CAPRICORN MUNICIPAL DEVELOPMENT GUIDELINES

EARTHWORKS

C213

CONSTRUCTION SPECIFICATION

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Keeping the Capricorn Municipal Development Guidelines up-to-date

The Capricorn Municipal Development Guidelines are living documents which reflect progress of municipal works in the Capricorn Region. To maintain a high level of currency that reflects the current municipal environment, all guidelines are periodically reviewed with new editions published and the possibility of some editions to be removed. Between the publishing of these editions, amendments may be issued. It is important that readers assure themselves they are using current guideline, which should include any amendments which may have been published since the guideline was printed. A guideline will be deemed current at the date of development approval for construction works.

GENERAL

C213.01 SCOPE

C213.01.01 The work to be executed under this Specification consists of:-

Scope

(a) Removal of topsoil

(b) All activities and quality requirements associated with site regrading, the excavation of cuttings, the haulage of material and the construction of embankments to the extent defined in the Drawings and Specification.

(c) Removal and replacement of any unsuitable material,

(d) Any spoil or borrow activities associated with earthworks, and

(e) Any additional processing of selected material for the selected material zone.

Quality

C213.01.02 Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in Annexure C213A.

Order of Priority

C213.01.03 The following order of priority for interpretation of documents will apply: (Please note that reference to a Guideline or Standard, is reference to the latest version of the relevant document, unless specifically a version number is specifically stated)

1. CMDG Relevant Design Specifications
2. CMDG C213 Earthworks Construction Guideline
3. AUSTROADS suite of documents
4. Australian Standards
5. QLD government legislations

C213.02 REFERENCE DOCUMENTS

Documents Standards Test Methods

C213.02.01 Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

(a) CMDG Specifications

C201 - Control of Traffic
C211 - Control of Erosion and Sedimentation
C212 - Clearing and Grubbing
C220 - Stormwater Drainage - General
C273 - Landscaping

(b) Australian Standards

AS 1289.6.1.1 - Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen.
AS 1289.3.3.1 - Calculation of the plasticity index of a soil.
AS 1289.5.1.1 - Determination of the dry density/moisture content relation of a soil using standard compactive effort.

AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio.
AS 1289.5.7.1	-	Compaction Control Test (Rapid Method).
AS 2187		Explosives - Storage, transport and use (SAA Explosive Code) Part 1 Storage and land transport Part 2 Use of explosives
AS 3798	-	Guideline on Earthworks for commercial and residential developments

(c) QLD Government Legislation

Explosives Act, 1952 and Regulations, 1955 and Amendments.

Environmental Planning Act, 1998

Environmental Protection Act, 1994 - Environmental Protection Noise Policy, 1997.

National Road Transport Commission/Federal Office of Road Safety, Joint Publication - Australian Code for the Transport of Explosives by Road and Rail

(d) Other

AUSTROADS - Explosives in Roadworks, Users Guide 1982.

C213.03 NATURAL SURFACE AND EARTHWORKS MATERIALS

(a) Earthworks Materials

C213.03.01 The Contractor shall be responsible for any assumptions in relation to the nature and types of the materials encountered in excavations and the bulking and compaction characteristics of materials incorporated in embankments.

Material Characteristics

C213.03.02 The estimated quantity for general earthworks at any cutting includes all types of materials which may be encountered in the cutting.

C213.03.03 Where material from excavations is acceptable for use in embankments, but the Contractor elects to:-

Embankment Material Deficiency

(a) Spoil it, or

(b) Use it for the Contractor's own purposes, or

(c) Use it as a source of pavement materials, or

(d) Construct embankments with dimensions in excess of those specified.

and a deficiency of material for embankment construction is thereby created, the Contractor shall make good that deficiency from sources of material meeting the quality requirements for embankment material in accordance with this specification. The cost of making good such deficiency of material shall be borne by the Contractor.

Contractor's Cost

C213.04 PROTECTION OF EARTHWORKS

C213.04.01 The Contractor's responsibility for care of the Works shall include the protection of earthworks.

Contractor's Responsibility

C213.04.02 The Contractor shall install effective erosion and sedimentation control measures in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION C211 and approved site based Erosion and Sedimentation Control Plans (ESCP), prior to commencing earthworks, and shall maintain these control measures for the duration of the contract.

Erosion and Sedimentation Control

C213.04.03 Adequate drainage of all working areas shall be maintained throughout the period of construction to ensure surface water runs off without ponding, except where ponding forms part of a planned erosion and sedimentation control system.

Drainage of Working Areas

C213.04.04 When rain is likely or when work is not proposed to continue in a working area on the following day, precautions shall be taken to minimise ingress of any excess water into earthworks material. Ripped material remaining in cuttings and material placed on embankments shall be sealed off by adequate compaction to provide a smooth tight surface.

Wet Weather Precautions

C213.04.05 Should insitu or stockpiled material become over wet as a result of the Contractor not providing adequate protection of earthworks, the Contractor shall be responsible for replacing and/or drying out the material and for any consequent delays to the operations.

Wet Material

C213.05 SETTING OUT OF EARTHWORKS

C213.05.01 Before earthworks operations commence and after survey controls are in place, batter profiles shall be established by the Contractor and the necessary pegs driven at 25 m intervals or at each cross section shown on the Drawings, whichever is the lesser. The chainage/station, offset from control line and slope distance to finished surface level, shall be clearly marked on each peg.

Batter Profiles

C213.05.02 The batter profiles shall be repositioned by the Contractor at each change in the slope of the batter and at intervals of not more than 5 m of vertical height.

Profile Location

C213.05.03 All pegs and batter profiles shall be maintained in their correct positions. They shall be removed by the Contractor on completion of the contract or separable part.

Retention and Removal of Pegs

C213.05.04 The foregoing shall be the minimum requirement. Additional pegs and profiles may be required to suit the Contractor. These shall not be painted with the same colours used for the specified setting out pegs and stakes.

Additional Pegs

C213.05.05 The position and extent of all transitions from cuttings to embankments and foundations for shallow embankments shall be marked with clearly labelled stakes in accordance with Clauses C213.14 and C213.17.

Transitions Cuttings/ Embankments

C213.05.06 The Contractor may utilise digital positioning in lieu of the methods prescribed in C213.05.01 through C213.05.05 if approved by the Superintendent.

Digital Positioning

C213.06 STOCKPILE SITES

C213.06.01 The Contractor shall obtain the written consent of the Superintendent to the use of any stockpile site which is not shown on the Drawings. Proposals in this regard shall be submitted at least three working days before stockpiling is due to commence and shall specify the maximum dimensions of the proposed stockpile.

Additional Stockpile Sites

C213.06.02 Any clearing and grubbing required for these sites shall be carried out in accordance with the Specification for CLEARING AND GRUBBING C212. Temporary erosion and sedimentation control measures shall be taken in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION C211.

Clearing and Grubbing

C213.06.03 Restoration of stockpile sites following completion of the work shall be carried out in accordance with the Specification for LANDSCAPING C273.

Restoration

REMOVAL OF TOPSOIL

C213.07 SCOPE

C213.07.01 Topsoil is surface soil normally high in organic material and contaminated by residual grass seed and grass roots, which is reasonably free from subsoil, refuse, clay lumps and stones. ***Definition***

C213.07.02 Removal of topsoil from any section of the Works shall only commence after erosion and sedimentation controls have been implemented and when clearing, grubbing and disposal of materials have been completed on that section of the Works. Topsoil throughout the length of the work shall be removed and stockpiled separately clear of the work with care taken to avoid contamination by other materials. ***Prerequisites***

C213.08 TOPSOIL STOCKPILES

C213.08.01 The maximum height of stockpiles shall not exceed 2.5 m and the maximum batter slope shall not exceed 2H:1V. ***Height and Batter***

C213.08.02 Topsoil stockpiles shall not contain any timber or other rubbish and shall be trimmed to a regular shape. ***Stockpiles Trimmed***

C213.08.03 To minimise erosion, stockpile batters shall be track rolled or stabilised by other means acceptable to the Superintendent. ***Erosion Control***

C213.08.04 Where seeding of stockpiles to encourage vegetation cover is specified, such work shall be carried out in accordance with the Specification for LANDSCAPING C273. ***Seeding Stockpile***

CUTTINGS

C213.09 SCOPE

C213.09.01 Construction of cuttings shall include all operations associated with the excavation of material within the limits of the batters including benching, treatment of cutting floors and transition from cut to fill. ***Extent of Work***

C213.10 EXCAVATION

C213.10.01 Materials encountered in cuttings shall be loosened and broken down as required so that they are acceptable for incorporation in the Works.

C213.10.02 Cuttings shall have batter slopes as shown on the Drawings. ***Batter Slopes***

C213.10.03 The tops of all cuttings shall be neatly "rounded".

C213.10.04 In all cuttings, undulations in the general plane of the batter shall not be permitted except where batters may require progressive flattening at the ends of cuttings due to the presence of less stable material.

Batters to be Even

C213.10.05 Cut faces shall be cleaned of loose or unstable material progressively as the excavation proceeds.

Unstable Material

C213.11 BATTER TOLERANCES

C213.11.01 The tolerances for horizontal alignment of the excavation of batters, measured at right angles to the design control line, shall be ± 300mm.

Batter Tolerances

C213.12 BENCHING IN CUTTINGS

C213.12.01 Cut batters shall be benched as shown on the Drawings to provide drainage and erosion control. Notwithstanding the tolerances permitted under this specification, bench widths shall not be less than those shown on the Drawings.

Bench Construction

C213.12.02 Benches shall be maintained and cleaned of loose stones and boulders regularly throughout the Construction period.

Bench Maintenance

C213.12.03 Benches shall be designed in accordance with relevant AUSTROADS standards.

C213.13 TREATMENT OF FLOORS OF CUTTINGS

C213.13.01 The floors of cuttings shall be excavated, parallel to the designed grade line, to a designed floor level which shall be at the underside of the selected material zone or where there is no selected material zone, to the underside of the pavement subbase. The floors shall then be trimmed to a level of not more than 50 mm above or below the designed floor level.

Excavation Level

C213.13.02 The Contractor shall then rip or loosen all material in the floor to a minimum depth of 200mm below the designed floor level for the width of the selected material zone (or subbase layer, where no selected material zone). The maximum dimension of any particles in the ripped or loosened zone shall not exceed 150mm.

Floor Material Ripped

C213.13.03 Prior to ripping or loosening the cutting floor the Contractor shall determine the CBR of the material in the floor in accordance with AS 1289.6.1.1. Sufficient tests shall be taken to represent all the various materials which may exist in the cutting floor. If material in the floors of cuttings has a CBR value less than the design value, the Superintendent will direct the action to be taken.

CBR Testing

C213.13.04 After re-compaction, the floors of cuttings shall be re-trimmed parallel with the finished wearing surface so that their levels do not vary more than 10 mm above or 40 mm below the designed floor levels.

Level Tolerances

C213.14 TRANSITION FROM CUT TO FILL

C213.14.01 After the removal of topsoil and before the excavation of any cutting commences the Contractor shall survey and mark the position of the intersection line between cutting and embankment occurring at the underside of the selected material zone or pavement subbase.

Intersection Line

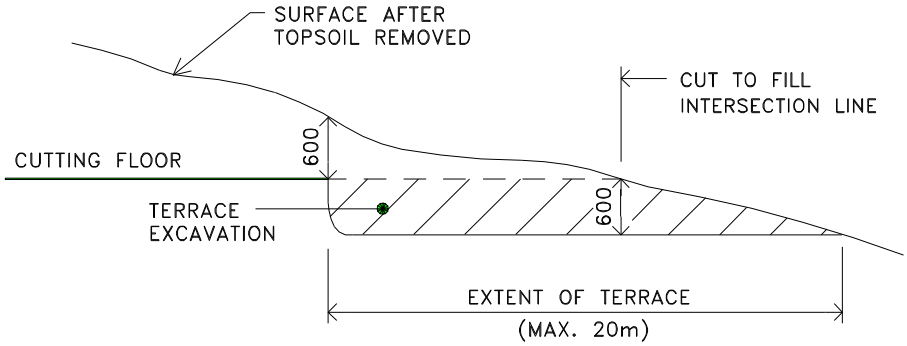
C213.14.02 Following excavation to the cutting floor, a terrace shall be excavated for the width of the selected material zone (or subbase layer, where no selected material zone) to a depth of 600mm below and parallel to the cutting floor, as shown in **Figure C213. 14.1 - Transition from Cut to Fill**.

Terrace Construction

C213.14.03 The terrace shall extend into the cut to the point where the cutting floor is 600mm below the original stripped surface, or a distance of 20 metres, whichever is the lesser.

Extent of Terrace

Figure C213. 14.1 - Transition from Cut to Fill



BLASTING

C213.15 GENERAL

C213.15.01 All Blasting is to be controlled by the Department of Natural Resources and Water (DNRW) and their requirements. The Local Governments will require to be informed about any proposed blasting and proof of approval by DNRW.

Approval

UNSUITABLE MATERIAL

C213.16 GENERAL

C213.16.01 Unsuitable material is material located below the designed floor level of cuttings and embankments that are identified as unsuitable for use as a foundation for earthworks, structures, and/or general fill and backfill.

Definition

C213.16.02 Such material shall be excavated and disposed of as directed to spoil or as fill in non-critical areas.

Extent of Excavation

C213.16.03 After removal of the unsuitable material, the floor of the excavation shall be inspected to determine whether a sufficient depth of unsuitable material has been removed and backfilled with replacement material to the required compaction standard.

Floor Inspection

C213.16.04 The unsuitable material which has been removed shall be replaced with material from cuttings, or with material borrowed in accordance with embankment construction.

Replacement Material

EMBANKMENT CONSTRUCTION

C213.17 SCOPE

C213.17.01 Embankment construction includes all operations associated with the preparation of the foundation areas on which fill material is to be placed, the placing and compacting of approved material within areas from which unsuitable material has been removed the placing and compacting of fill material and of materials of specified quality in nominated zones throughout the Works and all other activities required to produce embankments as specified to the alignment, grading and dimensions shown on the Drawings. It also includes any pre-treatment such as breaking down or blending material or drying out material containing excess moisture.

Extent of Work

C213.18 EMBANKMENT MATERIAL

C213.18.01 Material for embankment construction shall be obtained from the cuttings within the Works, supplemented by borrow material if necessary. The material shall be free of tree stumps and roots and shall be capable of being compacted in accordance with this specification.

Location and Quality

C213.19 FOUNDATIONS FOR EMBANKMENTS

C213.19.01 Foundations for embankments shall be prepared for embankment construction after removing topsoil and unsuitable material, by loosening the material exposed to a depth of 200mm, adjusting the moisture content of the loosened material and compacting as specified in Clause C213.30. The Contractor shall use equipment and techniques to minimise surface heaving or other foundation damage.

Preparation of Foundations

C213.20 HILLSIDE EMBANKMENTS

C213.20.01 Where embankments are to be constructed on or against any natural slopes or the batters of existing embankments, the existing slope or batter, if it is steeper than 4 horizontal to 1 vertical in any direction shall be cut in the form of horizontal terraces over the whole area to be covered by new filling. The existing slope or batter shall be stepped in successive terraces, each at least 1 metre in width, the terraces to be cut progressively as the embankment is placed. Wherever possible terraces shall coincide with natural discontinuities. Material thus excavated shall be compacted as part of the new embankment material.

Horizontal Terraces

C213.21 PLACING FILL FOR EMBANKMENT CONSTRUCTION

C213.21.01 The methods of excavation, transport, depositing and spreading of the fill material shall be selected so as to ensure that the placed material is uniformly mixed.

Uniformity of Material

C213.21.02 The embankment shall be constructed so as to derive its stability from the adequate compaction of the fine material embedding the large rock pieces rather than mechanical interlock of the rock pieces. The fine material shall be compacted to meet the requirements of this specification.

Embankment Stability

C213.21.03 Fill material for embankment construction shall be placed in conforming horizontal layers and compacted.

Layer Thickness

C213.21.04 The maximum dimension, measured in any direction, of rock pieces in the fill material for embankment construction shall not exceed two-thirds of the approved compacted layer thickness. Any larger rock pieces shall be reduced in size for incorporation in the embankment layers.

Maximum Size Rock Pieces

C213.21.05 Rock material shall be broken down and evenly distributed through the fill material, and sufficient fine material shall be placed around the larger material as it is deposited to fill the voids and produce a dense, compact embankment.

Grading of Fill Material

C213.21.06 Stony patches with insufficient fine material to fill the voids shall be reworked with additional fine material being blended in to achieve a dense, compact layer. The cost of any rework is to be borne by the contractor.

Reworking Stony Patches Contractor's Cost

C213.21.07 In placing embankment layers, the Contractor shall use equipment and techniques to avoid surface heaving or other damage to the foundations and underlying embankment layers.

Equipment Selection for Placement

C213.21.08 After compaction, embankment material in the zone(s) below the selected material zone (or subbase layer, where no selected material zone is identified) shall have a CBR value not less than the design value.

CBR Value

C213.21.09 For the purpose of this Clause, the CBR value of the material shall be determined by Test Method AS 1289.6.1.1.

Test Methods

C213.22 EMBANKMENT BATTERS

C213.22.01 When completed, the average planes of the batters of embankments shall conform to those shown on the Drawings. No portion of a batter shall project beyond the shape specified by more than 300 mm or one-third of the height of the batter, whichever is the lesser when measured at right angles to the control line. However, in no case shall the edge of the formation at the underside of the pavement be nearer to the roadway than shown on the Drawings.

Slope Tolerances

No portion of a rock batter shall overhang the outside edge of a table drain.

C213.22.02 Undulations in the general plane of the batter shall not be permitted. ***Slope Undulations***

C213.23 ROCK FACING OF EMBANKMENTS

C213.23.01 Where shown on the Drawings, embankment batters (including embankments at bridge abutments) shall be provided with a facing of clean, hard, durable rock. ***Extent***

C213.23.02 Rock may be placed by hand or plant but shall be placed in such a manner that its least dimension is vertical and that mechanical interlock between the larger stones occurs. Any rock deposited in the rock facing which has an excess of fine material surrounding it shall be removed together with the excess fine material and replaced. ***Mechanical Interlock***

C213.23.03 The space between larger batter rocks shall be filled 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. Fine material shall not cover the outside of the rocks on the face of the batter. ***Graded Filter***

C213.24 TRIMMING TOPS OF EMBANKMENTS

C213.24.01 The tops of embankments shall be trimmed parallel to the designed grade line at levels equal to the finished surface level less the thicknesses of pavement courses and the selected material zone. ***Levels***

C213.24.02 The tops of embankments at these levels shall be compacted to meet the requirements of Clause C213.30 and trimmed so that they do not vary more than 10 mm above or 40 mm below the levels as calculated above. ***Tolerances***

C213.25 SELECTED MATERIAL ZONE

C213.25.01 A selected material zone may be indicated on the Drawings as a zone below the subbase layer and in accordance with the following quality requirements: ***Dimension and Quality***

(a) it shall be free from stone larger than 100mm maximum dimension

(b) the fraction passing 19.0mm AS sieve shall have a CBR value of not less than 15 or as shown on the drawing.

C213.25.02 The selected material zone shall be placed and compacted in layers with the compacted thickness of each layer not exceeding 150mm. Compaction shall be as specified in Clause C213.30. ***Layer Thickness***

C213.25.03 After placement the selected material shall be homogeneous and free from patches containing segregated stone or excess fines. There shall be no areas containing material which does not comply with the specified requirements of this Clause. ***Homogeneous Layers***

C213.25.04 The top of the selected material zone shall be compacted and trimmed parallel with the designed grade line at a level equal to the finished surface level minus the thickness of pavement layers adopted. The top of the ***Tolerances***

selected material zone shall not vary more than 10mm above or 40mm below the levels as calculated above.

C213.26 TREATMENT AT WEEPHOLES

C213.26.01 Drainage adjacent to weepholes shall be provided by either a layer of broken stone or river gravel consisting of clean, hard, durable particles graded from 50mm to 10mm such that:

Grading

(a) The maximum particle dimension shall not exceed 50mm

(b) No more than 5 per cent by mass shall pass the 9.5mm A.S. sieve.

C213.26.02 The broken stone or river gravel shall be continuous in the line of the weepholes, extend at least 300mm horizontally into the fill and extend at least 450mm vertically above the level of the weepholes.

Extent

C213.26.03 Alternatively a synthetic membrane of equivalent drainage characteristics may be provided. It shall be stored and installed in accordance with Manufacturer's instructions.

Synthetic Membrane

C213.27 SELECTED BACKFILL

C213.27.01 Selected backfill shall be placed adjacent to structures in accordance with **Table C213. 27.1 - Selected Backfill, Width and Height**. The selected backfill shall consist of a granular material having a maximum dimension not exceeding 50mm and a Plasticity Index, determined by AS 1289.3.3.1, neither less than 2 nor more than 12.

Quality

Table C213. 27.1 - Selected Backfill, Width and Height

Structure Type	Selected Backfill	
	Width	Height
Bridge abutments	2m	H
Cast-in-place Box Culverts	H/3	H + 300mm
Corrugated Steel Pipes and Arches	0.5m	H + 500mm
Retaining Walls	H/3	H

(Where H = height of structure)

C213.27.02 The selected backfill shall be placed in layers, with a maximum compacted thickness of 150mm. Layers shall be placed simultaneously on both sides of box culverts to avoid differential loading. Compaction shall start at the wall and proceed away from it, and shall meet the requirements of Clause C213.30.

Placement in Layers

C213.27.03 The existing embankment slope behind the structure shall be cut in the form of successive horizontal terraces, each terrace being at least 1 metre in width, and the selected backfill shall be placed in accordance with Clause C213.21.

Horizontal Terraces

C213.27.04 No selected backfilling shall be placed against structures, retaining walls, headwalls or wingwalls within 21 days after placing of the concrete, unless the walls are effectively supported by struts to the satisfaction of the Superintendent, or when the Contractor can demonstrate that 85 per cent of the design strength of the concrete has been achieved.

Time of Placement

C213.27.05 Where a bridge deck is being concreted adjacent to an abutment, no filling shall be placed against the abutment within twenty-one days after placing concrete in the bridge deck, unless otherwise approved.

Adjacent to Concrete Deck

C213.27.06 In the case of spill-through abutments, rocks shall not be dumped against the columns or retaining walls but shall be built up evenly by individual placement around or against such structures.

Spill through Abutments

C213.27.07 In the case of framed structures, embankments at both ends of the structure shall be brought up simultaneously, the difference between the levels of the embankments at the respective abutments, shall not exceed 500mm.

Framed Structures

C213.28 SPOIL

C213.28.01 Spoil is surplus material from excavations which is not required to complete the Works as specified or material from excavations whose quality is deemed to be unacceptable for incorporation in the Works.

Definition

C213.28.02 Spoil shall be disposed of at locations within the specified working area for the Works or be removed and disposed of off-site by the Contractor.

Disposal of Spoil

C213.29 BORROW

C213.29.01 Where borrow material is required to complete the Works the quality of material shall be in accordance with Clauses C213.18, C213.23 or C213.25 as appropriate. The edges of borrow sites shall be no closer than 3 metres from any fence line, or edge of excavation or embankment. Adequate clearance shall be provided for the construction of catch drains. Borrow sites shall have drainage outlets acceptable to the Superintendent, cut batter slopes not steeper than 4 to 1, and shall be left by the Contractor in a tidy and safe condition.

Borrow Site Characteristics

C213.29.02 For borrow within the defined working area for the Works as specified, site preparation shall be in accordance with the Specification for CLEARING AND GRUBBING C212 and Clause C213.07. Restoration of borrow sites shall be carried out in accordance with the Specification for LANDSCAPING C273.

Site Preparation and Restoration

C213.29.03 If borrow material is obtained by uniformly widening a cutting, the requirements of Clauses C213.10, C213.11 and C213.13 as to the redetermination of batter slopes, the trimming of batters and the compaction of floors of cuttings respectively shall apply to the borrow area.

Widening of Cutting

C213.29.04 If borrow is to be obtained from locations outside the specified working area for the Works. The Contractor shall be responsible for obtaining any permits required for entry on land and for the payment of any royalty for such borrow material. The Contractor shall also comply with any requirements of the Environmental Planning Act, 1998, the Local Government Planning Scheme, local laws, local planning policies and land owners, as appropriate.

Contractor Responsibility

COMPACTION AND QUALITY CONTROL

C213.30 COMPACTION AND MOISTURE REQUIREMENTS

C213.30.01 In areas listed below, all layers shall be uniformly compacted to not less than the relative compaction specified before the next layer is commenced. Each layer of material shall be trimmed prior to and during compaction to avoid bridging over low areas. A smooth surface shall be presented at the top of each layer.

Trimming and Compaction

C213.30.02 The following areas shall be compacted to provide a relative compaction, determined by AS 1289 for standard compaction effort and proof rolling, of no less than 98% for up to 300 mm from subgrade level and 95% for the remainder.

- Each layer of material replacing unsuitable material
- Each layer of material placed in embankments, up to 0.3 metres from the top of the subgrade.
- The whole area on the floors of cuttings.
- Fill placed adjacent to structures up to 1.0 metre from the top of pavement.
- Material in unsealed verges and within medians up to the level at which topsoil is placed.
- Spoil (excluding unsuitable material)
- Foundations for embankments.
- Each layer of the embankment within 0.3 metres from the top of the subgrade.
- Each layer of the selected material zone
- Any areas of material of specified quality which may be shown on the Drawings or specified elsewhere behind kerbs and/or gutters or adjacent to rigid pavements.
- The fill material placed adjacent to structures within 1.0 metre from the top of the pavement. Unless otherwise stated

Compaction Requirements

C213.30.03 Unsuitable material shall be stockpiled as directed by the Superintendent and compacted by track rolling.

Unsuitable Material

C213.30.04 At the time of compaction the moisture content of the material shall be adjusted so as to permit the specified compaction to be attained at a moisture content of not less than 80% or more than 100% of the optimum moisture content as determined by AS 1289.5.1.1. Material which becomes wetted up after placement shall not be compacted until it has dried out so that the moisture content is within this range. The drying process may be assisted by aeration. If there is insufficient moisture in the material for it to be compacted as specified, water shall be added. The added water shall be applied uniformly and thoroughly mixed with the material until a homogeneous mixture is obtained.

Moisture Content

Contractor's Cost for Drying and Wetting

C213.30.05 Compaction shall be undertaken to obtain the specified relative compaction for the full depth of each layer in embankments and for the full width of the formation over the entire length of the work. Compaction shall be completed promptly to minimise the possibility of rain damage.

Prompt Compaction

C213.30.06 Any material placed by the Contractor that has attained the specified relative compaction but subsequently becomes wetted up so that the moisture content is greater than the apparent optimum, determined by AS 1289.5.1.1, shall be dried out and uniformly re-compacted to the required relative compaction in accordance with this Clause before the next layer of material is placed. Alternatively, the Contractor may remove the layer of wetted material to a stockpile site for drying and later re-use.

Moisture Content above Optimum

C213.30.07 Following completion of compaction and trimming, the entire subgrade area shall be inspected by proof rolling with a fully loaded single rear axle truck (or acceptable equivalent). Acceptable proof rolling shall be taken to be no visible signs of deformation or instability in the subgrade.

C213.31 TEST LOCATIONS

C213.31.01 The specified compaction and moisture tests shall be taken at the random test locations established in each lot in accordance with the specified minimum testing frequency. Prior to testing the Contractor shall work the lot to ensure uniform moisture content and compaction of all material within the lot.

Contractor to Prepare Area

C213.31.02 The test/s then taken shall be considered to represent the total volume of material placed within the lot.

Test Representation

LIMITS AND TOLERANCES

C213.32 SUMMARY OF LIMITS AND TOLERANCES

C213.32.01 The limits and tolerances applicable to the various clauses in this Specification are summarised in **Table C213. 32.1 - Summary of Limits and Tolerances** below:

Table C213. 32.1 - Summary of Limits and Tolerances

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Batter Slopes** a) Excavation	± 300mm	C213.11
	b) Embankment	± 300mm or 1/3H (the lesser)	C213.22
2.	**Floors** a) Floor of Cutting	Parallel to the designed grade line and ± 50mm of the designed floor level	C213.13
3.	**Tops of Embankments** Trimming tops of Embankments	Parallel to the designed grade line, +10mm or -40mm of the levels specified	C213.28

NOTE: *Plus (+) is towards the roadway/surface and minus (-) is away from the roadway/surface. Tolerances are measured at right angles to design surfaces.*

ANNEXURE 213A

C213.33 QUALITY CONTROL AND TESTING

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
MANDATORY TESTING				
Excavation	Geometry	10,000m^2	1 Cross Section per 25m	Survey
Floor of Cuttings	Material Quality - CBR	5,000m^2	1 per 1,000m^2 *	AS1289.6.1.1
	Compaction	10,000m^2	1 per 500m^2	AS1289.5.4.1
Foundation for Embankments	Compaction	5,000m^2	1 per 500m^2	AS1289.5.4.1
Embankments - General	Geometry	One layer 10,000m^2	1 Cross Section per 25m	Survey
	Material Quality - CBR	One layer 5,000m^2	1 per 800m^3	AS1289.6.1.1
	Compaction/Moisture Content	One layer 5,000m^2	1 per 250m^3	AS1289.5.1.1 AS1289.5.4.1 AS1289.5.7.1
Road Carriageway Embankments - Select Zone	Geometry	One layer 10,000m^2	1 Cross Section per 25m**	Survey
	Material Quality - Maximum Particle Size	10,000m^2	1 per 1,000m^3 *	AS1289.6.1.1
	- CBR	10,000m^2	1 per 500m^3 *	
Fill Adjacent to Structures: Bridges, Retaining Walls and Cast-in-Situ Culverts	Compaction/Moisture Content	1 Structure	1 per layer	AS1289.5.1.1, AS1289.5.4.1 AS1289.5.7.1
AUDIT TESTING – IF ORDERED BY COUNCIL				
Stripping Topsoil	Surface Levels	10,000m^2	1 Cross Section per 25m	Survey
Road Carriageway Embankments - Select Zone	Material Quality - Maximum Particle Size	10,000m^2	1 per 1,000m^3 *	AS1289.6.1.1
Fill Adjacent to Structures: Bridges, Retaining Walls and Cast-in-Situ Culverts	Material Quality - Maximum Particle Size	1 Structure	1 per 200m^3 *	AS1289.3.3.1
	- Plasticity Index	1 Structure	1 per 200m^3 *	

Note: the above quality control and testing may not be relevant to all sites with some site requiring additional testing and quality control. The quality control and testing shall be planned to be site specific and cover all predicted works.
*or part thereof, per lot.
**Minimum 2 per lot.