Engineering Construction Specification

C08 Flexible pavement base and subbase

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1 General

1.1 Responsibilities

1.1.1 General

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

1.2 Cross references

1.2.1 General

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

- *C02 Quality management (Construction)*
- *C03 Control of traffic*
- *C07 Stabilisation*
- *C09 Sprayed bituminous surfacing*

1.3 Interpretation

1.3.1 Abbreviations

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

- CBR: California bearing ratio.
- CRB: Crushed rock base.
- CRS: Crushed rock subbase.
- NGB: Natural gravel base.
- NGS: Natural gravel subbase.
- OMC: Optimum moisture content.
- CCB: Crushed concrete base.
- CCS: Crushed concrete subbase.
- RCMB: Recycled material base.
- RCMS: Recycled material subbase.
- UCS: Unconfined compressive strength.

1.3.2 Definitions

General: For the purposes of this worksection the definitions in Austroads AP-C087 and the following apply:

- Base/based 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. Stabilisation of the base course is not preferred due to the risk of reflective cracking. Council will consider stabilisation of the base course on a case by case basis, as an element of the overall pavement design.
- 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. Approved and certified recycled materials will be considered as part of the pavement design.

- 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 alumino siliceous 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 comprised of 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

1.4.1 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.

1.4.2 Subbase layer

Level: 0 mm to - 10 mm from design level.
Thickness: ± 10 mm from design thickness.

1.4.3 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

1.5.1 Execution details

Submit the following:

- Compaction test results: From a NATA accredited laboratory confirming the required relative compaction has been achieved including accompanying summary report.
- Pavement Deflection Testing using Benkelman Beam methodology – Council requires Benkelman beam test reports of Base Course including accompanying summary report.

Delivery: Submit the following:

- 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.
Core sampling if requested by Council

1.5.2 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.

1.5.3 Records

Contractor is to maintain records 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 deadweight 7.5 tonne dead weight roller or 15 tonne steel drum roller.

1.5.4 Tests

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

1.5.5 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

1.6.1 Notice

Any material laid without inspection may lead to council not accepting the finished material.
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.
- 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.

Roll test inspections: Roll test for subgrade, base, subbase. Tests for sub-grade and sub-base to be witnessed and approved by the Council as specified in the Councils development works standards. The Superintendent shall select the line of the roller and walk behind or beside the roller to detect any movement of the pavement by observation with Council.

- The roll test shall use 3 point deadweight 7.5 tonne dead weight roller or 15 tonne steel drum roller.

2 Materials

2.1 Unbound base and subbase materials

2.1.1 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.

2.1.2 Traffic loading and material selection

Design traffic: As documented on drawings.
Pavement materials: Select base and subbase material based on the traffic category in the **Traffic loading and pavement materials table**.

2.1.3 Traffic loading and pavement materials table

Traffic classification	Design traffic ESA (N)	Acceptable base material	Acceptable subbase material
Medium (M)	$10^6 \leq N < 4 \times 10^6$	CRB20-1	CRS20, CRS40
Light (L)	$N \leq 10^6$	CRB20-1, CRB20-2, CCB20-1, CCS20-2, NGB20, add DGB20 and update material properties and test method table	CRS20, CRS40, CCS20, NGS20, NGS40, add DGS20, DGS40, CSS and update material properties and test method table

2.1.4 Classes of crushed rock

Material: Provide from the following classes:

- Class 1: Pavement base material with a minimum plasticity index for unbound pavements requiring a very high standard of surface preparation for a sprayed sealed or thin asphalt surfacing.
- Class 2: Pavement base material with no minimum plasticity index for unbound pavements which may not require a very high standard of surface preparation. Use of recycled material is permitted.
- Class 3: Pavement subbase material requiring minimum permeability to provide positive drainage to the subsurface drains for medium traffic. Pavement base material for light traffic pavements provided the material produces sufficient cohesive fines during compaction. Use of recycled material is permitted.
- Class 4: Subbase material for unbound flexible pavements. Use of recycled material is permitted.

2.1.5 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 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.

2.1.6 Crushed concrete

Crushed rock 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.

2.1.7 Recycled materials

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.

2.1.8 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.		

2.1.9 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.

2.1.10 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 or grading (% passing through sieve) AS 1289.3.6.1	**Sieve size (mm)**	—	—	—	—		—
	26.5	100	100	100	100	100	100
	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:	—	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa

Property and test method	Differentiating criteria	Material requirements					
		CRB20-1	**CRB20-2**	**CCB20-1**	**CCB20-2**	**RCMB**	**NGB20**
Maximum dry compressive strength on fraction passing 19 mm sieve to AS C08.52							
Particle shape by proportional caliper (% misshapen for 2:1 caliper ratio) to AS C08.14	—	max 35%	max 35%	max 35%	max 35%	max 35%	—
Aggregate wet strength* to AS C08.22	—	min 100 kN	min 80 kN	min 100 kN	min 80 kN	Min 70kN	—
Wet/dry strength variation* (dry - wet)/dry to AS C08.22	—	max 35%	max 35%	max 35%	max 35%	max 35%	—
Los Angeles value (% loss or abrasion) to AS C08.23	—	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.							

2.1.11 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%
	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	—	min 1.0 MPa	min 1.0 MPa	min 1.0 MPa	min 1.0 MPa	min 1.0 MPa	min 1.0 MPa

Property and test method	Differentiating criteria		Material requirements				
		CRS20-3	CRS40-4	CCS20	RCMS	NGS20	NGS40
plasticity index is less than 1) to AS C08.52							
Particle shape by proportional calliper - % misshapen (2:1) to AS C08.14	—	max 35%	max 35%	max 35%	max 35%	—	—
Aggregate wet strength* to AS C08.22	—	min 50 kN	min 50 kN	min 50 kN	min 70 kN	—	—
Wet/dry strength variation* (dry - wet)/dry to AS C08.22	—	max 40%	max 40%	max 40%	max 40%	—	—
Los Angeles value to AS C08.23	—	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%
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

2.2.1 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**.

2.2.2 Shear strength table

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

2.3 Stabilised materials

2.3.1 Material properties and production

Stabilised materials: Conform to *C07 Stabilisation* for:

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

Material production: To *C07 Stabilisation* using one of following stabilisation method, as appropriate:

- Stationary mixing plant.
- In situ stabilisation.

2.4 Modified base and subbase materials

Council prefers not to use modified base course

2.4.1 Material properties

Materials after stabilisation: 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

Council prefers not to use bound base course

2.5.1 Material type

Requirement: Lightly bound or bound.

2.5.2 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

2.6.1 Quality

Requirement: Test for all characteristics in conformance with **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

3.1.1 Material transportation from a pugmill mixer

Delivery vehicles: Use delivery trucks with tipping bodies 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.

3.1.2 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 *C07 Stabilisation*.

3.2 Stockpiling unbound materials

3.2.1 Stockpile locations

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.

3.2.2 Stockpile and maintenance

Stockpiled material: Sample to AS C08.3.1 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 Underlying layer

3.3.1 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.

3.3.2 Layer preparation before constructing pavement

Subgrade: Prepare layer in conformance with *C06 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.

3.4 Placing

3.4.1 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.

3.4.2 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.

3.4.3 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.

3.4.4 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.

Inspections

Inspections of different pavement layers must in accordance with Council's hold points.

3.5 Trimming, compaction and curing

3.5.1 Plant

Compaction: Use self-propelling compaction plant where practical.

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

3.5.2 Compaction procedure

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

3.5.3 Subsequent layers

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

3.5.4 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.

3.5.5 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**.

3.5.6 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 a prime or 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 slurrying of the surface or leaching of the stabilising agent.

3.6 Acceptance of compaction

3.6.1 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**.

3.6.2 Lot acceptance criteria for compaction of unbound layers table

Traffic classification	Characteristic value of density ratio (%)		Mean value[1] of density ratio (%)		Assessment
	Base	Subbase	Base	Subbase	
Medium (M)	≥ 98	≥ 97	-	-	Accept lot
Light (L)	-	-	≥ 100	≥ 98	Accept lot
Note: 1. Allow for minimum 3 tests per lot.					

3.6.3 Lot acceptance criteria for compaction of bound layers

Requirement: Any zones with relative compaction of 97% (modified compactive effort) may be accepted if there is evidence that the zone forms less than 5% of the lot.
Layers thicker than 250 mm: Conform to the following relative compaction requirement:

- Top 150 mm: 97% (modified).
- Below 150 mm from the top: ≥ 92% (modified).

3.6.4 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.

3.7 Testing

3.7.1 Quality

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

3.7.2 Moisture content testing

Underlying layer site testing: To AS 1289.5.2.1.

3.7.3 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.

3.8 Non-conformance

3.8.1 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.

3.8.2 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.

3.9 Removal and replacement of non-conforming lot

3.9.1 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.

3.9.2 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.

3.10 Maintenance before completion of wearing surface

3.10.1 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 *C09 Sprayed bituminous surfacing*.

3.10.2 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: Not required

3.10.3 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.

3.10.4 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.

3.10.5 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.

3.10.6 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 - Summary of hold and witness points

Reference No:	Clause and description	Type*	Submission/Inspection	Submission/Notice details	Process held
C08-HP01	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
C08-HP02	SUBMISSIONS, Variations Variations to approved materials	H	Details of any changes to the approved base and subbase or source of supply.	Minimum 10 days before material delivery	Material delivery
C08-WP03	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	Upon delivery	-

Reference No:	Clause and description	Type*	Submission/Inspection	Submission/Notice details	Process held
			truck.		
C08-HP04	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.
C08-HP05	SUBMISSIONS, Execution details Placing outside layer thickness range	H	Proposal to place and compact layer outside the required thickness range.	Minimum 2 days before spreading.	Spreading of pavement materials.
C08-HP06	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.
C08-HP07	SUBMISSIONS, Execution details Trimming, compaction and curing Record of roll test for each layer of pavement. Record of deflection monitoring of completed pavement layer	H	Compaction test results and report from a NATA accredited laboratory authority for each completed pavement layer. All inspection records including roll tests for identification of any movement by visual observation by Council and Superintendant. Benkelman Beam test results and summary report prior to sealing.	Minimum 7 days before placement of next layer.	Placement of next layer.
C08-HP08	SUBMISSIONS, Execution details Non-conformance	H	Disposition of non-conforming lot. .	Minimum 5 days before corrective action or removal and replacement.	Corrective action or removal and replacement.
C08-WP09	INSPECTIONS, Notice Materials	W	Unbound, modified and bound materials.	Upon delivery.	-
C08-HP10	INSPECTIONS,	H	Quality of underlying	Minimum 2 days	Placing. For

Reference No:	Clause and description	Type*	Submission/Inspection	Submission/Notice details	Process held
	Notice Underlying layer		layer including assessment of required moisture content.	before placing.	development inspections book through "MyInspect".
C08-HP11	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. For development inspections book through "MyInspect".
C08-HP12	INSPECTIONS, Notice Deflection monitoring of subgrade and subbase pavement layers	H	Inspection of the condition of prepared subgrade and subbase courses confirming pavement works show no movement under roll test for each completed layer.	Minimum 2 days before placement of next layer.	Placement of next layer. For development inspections book through "MyInspect".
	*H = Hold Point W = Witness Point				

4.2 Annexure - Maximum lot sizes and minimum test frequencies

4.2.1 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 evidence and certification	1 contract		
	• 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		1 per 5,000 t	AS C08.52

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
	strength			
	• Particle shape		1 per 1,000 t	AS C08.14
	• Aggregate wet strength		1 per 5,000 t	AS C08.22
	• Wet/dry strength variation		1 per 5,000 t	AS C08.22
	• Los Angeles value		1 per 1,000 t	AS C08.23
	• 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 m² 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 m² or max 1 day's placement	10 per 5,000 m² 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

4.3 ANNEXURE - REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS C08		Methods for sampling and testing aggregates
AS C08.14	2007	Particle shape, by proportional caliper
AS C08.22	2008	Wet/dry strength variation
AS C08.23	2009	Los Angeles value
AS C08.3.1	2012	Sampling - Aggregates
AS C08.52	2008	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
Austroads AG:PT/T251	2010	Ball penetration test
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 T276	2012	Foreign materials content of recycled crushed concrete
RMS L/G/005	2015	Deflection testing of earthwork and pavement layers
Austroads AG:PT/05-19	2019	Guide to Pavement Technology Part 5: Pavement evaluation and treatment design