Earthworks & Pavement Construction

Road Building Model Specification

July 2022

Disclaimer

This road building specification has been prepared by GHD for the Western Australia Local Government Association (WALGA) for the purpose of outlining the requirements for the supply of **Earthworks and Pavement Construction**. To the extent permitted by law, GHD and WALGA exclude all warranties as to, and responsibility for, the accuracy, completeness or suitability of the information in the Specification or for any error or omission in the information.

To the extent permitted by law, GHD and WALGA disclaim all liability to the user for loss, injury or damage, arising out of, or related to, use of information and data in the Specification. Prior to applying the information presented herein, approval should be sought from the relevant Local Government or appropriate Road Authority.

While every care has been taken in preparing the Specification, GHD and WALGA do not guarantee the currentness of the information and have no ongoing obligation to inform users of changes, revisions or updates. Users of the Specification shall apply, and rely upon, their own skills and judgement to the issue they are considering.

Copyright

Acknowledgments

Main Roads Western Australia (Main Roads) technical guidelines and the Institute of Public Works Engineering Australia, Western Australia Division (IPWEA-WA) **Local Government Guidelines for Subdivisional Development** have been heavily referenced in preparing this road building specification.

The work of Reg Leach, Senior Consultant, Golder Associates Pty Ltd, in assembling the previous (2012) version of the Specification, upon which this document is based, is gratefully acknowledged.

Document Updates

The **Earthworks and Pavement Construction** road building model specification was originally published in July 2022. Subsequent document updates are shown in the table below:

Date	Updates	Contents and purpose	Edition No.	Amended Modules

Each update will be listed above with the model specification, as amended, available from the WALGA website.

GHD Pty Ltd | ABN 39 008 488 373
999 Hay Street, Level 10
Perth, WA 6000, Australia
T +61 8 6222 8222 | **F** +61 8 6222 8555 | **E** permail@ghd.com | **ghd.com**

Table of Contents

Table index

Figure index

1. SCOPE

This road building specification details the requirements for supply of material and delivery of **Earthworks and Pavement Construction** to the profiles, levels and surface finishes specified or as shown in the Contract Drawings. Construction consists of placing, compacting, finishing and maintaining. Both site-won and imported earthworks materials are included in the scope. Earthworks for structures, such as excavations, foundations and backfill at bridge abutments, are not included in the scope.

Specifications for the supply of unbound granular and centrally stabilised (plant-mix) pavement materials are provided in the Western Australia Local Government Association (WALGA) **Granular Pavement Materials** road building model specification.

Specifications for the supply of in situ stabilised pavement materials are provided in the WALGA **Pavement Rehabilitation** road building model specification.

Specifications for the supply of recycled pavement materials, such as sourced from construction and demolition activities, are provided in the joint Institute of Public Works Engineering Australasia (IPWEA)/WALGA **Specification for the Supply of Recycled Road Base**.

2. REFERENCES

Australian Standards, Main Roads Western Australia (Main Roads) test methods and Main Roads standards are referred to in abbreviated form (e.g. AS 1234, WA 123 or MRS 67-08-43). For convenience, the full titles are given below.

Equivalent Australian Standard test methods may be substituted for the Main Roads test methods quoted in the Specification.

Australian Standards

AS 1141	Methods for Sampling and Testing Aggregates
AS 1152	Specification for Test Sieves
AS 1160	Bituminous Emulsions for the Construction and Maintenance of Pavements
AS 1289	Methods of Testing Soils for Engineering Purposes
AS 1672	Limes and Limestones
AS 2008	Bitumen for Pavements
AS 2187	Explosives - Storage, Transport and Use
AS 2350	Methods of Testing Portland, Blended and Masonry Cements
AS 3705	Geotextiles - Identification, Marking and General Data
AS 3706	Geotextiles - Methods of Test
AS 3972	General Purpose and Blended Cements

Main Roads Test Methods

WA 0.1	Random Sample Site Location
WA 110.1	Moisture Content: Convection Oven Method
WA 110.2	Moisture Content: Microwave Oven Method
WA 115.1	Particle Size Distribution: Sieving and Decantation Method
WA 115.2	Particle Size Distribution: Abbreviated Method for Coarse & Medium Grained Soils
WA 120.2	Liquid Limit: Cone Penetrometer Method
WA 122.1	Plasticity Index

WA 123.1	Linear Shrinkage
WA 133.1	Dry Density/Moisture Content Relationship: Modified Compaction Fine and Medium Grained Soils
WA 133.2	Dry Density/Moisture Content Relationship: Modified Compaction Coarse Grained Soils
WA 134.1	Dry Density Ratio (Percent)
WA 135.1	Calibration of Nuclear Density Meters: Standard Density Blocks
WA 136.1	Moisture Ratio (Percent)
WA 140.1	Maximum Dry Compressive Strength
WA 141.1	Determination of the California Bearing Ratio of a Soil
WA 144.1	Foreign Material
WA 216.1	Flakiness Index
WA 220.1	Los Angeles Abrasion Value
WA 220.2	Los Angeles Abrasion Value of Crushed Limestone
WA 324.1	Determination of Field Density: Sand Replacement Method
WA 324.2	Determination of Field Density: Nuclear Method
WA 717.1	Dispersion of Bitumen in Soil
WA 730.1	Bitumen Content and Particle Size Distribution of Asphalt and Stabilised Soil: Centrifuge
WA 915.1	Calcium Carbonate Content

Main Roads Publications

6706-02-133	Water to be used in Pavement Construction
67-08-43	Digital Ground Survey Standard

Main Roads Specifications

301	Vegetation Clearing and Demolition
304	Revegetation

WALGA Road Building Specifications

Aggregate and Cementitious Binders
Earthworks and Pavement Construction
Erosion Control and Foreshore Protection
Granular Pavement Materials
Pavement Rehabilitation
Sprayed Bituminous Surfacing
Supply and Laying of Asphalt Road Surfacing (IPWEA / AAPA)
Supply of Recycled Road Base (IPWEA / WALGA)

Acts and Regulations

Aboriginal Heritage Act 1972
Contaminated Sites Act 2003
Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007
Environmental Protection Act 1986
Environmental Protection Regulations 1987
Environmental Protection (Clearing of Native Vegetation) Regulations 2004
Explosives and Dangerous Goods Act 1961
Health (Pesticide) Regulations 2011
Main Roads Act 1930
Occupational Safety and Health Act 1984
Occupational Safety and Health Regulations 1996
Rail Safety National Law (WA) Act 2015
Road Traffic Code 2000
Wildlife Conservation Act 1950

3. DEFINITIONS

The following particular definitions shall apply:

- “basecourse” shall be the material placed in the uppermost layer of the pavement providing the bulk of the structural capacity and upon which a surfacing may be applied.
- “contamination” shall be soil or rock that contains substances at levels above background concentrations that presents, or has potential to present, a risk of harm to human health, to the environment or to any environmental value.
- “Dieback” shall be infection with the plant pathogen *phytophthora cinnamomi* causing drought-like symptoms and death in native tree species, predominantly in Western Australia’s southwest.
- “general fill” shall be site-won, naturally occurring soil used in non-structural applications such as embankment foundation, general backfill and drainage bedding material.
- “Lot” [soil or rock] shall be the quantity of a single material type derived from a continuous, uninterrupted production process and dispatched from a single source. Shall be limited to no more than 2,500 m^3.
- “Lot” [earthworks or pavement] shall be a continuous section of the works having a uniform appearance, delivered using homogeneous materials and consistent processes and completed at the same time. Shall be limited to no more than one day’s production.
- “oversize material” shall be all material for use in road building, either natural or manufactured, with any dimension greater than 50 mm.
- “pavement” shall be the portion of the road, excluding shoulders, constructed above the subgrade for the purpose of supporting vehicular traffic.
- “retained pavement” shall be that portion of existing pavement remaining after removal of the existing seal.
- "rock excavation material" shall be all material requiring removal to achieve the levels presented in the Contract Drawings, including table drains, which cannot be ripped and excavated with a Caterpillar D10R (or equivalent) at a rate in excess of 90 m^3 (solid) per hour.
- “select fill” shall be imported, naturally occurring soil complying with specified requirements. Select fill is a higher standard material, as compared to general fill, specified for structural applications such as embankment construction, bridge foundation and backfill, in addition to pavement subgrade material.
- “spoil” shall be surplus material from excavations that is not required to complete the works, or material from excavations with properties that render it unacceptable for use in the works.
- “sub-base” shall be the material placed between the subgrade and the basecourse to make-up the required pavement thickness (i.e. over-and-above basecourse) and/or to provide a working platform.
- “subgrade” shall be the trimmed or prepared portion of the formation upon which the pavement is constructed.
- “unsuitable material” shall be all material for use in road building that includes substantial organic matter (e.g. peat), contains toxic or otherwise harmful substances, includes substantial foreign material (e.g. timber, plastic, metal), contains highly expansive particles (e.g. smectite clay) and/or is water saturated.

4. PRODUCTS AND MATERIALS

4.1 General

Unless otherwise specified by the Local Government, material for earthworks shall be suitable material extracted from cuttings on-site or, should such material be totally exhausted, shall be imported from approved sources.

Unless otherwise specified by the Local Government, material for pavements shall meet the requirements detailed in the WALGA road building specifications for **Granular Pavement Materials**, **Pavement Rehabilitation** and/or **Supply of Recycled Road Base**.

Material for earthworks and pavement construction shall be free from oversize and unsuitable material, as defined in Clauses 4.3 and 4.4 respectively, and shall be free from clods, stumps, roots, sticks, vegetable matter and any other deleterious material.

4.2 Use of Materials

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

Where material from excavations is suitable for use in earthworks, but the Contractor elects to:

– spoil it;
– use it for the Contractor's own purposes;
– use it as a source of pavement materials; or
– construct embankments with dimensions other than those shown on the Contract Drawings or to dimensions otherwise approved by the Local Government;

and a deficiency of material is thereby created, the Contractor shall make good that deficiency from sources of suitable material at no cost to the Local Government.

4.3 Oversize Material

4.3.1 General

Oversize material having any dimension greater than 100 mm shall not be used within 300 mm of the subgrade surface, shoulder surface and/or batter face.

Oversize material having any dimension greater than 300 mm shall not be used within 500 mm of the subgrade surface, shoulder surface and/or batter face. Such material shall not be used where other work under the Contract is to be completed including underground drainage, services, signs, street lighting and safety barriers.

Oversize material having any dimension greater than 1000 mm shall be reduced in size or shall be removed to spoil.

4.3.2 Spoil

Oversize material not used in earthworks shall be stockpiled in uniformly shaped heaps in spoil areas.

Oversize material shall be stockpiled in nominated spoil sites, as listed in ANNEXURE A. Where no such sites are nominated, oversize material shall be disposed of at an authorised waste disposal site.

4.4 Unsuitable Material

4.4.1 General

Unsuitable material and any other material that the Local Government deems to be unacceptable for use shall be disposed of at an authorised waste disposal site.

4.4.2 Contamination

Material subject to contamination and any other material that the Local Government deems to be contaminated shall be isolated from the works and subsequently disposed of in a manner and to a site in accordance with all relevant statutory and regulatory requirements. Where the contamination is a result of the Contractor's activities, the disposal shall be at no cost to the Local Government.

4.4.3 Removal and Replacement

Voids resulting from the excavation of unsuitable material shall be backfilled with conforming embankment material or other material approved by the Local Government. Prior to backfilling a void resulting from the excavation of unsuitable material, the Contractor shall give the Local Government at least 48 hours prior notice for the purpose of unsuitable material measurement in accordance with MRS 67-08-43.

4.5 Stockpile Sites

The Contractor shall construct and maintain stockpile sites in a tidy condition. Stockpile sites nominated by the Local Government for earthworks material and spoil are listed in ANNEXURE A. The Contractor may nominate alternative stockpile sites for Local Government approval no less than one (1) week prior to the planned transport of material.

The Contractor shall prepare and manage topsoil stockpiles as detailed in ANNEXURE B. Stockpile sites nominated by the Local Government for topsoil are shown in ANNEXURE B. The Contractor may nominate alternative stockpile sites for Local Government approval no less than one (1) week prior to the planned transport of material.

4.6 Earthworks Material

Material for earthworks shall be non-cohesive or low-cohesion granular material with no dimension greater than 100 mm unless otherwise specified by the Local Government. Where required, the earthworks material shall be free from contamination and certified “Dieback-free”.

4.6.1 General Fill

General fill material shall meet the grading requirements shown in Table 1 when tested in accordance with WA 115.1.

Table 1 General Fill Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass
37.5	80 – 100
2.36	30 – 100
0.075	0 - 10

General fill material shall also meet the other limits as shown in Table 2.

Table 2 General Fill Other Acceptance Limits

Test	Limits
Linear Shrinkage (WA 123.1)	≤ 3%
Organic Matter (AS 1289.4.1.1)	≤ 1%
Foreign Materials (WA 144.1)	
High density material (brick, tile, etc.)	< 5%
Low density material (plastic, plaster, etc.)	< 2%
Wood & plant material	< 1%
4-day Soaked California Bearing Ratio @ Specified Density & 100% OMC (WA 141.1)	Report [1]

Notes:

1) To be included with conformance certification.

4.6.1.1 Recycled Sand

Unless otherwise specified by the Local Government, sand recovered from construction and demolition activities is only suitable for use as general fill. Recycled sand shall be sourced from premises licenced under Part V of the

Environmental Protection Act 1986 by the Department of Water and Environmental Regulation (DWER) to supply such products. Recycled sand shall meet the requirements for general fill presented in Table 1 and Table 2.

4.6.2 Select Fill

Unless otherwise specified by the Local Government, select fill material shall be clean, non-cohesive granular material meeting the grading requirements shown in Table 3 when tested in accordance with WA 115.1.

Table 3 Selected Fill Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass
37.5	100
19.0	80 - 100
9.5	60 - 100
4.75	45 - 100
2.36	30 - 100
1.18	20 - 100
0.425	5 - 100
0.150	3 - 30
0.075	1 - 10

The source for the select fill material shall be free from contamination and certified “Dieback-free”. Select fill material shall also meet the other limits as shown in Table 4.

Table 4 Select Fill Other Acceptance Limits

Test	Limits
Linear Shrinkage (WA 123.1)	≤ 1%
Organic Matter (AS 1289.4.1.1)	≤ 1%
4-day Soaked California Bearing Ratio @ Specified Density & 100% OMC (WA 141.1)	Report [1]

Notes:

1) To be included with conformance certification.

4.6.3 Glass Cullet

Unless otherwise specified by the Local Government, glass cullet may be substituted for general fill and used in non-structural applications only.

Glass cullet shall be sourced from premises licenced under Part V of the Environmental Protection Act 1986 by DWER to supply such products. Glass cullet shall not contain recycled glass recovered from hazardous waste, laboratory equipment, televisions, computers, cathode ray tubes, porcelain products or cook tops.

Glass cullet shall be produced using a shape crushing plant (e.g. Barmac impactor) and shall be cleaned to ensure undesirable odours are eliminated.

Glass cullet material shall meet the grading requirements shown in Table 5 when tested in accordance with WA 115.1. Less than 1% of the material retained on the 4.75 mm sieve shall have a maximum dimension ratio greater than 5:1.

Table 5 Glass Cullet Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass
9.5	100
4.75	70 - 100
2.36	35 - 88

AS 1152 Sieve Size (mm)	% Passing by Mass
1.18	15 - 45
0.30	4 - 12
0.075	0 - 5

Glass cullet material shall also meet the other limits as shown in Table 6.

Table 6 Glass Cullet Other Acceptance Limits

Test	Limits
Organic Matter (AS 1289.4.1.1)	≤ 1%
Foreign Materials (WA 144.1)	
High density material (brick, tile, etc.)	< 5%
Low density material (plastic, plaster, etc.)	< 2%
Wood & plant material	< 1%
4-day Soaked California Bearing Ratio @ Specified Density & 100% OMC (WA 141.1)	Report [1]

Notes:

1) To be included with conformance certification.

4.7 Rock Fill Material

Rock fill shall consist of clean, hard, durable fragments of unweathered rock that shall not break up when alternately wetted and dried. Unless otherwise specified by the Local Government, shale, claystone, siltstone or mudstone shall not be used. Rock fill material shall be free from vegetable matter, lumps of clay, overburden and any other deleterious matter.

The particle size distribution of rock fill when tested in accordance with WA 115.1 shall meet the requirements shown in Table 7.

Table 7 Rock Fill Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass
1000	100
300	50 – 100
150	30 – 100
75.0	20 – 100
37.5	15 – 75
2.36	5 – 50

The rock fill material shall also meet the other limits as shown in Table 8.

Table 8 Rock Fill other Acceptance Limits

Test	Limits
Secondary Mineral Content (AS 1141.26) [1]	0 – 25%
Accelerated Soundness Index (AS 1141.29) [2]	≥ 94%

Notes:

2) The Secondary Mineral Content test is only applicable to basic igneous rock types.

2) The Accelerated Soundness Index test is only applicable to basic igneous rock types.

4.8 Drainage Layer Material

Material used in drainage layers shall meet the grading requirements shown in Table 9 when tested in accordance with WA 115.1.

Table 9 Drainage Layer Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass
37.5	90 - 100
2.36	30 - 100
0.075	0 - 1

Drainage layer material shall also meet the other limits as shown in Table 10.

Table 10 Drainage Layer Other Acceptance Limits

Test	Limits
Linear Shrinkage (WA 123.1)	≤ 1%
Organic Matter (AS 1289.4.1.1)	≤ 1%
4-day Soaked California Bearing Ratio @ Specified Density & 100% OMC (WA 141.1)	Report [1]

Notes:

1) To be included with conformance certification.

4.9 Pavement Material

Except where otherwise specified by the Local Government, all materials used in pavement layers shall conform to the requirements detailed in the relevant WALGA road building specification.

4.10 Geotextile

Geotextiles used in rock fill or drainage layers shall be a non-woven fabric consisting of long chain synthetic polymer fibres composed of at least 85% by mass of polyesters, polyolefins or polyamides. The fibres shall be formed into a fabric by needle punching, heat or chemical bonding processes, such that they are capable of retaining their relative position. Geotextile fibres shall be stabilised against ultra-violet (UV) radiation and shall have low water absorbency.

Geotextiles shall also meet the mechanical and hydraulic properties shown in Table 11 and Table 12 respectively.

Table 11 Mechanical Properties of Geotextiles

Test	Limit
G Rating (AS 3706.4 & 3706.5) [min] [1]	2000

Notes:

1) Burst Strength (CBR Plunger Method) shall be the 5th percentile value determined in accordance with AS 3706.4 and Puncture Resistance (Drop Cone Method) shall be the 5th percentile value determined in accordance with AS 3706.5.

Table 12 Hydraulic Properties of Geotextiles

Test	Limits
Equivalent Opening Size (AS 3706.7) [max] [1]	200 μm
Q_{100} (AS 3706.9) [min] [1, 2]	50 l/m²/sec

Notes:

1) Maximum Equivalent Opening Size and Minimum Q100 are mean values.

2) Q100 = Flow rate under 100mm constant head determined using the Perpendicular Flow Test.

4.11 Water

All water used in embankment material manufacture or any earthworks or pavement construction process shall comply with the requirements of 6706-02-133. Unless otherwise specified by the Local Government, water shall be free from significant quantities of suspended material, organic matter, salt, oil or acid.

5. PREPARATORY WORKS

5.1 Permits And Clearances

No clearing, topsoil removal or earthworks shall commence until all permits and clearances have been obtained in accordance with all relevant statutory and regulatory requirements. The Contractor shall develop and implement management plans where necessary to ensure compliance.

The Contractor shall investigate the location of all services in the area of the works and shall take all precautions necessary to prevent damage to existing services. The Contractor shall be fully responsible for damage to existing services and shall make good any losses by other parties as a result of the damage at no cost to the Local Government.

5.2 Survey Set Out

The works shall be set out and constructed in accordance with the alignments, levels, grades and cross sections as shown in the Contract Drawings. The Contractor shall be responsible for the accuracy of setting out the works.

The works shall be set out using appropriate survey equipment from the provided pegs and benchmarks and these shall be used constantly during the progress of the works to check accuracy. Care shall be taken not to disturb any survey pegs, survey recovery pegs or survey marks. Where it is necessary to cover a survey peg, such a peg shall have a substantial stake driven in beside it and this stake shall extend at least 75 mm above the finished surface and be appropriately marked to clearly identify it.

Any State Survey Mark affected by the works shall be identified and immediately reported to the Department of Land Administration for replacement or relocation.

5.3 Clearing

Clearing of vegetation shall be completed only to an extent sufficient to facilitate the construction works. Natural vegetation shall be retained where possible. Where the Local Government specifies the extent of clearing in Contract Drawings or otherwise, the Contractor shall limit the clearing to the area specified. The Contractor shall clearly mark out the extent of the area to be cleared with pegs and tags prior to commencing works.

Clearing shall include, but not be limited to:

1. the felling, cutting and removal of all trees standing or fallen;
2. the removal of all brush, shrubs, grasses and other vegetation;
3. the removal of rubbish and debris;
4. the removal of surface boulders and boulders dislodged during vegetation removal; and
5. the grubbing out of all stumps and roots larger than 80 mm diameter or with any dimension greater than 300 mm to a depth of 600 mm below either the existing surface or the finished subgrade surface, whichever is the lower.

Depressions caused by grubbing out tree roots and stumps, in cleared areas with no topsoil removal, shall be promptly backfilled with clean fill and compacted to the density and surface levels of the surrounding undisturbed ground.

Material cleared shall be either removed from site and disposed of in an approved manner or chipped and mulched as directed by the Local Government.

5.3.1 Weed Control

Clearing and earthwork operations shall be undertaken to meet the requirements for weed control and shall comply with all statutory and regulatory requirements and relevant management plans.

The Contractor shall implement an approved weed control program as necessary to control all weed species prior to undertaking any other works.

The Contractor shall avoid spreading weeds during clearing operations and shall remove all weeds from the ground surface and dispose of them in an authorised waste disposal site prior to clearing operations.

5.3.2 Erosion Control

Clearing and earthwork operations shall be undertaken to minimise all erosion and sedimentation and meet all statutory and regulatory requirements for erosion and sedimentation control.

5.3.3 Dieback Control

Clearing and earthwork operations shall be undertaken in accordance with the procedures for dieback control and shall comply with all statutory and regulatory requirements and relevant management plans (where dieback is a known risk).

5.4 Topsoil Removal

Topsoil shall only be the upper surface layer that consists of disease-free and weed-free surface soil and vegetable matter stripped and stockpiled after clearing for later re-spreading. Topsoil may include approved processed vegetative material incorporated during the clearing operations.

During the removal of topsoil, the Contractor shall take all precautions necessary to prevent damage to any retained vegetation within or adjoining the limits of clearing. Retained vegetation shall not be covered or buried with topsoil.

Cleared vegetation dropped to ground during the clearing operations and not to be removed shall be mixed into the existing topsoil, using suitable cultivation equipment or land conditioners, prior to the removal and stockpiling of the topsoil.

Topsoil shall be removed to the depth specified in the Contract Drawings or as otherwise specified by the Local Government. If not specified, a nominal depth of 75 mm of topsoil shall be removed.

All topsoil and vegetation from identified weed infested areas shall be stripped separately to the nominated depth and deposited in the nominated spoil sites or authorised waste disposal sites.

The Contractor shall ensure that all machinery used in the removal of weed-infested topsoil, shall be cleaned down before and between operations to prevent the introduction and spread of weeds outside weed infested areas.

Topsoil to be windrowed shall be stripped to the nominated depth and bladed outwards away from the centreline of the alignment or from other areas of excavation within the limits of clearing. For other areas of excavation, the topsoil shall be windrowed to the downstream side of the area wherever practical to avoid creating a dam effect for surface drainage.

Stockpiling operations shall occur in a manner to ensure that the properties of the topsoil are not degraded nor the topsoil made unsuitable for use in revegetation. Except for short-term storage during cartage, all stockpiles of topsoil shall be placed and managed as shown in ANNEXURE B.

6. EXCAVATIONS

6.1 General

Excavations in cut sections including benching shall be carried out to the shapes shown in the Contract Drawings and to the specified tolerances. General requirements for benching of stepped cut batters are given in the Contract Drawings.

Cut batters, other than in rock, greater than three metres in height shall be benched or stepped to provide drainage and erosion control, as shown in the Contract Drawings or ANNEXURE B. Cut batters in rock shall be treated as shown in the Contract Drawings or ANNEXURE B.

Benches shall be maintained free of loose materials until the finishing of batters and ground surfaces. Each bench shall drain back away from the lowest cut face and provide for longitudinal drainage.

All suitable materials from excavations may be used in embankment construction. No material from cutting operations shall be incorporated into the road pavement.

Any over-excavation below the subgrade surface and table drains shall be backfilled with conforming embankment material. Any backfilled material more than 150 mm below the subgrade surface shall be compacted as specified for embankment construction.

6.2 Existing Pavement

6.2.1 Road Widening

The existing bituminous surfacing shall be cut where new pavement is to be blended into existing work, or where widening is required. The existing surfacing shall be cut along a marked alignment and the area to be treated shall be excavated to the depth detailed in the Contract Drawings and to the specified tolerances. Prior to any cutting, the Contractor shall mark out and indicate to the Local Government the position of the proposed line of cut.

The cut edges of the existing surfacing and the wall of the excavation shall be in a smooth straight line, have no tears, jagged edges or undercutting of the materials to be retained. The sides of the cut shall be made at a slope of 1:1 (vertical to horizontal) sloping down and away from the material to be retained. There shall be no separation between the retained surfacing and underlying pavement material. The cut edge shall be to a smooth alignment within 50 mm of its marked position. The rate of change of the position of the cut edge shall not exceed 1 in 100 from the desired line.

Where any portion of existing pavement is shown on the Contract Drawings as "unused", the corresponding pavement, including bituminous products and manufactured materials, shall be ripped and removed from the works. The removed materials may be reused in embankment construction provided the material complies with the requirements for embankment material (Clause 4.6). Material that is not reused on site shall be removed to spoil areas, as shown in ANNEXURE B, or disposed to an authorised waste disposal site.

6.2.2 Overlays

The existing surfacing shall be removed from the roadway by grader blade or cold milling with minimal disturbance to the underlying pavement. The existing bituminous surfacing shall be maintained for as long as practicable before its removal.

Following the removal of the existing surfacing, the exposed surface of the retained pavement shall be prepared to provide a suitable surface prior to the addition of new pavement material. This preparation work shall include, but shall not be limited to, watering, rolling, and trimming of high spots.

6.3 Rock Excavation

6.3.1 General

Prior to undertaking a digital ground survey, the top surface of rock shall be exposed and cleared of all loose material, as far as practicable.

Rock cuttings and exposed rock surfaces adjacent to the roadway shall be trimmed to provide a natural appearance similar to local cliff faces. Any overhanging, loose or unstable material, whether outside or behind the specified slope, shall be removed. Trimming of the batters to the required standard shall be carried out by pulling down rock from a face excavated near the design line, breaking the rock on natural joints where possible.

“Rock excavation” shall be:

– in table drains, including independently graded table drains, the material that cannot be ripped and excavated using a Caterpillar D10R (or equivalent) at an effective total rate in excess of 40 m³ (solid) per hour. ANNEXURE C shows a diagrammatic definition for rock in table drains.
– in other drains, the material that cannot be ripped and excavated using a Caterpillar D10R (or equivalent) at an effective total rate in excess of 40 m³ (solid) per hour.
– in trenches, the material that cannot be ripped and excavated using a CASE 480E (or equivalent) with a 450 mm wide rock bucket with teeth fitted.

In rock cuttings, a 150 mm compacted thickness improved subgrade layer shall be constructed using embankment material according to Clause 7.3. The surface of the exposed rock shall be trimmed to allow free drainage to the table drains prior to the placement of the improved subgrade.

6.3.2 Blasting

6.3.2.1 General Requirements

The Contractor shall be liable for any accident, damage or injury to any person, property or thing resulting from the use of explosives. The Contractor shall conduct a survey of all structures within the region of influence of the proposed site of blasting to determine their pre-blast condition.

All purchase, manufacture, handling, transport, storage and use of explosives shall be in accordance with:

1. Explosives and Dangerous Goods Act 1961,
2. Local Authority by-laws, and
3. AS 2187.

Should any conflict of requirements occur, the requirements of the Act shall take precedence, followed by Local Authority by-laws.

Where explosives are used during the course of this Contract or any works associated with this Contract, the use, transportation and storage of explosives shall be under the direct control of, and be the responsibility of, an appointed qualified person who possesses a current Shot-firer's Permit issued by the Chief Inspector of Explosives for Western Australia.

At least three (3) weeks prior to any blasting or storage of materials on site, the Contractor shall submit to the Local Government details of all equipment, materials and procedures to be used for blasting and storage magazines, including the qualifications of the person in charge of blasting operations.

If the appointed Shot-firer leaves the Site, the Contractor shall notify the Local Government in writing of the name and permit number of the replacement Shot-firer at least three (3) days prior to any use, transportation and storage of explosives being carried out.

6.3.2.2 Blasting Records

The Contractor shall keep and maintain all records of blasting as required by the relevant Acts, Regulations and By-Laws. These records shall be made available to the Local Government on request.

6.4 Spoil

6.4.1 Spoil Areas

Spoil shall be stockpiled at sites nominated by the Local Government in ANNEXURE A. The Contractor may nominate alternative stockpile sites for Local Government approval no less than one (1) week prior to the planned transport of material. Where no spoil stockpile sites are nominator or approved, spoil shall be disposed to an authorised waste disposal site.

6.4.2 Use of Surplus Materials

Materials deemed surplus for road construction purposes may be used for revegetation and landscaping purposes with prior approval from the Local Government. Spoil material used in revegetation and landscaping shall not

contain contaminated materials, debris, rubbish or other deleterious materials that are considered environmentally hazardous or otherwise unsuitable by the Local Government. The placement of surplus material in areas designated for revegetation and landscaping shall achieve and or maintain the landform nominated in the Contract Drawings.

Spoil material used in the works shall have a minimum 500 mm cover of clean embankment material. Spoil material shall remain stable and free draining in the long term and be compacted to a similar density as the surrounding ground.

7. CONSTRUCTION OF EARTHWORKS

7.1 Embankment Foundation

After the completion of clearing and topsoil removal, the material upon which embankment is to be constructed shall be compacted as specified in this Clause to the depth shown in ANNEXURE D. The embankment foundation shall be watered or dried as required to achieve the minimum specified density.

Where the embankment is to be founded on the existing road, the existing seal shall be removed and the retained pavement prepared in accordance with Clause 6.2.

Unless otherwise specified by the Local Government, the existing seal material may be incorporated into the embankment foundation where pulverised to a maximum size less than 37.5 mm sieve and compacted in layers greater than 100 mm thickness. No seal material shall be placed within 500 mm of the subgrade surface, shoulder surface and/or batter face.

The embankment foundation shall be maintained in its Conforming Condition until embankment construction commences.

7.2 Embankment

Embankment construction shall not proceed until certification of embankment foundation conformance with the requirements of this Specification is provided by the Contractor to the Local Government.

Embankment materials shall be placed to the shapes and levels shown in the Contract Drawings with the specified batter tolerance.

Embankment material shall be worked in compacted layers not greater than 300 mm or less than 100 mm. Where less than 100 mm is required to be worked, the underlying material shall be scarified to such a depth that the resulting thickness of the layer to be worked is greater than 100 mm. Embankment material shall be placed uniformly without abrupt changes in material type, quality or size. The embankment material shall be watered or dried as required to achieve the minimum specified density.

Each layer shall be worked parallel to the finished pavement surface and shall, where practicable, extend the full width of the embankment at that particular level. The Contractor shall not allow the ponding of water on the embankment. Construction of embankment lifts shall not proceed until conformance of the underlying layer with the requirements of this Specification is confirmed.

7.3 Subgrade

Subgrade preparation shall be completed in all areas where a pavement is to be constructed, except where the pavement is to be placed directly onto any retained pavement. The subgrade shall be in a homogeneous, uniformly bonded condition with no evidence of layering or disintegration.

The subgrade surface shall be constructed to the shape and levels as shown in the Contract Drawings with the tolerances specified. During compaction, the Characteristic Moisture Content Ratio (CM_c) of the subgrade should be maintained within 70 - 110% of the optimum moisture content determined by WA 133.1 or 133.2.

The subgrade shall be maintained in its Conforming Condition until pavement construction commences. The subgrade surface shall be watered as necessary to prevent shrinkage cracking, dusting or loosening of its surface.

7.4 Rock Fill

Rock fill may be used anywhere in embankment construction except within two (2) metres of the subgrade surface. The Contractor shall ensure the rock fill material does not segregate and is not contaminated during placement. Foundations under rock fill are to be stripped of topsoil and shaped to ensure drainage is maintained and ensure that erosion of the foundation will not occur. The finished outer face of embankments utilising rock fill shall present a generally smooth, even textured and uniformly coloured appearance.

The compacted rock fill layer thickness must not exceed 1000 mm. The compaction of the rock fill material shall be deemed to be satisfactory when the rock fill has been compacted with not less than five (5) passes of a vibratory smooth drum or pad foot roller. Each roller pass shall overlap the previous one by not less than 10% of the roller width. At least 300 litres of water per cubic metre of rock fill shall be added to facilitate compaction (30 litres per square metre per 100 mm of layer thickness).

The vibratory smooth drum or pad foot roller shall be a self-propelled roller with a static mass of not less than eighteen (18) tonnes and a centrifugal force on the drum of not less than 150 kN in the frequency range of 20 to 30 Hertz. The rolling speed for the vibratory roller shall not exceed 7 km per hour. Only driven drum rollers shall be used.

A geosynthetic must be used on top of the rock fill where the material fulfills the criteria presented in Equation 1.

$$\frac{D_{15}}{D_{85}} \geq 5 \qquad \text{Equation 1}$$

where: D15 is the particle size in millimetres at which 15% of the sample is smaller in size; and

D85 is the particle size in millimetres at which 85% of the sample is smaller in size.

7.5 Drainage Layer

The drainage layer shall consist of a geotextile lining and a free-draining material meeting the requirements detailed in Clause 4.8. The drainage layer shall be constructed immediately above the subgrade or as shown in the Contract Drawings and shall connect to a positive drainage system.

7.5.1 Geotextile

Each roll of geotextile shall be provided with a suitable covering to protect the fabric against moisture and ultra-violet radiation. Each roll shall be marked in conformance with AS 3705.

Rolls shall be stored on site under a waterproof cover and shall be supported off the ground. The Contractor shall take appropriate measures to protect the geotextile from damage.

The Contractor shall ensure the process of installation of the geotextile does not damage the fabric.

Unless otherwise shown on the Contract Drawings, the minimum overlap shall be 300 mm. Successive sheets of geotextile shall be overlapped a minimum of 300 mm with the upslope section overlying the down slope section.

7.5.2 Drainage Material

The period of time between laying out and covering the geotextile shall not exceed fourteen (14) days.

The uncompacted thickness of drainage material placed directly over the geotextile shall be a minimum uncompacted thickness of 300 mm. Unless otherwise specified by the Local Government, vibratory compaction and heavy compaction plant shall not be applied for the initial lift of drainage material.

Construction of the drainage layer shall be as specified for sub-base material.

7.6 Acceptance

7.6.1 Surface Width

The outer top edge of the earthworks, measured at any location, shall lie within -0 mm to +100 mm of the position shown in the Contract Drawings.

7.6.2 Surface Shape

The earthworks surface shall not deviate by more than 15 mm from a 3-metre straight edge, measured in any direction and placed at any position.

For widenings, the cross fall measured at right angles to the road centreline shall be within ±0.5% of the existing cross fall, or within ±0.5% of any cross fall detailed in the Contract Drawings.

7.6.3 Surface Level

The level of the completed earthworks surface, measured at any location, shall lie within -35 mm to +5 mm of the position shown in the Contract Drawings.

7.6.4 Compaction

Permissible method(s) for demonstrating compaction conformance for each Lot of earthworks are presented in Table 13.

Table 13 Compaction Certification for Earthworks Materials

Earthworks Material	Passing 37.5 mm Sieve Opening (%)	Compaction Specification		
		End-product	Contractor's Method	Principal's Method
Embankment Foundation	≥ 80%	S [1]	O [2]	- [3]
	< 80%	- [3]	- [3]	S [1]
Embankment Construction	≥ 80%	S [1]	O [2]	- [3]
	< 80%	- [3]	- [3]	S [1]
Subgrade	≥ 80%	S [1]	- [3]	- [3]
	< 80%	- [3]	- [3]	S [1]
Rock Fill	< 80%	- [3]	- [3]	S [1]
Drainage Layer	≥ 80%	S [1]	- [3]	- [3]

Notes:

1) Specified methodology for demonstrating compaction conformance.
2) Optional methodology for demonstrating compaction conformance; requires prior approval from Local Government.
3) Not applicable.

7.6.4.1 End-product Specification

Where 80% or more by mass of the material passes the 37.5 mm sieve opening, compaction conformance shall be assessed using an end-product specification. The Characteristic Dry Density Ratio (R_c) shall be determined as detailed in Clause 9.2 and shall be considered conforming where greater than the minimum value presented in ANNEXURE D.

7.6.4.2 Contractor's Method Specification

Where 80% or more by mass of the material passes the 37.5 mm sieve opening, the Contractor may develop a method of compaction, with suitable controls to ensure the minimum Characteristic Dry Density Ratio (R_c) specified in ANNEXURE D is achieved, for Local Government approval no less than two (2) weeks prior to commencing works.

In addition to the Contractor's nominated controls, the Characteristic Moisture Content Ratio (CM_c) shall be determined as detailed in Clause 9.3 and should be maintained within 70 - 110% of the optimum moisture content for the duration of the compaction process.

Where the compacted layer is nonhomogeneous, the Contractor shall:

– establish a method of compaction for each type of material; and
– select Lot boundaries to include material of constant quality without obvious changes in attribute values.

7.6.4.3 Principal's Method Specification

Where less than 80% by mass of the material passes the 37.5 mm sieve opening, the Contractor shall follow the method of compaction specified below. Unless otherwise specified by the Local Government, the compaction process shall include:

1. maintaining the Characteristic Moisture Content Ratio (CM_c) within 70 – 110% of the optimum moisture content, determined as detailed in Clause 9.3, for the duration of the compaction process;
2. application of not less than five (5) complete coverages of a vibratory pad-foot roller with a total static mass greater than ten (10) tonnes and a centrifugal force on the drum greater than 150 kN in the frequency range of 20 to 30 Hertz;
3. application of not less than four (4) complete coverages of a grid roller with a total static mass greater than 13 tonnes, an open mesh drum of approximately 1.7 m diameter and 1.8 m width and mesh spacing of 125 mm x 125 mm; and
4. application of not less than six (6) complete coverages of a vibratory smooth-drum or rubber-tyred roller with a total static mass greater than 15 tonnes.

Each roller pass shall overlap the previous by not less than 10%. Pad-foot, smooth-drum and rubber-tyred rollers shall be the driven type and shall be operated at speeds not exceeding seven (7) km per hour. Grid rollers shall be towed behind a rubber-tyred tractor and shall be operated at speeds between 15 and 25 km per hour.

The compaction process detailed above does not apply for rock fill and the specified Principal's method for that material is presented in Clause 7.4.

8. CONSTRUCTION OF PAVEMENT

8.1 General

Pavement construction shall not proceed until certification of subgrade conformance with the requirements of this Specification is provided by the Contractor to the Local Government.

Where a drainage layer has been constructed on the prepared subgrade surface, the drainage layer shall be the foundation for the subsequent pavement layer(s).

Materials for use in pavement construction shall be of consistent quality and appearance, shall be moisture conditioned as appropriate for the Type and shall be handled in a manner that minimises segregation, breakdown and wastage.

8.2 Spreading

Each pavement layer shall be worked parallel to the finished pavement surface and shall extend the full width of the pavement at that particular level.

Sub-base and basecourse shall be worked in layers with compacted thickness between 100 and 250 mm. Where less than 100 mm is being added to an existing pavement (overlay), the underlying pavement shall be scarified to such a depth to ensure the resulting compacted thickness of the layer to be worked is not less than 100 mm.

Unless otherwise specified by the Local Government:

– transverse joins shall be offset from one layer to the next by not less than five (5) metres; and
– longitudinal joins shall be located within 300 mm of the planned edge/lane line.

8.3 Compaction

During compaction, the Characteristic Moisture Content Ratio (CM_c) of the pavement layer shall be greater than 95% of the optimum moisture content determined by WA 133.1 or 133.2. Compactive effort shall be consistently applied both longitudinally and transversely to achieve the minimum Characteristic Dry Density Ratio (R_c) presented in ANNEXURE D determined in accordance with Clause 9.2.

8.4 Trimming

The pavement shall be constructed to the width, shape and level as shown in the Contract Drawings with the tolerances specified.

Trimmings may be used in the construction of a subsequent Lot, where homogenised with any other material composing the Lot. If greater than 5% by mass of the material making up the Lot is comprised of trimmings, the blended material shall be reassessed, in accordance with the relevant specification, prior to use in the works. Materials not subject to reassessment shall be disposed to an authorised waste disposal site.

Final trim shall be completed prior to the basecourse layer achieving the maximum dryback Characteristic Moisture Content Ratio (CM_c) presented in ANNEXURE D. Final trim shall result in the removal of not greater than 20 mm of granular pavement material from the compacted basecourse surface. Where the maximum dryback and/or trim thickness are exceeded, the basecourse layer shall be reworked in accordance with Clause 8.6.

8.5 Dryback

Construction of pavement layers shall not proceed until the underlying layer has achieved the maximum dryback Characteristic Moisture Content Ratio (CM_c) presented in ANNEXURE D determined in accordance with Clause 9.3.

Where the subgrade or pavement layer is comprised of material with less than 80% by mass passing the 37.5 mm sieve opening, the dryback Characteristic Moisture Content Ratio (CM_c) shall be determined on that portion of the material that passes the 37.5 mm sieve opening.

The maximum dryback Characteristic Moisture Content Ratio (CM_c) of basecourse Lots shall be determined for both the upper half and lower half of the basecourse layer measured in accordance with Clause 9.3.

8.6 Rework

Where a pavement Lot requires rework, due to failing to meet the requirements of this Specification, reworking shall comprise ripping to a minimum depth of 100 mm.

Type 1, 2, 3, 5.1 and 5.3 granular pavement materials may be reworked a maximum of twice. Type 4.1 and 5.2 granular pavement materials shall not be reworked more than once. Where Type 4.1 granular pavement material has dried back to less than 80% of the optimum moisture content, it shall not be reworked.

Unless otherwise specified by the Local Government, materials that exceed the maximum rework allowance shall be reassessed, in accordance with the relevant specification, prior to use in the works. Materials not subject to reassessment shall be disposed to an authorised waste disposal site.

8.7 Acceptance

8.7.1 Surface Finish

Completed pavement layers shall be in a homogeneous, uniformly bonded condition with no evidence of layering, cracking, disintegration or surface tearing.

The finished surface shall appear as a stone mosaic interlocked with fine material and shall be dense, even textured and tightly bonded. Accumulation of fines on the surface shall be avoided.

8.7.2 Surface Width

The outer top edge of each pavement layer, measured at any location, shall lie within -0 mm to +100 mm of the position shown in the Contract Drawings.

8.7.3 Surface Shape

The pavement surface shall not deviate by more than 10 mm from a 3-metre straight edge, measured in any direction and placed at any position.

For widenings, the cross fall measured at right angles to the road centreline shall be within ±0.5% of the existing cross fall, or within ±0.5% of any cross fall detailed in the Contract Drawings.

8.7.4 Surface Level

The level of the completed pavement surface, measured at any location, shall lie within -20 mm to +5 mm of the position shown in the Contract Drawings.

8.7.5 Compaction and Dryback

Each pavement layer shall be compacted to the minimum Characteristic Dry Density Ratio (R_c) shown in ANNEXURE D. Each pavement layer shall be dried back to the maximum dryback Characteristic Moisture Content Ratio (CM_c) shown in ANNEXURE D.

8.8 Maintenance

The surface of compacted subgrade and pavement layers shall be maintained in a manner to minimise dust generation, ravelling, erosion, deformation or any other damage. The surface shall be kept clean and free from contamination until subsequent pavement works commence.

Completed pavement layers shall be maintained to the specified standards of surface finish, width, shape, level, compaction and dryback until the bituminous surfacing is applied.

Watering shall be continued as necessary to prevent shrinkage cracking, dusting and loosening of the surface.

9. MATERIAL QUALITY

9.1 General

The Contractor shall implement a quality management system to ensure material supplied under the Contract complies in all respects to the specified requirements for the Type of material purchased.

Testing shall be carried out in accordance with the relevant Main Roads or equivalent Australian Standard test method. Sampling methods shall be random and unbiased. Random site selection must be undertaken in accordance with WA 0.1.

The frequency of tests shall always be adequate to demonstrate that the material complies with the Specification. As a minimum, testing frequencies shall be as shown in Table 15 and Table 16. Prior to supply, the Contractor shall certify that the material complies in all respects with the specified requirements and shall provide National Association of Testing Authorities, Australia (NATA) endorsed test certificates to demonstrate compliance.

Unless otherwise specified, all testing shall be performed by a Laboratory holding current NATA accreditation for the methods undertaken. NATA accreditation shall be maintained until the completion of the Contract. All test reports shall be NATA endorsed by a current approved signatory for the Laboratory conducting the testing.

The Contractor shall allow, or cause to allow, the Local Government ready access to the quarry, pit, production and/or manufacturing site to inspect the works and/or to collect material samples.

9.2 Density Testing

Unless otherwise specified by the Local Government, density shall be measured in situ using a nuclear moisture/density meter in accordance with WA 324.2. Nuclear moisture/density meters shall be calibrated in accordance with WA 135.1 on standard blocks. All measurements shall be made using the direct transmission mode at the maximum depth that can be accommodated within the layer.

For materials with in situ densities less than 1.4 t/m^3 or greater than 3.05 t/m^3, density shall be measured using sand replacement in accordance with WA 324.1.

The conformance of every Lot of work under the Contract with respect to density shall be determined by comparing the characteristic dry density ratio (R_c) of the Lot to the limit specified in the Specification. The characteristic dry density ratio (R_c) shall be calculated as shown in Equation 2.

$$R_c = R - (k \times s) \qquad \text{Equation 2}$$

where: R is the mean of dry density ratio tests for the Lot being assessed, reported to the nearest 0.1%;

k is the application specific multiplier presented in Table 14; and

s is the standard deviation of dry density ratio tests for the Lot being assessed.

The mean of dry density ratio tests (R) for each Lot shall be calculated from no less than the number of sample site locations (n) specified in Table 14. Sample site selection shall be done in accordance with WA 0.1 and no portion of the works shall be excluded from testing.

Table 14 Application Specific Factors for Characteristic Value Determination

Works Component	Primary Distributors		District and Local Distributors		Access Streets	
	n	k	n	k	n	k
Embankment Foundation	6	0.50	5	0.46	4	0.21
Embankment Construction	6	0.50	5	0.46	4	0.21
Select Fill / Backfill	6	0.50	5	0.46	4	0.21
Drainage Layer	6	0.50	5	0.46	4	0.21
Subgrade	6	0.50	5	0.46	4	0.21
Sub-base	9	0.59	7	0.54	4	0.21
Basecourse	9	0.59	7	0.54	4	0.21

9.3 Moisture Content Testing

Unless otherwise specified by the Local Government, moisture content shall be measured using the oven method in accordance with WA 110.1. Where it is not practicable to apply the oven method, the microwave method (WA 110.2) may be used after a correlation between the oven and microwave methods has been determined for the material being measured.

The conformance of every Lot of work under the Contract with respect to moisture content shall be determined by comparing the characteristic moisture content ratio (CM_c) of the Lot to the limit specified in the Specification. The characteristic moisture content ratio (CM_c) shall be calculated as shown in Equation 3.

$$CM_c = M + (k \times s) \qquad \text{Equation 3}$$

where: M is the mean of moisture content ratio tests for the Lot being assessed, reported to the nearest 0.1%;

k is the application specific multiplier presented in Table 14; and

s is the standard deviation of moisture content ratio tests for the Lot being assessed.

The mean of moisture content ratio tests (M) for each Lot shall be calculated from no less than the number of sample site locations (n) specified in Table 14. Sample site selection shall be done in accordance with WA 0.1 and no portion of the works shall be excluded from testing.

9.4 Frequency of Testing

Table 15 Minimum Testing Frequency for Imported Materials

Method		Material Type	Minimum Frequency
WA 115.1	Particle Size Distribution	Rock fill; General fill; Select fill; Glass cullet; Drainage layer	1 : Lot
WA 123.1	Linear Shrinkage	General fill; Select fill; Drainage layer	1 : Lot
WA 141.1	California Bearing Ratio of a Soil	General fill; Select fill; Glass cullet; Drainage layer	1 : 10,000 m^3
WA 144.1	Foreign Materials	General fill; Glass cullet	1 : Lot
AS 1141.26	Secondary Minerals Content	Rock fill	3 : source
AS 1141.29	Accelerated Soundness Index	Rock fill	3 : source
AS 1289.4.1.1	Organic Matter Content	General fill; Select fill; Glass cullet; Drainage layer	3 : source
AS 3706	Geotextile Properties	-	1 : 10,000 m^2

Table 16 Minimum Testing Frequency for Earthworks and Pavement

Method		Material Type	Minimum Frequency
AS 1289.6.3.3	Perth Sand Penetrometer	Embankment	n : Lot [1]
WA 115.2	Particle Size Distribution	Embankment; Drainage; Subgrade; Sub-base; Basecourse	2 : Lot
WA 134.1	Dry Density Ratio	Embankment; Drainage; Subgrade; Sub-base; Basecourse	n : Lot [1]
WA 136.1	Moisture Ratio (construction)	Embankment; Drainage; Subgrade; Sub-base; Basecourse	n : Lot [1]
WA 136.1	Moisture Ratio (dryback)	Subgrade; Sub-base; Basecourse	n : Lot [1]
WA 313.2	Surface Shape	Subgrade; Sub-base; Basecourse	3 : Lot

Notes:

1) Application specific n-value presented in Table 14.

10. REHABILITATION

10.1 General

Following the completion of construction operations, all batter and ground surfaces as nominated shall be prepared for revegetation and landscaping in accordance with Main Roads Specification 304.

The finishing operations shall include as nominated the cultivation or ripping of soil surfaces, the spreading of topsoil and/or mulch and batter protection works in accordance with Main Roads Specification 304.

All imported topsoil and/or mulch material shall be supplied in accordance with Main Roads Specification 304.

10.2 Finishing of Batters and Ground Surfaces

Except during the construction of benched or stepped batters, batter slopes shall be smoothly shaped to a uniform plane from top to bottom and shall not at any point vary from the specified slope by more than 150 mm measured normal to the specified batter slope.

The top and toe of all batters shall be rounded, where practical, to match the shape of the surrounding topography as shown in ANNEXURE B, unless otherwise specified in the Contract.

The surface of all batters and other areas nominated for revegetation and landscaping works shall be excavated and filled, shaped and/or graded as necessary to achieve the finished soil levels and contours nominated in the Contract Drawings, prior to any surface preparation and soil improvements.

The toe of mounds shall be graded evenly to meet adjoining surface levels. The ground surface shall be shaped and/or graded evenly to avoid abrupt changes in levels abutting structures and paved surfaces.

Median or traffic island areas nominated for revegetation shall be prepared in accordance with Main Roads Specification 304.

Soil surfaces adjacent to rear face of kerb and edge of paving shall be prepared in accordance with Main Roads Specification 304.

Unless shown otherwise in the Contract Drawings or ANNEXURE B, existing redundant pavement shall be ripped and removed in accordance with Clause 6.2.1 and the area prepared by grading or other means to form a loose and roughened surface.

Topsoil from windrows and or stockpiles shall be prepared in accordance with Main Roads Specification 304.

Unless otherwise specified by the Local Government, the Contractor shall place any large rocks or boulders retained for use in landscaping as shown in the Contract Drawings, ensuring that the rocks or boulders are not scarred or broken by equipment during placement.

Unless otherwise specified by the Local Government, each rock or boulder shall be placed in accordance with Main Roads Specification 304.

Unless otherwise specified by the Local Government, the Contractor shall place nominated tree trunks salvaged from clearing operations as shown in the Contract Drawings, ensuring that the tree trunks are not broken by equipment during placement.

Where nominated, the Contractor shall evenly spread sub-base material over all stepped and sand fill batter surfaces to a nominal depth of 25 mm, unless otherwise specified in the Contract Drawings.

Where nominated, the Contractor shall finish soil surface of batters shall be marked by tracked vehicles running perpendicular to the contours of the slope, unless otherwise specified in the Contract Drawings.

Where nominated, the Contractor shall incorporate chipped vegetation mulch soils, as shown in the Contract Drawings or ANNEXURE B.

Unless otherwise specified by the Local Government, the finished soil surface of all batters and embankment slopes shall be left in a roughened state to facilitate revegetation works.

The Contractor shall ensure that all finished soil surfaces are protected from erosion and weed infestation until the revegetation and landscaping works have commenced or a Certificate of Practical Completion has been issued.

The Contractor shall implement appropriate measures where necessary to divert upslope runoff and excessive surface water flows away from areas to be treated for revegetation and landscaping.

The Contractor shall implement weed control measures in accordance with the approved weed control program and as shown in ANNEXURE B.

Any erosion or scouring of the surfaces nominated for revegetation shall be filled with embankment material and lightly compacted to match the surrounding ground level or nominated design levels.

The use of erosion control matting, mulch, seeding or hydro-mulching for soil surface protection and erosion control shall be in accordance with Main Roads Specification 304.

10.3 Topsoil Respread

Topsoil shall be placed as soon as practical following basecourse operations and/or other construction operations, in accordance with Main Roads Specification 304 and as shown in ANNEXURE B.

10.4 Mulch Respread

Approved mulch shall be placed as soon as is practical after finishing and preparation of batters and ground surfaces, in accordance with Main Roads Specification 304 and as shown in ANNEXURE B.

11. REGULATORY REQUIREMENTS

The Contractor shall conform to all statutory and regulatory requirements concerning the environment, aboriginal heritage, wildlife conservation, dangerous goods, occupational safety and health, rail safety, and road safety.

ANNEXURE A - STOCKPILE LOCATIONS

STOCKPILE LOCATIONS

Details of the locations of nominated stockpile locations are as follows:

Table 17 Local Government Nominated Stockpile Locations

Coordinates		Type	Treatment details
North	East		

ONSITE LOCATIONS FOR SPOIL MATERIALS

Details of the onsite spoil sites nominated by the Local Government are as follows:

Table 18 Local Government Nominated Spoil Locations

Coordinates		Type	Treatment details
North	East		

OFF-SITE LOCATIONS FOR SPOIL MATERIALS

Details of the offsite locations for disposal of spoil materials nominated by the Local Government are as follows:

Table 19 Local Government Nominated Disposal Locations

Spoil Site Name/Location	Comments

ANNEXURE B - REHABILITATION

The depth of topsoil removal shall be as follows:

Table 20 Topsoil Removal

Location/Section		Depth of Topsoil Removal (mm)	Comment on Treatment
To	From		

The depth of topsoil respread shall be as follows:

Table 21 Topsoil Respread

Location/Section		Depth of Topsoil Respread (mm)	Comment on Treatment
To	From		

Nominated stockpile locations are as follows:

Table 22 Topsoil Stockpile Locations

Co-ordinates		Type	Treatment details
North	East		

The depth of mulch respread shall be as follows:

Table 23 Mulch Respread

Location/Section		Depth of Mulch Respread (mm)	Treatment details
To	From		

The Contractor shall prepare and implement a Weed Control Program in accordance with Main Roads Specification 304 prior to undertaking any other works.

The Weed Control Program shall include, but not be limited to, the listing below of known locations of nominated weed species for control and disposal:

Table 24 Weed Control Requirements

Co-ordinates		Weed species	Timing of Control	Treatment details
North	East			

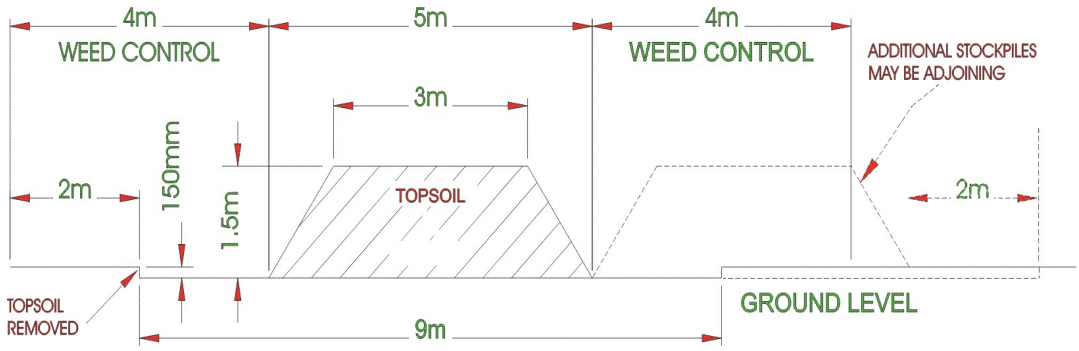

Figure 1 *Typical Cross Section for Stockpiles of Topsoil*

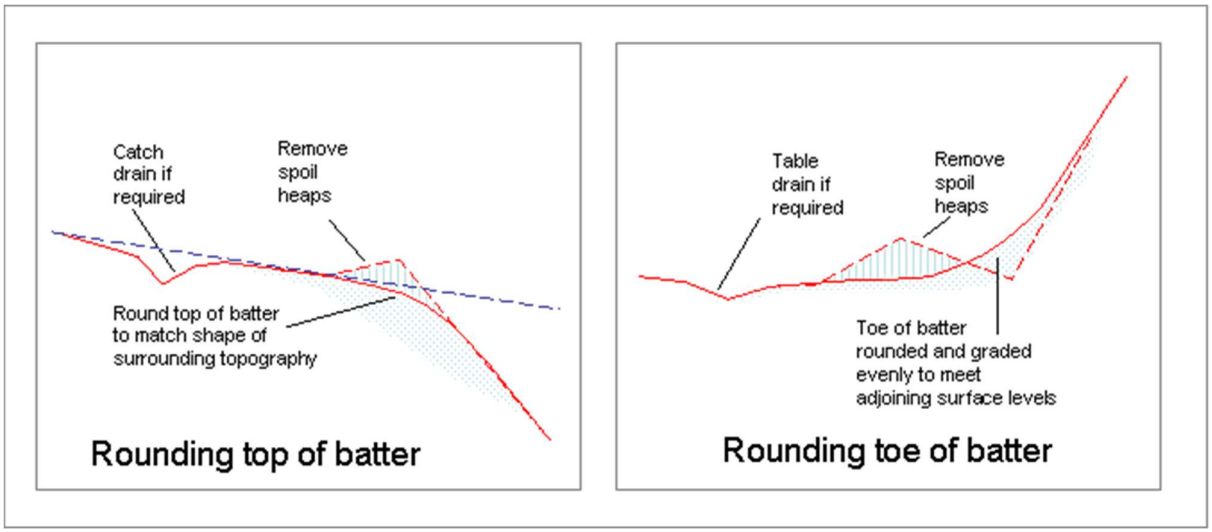

Figure 2 *Typical Cross Section for Rounding of Top and Toe of Batter Slopes*

ANNEXURE C - ROCK IN TABLE DRAIN

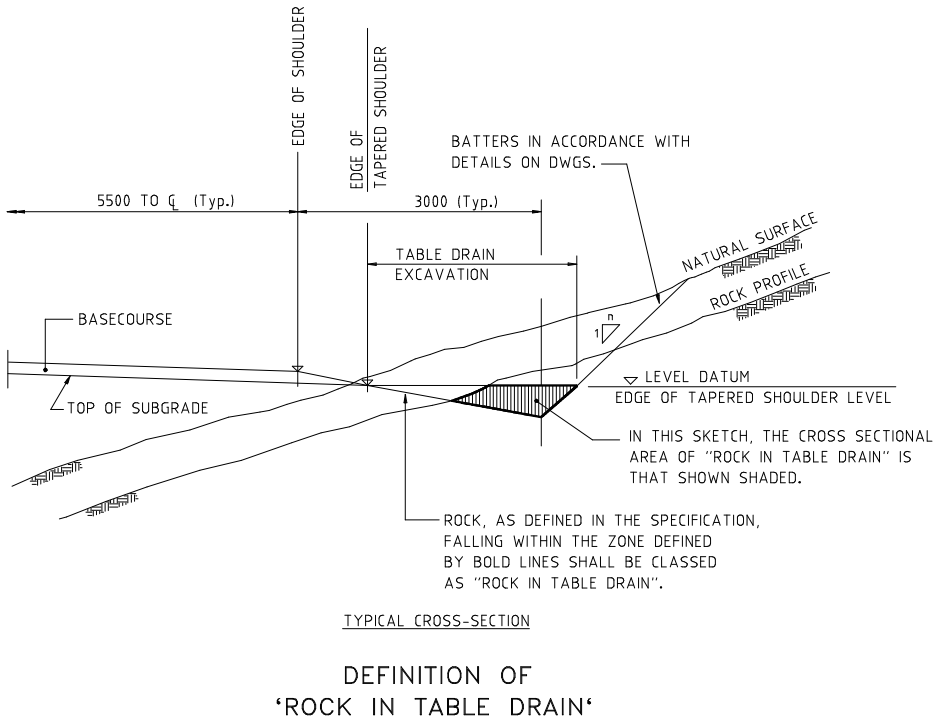

Figure 3 Definition of 'Rock in Table Drain'

ANNEXURE D - COMPACTION AND DRYBACK

DEPTH OF COMPACTION EMBANKMENT FOUNDATION

The depth of compaction for Embankment Foundation shall be 150 mm.

COMPACTION REQUIREMENTS (END PRODUCT SPECIFICATION)

The minimum characteristic dry density ratio for the various earthworks elements shall be as follows:

Table 25 Earthworks Compaction Requirements

Earthworks Element	Characteristic Dry Density Ratio (%)	
	Perth Sands	Other
Embankment Foundation	90	88
Embankment Construction	95	90
Subgrade	96	92

COMPACTION OF PAVEMENT LAYERS

The minimum characteristic dry density ratio for the various pavement material Types shall be as follows:

Table 26 Pavement Layer Compaction Requirements

Pavement Material Type	Minimum Characteristic Dry Density Ratio (%)
Drainage Layer	94%
Sub-Base	94%
Cement Stabilised Sub-Base	94%
Lime Stabilised Sub-Base	94%
Crushed Recycled Concrete Sub-Base	94%
Gravel Basecourse (final surfacing - sprayed seal)	96%
Gravel Basecourse (final surfacing - asphalt)	98%
Cement Stabilised Basecourse	96%
Lime Stabilised Basecourse	96%
Bitumen Stabilised Limestone Basecourse	98%
Crushed Rock Base Basecourse	99%

DRYBACK OF PAVEMENT LAYERS

Pavement layers shall be dried back to beyond the maximum characteristic moisture content ratio as follows:

Table 27 Pavement Layer Dryback Requirements

Pavement Layer	Maximum Characteristic Moisture Content Ratio (%)
Subgrade surface (150 mm)	85%
Drainage layer	85%
Sub-Base	85%
Basecourse (final surfacing - sprayed seal)	85%

Pavement Layer	Maximum Characteristic Moisture Content Ratio (%)
Basecourse (final surfacing - asphalt)	70%
Crushed Rock Base (all surfacing types)	60%