SPECIFICATION 302

EARTHWORKS

REVISION REGISTER			
Clause Number	**Description of Revision**	**Authorised By**	**Issue Date**
302.02; 302.10.2	Amended 'ASTM D 2794-14' to 'ASTM D 2974-14'	MME	28/06/2024
302.04.01	Deleted redundant phrase		
302.05.03	Amended sentence to include pavement works		
302.09	Deleted Select Fill specification in place of a reference to Specification 801, subsequent tables renumbered		
302.23	Amended definition of rock		
302.36.4	Amended oversize requirements		
302.41.5	Amended sentence		
302.53.3; 302.54.2	Changed wording from 'embankment foundation' to 'embankment construction'		
302.55	Amended Rock Fill clause		
302.55.2	Changed 'subgrade level' to 'subgrade surface'		
302.55.7	Added geotextile fabric criteria		
302.55.8	Added geotextile fabric hold point		
302.55.9	Added geotextile fabric storage clause		
302.55.10	Added geotextile fabric data clause		
302.55.11	Added geotextile fabric usage clause		
302.61.3	Amended 'embankment foundation' to 'subgrade'		
302.82.20	Amended sentence		
302.96.08; 302.97.07	Amended sentence to reflect focus on subgrade		
Table 302B.02	Deleted row referring to glass cullet		
Guidance Notes	Added clause 3.3 – Kimberley earthworks specification Added clause 3.4 – Great Southern earthworks specification		
Whole Document	Clause cross-referencing updated		
Guidance Notes	Hyperlink to Clause 2. Ground Survey for Volume and Area Calculations amended	MME	18/11/2020
Whole Document	Formatting updated to current standard	MME	21/10/2019
Whole Document	Reference to Specifications 204, 301 and 303 names updated		
302.04.01; 302.04.03; 302.11; 302.82; 302.83; 302.84; Annexure 302D	Removed sections of overlap with Specifications 204, 301, and 303, including applicable Guidance Notes		
302.04.01; 302.04.05; 302.06; 302.77; 302.82	Amended		

302.76	Added suitable spoil definition		
302.09; Annexure 302B	Removed reference to ‘certified as’ in terms of Dieback-free		
Guidance Note 3.3	Added Dieback Guidance Note 3.3 for imported material		
302.02	Added AS 2706 & WA 144.1 & ASTM D 2794-14		
302.03	Clarified Specification Limits		
302.09.4	Added Test Methods AS1289.4.1.1 & ASTM D 2794-14		
Table 302.02	Amended		
302.10.2	Added Recycled Sand		
302.43.3, 302.44.2, 302.53.2, 302.54.2, 302.61.3, 302.98.08.1, 302.92.07.2 7	Amended Moisture Content at Compaction		
302.55	Added Rock Fill		
302B1.1	Added Weeds		
302B1.3	Added minimum CBR requirement		
Guidance Note 3	Amended		
Whole document	Formatting and font change	PM	07/10/2015

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SPECIFICATION 302

EARTHWORKS

GENERAL

302.01 SCOPE

1. The work under this specification consists of all stages of work associated with earthworks for road construction to the profiles, levels and surface finishes as specified or as shown in the Drawings.

2. Earthworks at Bridge Sites, including excavations, foundations, backfill at abutments and associated requirements are covered in Specification 801 EXCAVATION AND BACKFILL FOR STRUCTURES.

302.02 REFERENCES

1. Australian Standards, MAIN ROADS Western Australia Standards and MAIN ROADS Western Australia Test Methods are referred to in abbreviated form (e.g. AS 1234, MRS 67-08-43 or WA 123). For convenience, the full titles are given below:

Australian Standards

AS 2187	Parts 1 and 2 – Rules of Storage, Transport and Use of Explosives
AS 1672	Building Limes
AS 3705	Geotextiles – Identification, marking and general data
AS 1289	Methods of testing soils for engineering purposes

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 Soils
WA 123.1	Linear Shrinkage
WA 133.1	Dry Density/Moisture Content Relationship: Modified Compaction (Fine & Medium Grained Soils)
WA 133.2	Dry Density/Moisture Content Relationship: Modified Compaction (Coarse Grained Soils)
WA 134.1	Dry Density Ratio
WA 144.1	Foreign Materials
WA 330.1	Layer Thickness: Direct Measurement

MAIN ROADS Standards

MRS 67-08-43 Main Roads Western Australia Survey and Mapping Standard 67-08-43 “Digital Ground Survey”

MRS 67-08-90 Main Roads Western Australia Survey and Mapping Standard 67-08-90 “Earthwork Volume Calculations”

Road Note 8 Engineering Road Note 8 “Statistically Based Quality Control for Density in Road Construction” (October 2003)

MAIN ROADS Specifications

Specification 100 GENERAL REQUIREMENTS
Specification 201 QUALITY MANAGEMENT
Specification 204 ENVIRONMENTAL MANAGEMENT
Specification 301 VEGETATION CLEARING AND DEMOLITION
Specification 303 MATERIAL AND WATER SOURCES
Specification 304 LANDSCAPING AND REVEGETATION
Specification 801 EXCAVATION AND BACKFILL FOR STRUCTURES

Other Standards

Australian Technical Infrastructure Committee (ATIC) Specification SP43 – Cementitious Materials for Concrete

ASTM D 2974-14 Test Method C Loss on Ignition Method

Waste Authority RtR Specification: Waste Authority Roads to Reuse Product Specification for recycled roads base and recycled drainage rock, March 2021

302.03 DEFINITIONS

1. Contaminated soil is soil that contains substances at levels above background concentrations that presents, or has potential to present, a risk of harm to human health, the environment or any environmental value (Western Australia Contaminated sites Act 2003). ***Contaminated Soil***

2. All specification limits are absolute. The AS 2706 “Absolute Method” is applicable. ***Specification Limits***

302.04 ASSOCIATED REQUIREMENTS

302.04.01 STOCKPILE SITES

1. The Contractor shall prepare and manage all Mulch and Topsoil Stockpiles in accordance with Specification 301 VEGETATION CLEARING AND DEMOLITION and Road Construction Material Stockpiles in accordance with Specification 303 MATERIAL AND WATER SOURCES. ***Stockpile Sites***

302.04.02 DIEBACK CONTROL

1. Earthworks operations shall be carried out in conjunction with any specified Dieback Control measures as detailed in Specification 204 ENVIRONMENTAL MANAGEMENT. ***Dieback***

302.04.03 WEED CONTROL

1. Earthwork operations shall be undertaken to meet the requirements for weed control as specified in Specification 204 ENVIRONMENTAL MANAGEMENT and in accordance with Specification 301 VEGETATION CLEARING AND DEMOLITION. ***Properties***

302.04.04 EROSION CONTROL

1. Earthwork operations shall be undertaken to meet the requirements for erosion and sedimentation control as specified in Specification 204 ENVIRONMENTAL MANAGEMENT.

302.04.05 COMPLETION OF WORK

1. At completion of work, including pavement construction, all table drains and batters and adjacent areas within the approved clearing limits shall be cleared of all surplus material, rocks and rubbish and removed to the nominated sites in Specification 204 ENVIRONMENTAL MANAGEMENT and/or Specification 301 VEGETATION CLEARING AND DEMOLITION.

302.04.06 COMPACTION VIBRATION

1. The Contractor shall ensure that vibration impacts are managed in accordance with the requirements outlined in Specification 204 ENVIRONMENTAL MANAGEMENT.

302.05 SUSTAINABILITY CONSIDERATIONS

1. Materials for earthworks construction shall be managed under the sustainability hierarchy of REDUCE, REUSE and RECYCLE.

2. Unless defined otherwise, the materials described in this specification shall be sourced from pits or quarries of natural materials, and shall be blended, crushed or processed as applicable to produce a homogenous material. These materials are a finite resource and waste shall be reduced to a minimum. ***Reduce***

3. Where practical, redundant pavement materials should be recovered and reused, or otherwise recycled to the highest level use practical. Reused materials shall be processed to produce a homogenous material and shall meet the specified applicable requirements for earthworks or pavement works. ***Reuse***

4. This specification also includes manufactured materials sourced from recycled Construction and Demolition Waste. Recycled materials for earthworks shall be blended, crushed or processed as applicable to produce a homogenous material by a recycling premises licensed by Department of Water and Environmental Regulation (DWER). Recycled materials shall only be included in materials which are designated as recycled. ***Recycle***

PRODUCTS AND MATERIALS

302.06 GENERAL

1. Unless specified otherwise, earthworks material for embankments shall be suitable material extracted from cuttings in the Works or, should such material be totally exhausted or not available, be imported onto the Site by the Contractor from other approved sources. Other sources shall include material sources nominated by the Principal in accordance with Specification 303 MATERIAL AND WATER SOURCES, or from the Contractor's own sources. ***Embankments***

2. Material for embankments shall be free from boulders having any dimension as detailed in clause 302.36 Oversize Material and shall be free from clods, stumps, roots, sticks, vegetable matter or other deleterious materials. ***Properties***

3. Material for noise bunds may include material otherwise deemed unsuitable for embankments, but shall be free of large objects such as old car bodies and similar sized debris, concrete slabs, and the like. All allowable material shall be incorporated into noise bunds with sufficient cover as shown on the Drawings. Where no such detail is shown on the Drawings the cover to any unsuitable material incorporated in noise bunds shall be a minimum of one (1) metre. ***Noise Bunds***

302.07 USE OF MATERIALS

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

2. The summary of the estimated quantity for general earthworks provided includes all types of materials that may be encountered in the cuttings.

3. Where material from excavations is suitable for use in embankments, but the Contractor elects to: ***Election of Material Usage***

   (a) spoil it;

   (b) use it for the Contractor's own purposes;

   (c) use it as a source of pavement materials; or

   (d) construct embankments with dimensions other than those shown on the Drawings, or to dimensions as otherwise authorised by the Superintendent,

   and a deficiency of material for embankment construction is thereby created, the Contractor shall make good that deficiency from sources of suitable material. The making good of such deficiency of material shall be affected at no cost to the Principal.

302.08 IMPORTED MATERIAL FOR EMBANKMENTS

1. Imported material for embankments, inclusive of Subgrade, shall be in accordance with Annexure 302B.

302.09 SELECT FILL

1. Select fill shall be in accordance with Specification 801 EXCAVATION AND BACKFILL FOR STRUCTURES.

302.10 RECYCLED MATERIALS

302.10.1 GLASS CULLET

The following requirements shall apply to recycled glass cullet used in embankment construction:

1. Glass must comply with DWER requirements for recycled materials and be sourced from food and beverage containers, and building or window glass. Glass that shall not be used includes recycled glass classified as hazardous waste, laboratory equipment, televisions, computers, cathode ray tubes, porcelain products or cook tops.

2. Limits of foreign materials in Glass Cullet tested in accordance with WA 144.1 are outlined in Table 302.01.

TABLE 302.01 GLASS CULLET FOREIGN MATERIAL LIMITS

Material	Maximum % Retained by Mass on 4.75 mm Sieve
High Density Materials (brick, tiles, etc.)	5.0
Low Density Materials (plastic, plaster, etc.)	2.0
Wood and other vegetable matter	1.0

3. The cullet shall be cleaned to ensure that undesirable odours are eliminated.

4. A shape crushing plant (e.g. Barmac impactor or equivalent) shall be included in the process to produce glass cullet.

5. The cullet shall be well graded and comply with the Particle Size Distribution in Table 302.02 when tested in accordance with WA 115.1.

6. The retained 4.75 mm material shall not contain more than 1% of particles with a maximum dimension ratio greater than 5:1.

TABLE 302.02 GLASS CULLET PARTICLE SIZE DISTRIBUTION

Sieve Size (mm)	% Passing
9.5	100
4.75	70 – 100
2.36	35 – 88
1.18	15 – 45
0.30	4 – 12
0.075	0 – 5

302.10.2 RECYCLED SAND

1. Recycled sand shall be sourced from recovered construction and demolition waste materials, and shall be free of contaminated soils and other deleterious materials.

2. The material shall satisfy the requirements in Table 302.03.

TABLE 302.03 ACCEPTANCE LIMITS

Test	Limits	Test Method
California Bearing Ratio	Not less than 12%	WA 141.1
Linear Shrinkage	Not greater than 3%	WA 123.1

3. Foreign material content shall be limited to the values shown in Table 302.04. ***Foreign Material***

TABLE 302.04 LIMITS OF FOREIGN MATERIAL

Material	Maximum % Retained by Mass on 4.75 mm Sieve	Test Method
High Density Materials (brick, glass, etc)	10	WA 144.1
Low Density Materials (plastic, plaster, etc)	3	WA 144.1
Organic matter	1	AS12894.1.1 ASTM D 2974-14
Other Contaminants	Note 1	

Note 1: Recycled materials must comply with DWER requirements.

302.11 TOPSOIL REMOVAL

1. Earthwork operations shall be undertaken to meet the requirements for topsoil removal as specified in Specification 301 VEGETATION CLEARING AND DEMOLITION.

302.12 – 302.15 NOT USED

SURVEY

302.16 DIGITAL GROUND SURVEY

1. After completion of clearing, removal of topsoil, and where applicable after removal of the existing seal and/or existing pavement, and after compaction of the embankment foundation but before the commencement of any other earthworks or culvert work, the Superintendent will undertake a digital ground survey in accordance with MRS 67-08-43. ***Taking of Levels***

2. Where rock is to be excavated from the alignment of the Works, the Superintendent will undertake a digital ground survey in accordance with MRS 67-08-43. ***Rocky Ground***

3. **After the completion of Foundation preparation work and prior to earthwork construction, the Contractor shall give the Superintendent at least 48 hours' notice of when a digital ground survey is required for the purpose of earthworks' measurement.** ***HOLD POINT***

302.17 – 302.20 NOT USED

EXCAVATIONS

302.21 GENERAL

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

2. 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 Drawings or in Specification 301 VEGETATION CLEARING AND DEMOLITION. ***Cut Batters***

3. Benches shall be maintained free of loose materials until the finishing of batters and ground surfaces.

4. Each bench shall drain back away from the lowest cut face and provide for longitudinal drainage.

5. Cut batters in rock shall be treated as shown in the Drawings or in Specification 301 VEGETATION CLEARING AND DEMOLITION.

6. All suitable materials from excavations may be used in embankment construction. No material resulting from cutting operations of the existing pavement shall be incorporated into the road pavement, but may be utilised as oversize material. ***Utilisation***

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

302.22 EXISTING PAVEMENT

302.22.01 ROAD WIDENING

1. The existing seal shall be cut where new pavement is to be blended into existing work, or where widening is required. In this context "seal" shall be deemed to mean the existing bituminous surfacing which may be a primerseal, single or double coat seal or asphalt surfacing. ***Widening Work***

2. The existing seal shall be cut along a marked alignment and the area to be treated shall be excavated to the depth as detailed in the Drawings and to the specified tolerances.

3. The Contractor shall mark the alignment of the cut by painting spots on the existing seal, not exceeding 50 mm in width at intervals of not greater than 3 metres. ***Marking of Seal***

4. **Prior to any cutting of the existing seal the Contractor shall mark out and indicate to the Superintendent the position of the proposed line of cut of the seal.** ***HOLD POINT***

5. The cut edges of the seal and the wall of the excavation shall be in a smooth straight line, have no tears, jagged edges, or undercutting to the materials to be retained. The sides of the cut shall be made at a slope of 1 vertical to 1 horizontal sloping down and away from the material to be retained. There shall be no separation of the retained seal from its base 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. The Contractor shall ensure that the cut seal edge and the wall of the excavation are not damaged and remain in the specified condition until the pavement stabilisation has been completed. ***Cutting of Seal***

6. Where any portion of existing pavement is shown on the Drawings as "unused", the pavement shall be rehabilitated, and the unused pavement including bituminous products and manufactured pavements shall be ripped and removed from the roadway. Natural gravels used in pavements may be left. The removed material may be used in embankment construction provided the material complies with the oversize limitations for Oversize Material or otherwise shall be removed to spoil areas shown in Annexure 302B or where no such sites are listed the material shall be disposed to an authorised waste disposal site in accordance with Specification 301 VEGETATION CLEARING AND DEMOLITION. ***Redundant Pavement***

7. All removed seal is defined as spoil unless otherwise specified and shall be disposed to an authorised waste disposal site as detailed in Specification 204 ENVIRONMENTAL MANAGEMENT. ***Disposal of Removed Seal***

302.22.02 OVERLAYS

1. The existing bituminous seal shall be maintained for as long as practicable before its removal.

2. The Superintendent will measure the width of the existing seal in accordance with MRS 67-08-43.

3. **Prior to any measurement of the width of the existing seal and its subsequent removal, the Contractor shall give the Superintendent at least 48 hours' notice of when such measurement is required.** ***HOLD POINT***

4. After the seal width has been measured the existing bituminous seal shall be removed from the roadway. This removal shall be completed with as little disturbance to the underlying pavement as possible.

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

6. After the surface has been prepared, the Contractor shall supply notice to the Superintendent in accordance with the Survey requirements of the Specification for the Superintendent to undertake a digital ground survey. These levels will be used as the basis for the calculation of the volume of any additional pavement material required to complete the construction of the overlay pavement.

302.23 ROCK EXCAVATION

1. Prior to under taking a digital ground survey, the top surface of rock shall be exposed and clear of all loose material as far as practicable.

2. "Rock excavation material" shall describe all material to be excavated to achieve the road design cross section including table drains which cannot be ripped and excavated with a track dozer in good condition with matching hydraulic single shank ripper of combined mass not less than 59 tonnes at a rate in excess of 90 m³ (solid) per hour. Isolated boulders each greater than 0.8 m³ in volume shall be defined as rock excavation. ***Definition of Rock***

3. In rock cuttings, a 150 mm compacted thickness subgrade layer shall be constructed using embankment material to the requirements for Subgrade Preparation. The surface of the exposed rock shall be trimmed to allow free drainage to the table drains prior to the placement of subgrade. ***Improved Subgrade***

4. 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. ***Trimming of Exposed Faces***

5. Rock excavation in table drains, including independently graded table drains, is defined as that material that cannot be ripped and excavated as specified above at an effective total rate in excess of 40 m³ (solid) per hour. Figure 302C.01 Definition of 'Rock in Table Drain' shows a diagrammatic definition for rock in table drains. ***Table Drains***

6. Rock excavation in other drains is defined as that material that cannot be ripped and excavated as specified above at an effective total rate in excess of 40 m³ (solid) per hour. ***Other Drains***

7. Rock excavation in trenches is defined as that material that cannot be ripped and excavated by a combination loader backhoe in good condition capable of exerting a minimum breakout force of 30 Kn at the bottom of the excavation with a 450 mm wide rock bucket fitted with teeth (e.g. CASE 480E or its equivalent). ***Trenches***

302.24 – 302.25 NOT USED

BLASTING

302.26 GENERAL REQUIREMENTS

1. 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.

2. All purchase, manufacture, handling, transport, storage and use of explosives shall be in accordance with Specification 203 HEALTH AND SAFETY MANAGEMENT and the provisions of:

   (a) the Western Australian Explosives and Dangerous Goods Act;

   (b) by-laws of the relevant Local Authority; and

   (c) AS 2187, Parts 1 and 2 – Rules of Storage, Transport and Use of Explosives.

3. Should any conflict of requirements occur between those provisions, the requirements of the Act shall take precedence, followed by the by-laws of the relevant Local Authority.

4. 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. ***Shot-firer's Permit***

5. **At least three (3) weeks prior to any blasting or storage of materials on Site, the Contractor shall submit to the Superintendent 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.** ***HOLD POINT***

6. If the appointed Shot-firer leaves the Site, the Contractor shall notify the Superintendent in writing of the name and permit number of the replacement Shot-firer at least three days prior to any Works associated with the use, transportation and storage of explosives being carried out. ***Stand-in***

302.27 BLASTING RECORDS

1. The Contractor shall keep and maintain all necessary records of blasting as required by the relevant Acts, Regulations and by-laws. These records shall be made available to the Superintendent on request. ***Availability***

302.28 – 302.30 NOT USED

UNSUITABLE MATERIAL

302.31 DEFINITION

1. Material which the Superintendent deems to be unsuitable for use in Embankment Construction, Subgrade Preparation, or Embankment Foundation shall be excavated and then disposed of in accordance with the Waste Disposal Sites clause in Specification 301 VEGETATION CLEARING AND DEMOLITION.

302.32 CONTAMINATED SOIL

1. Soil which the Superintendent deems to be unsuitable because it is 'contaminated' shall be isolated from all other work under the Contract and subsequently disposed of in a manner and to a site in accordance with Specification 204 ENVIRONMENTAL MANAGEMENT. When the soil has been contaminated as a result of the Contractor's activities then its disposal in accordance with this clause shall be at no cost to the Principal.

302.33 REMOVAL AND REPLACEMENT

1. A void created from the excavation of unsuitable material during Embankment Foundation or Subgrade preparation shall be backfilled with suitable embankment quality material or as directed by the Superintendent and compacted in accordance with the Embankment Construction Section. ***Backfilling***

2. **Prior to the backfilling of a void created from the excavation of unsuitable material the Contractor shall give the Superintendent at least 48 hours' notice of when a digital ground survey is required for the purpose of unsuitable material measurement.** ***HOLD POINT***

3. The Superintendent will take levels of the excavation after the removal of any unsuitable material prior to its replacement with the suitable backfill material in accordance with MRS 67-08-43.

302.34 – 302.35 NOT USED

OVERSIZE MATERIAL

302.36 DEFINITION

1. All oversize material having any dimension greater than 100 mm shall be reduced in size or shall be removed from excavated material intended to be used as fill within 300 mm of the subgrade and/or shoulder surfaces and/or batter face.

2. All oversize material having any dimension greater than 300 mm shall be reduced in size or shall be removed from excavated material intended to be used as fill within 500 mm of the subgrade and/or shoulder surfaces and/or batter face.

3. Notwithstanding paragraph 2 above, material having any dimension greater than 300 mm shall not be placed where other work under the contract is to be completed such as but not limited to; the installation of underground drainage and services, signs, street lighting, safety barrier systems etc.

4. All oversize material having any dimension greater than 1000 mm shall not be used as fill and shall be removed to spoil.

5. Rock fill shall comply with requirements outlined in clause 302.55 Rock Fill.

6. Oversize material not used in the embankment shall be stockpiled in uniformly shaped heaps in spoil areas.

302.37 DISPOSAL

1. Oversize material shall be disposed to the spoil sites as listed in Specification 301 VEGETATION CLEARING AND DEMOLITION. Where no such sites are listed, oversize material shall be disposed to an authorised waste disposal site in accordance with Specification 204 ENVIRONMENTAL MANAGEMENT.

302.38 – 302.40 NOT USED

EMBANKMENT FOUNDATION

302.41 GENERAL

1. 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 as shown in Annexure 302B.

2. Where the embankment is to be founded on the existing road, the existing seal shall be cut and removed and the retained pavement prepared in accordance with clause 302.22 Existing Pavement.

3. Subject to the other requirements of the Contract, the existing seal may be incorporated into the embankment foundation by means of a stabiliser to pulverise the seal to size that passes the 37.5 mm sieve and compacted in a layer of not less than 100 mm.

4. No seal material shall be placed within 500 mm of the subgrade surface or batter face.

5. The embankment foundation shall be maintained in its Conforming Condition until the overlying layer is placed. No embankment materials shall be placed until the embankment foundation has been levelled as specified in the Embankment Foundation Section.

302.42 COMPACTION: END PRODUCT SPECIFICATION

End Product Specification

1. Where the material in the embankment foundation contains 20% or less by mass of material retained on a 37.5 mm sieve the compaction shall be to the Characteristic Dry Density Ratio as shown in Annexure 302B or greater.

2. The Characteristic Dry Density Ratio (Rc) shall be determined in accordance with Specification 201 QUALITY MANAGEMENT.

3. During the compaction process, the embankment foundation shall be lightly watered or dried as required to maintain appropriate moisture content in order to achieve the required density.

302.43 COMPACTION: CONTRACTOR'S DEVELOPED METHOD SPECIFICATION

Contractor Method Specification

1. Where the material in the embankment foundation contains 20% or less by mass of material retained on a 37.5 mm sieve, the Contractor may develop a method of compaction, with suitable controls that will demonstrate the achievement of the Characteristic Dry Density Ratio as shown in Annexure 302B or greater.

HOLD POINT

2. **Where this option of compaction is chosen, the effectiveness of the Contractor's proposed method shall be demonstrated to the Superintendent prior to its implementation.**

3. During the whole of the compaction process the moisture content, at any point in a Lot, of embankment foundation comprised of Perth Sands shall be within 70% – 110% of the optimum moisture content as determined by WA 133.1 or WA 133.2. For Other Materials, at any point in a Lot, embankment foundation material shall be within 90% – 110% of the optimum moisture content for that material as determined by WA 133.1 or WA 133.2.

4. Where the embankment foundation is not of constant quality and consists of various types of embankment foundation material the Contractor shall:

   (a) establish a method of compaction for each type of foundation material; and

   (b) select lots which are of constant quality without obvious changes in attribute values.

5. During the compaction process, the embankment foundation shall be lightly watered or dried as required to maintain the specified moisture content.

302.44 COMPACTION: PRINCIPAL'S METHOD SPECIFICATION

1. Where the material in the embankment foundation contains more than 20% by mass of material retained on a 37.5 mm sieve the compaction shall be by a vibratory pad-foot or grid roller or similar approved by the Superintendent. The area shall be scarified to the depth shown in Annexure 302B and shall be compacted by not less than five (5) complete coverage of the roller. Each roller pass shall overlap the previous one by not less than 10%. ***Principal's Method Specification***

2. During the whole of the compaction process the Moisture Content, at any point in a Lot, of embankment foundation material which would pass a 37.5 mm sieve shall be within 90% – 110% of the optimum moisture content as determined by WA 133.2. ***Moisture Content***

3. The vibratory pad-foot roller shall be a self-propelled roller with a total static mass not less than ten (10) tonnes and a centrifugal force on the drum 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 utilised.

4. The grid roller shall have an open mesh drum of approximately 1.7 m diameter and 1.8 m width. The drum mesh shall be 125 mm x 125 mm. The roller including ballast shall have a total mass not less than 13 tonnes. The grid roller shall be towed by a rubber tyred tractor and each pass shall be made at speeds between 15 and 25 km per hour.

5. During the compaction process the embankment foundation shall be lightly watered or dried as required to maintain the specified moisture content.

302.45 – 302.50 NOT USED

EMBANKMENT CONSTRUCTION

302.51 GENERAL

1. **Prior to embankment construction, the Contractor shall certify to the Superintendent that the embankment foundation conforms to the requirements of the Specification.** ***HOLD POINT***

2. Embankment materials shall be placed to the shapes and levels shown in the Drawings and with the specified batter slope tolerance shown in Annexure 302B.

3. Embankment material shall be worked in compacted layers not greater than 300 mm or less than 100 mm for cohesive material and not greater than 450 mm or less than 100 mm for sand. Where less than 100 mm is required to be worked the underlying material shall be grader scarified or stabiliser mixed to such a depth that the resulting thickness of the layer to be worked is greater than 100 mm.

4. Each layer worked shall be generally parallel to the finished pavement surface and shall where practicable extend to the full width of the embankment at that particular level. The Contractor shall at all times prevent the ponding of water on the embankment. No layer of embankment shall be placed until the preceding layer conforms to all requirements.

5. Embankment material shall be placed uniformly without abrupt changes in material type, quality or size.

302.52 COMPACTION: END PRODUCT SPECIFICATION

End Product Specification

1. Where the embankment material contains 20% or less by mass of material retained on a 37.5 mm sieve then the embankment shall be compacted to the Characteristic Dry Density Ratio(s) as shown in Annexure 302B or greater.

2. The Characteristic Dry Density Ratio shall be determined in accordance with Specification 201 QUALITY MANAGEMENT.

302.53 COMPACTION: CONTRACTOR'S DEVELOPED METHOD SPECIFICATION

Contractor Method Specification

1. Where the embankment material contains 20% or less by mass of material retained on a 37.5 mm sieve the Contractor may develop a method of compaction with suitable controls to demonstrate the achievement of the Characteristic Dry Density Ratio(s) as shown in Annexure 302B, or greater.

HOLD POINT

2. **Where this option of compaction is chosen, the Contractor's proposed method shall be approved by the Superintendent prior to its implementation.**

3. During the whole of the compaction process the moisture content at any point in a Lot of embankment construction comprised of Perth Sand shall be within 70% – 110% of the optimum moisture content as determined by WA 133.1 or WA 133.2. For Other Materials, at any point in a Lot, embankment construction material shall be within 90% – 110% of the optimum moisture content as determined by WA 133.1 or WA 133.2.

4. Where the embankment construction is not of constant quality and consists of various types of embankment construction material the Contractor shall:

   (a) establish a method of compaction for each type of embankment material; and

   (b) select lots which are of constant quality without obvious changes in attribute values.

302.54 COMPACTION: PRINCIPAL'S METHOD SPECIFICATION

Principal's Method Specification

1. Where embankment material contains more than 20% by mass of material retained on a 37.5 mm sieve then compaction of the embankment shall be deemed to be satisfactory when the fill has been compacted with not less than five (5) complete coverage of a vibratory pad-foot roller followed by not less than four (4) complete coverage of a grid roller. The roller shall be as specified in clause 302.44 Embankment Foundation Compaction:

Principal's Method Specification and each pass shall overlap the previous one by not less than 10%.

2. During the whole of the compaction process the moisture content at any point in a Lot of embankment construction shall be within 90% – 110% of the optimum moisture content as determined by WA 133.2.

302.55 ROCK FILL

1. Rock fill shall consist of hard, sound and durable fragments which shall not break down during compaction to the extent that the free draining property of the fill is impaired. Shale, claystone, siltstone or mudstone shall not be used as rock fill unless it has been demonstrated by degradation tests that the rock fragments will remain stable under the action of load or water. Rock fill material shall not disintegrate in water or when exposed to weather.

2. Rock fill may be used anywhere in embankment construction except within 2 metres of subgrade surface. The rock fill material must be placed and spread in such a way as to avoid segregation and to ensure that it is not contaminated with foreign material. Foundations under rock fill are to be stripped of topsoil and silt, and shaped to ensure drainage is maintained and treated to 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 coloured appearance.

3. Compliance with the particle size requirements will be by visual appraisal, with initial assessment by the Superintendent to ensure the design intent is achieved. Rock fill material shall have a maximum dimension of 1000 mm and shall meet the following gradation requirements:

TABLE 302.05 ROCK FILL PARTICLE SIZE DISTRIBUTION

Maximum Dimension mm	Percentage Passing
1000	100
300	50 – 100
150	30 – 100
75	20 – 100
37.5	15 – 75
2.36	5 – 50

4. 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 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.

5. The vibratory smooth drum or pad foot roller shall be a self-propelled roller with a static mass of not less than eighteen 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.

6. 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).

7. A geotextile fabric, with a G robustness rating of greater than 3000 (non-woven), shall be placed as a separation between the proposed fill and over the top of the rock fill.

   Note: Geotextile Strength Rating, $G = (L.h_{50})^{0.5}$. Geotextile survivability refers to the ability of the Geotextile to withstand the installation stresses during construction. L (in Newtons) is the characteristic value of burst strength (CBR Plunger Method) for the batch tested determined in accordance with AS 3706.1 and AS 3706.4. h_{50} (in mm) is the characteristic value of puncture resistance (Drop Cone Method) for the batch tested determined in accordance with AS 3706.1 and AS 3706.5. The characteristic values of L and h_{50} shall be calculated as the mean value less 0.83 standard deviation.

8. **Prior to the use of the geotextile, the Contractor shall submit to the Superintendent product certificates of compliance from the supplier, showing that the geotextile complies with all the requirements of this specification. Test results shall be reported on NATA endorsed documents.** ***HOLD POINT***

9. When stored, geotextile fabric shall be:

   (a) wrapped with a waterproof opaque material including the ends of rolls;

   (b) stored in a shed away from direct sunlight and rain; and

   (c) kept off the ground and away from any source of moisture.

10. Rolls of geotextile fabric shall show the manufacturer's name, batch number and date of manufacture.

11. Geotextile fabric shall be used within 2 years of the date of manufacture.

302.56 – 302.60 NOT USED

SUBGRADE PREPARATION

302.61 GENERAL

1. 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 surface.

2. The subgrade surface shall be constructed to the shape and levels as shown in the Drawings and to specified requirements and tolerances of this clause.

3. During the whole of the compaction process the moisture content at any point in a Lot of subgrade comprised of Perth Sand shall be within 70% – 110% of the optimum moisture content as determined by WA 133.1 or WA 133.2. For Other Materials, at any point in the Lot, subgrade material shall be within 90% – 110% of the optimum moisture content as determined by WA 133.1 or WA 133.2.

4. The completed subgrade layer shall be in a homogeneous uniformly bonded condition with no evidence of layering or disintegration.

5. The completed subgrade surface shall be maintained in its conforming condition until pavement construction commences and shall be watered as necessary to prevent shrinkage cracking, dusting or loosening of its surface.

302.62 COMPACTION: END PRODUCT SPECIFICATION

1. Where material for a depth of 150 mm below the subgrade surface contains 20% or less by mass of material retained on a 37.5 mm sieve then that material shall be compacted to the Characteristic Dry Density Ratio as shown in Annexure 302B or greater.

2. The Characteristic Dry Density Ratio (Rc) shall be determined in accordance with Specification 201 QUALITY MANAGEMENT.

302.63 COMPACTION: PRINCIPAL'S METHOD SPECIFICATION

1. Where material for a depth of 150 mm below the subgrade surface contains more than 20% by mass of material retained on a 37.5 mm sieve then that material shall be compacted as detailed in clause 302.44 Embankment Foundation Compaction: Principal's Method Specification except that the vibratory pad-foot rolling shall be followed by no less than six (6) complete coverage by a fully ballasted 15 tonne rubber tyred roller.

302.64 SURFACE WIDTH

1. The outer top edge of the subgrade shall be no closer to the road centreline and no more than 100 mm further from the road centreline than the position shown in the Drawings.

302.65 SURFACE SHAPE

1. The shape of the subgrade surface shall be deemed to be conforming when the maximum deviation from a 3 metre straight edge placed in any position on the surface does not exceed 15 mm. ***Generally***

2. Additionally, for widening of the existing roadway the crossfall measured at right angles to the road centreline shall be within 0.5% of the existing crossfall, or within 0.5% of any crossfall detailed on the Drawings. ***Widening Sections***

302.66 SURFACE LEVELS

302.66.01 CONSTRUCTION OR OVERLAY/RECONSTRUCTION SECTIONS

1. The level of the completed subgrade surface shall be deemed to be conforming when the level measured at any point on the surface is within -35 mm, + 5 mm of the subgrade level at that point as determined from the Drawings. ***Construction Sections***

302.66.02 SEAL WIDENING SECTIONS

1. The level of the completed subgrade surface shall be deemed to be conforming when the levels at its junction with the existing pavement are within -35 mm, +5 mm of the levels as determined from the total pavement depth making due allowance for the existing crossfall of the pavement. ***Widening Sections***

302.67 – 302.70 NOT USED

NOISE BUNDS

302.71 DEFINITION

1. Noise bunds shall comprise all fill material above the noise bund foundation. The noise bund foundation shall be defined as either:

   (a) the original ground level where the noise bund is located in a cut situation, or

   (b) an imaginary horizontal line extending from the subgrade surface at the nearest edge of shoulder where the noise bund is located in a fill situation.

302.72 CONSTRUCTION

1. Noise bund construction shall be undertaken in accordance with the Embankment Construction Section, except that controlled compaction is not required.

302.73 – 302.75 NOT USED

SPOIL

302.76 DEFINITION

1. Spoil is defined as surplus material from excavations under the Contract which is not required to complete the Works, or material from excavations under the Contract whose quality renders it unacceptable for incorporation in the Works.

2. Suitable spoil is material that may be used in revegetation and landscaping. It shall not contain contaminated materials, debris, rubbish or other deleterious materials that are considered environmentally hazardous or contain other materials as specified by the Superintendent. Suitable spoil may be categorised into the following: ***Suitable Spoil***

(a) Surplus material from excavations, which is not required to complete the Works; or material from excavations under the Contract whose quality renders it unacceptable for incorporation in the Works.

(b) Materials deemed surplus for road construction purposes may be considered as suitable spoil and used for revegetation and landscaping purposes as approved by the Superintendent.

(c) Construction Unsuitable Material, unsuitable for use in embankment construction, subgrade preparation, or embankment foundation may also be considered as suitable spoil.

302.77 SPOIL AREAS

Principal's Nominated Spoil Sites

1. The Principal's nominated onsite and offsite suitable spoil sites are shown in Specification 301 VEGETATION CLEARING AND DEMOLITION Annexure 301D. Where no such areas are shown in Annexure 301D and the spoil is not suitable for alternate use or storage, the Contractor shall dispose spoil to an authorised waste disposal site in accordance with Specification 301 VEGETATION CLEARING AND DEMOLITION.

2. The Contractor may nominate alternative spoil sites, subject to the Superintendent's approval that the Site complies with the specifications.

302.78 USE OF SURPLUS MATERIALS

Suitable Surplus Materials

1. Materials deemed surplus for road construction purposes may be used for revegetation and landscaping purposes in accordance with Specification 304 LANDSCAPING AND REVEGETATION or as approved by the Superintendent.

2. Spoil material that may be suitable for use in revegetation and landscaping shall not contain contaminated materials, debris or rubbish or other deleterious materials that are considered environmentally hazardous or other materials as specified by the Superintendent.

3. To use any approved spoil material, the final placement shall have a minimum of 500 mm cover of clean embankment material.

Placement of Surplus Materials

4. The placement of surplus material in areas on the Site designated for revegetation and landscaping shall achieve and or maintain the landform nominated in the Drawings.

5. Material authorised by the Superintendent for placement must remain stable and free draining in the long term and be compacted to a similar density to the surrounding ground.

302.79 – 302.80 NOT USED

REHABILITATION

302.81 GENERAL

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

2. 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 Specification 304 LANDSCAPING AND REVEGETATION.

3. Imported topsoil material shall be supplied in accordance with Specification 304 LANDSCAPING AND REVEGETATION. ***Imported Topsoil***

4. Imported mulch material (where specified) shall be supplied in accordance with Specification 304 LANDSCAPING AND REVEGETATION. ***Imported Mulch***

302.82 FINISHING OF BATTERS AND GROUND SURFACES

1. 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 comply with Annexure 302B. ***Shaping of Batter Slopes***

2. The top and toe of all batters shall be rounded, where practical, to match the shape of the surrounding topography as shown in Specification 301 VEGETATION CLEARING AND DEMOLITION, unless otherwise specified in the Contract. ***Rounding of Top and Toe of Batter Slopes***

3. 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 Drawings, prior to any surface preparation and soil improvements. ***Shaping and Grading***

4. 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.

5. Median or traffic island areas nominated for revegetation shall be prepared in accordance with Specification 304 LANDSCAPING AND REVEGETATION. ***Medians***

6. Soil surfaces adjacent to rear face of kerb and edge of paving shall be prepared in accordance with Specification 304 LANDSCAPING AND REVEGETATION. ***Near Edges***

7. Unless shown otherwise in the Drawings all existing redundant pavement shall be ripped and removed as spoil to an authorised waste disposal site in accordance with Specification 301 VEGETATION CLEARING AND DEMOLITION. ***Redundant Pavement***

8. These areas shall then be prepared by grading or other means to form a loose and roughened surface.

9. Topsoil from windrows and/or stockpiles shall be prepared in accordance with Specification 304 LANDSCAPING AND REVEGETATION.

Other Areas

10. Unless shown otherwise in the Drawings or in Specification 301 VEGETATION CLEARING AND DEMOLITION, when all Other Areas are no longer required all soil surfaces and trafficked areas shall be cleared, excavated and filled, shaped and or graded to achieve and or maintain the landform nominated in the Drawings.

11. Topsoil from windrows and or stockpiles shall be prepared in accordance with Specification 304 LANDSCAPING AND REVEGETATION.

Placement of Large Rocks and Boulders

12. Unless specified otherwise, the Contractor shall place any large rocks or boulders retained for use in landscaping as shown in the Drawings, in accordance with Specification 304 LANDSCAPING AND REVEGETATION.

13. Unless specified otherwise, each rock or boulder shall be placed in accordance with Specification 304 LANDSCAPING AND REVEGETATION.

Placement of Salvaged Tree Trunks

14. Unless specified otherwise, the Contractor shall place nominated tree trunks salvaged from clearing operations in accordance with Specification 304 LANDSCAPING AND REVEGETATION.

Gravel Dressing of Stepped and Sand Fill Batters

15. Where specified the Contractor shall evenly spread sheeting grade gravel over all stepped and sand fill batters to a nominal depth of 25 mm over the surface unless otherwise specified in the Drawings.

16. Sheeting gravel shall be naturally occurring gravel that is free from clods, stumps, roots, sticks, vegetative matter, weed seed, disease or other deleterious materials prior to loading and carting.

Tracking of Batters

17. Where specified the finished soil surface of batters shall be marked by tracked vehicles running perpendicular to the contours of the slope, unless shown otherwise in the Drawings.

18. Where specified, chipped vegetation mulch shall be prepared in accordance with Specification 304 LANDSCAPING AND REVEGETATION.

Surface Preparation

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

Protection of Finished Surfaces

20. The Contractor shall ensure that all finished surfaces are protected from soil erosion and weed infestation until a Certificate of Practical Completion has been issued.

21. 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.

22. All weed control measures shall be in accordance with the approved weed control program and as shown in Specification 204 ENVIRONMENTAL MANAGEMENT.

Erosion

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

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

302.83 TOPSOIL RESPREAD

1. Topsoil will be respread in accordance with Specification 304 LANDSCAPING AND REVEGETATION.

302.84 MULCH RESPREAD

1. Mulch will be respread in accordance with Specification 304 LANDSCAPING AND REVEGETATION.

302.85 – 302.90 NOT USED

AS BUILT AND HANDOVER REQUIREMENTS

302.91 – 302.95 NOT USED

CONTRACT SPECIFIC REQUIREMENTS

302.96 – 302.99 NOT USED

ANNEXURE 302A

SUMMARY OF EARTHWORKS QUANTITIES

TABLE 302A.01 ESTIMATED EARTHWORKS QUANTITIES (For Information Only)

CHAINAGES		CUT (m^3 solid)	FILL (m^3 solid)
From	To		

NOTE:

1. All volumes shown are solid volumes, with no allowance for bulking.
2. The above volumes include topsoil, i.e. before removal of topsoil,

Or

The allowance (in millimetres) excluded from the above volumes for topsoil removal is:

(delete which is not applicable)

ANNEXURE 302B

302B.1 IMPORTED MATERIAL FOR EMBANKMENTS INCLUSIVE OF SUBGRADE

302B.1.1 Imported material shall be **certified** “dieback-free” (free from the plant disease *phytophthera cinnamomi*), and shall conform to the weed and dieback management requirements in Specification 204 ENVIRONMENTAL MANAGEMENT and to requirements for particle size distribution given in Table 302B.01.

TABLE 302B.01 PARTICLE SIZE DISTRIBUTION (IMPORTED MATERIAL)

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

302B.1.2 Other acceptance criteria are outlined in Table 302B.02.

TABLE 302B.02 OTHER ACCEPTANCE CRITERIA

Test	Limits
California Bearing Ratio	Minimum of 12%
California Bearing Ratio Swell	Maximum 1.5%
Linear Shrinkage	Maximum 1%
Organic Matter	Maximum 1%

*PROJECT MANAGER TO INSERT APPROPRIATE VALUES IN TABLES 302B.01 AND 302B.02. SEE GUIDANCE NOTE 5 AND DELETE THIS NOTE.

302B.2 EMBANKMENT FOUNDATION

302B.2.1 The depth (in millimetres) of compaction for embankment foundation shall be 150.

302B.3 COMPACTION REQUIREMENTS (END PRODUCT SPECIFICATION)

302B.3.1 The required densities for the various earthworks elements shall be as follows:

TABLE 302B.03 END PRODUCT COMPACTION REQUIREMENTS

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

*PROJECT MANAGER MAY VARY THESE VALUES AS REQUIRED TO SUIT LOCAL CONDITIONS AND KNOWLEDGE OF EXISTING MATERIALS. DELETE THIS NOTE.

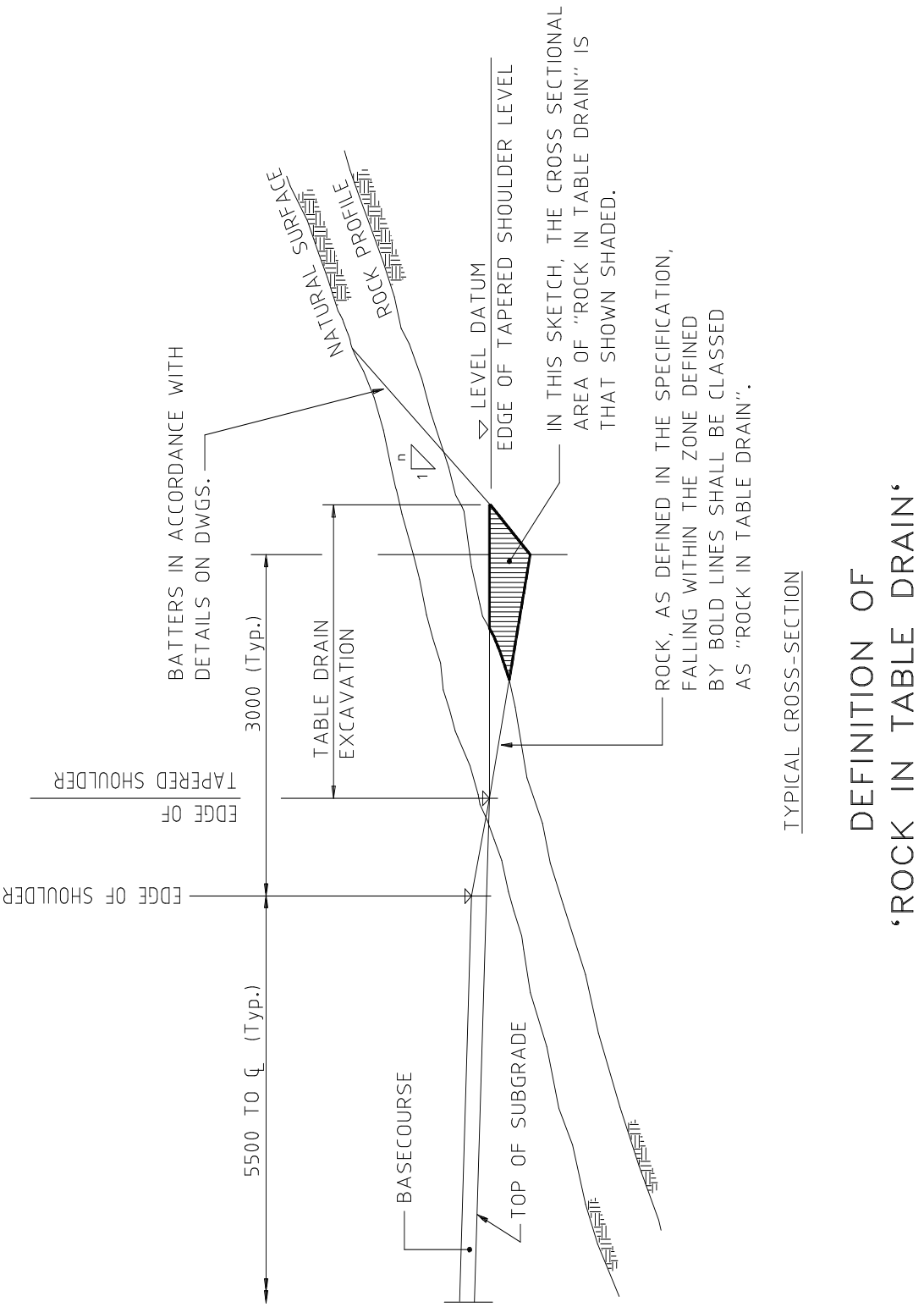
302B.4 BATTER SLOPE TOLERANCE

302B.4.1 Batter slopes shall not at any point vary from the specified slope by more than 150 mm measured normal to the specified batter slope.

ANNEXURE 302C

ROCK IN TABLE DRAIN

FIGURE 302C.01 DEFINITION OF 'ROCK IN TABLE DRAIN'



ANNEXURE 302D – NOT USED

GUIDANCE NOTES

FOR REFERENCE ONLY – DELETE GUIDANCE NOTES FROM FINAL DOCUMENT

1. All edits to this specification are to be made using track changes, to clearly show added/ deleted text.

2. If **all** information relating to a clause is deleted, the clause number should be retained and the words **"NOT USED"** should be inserted.

3. The proposed document with tracked changes must be submitted to the Project Manager for review, prior to finalising the document.

4. Once the Project Manager's review is complete, accept all changes in the document, turn off track changes and refresh the Table of Contents.

5. The Custodian of this specification is Manager Materials Engineering.

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1. EARTHWORKS QUANTITIES (ANNEXURE 302A)

1.1 Due to inevitable discrepancies between estimated and remeasured (actual) earthworks volumes, consideration could be given to issue any summary of earthworks quantities under the heading "Information for Tenderers" and reference to Annexure 302A deleted. The issue of the detailed MX GENIO output may be another alternative (perhaps even in electronic format), either as part of the normal tender documentation, or for inspection upon request.

1.2 If inserted at Annexure 302A, the earthworks summary should be limited to a summary of the major cuts and fills, and certain qualifications should be stated with the data:

(a) Volumes listed should be **solid** volumes (as they are in the Schedule of Rates), **and should be stated as solid volumes** (i.e. no bulking). Any assumptions about bulking when excavations are proposed to be used as fills should be left to the Contractor to make.

(b) The allowance made (if any) for the removal of topsoil, i.e. do the volumes in the summary include topsoil or not? (NOTE: Earthworks quantities given in the Schedule of Rates are usually given with the topsoil **removed**, as topsoil removal is measured separately as an area).

1.3 Add extra sheets to this Annexure as necessary.

2. GROUND SURVEY FOR VOLUME AND AREA CALCULATIONS

2.1 Typically, all survey undertaken to perform volume and area calculations will be performed in accordance with MRS 67-08-43 "Digital Ground Survey". The most up to date copy of this standard is located at www.mainroads.wa.gov.au.

TOPSOIL REMOVAL, STORAGE AND RESPREAD MOVED TO SPECIFICATION 304

3. IMPORTED MATERIAL FOR EMBANKMENTS INCLUSIVE OF SUBGRADE (CLAUSE 302.08 / ANNEXURE 302B)

3.1 The details shown in Annexure 302B Tables 302B.01 and 302B.02 are typical for imported material in the Perth area (commonly known as Perth sand), and are generally applicable when the Contract is situated in that area. Other sources of imported material are also used in the Perth area subject to design constraints:

(a) CBR satisfies pavement design criteria;

(b) assessment of capillary rise potential and consequently whether the material is suitable or for instance only suitable under a layer of Perth sand;

(c) assessment of CBR Swell and whether the minimum cover requirements in ERN9 are satisfied by the pavement design.

3.2 For Contracts outside the Perth area, insert a similarly worded clause with appropriate parameters based on local knowledge of material performance and design constraints discussed in section 5.1. Materials Engineering staff should be contacted for assistance with this.

3.3 The following may be used in the Kimberley region:

Particle Size Distribution:

Sieve Size (mm)	% Passing by Mass (Minimum and Maximum Limits)	Test Method
37.5	60 – 100	WA 115.1 Particle Size Distribution
2.36	30 – 100	
0.425	15 – 60	
0.075	≤ 25	

Other Limits:

Test	Limits	Test Methods
Linear Shrinkage (LS)	10% Maximum	WA 123.1
Product Rule = LS × (% Passing 0.425 mm Sieve)	250 Maximum	
Organic Matter	1% Maximum	ASTM D 2974-14 or AS12894.1.1
California Bearing Ratio (soaked) 92% MDD and 100% OMC	12% Minimum	WA 141.1
Swell (Embankment Construction)	2.5% Maximum	WA 141.1
Swell (Subgrade)	0.5% Maximum	WA 141.1

3.4 The following may be used in the Great Southern region:

Particle Size Distribution:

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

Other Acceptance Criteria:

Test	Limits
California Bearing Ratio	Minimum of 10%
California Bearing Ratio Swell	Maximum of 1.5%
Linear Shrinkage	Maximum 2%
Organic Matter	Maximum 1%

3.5 The Dieback status of the work site shall be considered when deciding if imported material must be Dieback-free. Refer to Specification 204 ENVIRONMENTAL MANAGEMENT for Dieback classification(s). If applicable, amend requirements in Annexure 302B.

4. DEPTH OF COMPACTION FOR EMBANKMENT FOUNDATION

4.1 Typically 150 mm. Other depths may be more appropriate depending on the type of material involved.

5. PRINCIPAL'S METHOD SPECIFICATIONS – PLANT REQUIREMENTS

5.1 The types of rollers and number of passes given in the Principal's Method Specifications for Embankment Foundation, Embankment Construction and Subgrade are fairly typical, but consideration could be given to providing Project Managers the opportunity to vary the rollers and number of passes in Annexure 302B. Annexure 302B would then include a table showing the required types of roller and number of passes, e.g.

Earthworks Element	Type of Roller	Number of Passes
Embankment Foundation		
Embankment Construction		
Subgrade		

(Any further rolling ordered by the Superintendent will be paid as Daywork.)

6. OVERLAY CONSTRUCTION (CLAUSE 302.22.02)

6.1 The preparatory work required on the retained pavement prior to the overlay being constructed could be paid as a Provisional Sum, as the nature and extent of such work is very difficult to price. This work will vary from contract to contract, and could include such items as:

(a) trimming off “high” spots;

(b) filling in “low” spots with additional pavement material;

(c) watering and rolling to tighten the exposed pavement surface.

6.2 Possibly, an allowance of $1,000.00 – $2,000.00 per km could be used to assess the amount of the Provisional Sum.

6.3 The questions whether the existing seal may be incorporated into the new pavement and whether any of the existing pavement will be incorporated into the new pavement need to be considered. Is it prone to excessive degradation in the mixing process, or are there cobbles present in the existing pavement that will lead to rapid wearing or damage of the mixing tynes?

(a) Where the seal is not allowed to be incorporated and mixing is to be carried out by grader only (clause 302.22.02 is applicable).

(b) Where the seal is not allowed to be incorporated and mixing may only be carried out by stabiliser (delete points 302.22.02 (5) and (6) – point (6) is not required as design levels will only be adjusted by the nominal thickness of seal and measurement will be by area).

(c) Where the seal may be incorporated and mixing must be carried out by a stabiliser (delete points 302.22.02 (2) to (5) and (6) – point (6) is not required as design levels are applicable and measurement will be by area).

(d) Overriding the above considerations in terms of the applicability of stabiliser mixing of pavement materials is the nature of the material, i.e. is it prone to excessive degradation in the mixing process? Advice from Materials Engineering staff should be sought.

7. LIME STABILISATION (CLAUSE 302.91)

7.1 Lime stabilisation of earthworks layers is not commonly used. It can be applied to any earthworks layer, but is typically only applied to the subgrade layer.

7.2 If lime stabilisation of the subgrade is specified, determine the following and insert into Annexure 302A (in addition to required compaction at Table 302B.02):

(a) Depth of stabilisation is typically 150 mm.

(b) Lime content is determined by laboratory testing. Because lime varies in purity (depending on manufacture) and strength (depending on whether it is quicklime, hydrated lime or lime slurry), the optimum lime content (see 16.3) must be expressed as a percentage of equivalent pure hydrated lime (calcium hydroxide) by dry mass of the subgrade material.

7.3 The process for determining whether Lime stabilisation is appropriate and the required % of pure hydrated Lime for subgrade stabilisation is:

(a) Refer to section 4.9 “Preliminary Binder Selection of the Austroads Guide to Pavement Technology – Part 4D: Stabilised Materials”, to determine if Lime is a suitable additive for the selected material.

If the stabilisation is not required for long-term soil stabilisation and is only undertaken to provide a working platform for subsequent construction, proceed to step (c) without undertaking the Lime Demand test. The Lime Demand requirements in step (d) are also not applicable.

(b) Undertake laboratory testing (only applicable to expansive soil) to determine the minimum % of lime (i.e. the Lime Demand) that must be added to achieve long term soil stabilisation. Determine the Lime Demand of the soil in accordance with VicRoads Manual of Testing, method RC 131.01 “Lime Saturation Point of Soil (pH Method)”. This method uses hydrated lime for the laboratory testing and includes reference to a methodology for determining the percentage of lime that must be added if another type of lime (e.g. quick lime) is used in the field.

(c) Determine the UCS of the stabilised material in accordance with Main Roads Test Method WA 143.1.

(d) The optimum Lime content of the soil for stabilisation must satisfy both the Minimum Lime Content to achieve long term stabilisation at step (b) (only applicable to expansive soil) and the % of lime that must be added to the soil to produce a 28 day UCS at step (c) falling in the range 0.7MPa to 1.5MPa.

(e) Should the Lime Demand test require a % of lime that results in a 28-day cured UCS that exceeds 1.5MPa then lime stabilisation must not be used (only applicable to expansive soil).

The minimum practical spread rate that can be achieved by most lime spreaders is 3 kg/m^2, which equates to approximately 1% lime for laterite gravel stabilised to a depth of 150 mm.

7.4 The safety aspects of using lime are referred to in clause 302.91.01 (3).

7.5 In addition to incorporating clause 302.91 into the CONTRACT SPECIFIC REQUIREMENTS section, ANNEXURE 302E (refer to CONTRACT SPECIFIC REQUIREMENTS details following), will need to be completed and incorporated into the document following ANNEXURE 302C.

8. CEMENT STABILISATION

8.1 Cement stabilisation can be applied to any earthworks layer, but typically only to the subgrade layer.

8.2 If cement stabilisation of the subgrade is specified determine the following and insert into Annexure 302E (in addition to required Compaction):

(a) Depth of stabilisation – typically 150 mm.

(b) Cement content – typical values are 1.0% to 2.0% by mass of the subgrade material.

(c) The cement content required will be determined from the unconfined compressive strength (UCS) of the material when tested in accordance with WA 143.1. The UCS specimens shall be compacted using General Purpose (type GP) cement, cured for seven (7) days in a controlled environment and immersed in water for four (4) hours prior to compression testing. The specimens are to be compacted at the applicable

Characteristic Dry Density Ratio and 100% of OMC. The UCS must be in the range of 0.6 – 1.0MPa.

8.3 The minimum practical spread rate that can be achieved by most cement spreaders is 3kg/m^2, which equates to approximately 1% cement for laterite gravel stabilised to a depth of 150 mm.

8.4 Pad-foot rollers must be used for initial compaction in accordance with clause 302.92.07.

8.5 In addition to incorporating clause 302.92 into the CONTRACT SPECIFIC REQUIREMENTS section, ANNEXURE 302E (refer to CONTRACT SPECIFIC REQUIREMENTS details following), will need to be completed and incorporated into the document following ANNEXURE 302C.

9. CONTRACTOR'S DEVELOPED METHOD SPECIFICATION (CLAUSES 302.43 & 302.53)

9.1 Only retain clauses 302.43 and 302.53 if you are satisfied that the Project Embankment Foundation and Embankment Construction material will be suitable for density compliance assessment using the Contractor's Developed Method Specification.

9.2 This method of density compliance assessment is only suitable for homogeneous materials. The compaction method may only be used if it is approved by the Superintendent. One in 5 Lots must be tested by NDM and six moisture samples must be taken from each Lot. The moisture content must be in the range 70% – 110% of OMC for an embankment foundation comprising of Perth Sand, or 90% – 110% of OMC for Other Material and the approved compaction process applied to achieve density compliance for a Lot.

9.3 It is recommended that clauses 302.43 and 302.53 are deleted if the project material will be variable or the level of surveillance required to verify density compliance using this methodology is not warranted.

CONTRACT SPECIFIC REQUIREMENTS

The following clauses are to be placed under the CONTRACT SPECIFIC REQUIREMENTS, as required. After inserting the clause, change the clause number and heading to style “H2 SP” so it appears in the Table of Contents.

The details for the chosen stabilising material will need to be added to the relevant Table in ANNEXURE 302E (following) and the Table for the material that is not being used can be deleted and the heading for the unused material marked as “NOT USED”. The ANNEXURE will then need to be incorporated into the specification following ANNEXURE 302C.

302.96 LIME STABILISATION

302.96.01 GENERAL

1. The subgrade material shall be stabilised with lime for the sections and to the compacted depths shown either in Annexure 302E or as detailed on the Drawings.

2. Modification shall include any preliminary loosening of subgrade layers, mixing and compacting, the subgrade material as necessary, spreading lime over the area to be treated, and the thorough blending of in-situ subgrade material, lime and water as required to produce a homogeneous stabilised layer over the specified lengths and widths.

Safety Requirements

3. The Contractor shall handle and use the quicklime/slaked lime in a safe manner, and shall provide adequate protection to the workforce, the public, stock and property.

302.96.02 MATERIALS

Lime

1. Lime for stabilisation of subgrade shall comply with the requirements of AS 1672. The lime shall be sufficiently dry to flow freely during application.

Delivery

2. The Contractor shall arrange lime delivery and have on site bulk storage facilities. The Contractor shall be responsible for all arrangements in regard to the transfer of lime between delivery vehicles, on site bulk storage facilities and lime spreaders.

302.96.03 PRELIMINARY TRIAL

1. The Contractor shall carry out a preliminary trial of the proposed stabilising operations. The trial shall determine:

   (a) the effectiveness of the plant;

   (b) the number of passes of the stabilising machine necessary to achieve the specified mixing; and

   (c) the compacted depth of layer being worked, including the allowance for trimming to spoil and level tolerances.

2. The trial section shall be located within the Works area.

3. **Prior to conducting such a trial the Contractor shall agree with the Superintendent the location, length and width of trial section(s) within the Works.** ***HOLD POINT***

4. The Contractor shall not change the method developed during the trial without first obtaining approval from the Superintendent.

302.96.04 PLANT AND EQUIPMENT

A. Lime Spreader ***Lime Spreader***

1. The spreading equipment shall be a mechanical stabilising agent spreader that has been specifically designed for such work. The spreader shall be capable of uniformly distributing lime and accurately controlling the spread rate such that when mixing is complete the lime content shall be in accordance with the requirements of sub-clause 302.96.06 Spreading of Lime.

2. The spreader shall be equipped with gates to vary the width of spread and with electronic weigh scales to give daily totals of product use.

B. Stabilising Machine ***Stabilising Machine***

3. Cutting, pulverising, mixing, adding water and spreading of blended material shall be accomplished using a machine specifically designed for pavement recycling. The stabilising machine's rotor action shall be such that the rotor revolves in an upwards and forwards cutting direction. The rotor shall be of the recycler type and fitted with bullet teeth cutting tips.

4. Rotary hoes and other implements normally used for agricultural work shall not be used. The stabilising machine shall also satisfy the following requirements:

   (a) be capable of producing a uniformly mixed material throughout the specified depth of the work;

   (b) be equipped with a variable depth of cut control, and an accurate gauge to measure depth of cut which is readily visible to the stabilising machine operator; and

   (c) have provision for adding water automatically through a system comprising a pump, flow meter, variable control valve and full width spray bar. Each nozzle on the spray bar shall be fully and independently adjustable and the water pump shall have the capacity to supply a minimum of 900 litres per minute.

302.96.05 PRELIMINARY TREATMENT

1. It shall be the Contractor’s responsibility to determine whether pre loosening and mixing of any in situ material is necessary.

2. Where the depth, length or width loosened exceeds the dimensions specified in the Drawings the Contractor shall add additional lime to the mix so that the specified percentage of lime is still achieved. The Contractor shall also add additional lime to allow for any depth cut to spoil during the trimming operation.

302.96.06 SPREADING OF LIME

1. Lime shall be spread uniformly at a controlled rate over the area to be stabilised using a suitable lime spreader.

2. The lime stabilised subgrade layer shall contain an average of not less than the equivalent percentage of hydrated lime (calcium hydroxide) as shown in Annexure 302E. The percentage stated is a percentage of the dry mass of the subgrade layer material. The Contractor shall keep daily records of the amounts of lime used and actual spread rates achieved per section treated and shall make such records available to the Superintendent upon request. ***Composition***

3. The actual spread rate of lime achieved shall be determined by either:

   (a) placing three trays each of approximately one third of a square metre in area in front of the lime spreader and measuring the mass of lime deposited on the trays for each lot, or

   (b) by the use of an on-board electronic weigh scale system.

4. The percentage lime (P%) shall be calculated thus:

$$P\% = \frac{M \times 100}{A \times T \times MDD}$$

   Where:

   M = total mass of lime (kg) as determined by one of the following methods:
   (a) on each tray
   (b) on-board electronic weight scale system

   A = method (a) total area of the trays (m^2)
   method (b) total measured area spread (m^2)

   T = Thickness to be stabilised (mm) (including allowances for tolerances and trimming)

   MDD = Maximum Dry Density of the pavement material without the addition of lime (kg/m^3)

5. The percentage lime determined for each tray in accordance with this clause shall be maintained within ± 10% by mass of the specified lime content throughout the stabilisation works.

6. The use of an on-board electronic weighing scale system in determining the values 'M' and 'A' is subject to satisfactory calibration of the measuring device and the production of associated certification in accordance with the Contractor's Quality System. Audits on this method shall be carried out using the measuring tray method.

7. Once the lime has been spread, no other plant other than that needed for spreading, or for mixing and spreading the mixed material, shall be permitted to travel over the area to be stabilised.

302.96.07 INCORPORATION OF LIME

1. The spreading of lime shall not proceed when rain is imminent. The spread lime shall be incorporated into the subgrade layer immediately following the spreading operation. All spread lime shall be incorporated into the subgrade layer within the same working day. Lime shall not be spread when the prevailing wind velocity is sufficient to make the lime particles airborne.

2. As a minimum cutting, pulverising, mixing, adding water and spreading of mixed material shall take place by the stabilising machine in two separate operations. The first operation shall incorporate 50% of the lime spread rate as specified into the full depth of the layer to be stabilised. Prior to incorporation of the remaining lime into the full depth of the layer to be stabilised, the stabilised layer shall be compacted by not less than four (4) complete coverage of a vibratory pad foot roller of a size not smaller than specified in clause 302.44 Embankment Foundation Compaction: Principal's Method Specification.

3. Cutting, pulverising, mixing, adding water and spreading of mixed material shall continue until the maximum size of all material (other than rock) is not greater than 25 mm, and the lime and water are uniformly incorporated into the mixed material without streaks or pockets of lime.

4. The depth of the stabilisation shall be judged to be acceptable when the depth after compaction is not less than the layer thickness specified in Annexure 302E, determined by measuring six (6) sites per lot in accordance with Main Roads Test Method WA 330.1.

302.96.08 MOISTURE CONTENT

1. During the whole of the compaction process the moisture content at any point in a Lot of earthworks shall be within 90% – 110% of the optimum moisture content for that material as determined by WA 133.1 or 133.2.

2. The Contractor shall be responsible for achieving and maintaining the required moisture content by controlling the amount of water added during the mixing process within the stabilising machine.

302.96.09 COMPACTION

1. The mixed material shall be compacted to the Characteristic Dry Density Ratio as shown in Annexure 302B, or greater.

2. The Contractor shall be responsible for any additional stabilising, including the supply and incorporation of additional lime, required as a result of non-compliance with this clause as directed by the Superintendent.

302.96.10 REWORK

1. If a completed section of lime stabilisation does not satisfy all of the requirements of the specification and has to be reworked, the Contractor shall rework the section without the addition of lime, at no cost to the Principal.

2. Rework shall include any disturbance to the surface of the lime stabilised layer during trimming to meet shape or level requirements and the rework depth shall not be less than the full depth of the affected layer.

302.96.11 CONSTRUCTION JOINTS

1. When the stabilising work cannot be completed in one continuous operation, the Contractor shall provide construction joints at each discontinuity in the operation.

2. Construction joints shall be made transverse to and/or parallel to the direction of the stabilising run, and shall be made just prior to the commencement of the next stabilising run.

3. The joints shall be formed by cutting back into the compacted stabilised material to form a vertical face. The loose trimmed material shall be removed from the joint before the next section is mixed and compacted and shall be disposed of to the Contractor's spoil area.

302.97 CEMENT STABILISATION

302.97.01 GENERAL

1. The Contractor shall cement stabilise the specified subgrade layer with the proportion of cement and to the depth of the subgrade layer as shown in Annexure 302E.

2. The cement stabilised subgrade layer shall be constructed at the locations shown in Annexure 302E and to the tolerances and requirements specified for the subgrade layer.

3. Cement for stabilisation of any subgrade layer shall comply with the requirements of AS 3972, Type LH. Any sampling and testing of cement shall be in accordance with AS 2350. The cement shall be dry to flow freely during application.

4. Cement for stabilisation of any subgrade layer shall comply with the requirements of Australian Technical Infrastructure Committee Specification (ATIC) SP43. The Cementitious Material Registration Scheme (CMRS) shall be used to confirm that the cement complies to ATIC – Specification SP43. The standard application form for CMRS registration is located at Annexure 302F.

5. **Prior to commencing cement stabilisation the Contractor shall confirm that the cement complies with ATIC – Specification SP43 and shall provide the CMRS registration number for the cement to the Superintendent for approval of the cement.** ***HOLD POINT***

302.97.02 TRIAL SECTION

1. The Contractor shall carry out a preliminary trial of the proposed stabilising operations. The trial shall determine:

   (a) the effectiveness of the plant;

(b) the number of passes of the stabilising machine necessary to achieve the specified mixing; and

(c) the compacted depth of layer being worked, including the allowance for trimming to spoil and level tolerances.

2. The trial section shall be located within the Works area.

3. **Prior to conducting such a trial the Contractor shall agree with the Superintendent the location, length and width of trial section(s) within the Works.** ***HOLD POINT***

4. The Contractor shall not change the method developed during the trial without first obtaining approval from the Superintendent.

302.97.03 PLANT AND EQUIPMENT

A. Cement Spreader

5. The spreading equipment shall be a stabilising agent spreader, which has been specifically designed for such work. The spreader shall be capable of uniformly distributing cement and accurately controlling the spread rate such that when mixing is complete, the cement content shall be in accordance with the requirements of sub-clause 302.97.05 Spreading of Cement.

6. The spreader shall be equipped with gates to vary the width of spread and with electronic weigh scales to give daily totals of product used.

B. Stabilising Machine

7. Cutting, pulverising, mixing, adding water and spreading of mixed material shall be accomplished using a stabilising machine specifically designed for stabilisation.

8. The stabilising rotor action shall be such that the rotor revolves in an upwards and forwards cutting direction. The rotor shall be of the recycler type and fitted with bullet teeth cutting tips.

9. The stabilising machine shall also satisfy the following requirements:

(a) It shall be capable of producing a uniformly mixed material throughout the specified depth of the work.

(b) It shall be equipped with a variable depth of cut control, and an accurate gauge to measure depth of cut which is readily visible to the stabilising machine operator.

(c) It shall have provision for adding water automatically through a system comprising a pump, flow meter, variable control valve and full width spray bar. Each nozzle on the spray bar shall be fully and independently adjustable, and the water pump shall have the capacity to supply up to 1500 litres per minute.

302.97.04 PRELIMINARY TREATMENT

1. It shall be the Contractor's responsibility to determine whether pre-ripping of any in-situ material is necessary. Under no circumstances shall ripping to a depth exceeding the depth to be stabilised be permitted.

302.97.05 SPREADING OF CEMENT

1. The cement stabilised subgrade layer shall contain not less than the proportion of cement as a percentage of the dry mass of subgrade material as shown in Annexure 302E. Cement shall be spread uniformly at a controlled rate over the area to be stabilised using a suitable cement spreader.

2. The Contractor shall keep daily records of the amounts of cement used and actual spread rates obtained per section treated.

3. The percentage cement shall be determined by either:

   (a) placing three (3) trays each of one third one square metre in area in front of the cement spreader and measuring the mass of cement deposited on the trays for each lot, or

   (b) by use of an on-board electronic weight scale system.

4. The percentage cement (P%) shall be calculated thus:

$$P\% = \frac{M \times 100}{A \times T \times MDD}$$

   Where:

   M = total mass of cement (kg) as determined by one of the following methods:
   (a) on each tray
   (b) on-board electronic weight scale system

   A = method (a) total area of the trays (m^2)
   method (b) total measured area spread (m^2)

   T = Thickness to be stabilised (mm) (including allowances for tolerances and trimming)

   MDD = Maximum Dry Density of the subgrade material without the addition of cement (kg/m^3)

5. The percentage cement determined for each tray in accordance with this clause shall be maintained within ± 10% by mass of the cement content specified in this clause throughout the stabilisation works.

6. The use of an on-board electronic weighing scale system in determining the values 'M' and 'A' is subject to satisfactory calibration of the measuring device and the production of associated certification in accordance with the Contractor's Quality System. Audits on this method shall be carried out using the measuring tray method.

7. Once the cement has been spread, no other plant other than that needed for spreading, or for mixing and spreading the mixed material, shall be permitted to travel over the area to be stabilised.

302.97.06 INCORPORATION OF CEMENT

1. The spreading of Cement shall not proceed when rain is imminent. The spread cement shall be incorporated into the subgrade layer immediately following the spreading operation. All spread cement shall be incorporated into the subgrade layer within the same working day. Cement shall not be spread when the prevailing wind velocity is sufficient to make the cement particles airborne.

2. Cutting, stabilising, mixing, adding water and spreading of mixed material shall take place as a single operation within the stabilising machine.

3. Cutting, stabilising, mixing, adding water and spreading of mixed material shall continue until the maximum size of all material (other than rock) is not greater than 25 mm, and the cement and water are uniformly incorporated into the mixed material without streaks or pockets of cement.

4. The depth of the stabilisation shall be judged to be acceptable when the depth after compaction is not less than the layer thickness shown in Annexure 302E, determined by measuring six (6) sites per lot in accordance with Main Roads Test Method WA 330.1.

302.97.07 COMPACTION

1. Compaction of the mixed material shall be completed within six (6) hours of the completion of incorporation of cement into the subgrade layer and shall be compacted to the Characteristic Dry Density Ratio as shown in Annexure 302B or greater.

2. During the whole of the compaction process the moisture content at any point in a Lot of earthworks shall be within 90% - 110% of the optimum moisture content for that material as determined by WA 133.1 or 133.2.

3. The Contractor shall achieve and maintain the required moisture content of the mixed material by controlling the amount of water added during the mixing process within the stabilising machine.

4. Initial compaction must be carried out with a vibratory pad foot roller of a size not smaller than specified in clause 302.44 Embankment Foundation Compaction: Principal's Method Specification.

302.97.08 REWORK

1. If a completed section of cement stabilisation does not satisfy all of the requirements of the specification and has to be reworked, the layer shall be reworked without the addition of cement at no cost to the Principal.

2. Rework shall include any disturbance to the surface of the cement stabilised layer during trimming to meet shape or level requirements and the rework depth shall not be less than the full depth of the affected layer.

302.97.09 CONSTRUCTION JOINTS

1. If the stabilised work is such that it cannot be completed in one continuous operation, the Contractor shall provide construction joints at each discontinuity in the operation.

2. All construction joints shall be made transverse to and/or parallel to the direction of the stabilised run, and shall be made just prior to the commencement of the next stabilised run.

3. The joints shall be formed by cutting back into the compacted stabilised material to form a vertical face. The loose trimmed material shall be removed from the joint before the next section is mixed and compacted.

ANNEXURE 302E

302E.1 LIME STABILISED SUBGRADE

302E.1.1 Lime stabilised subgrade layers shall be constructed with the parameters as shown in Table 302E.01:

TABLE 302E.01 LIME MODIFIED SUBGRADE

Section		Depth of Stabilisation (mm)	Width of Stabilisation (m)	Equivalent Pure Hydrated Lime Content (% by mass of Subgrade Layer)
From	To			

302E.2 CEMENT STABILISED SUBGRADE

302E.2.1 Cement stabilised subgrade layers shall be constructed at the locations and with the parameters as shown in Table 302E.02:

TABLE 302E.02 CEMENT STABILISED SUBGRADE

Section		Depth of Stabilisation (mm)	Width of Stabilisation (m)	Cement Content (% by mass of Subgrade Layer)
From	To			

ANNEXURE 302F

CEMENTITIOUS MATERIALS FOR CONCRETE

REQUEST FOR REGISTRATION BY MANUFACTURER

Cement or Blend Details	
Product Name	
Type	
Proportions	
Manufacturer	
Place of Manufacture	
Source of Constituent Materials	
Cement Clinker	
Fly Ash	
Slag	
Limestone	
Gypsum	
Grinding Aids	
Supply Details	
Dispatching Supplier	
Contact Name	
Contact Phone No.	
Contact Address	
Suppliers ABN	

Send this form with the sample to:

RMS Chemical and Materials Laboratory

Att: Laboratory Officer

Unit H, 75 St. Hilliers Rd,
Auburn NSW 2144

For RMS Laboratory Use Only:

Date of Registration:

Registration No:

AMENDMENT CHECKLIST

Specification No. **302** Title: **EARTHWORKS** Revision No: _____

Project Manager: _____ Signature: _____ Date: _____

Checked by: _____ Signature: _____ Date: _____

Contract No: _____ Contract Name: _____

ITEM	DESCRIPTION	SIGN OFF
Note: All changes/amendments must be shown in tracked changes until approved.		
4.	Project Manager has reviewed the Specification and identified additions and amendments.	
5.	Standard clauses amended? **MUST SEEK** approval from Manager Contracts and Commercial Management.	
6.	Any unlisted materials/products proposed and approved by the Project Manager? If "Yes" provide details at 16.	
7.	Deleted clauses shown as **"NOT USED"**.	
8.	Ensure appropriate **INSPECTION AND TESTING** parameters are included in Specification 201 (test methods, minimum testing frequencies verified).	
9.	**AS-BUILT AND HANDOVER** requirements addressed.	
10.	**CONTRACT SPECIFIC REQUIREMENTS** addressed? Contract specific materials, products, clauses added? (refer Specification Guidance Notes).	
11.	**ANNEXURES** completed (refer Specification Guidance Notes).	
12.	Estimates Manager has approved changes to **SMM**.	
13.	Project Manager certifies completed Specification reflects intent of the design.	
14.	Independent verification of completed Specification arranged by Project Manager.	
15.	Project Manager's review completed.	
16.	**SPECIFICATION GUIDANCE NOTES** deleted.	
17.	**TABLE OF CONTENTS** updated.	
18.	**FOOTER** updated with Document No., Contract No. and Contract Name.	
19.	Supporting information prepared and submitted to Project Manager.	
Additional information or further action:		

Signed: _____ *(Project Manager)* Date: _____