



AUS-SPEC

Infrastructure Specifications

**1141 Flexible Pavement Base and
Subbase**



1141 FLEXIBLE PAVEMENT BASE AND SUBBASE

IMPORTANT: This document has been adapted from the NATSPEC suite of specification templates for use in the MidCoast Council area by both Council and industry. NATSPEC regularly updates the base templates (currently in April and October each year), and Council may incorporate changes into its version of AUS-SPEC from time to time. To assist in highlighting any changes made by Council to the NATSPEC templates, the following conventions are used.

- See ANNEXURE M at the end of this document which contains (where practical) MidCoast Council customisations (also known as 'office master' text). References to the Annexure are to also be inserted at relevant clauses in the main body of the document.
- Where content is added to the main body of the document, it is to be **shown in brown text like this**.
- Where content is deleted or excluded from the main body of the document, it is to be shown ~~struck through like this~~. Such clauses are to have no effect.

Where there is a conflict between main body text and MidCoast Council specific clauses, Council's specific clauses shall prevail.

1 GENERAL**1.1 RESPONSIBILITIES****General**

Requirement: Provide flexible pavement base and subbase, as documented.

1.2 CROSS REFERENCES**General**

Requirement: This worksection is not a self-contained specification. In addition to the requirements of this worksection, conform to the following:

- 0136 General requirements (Construction).
- 0152 Schedule of rates (Construction).
- 0161 Quality management (Construction).
- 1101 Traffic management.
- 1113 Stabilisation.
- 1143 Sprayed bituminous surfacing.

1.3 INTERPRETATION**Abbreviations**

General: For the purposes of this worksection the following abbreviations apply:

- CBR: California bearing ratio.
- ~~CRB: Crushed rock base. (Not used)~~
- ~~CRS: Crushed rock subbase. (Not used)~~
- **DGB: Densely Graded Base (as per TfNSW specification 3051)**
- **DGS: Densely Graded Subbase (as per TfNSW specification 3051)**
- ~~NGB: Natural gravel base. (Not used)~~
- ~~NGS: Natural gravel subbase. (Not used)~~
- OMC: Optimum moisture content.
- ~~CCB: Crushed concrete base. (Not used)~~
- ~~CCS: Crushed concrete subbase. (Not used)~~
- ~~RCMB: Recycled material base (Not used)~~

- ~~RCMS: Recycled material subbase (Not used)~~
- UCS: Unconfined compressive strength.

Definitions

General: For the purposes of this worksection the definitions in Austroads AP-C87 and the following apply:

- Base/base course: One or more layers of material forming the uppermost structural element of a pavement and on which the surfacing may be placed. It may be composed of fine crushed rock, natural gravel, broken stone, stabilised material, asphalt or Portland cement concrete.
- Blended material: A material formed by the combination and mixing of materials obtained from different sources or rock types or recycled materials, in order to obtain a product with improved properties.
- Bound material: A granular or subgrade material to which a binder has been added to improve structural stiffness.
- Flexible pavement: A pavement which obtains its load-spreading properties from intergranular pressure, mechanical interlock and cohesion between the particles of the pavement material.
- Modified material: Granular materials to which small amounts of stabilising agent have been added to improve their performance (e.g. adjusting plasticity) without causing a significant increase in structural stiffness.
- Pozzolan: A siliceous or aluminosiliceous material, which in itself possesses little or no cementitious value but which in finely divided form may be mixed with lime or Portland cement to form a cementitious material.
- Recycled materials: Materials manufactured from recycled material such as crushed concrete, bricks, terracotta tiles or glass or reclaimed asphalt pavement (RAP).
- Subbase: Material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base, or to provide a working platform.
- Unbound base: A base comprising granular or mechanically stabilised materials and without the capacity to resist significant tensile stresses.
- Unbound material: Materials that are natural, manufactured or recycled mineral blends of graded particles which have not been modified or bound.
- **Windrows:** A shallow ridge of material formed by the action of a grader (or other) blade during in situ cutting or mixing operations.
- Working time: The duration at which the contractor has to mix a binder, compact and trim stabilised material before the material loses its intended strength. An unconfined compressive strength (UCS) test is used for the establishment of working time.

1.4 TOLERANCES

Layer width

~~Width of pavement: -50 mm to +300 mm of design dimension when the horizontal dimension measured from the design centre line to the edge of the constructed pavement base/subbase layer.~~
Conform to the following, measured from the centreline to the edge of the pavement:

- Base: 0 to +100 mm, with maximum 50 mm each side.
- Subbase: 0 to +150 mm, with maximum 75 mm each side.

Subbase layer

Level: 0 mm to - 10 mm from design level.

Thickness: \pm 10 mm from design thickness.

Base layer

Level: 0 mm to + 10 mm from design level.

Level adjacent to kerb and channel: + 5 to - 0 mm.

Thickness: 0 mm to + 20 mm from design thickness.

Shape: Less than 5 mm deviation from a 3 m straightedge laid in any direction after trimming and immediately before sealing.

1.5 SUBMISSIONS

Authority requirements: Submit proof of and comply with any environmental (including any DA conditions or REF recommendations) and/or roads authority permit(s) that are required by law.

Execution details

Trial section verification: Submit the following:

- Compaction test results: From a NATA accredited laboratory confirming the required relative compaction has been achieved.
- Survey reports: Covering line, level and thickness.
- Record data of straightedge test.

Delivery: Submit the following:

- ~~Delivery vehicles not fitted with fabric covers: If proposed for the delivery of modified or bound materials, details of vehicle.~~
- ~~Bound materials: Delivery dockets for each truck load of bound materials, indicating the time and date of mixing, and registration or fleet number of the delivery truck.~~

Alternative stockpile sites: If proposed, submit details of locations not documented on drawings.

Placing: Submit placing details if the following are proposed or required:

- Placing and compacting pavement layers outside the required layer thickness range.
- Placing bound materials outside the required ambient air temperature range.

Trimming, compaction and curing: Submit details of hand operated compaction plant required where self-propelling compaction plant is not practical.

Products and materials

Unbound base and subbase materials: Submit details for each proposed constituent material including the following:

- Source of supply.
- Blend proportions for blended materials.
- Test results for proposed base and subbase materials.

Test results for a sample of the proposed recycled constituent material to verify the limits of undesirable material to **Base/Subbase material properties and test methods tables**.

- Test results from a NATA accredited laboratory.

Alternative unbound base and subbase materials: If proposed, submit details of the following:

- Test results from a NATA accredited laboratory.
- Evidence of conformance to the **Shear strength table**.

Records

Survey of completed pavement layer: Submit survey reports covering line, level and thickness for each layer before placing the next layer.

Record of roll tests for observation of any movement of each layer tested with the 3 point dead weight roller.

Benkelman Beam: Test records to be submitted.

Ride quality: Test records to be submitted in accordance with Clause M4.

Tests

Results: Submit results of testing to **ANNEXURE – MAXIMUM LOT SIZE AND MINIMUM TEST FREQUENCIES**.

Variations

Variation to approved materials: Submit details of proposed changes to the approved base and subbase materials or source of supply. Obtain the approval of the variation prior to any material being delivered to site

1.6 INSPECTIONS

Notice

General: Give notice so that inspection may be made of the following:

- Materials at delivery: Subbase, base, modified and bound materials upon their delivery to the site.
- Underlying layer properties: Assess layer condition properties, including required moisture content before placing base and subbase material.
- Trial section construction: Completed trial base and subbase section.
- Non-conforming trial section: If the original trial section is deemed non-conforming, completed new trial section.
- Non-conforming lot: Completed base or subbase removal before replacement.
- Lot package closure certificate confirming works completed as specified.
- Wearing surface: Prepared base surface before applying ~~prime~~ or initial seal. **Primes are not permitted on local and Regional roads within the MidCoast area.**

Roll test: Conduct visual inspection of subgrade, base, subbase and wearing course as specified in the Council's development works standards by selecting the line of the roller and walking behind or beside the roller to detect any movement of the pavement by observation.

- Use 3-point deadweight 7.5 tonne roller or as agreed and guided by Council's specified standards.

2 MATERIALS

2.1 UNBOUND BASE AND SUBBASE MATERIALS

Granular material properties and production

Material properties: Provide unbound granular materials, including blends of two or more different materials, which develops structural stability and are uniform in grading and physical properties when compacted.

Material production: Materials produced by crushing plant or naturally occurring granular materials.

Moisture content of base/subbase materials: 60 to 90% of laboratory OMC to AS 1289.5.2.1, after spreading and before compaction.

Traffic loading and material selection

Design traffic: As documented on drawings.

Pavement materials: **To TfNSW QA Specification 3051 Granular Pavement Base and Subbase Materials.** Select base and subbase material based on the traffic category in the **Traffic loading and pavement materials table.**

Traffic loading and pavement materials table

TfNSW Traffic category	Design traffic ESA (N)	Acceptable base material	Acceptable subbase material
B	$4 \times 10^6 \leq N < 10^7$	Class 1 DGB20	DGS20, DGS40
C	$10^6 \leq N < 4 \times 10^6$	Class 1 or 2 DGB20	DGS20, DGS40
D	$N \leq 10^6$	Class 1 or 2 DGB20	DGS20, DGS40

Classes of material

Material: Provide from the pavement material classes given in TfNSW specification 3051.

Crushed rock

Crushed rock materials: Select from the following based on the **Base/Subbase material properties and test methods tables:**

- ~~CRB20-1: 20 mm nominal size, Class 1 crushed rock base.~~
- ~~CRB20-2: 20 mm nominal crushed rock base.~~
- ~~CRS20-3: 20 mm nominal crushed rock subbase.~~
- ~~CRS40-4: 40 mm nominal crushed rock subbase.~~

Crushed concrete

Use of crushed concrete: **Only permitted as part of a blended material that conforms to TfNSW / RMS material specifications.**

Crushed ~~concrete~~ materials: Select from the following based on the **Base/Subbase material properties and test methods tables**:

- CCB20-1: 20 mm crushed concrete base.
- CCB20-2: 20 mm crushed concrete base.
- CCS20: 20 mm crushed concrete subbase.

Recycled materials

Use of recycled materials: **Only permitted as part of a blended material that conforms to TfNSW / RMS material specifications.**

Requirements: Select individual recycled or manufactured material and blend with virgin materials or other recycled materials to the **Limits on use of recycled and manufactured materials as constituents table**. Properties for RCMB and RCMS are based on the **Base/Subbase material properties and test methods tables**.

- RCMB: Recycled material base.
- RCMS: Recycled material subbase.

Limits on use of recycled and manufactured materials as constituent materials table

Recycled material	Unbound or modified base and subbase	Bound base and subbase
Iron & steel slag	100%	100%
Crushed concrete ⁽¹⁾	100%	100%
Brick	20%	10%
RAP	40%	40%
Fly ash ⁽²⁾	10%	10%
Furnace bottom ash	10%	10%
Crushed glass fines ⁽³⁾	10%	10%

Notes:

1. For pavements using high percentages of crushed concrete, take into account the amount of available cement which will rehydrate when subjected to moisture to create rigid or semi-rigid pavement and result in subsequent shrinkage cracking.
2. For pavements using fly ash, take into account the possibility of hydration and binding when subject to moisture to create rigid or semi-rigid pavement and result in subsequent shrinkage cracking.
3. Crushed glass fines refer to clean glass, which has been processed to produce an aggregate product for which an exemption has been issued. Refer to the TfNSW *Recycled Crushed Glass in asphalt* guide available from www.rms.nsw.gov.au

Locally available materials

General: **Select from fit** for purpose locally available materials to Austroads AP-T352 and Austroads AP-T353.

Natural gravel

Unbound natural gravel materials: Select from the following based on the **Base/subbase material properties and test methods tables**:

- NGB20: 20 mm natural gravel base.
- NGS20: 20 mm natural gravel subbase.
- NGS40: 40 mm natural gravel subbase.

Base material properties and test methods table

Property and test method	Differentiating criteria	Material requirements					
		CRB20-1	CRB20-2	CCB20-1	CCB20-2	RCMB	NGB20
Particle size distribution of	Sieve size (mm)	—	—	—	—	-	—
	26.5	100	100	100	100	100	100

Property and test method	Differentiating criteria	Material requirements					
		CRB20-1	CRB20-2	CCB20-1	CCB20-2	RCMB	NGB20
grading (% passing through sieve) AS 1289.3.6.1	19.0	95 – 100	95 – 100	95 – 100	95 – 100	95-100	93 – 100
	13.2	77 – 93	77 – 93	78 – 92	78 – 92	70-90	—
	9.5	63 – 83	63 – 83	63 – 83	63 – 83	60-80	71 – 87
	4.75	44 – 64	44 – 64	44 – 64	44 – 64	40-65	47 – 70
	2.36	29 – 49	29 – 49	30 – 48	30 – 48	35-55	35 – 56
	0.425	13 – 23	13 – 23	13 – 21	13 – 21	10-30	14 – 32
	0.075	5 – 11	5 – 11	5 – 9	5 – 9	5-15	6 – 20
Liquid limit (w_L) to AS 1289.3.1.1	—	max 25%	max 25%	max 30%	max 30%	max 27%	max 25%
Plasticity index (I_p) to AS 1289.3.3.1	Rainfall	—	—	—	—	-	—
	All areas	min 2% -	— -	min 2%	—	-	—
	Areas with annual rainfall > 500 mm	max 6%	max 6%	max 6%	max 6%	max 6%	max 6%
	Areas with annual rainfall < 500 mm	max 10%	max 10%	max 10%	max 10%	max 10%	max 10%
Linear shrinkage (LS) to AS 1289.3.4.1	Rainfall	—	—	—	—	-	—
	All areas	min 0.7%	—	min 0.7% -	—	-	—
	Areas with annual rainfall > 500 mm	max 2.0%	max 2.0%	max 2.0%	max 2.0%	max 2.0%	max 2.0%
	Areas with annual rainfall < 500 mm	max 4.0%	max 4.0%	max 4.0%	max 4.0%	max 4.0%	max 4.0%
Undesirable constituent materials (% retained on a 4.75 mm sieve) to RMS T276	Material type	—	—	—	—	-	—
	Type I – Metal, glass, stone, ceramics and slag	—	—	max 2.0	max 2.0	max 2.0	—
	Type II – Plaster, clay lumps and other friable material	—	—	max 0.5	max 0.5	max 0.5	—
	Type III – Rubber, plastic, paper, cloth, paint, wood and other vegetable matter	—	—	max 0.1	max 0.1	max 0.1	—
For materials with plasticity index less than 1: Maximum dry compressive strength on fraction passing 19 mm sieve to AS 1141.52	—	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa
Particle shape by proportional	—	max 35%	max 35%	max 35%	max 35%	max 35%	—

Property and test method	Differentiating criteria	Material requirements					
		CRB20-1	CRB20-2	CCB20-1	CCB20-2	RCMB	NGB20
caliper (% misshapen for 2:1 caliper ratio) to AS 1141.14							
Aggregate wet strength* to AS 1141.22	—	min 100 kN	min 80 kN	min 100 kN	min 80 kN	Min 70kN	—
Wet/dry strength variation* (dry – wet)/dry to AS 1141.22	—	max 35%	max 35%	max 35%	max 35%	max 35%	—
Los Angeles value (% loss or abrasion) to AS 1141.23	—	max 35%	max 35%	max 40%	max 40%	max 40%	—
4 day soaked CBR (98% modified compaction) to AS 1289.6.1.1	—	min 80%	min 80%	min 80%	min 80%	—	min 80%
Unconfined compressive strength to AS 5101.4	—	max 1.0 MPa	max 1.0 MPa	max 1.0 MPa	max 1.0 MPa	max 1.0 MPa	—
NOTES:							
* Use the fraction with the highest wet/dry strength variation as the value for determining conformance. Test the fraction 19.0 to 9.5 mm. For blended materials, also test the fraction 9.5 to 4.75 mm. Test any other fraction where there is risk of failing.							

Subbase material properties and test methods table

Property and test method	Differentiating criteria	Material requirements					
		CRS20-3	CRS40-4	CCS20	RCMS	NGS20	NGS40
Particle size distribution or grading (% passing through sieve) to AS 1289.3.6.1	Sieve size (mm)	—	—	—	—	—	—
	53.0 mm	—	100	—	—	—	100
	37.5	—	90 – 100	—	—	—	95 – 100
	26.5	100	74 – 96	100	100	100	80 – 97
	19.0	90 – 100	62 – 86	95 – 100	85 – 100	96 – 100	—
	13.2	74 – 96	—	75 – 95	70 – 90	—	—
	9.5	61 – 85	42 – 66	60 – 90	60 – 80	65 – 89	48 – 85
	4.75	42 – 66	28 – 50	42 – 76	40 – 65	47 – 80	35 – 73
	2.36	28 – 50	20 – 39	28 – 60	30 – 55	32 – 67	25 – 58
	0.425	11 – 27	8 – 21	10 – 28	10 – 30	14 – 42	10 – 33
	0.075	4 – 14	3 – 11	2 – 10	5 – 15	6 – 26	3 – 21
Liquid limit (w _L) to AS 1289.3.1.1	—	max 25%	max 25%	max 30%	max 27%	max 25%	max 25%
Plasticity index (I _p) to AS 1289.3.3.1	Rainfall	—	—	—	—	—	—
	Areas with annual rainfall > 500 mm	max 12%	max 12%	max 12%	max 6%	max 12%	max 12%

Property and test method	Differentiating criteria	Material requirements					
		CRS20-3	CRS40-4	CCS20	RCMS	NGS20	NGS40
	Areas with annual rainfall < 500 mm	max 12%	max 12%	max 12%	max 12%	max 12%	max 12%
Linear shrinkage (LS) to AS 1289.3.4.1	Rainfall	—	—	—	-	—	—
	Areas with annual rainfall > 500 mm	max 4.5%	max 4.5%	max 4.5%	max 4.5%	max 4.5%	max 4.5%
	Areas with annual rainfall < 500 mm	max 6.0%	max 6.0%	max 6.0%	max 6.0%	max 6.0%	max 6.0%
Undesirable constituent materials (% retained on the 4.75 mm sieve) to RMS T276	Type I – Metal, glass, stone, ceramics and slag	—	—	max 3.0	max 3.0	-	—
	Type II – Plaster, clay lumps and other friable material	—	—	max 0.2	max 0.2	-	—
	Type III – Rubber, plastic, paper, cloth, paint, wood and other vegetable matter	—	—	max 0.2	max 0.2	-	—
Maximum dry compressive strength on fraction passing 19 mm sieve (only applies if plasticity index is less than 1) to AS 1141.52	—	min 1.0 MPa	min 1.0 MPa	min 1.0 MPa	min 1.0 MPa	min 1.0 MPa	min 1.0 MPa
Particle shape by proportional calliper – % misshapen (2:1) to AS 1141.14	—	max 35%	max 35%	max 35%	max 35%	—	—
Aggregate wet strength* to AS 1141.22	—	min 50 kN	min 50 kN	min 50 kN	min 70 kN	—	—
Wet/dry strength variation* (dry – wet)/dry to AS 1141.22	—	max 40%	max 40%	max 40%	max 40%	—	—
Los Angeles value to AS 1141.23	—	max 40%	max 40%	max 40%	max 40%	—	—
4-day soaked CBR (98% modified compaction) to AS 1289.6.1.1	—	min 30%	min 30%	min 30%	min 60%	min 30%	min 30%

Property and test method	Differentiating criteria	-	Material requirements			
		CRS20-3	CRS40-4	CCS20	RCMS	NGS20
NOTES: * Use the fraction with the highest wet/dry strength variation as the value for determining conformance. Test the fraction 19.0 to 9.5 mm. For blended materials, also test the fraction 9.5 to 4.75 mm. Test any other fraction where there is risk of failing.						

2.2 ALTERNATIVE UNBOUND BASE AND SUBBASE MATERIALS (NOT USED)

Shear strength

Requirement: If proposed materials conform to the ~~Base/subbase material and test method table~~ except for particle size distribution (grading), conform to ~~Shear strength table~~.

Shear strength table

Material layer	Modified Texas Triaxial Classification number (RMS Test method T171)
Base	Maximum 2.5
Subbase	Maximum 3.2

2.3 STABILISED MATERIALS

Material properties and production

Stabilised materials: Conform to 1113 Stabilisation for:

- Modified base and subbase.
- Bound base and subbase.

Material production: To 1113 Stabilisation using one of following stabilisation method, as appropriate:

- Stationary mixing plant.
- In situ stabilisation.

2.4 MODIFIED BASE AND SUBBASE MATERIALS

Material properties

Requirement: Conform to **UNBOUND BASE AND SUBBASE MATERIALS**.

~~CRB20 material before stabilisation:~~ Conform to the requirements for CRS20 in the ~~Subbase material properties and test methods table~~ and the following:

- ~~Aggregate wet strength: > 80 kN.~~

~~CRB20 material after stabilisation:~~

- ~~CBR: ≥ 80.~~
- ~~UCS: < 1.0 MPa.~~

Testing period: Sample within 24 hours of adding stabilisation binder and test after 7 days accelerated curing.

2.5 BOUND BASE AND SUBBASE MATERIALS

Material type

Requirement: Lightly bound or bound.

Properties

Material UCS after bound stabilisation:

- Lightly bound material: 1 to 2 MPa.
- Bound material: > 2 MPa.

Testing period: Sample within 1 hour of adding stabilisation binder and test after 7 days accelerated curing.

2.6 TESTING

Quality

Requirement: Test for all characteristics in conformance with TfNSW specification 3051 and **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

Quality verification: If material/product quality verification can be obtained from the supplier, documented tests need not be repeated.

3 EXECUTION

3.1 DELIVERY

Material transportation from a pugmill mixer

Delivery vehicles: Use delivery trucks with tipping bodies, or with a live (conveyor belt) bottom, including semi-trailers and dog trailers. Cover the body to prevent moisture loss during transit.

Material condition at delivery: Handle materials as little as possible to minimise segregation, moisture loss and loss of fines during transit.

Material moisture content at delivery: Uniformly distributed and within - 2% and 0% of the OMC.

Modified or bound materials

Allowable working time: Allow for mixing, delivery and incorporation into the works, including trimming and compaction, to the **Maximum allowable working time table** in 1113 *Stabilisation*.

3.2 STOCKPILING UNBOUND MATERIALS

Stockpile locations

Stockpiling unbound materials is not preferred, Council to consider on a case by case basis.

Locations: Locate each stockpile on a firm level ground, as shown on drawings.

Clearances: Allow adequate clearance between machinery and overhead power lines.

Stockpile site preparation: Clear sites of all vegetation and extraneous matter, and shape to form a crown so that the area drains freely. Compact the area to 95% minimum relative compaction, tested to AS 1289.5.4.1.

Stockpile and maintenance

Stockpiled material: Sample to AS 1141.3.1 within 3 days of delivery.

Stockpile height: < 3 m.

Stockpile shape and slopes: Uniform shape with side slopes not steeper than 1.5H:1V or flatter than 3H:1V.

Stockpile material moisture content: Maintain at a level sufficient to prevent loss of fines. Spray the stockpile with waterproofing material to prevent wet weather damage to the gravel.

Contamination of materials: Make sure stockpile materials do not become intermixed, segregated or contaminated with foreign material.

Surplus materials: At completion of the Works, clear stockpile sites of all surplus material and leave in a clean and tidy condition.

3.3 BASE AND SUBBASE PAVING TRIAL

Trial section

Extent: Construct trial section **only if required under the Contract (Council contracts do not typically require trial sections)** as follows:

- So that it may be incorporated in the finished work.
- Length: 50 m.
- Width: Same as that required for the pavement.

Materials and methods: Use the same materials, equipment and methods as that required for the pavement works.

Compaction requirements: To **TRIMMING, COMPACTION AND CURING** and **ACCEPTANCE OF COMPACTION**.

Line, level and thickness: To **TOLERANCES**.

Non-conforming trial section

Requirement: If the trial concrete subbase is deemed non-conforming remove the non-conforming subbase, rectify any damage caused by the removal, and construct the new trial subbase in conformance with REMOVAL AND REPLACEMENT OF NON-CONFORMING LOT.

3.4 UNDERLYING LAYER

Layer condition

Compaction, shape and levels: Before constructing unbound granular pavement, compact the underlying layer so that there are:

- No soft spots that can cause premature failure of the pavement.
- No significant high spots that can reduce the pavement below the required thickness.

Layer preparation before constructing pavement

Subgrade: Prepare layer in conformance with *1112 Earthworks (Road reserve)*.

Subbase: Prepare layer to the following:

- **UNBOUND BASE AND SUBBASE MATERIALS** and this subsection.
- Moisture content: Less than 80% of the OMC.
- Layer condition: Free from rutting and foreign matter.

3.5 PLACING

Spreading

Plant: Use the following for the placing of base and subbase:

- Grader.
- Mechanical spreader.

Ambient air temperature for spreading bound materials: 5 to 35°C in the shade.

Levels adjacent to kerb and channel: Where pavement is to be constructed to the lip level of kerb and channel, construct flush with the lip of the channel.

Grader-placed layers

Placing: Place base or subbase in stages as follows:

- Dumping: Upon delivery, tip the material into uniform windrows across the pavement.
- Amount of material dumped: Not more than that which can be placed and compacted in one day.
- Spreading: Provide an even distribution of material over the whole pavement, as follows:
- Windrows: Respread across the formation or subbase in a continuous cycle and at a speed that allows for proper control.
- Spread material: To the required depth, crossfall and grade ready for compaction.
- Mixing and watering: Undertake concurrently with spreading.
- Low spots: Cut to fill without lensing or laminating occurring.
- Moisture content: If necessary, add water or remix material to achieve the required moisture content.
- Mixing passes: 3 to 6.

Turning over of materials: Minimise turning by grader to avoid segregation.

Mechanical spreaders

Spreader: Use self-propelling spreader with automated level control.

Rate of material delivery: Allow for the spreader to operate in continuous process, so that surface irregularities do not occur from spreader stop-start action.

Layer thickness: Set screed to the required layer thickness so that the compactive effort is even throughout.

Joints

Number of joints: Minimise.

Transverse joints: Locate at minimum 2 m offset from any joint in the layer below.

Longitudinal joints: Locate along lane linemarkings or midway between linemarkings. Offset minimum 100 mm from any joint in the layer below.

Bound materials work boundaries: Provide vertical faces for transverse and longitudinal joints.

3.6 TRIMMING, COMPACTION AND CURING

Plant

Compaction: Use self-propelling compaction plant where practical.

Plant movement restrictions: Do not stand watering and compaction plant on the pavement being compacted.

Compaction procedure

Process: Uniformly compact the entire area to **ACCEPTANCE OF COMPACTION**. Trim compacted layer to the required thickness.

Compacted layer thickness: As documented on the Drawings, or if not documented, 100 to 200 mm. Allow for multi-layer courses with equal layer thickness. The minimum loose layer thickness must not be less than 2.5 x nominal size of material, i.e. 2.5 x 40 mm = 100 mm.

One-way crossfall sections: Compact from the low to the high side.

Crowned sections: Compact from edge to crown on each side of the pavement.

Rolling: Pass rollers parallel to the centreline of the pavement and uniformly overlap each preceding pass.

Compacting sides: Allow minimum 2 additional passes of roller to the outer 1 m width on both sides of the pavement.

Subsequent layers

Placing subsequent layers: Do not place until testing has been completed and the test results for each layer has been approved.

Excessive moisture content

Wetted layers: If an unbound layer becomes wet after completing compaction, allow to dry out. If required, uniformly re-compact and trim to the required density and level tolerances.

Unstable areas

Rejection criteria: Any area that becomes unstable during rolling or is identified by proof rolling.

Replacement: Open up, dry back and re-compact. If dry back is not possible, remove the full depth of the layer and replace with fresh material to **REMOVAL AND REPLACEMENT OF NON-CONFORMING COURSES**.

Curing of bound materials

Curing time: Start curing the surface layer of a lot immediately after completing compaction.

Water curing: Before placing subsequent layer or applying an initial seal, keep stabilised work continuously wet or damp during the curing period to prevent rapid drying out.

Water curing procedure: Provide frequent light uniform water spray without significant run-off or flooding. Avoid slurring of the surface or leaching of the stabilising agent.

3.7 ACCEPTANCE OF COMPACTION

Acceptance criteria for lots

Acceptance of work: Based on density testing of the work in lots.

Lots: Nominate lots as follows:

- Extent generally: A single layer of work, constructed under uniform conditions in continuous operation, not crossing any transverse construction joint.
- Extent for unbound materials: A day's output using the same material.

Lot dimensions and levels: To **TOLERANCES**.

Lot acceptance criteria for compaction of unbound layers table

TfNSW Traffic category	Characteristic value of density ratio (%)		Mean value ¹ of density ratio (%)		Assessment
	Base	Subbase	Base	Subbase	
B or C	≥ 98	≥ 97	-	-	Accept lot
D	-	-	≥ 100	≥ 98	Accept lot

Note:
1. Allow for minimum 3 tests per lot.

Lot acceptance criteria for compaction of bound layers

Requirement: Conform to the following relative compaction:

- Each layer: At least 97% (modified). 95 to 97% is acceptable if values within this range represent less than 5% of the lot.
- Below 150 mm from the top: ≥ 92% (modified).

Relative compaction determination

Calculation: Calculate the relative compaction of pavement material, at each location tested for field dry density, as follows:

- Relative compaction % = [(Field dry density*)/(Laboratory maximum dry density)] x 100.

*Field dry density: Calculate to AS 1289.5.4.1.

Prior to the application of the seal

Ride quality: Conform to Clause M4.

Benkelman Beam: Conform to Clause M5.

3.8 TESTING**Quality**

Requirement: Test for all characteristics in conformance with **ANNEXURE – MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES.**

Moisture content testing

Underlying layer site testing: To AS 1289.5.2.1.

Density testing

Laboratory density: Test as follows:

- Unbound layers: Test to AS 1289.5.2.1.
- Bound layers: Test to RMS T130 within two hours of adding stabilisation binder to the mix.

Field dry density testing: The following methods can be used:

- Sand replacement method: Test the compacted material to AS 1289.5.3.1, AS 1289.5.3.2 or AS 1289.5.3.5.
- Nuclear density meter: Test compacted material to AS 1289.5.8.1.

3.9 NON-CONFORMANCE**Unbound**

Density and compaction: If lot or area has been assessed as non-conforming, rework the area and allow for compaction reassessment.

Width, shape and level tolerance: If the lot can be corrected by further trimming, obtain approval for trimming.

- Trimming: Trim layer to produce a uniform, hard surface by cutting without filling, with corrected surface conforming to **TOLERANCES**.

Removal and replacement: If lot or area has become degraded, segregated or reduced in quality from reworking, remove and replace layer/course with fresh material to **REMOVAL AND REPLACEMENT OF NON-CONFORMING LOT** before placing next layer.

Bound materials

Subbase course is lower than the design level: Increase the base course thickness to make up the thickness deficiency.

Subbase course is above the design level: Obtain approval for regrading, to increase the base course level by maximum 20 mm above the original design level without decreasing the base course thickness.

Base course is above the design level: Obtain approval to regrade the base course level.

Corrective regrading of base course level: Approval may be granted for regrading subject to the following:

- The rate of change of grade from the original finished design surface level is less than 3 mm/m.
- Regrading will not interfere with the proper functioning of the drainage system.
- Regrading will not affect levels at property boundaries and will not increase or decrease the footpath or footpath crossover levels and the levels are within the Council's allowable design limits.

Removal and replacement: Lots that cannot be corrected by trimming or regrading.

3.10 REMOVAL AND REPLACEMENT OF NON-CONFORMING LOT

Extent of removal

Extent: Non-conforming material over the full length and width of the lot with the following exceptions:

- Exceptions from removing full length of lot: If the minimum length of pavement layer to be removed is 50 m and the cause of non-conformance can be isolated.
- Exception from removing full width of lot: If the cause of non-conformance can be isolated transversely and the new longitudinal cold joint is formed along the centreline of the road pavement.

Replacement of base/subbase

Replacement material: Replace with fresh material. Make sure material used, and the subsequent spreading, compaction, trimming, curing and testing of the replacement materials, conforms to the requirements of this worksection.

Damage to abutting or underlying layers or structures: Rectify to match existing.

3.11 MAINTENANCE BEFORE COMPLETION OF WEARING SURFACE

Surface condition and protection

Prepared surface: Maintain the approved condition of the base course until the initial seal is completed.

Pavement surfacing: Within 7 days of lot approval, cover the full width of base course with ~~prime or~~ initial seal to *1143 Sprayed bituminous surfacing*. **Primes are not permitted on local and Regional roads within the MidCoast area.**

Pavement condition before pavement surfacing

Dry back: Allow material to dry to 60 to 80% of the OMC before applying the prime, initial seal or wearing surface.

Embedment test: Before starting any spray seal surface treatments, perform embedment test as follows:

- Method: To Austroads AG:PT/T251.
- Timing of test: Within 48 hours before applying sprayed seal.
- Embedment value allowance: Maximum 3 mm.

Deteriorated pavement condition

Requirement: If the base condition deteriorates before applying the ~~prime or~~ initial seal, and approval to proceed with bitumen surfacing work is withdrawn, re-prepare the base.

Surface drainage

Ponded water: Maintain adequate drainage of the pavement before completion of the wearing surface. Remove any ponded water within 12 hours if free drainage is not achievable.

Restrictions on movement

Bound pavements: Prevent construction plant and vehicles not involved in current construction or testing activities from using the pavement before applying the initial seal and within 7 days of placing the base course.

Unbound pavements: Prevent construction plant and vehicles not involved in current construction or testing activities from using the pavement before applying the initial seal.

Opening to traffic

Traffic restriction: Do not permit traffic on bound pavements within 7 days after completing the full pavement depth and initial seal.

4 ANNEXURES**4.1 ANNEXURE - SCHEDULES****Authority requirements schedule**

Property/Requirement	A	B	C

Notes to schedule:

A, B, C: These designate each instance or type or location of the pavement scheduled. Edit to align with the project's codes or tags.

Edit codes in the **Schedule** to match those on drawings.

4.2 ANNEXURE - SUMMARY OF HOLD AND WITNESS POINTS

For private developments, certain Hold and Witness Points where specifically noted below require representatives of both the Superintendent and the Principal Certifier (e.g. Council) to authorise release.

Clause and description	Type*	Submission/Inspection	Submission/Notice details	Process held
SUBMISSIONS , Products and materials Unbound base and subbase materials	H	Test results from NATA accredited laboratory as evidence of material conformance	Minimum 10 days before material delivery	Material delivery
SUBMISSIONS , Products and materials Alternative unbound base and subbase materials	H – Superintendent and Principal Certifier	Test results from a NATA accredited laboratory as evidence of material conformance of alternative materials.	Minimum 10 days before material delivery	Material delivery
SUBMISSIONS , Variations	H – Superintendent	Details of any changes to the approved base and subbase or source of supply.	Minimum 10 days before material delivery	Material delivery

Clause and description	Type*	Submission/Inspection	Submission/Notice details	Process held
Variations to approved materials	and Principal Certifier			
SUBMISSIONS, Execution details Trial section (Only if required under the Contract)	H	Compaction test results from a NATA accredited laboratory for the subbase and base layer of trial section. Survey report covering line, level and thickness for the subbase and base layer of trial section. Record data of straightedge test.	Minimum 2 days before commencement of remaining pavement works.	Commencement of remaining pavement works.
SUBMISSIONS, Execution details - Delivery vehicles	H	Use of vehicles not fitted with fabric covers for the delivery of modified or bound materials.	Minimum 2 days before delivery.	Material delivery.
SUBMISSION, Execution details - Delivery of bound materials	W	Delivery dockets of bound materials indicating time and date of mixing and registration or fleet number of delivery truck.	Upon delivery	-
SUBMISSION, Execution details Placing outside temperature range	H	Proposal to place bound materials when temperatures are outside the required ambient air temperature.	Minimum 2 days before spreading.	Spreading of bound materials.
SUBMISSIONS, Execution details Placing outside layer thickness range	H – Superintendent and Principal Certifier	Proposal to place and compact layer outside the required thickness range.	Minimum 2 days before spreading.	Spreading of pavement materials.
SUBMISSIONS, Execution details Trimming, compaction and curing	H	Details of any hand operated compaction plant as to where and why hand equipment is to be used.	Minimum 2 days before use of hand operated compaction plant.	Use of hand operated compaction plant.
SUBMISSIONS, Execution details	H – Superintendent and Principal Certifier	Compaction test results from a NATA accredited laboratory authority for the completed pavement layer.	Minimum 2 days before placement of next layer.	Placement of next layer.

Clause and description	Type*	Submission/Inspection	Submission/Notice details	Process held
Trimming, compaction and curing Record of roll test for each layer of pavement.		Survey report covering line, level and thickness for the completed pavement layer. Record data of straightedge test. Records of roll tests for identification of any movement under 3 point 7.5 tonne roller by visual observation by Council Superintendent and Principal Certifier.		
SUBMISSIONS, Execution details Non-conformance	H – Superintendent and Principal Certifier	Disposition of non-conforming lot.	Minimum 5 days before corrective action or removal and replacement.	Corrective action or removal and replacement.
INSPECTIONS, Notice Materials	W	Unbound, modified and bound materials.	Upon delivery.	-
INSPECTIONS, Notice Underlying layer	H – Superintendent and Principal Certifier	Quality of underlying layer including assessment of required moisture content.	Minimum 2 days before placing next layer.	Placing next layer.
INSPECTIONS, Notice Removal and replacement of non-conforming lot	H	Inspection of completion of removal of non-conforming base or subbase.	Minimum 1 day before inspection.	Replacement of non-conforming lot.
INSPECTIONS, Notice Maintenance before completion of wearing surface	H – Superintendent and Principal Certifier	Inspection of the condition of prepared base course. Submission by the contractor of the lot closure certificates confirming the pavement works have been completed and prepared for seal as specified.	Minimum 2 days before prime or initial seal.	Initial seal.
*H = Hold Point W = Witness Point				

4.3 ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

Flexible pavement base and subbase table

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
Base and subbase supply	Material quality – Supplier's documentary	1 contract		

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
	evidence and certification			
	- Particle size distribution		1 per 1,000 t	AS 1289.3.6.1
	- Liquid limit		1 per 1,000 t	AS 1289.3.1.1
	- Plasticity index		1 per 1,000 t	AS 1289.3.3.1
	- Linear shrinkage		1 per 1,000 t	AS 1289.3.4.1
	- Undesirable constituent material		1 per 1000 t	RMS T276
	- Maximum dry compressive strength		1 per 5,000 t	AS 1141.52
	- Particle shape		1 per 1,000 t	AS 1141.14
	- Aggregate wet strength		1 per 5,000 t	AS 1141.22
	- Wet/dry strength variation		1 per 5,000 t	AS 1141.22
	- Los Angeles value		1 per 1,000 t	AS 1141.23
	- CBR		1 per 5,000 t	AS 1289.6.1.1
	- Modified Texas Triaxial Class		1 per contract	RMS T171
	- Unconfined compressive strength		1 per 5,000 t	AS 5101.4
	- Unconfined compressive strength (bound)	1 Contract	1 per mix design	AS 5101.4
Placement	Geometry: Alignment and level - Width and surface trim	One layer 2,000 m ² or max. 1 day's placement	1 cross section per 15 m 10 per selected 200 lin. m	Survey Measure and deviation from a 3 m straightedge
	Compaction/moisture content/ dry density testing	One layer 5,000 m ² or max 1 day's placement	10 per 5,000 m ² layer or 3 per lot whichever is greater	RMS T130 AS 1289.5.2.1 AS 1289.5.3.1 AS 1289.5.3.2 AS 1289.5.3.5 AS 1289.5.4.1 AS 1289.5.8.1

4.4 ANNEXURE - PAY ITEMS

This Annexure applies to Council projects. For private development works use of this schedule is optional, at the Superintendent's discretion.

Pay items	Unit of measurement	Schedule rate inclusions
1141.1 Supply, place and compact subbase course	m ³ volume compacted - Determine quantity by the length and width of work for total relevant thickness.	Do not account for allowable tolerances. All costs associated with all documentation and approvals and: - Supplying, placing, compaction, trimming, jointing, and testing of the subbase course, and curing of bound material.
1141.2 Supply, place and compact base course	m ³ volume compacted - Determine quantity by the length and width of work for total relevant thickness.	Do not account of allowable tolerances. All costs associated with: - Supplying, placing, compaction, trimming, jointing, and testing of the base course, and curing of bound material.
Traffic management	Lump sum.	To 1101 Traffic management.

4.5 ANNEXURE - REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

ARRB	2020	Sealed Roads Best Practice Guide
ARRB	2020	Unsealed Roads Best Practice Guide
AS 1141		Methods for sampling and testing aggregates
AS 1141.14	2007	Particle shape, by proportional caliper
AS 1141.22	2019	Wet/dry strength variation
AS 1141.23	2009	Los Angeles value
AS 1141.52	2019	Unconfined cohesion of compacted pavement materials
AS 1289		Methods of testing soils for engineering purposes
AS 1289.3.1.1	2009	Soil classification tests - Determination of the liquid limit of a soil - Four point Casagrande method
AS 1289.3.3.1	2009	Soil classification tests - Calculation of the plasticity index of a soil
AS 1289.3.4.1	2008	Soil classification tests - Determination of the linear shrinkage of a soil - Standard method
AS 1289.3.6.1	2009	Soil classification tests - Determination of the particle size distribution of a soil - Standard method of analysis by sieving
AS 1289.5.2.1	2017	Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort
AS 1289.5.3.1	2004	Soil compaction and density tests - Sand replacement method using a sand-cone pouring apparatus
AS 1289.5.3.2	2004	Soil compaction and density tests - Sand replacement method using a sand pouring can, with or without a volume displacer
AS 1289.5.3.5	1997	Soil compaction and density tests- Determination of the field dry density of a soil - Water replacement method
AS 1289.5.4.1	2007	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.8.1	2007	Soil compaction and density tests - Determination of field density and field moisture content of a soil using a nuclear surface moisture-density gauge - Direct transmission mode

AS 1289.6.1.1	2014	Soil strength and consolidation tests - Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen
AS 5101		Methods for preparation and testing of stabilized materials
AS 5101.4	2008	Unconfined compressive strength of compacted materials
Austrroads AG:PT/T251	2010	Ball penetration test
Austrroads AP-T352	2020	Sustainable Roads through fit-for-purpose use of available materials: Technical basis
Austrroads AP-T353	2020	Sustainable Roads through fit-for-purpose use of available materials: Evaluation tool and users guide
TfNSW 3051	2020	QA Specification 3051 Granular pavement base and subbase materials
TfNSW R71	2020	Construction of Unbound and Modified Pavement Course
TfNSW R83	2020	Concrete Pavement Base
TfNSW R116	2020	Heavy Duty Dense Graded Asphalt
TfNSW R117	2020	Light Duty Dense Graded Asphalt
TfNSW R118	2020	Crumb Rubber Asphalt
TfNSW R119	2020	Open Graded Asphalt
TfNSW R121	2020	Stone Mastic Asphalt
TfNSW R123	2020	Thin Open Graded Asphalt Surfacing
TfNSW R126	2020	High Modulus Asphalt
RMS T130	2012	Dry density/moisture relationship of road construction materials (blended in the laboratory with cementitious binders)
RMS T171	2012	Modified Texas triaxial compression test for pavement materials
RMS T182	2012	Road roughness testing (NAASRA Roughness Meter)
RMS T187	2012	Measurement of ride quality of road pavements by laser profiler
RMS T188	2012	Project ride quality (Vehicular laser profilometer)
RMS T276	2012	Foreign materials content of recycled crushed concrete
TfNSW RCG Guide	2020	Recycled crushed glass in asphalt

5 ANNEXURE M – MIDCOAST COUNCIL SPECIFIC CLAUSES

M1.	Variations to or non-conformances with Council's AUS-SPEC are to be evaluated with reference to the procedure in Council's <i>Development Engineering Handbook</i> . Acceptance is to be obtained in writing from: <ul style="list-style-type: none"> a) an authorised representative of Council's Director of Infrastructure and Engineering Services, or b) an accredited certifier where they are the Principal Certifier and hold the relevant accreditation category for the type of work. 	Variation procedure
M2.	This specification applies in addition to any development consent (DA) conditions. If there is any inconsistency, the conditions of consent shall prevail.	DA conditions
M3.	Refer to the MidCoast Council <i>Development Engineering Handbook</i> for final inspection, works-as-executed and handover requirements.	Completion
M4.	Test methods for ride quality: To RMS T182 (NAASRA roughness), T187 or T188 (International Roughness Index). Surface courses on new roads: Provide roughness measurement test results for review after trimming and before sealing. Results are to conform to the relevant RMS specification for the surface course material:	Ride quality

	<ul style="list-style-type: none"> • Unbound and Modified Base Courses (with or without Sprayed Bituminous Seal): To Table R71/B.3. • Concrete Base Courses: To Table R83/27. • Asphalt Course: To 1144 Asphalt (Roadways) worksection Clause 4.7. RMS specifications R116, R117, R118, R119, R121, R123 or R126, as applicable to the type of asphalt used, are supplementary reference material. <p>Note: Test results generally less than or equal to 1.56m/km/lane (International Roughness Index) comply, and higher values may be acceptable in accordance with the RMS specifications. However, if specified under the Contract, an incentive payment or deduction amount is to be applied in line with the RMS values given.</p> <p>Guidance on threshold levels for maintenance intervention: Refer to ARRB Sealed and Unsealed Roads Best Practice Guides.</p> <p>Amendments: This clause is used in worksections <i>1113 Stabilisation, 1133 Plain and reinforced concrete base, 1141 Flexible pavement base and subbase, and 1144 Asphalt (Roadways)</i>.</p>																									
M5.	<p>Prior to sealing, pavement assessment shall be undertaken according to the elastic rebound deflection test, in conformance with RMS Test Method T160 utilising the Benkelman Beam or an equivalent method. The average maximum deflection for any lot shall not exceed the values in the table below. The co-efficient of variation (CV) in recorded deflections shall not exceed 30%. Frequency of testing shall be on alternate wheel paths at generally 15 metres (maximum) intervals.</p> <table border="1" data-bbox="311 1108 1209 1644"> <thead> <tr> <th>Road Type</th> <th>ESA's</th> <th>Characteristic Deflection Unbound Pavement</th> <th>Characteristic Deflection Bound Pavement</th> </tr> </thead> <tbody> <tr> <td>Access Street</td> <td>6x10⁴</td> <td>1.2</td> <td>0.8</td> </tr> <tr> <td>Local Street</td> <td>3x10⁵</td> <td>1.1</td> <td>0.6</td> </tr> <tr> <td>Collector Road</td> <td>1x10⁶</td> <td>1.0</td> <td>0.5</td> </tr> <tr> <td>Distributor Road</td> <td>2x10⁶</td> <td>0.9</td> <td>0.5</td> </tr> <tr> <td>Industrial</td> <td>5x10⁶</td> <td>0.8</td> <td>0.45</td> </tr> </tbody> </table>	Road Type	ESA's	Characteristic Deflection Unbound Pavement	Characteristic Deflection Bound Pavement	Access Street	6x10 ⁴	1.2	0.8	Local Street	3x10 ⁵	1.1	0.6	Collector Road	1x10 ⁶	1.0	0.5	Distributor Road	2x10 ⁶	0.9	0.5	Industrial	5x10 ⁶	0.8	0.45	Benkelman Beam
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6 AMENDMENT HISTORY

0	14/12/2020	First Published
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