6;
- (c) Compact the material exposed at the floor of the cutting with not less than six passes of a vibrating roller;
- (d) Place backfill material conforming to the requirements of Clause 2.8.4 and Annexure R44/A2.2, and compact to the relevant requirement specified in Table R44.7 under Clause 7.2;
- (e) Trim the compacted backfill to the Designed Floor Level and within the tolerances specified in Clause 7.7.



Note:

(1) Unless shown otherwise on the Drawings.

Figure R44.3(b) – Cutting Foundation Treatment Type C2 – Excavation and Backfill

Include the volume that is excavated between the Designed Floor Level and the Foundation Level for the Type C2 treatment when measuring the total excavation volume under general earthworks, for payment under Pay Item R44P2.

Payment for the backfilling under item (d) of this Clause will be made under Pay Item R44P7.3.

3.2.3 Treatment Type C3 – Working Platform

Where shown on the Drawings or specified or directed or authorised by the Principal, carry out a Type C3 treatment to the floors of the cuttings by either the C3(I) or C3(II) method, as follows. Use the latter method where so specified in Annexure R44/A3.

(a) Type C3(I)

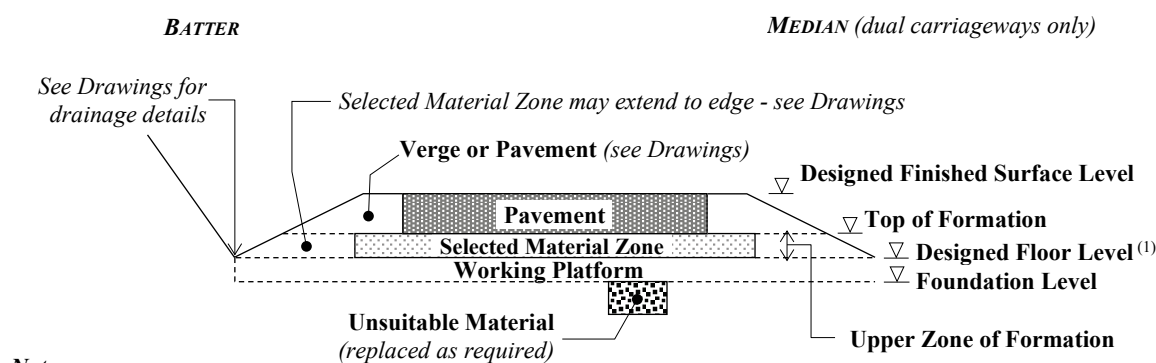
Increase the strength of the insitu material by stabilisation in accordance with Specification TfNSW R50 to form a Working Platform on which to construct the formation.

Undertake the same steps as those for Type C1 Treatment in Clause 3.2.1 except that after loosening of the material below the floor of the cutting, mix a stabilising binder into the loosened material in accordance with TfNSW R50.

(b) Type C3(II)

Construct a Working Platform using plant mixed stabilised material in accordance with TfNSW R50.

Undertake the same steps as those for Type C2 Treatment in Clause 3.2.2 except that after compaction of the floor of the cutting, place plant mixed stabilised material in accordance with TfNSW R50 as the backfill material.



Note:

⁽¹⁾ Unless shown otherwise on the Drawings.

Figure R44.3(c) – Cutting Foundation Treatment Type C3 – Working Platform

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

Include the volume that is excavated between the Designed Floor Level and the Foundation Level for the Type C3(II) treatment when measuring the total excavation volume under general earthworks, for payment under Pay Item R44P2.

3.2.4 Treatment Type C4 – Geotextile/Geogrid Layer(s)

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

The geotextile and geogrid must conform to Specifications TfNSW R63 and TfNSW R67 (short term design strength only) respectively. Place the geotextile and geogrid in conformity to TfNSW R63 and TfNSW R67 respectively.

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

3.2.5 Treatment Type C5 – Drainage Layer

Where shown on the Drawings or specified or directed or authorised by the Principal, carry out a Type C5 treatment to the floors of the cuttings as follows:

- (a) After excavation to the Foundation Level which is parallel to, and at a depth below the Designed Floor Level equal to the required thickness of the drainage layer, trim the floor of the cutting to within the tolerances specified in Table R44.8 under Clause 7.7 and to the same crossfall as the pavement above to ensure that drainage within the cutting can occur;

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

Provide end outlet/drainage treatment as shown on the Drawings, or directed by the Principal.

- (b) Remove and replace all unsuitable material present in accordance with Clause 2.6;
- (c) Compact the material exposed at the floor of the cutting with not less than six passes of a vibrating roller;
- (d) Prior to placing the drainage layer, place a geotextile conforming to TfNSW R63, over the floor of the cutting, except where the cutting is in rock;
- (e) Place and spread the drainage layer material over the geotextile, to a minimum layer thickness of 300 mm, avoiding segregation and contamination with foreign material.

The drainage layer material must conform to the properties specified in Table R44.2. Do not use steel furnace slag aggregates in the drainage layer.

Table R44.2 – Drainage Layer Material Properties

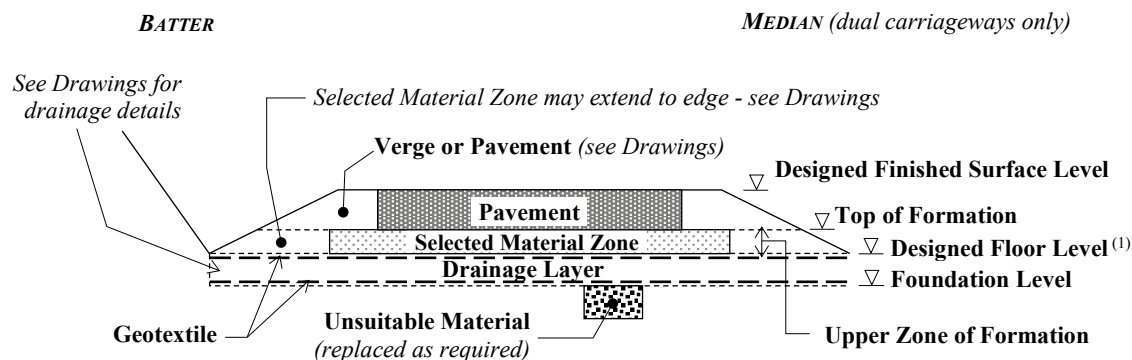
Property	Requirement
Maximum particle dimension	125 mm
Percentage passing:	
19.0 mm AS sieve	0 – 15%
1.18 mm AS sieve	0 – 5%
75 µm AS sieve	< 0.5% ⁽¹⁾
Percentage of +19.0 mm fraction with $I_{s(50)}$ less than the specified value in Annexure R44/A2.2	10% (max)
Wet/Dry Strength Variation	Annexure R44/A2.2

Note:

⁽¹⁾ Test only where directed.

- (f) Adjust the grading of the drainage layer material as necessary to within the limits specified in Table R44.2 to ensure that it provides a stable foundation for compaction of the overlying Selected Material Zone.
- (g) Compact the drainage layer using the nominated compaction procedure developed in accordance with Clause 7.4.2. After compaction, the upper surface of the drainage layer must be within the tolerances specified in Table R44.8.

- (h) Place a geotextile of the same type as that specified in item (d) above over the top of the drainage layer.



Note:

⁽¹⁾ Unless shown otherwise on the Drawings.

Figure R44.3(d) – Cutting Foundation Treatment Type C5 – Drainage Layer

Payment for the drainage layer will be made under Pay Item R44P7.6. Include the volume that is excavated for the Type C5 treatment when measuring the total excavation volume under general earthworks, for payment under Pay Item R44P2. Payment for the geotextile will be made under Pay Item R44P7.5(a).

3.2.6 Other Treatments

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

3.3 FOUNDATION TREATMENTS UNDER EMBANKMENTS

After preparation of the embankment foundation area and prior to commencing the foundation treatment, present the area for inspection by the Principal.

HOLD POINT

Process Held:	Treatment of each Lot of embankment foundation.
Submission Details:	<ul style="list-style-type: none"> (a) Survey report. (b) Notification of completion of clearing operations. (c) In areas other than beneath Shallow Embankments, notification that: <ul style="list-style-type: none"> (i) topsoil has been removed in accordance with Clause 2.5; or (ii) grasses have been flattened/mowed if so shown on the Drawings or specified. (d) In areas beneath Shallow Embankments: <ul style="list-style-type: none"> (i) notification that topsoil has been removed and surface excavated in accordance with Clause 3.5.1; and (ii) CBR and PI test results, if required in accordance with Clause 3.5.1.
Release of Hold Point:	<p>The Principal will consider the submitted documents, inspect the prepared embankment foundation area, and may direct further action prior to authorising the release of the Hold Point.</p> <p>Further action may include removal of unsuitable material in accordance with Clause 2.6, or treatment in accordance with Clause 3.3.</p>

The following types of treatments for foundations under embankments are depicted in Figures R44.4(a) to R44.4(e) or described under Clause 3.3.6:

- 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 shown on the Drawings or specified or directed or authorised by the Principal.

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

Carry out Type E1 treatment for all embankment foundations, unless shown otherwise 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 you have commenced embankment construction. You will bear the cost of any additional foundation treatment 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.

3.3.1 Treatment Type E1 – Loosen and Recompact

Unless shown otherwise on the Drawings or specified or directed or authorised by the Principal, carry out a Type E1 treatment to the embankment foundation as follows:

- (a) Remove and replace any unsuitable material present in accordance with Clause 2.6;
- (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 3.4;
- (d) Adjust the moisture content of the loosened material as required and recompact it to conform to the relative compaction level specified in Clause 7.2.

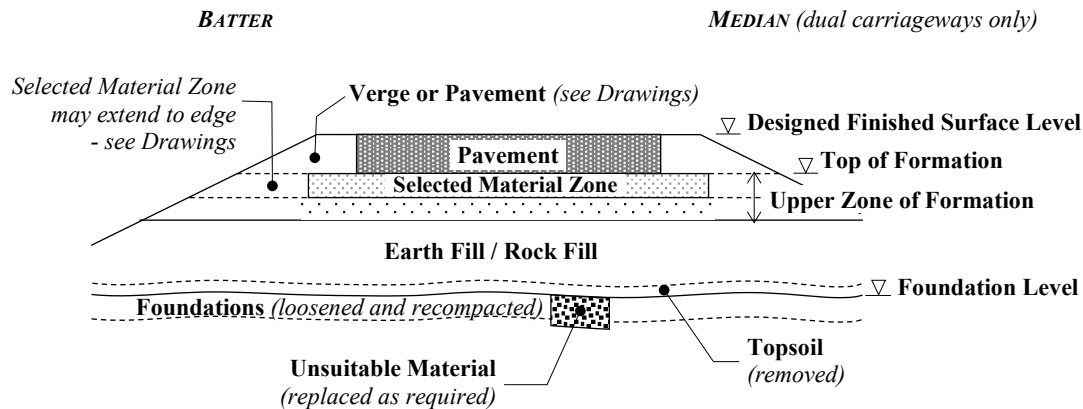


Figure R44.4(a) – Embankment Foundation Treatment Type E1 – Loosen and Recompact

Payment for the Type E1 treatment will be made under Pay Item R44P7.2. Do not include the volume that is loosened (and recompact) for the Type E1 treatment when measuring the total excavation volume under general earthworks, for payment under Pay Item R44P2.

3.3.2 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 7.2, carry out a Type E2 treatment by constructing 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 specified in Annexure R44/A3.

You may construct the bridging layer using either earth fill or rock fill material. Whichever material is used, the bridging layer must provide a stable platform upon which a conforming earthworks layer can be constructed.

Earth fill used must conform to the requirements of Clause 5.2.1, and in addition must consist of granular material with strong mechanical interlock and low sensitivity to moisture. Rockfill used must conform to the requirements of Clause 5.3.1.

If specified or directed by the Principal, prior to placing the bridging layer, place a geotextile conforming to TfNSW R63 over the embankment foundation area.

Place the bridging layer material by end-dumping and spreading it in a single layer of sufficient thickness to allow the passage of earthmoving equipment over the bridging layer with minimal surface

heaving. The compaction requirements of Clause 7.4 for rock fill placing do not apply to the bridging layer.

The thickness of the bridging layer when completed must conform to that specified in Annexure R44/A3.

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.

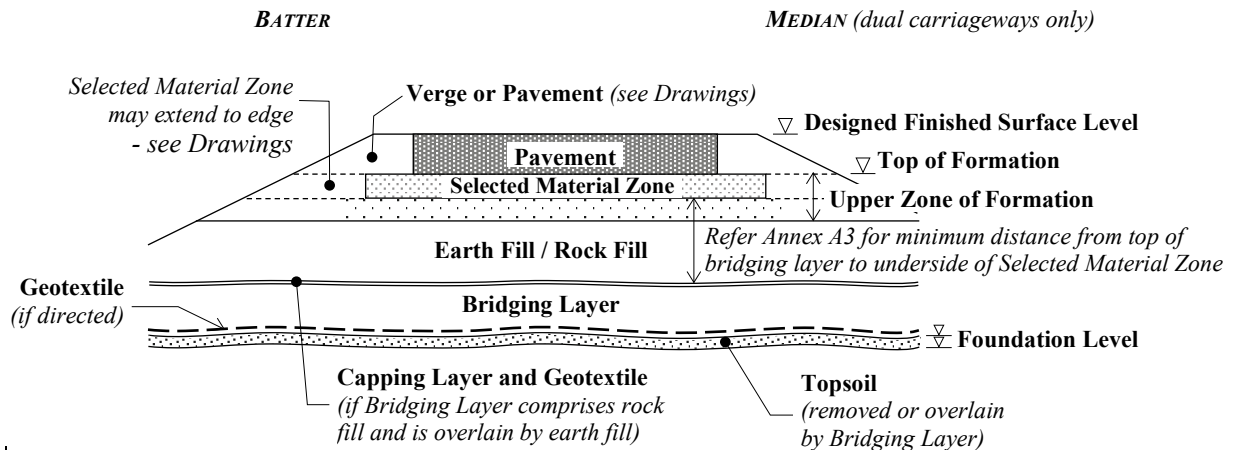


Figure R44.4(b) – Embankment Foundation Treatment Type E2 – Bridging Layer

Where the bridging layer is constructed from rock fill material, and the bridging layer is to be overlain by earth fill, place a rock capping layer, including geotextile, immediately above the rock fill in accordance with Clause 5.3.4 unless approved otherwise by the Principal.

Payment for the bridging layer will be made under Pay Item R44P7.4. Payment for the geotextile will be made under Pay Item R44P7.5(a).

3.3.3 Treatment Type E3 – Working Platform

Where shown on the Drawings or specified or directed or authorised by the Principal, carry out a Type E3 treatment to the embankment foundation by either the E3(I) or E3(II) method, as follows. Use the latter method where so specified in Annexure R44/A3.

(a) Type E3(I)

Increase the strength of the insitu material by stabilisation in accordance with TfNSW R50 to form a Working Platform on which to construct the formation.

Undertake the same steps as those for Type E1 Treatment in Clause 3.3.1 except that after loosening of the material in the foundation, mix a stabilising binder into the loosened material in accordance with TfNSW R50.

(b) Type E3(II)

Construct a Working Platform using plant mixed stabilised material in accordance with TfNSW R50.

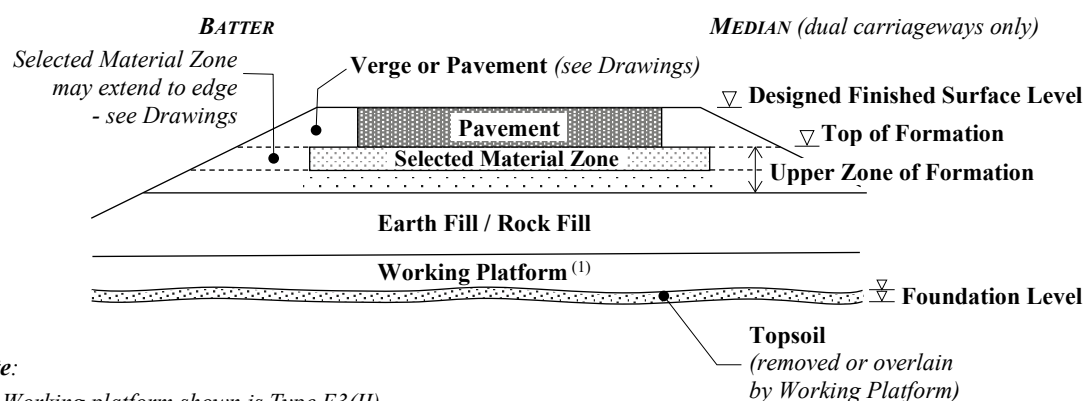


Figure R44.4(c) – Embankment Foundation Treatment Type E3 – Working Platform

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

3.3.4 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 to the embankment foundation by placing a layer (or multiple layers) of geotextile and/or geogrid over the foundation area.

The geotextile and geogrid must conform to TfNSW R63 and TfNSW R67 (short term design strength only) respectively. Place the geotextile and geogrid in conformity to TfNSW R63 and TfNSW R67 respectively.

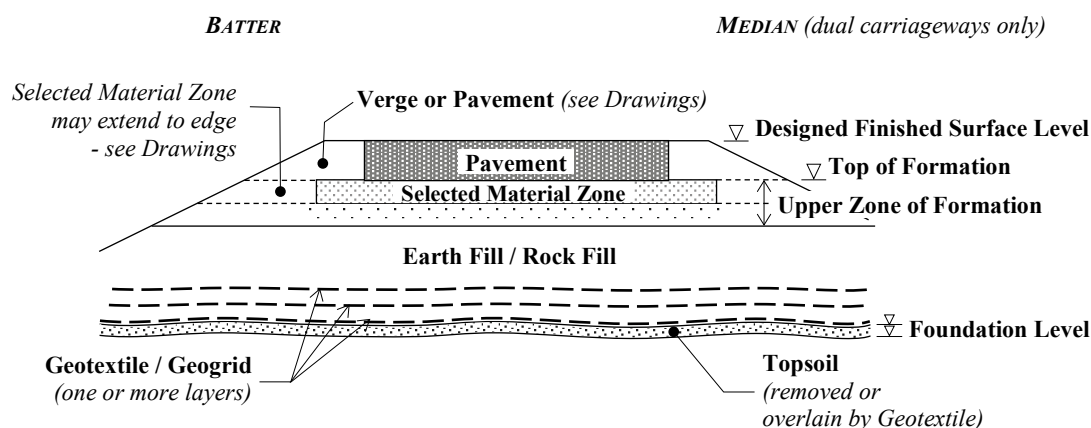


Figure R44.4(d) – Embankment Foundation Treatment Type E4 – Geotextile/Geogrid Layer(s)

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

3.3.5 Treatment Type E5 – Drainage Layer

Where shown on the Drawings or specified or directed or authorised by the Principal, carry out a Type E5 treatment to 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 specified in Annexure R44/A3.

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 conforming to TfNSW R63 over the embankment foundation area.

Place and spread the drainage layer material over the geotextile, avoiding segregation and contamination with foreign material.

The drainage layer material must conform to the properties specified in Table R44.2 under Clause 3.2.5. Do not use steel furnace slag aggregates in the drainage layer.

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

Compact the drainage layer using the nominated compaction procedure developed in accordance with Clause 7.4.2.

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

The thickness of the drainage layer when completed must conform to that specified in Annexure R44/A3.

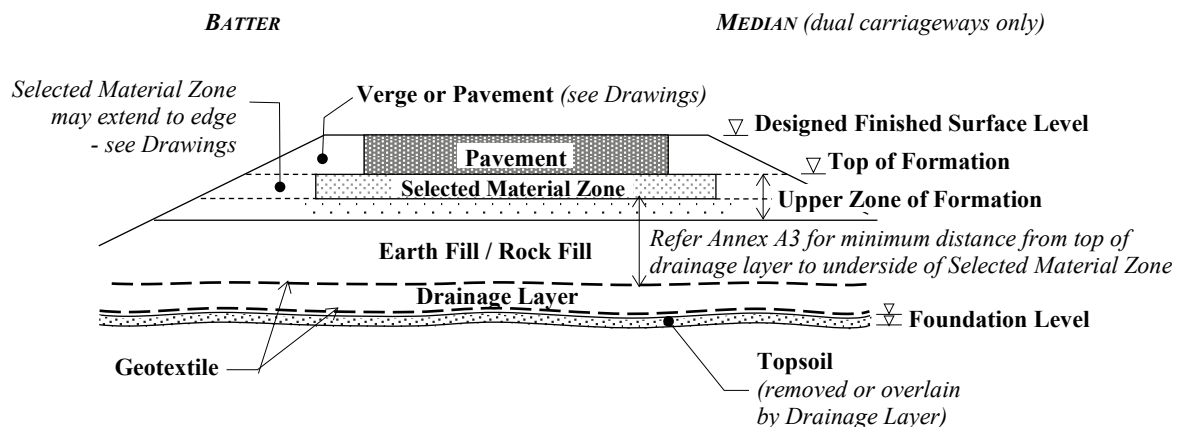


Figure R44.4(e) – Embankment Foundation Treatment Type E5 – Drainage Layer

Payment for the drainage layer will be made under Pay Item R44P7.7. Payment for the geotextile used in the Works will be made under Pay Item R44P7.5(a).

3.3.6 Treatment Type E6 - Earth Fill Foundation Treatment

Where shown on the Drawings or specified or directed or authorised by the Principal where you can demonstrate that it is impractical to achieve the degree of compaction specified for the foundation in Clause 7.2, carry out a Type E6 treatment by placing an earth fill layer over the embankment foundation area.

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

The material for this earth fill layer must conform to the requirements for earth fill in Clause 5.2, except that the maximum particle dimension of rock must not be greater than 200 mm. The moisture content must be within the limits specified in Annexure R44/A5.

Place the material such that the top 300 mm of the layer is compacted to the relevant relative compaction specified in Table R44.7 under Clause 7.2.

The thickness of the earth fill layer when completed must conform to that specified in Annexure R44/A3.

After placing, the Principal may require you to carry out proof rolling of each Lot in accordance with Clause 7.5. If proof rolling shows that this earth fill layer exhibits excessive deflection, or if subsequent layers cannot be compacted to meet the specified requirements for earth fill, remove the layer placed for this Foundation Treatment and treat the foundation as re-determined by the Principal.

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.

Payment for the earth fill foundation treatment layer will be made under Pay Item R44P7.8.

3.3.7 Other Treatments

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

3.4 FOUNDATION TREATMENT FOR HILLSIDE EMBANKMENTS – TERRACING

Where embankments are to be constructed on or against any batters of existing embankments (including batters resulting from the partial construction of embankments under the Contract), and the existing slope of the batter is equal to or steeper than 10H:1V in any direction, cut horizontal terraces into such batters so that the overlying embankment can be placed in horizontal layers.

Such horizontal terraces are not required for slopes flatter than 10H:1V.

Cut each successive terrace step to the depths shown in Figure R44.5. Cut the terraces progressively as you construct the embankment.

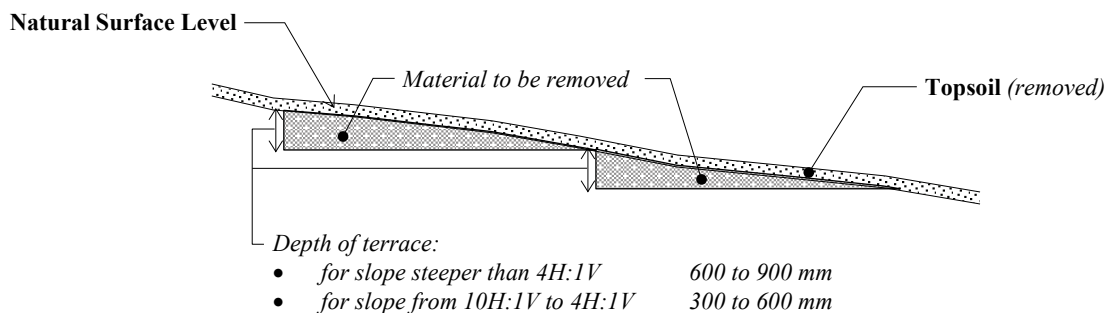


Figure R44.5 – Hillside Terracing Requirements

Inspect the floor of each terrace in accordance with Clause 2.6 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 2.7.

Do not include the volume of material removed in terracing when measuring the total excavation volume under general earthworks, for payment under Pay Item R44P2.

3.5 SHALLOW EMBANKMENT AND CUT/FILL TRANSITION ZONE

3.5.1 Shallow Embankment

Where the height of the embankment from the Stripped Surface Level to Top of Formation is less than the Shallow Embankment height specified in Annexure R44/A4, carry out further excavation of the area to a depth below the Stripped Surface Level necessary to achieve that height, unless otherwise shown on the Drawings or directed by the Principal.

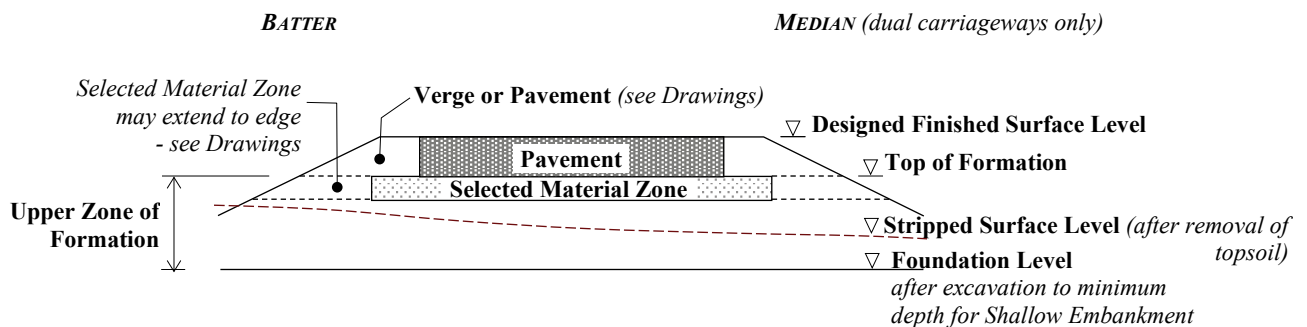


Figure R44.6(a) – Shallow Embankment Nomenclature

You may propose to the Principal a height that is less than the specified Shallow Embankment height, to reduce the depth of excavation required. The Principal may approve this reduced height if you can verify by testing, that CBR and PI values at your proposed higher Foundation Level conform to that specified in Annexure R44/A2.2.

Observe the Hold Point in Clause 3.3 and carry out embankment foundation treatment(s) in accordance with Clause 3.3, before placing the overlying formation.

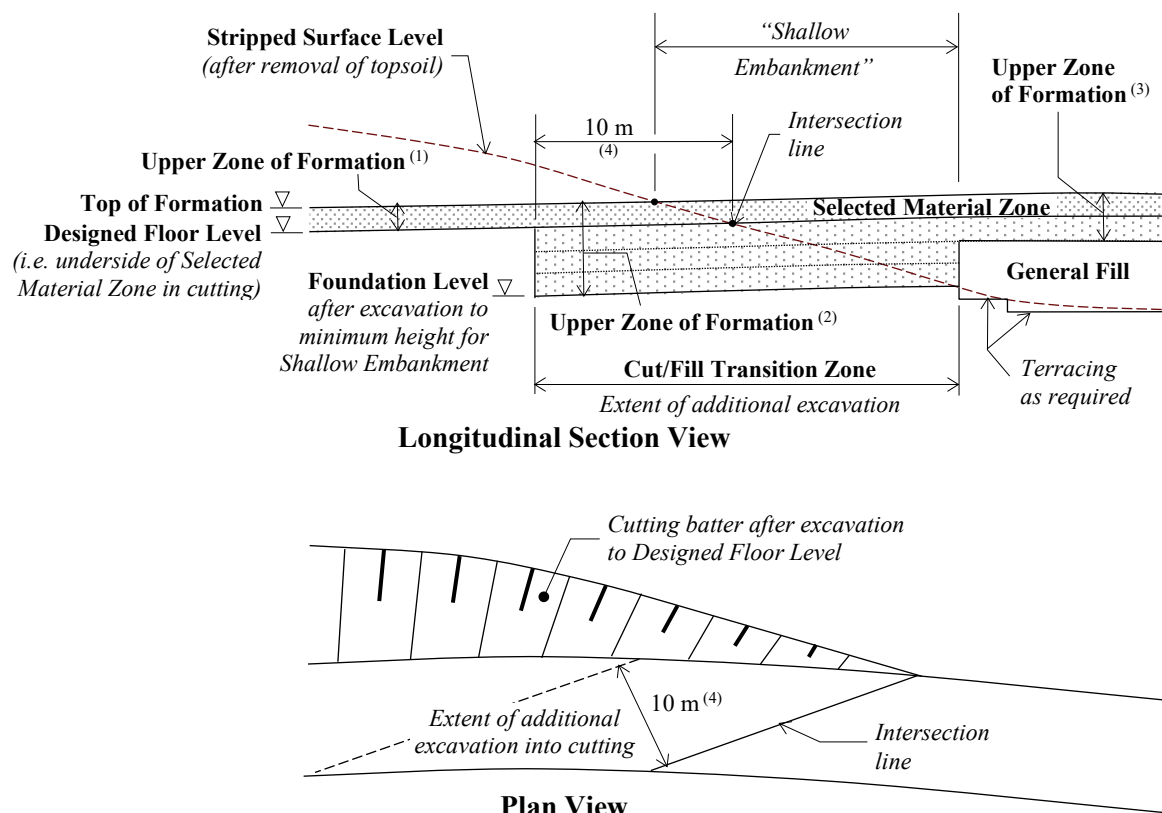
When the height of the embankment conforms to the specified Shallow Embankment height, then the thickness of the Upper Zone of Formation will conform to that specified in Annexure R44/A4 corresponding to “Shallow Embankment”, unless the Principal has approved a reduced height as mentioned above. (The entire formation from Foundation Level to Top of Formation will thus comprise solely of the Upper Zone of Formation.)

Include the volume of material excavated to achieve the Shallow Embankment height when measuring the total excavation volume under general earthworks, for payment under Pay Item R44P2.

3.5.2 Cut/Fill Transition Zone

The Cut/Fill Transition Zone is shown schematically in Figure R44.6(b).

Within the Cut/Fill Transition Zone, following excavation to the Designed Floor Level, carry out further excavation, parallel to the cutting floor, to a depth below the Designed Floor Level necessary to achieve the minimum thickness specified for the Upper Zone of Formation corresponding to “Cut/Fill Transition Zone” in Annexure R44/A4, as shown in Figure R44.6(b).

**Notes:**

- (1) Within this zone, which is outside the Cut/Fill Transition Zone and within the cutting, the thickness of the Upper Zone of Formation will be that corresponding to "Cutting" in Annexure R44/A4.
- (2) Within this zone, where the height from the Stripped Surface Level to the Top of Formation is less than the Shallow Embankment height, further excavation to achieve the Shallow Embankment height is necessary. This excavation extends into the cutting 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) Within this zone, where the height from the Stripped Surface Level to the Top of Formation is greater than the Shallow Embankment height, 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.
- (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

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

Where so specified in Annexure R44/A6, extend the cut/fill transition treatment into the medians. Do not extend this cut/fill transition treatment into the cutting batter.

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

Include the volume of material excavated when measuring the total excavation volume under general earthworks, for payment under Pay Item R44P2.

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 TfNSW R33.

4 CUTTINGS

4.1 GENERAL

4.1.1 Scope

Excavation of cuttings includes:

- (a) excavation of material within the batter limits shown on the Drawings;
- (b) foundation treatments in accordance with Clause 3.2;
- (c) excavation specified for Shallow Embankments in accordance with Clause 3.5.1, and cut/fill transition in accordance with Clause 3.5.2;
- (d) benching or terracing of batters;
- (e) cleaning of batter surfaces;

to the alignment, levels, dimensions and batter slopes shown on the Drawings, and within the tolerances specified in Clause 7.

4.1.2 Batter Slopes Re-determination

The batter slopes in cuttings shown on the Drawings may be re-determined by the Principal, following an inspection and investigation during excavation (refer to Clause 4.2).

4.2 CLEANING OF CUTTING BATTERS AND INSPECTION

During excavation, clear the cut faces of any loose or unstable material progressively as excavation proceeds.

Remove by hand or machine any loose or unstable blocks which are too large to be removed by other means, unless otherwise directed by the Principal.

Clean the surfaces of cutting batters in rock with slopes of 1H:1V or steeper using compressed air. Do not use water jets or air-water jets for cleaning unless specifically approved by the Principal for specific areas.

Immediately following completion of excavation in rock to the level of each bench, remove all loose rock and soil material and clean the rock surfaces to sufficiently expose the batter surface, and particularly the joints, to allow the Principal to 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:	<p>The Principal will inspect the cleaned surfaces and may direct further action prior to authorising the release of the Hold Point.</p> <p>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.</p>

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

4.3 OVER-EXCAVATION AND ACTIONS REQUIRED

If the batter is over-excavated beyond the tolerance applicable for the batter slope line (refer to Clause 7.8), or after cleaning the batter is beyond the tolerance applicable, restore the batter to the specified slope and stability to the Principal's satisfaction. Any proposals for restoration must take into account long term stability, durability, and consideration of urban design requirements. 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 you to re-form the batter to the average batter slope using randomly mortared stone or other treatments. Where the former is directed, the stone used must be similar to the sound rock in the cutting and the mortar used must be coloured to match the colour of the rock.

Alternatively, you may propose 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 re-determination of the batter slope under Clause 4.1.2, and no additional payment will be made. If your proposal is not approved, restore the batter to the specified slope and stability, to the satisfaction of Principal.

4.4 BENCHING IN CUTTINGS**4.4.1 General**

Construct benches at cutting batters as shown on the Drawings to provide geotechnical stability, provide drainage and erosion control, and allow access for maintenance purposes. Notwithstanding the tolerances permitted under Clause 7.8, bench widths must not be less than those shown on the Drawings.

Clean the surface of benches in rock cuttings, using compressed air, to allow inspection of the bench and assessment of its stability, unless otherwise directed by the Principal.

4.4.2 Bench Drainage

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

Construct the 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.

4.4.3 Maintenance

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

4.5 LINE DRILLING OR PRE-SPLITTING**4.5.1 General**

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

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

4.5.2 Hole Diameter and Hole Spacing

When carrying out line drilling or pre-splitting, do not exceed the centre-to-centre spacing of the drill holes shown in Table R44.3.

Table R44.3 – Hole Diameter and Spacing for Line Drilling or Pre-splitting

Cutting Batter Treatment	Hole Diameter (mm)	Maximum Hole Spacing⁽¹⁾ (mm)
Line Drilling	Up to 51	150
Line Drilling	51 – 76	250
Pre-splitting	38 – 51	450 ⁽²⁾
Pre-splitting	51 – 64	750 ⁽²⁾
Pre-splitting	76 – 89	900 ⁽²⁾

Notes:

⁽¹⁾ Spacing measured centre-to-centre.

⁽²⁾ Reduce the maximum hole spacing as necessary to produce a uniform and neat batter surface after excavation.

4.5.3 Line Drilling or Pre-splitting Prior to Blasting

Prior to commencing blasting (refer to Clause 4.6) for excavation with batter slope of 1H:1V or steeper, carry out line drilling or pre-splitting to the designed batter profile at the hole spacings shown

in Table R44.3, so as to produce a uniform and neat batter surface after excavation which is acceptable to the Principal.

4.6 BLASTING

Clause 4.6 applies only where blasting is permitted under the Contract, as indicated in Annexure R44/A7. Burden blasting must not damage the batter face.

4.6.1 General

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

The Hold Point in TfNSW G36 for the submission of the Noise and Vibration Management Sub Plan (previously Vibration and Airblast Management Sub-Plan) and the Building Condition Inspection Reports applies prior to the commencement of blasting. Include in the Noise and Vibration 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 2187.1 and AS 2187.2. Comply also with the requirements of external agencies including, but not limited to, the NSW Environment Protection Authority (EPA) and SafeWork NSW, and demonstrate compliance.

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

4.6.2 Blasting Design

Prior to the start of each blast, submit to the Principal details of the following:

- (a) proposed blasting design, and estimated airblast overpressure (noise) and peak particle velocity (ground vibration) at sensitive locations;
- (b) measures to limit noise and ensure that vibration from blasting does not adversely affect nearby structures.

HOLD POINT

Process Held:	Start of each blast.
Submission Details:	Proposed blasting design, estimated airblast overpressure and peak particle velocity at sensitive locations, and measures to limit noise and ensure that vibration from blasting does not adversely affect nearby structures, at least 24 hours prior.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

If you revise the blasting design, re-submit details of the revised blasting design, and the above Hold Point again applies.

4.6.3 Blasting Operations

Confine your blasting operations to the weekdays of Mondays to Fridays but excluding public holidays, between the hours of 9:00 am and 3:00 pm, unless otherwise approved by the Principal.

During blasting operations, 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 National Association of Australian State Road Authorities (NAASRA) Explosives in Roadworks Users Guide 1982 and implement 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. Include in the notification the likely times, frequency and duration of blasting and precautions being taken to ensure that damage to property will not result.

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

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

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

4.6.4 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.

These details must be written down at the time when the holes are loaded and not afterwards, and the records must be signed by the shotfirer. Provide a copy of the records to the Principal on the same day as the blast.

Perform also a high definition video recording of the blasting event, covering the period between at least 5 seconds before the blast to 30 seconds after. Record the video at a minimum of 120 frames per second and a minimum resolution of 720p. Retain the video recording as an Identified Record.

4.6.5 Control of Airblast

Clause 4.6.5 will apply only where a noise sensitive location exists which will be impacted by the blasting.

Carry out monitoring of airblast from blasting operations to verify that the limits specified in Annexure R44/A7 are not exceeded at any noise sensitive location. The equipment for this monitoring must be sited at the perimeter of the noise sensitive location at the point closest to the maximum charge.

The monitoring equipment used must be calibrated annually by a NATA accredited testing facility or manufacturer's facility approved by the Principal.

Report all monitoring readings on test certificates, indicating clearly whether they are in conformity to the requirements of this Specification. Provide a copy of the test certificate to the Principal.

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

4.6.6 Control of Ground Vibration

Clause 4.6.6 will apply only where a vibration sensitive location exists which will be impacted by the blasting.

Carry out monitoring of ground vibrations from blasting operations to verify that the limits specified in Annexure R44/A7 are not exceeded at any vibration sensitive location. The equipment for this monitoring must 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 specified criteria must be in accordance with AS 2187.2.

The monitoring equipment used must be calibrated annually by a NATA accredited testing facility or manufacturer's facility approved by the Principal.

Report all monitoring readings on test certificates, indicating clearly whether they are in conformity to the requirements of this Specification. Provide a copy of the test certificate 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:

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

or

$$MIC = 0.5 D^2 \left[\frac{p.p.v.}{1140} \right]^{1.25}$$

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, you may adjust the charge weight and other aspects of the blast design, provided that you undertake further ground vibration monitoring and re-determine the blasting site relationship 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 2.6, 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 zones where subsequent pile foundation works are to be undertaken.

to the alignment, levels, dimensions and slopes shown on the Drawings, and within the tolerances specified in Clause 7.

5.1.2 Materials Management

Program and manage the Works as detailed in the EARTHWORKS PLAN (refer to Clauses 1.5 and 2.2) such that material of the quality specified in Clause 2.8 for the Upper Zone of Formation, verge and spill through bridge abutment zone 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

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

Before and after placing any imported fill material, carry out a survey (if so required) of the surfaces in accordance with Clause 1.6.1 to determine the compacted volume of imported fill material placed in the Works.

Place fill material for embankment construction in layers parallel to the grade line. When placing additional material against existing embankment batters, conform to the hillside terracing requirements specified in Clause 3.4.

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

When placing embankment layers, use suitable equipment and methods to avoid surface heaving or other damage to the foundations and underlying embankment layers.

Maintain effective drainage for the embankment during its construction.

5.1.4 Batter Slopes Re-determination

The batter slopes shown on the Drawings may be re-determined by the Principal, depending on the earthworks materials available for use.

5.2 EARTH FILL EMBANKMENTS

5.2.1 Earth Fill Material

Earth fill is material other than that conforming to rock fill requirements (refer also to the definition for earth fill in Clause 1.3).

Earth fill material must have a grading of greater than 60% passing the 37.5 mm AS sieve, and a maximum particle dimension of rock no greater than two thirds the compacted layer thickness.

If the material does not meet these requirements, before using, break down further the material and/or blend it with material of finer grading. You may obtain additional finer material from other places within the Site or by a change in the method of winning and processing the material.

5.2.2 Placing Earth Fill

Unless otherwise approved, place earth fill in layers of not less than 100 mm and not more than 300 mm in thickness when compacted. Where more than 25% by volume of the earth fill consists of rock with any dimension larger than 150 mm, the Principal may authorise an increase in the compacted layer thickness to 500 mm.

Distribute any rock material evenly throughout the layer to prevent the formation of voids and to produce a dense, compact embankment. Trim each layer of material placed prior to and during compaction.

Compact all layers of material placed in the Works uniformly over the full area, and full depth of the layer to achieve the relative compaction specified in Clause 7.2 before placing the next layer. Complete the compaction promptly to ensure that the moisture content remains conforming and uniform, and to minimise the possibility of rain damage.

Include in the EARTHWORKS PLAN details of the procedure to verify that the specified compaction has been achieved over the full depth of each layer, and that the specified layer thickness has not been exceeded (refer to item (k) in Clause 1.5.1).

5.2.3 Spill Through Bridge Abutment Zones

At spill through bridge abutments, place Type ST 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.)

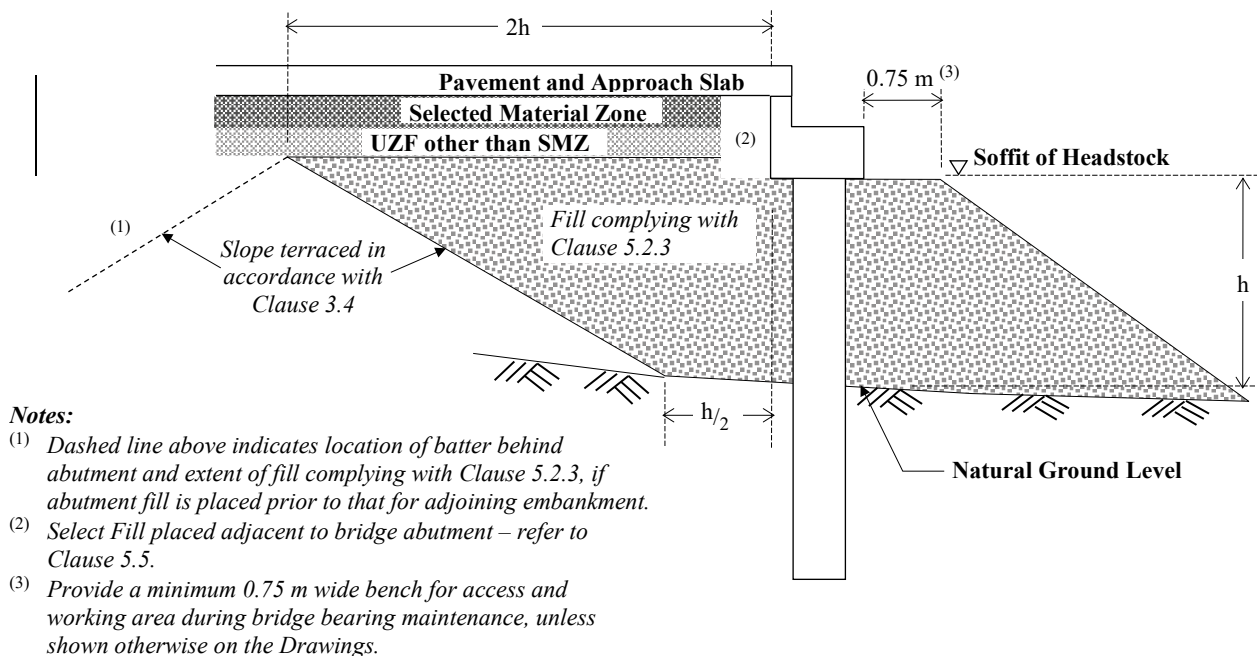


Figure R44.7 – Dimensions of Fill at Spill Through Bridge Abutment Zones

Place the fill material in layers not exceeding 300 mm in thickness when compacted, and compact to the relevant requirement specified in Table R44.7 under Clause 7.2.

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 (refer also to the definition for rockfill in Clause 1.3).

Material for rock fill must conform to the properties specified in Table R44.4. The constituent particles must be of uniform strength and soundness.

Table R44.4 – Rock Fill Material Properties

Property	Requirement
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 $I_{s(50)} < \text{Annexure R44/A2.2 specified value}$	10% (max)
Wet/Dry Strength Variation	Annexure R44/A2.2

To produce site won rock fill material meeting the grading and rock strength specified, you may need to adjust your working methods, including screening and (where necessary) secondary processing, during excavation of cuttings.

Where the site won material does not meet the requirements for rock fill, break down the material further into finer particles, or have additional fines incorporated, for use as earth fill in accordance with Clause 5.2.1.

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 placed.

Shape and treat the foundations under rock fill 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 conforming to TfNSW R63 over the foundation area prior to placing the rock fill.

Place the rock fill material in layers not exceeding 550 mm in thickness when compacted, and place and spread the material in such manner as to avoid segregation and contamination with foreign material.

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 in accordance with Clause 7.4.2.

5.3.3 Surplus Rock Fill Material

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

- (a) processing the material for use as earth fill; or
- (b) removing the earth fill, and replacing it with the surplus rock as rock fill, at your own cost.

5.3.4 Rock Capping Layers

Place a rock capping layer, composed of graded rock fill conforming to the properties specified in Table R44.5, with a completed thickness as specified in Annexure R44/A4, immediately above the completed rock fill embankment.

Table R44.5 – Rock Capping Layer Material Properties

Property	Requirement
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 $I_{s(50)} < \text{Annexure R44/A2.2 specified value}$	10% (max)
Wet/Dry Strength Variation	Annexure R44/A2.2

Place and spread the capping layer material in such manner as to avoid segregation and contamination with foreign material. Compact the capping layer using the nominated compaction procedure, developed in accordance with Clause 7.4.2.

Place a geotextile conforming to TfNSW R63 as separation between the 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 ROCK FACING TO EMBANKMENTS**5.4.1 General**

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

Program and manage the Works 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 the requirements in Clause 5.4.2 as rock facing on embankment batters which are not shown on the Drawings to have rock facing.

Place the rock facing outside of the general embankment dimensions.

5.4.2 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 specified in Annexure R44/A2.2.

5.4.3 Placing Rock Facing

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

Provide a geotextile conforming to 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.

5.4.4 Payment

Payment for the rock facing will be made under Pay Item R44P2. Payment for the geotextile will be made under Pay Item R44P7.5(a).

5.5 SELECT FILL ADJACENT TO STRUCTURES

5.5.1 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 5.5.2 to 5.5.4.

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

5.5.2 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.

5.5.3 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 TfNSW R11.

5.5.4 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

Construct the Upper Zone of Formation, including the Selected Material Zone (see Figures R44.1(a), R44.1(b), R44.6(a) and R44.6(b)), to the thickness specified in Annexure R44/A4, using materials conforming to the requirements specified in Clause 2.8.

Unless otherwise specified, 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 and imported material for 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 for placing.
Release of Hold Point:	The Principal will consider the submitted details and may inspect the source and stockpiles of material prior to authorising the release of the Hold Point.

Before placing any imported Upper Zone Material (including Selected Material), carry out a survey (if so required) of the existing surface in accordance with Clause 1.6.1 to be able to later determine the compacted volume of imported Selected Material placed in the Works.

When placing the material, conform to the moisture content and compaction requirements in Clause 7.

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

6.1.2 Selected Material Zone

Construct a Selected Material Zone (see Figures R44.1(a), R44.1(b), R44.6(a) and R44.6(b)) to the thickness specified in Annexure R44/A4, using materials conforming to the requirements specified in Clause 2.8.5.

Where so 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 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.

Place and compact materials for the Selected Material Zone in layers of compacted thickness not exceeding 150 mm, unless specified otherwise in Annexure R44/A4.

The placed Selected Material Zone must be homogeneous and free from patches containing segregated stone or excess fines. If the placement method used is considered to result in excessive breakdown of the material, the Principal can request additional testing to verify conformity with the requirements of Clause 2.8.5 and Annexure R44/A2.2 following placement of each Lot.

Trim the Selected Material Zone to meet the level tolerances specified in Clause 7.7.1. As part of the trimming operation, prepare the surface in accordance with 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

Construct verges as shown on the Drawings, using material conforming to the requirements specified in Clause 2.8.

Unless otherwise specified, 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 and imported material for the verges.
Submission Details:	Proposed source locations, 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 or allocated for placing.
Release of Hold Point:	The Principal will consider the submitted details and may inspect the source and stockpiles of material prior to authorising the release of the Hold Point.

Before placing any verge material (and not just imported verge material), carry out a survey of the existing surface in accordance with Clause 1.6.1 to be able to later determine the compacted volume of verge material placed in the Works.

When placing the material, conform to the moisture content and compaction requirements specified in Clause 7.

Place and compact the verge in layers of compacted thickness as specified in Annexure R44/A4. You may compact adjacent to a concrete pavement not earlier than 10 days after concrete placement, or immediately after completion of joint sealing, whichever is the later.

The placed verges must be homogeneous and free from patches containing segregated stone or excess fines.

Trim the verge to meet the level tolerances specified in Clause 7.7.1.

6.3 OTHER TREATMENTS

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

7 CONFORMITY REQUIREMENTS

7.1 EARTH FILL MOISTURE CONTENT

7.1.1 General

Maintain the moisture content of earth fill, at the time of compaction, to within the range specified in Annexure R44/A5 at all locations within the Lot. Adjust the moisture content as required to enable the specified compaction to be achieved.

Include a procedure for monitoring and adjusting of moisture content in the EARTHWORKS PLAN (refer to item (k) in Clause 1.5.1).

7.1.2 Field Moisture Content Determination

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.

7.1.3 Nonconformity – Actions Required

7.1.3.1 Excessive Moisture

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 to the extent that the moisture content is within the specified range. To assist with drying, you may use aeration or, where approved by the Principal, hydrated lime or quicklime complying with Specification TfNSW 3211, at your own 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 to be included in the rates generally.

7.1.3.2 Insufficient Moisture

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

7.2 COMPACTION

7.2.1 Lot Definition

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

Exclude from the Lot areas which fail to meet these conditions, and test such areas separately as one or more additional Lots.

Include in the PROJECT QUALITY PLAN procedures for identification and inspection of Lots for homogeneity in accordance with TfNSW Q.

7.2.2 Sampling and Testing

Select the sample locations in accordance with TfNSW Q. Provide a smooth surface at each sampling location for the purpose of obtaining samples.

At each sample location selected for determination of relative compaction, carry out a field density test and obtain a sample for laboratory testing to determine 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 test methods used must conform to that specified in Table R44.6.

Table R44.6 – Applicable Test Methods for Determining Field Density and Relative Compaction

Fill Material Properties	Test Method / Actions
≤ 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) ⁽¹⁾
> 40% by mass retained on 37.5 mm AS sieve	Report only % by mass of oversize material ⁽²⁾
Fine to medium grained cohesionless materials, including single size material or gap graded material	T165 (fixed volume extractive method)

Notes:

- (1) If % by mass retained on 37.5 mm AS sieve is between 20% and 40%, do not use the nuclear gauge method.
- (2) 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. This material does not conform to the requirements for earth fill in Clause 5.2.1.

Unless otherwise specified, do not use TfNSW T173 (nuclear gauge) for insitu density tests if the layer thickness exceeds 300 mm.

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

Determine field moisture content in accordance with Clause 7.1.2.

7.2.3 Relative Compaction and Characteristic Value

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 TfNSW T166.

Determine by calculation the minimum (lower limit) characteristic value of relative compaction in accordance with TfNSW Q. Round off the individual relative compaction value, and the characteristic relative compaction value, to the nearest 0.1%.

7.2.4 Conformity

Conformity of a Lot is achieved if the calculated minimum characteristic value of relative compaction of that Lot is not less than the corresponding specified value in Table R44.7.

Table R44.7 – Minimum Characteristic Values of Relative Compaction

Lot Location	Minimum Characteristic Value of Relative Compaction
(a) Earth mounds. Spoil stockpiles.	90.0%
(b) (i) Each layer of material replacing unsuitable material under embankments. (ii) Foundation treatments under embankments (except Type E2 and Type E5).	95.0%
(c) Each layer of material replacing unsuitable material in cuttings. Foundation treatments in cuttings.	98.0%
(d) (i) Each layer of material placed in formation up to underside of Selected Material Zone, including that in Shallow Embankments and Cut/Fill Transition Zone. (ii) Each layer of material in verges, or within medians up to level at which topsoil is placed.	98.0%
(e) Each layer of material placed in spill through bridge abutment zone.	100.0%
(f) Each layer of material placed in Selected Material Zone.	102.0%
(g) Other areas not specifically mentioned herein.	98.0%

Where conformity of Lot is not achieved, either re-work the Lot, or re-check the Lot for homogeneity and/or re-determine the Lot boundaries, and subsequently re-nominate the Lot (or parts thereof) for further compaction testing.

7.3 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 ROCK FILL PLACING

7.4.1 General

Conformity of rock fill placing is based on compliance with your nominated compaction procedure, developed and verified in accordance with Clause 7.4.2 and proof rolling in accordance with Clause 7.5.

All costs associated with the development and verification of the compaction procedure, and the utilisation of the nominated compaction procedure on rock fill layers, is to be included in the rate for general earthworks, for payment under Pay Item R44P2.

7.4.2 Compaction Procedure

Through construction and testing of some trial sections, develop a compaction procedure using parameters such as material characteristics including grading, blending and moisture conditioning, layer thickness and rolling procedure.

The compaction procedure must include the use of at least one vibrating roller. If the procedure includes insitu modification (e.g. with a grid roller or similar), then determine the grading of the material after rolling and compaction.

The length of a trial section must not exceed 50 m, and the width must be greater than or equal to two times the maximum roller drum width. Do not select areas as trial sections that are within 1.5 m of the underside of the Selected Material Zone.

Verify the compaction procedure by using results from two separate trial sections which are not contiguous or constructed concurrently.

WITNESS POINT

Process to be Witnessed: Construction of each trial section of rock fill.

Submission Details:	<p>Notification of the location, date and time of the trial section construction, with details of your compaction procedure, including:</p> <ul style="list-style-type: none"> (a) material(s) to be used and their specification(s), including any moisture conditioning prior to and during rolling; (b) plant type(s) and their specification(s); (c) number of roller passes; (d) maximum and minimum roller speed and frequency of vibration; <p>at least three working days prior.</p> <p>If the trial section is for verification of the procedure carried out on previous trial section(s), submit also:</p> <ul style="list-style-type: none"> (i) test results of all previous trial section(s); (ii) in-process testing regime and proof of embankment stability, with no remaining internal settlement of the previous trial section(s).
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Submit your nominated compaction procedure after verification to the Principal.

HOLD POINT

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

7.4.3 Nonconformity – Actions Required

Where in-process testing of the placed rock fill using the nominated compaction procedure reveals nonconforming results, cease all placing and compaction, and re-develop 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 re-developed procedure prior to recommencement of placement and compaction operations.

7.5 DEFLECTION – PROOF ROLLING**7.5.1 General**

All Lots within the Selected Material Zone (whether in cuttings, embankments, shallow embankments or cut/fill transitions) and all Lots in an embankment must be capable of withstanding proof rolling to verify their stability.

Carry out proof rolling in accordance with Test Method TfNSW T198.

Unless otherwise specified, proof roll each layer within three days of compaction testing and moisture conformity testing.

The moisture content of the compacted material being proof rolled must be within the range specified in Annexure R44/A5.

7.5.2 Proof Rolling Areas

Carry out proof rolling on all Lots within the Selected Material Zone and within 1.5 m below the underside of the Selected Material Zone.

Where directed by the Principal, carry out proof rolling on all embankment Lots which are deeper than 1.5 m from the underside of the Selected Material Zone.

The proof rolling pattern must cover the full width and length of each Lot.

WITNESS POINT

Process to be Witnessed: Proof rolling of surface of any Lot.

Submission Details: Notification of the location, date and time of the proof rolling, and providing verification that the subject layer or surface conforms in all respects except for proof rolling, at least one working day prior.

7.5.3 Conformity

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

7.6 DEFLECTION – BENKELMAN BEAM TESTING**7.6.1 General**

Carry out deflection testing using the Benkelman Beam in accordance with TfNSW T199.

When carrying out deflection testing by Benkelman Beam, conform to the grid sampling pattern specified in TfNSW T199, and maximising the number of sampling points that can be accommodated within the Lot. Where a minimum of 12 points cannot be obtained using this grid sampling pattern, use a random pattern of at least 12 points over the Lot.

Unless otherwise specified, carry out deflection testing by Benkelman Beam within three days of testing the Lot for compaction and moisture conformity. Except for reasons due to wet weather conditions, any results of deflection testing which have been carried out later than three days after compaction conformity testing will not be accepted.

7.6.2 Testing Areas

Carry out deflection testing by Benkelman Beam on the following areas, where so specified in Annexure R44/A4:

- (a) underside of the Selected Material Zone, except where a drainage layer lies immediately below the Selected Material Zone, e.g. in Treatment Type C5;
- (b) top of the Selected Material Zone.

Where a Selected Material Zone is not part of the Works, carry out deflection testing of the formation at the level of the underside of pavement.

7.6.3 Lot Definition

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 lane 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.

WITNESS POINT

Process to be Witnessed: Benkelman Beam testing of surface.

Submission Details: Notification of the location, date and time of the Benkelman Beam testing, and providing results of any previous proof rolling, at least one working day prior.

7.6.4 Characteristic Deflection Determination

Determine the maximum deflection for each sampling point within the Lot, and their standard deviation and coefficient of variation for each Lot, in accordance with TfNSW T199. Calculate the maximum (upper limit) characteristic deflection (CD) for each Lot in accordance with T199.

7.6.5 Conformity

The Lot is conforming if the maximum (upper limit) characteristic deflection (CD) does not exceed the value specified in Annexure R44/A4, and either the standard deviation does not exceed 0.2 mm or the coefficient of variation does not exceed 25%.

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: Deflection test results, Survey Report of the finished surface and verification of conformity of each Lot tested, at least three working days prior.

Release of Hold Point: The Principal will consider the submitted documents, and may direct further action prior to authorising the release of the Hold Point.

Where conformity of Lot is not achieved, either re-work the Lot, or re-check the Lot for homogeneity and/or re-determine the Lot boundaries, and subsequently re-nominate the Lot (or parts thereof) for further deflection testing.

7.7 FINISHED SURFACE LEVELS**7.7.1 Tolerances**

The finished surface levels of the various surfaces must conform to the tolerances specified in Table R44.8.

Table R44.8 – Level Tolerances

Location	Tolerance
(a) 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
(b) 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
(c) Foundation Level at Shallow Embankment and Cut/Fill Transition Zone	+50 mm / –150 mm
(d) Floor of benches in cutting	+50 mm / –50 mm
(e) 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
(f) Top of lower layer of Selected Material Zone	+10 mm / –40 mm
(g) Top of upper 150 mm layer of Selected Material Zone, or top of formation where there is no Selected Material Zone	+0 mm / –20 mm
(h) Surface of verges	+0 mm / –20 mm

Note: Refer to Clause 1.3 and Figures R44.1(a) and R44.1(b) for definitions of “Designed Floor Level” and “Foundation Level”.

7.7.2 Acceptance of Areas Below Level Tolerances (Where Overlying Pavement is Not Part of Contract)

Where the overlying pavement 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 specified in Table R44.8 (+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:

- Deductions applied at the rate shown in Annexure R44/A4 for the volume that is outside the lower limit of tolerance (–20 mm);
- 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.

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

7.8 DIMENSIONS**7.8.1 Cutting Batters**

Batters in cuttings will generally require progressive flattening towards the bottom end of the cutting owing to the presence of less stable material.

Completed batters in cuttings must conform to that shown on the Drawings, unless otherwise authorised or re-determined by the Principal, and within the tolerances specified in Table R44.9.

Table R44.9 – Dimension Tolerances for Cutting Batters

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.

Round off the top edges of cutting batters to the dimensions shown on the Drawings unless otherwise directed.

7.8.2 Embankment Batters

Completed batters of embankments must conform to that shown on the Drawings, unless otherwise authorised or re-determined by the Principal, and within the tolerances shown in Table R44.10.

Table R44.10 – Dimension 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:

- (1) 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.

7.9 BATTER SURFACES

7.9.1 Cutting Batters

Batter surfaces must not have undulations in the general plane of the batter outside of the tolerance specified in Clause 7.9.3, and must be free of rills running down the face of the batter, except those resulting from pre-splitting or line drilling boreholes (refer to Clause 4.5).

Treat the face of the batter where such treatment is shown on the Drawings.

7.9.2 Embankment Batters

Batter surfaces must not have undulations in the general plane of the batter outside of the tolerance specified in Clause 7.9.3, and must be free of rills running down the face of the batter.

7.9.3 Undulation Tolerances

Undulations in the general plane of the batter must conform to the following tolerances:

- (a) 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;
- (b) 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.

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

Refer to Clause 1.6.

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

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

Delete whichever of the “Yes / No” options shown below that is not applicable.

Review the default values shown below for “Joint Survey”, and amend if appropriate. Prior to completing the table, consult TfNSW Survey Section whether TfNSW survey resources are available for undertaking the joint surveys shown in the table below.

Clause	Area To Be Surveyed	Requirements	
		Joint Survey	Model File ⁽¹⁾
2.5.1	Surface of existing ground before commencing construction of bridging layer where topsoil is not required to be removed	Yes	Yes / No
2.5.2	Surface at each topsoil stockpile location before commencing stockpiling	Yes	Yes / No
2.5.3	Surface after stripping of topsoil	Yes	Yes / No
2.6.4	Surface before and after removal of unsuitable material	Yes	Yes / No
3.2, 7.7.1	Floor of cutting before placing material for foundation treatment or formation	No	Yes / No
5.1.3, 6.1.1	Surface before and 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
7.8, 7.9	Completed batter in cutting and embankment prior to topsoiling, vegetation or other treatments	No	Yes / No

Note:

- ⁽¹⁾ 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)

Complete the table below by filling in the required details, and deleting whichever of the “Yes / No” options shown below that is not applicable.

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

Clause	Description	Requirement
2.3.2	Borrow areas:	
	- Nominated borrow area locations	
	- Maximum slope of cutting batter at borrow area	
2.5.1	Topsoil:	
2.5.1 (a)	- stockpile within the Site	Yes / No
2.5.1 (b)	- stockpile as a windrow	Yes / No
2.5.1 (c)	- dispose of as spoil outside the Site	Yes / No
2.5.1 (d)	- dispose of as contaminated material	Yes / No
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	
2.8.7	- Spill through bridge abutment zone	
3.2.3 (b), 3.3.3 (b)	- Working platform for Foundation Treatment Types C3(II) or E3(II)	
5.2, 5.3	- General fill	
6.1.2	Material in both layers of the Selected Material Zone at any location must be from the same source	Yes / No ⁽¹⁾

Note:

- ⁽¹⁾ 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 (1, 2)
2.8.4, 3.5	Upper Zone Material other than Selected Material, including at Shallow Embankment and Cut/Fill Transition Zone:			
	a) CBR _{10 day} ⁽³⁾	8 min	T117	T102/T103
	b) Plasticity Index	25 max	T109	T102/T103
2.8.5.1	Site won Selected Material:			
	a) Selected Material Zone, upper 150 mm thick layer CBR _{4 day} ⁽³⁾ , characteristic value (Q) ⁽⁴⁾	33 min ⁽⁵⁾	T117	T102/T103
	b) Selected Material Zone, lower layer CBR _{4 day} ⁽³⁾ , characteristic value (Q) ⁽⁴⁾	19 min	T117	T102/T103
	c) Plasticity Index	15 max	T109	T102/T103
2.8.6	Verge material:			
	a) CBR _{4 day} ⁽³⁾ , characteristic value (Q) ⁽⁴⁾	19 min	T117	T102/T103
	b) Plasticity Index	6 min, 12 max	T109	T102/T103
2.8.7	Spill through bridge abutment fill (Type ST) material:			
	a) CBR _{10 day} ⁽³⁾	8 min	T117	T102/T103
	b) Plasticity Index	6 min, 25 max	T109	T102/T103
3.2	Material in floor of cutting:			
	a) CBR _{10 day} ⁽³⁾	8 min	T117	T102/T103
	b) Plasticity Index	25 max	T109	T102/T103
3.2.2	Backfill material for Foundation Treatment Type C2:			
	a) CBR _{10 day} ⁽³⁾	8 min	T117	T102/T103
	b) Plasticity Index	25 max	T109	T102/T103
3.2.5, 3.3.5	Material for drainage layer (Foundation Treatment Type C5 and E5):			
	a) Point Load Strength Index I _{s(50)}	3 MPa min	T223	NA
	b) Wet/Dry Strength Variation	35% max	T215	NA
3.5	Material in foundation of Shallow Embankment and Cut/Fill Transition Zone, where depth of excavation is less than specified:			
	a) CBR _{10 day} ⁽³⁾	8 min	T117	T102/T103
	b) Plasticity Index	25 max	T109	T102/T103
5.3.1, 5.3.4	Rock fill / rock capping material:			
	a) Point Load Strength Index I _{s(50)}	2 MPa min	T223	NA
	b) Wet/Dry Strength Variation	35% max	T215	NA
5.4.2	Rock facing material:			
	a) Point Load Strength Index I _{s(50)}	2 MPa min	T223	NA
	b) Wet/Dry Strength Variation	35% max	T215	NA

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

Notes:

- (1) Refer to Clause 2.8.3. Where shown in table above under column titled "Pre-treatment" as "T102/T103", determine the appropriate pre-treatment regime (whether T102 or T103) for samples of the material, in accordance with Clause 2.8.3. Where samples are taken from the compacted formation, pre-treatment in accordance with TfNSW T102 is not required.
- (2) Where samples are taken from stockpiles or source, carry out pre-treatment in accordance with TfNSW T102 or TfNSW T103, and testing to verify that the material is conforming before placing the material.
- (3) Compaction for CBR test must be at 100% of MDD under standard compaction.

(4) When calculating CBR characteristic value, report values calculated to the nearest 1%.

(5) Refer to Clause 2.8.5.1.

If the site won 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 Contractor may modify the Selected Material by mixing it with hydrated lime, or other binders approved by the Principal, to make it conforming to the specified requirements of the upper layer.

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, but must otherwise conform to the specified requirements of the upper layer.

If using hydrated lime as the binder, a suggested application rate is 1 to 2% by mass, but the Contractor must by laboratory trials determine the appropriate application rate to be used. Do not use binders which are prone to give rise to rapid or uneven strength gain or excessive shrinkage.

A3 FOUNDATION TREATMENT

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

Complete the table below by filling in the required details, and deleting whichever of the “Yes / No / NA” options shown below that is not applicable.

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

Clause	Description	Requirement
3.2.3, 3.3.3	Foundation Treatment Types C3 and E3 - Working Platform	
3.2.3	- To be Type C3(II)	Yes / No / NA
3.3.3	- To be Type E3(II)	Yes / No / NA
3.3.2	Foundation Treatment Type E2 - Bridging Layer	
	- Minimum distance from top of bridging layer to underside of Selected Material Zone	900 mm
	- Completed thickness of bridging layer	800 mm (±100 mm)
3.3.5	Foundation Treatment Type E5 - Drainage Layer	
	- 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)
3.3.6	Foundation Treatment Type E6 - Earth Fill Foundation Treatment	
	- 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 (±100 mm)
3.2, 3.3	Specified Foundation Treatment	
	—	Type:
	—	Type:

Note: NA = Not applicable

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)

Complete the table below by filling in the required details, and deleting whichever of the “Yes / No” options shown below that is not applicable.

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

Clause	Description	Requirement
3.5.1	Shallow Embankment height	1,200 mm
5.3.4	Completed thickness of rock capping layer	300 mm (+100 mm, -0 mm)
6.1.1, 3.5	Thickness of Upper Zone of Formation (incorporating Selected Material Zone) within:	
	– Cutting	300 mm
	– Embankment	600 mm
	– Shallow Embankment	1,200 mm
	– Cut/Fill Transition Zone	1,200 mm
6.1.2	Thickness of Selected Material Zone	300 mm
6.1.2	Maximum compacted thickness of each layer in Selected Material Zone	150 mm
6.2	Compacted thickness of each layer in verge	100 mm to 200 mm
7.6.2	Deflection testing with Benkelman Beam required at:	
	– Underside of Selected Material Zone ⁽¹⁾	Yes / No
	– Top of Selected Material Zone	Yes / No
7.6.5	Maximum (upper limit) characteristic deflection (CD) for any Lot at:	
	– Underside of Selected Material Zone	1.2 mm
	– Top of Selected Material Zone	1.0 mm
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 ³

Note:

⁽¹⁾ Except where a drainage layer lies immediately below the Selected Material Zone, e.g. in Foundation Treatment Type C5.

A5 MOISTURE CONTENT

NOTES TO TENDER DOCUMENTER: (Delete this boxed text after customising Annexure A5)

Complete the table below by filling in the required details.

Review the default value of 60% – 90% moisture range shown below.

This default value of moisture range will generally provide a satisfactory result required for attaining the specified compaction, but may be adjusted to reflect the material types and likely environmental moisture conditions.

For clay soils in wet conditions, it may be preferable to raise the 90% limit and/or specify placement in the core of fill embankments. For granular non-cohesive soils, it may be preferable to lower both percentages.

Refer to Clause 7.1.

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

Notes:

⁽¹⁾ Material types above are project specific.

⁽²⁾ “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 to Clauses 3.2, 3.3, 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. Types C1 to C5, and E1 to E6) in the middle column.

For cut/fill transition treatment or structural treatment in medians, delete whichever of “Yes / No” options that is not applicable.

Location		Treatment Types Required in Medians		
From Chainage	To Chainage	Foundation Treatment Type	Cut/Fill Transition	UZF (incorp SMZ)
			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 to Clause 4.6.

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

Point of Potential Damage (within 1 km from the proposed blast site)	Noise (Airblast Overpressure)	Ground Vibration (Peak Particle Velocity ⁽¹⁾)
Bridge and other structures, constructed and older than 14 days	Not applicable	10 mm/s
Bridge and other structures, under construction	Not applicable	10 mm/s
Residential premises, schools, hospitals and other buildings ⁽²⁾	115 dB(L)	5 mm/s
Building or monument of historical significance	115 dB(L)	2 mm/s

Notes:

- ⁽¹⁾ 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.

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

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 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 2.5. The volume is determined by survey or manual measurement and hand 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 TfNSW R178.

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

This pay item applies only to 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 2.5.1 items (c) and (d). The volume is determined by survey or manual measurement and hand calculation.

The rate is an average rate to cover the cost of classification in accordance with EPA Waste Classification Guidelines, removal, loading, handling, transporting and disposal 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 2.7.2, 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.

The total excavation volume is determined as follows:

- (a) The top of the excavation is taken as the stripped surface, from the survey carried out in accordance with Clause 2.5.3;
- (b) The sides of the excavation are taken as either the design cutting batters shown on the Drawings, or as determined by the Principal;
- (c) The base of the excavation is taken as either:
 - (i) the Designed Floor Level for Foundation Treatment Types C1, C3(I) or C4;

or

- (ii) 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.

When measuring the total excavation volume for payment, do not include the volumes arising from:

- (a) removal of unsuitable material which is paid under Pay Item R44P4;
- (b) level or batter tolerances;
- (c) material removed in hillside terracing (refer to Clause 3.4);
- (d) excavations for drainage works (other than that for table drains and gutters) and utility adjustment works, which is paid under TfNSW R11 and TfNSW G7 respectively.

The rate is an average rate to cover excavation in all types of material, processing of the excavated material for use as fill material, placing and compaction of the fill material in embankments, or disposal of surplus excavated material in other than embankments within the Site.

It includes all costs associated with the following:

- (a) excavation to form benches, table drains and gutters;
- (b) excavation in hillside terracing;
- (c) rounding of the tops of batters;
- (d) restoring, stabilising or re-forming any over-excavation;
- (e) haulage and double handling of material arising from your construction sequence and staging;
- (f) placing and compaction of conforming material to replace unsuitable material and contaminated material that has been removed;
- (g) placing and compaction of materials of specified quality in Shallow Embankments, Cut/Fill Transition Zones, spill through bridge abutment zones and Upper Zone of Formation other than Selected Material Zone;
- (h) working fill material to bring its moisture content to within the specified range, including drying out material containing excess moisture;
- (i) trimming to level tolerances;
- (j) development and verification of compaction procedure for rock fill;
- (k) placing and compaction of rock capping layers, including that placed over bridging layers;
- (l) placing of rock facing in embankment batters;
- (m) deflection testing by proof rolling (which is not a scheduled test under Primary Testing);
- (n) placing and compaction of material of specified quality in reinforced soil block (but see item (viii) below);
- (o) measures to address any deficiency at the Site for stockpile areas, including having to dispose of unsuitable materials outside the Site and supplying replacement material later;

except that:

- (i) additional cost for loosening (and recompacting) the floor of cuttings in Foundation Treatment Types C1 and E1 (refer to Clauses 3.2.1 and 3.3.1 respectively) is paid under Pay Items R44P7.1 and R44P7.2 respectively;

- (ii) additional cost for supply and placing of site won and imported material for Foundation Treatment Types C2, E2, C5, E5, and E6 is paid under Pay Items R44P7.3, R44P7.4, R44P7.6, R44P7.7 and R44P7.8 respectively;
- (iii) additional cost for Foundation Treatment Types C3 and E3, involving stabilisation of insitu material and imported stabilised material, is paid under the relevant pay items in TfNSW R50, and Pay Item R44P3;
- (iv) cost for supply and placing of imported or borrowed general fill material and Upper Zone materials (other than Selected Material and verge material) is paid under Pay Item R44P3;
- (v) additional cost for placing site won Selected Material and verge material is paid under Pay Items R44P5.1 and R44P5.3 respectively, while the cost for supply and placing of imported Selected Material and verge material is paid under Pay Item R44P5.2 and R44P5.4 respectively;
- (vi) additional cost of disposal outside the Site of non-contaminated spoil is paid under Pay Item R44P6;
- (vii) additional cost for identification, treatment and disposal of contaminated material is paid under Pay Item R44P8;
- (viii) additional cost for placing of material in reinforced soil block is paid as an “extra over” under TfNSW R58/R59;
- (ix) cost for placing of site won Select Fill adjacent to structures is paid under the relevant pay items in TfNSW B30, R11 and R58/R59 as applicable;
- (x) payment for incorporation into embankments of surplus material from other works under the Contract, is made under the relevant pay items in the associated 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.

The volume for payment includes imported or borrowed material for Foundation Treatment Types C3(II) and E3(II). Stabilisation of the imported or borrowed material is paid under the relevant pay item in TfNSW R50.

The volume for payment excludes imported or borrowed material for the following:

- (a) Foundation Treatment Types C2, E2, C5 and E5 which are paid under Pay Items R44P7.3(b), R44P7.4(b), R44P7.6(b) and R44P7.7(b) respectively;
- (b) Selected Material and verge material, which are paid under Pay Items R44P5.2 and R44P5.4 respectively;
- (c) Select Fill adjacent to structures, which is paid under the relevant pay items in TfNSW B30, R11 and R58/R59 as applicable.

Payment will not be made for imported material used in embankment widening which have not been authorised by the Principal, or wasted by you.

The rate covers all costs associated with supply, haulage, placing, compaction, and trimming 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 also includes all costs associated with the opening up of the borrow area, excavation of material from the borrow area, maintenance of the borrow area, and restoration of the borrow area.

Pay Item R44P4 - Unsuitable Material

This Pay Item refers only to unsuitable material as defined in Clause 1.3 and described in Clause 2.6.

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

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 2.6 for the incorporation of unsuitable material in embankments or all activities required for disposal within the Site in accordance with Clause 2.7.1.

Placing and compaction of conforming material to replace the unsuitable material removed is paid under Pay Item R44P2 if using site won material, or under Pay Item R44P3 if imported or borrowed material is authorised for this purpose by the Principal.

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, classification, treatment and disposal 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 (for site won material) or purchasing (for imported material), 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 to Clause 2.8.5.1), payment for the work is made under the relevant pay item in 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 relevant costs as stated above (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 relevant costs as stated above (including the cost of any modification required to conform to TfNSW 3071).

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

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

Pay Item R44P7 – Foundation Treatments

Pay Item R44P7.1 – Treatment Type C1 – Loosen and Recompact

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

The quantity is determined by survey or manual measurement, and calculation. The quantity measured excludes 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 the surface after compaction.

Pay Item R44P7.2 – Treatment Type E1 – Loosen and Recompact

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

The quantity is determined by survey or manual measurement, and calculation. The quantity measured excludes 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 the surface after compaction.

Pay Item R44P7.3 – Treatment Type C2 – Excavation and Backfill

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

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

Pay Item R44P7.3(a) – Treatment Type C2 – Backfill – 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, 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 R44P7.3(b) – Treatment Type C2 – Backfill – Imported Material

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

Excavation to Foundation Level is paid under Pay Item R44P2.

Pay Item R44P7.4 – 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 quantity measured excludes 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, and allows for a capping layer where a rock fill bridging layer is overlain by earth fill.

Pay Item R44P7.4(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 R44P7.4(b) – Treatment Type E2 – Bridging Layer – Imported Material

The rate covers all costs associated with the identification, 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 R44P7.5 – Treatment Type C4 and Type E4 – Geotextile and Geogrid

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

The quantity of geotextile or geogrid is determined using the width and length measured in place. The quantity 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, rock capping and foundation treatments.

Pay Item R44P7.6 – Treatment Type C5 – Drainage Layer

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

The quantity is determined by calculation using the specified thickness and measured area. The quantity measured 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 C5 – Drainage 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, 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 C5 – Drainage Layer – Imported Material

The rate covers all costs associated with the identification, purchasing, processing (including breaking down), stockpiling (including double handling to suit your construction staging), haulage, 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 R44P7.7 – Treatment Type E5 – Drainage Layer

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

The quantity is determined by calculation using the specified thickness and measured area. The quantity measured 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 E5 – Drainage 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, 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 E5 – Drainage Layer – Imported Material

The rate covers all costs associated with the identification, purchasing, processing (including breaking down), stockpiling (including double handling to suit your construction staging), haulage, 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 R44P7.8 – 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 quantity measured 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 your construction staging), 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 Outside 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, together 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 locations 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 or R44P6 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 2.7.2 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 1.2.3.

C1 SCHEDULE OF HOLD POINTS

Clause	Description
G71	Notification of joint survey.
2.5.3, G71	Submission of Survey Report, and presentation of set out.
2.6.1	Presentation of area where unsuitable material has been removed, prior to backfilling.
3.2	Presentation of each Lot of floor of cutting, and submission of CBR and PI test results of material in floor of cutting, if required.
3.3	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.
4.2	Presentation of cleaned cutting batter and bench/floor surfaces for geotechnical inspection.
4.6.1, G36	Submission of Vibration and Airblast Management Sub-Plan and Building Condition Inspection Reports.
4.6.2	Submission of blasting details for each blast.
6.1.1	Submission of details of Upper Zone materials (including Selected Material) to be delivered. If imported, verification that all possible sources of material within the Site have been exhausted or allocated for placing.
6.1.2	Submission of verification of conformity of stockpiled Selected Material.
6.1.2	Submission of verification of conformity of each Lot of Selected Material Zone placed, with test and survey reports.
6.2	Submission of details of verge material to be delivered. If imported, verification that all possible sources of material within the Site have been exhausted or allocated for placing.
7.4.2	Submission of verification of conformity of trial sections of rock fill carried out, and details of nominated compaction procedure for remaining sections of rock fill.
7.6.5	Submission of deflection test results, Survey Report and verification of conformity of each Lot tested.

C2 SCHEDULE OF WITNESS POINTS

Clause	Description
7.4.2	Construction of each trial section of rock fill.
7.5.2	Proof rolling of surface of any Lot.
7.6.3	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.

Clause	Description of Identified Record
2.3.3	Records of Contractor arranged borrow areas, including their locations, relevant consents and planning and environmental approvals, and placement Lot records.
2.4.1	Approvals and consents of proposed stockpile areas, other than those areas nominated on the Drawings or specifications.
2.4.2	Pre-construction land condition assessment of stockpile areas.
2.7	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.
2.8.2	Details of source, location, quantities and type of imported Selected Material.
4.6.2	Details of blasting design and measures to limit noise and ensure that vibration from blasting does not adversely affect nearby structures.
4.6.3	Blasting records, including video recording.
7.5, 7.6	Deflection testing results of each Lot of formation.

ANNEXURE R44/D – PLANNING DOCUMENTS

Refer to Clause 1.2.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. Review the requirements of this Specification and other contract documents to determine any additional documentation requirements.

Clause	Description of Document
1.5, 2.3.1	Earthworks Plan
7.2.1	Procedures for identification and inspection of Lots for homogeneity
7.3	Method of reinstating test holes
7.4.2	Compaction procedure for rock fill

ANNEXURES R44/E 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

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
1. PROJECT PLANNING	1.4			
Submit EARTHWORKS PLAN	1.5			
2. EROSION AND SEDIMENTATION CONTROL	1.4, 1.8			
Install and maintain erosion and sedimentation control measures, including at borrow and stockpile areas	G36, G38, 2.3, 2.4	Inspection	Each section or area	Approved Env Sed Ctrl Plan
3. CLEARING AND GRUBBING	1.4			
Clear and grub	G40	Inspection	Each section	Complete
4. SETTING OUT OF EARTHWORKS	1.6.2			
Set out location and extent of all cuttings and embankments	1.6.2, 3.5.2	Survey	Each section	Pegs in place
Install and maintain batter profiles	1.6.2	Survey	Each section	Pegs in place
Remove pegs at completion of work		Inspection	Each section	Pegs removed
5. BORROW AREAS AND IMPORTED MATERIALS	2.3, 2.8, 6			
Principal nominated borrow areas:				
- Carry out site preparation	2.3.2	Inspection	Each area	2.3.2, G40
- Conform to batter location and slope	2.3.2	Inspection	Each area	2.3.2, Annex R44/A2.1
Contractor arranged borrow areas: Advise Principal at least 10 working days prior	2.3.3		Each area	Evidence of approvals and consents
Restore borrow areas	2.3.2	Inspection	Each area	R178
Deliver site won and imported materials Hold Point for Upper Zone and verge materials	2.8.2, 6.1.1, 6.2	Annex R44/A2.2	Each source	Release of Hold Point
Survey to determine quantity of imported materials placed in Works	1.6.1, 5.1.3, 6.1.1, 6.2	Survey	Each section	Survey report
6. STOCKPILE AREAS	2.4			
Stockpile areas not nominated by Principal: Obtain Principal's concurrence at least 10 working days prior	2.4		Each area	Evidence of approvals and consents
Carry out pre-construction land condition assessment	2.4.2, G36		Each area	G36
Restore stockpile areas	2.4.3, G36	Inspection	Each area	G36, R178
Carry out post-construction land condition assessment	G36		Each area	G36

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
7. TOPSOIL	2.5			
7.1 Removal of Topsoil	2.5.1			
Remove topsoil and survey stripped surfaces Hold Point	2.5.3, 1.6.1	Survey	Each section	Release of Hold Point
7.2 Stockpiling Topsoil				
Survey stockpile areas prior to stockpiling	2.5.2, 1.6.1	Survey	Each area	Report
Conform to contents being free from foreign material	2.5.2	Inspection	Each stockpile	2.5.2
Conform to stockpile height < 2.0 m and slope < 2H:1V	2.5.2	Measure	Each stockpile	2.5.2
Seeding stockpile with cover crop	2.5.2, R178	Inspection	R178	R178
8. SPOIL	2.7			
8.1 Non-contaminated Materials	2.7.1			
Obtain authorisation for disposal within Site	2.7.1		Each location within Site	Authorised
Obtain authorisation for disposal outside Site	2.7.1		Each location outside Site	Evidence of approvals, authorised
8.2 Contaminated Materials	2.7.2			
Submit method of and location for disposal	2.7.2	Submission	Each source or location	G36
<i>[Additional details to be inserted by Project Manager as appropriate]</i>				
9. PROTECTION OF EARTHWORKS	1.7			
Protect earthworks	1.7	Inspection	Daily	1.7
10. CUTTINGS	4			
10.1 Preparation of Cutting Area				
Remove topsoil and survey stripped surface - refer item 7.1 of this table				
10.2 Excavation	4.1			
Loosen and break down material to meet requirements for use as:	2.8.2, 2.9.1	Inspection		
- Earth fill	5.2.1			5.2.1
- Rock fill	5.3.1			Table R44.4
- Drainage layer	3.2.5, 3.3.5			Table R44.2
- Bridging layer	3.3.2			3.3.2
- Rock capping layer	5.3.4			Table R44.5
- Rock facing	5.4.2			5.4.2
- Spill through bridge abutment fill (Type ST) material	2.8.7, 5.2.3			2.8.7
- Upper Zone Material other than Selected Material	2.8.4, 6.1.1			2.8.4
- Selected Material	2.8.5, 6.1.2			2.8.5
- Verge material	2.8.6, 6.2			2.8.6
- Select Fill adjacent to structures	5.5, B30, R11, R58/R59			B30, R11, R58/R59
10.3 Cutting Batters	4.2			
Conform to batter dimension and surface tolerances	7.8.1, 7.9.1	Survey	Each batter	Table R44.9, 7.9.3

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
Treat top and bottom edges of cutting batters	7.8.1	Inspection	Each batter	
Clean down cutting batter and bench surfaces in rock Hold Point	4.2	Inspection	Each batter	Release of Hold Point
Stabilise batters	4.3	As directed	As directed	As directed
Treat batters	4.3	As directed	As directed	As directed
Conform to bench tolerances	4.4, 7.7.1	Survey	Each bench	Table R44.8
Provide effective bench drainage	4.4.2	Inspection	Each bench	4.4.2
10.4 Line Drilling or Pre-splitting	4.5			
Select drill hole diameter and spacing	4.5.2	Measure	Each batter	Table R44.3
10.5 Blasting	4.6			
Submit Noise and Vibration Management Sub-Plan and Building Condition Inspection Reports Hold Point	4.6.1, G36			Release of Hold Point
Obtain licences and other regulatory requirements	4.6.1			Evidence of licences
Liaise with community	G36	Monitor		
Pre-split batters with slopes steeper than 1H:1V Drill hole diameter and spacing	4.5.3	Measure	Each blast	Table R44.3
Before each blast: submit details of blasting design and measures to limit noise and vibration Hold Point	4.6.2		Each blast	Release of Hold Point
Keep blasting records	4.6.4		Each blast	Records
Control noise (airblast overpressure)	4.6.5	AS 2187.2	Each blast	Annex R44/A7
Control ground vibration	4.6.6	AS 2187.2	Each blast	Annex R44/A7
11. FOUNDATION TREATMENTS FOR CUTTINGS	3.2			
11.1 Preparation of Cutting Foundations	3.2			
Excavate to Designed Floor Level or Foundation Level	3.2,	Survey	Each section	Table R44.8
Test cutting floor for:				
- CBR	3.2	Annex R44/A2.2	1,000 m ²	Annex R44/A2.2
- Plasticity Index	3.2	Annex R44/A2.2	1,000 m ²	Annex R44/A2.2
Present cutting floor for inspection Hold Point	3.2		Each section	Release of Hold Point
11.2 Unsuitable Material	2.6			
Survey surface before removal of unsuitable material	2.6.4, 1.6.1	Survey	Each Lot	Report
Remove unsuitable material Hold Point	2.6	Inspection	Each Lot	Release of Hold Point
Survey surface after removal of unsuitable material	2.6.4, 1.6.1	Survey	Each Lot	Report
Replace with suitable material:	2.6.2	Inspection	Each Lot	Complete
- Moisture content	7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	7.2	T111, T119, T162, T166, T173	Q	Table R44.7
11.3 Treatment Type C1 - Loosen and Recompact	3.2.1			
Obtain authorisation	3.2.1		Each section	Authorised
Trim floor of cutting to within tolerance	3.2.1, 7.7.1	Survey	Each section	Table R44.8

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
Loosen material in floor to specified depth and extent and maximum particle dimension	3.2.1	Inspection	Each section	3.4.1
Compact loosen material:	3.2.1			
- Moisture content	7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	7.2	T111, T119, T162, T166, T173	Q	Table R44.7
Trim floor of cutting to within tolerance	3.2.1, 7.7.1	Survey	Each section	Table R44.8
11.4 Treatment Type C2 - Excavation and Backfill	3.2.2			
Obtain authorisation	3.2.2		Each section	Authorised
Excavate further to Foundation Level and trim to within tolerance	3.2.2, 7.7.1	Survey	Each section	Table R44.8
Compact excavated surface – 6 passes of vibrating roller	3.2.2		Each section	Inspection
Conform to backfill material properties:				
- CBR	3.2.2	Annex R44/A2.2	1,000 m ³	Annex R44/A2.2
- Plasticity Index	3.2.2	Annex R44/A2.2	1,000 m ³	Annex R44/A2.2
Compact backfill:	3.2.2			
- Moisture content	7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	7.2	T105, T111, T119, T162, T166, T173	Q	Table R44.7
Trim top of backfill to within tolerance	3.2.2, 7.7.1	Survey	Each section	Table R44.8
11.5 Treatment Type C3(I) - Working Platform by Stabilisation of Insitu Material	3.2.3 (a)			
Obtain authorisation	3.2.3		Each section	Authorised
Trim floor of cutting to within tolerance	3.2.3 (a), 7.7.1	Survey	Each section	Table R44.8
Loosen to specified depth and extent	3.2.3 (a)	Inspection	Each section	3.4.3
Mix stabilising binder	3.2.3 (a), R50	Inspection	Each section	R50
Recompact stabilised material:	3.2.3 (a)			
- Moisture content	R50	T120, T121, T180	Q	R50
- Relative compaction	7.2	T111, T119, T162, T166, T173	Q	R50, Table R44.7
Trim top of working platform to within tolerance	3.2.3 (a), 7.7.1	Survey	Each section	Table R44.8
11.6 Treatment Type C3(II) - Working Platform Using Imported Stabilised Material	3.2.3 (b)			
Obtain authorisation	3.2.3		Each section	Authorised
Excavate further to Foundation Level and trim to within tolerance	3.2.3 (b), 7.7.1	Survey	Each section	Table R44.8
Compact excavated surface – 6 passes of vibrating roller	3.2.3 (b)	Inspection	Each section	Inspection
Place and compact imported stabilised material:	3.2.3 (b), R50			
- 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 *
- Relative compaction	7.2	T111, T119, T162, T166, T173	Q	Table R44.7
Trim top of working platform to within tolerance	3.2.3 (b), 7.7.1	Survey	Each section	Table R44.8
11.7 Treatment Type C4 - Geotextile or Geogrid Layer	3.2.4			
Obtain authorisation	3.2.4		Each section	Authorised
Trim floor of cutting to within tolerance	3.2.4, 7.7.1	Survey	Each section	Table R44.8
Conform to geotextile or geogrid material properties	3.2.4	R63, R67	R63, R67	R63, R67
Place geotextile or geogrid	3.2.4	Inspection	R63, R67	R63, R67, inspection
11.8 Treatment Type C5 - Drainage Layer	3.2.5			
Obtain authorisation	3.2.5		Each section	Authorised
Excavate further to Foundation Level and trim to within tolerance	3.2.5, 7.7.1	Survey	Each section	Table R44.8
Compact excavated surface – 6 passes of vibrating roller	3.2.5		Each section	Inspection
Conform to drainage layer material properties:				
- 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	T223	Min 10 per stockpile	Annex R44/A2.2
- Wet/Dry Strength Variation	3.2.5	T215	Stockpile	Annex R44/A2.2
Conform to geotextile material properties	3.2.5, R63	R63	R63	R63
Place geotextile over cutting floor	3.2.5	Inspection	Each section	R63, inspection
Place and compact drainage layer - nominated compaction procedure	3.2.5, 7.4.2	Inspection	Each section	3.4.5, 7.4.1
Trim top of drainage layer to within tolerance	3.2.5, 7.7.1	Survey	G71	Table R44.8
Place geotextile over drainage layer	3.2.5		Each section	3.4.5
11.9 Other Foundation Treatment Types	3.2.6			
12. CUT/FILL TRANSITION ZONE	3.5.2			
Set out extent of Cut/Fill Transition Zone, including intersection of plane of Designed Floor Level with plane of stripped surface	1.6.2, 3.5.2	Survey	Each transition	Pegs in place
Excavate to Foundation Level within Cut/Fill Transition Zone and trim to within tolerances	3.5.2, 7.7.1	Survey	Each transition	3.5.2, Annex R44/A4
Ensure excavation is free-draining	3.5.2	Inspection	Each transition	Drainage achieved
13. EMBANKMENT FOUNDATIONS	3			
13.1 Preparation of Embankment Foundations	3.3			
Remove topsoil and survey stripped surface - refer item 7.1 of this table				
Excavate further to achieve specified Shallow Embankment height and trim to within tolerances	3.5.1, 7.7.1	Survey	Each section	Report
Test foundation, if proposing reduced Shallow Embankment height:				

Work Activity	* clause reference in R44, unless noted otherwise			
	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
- CBR	3.5.1	Annex R44/A2.2	1,000 m ²	Annex R44/A2.2
- Plasticity Index	3.5.1	Annex R44/A2.2	1,000 m ²	Annex R44/A2.2
Survey excavated surface	1.6.1	Survey	Each section	Report
Present embankment foundation for inspection Hold Point	3.3	Inspection	Each section	Release of Hold Point
13.2 Unsuitable Material	2.6			
Survey surface before removal of unsuitable material	2.6.4, 1.6.1	Survey	Each Lot	Report
Remove unsuitable material Hold Point	2.6	Inspection	Each Lot	Release of Hold Point
Surface survey after removal of unsuitable material	2.6.4, 1.6.1	Survey	Each Lot	Report
Replace with suitable material:	2.6.2	Inspection	Each Lot	Complete
- Moisture content	7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	7.2	T111, T119, T162, T166, T173	Q	Table R44.7
13.3 Treatment Type E1 - Loosen and Compact	3.3.1			
Obtain authorisation	3.3.1		Each section	Authorised
Loosen material in foundation to specified depth and extent	3.3.1	Inspection	Each section	3.3.1
Compact loosen material:	3.3.1			
- Moisture content	7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	7.2	T111, T119, T162, T166, T173	Q	Table R44.7
13.4 Treatment Type E2 - Bridging Layer	3.3.2			
Obtain authorisation	3.3.2		Each section	Authorised
Conform to minimum distance from top of bridging layer to underside of Selected Material Zone	3.3.2	Survey	Each section	Annex R44/A3
Conform to geotextile material properties	3.3.2, R63	R63	R63	R63
Place geotextile over foundation area	R63	R63	R63	R63 and inspection
Conform to bridging layer material properties	3.3.2, 5.2.1, 5.3.1	Inspection	Each section	3.3.2, 5.2
Carry out trial section	3.3.2	Inspection	As directed	3.3.2
Place bridging layer – stable platform	3.3.2	Inspection	Each section	3.3.2
Place rock capping layer and geotextile (if applicable)	3.3.2	Inspection	Each section	3.3.2
Conform to completed layer thickness	3.3.2	Survey	Each section	Annex R44/A3
13.5 Treatment Type E3(I) - Working Platform by Stabilisation of Insitu Material	3.3.3			
Obtain authorisation	3.3.3		Each section	Authorised
Loosen to specified depth and extent	3.3.3	Inspection	Each section	3.3.3
Mix stabilising binder	3.3.3, R50	Inspection	Each section	R50
Recompact stabilised material:	3.3.3			
- 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 *
- Relative compaction	7.2	T111, T119, T162, T166, T173	Q	R50, Table R44.7
13.6 Treatment Type E3(II) - Working Platform Using Imported Stabilised Material	3.3.3			
Obtain authorisation	3.3.3		Each section	Authorised
Place and compact imported stabilised material:	3.3.3, R50			
- Moisture content	R50	T120, T121, T180	Q	R50
- Relative compaction	7.2	T111, T119, T162, T166, T173	Q	Table R44.7
13.7 Treatment Type E4 - Geotextile or Geogrid Layer	3.3.4			
Obtain authorisation	3.3.4		Each section	Authorised
Conform to geotextile or geogrid material properties	3.3.4	R63 or R67	R63 or R67	R63 or R67
Place geotextile or geogrid	3.3.4	R63 or R67	R63 or R67	R63 or R67 and inspection
13.8 Treatment Type E5 - Drainage Layer	3.3.5			
Obtain authorisation	3.3.5		Each section	Authorised
Conform to minimum distance from top of drainage layer to underside of Selected Material Zone	3.3.5	Survey	Each section	Annex R44/A3
Conform to drainage layer material properties:				
- Maximum particle dimension	3.3.5	Inspection, T280 if required	Q	Table R44.2
- Grading	3.3.5	T201	Q	Table R44.2
- Point Load Strength Index of +19 mm fraction	3.3.5	Annex R44/A2.2	Min 10 per stockpile	Annex R44/A2.2
- Wet/Dry Strength Variation	3.3.5	Annex R44/A2.2	Stockpile	Annex R44/A2.2
Conform to geotextile material properties	3.3.5, 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	3.3.5, 7.4.2	Inspection	Each section	3.3.5, 7.4.1
Conform to completed layer thickness	3.3.5	Survey	Each section	Annex R44/A3 and inspection
Place geotextile over completed layer	R63	R63	R63	R63 and inspection
13.9 Treatment Type E6 - Earth Fill Foundation Treatment Layer	3.3.6			
Obtain authorisation	3.3.6		Each section	Authorised
Conform to minimum distance from top of earth fill foundation treatment layer to underside of Selected Material Zone	3.3.6	Survey	Each section	Annex R44/A3
Conform to earth fill material properties	3.3.6, 5.2.1	Inspection	Each section	3.3.6
Carry out trial section	3.3.6	Inspection	As directed	3.3.6
Place earth fill foundation treatment layer:	3.3.6	Inspection	Each section	3.3.6
- Moisture content of top 300 mm of layer	3.3.6, 7.1	T120, T121, T180	Q	Annex R44/A5

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
- Relative compaction of top 300 mm of layer	3.3.6, 7.2	T111, T119, T162, T166, T173	Q	Table R44.7
Conform to completed layer thickness	3.3.6	Survey	Each section	Annex R44/A3
Proof roll placed layer	7.5	T198	As directed	No deformation
13.10 Hillside Terracing	3.4	Inspection	Each earthworks Lot	Terraced as per 3.4
13.11 Other Foundation Treatment Types	3.3.7			
14. EMBANKMENTS	5			
14.1 General Fill Material other than Type ST material	2.9, 5.2, 5.3			
Conform to earth fill material properties:	5.2			
- Free from tree stumps, roots and refuse	2.9.1	Inspection	Each Lot	No tree stumps, etc
- 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
Conform to rock fill material properties:	5.3			
- Maximum particle dimension	5.3.1	Inspection, T280 if required	Each Lot	Table R44.4
- Grading	5.3.1	T201	500 m ³	Table R44.4
- Point Load Strength Index of +100 mm fraction	5.3.1	Annex R44/A2.2	10 per 50 m ³	Annex R44/A2.2
- Wet/Dry Strength Variation	5.3.1	Annex R44/A2.2	Each source	Annex R44/A2.2
Conform to rock capping layer material properties:	5.3.4			
- Maximum particle dimension	5.3.4	Inspection, T280 if required	Each Lot	Table R44.5
- Grading	5.3.4	T201	500 m ³	Table 44.5
- Point Load Strength Index of +19 mm fraction	5.3.4	T223	10 per 50 m ³	Annex R44/A2.2
- Wet/Dry Strength Variation	5.3.4	T215	Each source	Annex R44/A2.2
14.2 Earth Fill Embankment Construction	5.2			
Place earth fill for embankment construction:	5.2.2			
- Layer thickness	5.2.2	Measure	Each Lot	5.2.2
- Lot homogeneity	7.2.1	Inspection	Each Lot	7.2.1
- Moisture content	7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	7.2	T105, T111, T119, T162, T166, T173	Q	Table R44.7
14.3 Spill Through Bridge Abutment Fill (Type ST) Material	2.8.7			
Conform to Type ST material properties:				
- CBR	2.8.7	Annex R44/A2.2	Each Lot	Annex R44/A2.2

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
- Plasticity Index	2.8.7	Annex R44/A2.2	Each Lot	Annex 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
14.4 Spill Through Bridge Abutment Fill Construction	5.2.3			
Place spill through bridge abutment fill (Type ST) material:				
- Width and height of zone	5.2.3	Survey	Each zone	Figure R44.7
- Layer thickness	5.2.3	Measure	Each Lot	5.2.3
- Lot homogeneity	7.2.1	Inspection	Each Lot	7.2.1
- Moisture content	7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	7.2	T105, T111, T119, T162, T166, T173	Q	Table R44.7
14.5 Rock Fill Embankment Construction	5.3			
Place rock fill for embankment construction:				
- Carry out trial section and develop compaction procedure Witness Point/Hold Point	7.4.2	7.4.2	Each trial section	Release of Hold Point
- Layer thickness	5.3.2	Measure	Each Lot	5.3.2
- Lot homogeneity	7.2.1	Inspection	Each Lot	7.2.1
- Proof roll placed layer Witness Point	7.5	T198	As directed	7.5
Place rock capping layer over rock fill	5.3.4			
- Conform to minimum distance from top of rock capping layer to underside of Selected Material Zone	5.3.4	Survey	Each Lot	5.3.4
- Carry out trial section and develop compaction procedure Witness Point/Hold Point	7.4.2	7.4.2	Each trial section	Release of Hold Point
- Layer thickness	5.3.4	Measure	Each Lot	Annex R44/A4
- Lot homogeneity	7.2.1	Inspection	Each Lot	7.2.1
- Proof roll placed layer Witness Point	7.5	T198	As directed	7.5
Conform to geotextile material properties	5.3.4	R63	R63	R63
Place geotextile	5.3.4	R63	R63	R63
14.6 Embankment Batters	5.1.3			
Conform to batter dimension and surface tolerances	7.8.2, 7.9.2	Survey	Each batter	Table R44.10
Remove loose material from batters	5.1.3	Inspection	Each batter	5.1.3
Treat batters	5.1.4	As directed	As directed	As directed
14.7 Rock Facing to Embankment Batters	5.4			
Conform to rock facing material properties:				
- Minimum dimension	5.4.2	Inspection	Each batter	5.4.2
- Point Load Strength Index	5.4.2	Annex R44/A2.2	10 per batter	Annex R44/A2.2
- Wet/Dry Strength Variation	5.4.2	Annex R44/A2.2	Each source	Annex R44/A2.2
Place rock facing to embankment batters	5.4.3	Inspection	Each batter	5.4.3

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
14.8 Select Fill adjacent to Structures	5.5	B30, R11 or R58/R59	B30, R11 or R58/R59	B30, R11 or R58/R59
15. STRUCTURAL TREATMENTS				
15.1 Upper Zone Material other than Selected Material				
Conform to material properties:				
Site won:				
- CBR	2.8.4.1	Annex R44/A2.2	Each Lot	Annex R44/A2.2
- Plasticity Index	2.8.4.1	Annex R44/A2.2	Each Lot	Annex 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
Imported:				
- CBR	2.8.4.2	Annex R44/A2.2	Each Lot	Annex R44/A2.2
- Plasticity Index	2.8.4.2	Annex R44/A2.2	Each Lot	Annex R44/A2.2
- Maximum particle dimension	2.8.4.2	Inspection, T280 if required	Each Lot	2.8.4.1
- Grading	2.8.4.2	T106	Each Lot	2.8.4.1
15.2 Selected Material	2.8.5			
Conform to material properties:				
Site won				
- CBR	2.8.5.1	Annex R44/A2.2	Each Lot	Annex R44/A2.2
- Plasticity Index	2.8.5.1	Annex R44/A2.2	Each Lot	Annex 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
Imported	2.8.5.2, 3071	3071	3071	3071
15.3 Verge Material	2.8.6			
Conform to material properties:				
Site won				
- CBR	2.8.6.1	Annex R44/A2.2	Each Lot	Annex R44/A2.2
- Plasticity Index	2.8.6.1	Annex R44/A2.2	Each Lot	Annex 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
Imported				
- CBR	2.8.6.2	Annex R44/A2.2	Each Lot	Annex R44/A2.2

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
- Plasticity Index	2.8.6.2	Annex R44/A2.2	Each Lot	Annex R44/A2.2
- Maximum particle dimension	2.8.6.2, 3071	3071	3071	3071
- Grading	2.8.6.2, 3071	3071	3071	3071
15.4 Placing Material in Upper Zone of Formation other than Selected Material Zone	6.1.1			
Deliver Upper Zone Material other than Selected Material Hold Point	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	Annex R44/A4
- Moisture content	6.1.1, 7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	6.1.1, 7.2	T105, T111, T119, T162, T166, T173	Q	Table R44.7
Trim to within tolerance	6.1.1, 7.7.1	Survey	Each section	Table R44.8
15.5 Placing Material in Selected Material Zone	6.1.2			
Deliver Selected Material Hold Point	6.1.1			Release of Hold Point
Place material in Selected Material Zone:				
- Layer thickness	6.1.2	Measure	Each Lot	Annex R44/A4
- Moisture content	6.1.2, 7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	6.1.2, 7.2	T105, T111, T119, T162, T166, T173	Q	Table R44.7
Trim to within tolerance	6.1.2, 7.7.1	Survey	Each section	Table R44.8
Verify conformity before covering Hold Point	6.1.2	Reports	Each Lot	Release of Hold Point
15.6 Placing Material in Verges	6.2			
Deliver verge material Hold Point	6.2			Release of Hold Point
Place material in verge:				
- Layer thickness	6.2, Annex R44/A4	Measure	Each Lot	Annex R44/A4
- Moisture content	6.2, 7.1	T120, T121, T180	Q	Annex R44/A5
- Relative compaction	6.2, 7.2	T105, T111, T119, T162, T166, T173	Q	Table R44.7
- Trim to within tolerance	6.2, 7.7.1	Survey	Each section	Table R44.8
15.7 Other Treatments <i>[Additional details to be inserted by Project Manager as appropriate]</i>	6.3			
16. DEFLECTION TESTING	7.6			
Proof roll all surfaces within Selected Material Zone and within 1.5 m of underside of Selected Material Zone Witness Point	7.6.1	T198	As directed	No deformation

R44**Earthworks**

* clause reference in R44, unless noted otherwise				
Work Activity	Clause Reference *	Test Method	Minimum Frequency	Acceptance Criteria *
Carry out Benkelman Beam testing at underside of Selected Material Zone Hold Point	7.6.2	T199	7.6.2	7.6.2, Annex R44/A4
Carry out Benkelman Beam testing at top of Selected Material Zone Witness Point/Hold Point	7.6.2	T199	7.6.2	7.6.2, Annex R44/A4

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

Total Mass of Lot Represented (tonnes)	1 – 500	501 – 1,000	1,001 – 2,000	2,001 – 4,000
Minimum Number of Samples per Lot	2	3	4	5

ANNEXURE R44/M – REFERENCED DOCUMENTS

Refer to Clause 1.2.6.

TfNSW Specifications

TfNSW G7	Utility Adjustment
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	Construction of Reinforced Soil Walls (Contractor Design), or
TfNSW R59	Construction of Reinforced Soil Walls (Principal's Design)
TfNSW R63	Geotextiles (Separation and Filtration)
TfNSW R67	High Strength Geosynthetic Reinforcement
TfNSW R178	Vegetation
TfNSW 3071	Selected Material for Earthworks
TfNSW 3211	Cementitious Materials, Binders and Fillers

TfNSW Test Methods

TfNSW T102	Pre-treatment of Road Construction Materials by Repeated Compaction
TfNSW T103	Pre-treatment 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 Washing)
TfNSW T109	Plastic Limit and Plasticity Index of Road Construction Materials
TfNSW T111	Dry Density/Moisture Relationship of Road Construction Materials
TfNSW T112	Dry Density/Moisture Relationship of Road Construction Materials (Modified Compaction)
TfNSW T117	California Bearing Ratio of Remoulded Specimens of Road Construction Material
TfNSW T119	Field Density of Road Construction Materials (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 T164	Maximum Dry Density of Cohesionless Materials (by Vibration)
TfNSW T165	Density in Situ of Road Construction Materials (Fixed Volume Extractive 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	Determination of the Point Load Strength of Rock Specimens
TfNSW T280	Determination of Maximum Particle Dimension of Road Construction Materials by Direct Measurement
TfNSW T2105	Correlation of Moisture Content with Standard Method

Australian Standards

AS 2187	Explosives – Storage, transport and use
AS 2187.1	Part 1: Storage
AS 2187.2	Part 2: Use of explosives

Other References

NAASRA Explosives in Roadworks Users Guide 1982