

SECTION 11 ROADWORKS (PAVEMENT)

1 GENERAL

1.1 SCOPE

Outline description

This section applies to all roadworks forming the whole, or part of the Works.

Cross references

Conform also to the *Preliminaries* and *General Requirements* and *Environmental Requirements* worksections, including to requirements for:

- All imported materials to be certified as free from building waste and asbestos containing material (ACM);
- Procedures to be followed if suspected or confirmed ACM is discovered during the course of the Works.

1.2 DEFINITIONS

Standard

To AS 1348.

1.3 CERTIFICATION

Requirement

Upon completion of the base and subbase and before any bitumen pavement is laid provide to the Superintendent certification by a practising professional civil engineer registered under the Professional Engineers Act 2002 (Queensland) (Contractor's Certifying Consultant) that:

- (1) All tests to roadworks and roadworks materials required under the contract have been completed; and
- (2) Roadworks materials and completed roadworks conform in all respects to the Drawings and Specification.

Refer also to *Preliminaries* Section, clause WORKS CERTIFIED BY CONTRACTOR'S CERTIFYING CONSULTANTS.

1.4 TRAFFIC CONTROL DEVICES

Standard

To AS 1742.

Requirement

Install all signs and traffic control devices required by Drawings and/or Specification at their correct locations to the Superintendent's approval and maintain them in clear working order for the duration of their required use or Contract duration, whichever is the lesser.

2 SITE MANAGEMENT

2.1 INSPECTION

Notice

Give sufficient notice, not less than one clear working day before the work is ready for inspection, so the following may be inspected:

Item:

- Materials or areas of work for specified tests;
- Subgrade material opened up so that its nature can be assessed;
- Prepared subgrade;

- Each pavement layer placed and compacted;
- Surface prepared for priming, sealing or asphalt surfacing;
- Commencement of bituminous spraying;
- Automatic level control devices in place;
- Commencement of asphalt surfacing.

2.2 RECORDS OF MEASUREMENT

Requirement

If a schedule of rates applies to the work, or provisional quantities are specified, or there have been variations to the Contract levels or dimensions of work, unless otherwise directed do not do any work which would make the taking of measurement not possible until agreement has been reached on the measured quantity of the item which is a provisional quantity or is so scheduled or varied.

Certified records

Provide a copy of the agreed records of measurement certified by the Contractor and the Superintendent.

2.3 TESTING

Requirement

Except for tests specified to be carried out by the Superintendent, arrange for tests specified in the Contract documents to be carried out by a testing authority (in the case of compliance assessment tests, by an independent testing authority) registered with the National Association of Testing Authorities (NATA) to perform the tests so required.

Process control tests

The specified process control tests are the minimum requirement. Perform tests of the type and frequency necessary to adequately control the materials and processes used in the construction of the Works.

Compliance assessment tests

Materials and work specified to be subject to testing may not be accepted as complying with the Contract until the results of all tests (including process control tests) relating to that material or work are satisfactory.

Records

Process Control: Show the results of process control tests on control charts or graphs displayed on site in a readily accessible location and updated daily.

Compliance assessment: Arrange for the independent testing authority to submit three copies of each test result direct to the Superintendent.

Methods

Unless otherwise specified use applicable standard test methods specified in Australian Standards. Use wet preparation methods where applicable.

Sampling

Except for sampling specified to be carried out by the Superintendent, take and prepare the samples required for the specified tests. The Superintendent shall determine the timing and location of sampling, other than sampling for process control testing.

Timing: Unless otherwise specified materials samples shall be obtained at the time of delivery to the site.

Location: The Superintendent shall designate uniform test lots, consisting usually of an area placed and/or compacted in one day, and shall select sampling sites within each test lot on a random basis. If test results show that a test lot is not uniform as regards material properties or density the Superintendent may require the tests to be repeated on samples from new uniform test lots.

Certificates of compliance

Where a certificate of compliance is specified to be acceptable as an alternative to testing a manufactured material, submit the manufacturer's certificate together with the results of recent tests undertaken by the manufacturer, showing compliance with the specified test criteria.

2.4 MATERIAL TESTS

Material properties

Specified properties of materials apply to their condition as installed in the completed Works. Where it is expected that properties will change significantly during construction, adjust the delivered material accordingly.

Material tests standards

Material	Standard
Concrete	AS 1012
Cement	AS 1315
Aggregates	AS 1141, AS 1289
Base and subbase materials	AS 1141, AS 1289
Soils	AS 1289
Asphalt	AS 2150
Bitumen	AS 2341
Bitumen emulsion	AS 1160

2.5 DENSITY TESTS

Criteria

Each section of the subgrade or unbound pavement layer required to be tested shall meet the following criteria:

Number of tests:	Maximum number of results below the required density ratio:		
	0 – 1% below:	1 – 2% below:	more than 2% below:
0 – 5	1	1	Nil
6 – 10	2	1	Nil
11 or more	20%	10%	Nil

3 COMPACTION

3.1 SUBGRADE, SUBBASE AND BASE COMPACTION

Compaction requirements

Apply uniform and sufficient compactive effort by appropriate equipment over the whole area to be compacted, to achieve the required densities.

Layer thickness

Compact the material in layers of not less than 100 mm and not more than 200 mm uncompacted thickness, except that no layer shall exceed 150 mm in thickness unless the Contractor has demonstrated that the proposed compaction equipment can achieve the specified density throughout the layer. Within these limits, layers of the same material in multi-layer courses shall be of equal thickness.

Compaction procedure

Commence compaction of each layer as soon as practicable after spreading. Compact the lower edge of the pavement first and progress upward towards the crown or higher edge. Compaction passes shall overlap and be parallel to the base and subbase centreline.

Moisture content

During compaction, maintain the materials at the optimum moisture content for the specified compaction appropriate to each material, within the following tolerances:

- Unbound base materials and cement-treated materials: +/- 1%.
- Unbound subbase materials: +/- 2%.

Rectification

If a section of subgrade or pavement material fails to meet the specified density after compaction, rectify without extra charge as follows:

Fill subgrades: Remove the non-complying material, replace with fill material as specified in PLACING FILLING – GROUNDWORKS.

Cut subgrades: Rework the material and recompact.

Pavement material: Rework the material and recompact.

Level corrections

Rectify incorrect levels without extra charge as follows:

High areas, unbound layers: Grade off as directed.

High areas, bound layers: Remove to the full depth of the layer, replace with new bound material, and recompact.

Low areas: Remove bound layers to the full depth and unbound layers to a minimum depth of 75 mm, replace with appropriate new material and recompact.

Low areas in subgrades: Repair as specified in SUBGRADE PREPARATION – ROADWORKS.

3.2 COMPACTION EQUIPMENT

Rollers

Use approved rollers, appropriate to the materials and compaction requirements.

Spraying

To maintain moisture content, use water spraying equipment capable of distributing water uniformly in controlled quantities over uniform lane widths without washing fines from the base or subbase material.

4 SUBGRADE

4.1 SUBGRADE PREPARATION

Generally

Subgrades shall be constructed in accordance with *Groundworks*.

Compaction

Notwithstanding the compaction requirements stated in *Groundworks*, the top 150 mm of all subgrades shall be compacted to a Dry Density Ratio of 95% of the maximum dry density as determined by tests 5.2.1, 5.3.1 and 5.4.1 of AS 1289.

Tolerances

Notwithstanding the requirements contained in *Groundworks*, the level tolerance applicable to the finished subgrade surface shall be + 0 mm to – 100 mm.

Rectification

Sections of subgrade which are lower than 100 mm below finished subgrade level shall be rectified by addition of fill material in accordance with PLACING FILLING – GROUNDWORKS. Sections of subgrade which are less than 100 mm below finished subgrade level shall be rectified by increasing the thickness of the subbase layer.

5 BASE AND SUBBASE

5.1 BASE AND SUBBASE MATERIALS

Source material

Crushed rock or soil aggregate consisting of hard, dense, durable particles of uniform quality, free from deleterious materials or coatings or clay or organic matter as specified in CRUSHED ROCK MATERIAL – ROADWORKS or SOIL AGGREGATE MATERIAL – ROADWORKS as appropriate.

Reference samples

Submit to the Superintendent two samples together with test certificates of the proposed type of base and subbase material, each clearly marked with the type of material, its source and the name of the job. Conform with AS 1141 for sampling procedure and sample size. Deliver both samples to the Superintendent’s office and store as directed, sufficiently in advance of the intended importation of the material to enable the Superintendent to determine the acceptability of the material or otherwise. A sample, if approved, shall be designated the ‘reference sample’ for that type of material. Each material supplied under the Contract shall be of a quality appreciably the same as the reference sample and the samples for approval.

Delivery of material

Do not commence delivery of material for incorporation into the works until the samples have been accepted by the Superintendent for the purpose for which they are intended.

Removal of unsuitable material

Remove imported material of lesser quality than the accepted sample from the site within 3 days of notification by the Superintendent.

5.2 CRUSHED ROCK MATERIAL

General

Crushed rock shall consist of rock fragments crushed from clean, durable, selected quarried rock or river gravels, having an Aggregate Crushing Value not exceeding 25%. This processed material shall be of uniform quality consisting of crushed rock fragments or a combination of crushed rock fragments and sand or other approved filler, suitably made by processing, which shall be taken to include crushing, screening and recombining of the rock fragments, combining with other materials (including the addition of water as necessary) and any other operation carried out to produce the required material.

Grading

The processed material shall conform to the following grading:

A.S. Sieve Size (mm)	Percentage (by Mass) Target	Passing Sieve	
		Minimum Limit	Maximum Limit
37.5	100	100	100
26.5	100	85	100
19.0	87	75	100
9.5	69	58	80
4.75	54	45	62
2.36	39	33	45
0.425	18	14	22
0.075	7	5	10

Limits: The limits shown are acceptable for random departures from the target grading, but the actual grading curve for the material shall be smooth and free from sharp irregularities. The ratio of the percentage of material passing the 0.075 mm sieve and that passing the 0.425 mm sieve shall not exceed 0.55.

Other properties

Material passing the 0.425 mm sieve shall conform to the following properties:

Property	Value	
	For Subbase:	For Base:
Liquid Limit %	28	25

Plasticity Index (PI) %	6	4
Maximum Linear shrinkage %	3	3

5.3 SOIL AGGREGATE MATERIAL

General

Soil aggregate materials may include:

- Gravels (e.g. pit, ridge, creek or waterworn material; crusher product mixed with binder; decomposed rock).
- Loams.
- Sand-clay mixes.

Quality: Use material of uniform quality consisting of materials, either in the natural state or processed. Processing may include crushing, screening and recombining of materials, combining with other materials (including the addition of water as necessary) and any other operation carried out to produce the required material. Use processed or natural material which conforms to the grading shown in the following table, except that only either C or D gradings shall be used if the soil aggregate material is to be stabilised, and in this case 100% of the material shall pass the 26.5 mm sieve.

A.S. Sieve Size (mm)	Percentage by Mass Passing Sieve		
	Grading B	Grading C	Grading D
75.0	---	---	---
53.0	100	---	---
37.5	85 – 100	100	---
19.0	55 – 90	80 – 100	100
9.50	40 – 70	55 – 90	80 – 100
4.75	28 – 55	40 – 70	55 – 90
2.36	20 – 45	30 – 55	40 – 70
0.425	10 – 25	12 – 30	20 – 40
0.075	4 – 14	5 – 20	8 – 25

Grading Curve: The grading curve shall be reasonably smooth and free from sharp irregularities. The ratio of the percentage of the material passing the 0.075 mm sieve and the percentage of the material passing the 0.425 mm sieve shall lie between a maximum of 0.65 and a minimum of 0.35.

Other properties

Material passing the 0.425 mm sieve shall conform to the following properties:

Property	Value	
	For Subbase:	For Base:
Maximum Liquid Limit %	35	28
Max. Plasticity Index (PI) %	12	8

Maximum Linear shrinkage %	8	4
Maximum value of product of P.I. x percentage of whole sample passing the 0.425 mm sieve	360*	200*

*This value of this product shall apply as a requirement of the material irrespective of the specified upper percentage limit for material passing the 0.425 mm sieve.

5.4 CEMENT TREATED MATERIALS

Material

Use materials conforming to CRUSHED ROCK MATERIAL – ROADWORKS for subbase or to SOIL AGGREGATE MATERIAL – ROADWORKS for subbase with grading either C or D.

Sample

Submit a 50kg sample of the proposed material at least one month before commencing subbase construction.

Cement

Type A to AS 1315.

Proportions: As prescribed by the Superintendent. When tested, the cement content of the mix by mass of aggregate shall be within +/-0.3% of that prescribed.

Provisional quantity of cement

5%.

Adjustment of provisional quantity: The difference between the specified provisional quantity of cement and the actual quantity as prescribed shall be adjusted at the scheduled rate.

Mixing

Mix cement and water with the subbase material in an approved mixing plant prior to placing the material. Obtain prior approval to the proposed method of mixing. Notwithstanding approval of method, mixes which are not consistently uniform, of the required proportions and moisture content, or otherwise fail to meet contract requirements, are liable to rejection.

5.5 PLACING BASE AND SUBBASE

General

Do not place material on a surface which has been so weakened by moisture that it will not support, without damage, the constructional plant required to perform the work under the Contract. Spread material in uniform layers as near as practicable to the required thickness by direct tipping from suitable vehicles or by the use of a mechanical spreader. Avoid segregation of material during tipping and spreading. Minimize the tipping of material in heaps and spreading by grader. If material becomes segregated, remix as directed using a rotary hoe or other suitable equipment.

Moisture content: Maintain wet-mixed materials at the specified moisture content prior to and during spreading. Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading, to bring the material to the specified moisture content.

Layer thickness: Not greater than 150 mm nor less than 75 mm compacted thickness.

Moisture control

Moisten prepared subgrades and preceding layers of subbase immediately before spreading subbase or base material. Keep the leading edges of subbase or base material moist until new material is added adjacent to it. If it dries out, the Superintendent may order the formation of a joint.

5.6 PLACING CEMENT-TREATED SUBBASE

Compaction

Begin compacting immediately after spreading and complete in a continuous operation not more than 2 hours after the cement and water have been mixed into the material. Compact the lower edge of the pavement first

and progress upward towards the crown or higher edge. Compaction passes shall overlap and be parallel to the base and subbase centreline.

Joints

Make longitudinal and transverse joints as specified in **JUNCTIONS WITH EXISTING PAVEMENTS – ROADWORKS**:

- at the end of each day's work;
- where spreading has been halted for more than two hours;
- where shown on the Drawings.

Moisture control

Keep the compacted surface of each layer moist by watering until covered by further material or a bituminous curing seal.

Bituminous curing coat

Apply to the final surface as soon as possible after the completion of compaction and in any case not more than 8 hours thereafter.

Material: Bitumen emulsion to AS 1160, designation ARS/170.

Application: As specified in **TACK COAT – ROADWORKS**.

Application Rate: Between 0.5 and 0.55 L/m² of residual bitumen.

Protection

Keep traffic off the sealed surface and protect it as specified in **TRAFFIC ON PRIMED SURFACES – ROADWORKS**.

5.7 BASE AND SUBBASE DENSITIES

Required densities

Using Tests 5.2.1, 5.3.1, 5.4.1 of AS 1289.

Base: 95% of modified maximum dry density.

Subbase: 95% of modified maximum dry density.

Cement-treated subbase: 95% of modified maximum dry density.

5.8 FINISHING BASE SURFACES

Surface finish

Construct the surface slightly higher than the required levels and toward the end of the compaction process cut it with a power grader to conform to alignment, levels and profiles shown on the Drawings. Complete the compaction and produce a tight even surface without loose stones or a slurry of fines.

5.9 BASE AND SUBBASE TOLERANCES

Levels

Finished surfaces shall be free draining and evenly graded between level points. The following tolerances apply to the finished levels of each base and subbase layer, unless overridden by the specified requirements (including tolerances) for the finished levels and thickness of the surface course:

Absolute level tolerance: (Maximum deviation from design level):

- Base surface: + 5 mm/-10 mm.
- Subbase surface: + 5 mm/-20 mm.

Relative level tolerance: 10 mm.

(Maximum deviation from a 3 m straightedge laid anywhere on the surface.)

Edges abutting gutters: Within +/- 5 mm of the level of the actual gutter edge, less the specified thickness of the surface course, if applicable.

Thickness

Tolerance on total thickness of the granular layers over the subgrade, and on the thickness of each individual layer:

- + unspecified, - 10 mm.

5.10 JUNCTIONS WITH EXISTING PAVEMENTS

Requirement

Where the pavement is to be joined to an existing pavement remove a strip of the existing pavement at least 300 mm wide for its full depth and trim the edge to an angle of approximately 45° in steps of maximum height 150 mm before placing new pavement material. If the existing pavement is sealed, trim the seal to a neat edge using pneumatic tools or other suitable means.

5.11 TRAFFIC ON PAVEMENT BASE

Requirement

Unless otherwise specified or permitted, do not open the pavement to traffic until the specified surfacing is complete. If the pavement is to be opened before completion, apply a suitable temporary seal or primer-seal to protect as specified in TRAFFIC ON PRIMED SURFACES – ROADWORKS.

6 ASSOCIATED ROADWORKS ELEMENTS

6.1 ASSOCIATED ELEMENTS

Definition

'Associated elements' for the purposes of this Section shall include, where applicable, concrete footpaths, driveways, minor paving, kerbs, gutters, crossings, mower strips and the like.

6.2 SUBBASE FOR ASSOCIATED ELEMENTS

Material

Subbase as specified in BASE AND SUBBASE MATERIALS – ROADWORKS or crushed dust.

Crusher dust properties:

- Liquid limit: 35% maximum.
- Plasticity index: 12% maximum.
- Linear shrinkage: 6% maximum.

Placing

As specified in PLACING BASE AND SUBBASE – ROADWORKS.

Kerb and footpath subbase

Compacted thickness: 75 mm minimum or as shown on the Drawings.

Required density: To a Dry Density Ratio of 90% of the maximum dry density as determined by tests 5.2.1, 5.3.1 and 5.4.1 of AS 1289.

6.3 MATERIALS FOR ASSOCIATED ELEMENTS

Concrete and reinforcement

In accordance with *Concrete*.

Minimum concrete compressive strength: 20 Mpa, in accordance with AS 3600.

Joint seals: Use bitumen impregnated fibreboard unless shown otherwise on the Drawings.

6.4 FORMWORK FOR ASSOCIATED ELEMENTS

Specification reference

In accordance with *Concrete*.

Slip forming

Kerbs may be formed by suitable slip-forming equipment.

6.5 CURING ASSOCIATED ELEMENTS

Specification reference

In accordance with *Concrete*.

Curing compound method

Application rate for curing compound: Not less than 0.5 L/m².

Minimum curing time: 5 days.

6.6 ASSOCIATED ELEMENTS FINISHES

Formed concrete finish

To class 3 of AS 3610.

Applied finishes

In accordance with *Concrete*. Finish the surfaces of associated elements as follows:

- Scored finish: Surfaces of paths and minor paving subject to pedestrian traffic. Draw a moistened nylon broom across the surface at right angles to the direction of traffic, to produce an anti-slip texture.
- Steel trowelled finish: Surfaces not otherwise specified.

6.7 ASSOCIATED ELEMENTS TOLERANCES

Linear elements (Kerbs, gutters, strips and the like)

Maximum deviation from design level: +/- 10 mm.

Maximum deviation from design horizontal alignment: +/- 25 mm.

Straightness: 5 mm.

(Maximum departure from a 3 m straightedge placed on horizontal, vertical, or sloping surfaces required to be straight.)

Footpaths and other paving

Maximum deviation from design level or from horizontal alignment: +/- 25 mm.

Pavement thickness: +/- 5 mm.

Surfaces generally

Shall be free from depressions in which water can lie.

6.8 JOINTS IN ASSOCIATED ELEMENTS

Kerbs and gutters

Contraction joints: Weakened plane joints 3 mm wide extending at least one-quarter the depth of the section, at approximately 3 m intervals, adjusted if necessary to avoid short closing lengths.

Expansion joints: At junctions with drainage structures, at tangent points of curves of less than 25 m radius, and at 30 m intervals elsewhere, 15 mm wide, filled with preformed self-expanding cork seals. Do not tool off joint arrises abutting the seal.

Footpaths, driveways and minor paving

Contraction joints: Weakened plane joints 3 mm wide extending at least one-quarter the depth of the section, at spacing approximately equal to the paving width but not exceeding 2 m. Tool off arrises to 6 mm radius.

Expansion joints: At junctions with fixed structures such as buildings and manholes, at path intersections, and at intervals not exceeding 15 m elsewhere, 15 mm wide, filled with preformed self-expanding cork seals. Do not tool off joint arrises abutting the seal.

Construction joints: Locate to coincide with contraction and expansion joints.

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