



AUS-SPEC

Infrastructure Specifications

1132 Lean mix concrete subbase

1132 LEAN MIX CONCRETE SUBBASE

IMPORTANT: This document has been adapted from the NATSPEC suite of specification templates for use in the Cessnock City 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) Cessnock City 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**.
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Where there is a conflict between main body text and Cessnock City Council specific clauses, Council's specific clauses shall prevail.

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

Requirement: Provide lean mix concrete subbase and associated components, 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)*.
- 0319 *Auxiliary concrete works*.
- 1101 *Traffic management*.
- 1102 *Control of erosion and sedimentation (Construction)*.
- 1112 *Earthworks (Road reserve)*.
- 1133 *Plain and reinforced concrete base*.
- 1143 *Sprayed bituminous surfacing*.

1.3 STANDARDS**General**

Standards: To AS 1379 (2007), AS 3600 (2018), Austroads AGPT08 (2019) and Austroads AGPT04C (2017).

1.4 INTERPRETATION**Abbreviations**

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

- CRCP: Continuously reinforced concrete pavement.
- JRCPC: Jointed reinforced concrete pavement.
- PCP: Plain concrete pavement.
- SFCPC: Steel fibre reinforced concrete pavement.

Definitions

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

- Batch and load: Varies according to mixer types as follows:

- . Central batch mixers: For mixers discharging into a tipper truck, a load may comprise more than one batch.
- . Mobile batch mixers: A batch is deemed to be a load, a load must not comprise more than one batch.
- . Continuous mixers: A batch is a load produced in a single discrete operation.
- Control line: A line generally at or near the centreline of a road on which the design is based and from which measurements for setting out may be conveniently made.
- Efficiency index: The effectiveness of a curing compound in retaining moisture, assessed as a percentage of water retained in the test specimens relative to the uncoated specimens.
- Geopolymer binder: Polymeric binder formed by reacting alumina-silicate pre-cursors with alkaline activator(s).
- Geopolymer concrete: Geopolymer binder aggregates, water and additives.
- Load: A single truckload of concrete comprising one or more batches.
- Mix: The proportions of component materials in a quantity of concrete.
- Nominated mix: The designed mix submitted for approval.
- Plan area: The Works area.
- Trial mix: Trialling of the nominated mix to demonstrate that the mix design conforms to the documented requirements.
- Vebe testing: A flow test on a vibrating table, used as a measure of workability in a stiff mix.

1.5 TOLERANCES

Concrete consistency

Maximum permissible difference in slump:

- Slipformed concrete: ± 10 mm.
- Manually placed concrete: ± 15 mm.

Concrete production tolerances table

Description	Tolerance (% by mass)
Particle size distribution (AS sieve):	
37.50 mm	± 5
19.00 mm	± 10
13.20 mm	± 10
4.75 mm	± 10
1.18 mm	± 5
600 μm	± 5
150 μm	± 2
Binder content	± 3

1.6 SUBMISSIONS

Certification

Certificate of calibration: Submit certification, from a registered testing authority, as evidence of accuracy of scales before handling and batching of material.

Execution details

Work method statement: Submit details of the proposed work method including the following:

- Handling, storing and batching of materials for concrete.
- Monitoring and measuring of constituent materials for concrete.
- Mixing and transporting of concrete.
- Placing and finishing of concrete, including a paving plan showing paving widths, sequence and estimated daily outputs.
- Plant and equipment to be used, including evidence of conformance to AS 1379 (2007).

Non-conforming trial section: Submit details of changes proposed for constructing the new trial section including the equipment, materials, mix, plant or rate of paving, to rectify non-conformance.

Non-conforming subbase thickness: If the subbase level exceeds the low level tolerance, submit proposals for rectification.

Removal and replacement of subbase: Submit details of proposed work method for the removal and replacement of non-conforming subbase, including control measures for preventing damage to the adjoining subbase.

Products and materials

Nominated mix: Submit details of the following:

- Constituent materials:
 - . Cement: Brand and source.
 - . Fly ash: Powerhouse source.
 - . Water: Source.
 - . Admixtures: Proprietary source, type, name, dosage recommended by the manufacturer and evidence of conformance to AS 1478.1 (2000).
 - . Aggregates: Source, geological type, moisture condition, blend proportions and grading for each type of aggregate.
 - . Soluble salt content.
- Mix design:
 - . Constituent quantities per m³ of concrete.
 - . Nominated particle size distribution of aggregates, including fine, coarse and combined particle size distribution.
 - . Forming time for each nominated mix.
- Trial mix test results: For each nominated mix, determined at the nominated slump, showing conformity for the following, as appropriate:
 - . Content of cement content, flyash and content of cementitious material per yielded m³ of concrete.
 - . Compressive strength at 28 days.
 - . Vebe reading.
 - . Drying shrinkage after 21 days air drying.
 - . Air content, if air entraining agent is used.

Steel reinforcement: Submit evidence of conformity with AS/NZS 4671 (2019).

Curing and surface debonding compounds: Submit evidence that the efficiency index conforms to **CURING AND DEBONDING COMPOUNDS, General** and test results confirming the non-volatile content.

Records

Subgrade survey: Submit a work-as-executed survey of the completed subgrade conforming to **SITE ESTABLISHMENT, Subgrade survey**.

Alignment and surface tolerances: Submit survey to verify that subbase alignment, surface levels, joints and edges conform to the requirements of this worksection.

Samples

Curing and surface debonding compounds: Submit reference sample for testing.

Tests

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

Variations

Approved nominated mix: If change to the mix is proposed, submit details of the alternative mix, including its production method and source of constituent materials.

1.7 INSPECTIONS

Notice

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

- Trial mix: Mixing of the trial mix.
- Trial section construction: Completed trial concrete subbase.

- Non-conforming trial section: If the original trial section is deemed non-conforming, completed new trial section.
- Excavation: Completed excavation for subgrade beams.
- Steel reinforcement: Steel reinforcement for subgrade beams in place before placing concrete.
- Repairing core holes: Completed restoration of cored areas where testing specimens were extracted.
- Non-conforming subbase thickness: Completed remedial work for subbase with non-conforming thickness.
- Removal and replacement of subbase: Completed replacement of non-conforming subbase.

2 MATERIALS

2.1 GENERAL

Nominated mix

Variations to the nominated mix: Any change without approval is subject to removal from the Works.

Storage and handling

Cement more than 3 months old (from date of manufacture): If required, retest to verify that the cement conforms to AS 3972 (2010) before using.

Transportation: Transport cement in watertight packaging, protected from moisture.

Storage and handling facilities: Prevent the aggregates becoming intermixed, mixed with foreign materials or segregated.

Storage area flooring: Concrete.

Non-conforming storage and handling facilities of concrete mix: If found, stop concrete production and delivery of materials until condition is rectified.

Storing cement bags: Under cover and clear of the ground.

2.2 CEMENT

General

General purpose and blended cement: To AS 3972 (2010).

Caked or lumpy cement: Do not use.

Geopolymer concrete

Geopolymer concrete: To SA TS 199 (2023) and supply of geopolymer concrete to Austroads ATS 5330 (2020).

2.3 FLY ASH

General

Requirement: Fine grade fly ash to AS/NZS 3582.1 (2016).

2.4 WATER

General

Mixing water: To AS 1379 (2007) clause 2.4.

Water properties: Clean potable water, free from any material which may be harmful to the concrete or reinforcement including oil, acid, alkali, organic or vegetable matter.

Limits of impurities in mixing water: To AS 1379 (2007) Table 2.2 and the following:

- Chloride ion: Maximum 300 parts per million to AS 1478.1 (2000) Appendix C.
- Sulfate ion: Maximum 400 parts per million to AS 1289.4.2.1 (2020).

2.5 ADMIXTURES

General

Chemical admixtures: To AS 1478.1 (2000).

Requirement: Free of calcium chloride, calcium formate, or triethanolamine or any other accelerators.

Chemical admixture dosage: To the manufacturer's recommendations for the air temperature and setting time.

Combining admixtures: Do not combine without verification from the admixtures manufacturers that they are compatible.

Types of admixtures

Warm season retarder: From October to March, use a lignin or lignin-based set-retarding admixture, Type Re or Type WRRe, for controlling slump within the limits in **CONCRETE PROPERTIES, Consistency**.

Cool season retarder: From April to September, use a lignin or lignin-based set-retarding admixture containing maximum 6% reducing sugars, Type WRRe conforming to AS 1478.1 (2000).

Mixes with less than 50% flyash: Make sure total alkali contribution from all admixtures does not exceed 0.20 kg/m³.

Air-entraining agent: If used, conform to **CONCRETE PROPERTIES, Air content**.

Other admixtures which may be used: Superplasticisers and high range water reducers, Type HR, WR, Re.

2.6 AGGREGATES

General

Properties: To AS 2758.1 (2014) and the following:

- Clean, durable materials sourced from natural gravel, crushed stone, air-cooled iron blast furnace slag and sand. Do not use steel-plant slag.
- Chloride ion contents: Less than 0.8 kg/m³.
- Sulfate ion contents: Less than 5%.

Soluble salt content: Assess maximum 12 months before closing of tenders.

Samples for testing: Take from dedicated stockpiles or from materials delivered to site.

Blending of aggregates: If blending two or more fine aggregates or two or more coarse aggregates, make sure the aggregate from each source conforms to the **Fine aggregate properties table** or **Coarse aggregate properties table**, as appropriate.

Fine aggregates

Manufactured fine aggregate: Crushed from rock conforming to the **Coarse aggregate properties table** and non-plastic tested to the AS 1289.3 series, as appropriate.

Aggregate size: Less than AS 4.75 mm sieve.

- Permissible deviations: To AS 2758.1 (2014) Table 2.

Fine aggregate properties table

Property	Requirement	Test method
Bulk density ^a	Minimum 1200 kg/m ³	AS 1141.4 (2000)
Water absorption	5.0% maximum, except slag aggregate: 6.0%	AS 1141.5 (2000) and AS 1141.6.1 (2000)
Material finer than 75 µm	Maximum 10.0%	AS 1141.12 (2015)
Material finer than 2 µm	Maximum 1.0%	AS 1141.13 (2007)
Soundness	12 % max weighted average loss	AS 1141.24 (2018)
Organic impurities	Maximum 0.5%	AS 1289.4.1.1 (2019)
Sugar content	Less than 1 part in 10,000	AS 1141.35 (2019)

a. Bulk density in AS 2758.1 (2014) means the same as unit mass in AS 1141.4 (2000).

Sodium sulfate soundness limits

Percentage of loss by mass: 6%.

Coarse aggregate properties table

Property	Requirement	Test method
Bulk density ^a	Minimum 1200 kg/m ³	AS 1141.4 (2000)
Water absorption	Slag: Maximum 6% Other: Maximum 5%	AS 1141.6.1 (2000)
Material finer than 75 µm	Maximum 2.0%	AS 1141.12 (2015)
Material finer than 2 µm	Maximum 1.0%	AS 1141.13 (2007)

Property	Requirement	Test method
Particle shape, 2:1 and 3:1 ratios	Maximum 35% and 10%	AS 1141.14 (2007)
Wet strength	Minimum 50 kN	AS 1141.22 (2019)
Wet/dry strength variation	Maximum 35%	AS 1141.22 (2019)

a. Bulk density in AS 2758.1 (2014) means the same as unit mass in AS 1141.4 (2000).

Coarse aggregate grading

Testing: To AS 1141.11.1 (2020) and AS 1141.11.2 (2019).

Aggregate size: Less than AS 26.50 mm sieve.

- Permissible deviations: To AS 2758.1 (2014) Table 1.

Recycled concrete aggregate

Coarse aggregates from demolition concrete: To the recommendations of Austroads AGPT04E (2022) and ARRB Best Practice Guide 1 (2020) - *Road materials*.

2.7 CURING AND SURFACE DEBONDING COMPOUNDS

General

Compounds for curing and debonding: To Austroads AGPT04C (2017) clause 6 and the following:

Bituminous emulsions: To AS 1160 (1996).

Liquid curing compounds: To AS 3799 (1998).

Compound types: Use one of the following:

- Wax emulsion: Class A, Type 2 to AS 3799 (1998).
 - . Stability: Rate of separation in 7 days is not more than 4% tested to AS 1160 (1996).
- Hydrocarbon resin: Class B, Type 1-D to AS 3799 (1998).
- Waterborne hydrocarbon resin or styrene butadiene resin (SBR): Class Z, Type 1-D or Type 2 to AS 3799 (1998).
- Bitumen emulsion: Grade CRS/170. Cut back bitumen with up to 3% cutter oil.

Sprayed bituminous seal aggregates: Free of dust or treated with a bitumen base precoat and minimum nominal size of 5 mm.

Aggregate: To **AGGREGATE** in 1143 *Sprayed bituminous surfacing*.

Water retention efficiency index: Minimum 90% tested to AS 3799 (1998) Appendix B.

Reference sample testing: To AS 3799 (1998). Test for conformity to the following tolerances in AS 3799 (1998):

- Non-volatile content.
- Efficiency index.
- Density.
- Drying time.
- Viscosity.
- Infrared spectrum.

2.8 STEEL REINFORCEMENT

General

Steel reinforcing materials: To AS 3600 (2018) clause 17.2.

Supply and placement of reinforcing steel: To Austroads ATS 5310 (2020).

Grade, type and size: As documented. Make sure this can be readily identified on the reinforcement.

Surface condition: Free from loose mill scale, rust, grease, tar, paint, oil, mud, mortar or any other material which may reduce the bond between the reinforcement and the concrete. Do not bring surface to a smooth polished condition.

Bar chairs: Plastic bar chairs or plastic tipped wire to AS/NZS 2425 (2015) and chairs capable of withstanding a load of 200 kg mass on the chair for one hour at 23 ±5°C without malfunction.

Galvanized bars: Hot-dip to AS/NZS 4680 (2006).

2.9 COATING PROPERTIES

Compressive strength

Minimum compressive strength:

- At 7 days: 4 MPa.
- At 28 days: 5 MPa for flyash blended cement.

Maximum compressive strength:

- At 28 days: 15 MPa.

Sampling and testing: Conform to **TESTING**.

Drying shrinkage

Maximum drying shrinkage after 21 days air drying: Conform to the following:

- Maximum aggregate size > 20 mm: 450 $\mu\epsilon$.
- Maximum aggregate size \leq 20 mm: 550 $\mu\epsilon$.

Preparation of test specimen: To AS 1012.8.4 (2015).

Consistency

Requirement: As required to allow the production of a dense, non-segregated mass with bleeding limited to prevent bleed water flowing over the slab edge under the conditions of pavement. Make sure the slab edge maintains its shape, and does not sag or tear.

- Bleed water flowing over the edge: Stop paving until mix is adjusted or redesigned and approved.

Slump range:

- For slipformed concrete: 20 mm to 40 mm.
- For hand placed concrete: 55 mm to 65 mm.

Slipform concrete mix: Vebe reading of the trial mix to AS 1012.3.3 (1998).

Air content

Air content of fresh concrete: 3 to 7%.

2.10 CONCRETE FOR SUBGRADE BEAMS

General

Concrete: Conform to the *0319 Auxiliary concrete works* worksection.

Minimum compressive strength at 28 days: 32 MPa normal class to AS 1379 (2007).

Maximum nominal aggregate size: 20 mm.

Slump at the point of placement: 50 to 80 mm.

2.11 BINDER CONTENT FOR LEAN MIX CONCRETE

Cementitious binder content table

Mix category	Flyash (kg/m ³) ^a	Cement (kg/m ³) ^a	Total binder (kg/m ³) ^a
Subbase	100 minimum	90 minimum	250 minimum
a. per yielded m ³ of concrete			

2.12 TESTING

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 NOMINATED MIX

Trial mix

Requirement: Before starting production of each mix, mix a trial batch of each nominated mix for testing as follows:

- Sampling: To AS 1012.1 (2014).
- Preparation of cylinders: Inspected, capped and crushed to AS 1012.9 (2014).
- Unit mass: Determine to AS 1012.12.1 (1998) or AS 1012.12.2 (1998) after dressing of voids in the specimen.

Compressive strength testing: Use 3 specimens conforming to the following:

- Cylinders: 28 days old concrete.
- Size: 100 mm nominal diameter.
- Sampling: From the same concrete.
- Specimens more than 28 days old: Adjust the age to the **TESTING, Concrete age conversion factors table**.

Testing: To the **Ready-mixed concrete production and supply table** in the **ANNEXURES**.

Date of testing: Maximum 18 months before starting paving.

3.2 PRODUCTION, TRANSPORT AND DELIVERY OF CONCRETE

Standard

Handling, storing and batching of materials, mixing, transport and consistency of concrete: To AS 1379 (2007) Section 4 and Appendix A.

Mixers: To AS 1379 (2007) clause 3.5.

Storage and handling

Aggregate moisture content: Determine at least twice daily immediately before batching and make corrections to quantities of aggregate and water, as appropriate.

Cementitious material: Weigh separately with an individual hopper, weighing the cement first.

Continuous type mixer: If used, measure using a continuous weighing method, except for liquids which may be measured by volume or flow rate meter.

Volumetric batching of water: Measure with a device calibrated in one litre increments.

Concrete for manually placed concrete: Deliver concrete in agitator vehicles.

Mixing and batching

Split drum mixer producing centrally mixed concrete: If used, discharge the whole batch into the tray of a moving vehicle for performing mixer uniformity tests to AS 1379 (2007) Appendix A.

Truck-mixed concrete: If required, add water to AS 1379 (2007), within 10 minutes of completing batching and 200 m from batching facilities.

Mixing time: Conform to the following:

- Stationary batch mixers: Minimum 54 seconds +6 sec/m³.
- Mobile batch mixers: Complete the full period of mixing at either the testing station or the point of placement. Ignore all other mixing and agitation for the purpose of assessing the actual mixing time for the batch.

Size of batching in an agitator: Do not exceed the manufacturer's rated capacity or exceed 80% of the mixer drum gross volume.

Maximum mixing time: Conform to the following:

- Generally: 10 minutes.
- Split mixer drums: 5 minutes.

Retempering

Addition of water: To AS 1379 (2007) clause 4.2.3.

Adding admixture

Requirement: Separately predilute in the mixing water before adding to other materials. Incorporate using a method that does not cause adverse interaction, as recommended by the admixture manufacturer.

Production and transport

Transport and production equipment: Use equipment which:

- Prevents segregation or loss of materials.
- Supplies a homogenous product.

- Provides concrete workability compatible with the capacity of the paving equipment to achieve the required compaction and nominal finish, and requires only nominal manual finishing.

Transport capacity for slipform paving: Use transportation with sufficient capacity for continuous paving at a speed of at least 1 m/minute.

Consistency

Testing: Slump test for consistency within the times measured from completion of batching, as appropriate for the concrete temperature, as follows:

- Temperatures $\leq 25^{\circ}\text{C}$: 40 minutes.
- Temperatures $> 25^{\circ}\text{C}$: 30 minutes.

Concrete temperature: Measure at start of discharge of batch at intervals not exceeding 60 minutes throughout the paving operation.

Forming time

Maximum forming time: Determine time required for each mix to achieve the required concrete workability, taking into consideration prevailing weather conditions and concrete temperature.

Monitoring: Monitor and record forming time for any batch exceeding the following:

- Air temperature $< 30^{\circ}\text{C}$: 90 minutes.
- Air temperature $\geq 30^{\circ}\text{C}$: 45 minutes.

Conformity of batch: Determined conditional on the compressive strength of the cores from that batch.

Concrete delivery

Delivery information: For each batch of mix, keep a record of the following:

- Batch number: Issued sequentially with the batching order.
- Supplier name and location.
- Volume of material supplied, including amount of water.
- Product identification.
- Completion of batching time and date.

Segregated or non-uniform mix: Do not deliver.

3.3 CONSTRUCTION PLANT AND EQUIPMENT

Paver machine

Mechanical paver: Use pavers conforming to the following:

- With an automatic control system, including a sensing device for controlling line and level to the documented tolerances.
- With internal vibrators capable of compacting the full depth of the concrete.
- With adjustable extrusion screed and/or conforming plate for forming the slab profile and producing the required finish on all surfaces.
- Capable of paving the documented slab widths or a combination of slab widths and slab depths.
- Able to spread the mix uniformly and regulate the flow of mix to the vibrators without segregation of components, to produce a dense and homogenous slab with a smooth uniform finish, requiring minimal hand finishing.

Gross operating mass: Use a self-propelling machine with mass not less than 4 tonnes/linear metre of paved width.

Paving speed: 1 m/minute or less, as required to enable the continuous operation of paver and obtain the required degree of compaction.

3.4 SITE ESTABLISHMENT

Site preparation

General: Conform to *1112 Earthworks (Road reserve)*.

Subgrade survey

Measuring subbase invert levels: If spray sealing is required for the underlying layer, take levels on the top of the seal after removal of foreign or loose material such as aggregate.

Survey method: Survey on a 5.0 m grid or a plan area, reporting levels to the nearest mm.

Completion of subgrade: Submit a work-as-executed survey of the subgrade for the full extent of works. Highlight any locations where the actual level is higher than the design levels.

Non-conforming levels: Adjust pavement levels locally, this may include trimming and adjusting the paving layer.

3.5 CONCRETE SUBBASE PAVING TRIAL

Trial section construction

Requirement: Before starting normal concrete subbase paving, construct a trial section of the lean mix concrete subbase on the carriageway as follows:

- So that it may be incorporated in the finished work.
- Construct separate trial sections, for each subbase type, in a continuous operation without intermediate construction joints.
- Length:
 - . 50 m to 100 m for mechanical placing in one continuous operation.
 - . 15 m to 50 m for manual placement with a 20 m³ minimum volume.
- Width: Same as that documented for the Works.

Materials and methods: Use the nominated materials, concrete mix, equipment and methods.

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 SUBBASE**.

3.6 SUBGRADE BEAMS

General

Location: Provide below the subbase at expansion joints and isolation joints in the concrete base, as documented. Construct subgrade beams before the subbase.

Extent: Extend beam the full length of joints or as documented on drawings.

Construction time: Construct beam before placing subbase.

Excavation

Dimensions and levels: Excavate to the documented dimensions. Finish the top surface of the subgrade beam level with the top of the subgrade.

Finishing: Trim the vertical faces to neat lines and remove all loose material. Re-compact the bottom of the trench, as required, to match the degree of consolidation of adjacent undisturbed material.

Steel reinforcement

Requirement: Conform to **INSTALLATION OF STEEL REINFORCEMENT** in *1133 Plain and reinforced concrete base*.

Reinforcement: Conform to the following:

- Form to documented shapes and sizes.
- Bend to an internal bend radius at least twice the diameter of the bar.
- Do not bend or straighten so that it will damage the material.
- Do not use with kinks or bends which is not documented.

Bending: Bend without impact or damage to the bar.

- Bend procedure: To AS 3600 (2018) clause 17.2.3.1 using one the following:
 - . Cold bending around pins.
 - . Applying uniform heat not exceeding 450°C to the portion to be bent.

Lapped splices

Requirement: Weld or securely tie together in at least 2 places the ends of bars forming a lapped splice.

Minimum length of lapped splices: To AS 3600 (2018) clause 13.2.

Splices in reinforcing fabrics: To AS 3600 (2018) clause 13.2.3 so that the two outermost transverse wires of one sheet overlap the two outermost transverse wires of the lapping sheet.

- Orientation of sheets: Make sure sheets mechanically engage each other.
- Sheet overlap: Not less than the pitch of the transverse wires plus 25 mm.

Construction and protection

Concrete compressive strength: Determine at 7 days for one specimen of concrete per subgrade beam pour.

- Minimum concrete strength: 20 MPa.

Concrete placing and finishing: To **CONCRETE PLACING AND FINISHING**.

- Loose subgrade material: Remove or recompact to the correct level. Where removal is required, fill voids with mortar or concrete and screed to provide a surface flush with the top of the subgrade beam.
- Finish: Steel float to produce a smooth surface, free of any texture.

Protection: Protect from damage by plant, motor vehicles and the paving operation. Rectify any damage.

- Vehicular traffic: Do not load beam until the concrete cylinder, stored adjacent to the beam, has achieved 20 MPa compressive strength.

Curing: Cure the top surface of the subgrade beam before placing the subbase in conformance with **CURING AND DEBONDING**.

Bond breaker: Apply to top surface of the subgrade beam, consisting of a further application of curing compound, 24 to 72 hours before placing subbase concrete.

3.7 CONCRETE PLACING AND FINISHING**Ambient conditions**

Concrete placing: Do not place if:

- Rain appears imminent or during rain.
- Air temperature in the shade is below 5°C or above 36°C.
- Concrete temperature at the point of discharge is less than 10°C or more than 32°C.

Air temperature: If the air temperature in the shade is below 10°C or above 30°C, protect the concrete from cold or hot weather. Provide detailed proposals for protection of concrete in cold or hot weather.

Diurnal temperature changes $\geq 20^\circ\text{C}$: Make sure the upper limit of the concrete temperature is not more than 30°C before placing.

Surface temperature: Monitor the concrete surface temperature for the first 24 hours after placement, make sure it does not fall below 5°C.

- Measurement: Using a purpose-made thermometer, measure at 2 or more locations within each day's paving.

Records: Measure and record concrete air temperature in the shade and wind velocity at the point of concrete placement throughout the course of the Works.

- Air temperature measurement: Measure at an outdoor location, remote from artificial influences such as machinery.

Ground surface conditions

Requirement: Place concrete on a surface which is damp at the time of placement, clean, compacted and free of loose or foreign matter including sealing aggregate.

At time of placement: Make sure there is no ponded water on the surface.

Evaporation and moisture loss

Evaporation limit: If the rate of evaporation exceeds 0.50 kg/m²/hr, determined from **ANNEXURE – RATE OF EVAPORATION**, perform approved measures to prevent excessive moisture loss or cease work.

Evaporation retarder: If used to prevent excessive moisture loss, apply by fine uniform spray after all finishing operations have been completed, except minor manual bull-floating. If re-application is required, carry out after level floating and so as not to incorporate the retarder into the surface mortar.

Monitoring and inspection: Regularly inspect plastic concrete to monitor the effectiveness of the procedures.

Paving generally

Requirement: Place, pave and finish concrete as follows:

- Prevent segregation or loss of materials.
- Prevent premature stiffening.

- Produce a uniform, dense, homogenous slab throughout the pavement.
- Expel entrapped air and make sure reinforcement and embedments are closely surrounded.
- Produce the documented thickness and surface finish.

Subbase surface after paving: Uniform, dense and compacted finish.

Surface finish: Conform to the following:

- Generally: Steel screed or float finish.
- For asphaltic base or concrete base with bitumen seal: Hessian dragged finish.
 - . Mean texture depth: Maximum 0.6 mm measured to RMS T192 (2012).
- For concrete base without bitumen seal: Smooth surface without dimpling, ridges or recesses. Rectify non-conforming surface so that it is smooth before base paving.

Base slab anchors: If required, make provisions for base slab anchors during construction of the subbase at the documented locations to Austroads ATS 5860 (2023).

Disruptions: If disruptions occur, form a construction joint before restarting the paving operations.

Mechanical (slipform) paving

Requirement: Spread, compact, screed and finish freshly placed concrete to form a dense, homogenous slab with a smooth uniform finish requiring minimal hand finishing.

Slab edge produced: Be able to maintain its shape without sagging or tearing. If excessive bleed water occurs, by flowing over the slab edge, stop paving until the mix consistency has been adjusted to prevent the flow.

Supplementary manual vibration: If mechanical paving is unable to fully compact and finish the concrete, such as at transverse construction joints, use manual vibration.

Paving continuity: Make sure the supply of concrete and concrete paving operations is continuous so that the mechanical paver does not require stopping once spreading commences.

Supporting surface: Provide a smooth and firm supporting surface for the tracks of the paver, curing machine and any other equipment in the paving and curing train.

Hand paving

Application: Use hand placement in areas where mechanical placement is not practical.

Formwork: Construct formwork conforming to the following:

- Construct so that it can be removed without damaging the concrete.
- True to line and grade.
- Braced sufficiently to support wet concrete.
- Mortar tight.
- Debonded to prevent adhesion of concrete to the forms.
- Set to tolerances equivalent to that required for the finished subbase finish.

Placing in forms: Deliver concrete in agitator trucks and deposit uniformly in the forms without segregation and by means other than vibration.

Compaction: Compact the concrete using poker vibrators and by two passes only of a hand-guided vibratory screed traversing the full width of the slab on each pass.

Build-up: Prevent any build-up of concrete between the forms and vibratory screed.

Poker vibrators: Use at systematic spacings and duration required to produce a homogenous slab with uniform compaction.

Number of working internal vibrators: Not less than 1 for each 10 m³ of concrete placed per hour. For paving widths greater than 2.5 m, use minimum 2 vibrators.

Standby vibrators: ¼ of the vibrator number in use, with a minimum of 1 vibrator.

Alignment and surface tolerances

Alignment and surface levels: Within 4 days of placing, survey the alignment and surface levels, and inspect each joint for conformity.

Outer edge: Construct outer edges of the subbase conforming to the following:

- 50 mm ±25 mm wider than the plan position of the overlying concrete base.
- 25 mm ±25 mm wider than the plan position of other overlying base types.
- Square to the finished top surface of the subbase with a tolerance of ±10°.

Conformity with straightedge profile: Start with the trial paving, test at random locations at the following minimum frequencies for each longitudinal and transverse alignment:

- One test of longitudinal and transverse surface profile per 10 m per paving run until 5 conforming results are recorded.
- After recording 5 conforming results, one test of longitudinal and transverse surface profile per 100 m per paving run.
- If non-conformity is discovered, retest from the beginning.

Longitudinal construction joint: If an edge of a slab is to form a longitudinal construction joint line, conform to **JOINT**, Longitudinal construction joints for horizontal alignment tolerances.

Assessment of subbase thickness

Subbase survey: Survey level runs, for the full extent of works, after subbase placement, taken on a 5 m grid. Round off measurements to the nearest 5 mm.

- Timing of survey: Within 4 days of placing.

Subbase thickness determination: Assess subbase thickness by comparing the subbase survey to the subgrade survey within each lot. Highlight locations which do not conform to **TOLERANCES, Finished subbase.**

Lot conformity: A lot is deemed conforming in thickness if:

- The mean thickness is not less than the documented thickness.
- No individual result is 15 mm or more below the documented thickness.

Non-conforming subbase thickness

Non-conforming thickness: Remove subbase if its thickness is more than 20 mm below the design thickness.

Remedial works: Remove concrete found to be above the design level. If the concrete is below the level tolerance, increase the thickness of the base course.

Protection of work

Traffic restrictions: Do not allow traffic or construction equipment, other than those associated with testing, on the subbase until the strength of the subbase has reached at least 4.0 MPa. Following this, only allow construction equipment with gross mass less than 1.5 tonnes on the subbase if they are associated with the following operations:

- Debonding treatment and spall treatment.
- Base paving at a distance of up to 300 m immediately ahead of the paver.

Rain protection: Do not expose concrete to rain within the period from tipping to application of curing compound. If the concrete is exposed, it will be deemed non-conforming. Beyond this period, acceptance of conformity will be assessed based on the surface finish.

Damage: Rectify any damage caused to the subbase.

3.8 JOINTS

Transverse construction joints

Requirement: Provide joints in conformance with the following:

- Need not be scabbled.
- Provide only at discontinuities in the placement of concrete determined by the paving operations.
- Be continuous over the paving width without steps or offsets in any axis. The line of joint is not more than 20 mm from a 3 m straightedge nor more than 10 mm from a 0.3 m straightedge.
- Constructed $90^\circ \pm 5^\circ$ to the longitudinal joints with the joint face corrugated and square to the finished top surface of the subbase, to the documented dimension.
- Top surface of joint: 3 mm maximum deviation from a 0.3 m straightedge placed along the joint.
- Smooth across the joint.

Longitudinal construction joints

Requirement: Provide joints in conformance with the following:

- Do not scabble.
- Do not form within 100 mm of the base longitudinal joints and as documented.
- Maximum deviation from the planned or documented position: 20 mm \pm 0.15 mm.
- Maximum deviation from a 3 m straightedge: 10 mm with allowances for any planned curvature.

- Smooth across the joint.
- Perpendicular to the subgrade surface.
- Under flexible bases:
 - . Square of $\pm 5^\circ$ to the finished top surface of the subbase.
 - . Top surface of longitudinal construction joints: 3 mm maximum deviation from a 0.3 m straightedge placed along the joint.

3.9 CURING AND DEBONDING

Curing and debonding treatments table

Base type	Recommended curing treatment	Recommended debonding treatment
Plain concrete (PCP) base:		
-Bituminous interlayer debonding treatment applied before placing base	Wax emulsion, hydrocarbon resin, waterborne hydrocarbon resin or styrene butadiene (SBR) compounds	Sprayed bituminous seal, bitumen emulsion or wax emulsion
-Other situations	Wax emulsion	Sprayed bituminous seal
Joint reinforced dowelled concrete (JRCP) base	Wax emulsion, hydrocarbon resin, bitumen emulsion	Sprayed bituminous seal or bitumen emulsion
Continuously reinforced concrete (CRCP) base	Wax emulsion	Sprayed bituminous seal
Steel fibre reinforced concrete (SFRC) base	Wax emulsion	Sprayed bituminous seal, bitumen emulsion or wax emulsion
Asphalt base	Bitumen emulsion	Sprayed bituminous seal
Granular flexible base	Hydrocarbon resin, waterborne hydrocarbon resin or bitumen emulsion	Sprayed bituminous seal

Application of curing compound

Application method: Fine spray immediately following the surface finishing, when the surface is free of bleed water as follows:

- Paving < 2.5 m wide: By hand with single or multiple nozzles.
- Paving ≥ 2.5 m wide: By spray bar or hand lance fitted with minimum 3 nozzles spaced to give uniform cover over a minimum 1 m width in a single pass.
- Slipformed paving > 4.5 m: By mechanical sprayer fitted with a spray bar with multiple nozzles spaced to give uniform cover for the full paving width in a single pass.

Spray bars and lances: Fit with protective hoods to minimise drift of curing compounds to workers and roadside areas.

Sprayer features: Incorporate a device for continuous agitation and compound mixing in its container during spraying and nozzles which do not drip after shut-off.

Minimum application rate: As recommended by the manufacturer or at the following rates, whichever rate is greater.

- Generally: 0.2 L/m².
- Bitumen emulsion: 0.5 L/m².
- Hand lance application: 25% higher than that recommended by the manufacturer.
 - . Application areas: Faces of formed joints and sections of slipformed edges which were supported by temporary forms at the time of initial spraying.

Calculations of application rate: Calculate the amount of curing compound applied to a measured area as follows:

- Calculate the average application rate from the total measured quantity of compound applied over each paving run.
- Local application rate: Test the local amount of curing compound measured on test mats placed on the pavement. Calculate the mean local rates falling on 3 test mats, each approximately 0.25 m²,

placed randomly within an area of 100 m² on the surface to be treated. Carry out testing at minimum frequency of once per 2000 m².

- Edge of slab sprayed by mechanical means: Calculate local application rate at minimum frequency of once per 3000 m² of upper surface paving. Randomly place 3 mats within a total edge length of 20 linear metres.

Conforming application rates: The application rate in a test area is deemed conforming if the average rate and the mean local rate is equal to or exceeds the required rate and if no single rate is more than 5% below the required rate.

Non-conforming application rates: Respray, within 6 hours of testing, at an application rate not less than twice the deficiency in the original application. Test resprayed application as for the first application.

Curing period: Maintain the curing membrane intact, in a continuous and unbroken film, for 7 days after placing the concrete.

Damage to curing membrane: Repair affected areas by hand spraying.

Adjoining hardened concrete: Respray hardened concrete less than 7 days old, at commencement of paving run, with a single application for a minimum distance of 7 m and extend to areas trafficked by people during placement at the construction joint.

Application of bond breaker

Preparation: Immediately before the application, clean the subbase surface, removing all loose, foreign and deleterious material. Treat spalled areas conforming to **Treatment of spalling** before applying bond breaker or asphaltic concrete.

Debonding treatment application: Apply to the top surface of the subbase and as an additional treatment to the curing treatment.

Application method: Conform to **Application of curing compound**.

Application rate: Minimum 0.2 L/m².

Application timing: Apply debonding treatment conforming to the following:

- After the curing compound is has been applied.
- Do not apply until the subbase has achieved a strength of 4.0 MPa.
- Do not apply until the subbase level schedules have been submitted and disposition of non-conformity is completed.
- Within 14 days of achieving the required strength.
- Minimum 72 hours before placement of the base.

Wax emulsion curing compound: If used, use the same wax emulsion as bond breaker.

3.10 CONCRETE CRACKING

Typical subbase cracks

Description: Full-depth transverse cracks continuous for the full width of the paving at approximately 3 to 15 m centres.

Subbase more than 6 m wide placed in a single pass: Longitudinal full-depth cracks at 4 m spacing in continuous lengths exceeding 4 m.

Remedial work: Not required.

Plastic shrinkage cracks

Description: Discrete cracks less than 300 mm long and with a depth less than 50% of the slab thickness, that does not intersect a formed edge.

Remedial work: Conform to **Corrective action**.

Other longitudinal and transverse cracks

Description: Cracks with cumulative length greater than 2 m in any 25 m² area of subbase.

Remedial work: If a bond breaker has been applied, conform to **Corrective action**.

Repair work

Repair of concrete cracks: To Austroads ATS 5340 (2020) and Austroads ATS 5341 (2023).

Corrective action

Strain alleviating membrane strip: Apply 300 mm minimum wide geotextile backed polymer modified bitumen strip over the crack before placing the first asphalt base layer or concrete base.

Installation: To recommendations of the manufacturer and Austroads AGPT04G (2009).

Wax emulsion: Apply two coats of 300 mm wide wax emulsion along the crack when a concrete base is required.

Non-conforming concrete for replacement

Replacement: Remove and replace subbase if one or more of the following occurs:

- Transverse cracks: Over 300 mm in length, at average spacing of less than 2 m over a length of 5 m.
- Longitudinal cracks: Continuous length exceeding 5 m.
- Cracks over 300 mm long: Within a distance of 1.5 m from a construction joint, isolation joint or free edge.

Treatment of spalling

Spalled areas greater than 10 mm deep and 15 mm wide: Infill with low-shrink rapid-hardening cement mortar or a mixture of aggregate and bitumen and screed the surface flush with the surrounding subbase concrete.

Full-depth cracks spalled more than 10 mm deep and 15 mm wide: Infill with an appropriate sealant or a mixture of sand bitumen so that the surface is flush with the surrounding subbase.

Spalling repair time: Complete treatment no earlier than five working days before applying bond breaker.

3.11 TESTING

Quality

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

Test authority: A registered laboratory.

Sampling, curing and testing of fresh concrete

Sampling method: To AS 1012.1 (2014).

Sampling: Take samples from the delivery vehicles or from rolled concrete deposited ready for placement.

Frequency of sampling: To AS 1379 (2007) and the following:

- At least one sample for the concrete being placed at one time.
- At least one sample for each lot.

Test specimens: Mould at least two test specimens from each sample to AS 1012.8.1 (2014). Supply the number of moulds required for the documented frequency of testing. Inspect, cap and mark specimens before sending to testing laboratory.

- Initial curing: Carry out initial on-site (field) curing between 18 to 36 hours to AS 1012.8.1 (2014) clause 9.
- Transportation: Transport cylinders only after initial on-site curing.

Testing for compressive strength

Compressive strength testing: To AS 1012.9 (2014).

Compressive strength of each sample: Average compressive strength of the two specimens taken from the sample, tested at the same age.

Age of specimens: 7 and 28 days.

Adjustment due to age: If specimens are tested at more than 28 days after moulding, obtain the equivalent 28 day compressive strength by dividing the test compressive strength by the factor shown in the **Concrete age correction factors table**.

Concrete age correction factors table

Age of specimen at time of test (days)	Correction factor (AF)					
	Cylinders			Cores		
	Flyash content (%) ^a					
	< 10	10 – 25	> 25	< 10	10 – 25	> 25
28	1.00	1.00	1.00	1.00	1.00	1.00
35	1.02	1.03	1.03	1.00	1.00	1.00

Age of specimen at time of test (days)	Correction factor (AF)					
	Cylinders			Cores		
	Flyash content (%) ^a					
42	1.04	1.06	1.06	1.00	1.00	1.00
49	1.06	1.09	1.09	1.02	1.03	1.09
56	1.08	1.12	1.12	1.04	1.06	1.17
70	1.10	1.15	1.15	1.06	1.09	1.35
84	1.12	1.18	1.18	1.07	1.11	1.54
112	1.14	1.21	1.21	1.10	1.14	1.75
140	1.16	1.24	1.24	1.11	1.16	1.95
168	1.18	1.27	1.27	1.13	1.18	2.04
196	1.20	1.30	1.30	1.14	1.20	2.14
224	1.22	1.33	1.33	1.14	1.21	2.17
308	1.24	1.36	1.36	1.15	1.22	2.21
365 or greater	1.25	1.38	1.38	1.15	1.23	2.23

a. Relative to the total cementitious binder content.
Note: For intermediate ages factor, determine on a prorata basis rounded to the nearest second decimal place.

Acceptance criteria

Assessment process of test results: To AS 1379 (2007) Section 6.

Reports and records of test results: To the AS 1012 series. Submit test results and keep copies on-site.

Average compressive strength of samples representing the lot: Conform to **CONCRETE PROPERTIES, Compressive strength**.

Non-conforming concrete: Conform to **Testing by specimens cut from the work**.

Under-strength results from a lot: If the compressive strength of test cylinder is less than the required strength, remove and replace the lot represented by the test cylinder in conformance with **REMOVAL AND REPLACEMENT OF SUBBASE**.

Testing by specimens cut from the work

Requirement: If the subbase concrete strength is non-conforming, obtain approval to core the in situ subbase for testing and provide specimens conforming to the following:

- Shape: Cylindrical cores.
- Preferred dimension of cores: 100 mm diameter.
- Minimum dimension of cores: 75 mm diameter or 2½ times the nominal size of the coarse aggregate, whichever is the greater.
- Tolerance in uncapped state: 5 mm.
- Minimum length: Same as the core diameter.

Coring: Assess the in situ properties of concrete by coring of hardened concrete to Austroads ATS 5317 (2023).

Before coring: Make sure the concrete has hardened enough to permit removal without disturbing the bond between the mortar and the coarse aggregate.

Frequency of coring: One core for each lot or one core for the area of subbase placed between any two consecutive construction joints, whichever is the lesser. Nominate the lot represented by each core at the time of sampling and record before testing.

Curing of cores: Despatch cores to arrive at the testing laboratory within 24 hours of cutting from the subbase. Start wet curing within 24 hours of receipt of the cores.

Test method: To AS 1012.14 (2018) and the following:

- Adjust the test strength by a factor conforming to the **Shape correction** factor table and the **Concrete age conversion factors table**.

- Core strength: [Test strength x SF factor] ÷ AF factor.
- Only use wet conditioning.

Shape correction factor (SF) table

Length/diameter ratio of core	Correction factor (SF)
2.00	1.00
1.75	0.98
1.50	0.96
1.25	0.93
1.00	0.87

Repair of core holes

Restoration method: Clean and restore all core holes in the subbase with non-shrink cementitious concrete, with compressive strength not less than the subbase and aggregate size of 10 mm nominal maximum.

Acceptance criteria for cored concrete

Equivalent 28 days compressive strength of the specimens cut from work: Conform to **CONCRETE PROPERTIES, Compressive strength**.

Non-conforming concrete: Conform to **REMOVAL AND REPLACEMENT OF SUBBASE**.

Corrected core strength of specimens cut from the subbase: 5 MPa for in situ compressive strength.

3.12 REMOVAL AND REPLACEMENT OF SUBBASE

Subbase sawcuts

Transverse sawcut: Make sawcuts in conformance with the following:

- Cut the full depth of the subbase layer at each end of the section to be removed.
- Cut in a straight line, continuous between adjacent longitudinal joints, edges or proposed sawcuts.
- Cut normal to the control line at not less than 84° to the longitudinal construction joint.
- Do not oversaw into the adjoining base or underlying sub base.

Longitudinal sawcuts: Make sawcuts in conformance with the following:

- Cut 150 to 300 mm offset from planned longitudinal contraction joints in the overlying base.
- Do not to extend more than 150 mm past the transverse sawcut at each end of the section to be removed.
- So that the exposed face conforms to **Longitudinal construction joints**.

Oversawing: Do not oversaw on any additional internal sawcuts made to aid the removal of the subbase.

Removal and replacement of subbase

Removal of concrete: Remove to an existing longitudinal joint/edge or a newly sawn longitudinal joint conforming to the following:

- Slab width: Width of replacement slab and width of residual slab (the slab remaining after removal) is not less than 0.3 m, measured 90° to the control line.
- Slab length: Length of replacement slab and length of residual slab (the slab remaining after removal) is not less than 0.6 m, measured parallel to the control line.
- Corner angles resulting from removal and replacement of the slab is not more acute than 84°.

Disposal of removed subbase: Remove from site.

Damage to adjoining pavement: Remove and replace pavement adjacent to the original area of rejected subbase damaged by the operations.

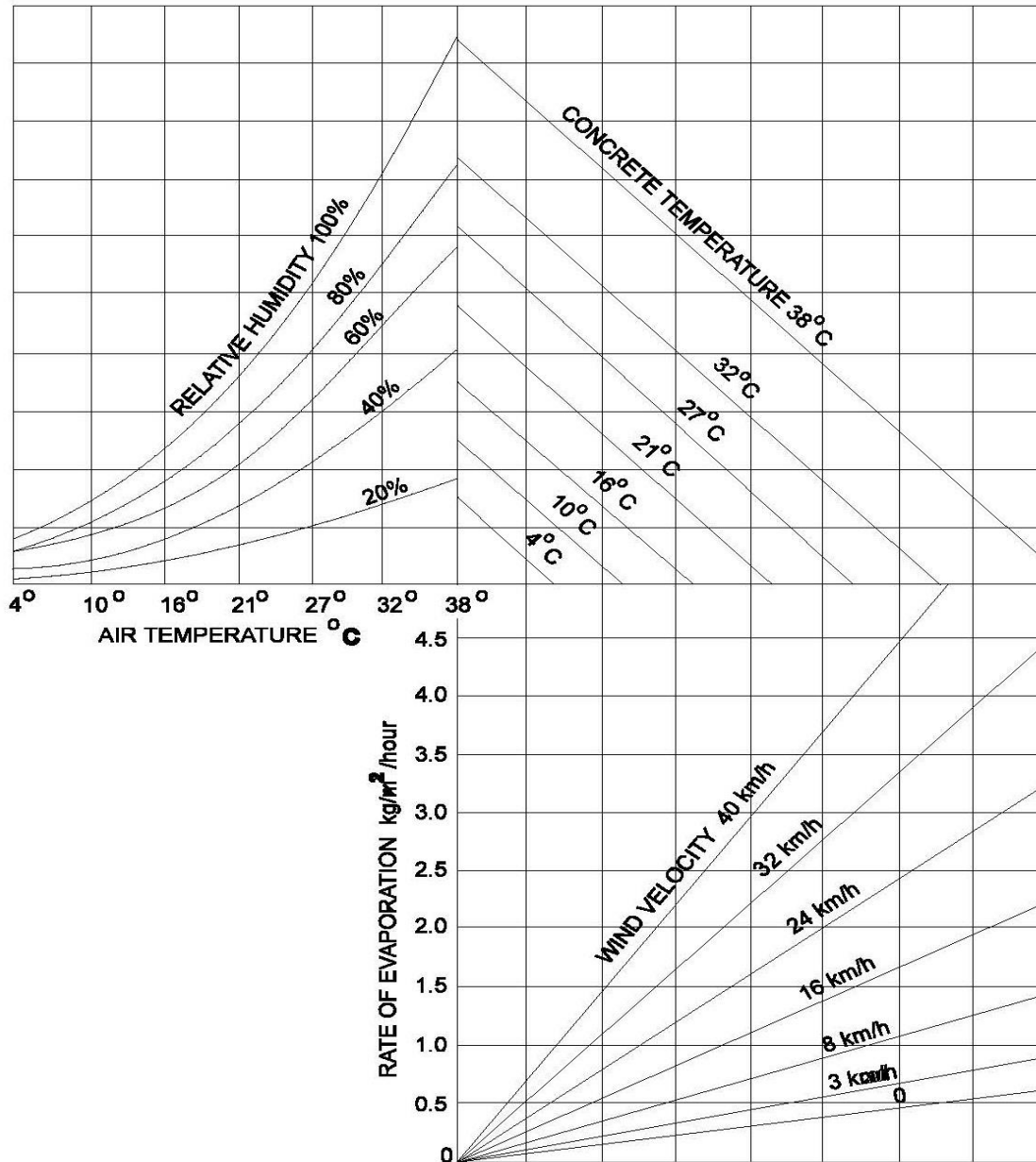
Non-conforming subbase more than 25 m long: Replace by mechanical means unless the slabs are odd-shaped or mismatched.

Application of bond breaker: After completion of the replacement subbase, prepare and debond the pavement in conformance with **Application of bond breaker**.

4 ANNEXURE A

4.1 ANNEXURE - RATE OF EVAPORATION

Rate of evaporation graph



Using the Rate of evaporation graph

Information: The graph shows the effects of air temperature, humidity, concrete temperature and wind velocity on the rate of evaporation of water from freshly placed and unprotected concrete.

Example: To determine the evaporation rate from the graph using air temperature at 27°C, relative humidity at 40%, concrete temperature at 27°C and a wind velocity of 26 km/h:

- Enter the graph at the air temperature of 27°C.
- Move vertically to intersect the curve for relative humidity encountered 40%.
- Move horizontally to the respective line for concrete temperature of 27°C.
- Move vertically down to the respective wind velocity curve and interpolate for 26 km/hour.
- Then move horizontally to the left to intersect the scale for the rate of evaporation.
- The rate of evaporation would be 1.6 kg/m²/hour in this example.

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 details	Submission/Notice times	Process held
SUBMISSIONS, Execution details Work method statement	H	Details of proposed work method.	4 weeks before commencement	Commencement
INSPECTIONS, Notice Trial mix	W	Mixing of trial mix.	2 days before mixing	Production of each concrete mix
SUBMISSIONS, Products and materials Nominated mix	H	Details of constituent materials, mix design and trial batch test results.	3 weeks before ordering materials	Ordering and delivery of material
SUBMISSIONS, Variations Approved nominated mix	H	Details of alternative mix.	3 weeks before implementing change	Ordering and delivery of material
SUBMISSIONS, Records Subgrade survey	H	Work-as-executed subgrade survey.	2 days before paving/trial paving	Paving/trial section
INSPECTIONS, Notice Trial section construction	H – Superintendent and Principal Certifier	Completed trial subbase.	5 days before paving	Trial section acceptance
SUBMISSIONS, Execution details Non-conforming trail section	H	Details of proposed changes to the trial section.	1 day after non-conformance has been identified	Paving
INSPECTIONS, Notice Non-conforming trail section	H – Superintendent and Principal Certifier	Completed new trial section.	1 day before the inspection	Paving
INSPECTIONS, Notice Excavation	W	Excavation for subgrade beam.	2 days before placing concrete	-
INSPECTIONS, Notice Steel reinforcement	W – Superintendent and Principal Certifier	Steel reinforcement of subgrade beam in place.	2 days before placing concrete	-
SUBMISSIONS, Records Alignment and	H	Survey of subbase surface levels and alignment.	2 days after paving	Subbase acceptance or rectification

Clause and description	Type	Submission/Inspection details	Submission/Notice times	Process held
surface tolerances				
INSPECTIONS, Notice Repair of core holes	W	Completed restoration of cored areas.	1 day before the inspection	-
INSPECTIONS, Notice Non-conforming subbase thickness	W	Completed remedial work for subbases with non-conforming thicknesses.	1 day before the inspection	-
SUBMISSIONS, Execution details Removal and replacement of subbase	H	Details of proposed work method for removing and replacing non-conforming subbase.	5 days before removal	Removal and replacement of subbase
INSPECTIONS, Notice Removal and replacement of subbase	W – Superintendent and Principal Certifier	Completed replacement of subbase.	1 day before the inspection	-

Note: H = Hold point, W = Witness point

4.3 ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

Placement of lean mix concrete subbase table

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
Steel supply	Steel reinforcement	1 contract	1 per contract	AS/NZS 4671 (2019)
Concrete supply	To the Ready-mixed concrete production and supply table.			
	Concrete/air temperature	50 m ³	1 per 50 m ³	Measure
	Air content	50 m ³	1 per 50 m ³	AS 1012.4.2 (2014)
	Consistency – slump	50 m ³	1 per load	AS 1012.3.1 (2014)
Curing	Compressive strength (7 and 28 days)	50 m ³	1 per pour	AS 1012.9 (2014)
	Material quality – supplier's documentary evidence	1 contract	1 per production batch	AS 3799 (1998) Section 3 AS 2341 series
	Application rate	1 day's work	1 per 1000 m ²	
Joints	Geometry	50 m ³	All joints	Survey

Ready-mixed concrete production and supply table

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
Raw materials supply	Material quality – supplier's documentary evidence			
	Cement	1 month's production	1 per week	AS 3972 (2010) Table 2
	Fly ash	1 month's	1 per month	AS/NZS 3582.1 (2016)

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
		production		
	Water	1 contract	1 per contract	AS 1289.4.2.1 (2020) and AS 1478.1 (2000) Appendix C
	Admixtures	1 month's production	1 per month	AS 1478.1 (2000)
	Fine aggregates			
	Grading	1 week's production	1 per 200 m ³ concrete ^a	AS 1141.11.1 (2020)
	Moisture content	N/A	1 per day	
	Sodium sulfate soundness	1 contract	1 per contract	AS 1141.24 (2018)
	Bulk density	1 contract	1 per contract	AS 1141.4 (2000)
	Unit mass (particle density)	1 contract	1 per contract	AS 2758.1 (2014)
	Water absorption	1 contract	1 per contract	AS 2758.1 (2014)
	Material finer 2 µm	1 contract	1 per contract	AS 1141.13 (2007)
	Deleterious material (impurities/reactive)	1 contract	1 per contract	AS 2758.1 (2014)
	Coarse aggregates			
	Grading	1 week's production	1 per 200 m ³ concrete ^a	AS 1141.11.1 (2020)
	Moisture content	N/A	1 per day	
	Wet strength	1 contract	1 per contract	AS 1141.22 (2019)
	Wet/dry strength variation	1 contract	1 per contract	AS 1141.22 (2019)
	Sodium sulfate soundness	1 contract	1 per contract	AS 1141.24 (2018)
	Particle shape	1 contract	1 per contract	AS 1141.14 (2007)
	Fractured faces	1 contract	1 per contract	AS 1141.18 (2022)
	Bulk density	1 contract	1 per contract	AS 1141.4 (2000)
	Unit mass (particle density)	1 contract	1 per contract	AS 2758.1 (2014)
	Water absorption	1 contract	1 per contract	AS 2758.1 (2014)
	Material finer 75 µm	1 contract	1 per contract	AS 1141.12 (2015)
	Weak particles	1 contract	1 per contract	AS 2758.1 (2014)
	Light particles	1 contract	1 per contract	AS 2758.1 (2014)
	Deleterious materials (impurities/reactive)	1 contract	1 per contract	AS 2758.1 (2014)
	Iron unsoundness	1 contract	1 per contract	AS 2758.1 (2014)
	Falling/dusting unsoundness	1 contract	1 per contract	AS 2758.1 (2014)
Mix design	Compressive strength	1 contract mix	1 per mix per contract	AS 1012.9 (2014)
	Aggregate moisture content	1 contract mix	1 per mix per contract	RMS T262 (2012)
	Consistency – slump	1 contract mix	1 per mix per load	AS 1012.3.1 (2014)
	Air content	1 contract mix	1 per mix per contract	AS 1012.4.2 (2014) Method 2

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
	Drying shrinkage	1 contract mix	1 per mix per contract	AS 1012.13 (2015)
a. or part thereof, per lot.				

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
1132.1 Supply and place concrete in subbase	m ³ of concrete in place. Volume calculated from width, length and depth, as documented.	All costs associated with all documentation and approvals and the supply and placing of concrete subbase in place, including construction joints.
1132.2 Finish and cure subbase	m ² of subbase. Area calculated from width, length and depth, as documented. Do not include sides of slabs in area calculation.	All costs associated with the finishing and curing of the subbase.
1132.3 Crack treatment by stress alleviating membrane strip (for asphalt base)	Linear metre of strip. Length is actual length measured on site.	All costs associated with the supply and installation of membrane strip.
1132.4 Bond breaker	m ² of bond breaker. Area based on actual length, measured on site and design width, as documented. Do not account for tolerances.	All costs associated with the supply and installation of bond breaker.
1132.5 Subgrade beams	m ³ of concrete. Volume determined from width, length, and depth, as documented.	All costs associated with the supply, placing and installation of concrete and reinforcing steel for subgrade beams.
Traffic management		To 1101 <i>Traffic management</i> .
Erosion and sedimentation control		To 1102 <i>Control of erosion and sedimentation (Construction)</i> .
Base slab anchors		To 1133 <i>Plain and reinforced concrete base</i> .

4.5 ANNEXURE - REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS 1012		Methods of testing concrete
AS 1012.1	2014	Sampling of concrete
AS 1012.3.1	2014	Determination of properties related to the consistency of concrete - Slump test
AS 1012.3.3	1998	Determination of properties related to the consistency of concrete - Vebe test
AS 1012.4.2	2014	Determination of air content of freshly mixed concrete - Measuring reduction in air pressure in chamber above concrete
AS 1012.8.1	2014	Method for making and curing concrete - Compression and indirect tensile test specimens
AS 1012.8.4	2015	Method for making and curing concrete - Drying shrinkage specimens prepared in the field or in the laboratory
AS 1012.9	2014	Compressive strength tests - Concrete, mortar and grout specimens
AS 1012.12.1	1998	Determination of mass per unit volume of hardened concrete -

		Rapid measuring method
AS 1012.12.2	1998	Determination of mass per unit volume of hardened concrete - Water displacement method
AS 1012.13	2015	Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory
AS 1012.14	2018	Method for securing and testing cores from hardened concrete for compressive strength and mass per unit volume
AS 1141		Methods for sampling and testing aggregates
AS 1141.4	2000	Bulk density of aggregate
AS 1141.5	2000	Particle density and water absorption of fine aggregate
AS 1141.6.1	2000	Particle density and water absorption of coarse aggregate - Weighing-in-water method
AS 1141.11.1	2020	Particle size distribution - Sieving method
AS 1141.11.2	2019	Particle size distribution for vision sizing systems
AS 1141.12	2015	Materials finer than 75 µm in aggregates (by washing)
AS 1141.13	2007	Material finer than 2 micrometer
AS 1141.14	2007	Particle shape, by proportional caliper
AS 1141.18	2022	Crushed particles in coarse aggregate derived from gravel
AS 1141.22	2019	Wet/dry strength variation
AS 1141.24	2018	Aggregate soundness - Evaluation by exposure to sodium sulfate solution
AS 1141.35	2019	Detection of sugar contamination in concrete aggregates
AS 1160	1996	Bitumen emulsions for the construction and maintenance of pavements
AS 1289		Methods of testing soils for engineering purposes
AS 1289.3		Soil classification tests
AS 1289.4.1.1	2019	Soil chemical tests - Determination of the organic matter content of a soil - Normal method
AS 1289.4.2.1	2020	Soil chemical tests - Determination of the sulfate content of a natural soil and the sulfate content of the groundwater - Normal method
AS 1379	2007	Specification and supply of concrete
AS 1478		Chemical admixtures for concrete, mortar and grout
AS 1478.1	2000	Admixtures for concrete
AS 2341		Methods of testing bitumen and related roadmaking products
AS/NZS 2425	2015	Bar chairs in reinforced concrete - Product requirements and test methods
AS 2758		Aggregates and rock for engineering purposes
AS 2758.1	2014	Concrete aggregates
AS/NZS 3582		Supplementary cementitious materials
AS/NZS 3582.1	2016	Fly ash
AS 3600	2018	Concrete structures
AS 3799	1998	Liquid membrane-forming curing compounds for concrete
AS 3972	2010	General purpose and blended cements
AS/NZS 4671	2019	Steel for the reinforcement of concrete
AS/NZS 4680	2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
SA TS 199	2023	Design of geopolymers and alkali-activated binder concrete structures
ARRB BPG1	2020	Road materials
Austroads AGPT		Guide to pavement technology
Austroads AGPT04C	2017	Materials for concrete road pavements
Austroads AGPT04E	2022	Recycled materials
Austroads AGPT04G	2009	Geotextiles and geogrids
Austroads AGPT08	2019	Pavement Construction
Austroads ATS		Austroads technical specifications
Austroads ATS 5310	2020	Supply and placement of steel for the reinforcement of concrete
Austroads ATS 5317	2023	Coring of hardened concrete

Austrroads ATS 5330	2020	Technical specification for the supply of geopolymer concrete
Austrroads ATS 5340	2020	Technical specification cementitious patch repair of concrete
Austrroads ATS 5341	2023	Repair of concrete cracks
Austrroads ATS 5860	2023	Bonded anchors
RMS T192	2012	Determination of the texture depth of road surfacing by the TRL Mini Texture Meter
RMS T262	2012	Determination of moisture content of aggregates (Standard method)
EN 15804	2012	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
ISO 14025	2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 21930	2017	Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services

5 ANNEXURE M – CESSNOCK CITY 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: an authorised representative of Council's Director of Infrastructure and Engineering Services.	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 Cessnock City Council <i>Development Engineering Handbook</i> for final inspection, works-as-executed and handover requirements.	Completion

6 AMENDMENT HISTORY

0	15/01/2024	First Published
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