Construction Specification for Civil Works

C244 - Sprayed Bituminous Surfacing

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This document was originally based on AUS-SPEC - Development Construction Specification C244 - Sprayed Bituminous Surfacing. Substantial parts of the original AUS-SPEC document have been deleted and replaced in the production of this Tamworth Regional Council Specification for Civil Works. The parts of the AUS-SPEC document that remain are still subject to the original copyright.

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REVISIONS: C244 - SPRAYED BITUMINOUS SURFACING

REVISIONS	CLAUSES AMENDED	AMENDMENT DETAILS	DATE
1		Original Issue	20/05/2019
2	C244.17	Updated references to TfNSW Additional minimum pavement temperature requirements	01/05/2023

This Specification includes a series of Annexures that detail Project Specific Requirements

GENERAL

C244.01 SCOPE

Scope

The work to be executed under this Specification includes all of the following:

(i) Supply and delivery of all materials.

(ii) Storage and handling of raw materials.

(iii) Precoating of aggregate.

(iv) Preparation of pavement surfaces.

(iv) Preparation of bitumen binder.

(v) Application of prime, primerbinder and binder.

(vi) Application and incorporation of aggregate.

(vii) Removal of loose aggregate.

Quality

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in *CQC-Quality Control Requirements Sub-Annexure B6.*

C244.02 DEFINITIONS

The Works

The Works – Defined as follows:

- **Developer Infrastructure Works** - work includes subdivisions and any public infrastructure work associated with an approved Development in the TRC local government area requiring a construction certificate.
- **Contracted Works –** infrastructure work undertaken by a Principal Contractor or subcontractor formally appointed by TRC and supervised by TRC.
- **Internal Works** - infrastructure work undertaken by TRC's day labour workforce.

Constructor

Constructor – Defined as the organisation responsible for construction of the Works and the Principal Contractor as defined in the *Work Health and Safety Act 2011*.

TRC Representative

TRC Representative – Defined as follows:

- **Developer Infrastructure Works** – Nominated TRC officer(s) for the approved Development.
- **For Contracted Works –** the Superintendent.
- **For Internal Works –** TRC Asset Owner

Constructor's Representative

Constructor's Representative – Defined as follows:

- **Contracted Works** – the Principal Contractor's nominated representative as per the relevant contract.
- **Internal Works** – TRC officer responsible for delivery.

Developer's Representative

Developer's Representative– Defined as the person or organisation appointed by the Developer to administer the Constructor responsible for the delivery of **Developer Infrastructure Works**.

C244.03 REFERENCE DOCUMENTS

Documents Standards Test Methods

Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. The Constructor shall possess, or have access to, the documents required to comply with this Specification.

Currency

Where not otherwise specified in the relevant Tamworth Regional Council (TRC) Construction Specifications or the approved design drawings, the Constructor shall use the latest versions of the Reference documentation, including amendments and supplements, listed in the TRC Construction Specifications at the time of the Works approval.

(a) Tamworth Regional Council (TRC) Specifications

C201 - Control of Traffic.

C242 - Flexible Pavements.

CQC - Quality Control Requirements.

(b) Transport for NSW (TfNSW) Specifications

TfNSW QA Specification 3151 – Cover Aggregate for Sprayed Bituminous Surfacing

TfNSW QA Specification 3253 – Bitumen for Pavements.

TfNSW QA Specification 3258 – Aggregate Precoating Agent (for Bitumen).

TfNSW QA Specification 3259 – Bitumen Adhesion Agent (for Bitumen).

TfNSW QA Specification 3261 – Cutback Bitumen.

TfNSW Guides

TfNSW Sprayed Sealing Guide (Edition 2) 1997

TfNSW Forms

TfNSW Form 354 – Sprayer Certificate

TfNSW Form 382 – Sprayed Bitumen Surfacing Cutback Chart

TfNSW Form 395A – Primer or Primerseal Design Calculation Sheet

TfNSW Form 500A – Cutback Bitumen Prime and Primerseal Daily Record

TfNSW Form 500C – Cutback Bitumen Seal and Reseal Daily Record

TfNSW Test Methods

TfNSW Test Method T271 – Ball Penetration Test

TfNSW Test Method T274 – Aggregate Spread Rate (field method)

(c) Australian Standards

References in this Specification or on the approved design drawings to Australian Standards are noted by their prefix AS or AS/NZS.

AS 3568 – Oils for reducing the viscosity of residual bitumen for pavements.

AS 2008 – Residual bitumen for pavements.

AS 2157 – Cutback bitumen.

C244.04 CONTROL OF TRAFFIC

Control of Traffic

Control of traffic is to comply with the Traffic Control Plan, prepared in accordance with *C201 – Control of Traffic*.

MATERIALS

C244.05 SAMPLING AND TESTING OF MATERIALS

NATA Registration

Sampling and testing of materials shall be arranged by the Constructor and is to be carried out by a laboratory with appropriate NATA registration in accordance with the relevant material specifications cited in this Specification.

C244.06 BITUMINOUS MATERIALS AND ADDITIVES

(a) Bituminous Materials

Binder Conformance

Binder materials for seals and reseals shall conform to the current version of TfNSW QA Specification 3253. Refinery cutback bitumen must conform to the current version of TfNSW QA Specification 3261.

Heat Tolerances

The binder shall not be heated above 190ºC or the manufacturers recommendations, whichever is the lesser. Binder that has either been overheated, or been stored in violation of the temperature and time combinations of the manufacturer's requirements cannot be incorporated into the Works.

C244.07 AGGREGATE PRECOATING AGENT AND BITUMEN ADHESION AGENT

Material Requirements

Aggregate precoating agents shall conform to the current version of TfNSW QA Specification 3258. Test results demonstrating the conformance of each lot shall be undertaken.

Bitumen adhesion agents shall conform to TfNSW QA Specification 3259. Test results demonstrating the conformance of each lot shall be undertaken.

C244.08 OILS FOR REDUCING VISCOSITY OF BITUMEN (CUTTER OIL)

Material Requirements

Oils for reducing the viscosity of bitumen must conform to AS 3568. Test results demonstrating the conformance of each lot shall be undertaken.

Delivery & Storage

Delivery and storage procedures for cutter oil delivered in drums or in bulk shall ensure that all containers are free from any deleterious material prior to filling with cutter oil, and all drums are stored so as to ensure that entry of water through seals or welds in the drums is prevented.

C244.09 AGGREGATE

Material Requirements

The supply and delivery of aggregate must conform to TfNSW QA Specification 3151. Test results demonstrating the conformance of each lot shall be undertaken.

DESIGN OF BITUMINOUS SURFACING

C244.10 GENERAL

Proposed Design

At least five (5) working days before commencing sprayed bituminous surfacing work, the Constructor shall submit to the TRC Representative and/or the Developer's Representative (for Developer Infrastructure Works) for approval, details of the proposed bituminous surfacing design for the work together with a certification that the nominated materials for the work meet the requirements of this Specification and the approved design drawings. **Annexure C244A** shall be completed by the Constructor to conform with this approval.

AUSTROADS Design Procedure

The Constructor's design rates of application of binder and aggregate for bituminous surfacing shall be in accordance with the AUSTROADS design procedure for Sprayed Seals. and the Constructor shall submit these design details to the TRC Representative. Design application rates shall be known as "nominated application rates" and materials as "nominated materials".

Additional Information Sought

The following additional details are required to be submitted with the proposed bituminous surfacing design:

(a) Test results for all nominated materials.

(b) Aggregates - source, geological type, nominated grading, Average Least Dimension (ALD).

(c) Precoating agent and bitumen adhesion agent – types, proportions and manufacturer (if applicable).

(d) Bitumen - refinery source and certification of compliance with AS 2008.

(e) Cutback bitumen - refinery source of bitumen, type of cutter, source of cutter, cutter oil fraction, certification of compliance with AS 2157.

HOLD POINT

Hold Point

The nominated design and the test results for all constituent materials shall be submitted to the TRC Representative and/or the Developer's Representative (for Developer Infrastructure Works) at least five (5) working days prior to the proposed sealing. All of the test results nominated each of the material specifications and Australian Standards nominated shall be provided for each lot.

PROCESS HELD: Application of Sprayed Seal.

PRECOATING OF AGGREGATE

C244.11 GENERAL

Precoating Requirements

Apply the precoating agent to the aggregate in a manner and at a rate and time that provides a complete, light, uniform, effective cover of all aggregate at the time of spreading.

Precoating shall not be undertaken when rain is imminent. Precoated aggregate shall be covered where rain is either imminent or forecast. Details shall be documented in the Constructor's Project Quality Plan to avoid the settlement of dust and drying out of the precoating agent.

APPLICATION OF SPRAYED BITUMINOUS SURFACING

C244.12 GENERAL

Work Quality

The Constructor shall carry out sprayed bituminous surfacing so as to:

(a) provide a uniform application of binder with adequate adhesion to the underlying surface;

(b) provide a complete cover of interlocking aggregate particles, and

(c) achieve effective bond between binder and aggregate.

Equipment and Methods

Details of equipment and methods to be used for sprayed bituminous surfacing shall be submitted to the TRC Representative and/or the Developer's Representative (for Developer Infrastructure Works) for approval prior to their use on the Works.

C244.13 PLANT

Sprayer Requirements

The sprayer must have a current Sprayer Certificate in accordance with TfNSW Form 354 issued by TfNSW. The spray nozzles must be of the make and type endorsed on the Sprayer Certificate. Damaged, defective and worn nozzles shall be replaced with the same type and size.

Spreading Equipment

Spreading equipment must be used to spread aggregate. The equipment shall be capable of achieving a uniform spread rate.

Roller Requirements

Dual axle smooth pneumatic tyred multi-wheel rollers shall be used. The mass of the rollers shall exceed 7 tonnes, without ballast. The tyre pressure shall exceed 550kPa.

C244.14 PREPARATION OF PAVEMENT SURFACE

Pavement Sweeping

Before the application of primer, primerbinder or binder, the pavement surface shall be swept by the use of a mechanically-operated rotary road broom or suction broom to provide a uniformly clean surface. If necessary, additional sweeping shall be done by hand, using stiff brooms. Sweeping shall, where possible, extend at least 300mm beyond each edge of the area to be sprayed.

Foreign Matter on Pavement

Adherent patches of foreign material shall be removed from the surface of the pavement.

Damp Pavement

For the spraying of primer or primerbinder, the pavement surface shall be slightly damp so as to impede dust interfering with initial adhesion except where explicit instructions are provided with the seal design.

C244.15 REVIEW OF NOMINATED APPLICATION RATES

Aggregate Lots

The Constructor shall select the locations where each lot of aggregate is to be incorporated in the Works.

Target Application Rates

The Constructor shall review the bituminous surfacing design at each location based on the ALD test result for the Lot of aggregate instead of the nominated ALD value of the aggregate adopted at design submission. The revised application rates shall be known as "target application rates".

C244.16 BINDER TEMPERATURE REQUIREMENTS

Binder Temperature

The binder temperature ranges shall be:

(a) 160-190^{o}C for Class 170 and multigrade 600/170.

(b) 170-200^{o}C for Class 320.

Cutback bitumen spray temperatures shall be in accordance with **Annexure C244B.**

C244.17 PAVEMENT TEMPERATURE AND WEATHER CONDITIONS

Pavement Temperature

The pavement temperature shall be recorded at regular intervals during the course of work. The type of temperature gauge shall be submitted for approval with the nominated seal design.

Spraying of primers, primerbinders and binders is only permissible if the pavement temperature has been at or above the specified minimum temperature for at least one hour before commencement of spraying and does not fall below the specified minimum pavement temperature for spraying during the period of spraying. For temperatures slightly less than the specified minimum temperature, the use of Fast Curing cutter oils may be considered.

Minimum Pavement Temperatures:

(a) 10ºC for primes

(b) 15ºC for initial seals containing AMC4 to AMC6 cutback bitumen

(c) 20ºC for treatments containing AMC7 cutback bitumen, bitumen, and

(d) 25ºC for treatments containing polymer modified binders (other than crumb rubber binders)

Do not spray wet pavement or while rain appears imminent or during strong winds or dust storms.

C244.18 INCORPORATION OF CUTTER OIL, FLUX OIL AND ADHESION AGENT

(a) Cutting Back Bitumen

Incorporating Cutter Oil

The proportion of cutter oil shall be determined by using TfNSW Form 382 for seals and reseals and TfNSW Form 395A for primes and primerseals. The cutter oil shall be added to the tank first, without being preheated, then circulated at a rate of at least 700 litres per minute for 20 minutes to create a homogeneous mix.

(b) Fluxing Bitumen

Mixing Flux Oil

Where flux oil is to be incorporated, add it to the bitumen in the sprayer then circulate at a rate of at least 700 litres per minute for 15 minutes.

(c) Bitumen Adhesion Agent

Mixing Adhesion Agent

Where bitumen adhesion agent is to be incorporated, add it to the bitumen in the sprayer then circulate at a rate of at least 700 litres per minute for 15 minutes.

C244.19 APPLICATION OF PRIMER, PRIMERBINDER AND BINDER

(a) Primer and Primerbinder

Application of Primer and Primerbinder

Apply the class and grade of primer and primerbinder at the nominated application rates. After application of a primer, allow a period of at least 48 hours, or such longer period as determined to be necessary, for the primer to become completely dry, before the binder seal is applied. No traffic shall be put over a primed surface.

Where a bitumen adhesion agent or cutter oil have been added to the binder, adjust the total application rate of the total binder at 15ºC, using TfNSW Form 500A to make allowances within the overall mixture.

After application of a primerbinder, allow a period of at least 12 months before the binder for a seal is applied. Alternatively, if the hardness of the seal is less than 2.5mm, using TfNSW Test Method T271, the duration after the application of the primerbinder may be shortened.

(b) Binder

Application of Binder

Apply the class and grade of cutback bitumen at the nominated application rates. The target application rates shall be based on the volumes of bitumen at 15ºC excluding the quantities of bitumen adhesion agent or cutter oil to be incorporated. If flux oil has been added to the bitumen, include the quantity of flux oil as part of the binder.

Where bitumen adhesion agent and/or cutter oil have been added to the binder, adjust the application rate of the total binder at 15ºC to allow for the additional quantities in the mixture. The hot application rate of the 'total binder' shall be determined using TfNSW Form 382.

Where refinery cutback bitumen is used increase the target application rate of binder to allow for the cutter oil in the mixture in accordance with Table C244.1 below.

Grade of Refinery Cutback Bitumen	Approx. Amount of Cutter Oil in Grade (%)	Increase to Target Application Rate (%)	Permissible Ranges of Pavement Temperature (ºC) Aggregate Precoated	
			No Moisture on Aggregate	Moisture on Aggregate
AMC4	16	19	–	10 – 15
AMC5	11	12	12 – 17	17 – 28
AMC6	7	8	22 – 27	27 – 38
AMC7	3	3	32 – 37	37 – 48
FC4	15	18	–	9 – 18
FC5	10	11	15 – 20	20 – 30
FC6	7	8	22 – 27	27 – 38
FC7	3	3	32 – 37	37 – 48

Table C244.1 - Refinery Cutback Bitumen

(c) Operation of the Sprayer

Sprayer Operation

The spray nozzles shall be compatible with the binder and the application rate.

Each sprayer run shall commence and end on a protective strip of heavy paper laid perpendicular to the direction of the seal. The protective strip shall be secured to the pavement to prevent movement.

The sprayer must be moving at sufficient speed prior to the commencement of the spray run to ensure correct application. A constant speed shall be maintained throughout the spray run.

If a resultant defect becomes evident (i.e. as a result of blocked nozzles) cease spraying until the defect is rectified. Approval to recommence, supported by evidence that the problem has been rectified, shall be sought from the TRC Representative and/or the Developer's Representative (for Developer Infrastructure Works).

C244.20 APPLICATION AND ROLLING OF AGGREGATE

Incorporation of Aggregate

Precoated aggregate shall be used for all seals and primerseals. The precoated aggregate shall be incorporated within 15 minutes of the application of the binder to the pavement surface. If the precoated aggregate has been contaminated, particularly by water, the affected material shall not be incorporated into the Works.

The precoated aggregate shall be applied at the nominated size and application rate as determined in the approved seal design. The spreading equipment utilised shall ensure that the precoated aggregate is uniformly spread over the sprayed surface area. Aggregate shall be re-applied where a uniform cover is not achieved. Brooming may be

required to improve the uniformity of the cover after the initial rolling. The actual spread rate shall be determined using TfNSW Test Method T274.

Once a uniform cover of precoated aggregate is achieved, rolling shall commence using two or more dual axle pneumatic tyred multi-wheel rollers of mass greater than 7 tonnes with a minimum tyre pressure of 550kPa. A minimum of 8 passes shall be undertaken within one hour of the application of the binder.

Removal of Loose Particles

Final sweeping shall be undertaken within 48 hours of the application of the seal. After final sweeping, and before removal of speed restriction and warning signs, the number of loose aggregate particles remaining on the surface of seals constructed with 10 mm, or larger, aggregates not to exceed the values documented in Table C244.2 below.

Road Type	Loose Stones
Urban areas	20 particles per m^2
Other medium to high traffic (>250 vehicles/lane/day)	30 particles per m^2
Other low traffic (<250 vehicles/lane/day)	40 particles per m^2

Table C244.2 - Loose Stones

WP

WITNESS POINT

Inspection of loose aggregate by the TRC Representative and/or the Developer's Representative (for Developer Infrastructure Works) including evidence that the loose stones do not exceeed specified limits. Linemarking and permanent signage installed where applicable.

PROCESS HELD: Removal of speed restriction and warning signs.

C244.21 WORK RECORDS

Sprayer Run Records

Records of the particulars of the work performed shall be recorded on TfNSW Form 500A or 500C. The Constructor may use an alternative form to record the work records provided the information recorded is either equivalent or exceeds the records required in the forms nominated.

C244.22 PROTECTION OF SERVICES AND ROAD FIXTURES

Protection of Other Infrastructure

All necessary precautions shall be taken to prevent the binder, aggregate or other materials from adhering to or entering other nearby infrastructure including, but not limited to, gratings, hydrants, valve boxes, manhole covers, bridge or culvert decks and other road fixtures. Other related infrastructure shall be left in a condition equivalent to that existing when the Constructor commenced the sprayed surfacing work.

NONCONFORMANCE OF MATERIALS AND WORK

C244.23 GENERAL

Conditions

If any materials supplied fail to conform to the requirements in this Specification or if any section of sprayed bituminous surfacing work fails to conform to the requirements of this Specification, whether failure of the work is due to bad workmanship, defective materials supplied by the Constructor or materials made defective by the method of operation adopted or any other cause, then such failure or failures shall constitute a 'Non-conformance'.

C244.24 ACCEPTANCE OF NONCONFORMANCES

TRC Representative's Authority

Non-conformances of materials and work may be accepted at the absolute discretion of the TRC Representative. Non-conformance related to the achieved application rates for primer, primerbinder or binder as determined from the Bituminous Surfacing Daily Record shall be dealt with by the TRC Representative strictly on the basis set out below:

(a) Variations will be considered as departures from the design target application rates after allowing for adjustments due to adhesion agent, cutting oil, flux oil and temperature. Adjustments made on site due to surface condition and stockpile ALD dimension will also be allowed for, subject to a record of their prior approval by the TRC Representative being available.

(b) Variations up to ±5% of the adjusted design target application rate shall be deemed as conforming.

(c) Variations greater than ±5% shall be rejected.

LIMITS AND TOLERANCES

C244.25 SUMMARY OF LIMITS AND TOLERANCES

The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C244.3.

Item	Activity	Limits/Tolerances	Spec Clause
1	**Design of Bituminous Surfacing**		
	Design of Bituminous Surfacing	Constructor to provide details of design to TRC Representative at least 5 working days before proposed commencement of work.	C244.10
2	**Sweeping of Pavement Surface**		
	Sweeping of Pavement Surface	Sweeping shall extend at least 300mm beyond each edge of the area to be sprayed by a mechanically operated rotary broom.	C244.14
3	**Bitumen Heating**		
	(a) Bitumen Temperature		C244.16
	(i) Class 170	160-190 ºC	
	(ii) Multigrade 600/170	160-190 ºC	
	(iii) Class 320	170-200 ºC	
`	(b) Refinery Cutback Bitumen Temperature	Refer **Annexure C244B**.	C244.16
4	**Spraying Temperature**		
	(a) Pavement Temperature	Bituminous surfacing shall not be undertaken if the pavement temperature has not been at or above 10ºC for at least 1 hour before commencement of spraying or if the pavement temperature falls below the specified minimum during the period of spraying.	C244.17
5	**Cutting Back Bitumen**		
	Cutting Back Bitumen	Circulation of hot bitumen and cutter oil mixture in the sprayer shall be at the rate of 700 litres / minute for 20 minutes.	C244.18(a)
6	**Fluxing Bitumen or adding Bituminous Adhesion Agent**		
	Fluxing Bitumen or adding Bituminous Adhesion Agent	Circulation of fluxing oil or bituminous adhesion agent with hot bitumen shall be at the rate of 700 litres / minute for 15 minutes.	C244.18(b)
7	**Application of Bituminous Material**		
	(a) Spray Area	Area to be sprayed shall be limited to area which can be covered by aggregate at target application rate within 15 minutes of spraying.	C244.19
	(b) Application Rates	Application rates and quantities shall apply to a temperature of 15ºC and have tolerances of ±5%.	C244.19
	(c) Primer	At least a 48 hour period shall elapse after spraying of primer before binder for a seal is applied.	C244.19
	(d) Primerbinder	At least a 14 day period shall elapse after spraying of primerbinder before application of binder.	C244.19
8	**Application of Aggregate**		
	(a) Spreading Time	Application of aggregate shall be completed within 15 minutes of spraying bitumen or cutback bitumen on each section.	C244.20

Item	Activity	Limits/Tolerances	Spec Clause
9	**Rolling**		
	(a) Roller Numbers and Type	Initial rolling shall be carried out with 2 or more dual axle smooth pneumatic tyred multi-wheeled rollers. Minimum load of 1 tonne per tyre and minimum tyre pressure 550KPa.	C244.20
	(b) Duration	A minimum of 8 passes shall be undertaken within 1 hour of application of the binder.	C244.20
	(c) Loose Aggregate		C244.20
	(i) Urban areas	20 particles per m^2	
	(ii) >250 veh/lane/day	30 particles per m^2	
	(iii) <250 veh/lane/day	40 particles per m^2	

Table C244.3 - Summary of Limits and Tolerances

ANNEXURE C244A - DETAILS OF WORK

To be completed by the Constructor for approval from the TRC Representative.

Section		**Prime**	**Primer Seal**		**Seal or Reseal**	
Road Name		Binder Type	Binder Type	Aggregate	Binder Type	Aggregate
From	To			Nom. Size		Nom. Size

Note: Prime and Primer Seal Binder Type shall be indicated in this Annexure using the descriptive terms as follows:

(i) Very Light Prime or Primer - equivalent cut back bitumen to grade AMCOO.

(ii) Light/Medium Prime or Primer - equivalent cutback bitumen to grade AMCO or AMC1.

(iii) Heavy Prime or Primer - equivalent cut back bitumen to grade AMC1 or AMC2.

ANNEXURE C244B - CUTBACK BITUMEN SPRAYING TEMPERATURES

Grade	Equivalent Cutter (%)	Temperature Range (ºC)
AMC00	56	10 – 30
AMC0	44	35 – 55
AMC1	34	60 – 80
AMC2	27	75 – 100
AMC3	21	95 – 115
AMC4	16	110 – 135
AMC5	11	120 – 150
AMC6	7	135 – 160
AMC7	3	150 – 175
FC2	25	70 – 95
FC3	20	80 – 95
FC4	15	95 – 110
FC5	10	120 – 140
FC6	7	130 – 150
FC7	3	140 – 160

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