

# ROADS AND MARITIME SERVICES (RMS)

## QA SPECIFICATION R110

### COLOURED SURFACE COATINGS FOR BUS LANES AND CYCLEWAYS

#### NOTICE

This document is a Roads and Maritime Services QA Specification. It has been developed for use with roadworks and bridgeworks contracts let by Roads and Maritime Services or by local councils in NSW. It is not suitable for any other purpose and must not be used for any other purpose or in any other context.

Copyright in this document belongs to Roads and Maritime Services.

#### REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 1/Rev 0		Initial Issue for Trials		
Ed 2/Rev 0	All	Technical changes based on trials and performance	GM, RNIC	19.09.03
Ed 2/Rev 1	Guide Notes	“Notice to Tenderers” changed to “Request for Tenders”. “Clause 2.1” – clause reference updated. “Annex R110/A” – Branch name updated.	GM, IC	28.03.11
	1.3.3	“Witness Points” added. Definitions of Hold Points and Witness Points - reference changed to “RTA Q”.		
	1.3.5	Retitled “Reference Documents and Definitions”.		
	2.2.2	Reworded to clarify intent.		
	2.2.3	Australian Standard reference updated.		
	4	Name of Government Authority updated.		
	Annex M	Reference documents updated.		

# **GUIDE NOTES**

(Not Part of Contract Document)

## **Using Specification R110**

RMS R110 is a QA Specification and the use of QA Specifications requires the implementation of a Quality System by the Contractor that meets the quality system requirements specified in RMS Q. To comply with the intention of government policy as well as RMS R110, coloured surface coatings works carried out using RMS R110 require adequate surveillance and audit by the Principal.

RMS R110 requires the RMS Project Manager to select appropriate parameters identified in RMS R110 and nominate the requirement in Annexure R110/A. The Project Manager is also required to select an appropriate version of RMS Q commensurate with the size of the project and the risk to the Principal.

This specification is for sheet coverage of coloured surfacing on bus lanes and cycleways. Linemarking and other pavement markings are not within the scope of this specification.

## **Edition 2**

Edition 2 is the first major revision of the specification and it is expected that it may require further upgrading on the basis of field experience. Comments and suggestions, including those of contractors, should be forwarded to the Manager, Contracts Quality, Infrastructure Contracts Branch.

## **Technical Reference Notes**

The following notes are intended to provide guidance on the application of the specification. Project Managers should ensure that relevant issues addressed in the guide notes but not specifically covered in the specification are included in the Contractor's PROJECT QUALITY PLAN.

## **Request for Tenders**

Project Managers are advised that the Request for Tenders should include the following requirement:

“All tenderers must submit with their tender a sample of their tendered coloured surfacing system(s). The system sample(s) must be applied to a dense particle-board having an area of at least 300 mm x 300 mm.”

## **Maintenance**

It is intended that a maintenance period of 12 months be specified in conjunction with this specification.

## **Job Specific Requirements**

The provision of temporary pavement markers, linemarking and other pavement markings should be carried out in accordance with Specifications RMS G10, RMS R141 and RMS R142.

Project Managers are advised to prepare a detailed plan of the area to which the coloured surfacing is to be applied. Coloured surface coatings would not normally be applied to:

- (i) Service pit covers and frames
- (ii) Drainage grates and frames
- (iii) Pedestrian crossings

- (iv) Vehicular intersection areas
- (v) Traffic control loop
- (vi) Linemarking
- (vii) Raised Pavement Markers.

## **Clause 1.2 Coloured Surface Coatings**

Coloured surface coatings, comprising aggregate and resin based binders, should be treatments having a known thickness of binder applied to a sound substrate and covered with an aggregate to provide a textured, durable surfacing of adequate skid resistance.

Coloured surface coatings are generally not suitable for application over high porosity surfaces such as open graded asphalt. Some may be suitable for application over new asphalt whilst others will require the asphalt to be trafficked for up to 6 weeks in advance. Project Managers are advised to check manufacturer's recommendations in this regard.

## **Clause 2.1 Materials**

Certain products may contain ingredients such as phenols potentially dangerous to the aquatic environment. Specifications RMS G35 and RMS G36, Environmental Protection Clause 6.12 is relevant.

### **Clause 2.2.2 Nominal Size**

As with sprayed seal, the nominal size of the aggregate affects the thickness of the binder film which must be applied to the pavement surface. As a general rule, coloured surface coatings subjected to heavy traffic should comprise thicker films than those subjected to light traffic, as the thicker films have more cohesion simply due to the greater quantity of material present.

A nominal maximum size of 3.0 mm is commonly used on bus lanes.

### **Clause 2.2.3 Colour**

Over a period of time, aggregate particles are subject to wear and weathering. Thus, for those aggregates which are coated to achieve the specified colour, the base colour of the aggregate may become an important factor in achieving specified colour retention throughout the defects liability period and thereafter. Very sharp and high friction aggregates abrade tyres and in so doing become blackened. As the technology is still relatively new to RMS, contractors should be aware that RMS is continuously monitoring the colour of the coloured network. Colour retention based on present performance will influence future specifications and purchasing.

## **Clause 2.3 Pigmented Binder System**

The binder should be a thermosetting resin pigmented as required to obtain sufficient depth of colour in the surfacing to comply with the specified Australian Standard Colour. Until further field trials have been undertaken, and under this specification reference, binder type will generally be limited to thermosetting epoxy, urethane, acrylic or methylmethacrylate.

Most binders require the mixing of at least two components to facilitate curing of the binder into a trafficable and durable surfacing material. Mixing should be carried out by mechanical agitation at a suitable speed for mixing of the components. In some cases, mechanical mixing may occur as part of an integral and continuous process with the application. In all cases, binder components should be batched and mixed in accordance with the binder manufacturer's recommendations which must be attached to the PROJECT QUALITY PLAN. RMS surveillance officers should note if the practice of holding the mixed binder for a time to thicken is contrary to the manufacturer's recommendations.

Components should be accurately proportioned either by mass or volume to within 5% of the design proportions as large variations could affect pot life and result in possible poor adhesion and/or poor durability.

#### **Clause 4 Delamination Issues**

**To maximise adhesion of coloured surface coatings, the following should be considered:**

- (i) Excess oil and other deleterious materials on the surface to be coated are likely to reduce adhesion. These must be removed prior to the coating being applied.
- (ii) A high stiffness differential between the coating and the underlying asphalt may have adverse impacts
- (iii) Differing thermal properties of the coating and asphalt may also contribute to poor adhesion.
- (iv) Coatings are less likely to adhere well to damaged asphalt or milled surfaces
- (v) There is evidence that water in the pavement is a factor in delamination. The mechanism by which water causes failure is not clear. Pavements should be well drained and dry at the time of placing coloured surface coatings. Existing thermoplastic road markings, epoxy resin adhesives and painted linemarkings should be removed or covered prior to the application of coloured surface coatings.
- (vi) Asphalt to which coloured surfacing is to be applied should conform to Specification RMS R116 or RMS 119, and preferably mixes should be heavy duty. In particular, asphalt should be resistant to moisture damage.
- (vii) Coloured surface coatings of the type conforming to RMS R110 do not perform well over traffic detection loops.
- (viii) There is some evidence that delamination may be less prevalent on new asphalt. Asphalt should be trafficked for 4 to 6 weeks prior to coating. The traffic during this period will close up surface voids.
- (ix) Compliance with resin manufacturers recommendations has proven to reduce incidence of delamination.

Most potential suppliers' technical and sales documentation state their product is suitable for coating asphalt. Tenderers should be given the opportunity to inspect and sign off on the proposed site before tendering. Some suppliers/contractors do not place their material over existing cracks and joints. Some suppliers (and the RMS) have an adhesion pull-off tester to measure the system strength on a small trial patch placed on the subject surface or a core.

Although most materials have proven elongation properties, the stress is only relaxed by cracking and tearing. Therefore rutting and shoving in the underlying asphalt is reflected in crescent cracking of the coloured surfacing.

#### **Clause 5.4 Pavement Temperature and Weather Conditions**

The simplest temperature gauge would be a thermocouple pressed against the pavement surface with a piece of foam rubber or polystyrene by standing on it for 1 minute. Other methods include infrared temperature gauges or infrared cameras.

#### **Clause 5.5 Application of Binder**

Binder must be applied in even thickness over the area to be treated at the rate nominated in the PROJECT QUALITY PLAN. Variations in texture of the surface being coated should be considered and allowed for.

Application of binder should be undertaken only if the road temperature has been at or above the supplier's recommended minimum temperature for at least one hour prior to commencement of application and is expected to remain at or above that recommended minimum during the period of the application and for a period of up to 6 hours thereafter. This is an important consideration because thermosetting binders require heat to cure. Excessive external heat or excessive accelerator/catalyst may cause part cure prior to application and have an adverse impact on adhesion to the pavement and aggregate retention. Insufficient heat in the process may retard curing rate and delay trafficability. Ambient and road temperatures should be measured as set out in Clause 6.4. Application should not proceed if rain is imminent.

Binder should be applied as soon as thorough mixing has been achieved. Binder should not be allowed to thicken up prior to application unless specifically recommended in writing by the binder manufacturer.

Radiant heating to accelerate cure is permissible if conditions are documented in the PROJECT QUALITY PLAN. The mixing pot must not be heated unless specifically detailed in the manufacturer's recommendations and recorded in the PROJECT QUALITY PLAN.

Binders such as urethanes which cure differently in the presence of water require management of this behaviour to be addressed in the PROJECT QUALITY PLAN. Typically by monitoring of dew point and ensuring that aggregates are stored and used dry.

The area of pavement to be treated at any one time should be limited to that on which the incorporation and adhesion of aggregate can be successfully achieved. The curing time of the binder under the prevailing conditions should be considered in this regard.

The binder may be applied in one or more layers by spray, brush, roller, screed box or squeegee. The Contractor is required to design the binder application rate to suit the particular application including consideration of existing surface texture, porosity and grade. Binders of viscosity lower than 3 Pa.s (e.g. acrylics) will require an additional coat of pigmented binder after the aggregate is broadcast.

During the course of the work, it is the responsibility of the Contractor to ensure that all edges have a clean, smooth and sharp delineation.

### **Clause 5.6 Application of Aggregate**

Following the application of binder, aggregate should be evenly applied over the whole area of binder at the rate nominated in the PROJECT QUALITY PLAN. The application of aggregate should be completed within the binder supplier's recommended time frame.

Any areas in which the binder and/or aggregate is insufficiently applied, or is defective in any way, should be rectified by the Contractor. Rectification by patching must only be applied to the whole of squared areas bounded by masking material. Undefined freehand patching is unacceptable.

### **Clause 5.7 Clean up of Work**

Depending on application rate of aggregate and the effectiveness of the binder film, the coloured surfacing may lose aggregate from the surface for some time after opening to traffic. A period of intensive clean up effort is often required for approximately two weeks after opening to traffic until the surfacing has "settled down". Clean up of loose aggregate will normally be required well beyond the confines of the work area. The Contractor's PROJECT QUALITY PLAN is required to adequately address these issues.

Loss of aggregate such that the surface is considered to have ravelled is subject to the provisions of Clause 7.2.

## **Clause 7.2 Surface Friction**

Because coloured surface coatings are not generally used for the full width of a carriageway and any abrupt transverse changes in skid resistance should be minimised, it is desirable to use materials having frictional characteristics which are compatible with the surrounding surfacing.

In addition to the PAFV of the aggregate, the skid resistance of the final surfacing will also be influenced by the surface texture characteristics of both the applied surface coating and the surrounding surface. The surface texture of the coloured surface coating may be different from that of the surrounding surface and this should be considered by the Contractor in the surfacing design process. In this regard, the Vicroads/RMS "Guide to the Measurement and Interpretation of Skid Resistance using SCRIM" should also be considered.

Subject to the requirements of the above referenced guide, it is recommended that a minimum SRV of 55 be specified in Annexure R110/A for normal applications and a minimum SRV of 65 be specified for high skid risk applications. Alternatively the PAFV should be higher than 55 or as otherwise specified in R110/A, during the entire defect liability period.

## **Clause 7.3 Delamination and Ravelling**

Where delamination or ravelling has occurred, the affected area of coloured surface coating should be completely removed in advance of any repair/rectification work.

Ravelling is the loss from the surface of aggregate that has been in contact with, or embedded in, the binder film. This should not be confused with loss from the surface of aggregate that has been applied in excess of the design rate during the surfacing operation. Delamination is the failure of the coloured surfacing to adhere to the surface on which it is placed.

In some cases loss of a very hard aggregate, such as through stripping or ravelling, causes scrubbing of the remaining coating.

## **Clause 7.4 Colour**

Colour spaces bounded by three shades of red for bus lanes and three shades of green for cycleways have been included to allow suppliers some latitude in selection of colouring materials and to broaden the purchase base.

Project Managers may make a project specific amendment to allow the use of only one shade of each colour in which case it is recommended that those colours be R62 Venetian Red and G16 Traffic Green.

## **Annexure R110/A**

RMS R110 requires the RMS Project Manager to nominate the working shift, i.e. hours that the Contractor can work. It also requires the Project Manager to consider that the coloured surface coating must have cured sufficiently before opening the new surfacing to traffic.

Information on test certificates and test results should be forwarded to Road Pavements and Geotechnology Branch when requested or where important design and performance issues have arisen.



# COLOURED SURFACE COATINGS FOR BUS LANES AND CYCLEWAYS

Copyright – Roads and Maritime Services  
IC-QA-R110

VERSION FOR: DATE:
-----------------------



## CONTENTS

CLAUSE	PAGE
FOREWORD .....	III
RMS Copyright and Use of this Document .....	iii
Revisions to Previous Version.....	iii
Project Specific Changes .....	iii
1    GENERAL.....	1
1.1    Scope of Work.....	1
1.2    Coloured Surface Coatings.....	1
1.3    Structure of the Specification.....	1
2    MATERIALS .....	2
2.1    General .....	2
2.2    Aggregate .....	3
2.3    Pigmented Binder System .....	3
2.4    Priming Materials .....	3
2.5    Sampling and Testing.....	3
3    NOMINATED MATERIALS AND DESIGN OF COLOURED SURFACE COATINGS.....	4
4    SURFACE PREPARATION.....	4
5    APPLICATION OF COLOURED SURFACE COATINGS .....	5
5.1    General .....	5
5.2    Plant and Equipment .....	5
5.3    Protection of Work.....	5
5.4    Pavement Temperature and Weather Conditions.....	6
5.5    Application of Binder.....	6
5.6    Application of Aggregate .....	6
5.7    Clean up of Work .....	6
5.8    Protection of Services and Road Fixtures .....	7
5.9    Surplus and Waste Materials.....	7
5.10   Work Record .....	7
6    MAINTENANCE AFTER COMPLETION.....	7
7    FINISHED SURFACING PROPERTIES .....	8
7.1    Surface Texture .....	8
7.2    Frictional Characteristics .....	8
7.3    Delamination and Ravelling.....	8
7.4    Colour.....	8
7.5    Nonconformity .....	9
ANNEXURE R110/A – DETAILS OF WORK.....	10
ANNEXURE R110/B – MEASUREMENT AND PAYMENT .....	11
ANNEXURE R110/C – SCHEDULES OF HOLD POINTS AND WITNESS POINTS AND IDENTIFIED RECORDS	11
C1    Schedule of Hold Points and Witness Points .....	11
C2    Schedule of Identified Records .....	11

ANNEXURE R110/D – PLANNING DOCUMENTS .....	12
ANNEXURES R110/E TO R110/K – (NOT USED).....	12
ANNEXURE R110/L – TESTING PROCEDURES .....	13
L1    Minimum Frequency of Testing .....	13
ANNEXURE R110/M – REFERENCE DOCUMENTS .....	14
LAST PAGE OF THIS DOCUMENT IS .....	14

## FOREWORD

### RMS COPYRIGHT AND USE OF THIS DOCUMENT

Copyright in this document belongs to the Roads and Maritime Services.

#### When this document forms part of a contract

This document should be read with all the documents forming the Contract.

#### When this document does not form part of a contract

This copy is not a controlled document. Observe the Notice that appears on the first page of the copy controlled by RMS. A full copy of the latest version of the document is available on the RMS Internet website: [www.rta.nsw.gov.au/doingbusinesswithus/specifications](http://www.rta.nsw.gov.au/doingbusinesswithus/specifications)

### REVISIONS TO PREVIOUS VERSION

This document has been revised from RMS Specification R110 Edition 2 Revision 0.

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

### PROJECT SPECIFIC CHANGES

Any project specific changes have been indicated in the following manner:

- (a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. ***Additional Text***.
- (b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.



# **RMS QA SPECIFICATION R110**

## **COLOURED SURFACE COATINGS FOR BUS LANES AND CYCLEWAYS**

### **1 GENERAL**

#### **1.1 SCOPE OF WORK**

Coloured surface coatings supplied under this Specification must be suitable for use on pavement designated as Bus Lane or Cycleway which may also be trafficked by other vehicles and pedestrians.

The work to be executed under this Specification consists of:

- (a) preparation of the existing surface;
- (b) selection and supply of constituent materials including design of application rates; and
- (c) application of the coloured surface coating including the application of priming materials.

The use of thermoplastic binders is not within the scope of this specification nor are paints, either solvent or water based.

Further details of the work are set out in Annexure R110/A.

Existing pavement condition considered to prevent proper fulfilment of the specified requirements must be reported to the Principal at least 7 days prior to the commencement of work.

#### **1.2 COLOURED SURFACE COATINGS**

Coloured surface coatings must comprise a continuous application over the specified area. Bars and stripes of coloured surface coating are not permitted unless otherwise specified or required by the contract documents.

Coloured surface coatings must be able to be trafficked, without rupture or damage, within a maximum of four hours after application and be resistant to spillage of petroleum or oil droppings. The coloured surface coatings must be capable of withstanding normal street cleansing operations, including brooming.

Coloured surface coatings and all components thereof must be free from lead and be UV stable.

#### **1.3 STRUCTURE OF THE SPECIFICATION**

This Specification includes a series of annexures that detail additional requirements.

##### **1.3.1 Details of Work**

Details of work are shown in Annexure R110/A.

### **1.3.2 Measurement and Payment, Resolution of Nonconformities**

The method of measurement and payment and the acceptance of materials and work must comply with Annexure R110/B.

### **1.3.3 Schedules of HOLD POINTS, WITNESS POINTS and Identified Records**

The schedules in Annexure R110/C list the **HOLD POINTS** and **WITNESS POINTS** that must be observed. Refer to Specification RMS Q for the definitions of **HOLD POINTS** and **WITNESS POINTS**.

The records listed in Annexure R110/C are Identified Records for the purposes of RMS Q Annexure Q/E

### **1.3.4 Planning Documents**

The **PROJECT QUALITY PLAN** must include each of the documents and requirements listed in Annexure R110/D and must be implemented.

If the Contract does not require the implementation of a **PROJECT QUALITY PLAN**, the documents listed in Annexure R110/D must be submitted to the Principal for consideration at least 5 working days prior to work commencing and must be implemented.

Each technical procedure must stipulate clearly, concisely and accurately those instructions which are necessary to carry out the particular operation or activity. Each inspection and test plan must also be prepared to facilitate verification that the coloured surface coating complies with specified requirements and that the procedure is being implemented in accordance with the **PROJECT QUALITY PLAN**.

### **1.3.5 Reference Documents and Definitions**

Unless otherwise specified the applicable issue of a reference document, other than an RMS Specification, must be the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 1234). For convenience, the full titles are given in Annexure R110/D.

The terms “you and “your” mean “the Contractor” and “the Contractor’s” respectively.

## **2 MATERIALS**

### **2.1 GENERAL**

Materials used in the work must be equal in quality to the sample tested for the purpose of design, and the sample panel supplied at the time of tendering.

If requested by the Principal, provide, at no cost to the Principal, representative samples of constituent materials to the Principal. Materials Safety Data Sheets (MSDS) must be supplied for the cleaning materials, priming materials, binder, binder components, aggregate and aggregate coating proposed for use in the work.

## **2.2 AGGREGATE**

### **2.2.1 General**

Aggregate must consist of clean, dry, hard, tough, durable, moderately sharp grains of either natural stone or synthetic material, of uniform quality, free from dust, dirt and other deleterious matter. In the case of systems where the binder is moisture sensitive (e.g. urethanes) the aggregate must be dry, stored and transported under cover at all times, unless otherwise specified in the PROJECT QUALITY PLAN.

### **2.2.2 Nominal Size**

The aggregate must be a one-sized aggregate of nominal size 3 mm. The aggregate must have a minimum 95% passing 3.35 mm sieve and a maximum 5% passing 1.18 mm sieve.

### **2.2.3 Colour**

The colour of the aggregate applied to Bus Lanes must be an approximate match (AS/NZS 1580.601.1) to one of Australian Standard Red colours of AS 2700S as listed in Clause 7.4.

The colour of aggregate applied to Cycleways must be an approximate match (AS/NZS 1580.601.1) to one of Australian Standard Green colours of AS 2700S as listed in Clause 7.4.

Aggregate may be coated with coloured polymer resin to facilitate compliance with colour specifications detailed in this clause and Clause 7.4.

## **2.3 PIGMENTED BINDER SYSTEM**

The binder must be a two or more component thermosetting resin suitably pigmented to provide the necessary depth of specified colour in the finished surface coating, and provide adhesion to aggregate and substrate.

At the time of mixing and application to the pavement surface, the binder must have a sufficient pot life to facilitate the application of a uniform thickness of coating and achieve adhesion to pavement and aggregate under the prevailing ambient temperatures.

## **2.4 PRIMING MATERIALS**

Priming materials must be applied to the pavement surface prior to the application of the coloured surface coating, if recommended by the manufacturer.

## **2.5 SAMPLING AND TESTING**

All materials used in the work must be sampled and tested to verify conformity to the requirements of this Specification and the PROJECT QUALITY PLAN.

The PROJECT QUALITY PLAN must nominate the proposed testing frequency which must not be less than that specified in Annexure R110/L. Where a minimum frequency is not specified, you must nominate an appropriate frequency in the PROJECT QUALITY PLAN.

Binder thickness may be measured during application. All other tests including T231 must be performed between 1 and 12 months from application.

### 3 NOMINATED MATERIALS AND DESIGN OF COLOURED SURFACE COATINGS

The coloured surface coating must be designed in accordance with the supplier’s recommendations to suit the specified application.

Submit details of the proposed design to the Principal at least 7 days prior to commencement of work. The submitted design must be referred to as the “nominated design”.

The nominated design must include the following details:

- (a) Cleaning and priming materials (if the system uses a primer) - type, source and method of application;
- (b) Application rates of binder, priming materials (if the system uses a primer) and aggregate including tolerances;
- (c) Explicit coating rate of top coat coloured binder in the case of low viscosity (e.g. acrylic) systems;
- (d) Aggregate - source, geological type, nominated particle size distribution and manufacturing process;
- (e) Binder - type and source, manufacturer’s specification, curing time/temperature characteristics;
- (f) Colour - pigment type.

To vary the nominated design, you must submit a new nominated design in accordance with this clause.

#### **HOLD POINT**

Process Held:	Application of coloured surface coating to pavement.
Submission Details:	Proposed design together with certification for the nominated materials and design verification documentation at least seven days prior to the commencement of work.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

### 4 SURFACE PREPARATION

Consider cleaning and preparing the pavement surface prior to applying the coloured surface coating. Cleaning operations must comply with the requirements of the Environmental Protection Authority. Arrangements for the removal and disposal of loose and foreign materials must be detailed in the PROJECT QUALITY PLAN. Evaluate the cleanliness and suitability of the surface according to criteria documented by the source of the technology and if necessary take steps such as cleaning and priming to improve the suitability of the surface. Unsuitable areas such as existing cracks and joints must also be notified at the time of tendering.

Priming materials (if used) applied to the road surface must be protected from contamination and trafficking prior to application of the binder.

**WITNESS POINT**

Process Witnessed: Preparation of surface.

Submission Details: At least seven days written notice of intention to commence preparation of surface, for each location.

**5 APPLICATION OF COLOURED SURFACE COATINGS**

**5.1 GENERAL**

Target the nominated design and control the process to achieve:

- (a) uniform application of binder and aggregate in accordance with the nominated design with adequate adhesion to the underlying surface;
- (b) complete cover with aggregate particles over the whole of the treated area; and
- (c) effective bond between binder and aggregate.

Work must be planned and executed so that the pavement is trafficable at all times outside the specified working hours for the contract. Circumstances which may cause any delay in opening of the pavement to traffic at the end of the specified working hours must be notified to the Principal immediately and adjust the work plan immediately to minimise delays in the opening of the pavement to traffic.

Acknowledge the increase in cure time of the resin binder with decrease in temperature and plan work accordingly. The use (if any) of accelerators/catalysts and heat to increase curing rate must be strictly in accordance with the binder manufacturer's recommendations which must be attached to the PROJECT QUALITY PLAN.

**5.2 PLANT AND EQUIPMENT**

Provide all the plant and equipment necessary for carrying out the work in accordance with this Specification.

Remove from the work any plant or equipment not fully operational or not in a satisfactory condition for carrying out work in accordance with this Specification.

Details of the plant and equipment and methods to be used for the application of coloured surface coatings must be included in the PROJECT QUALITY PLAN.

**5.3 PROTECTION OF WORK**

Provide for traffic in accordance with Specification RMS G10.

Take all necessary precautions to protect the work from damage, until such time as the new surfacing has developed sufficient strength to carry normal traffic without damage.

## **5.4 PAVEMENT TEMPERATURE AND WEATHER CONDITIONS**

Measure and record ambient air and pavement temperatures at regular intervals during conduct of the work. For this purpose a suitable thermometer or temperature gauge, accurate to  $\pm 2^{\circ}\text{C}$ , must be used and time intervals between temperature measurements must not exceed two hours. In the case of urethanes, a wet/dry bulb hygrometer must be used to report the dew-point or relative humidity.

If the work is performed in daylight hours and the pavement is partly in sun and partly in shade, the cooler shade temperature will determine the cure of the whole work, so the shade temperature must be monitored.

The application of coloured surface coating must not be carried out on a wet pavement, when rain appears imminent or during high winds or dust storms.

## **5.5 APPLICATION OF BINDER**

Binder must be applied in a uniform thickness/es and at a rate/s in accordance with the nominated design. The work area must be treated in a suitable number of lots.

Low viscosity ( $< 3 \text{ Pa.s}$ ) binders such as acrylics require an additional application after the aggregate is broadcast.

After each application of binder to each Lot, the quantity of material used must be checked against the area covered and any necessary adjustments made to ensure that the specified or agreed rate of application is maintained in subsequent applications. The method to determine the actual binder application rate must be detailed in the PROJECT QUALITY PLAN.

## **5.6 APPLICATION OF AGGREGATE**

Aggregate must be applied at a uniform rate and adequately embedded in the binder.

The aggregate must be dry at the time of application.

After the application of the binder and aggregate, a period of at least the minimum time recommended by the binder supplier, or such longer period as may be necessary for the binder to cure, must elapse before the area is opened to traffic. During this curing period, traffic must be kept off the treated surface.

Any bare or insufficiently covered areas must be re-covered as necessary to give a uniform and complete surface coverage within the specified time.

After the application of aggregate to each Lot, the quantity of material used must be checked against the area covered and any necessary adjustments made to ensure that the specified or agreed rate of application is maintained in subsequent applications. Describe the method to determine the actual aggregate spread rate in the PROJECT QUALITY PLAN.

## **5.7 CLEAN UP OF WORK**

Immediately following application of the coloured surface coating, all masking material must be removed together with any binder or aggregate adhering to same. During the cure period, ensure that no contamination, disturbance or trafficking of the coated surface occurs. After initial curing, excess

aggregate must be removed by a vacuum sweeper or equivalent means. Describe in the PROJECT QUALITY PLAN the method, timing of removal and traffic control to protect persons and property.

When the aggregate has been evenly applied and the binder has cured, any remaining aggregate spread in excess of the specified or ordered rate must be removed from the pavement surface prior to opening to traffic.

Remove any loose aggregate from the works and/or the proximity of the works until the surfacing is no longer losing any aggregate.

## **5.8 PROTECTION OF SERVICES AND ROAD FIXTURES**

Take all necessary precautions to prevent binder, aggregate or other materials used on the work from entering or adhering to structures such as gratings, hydrants or valve boxes, man-hole covers, bridge or culvert decks, kerb and guttering,.

## **5.9 SURPLUS AND WASTE MATERIALS**

Surplus materials and all empty containers remaining after completion of the work become your property and must be removed from the site. Describe in the PROJECT QUALITY PLAN the method for the removal and disposal of surplus and waste materials.

The work must be left in a neat and tidy condition.

## **5.10 WORK RECORD**

Record and verify details of the work performed and make available to the Principal on the same day the work is performed. The location, width, area, application rates of binder, priming material and aggregate together with details of the temperature/s must be recorded immediately after completion of each lot.

### **WITNESS POINT**

Process Witnessed: Measurement of areas, binder and aggregate application rates.

Submission Details: At least two working days written notice of intention to apply coloured surfacing, for each location.

## **6 MAINTENANCE AFTER COMPLETION**

Unless otherwise specified, the work must be maintained by you during a maintenance period of twelve calendar months from the date of completion.

During this maintenance period, maintain the coloured surface coating to achieve continuing compliance with the requirements of this specification provided that you will not be responsible for deterioration or damage which is not within your control.

Removal of loose aggregate must be carried out as set out in Clause 5.7.

## **7 FINISHED SURFACING PROPERTIES**

### **7.1 SURFACE TEXTURE**

The surface texture of the coloured surface coating must be measured in accordance with RMS T240 or RMS T192. The frequency of testing must be in accordance with Annexure R110/L.

Throughout the period of Post-Completion Undertaking, the surface texture must be a minimum of 0.6 mm.

### **7.2 FRICTIONAL CHARACTERISTICS**

When subjected to simulated trafficking by AS 1141.41 and assessed for frictional properties by AS 1141.42, the Polished Aggregate Friction Value (PAFV) test, the PAFV of a system panel prepared with the same materials, at the same thickness and by the same techniques as proposed for the works, must not be less than the minimum value specified in Annexure R110/A.

If the proposed coloured surface coating includes a second coat of binder to be applied over the aggregate, the system panel for PAFV must be prepared the same. For aggregates which are not rolled after broadcasting and are held by a thermosetting binder there must be no requirement to form a mosaic by hand and AS1141.42 7.2(b) does not apply.

The frictional characteristics of the coloured surface coating must be determined in accordance with the RMS T231. Testing must be performed 2 to 4 weeks after the coating was applied. The minimum SRV will be 55 unless otherwise specified in Annexure R110/A. The frequency of testing must be in accordance with Annexure R110/L.

### **7.3 DELAMINATION AND RAVELLING**

Throughout the maintenance period, all delamination and ravelling must be rectified.

At any time during the maintenance, the area of the work which has delaminated or ravelled must not exceed 1% in any square metre and 0.1% of the total area of the work.

### **7.4 COLOUR**

Bus lanes must be an approximate match to any one of the following standard red colours in accordance with Australian Standard AS 2700 S – 1996:

R 62	Venetian Red
R 54	Raspberry
R 53	Redgum

Cycleways must be an approximate match to any one of the following standard green colours in accordance with Australian Standard AS 2700 S – 1996:

G 13	Emerald
G 16	Traffic green
G 23	Shamrock

Approximate match of colour must be determined in accordance with AS/NZS 1580.601.1.

Throughout the defects liability period and at the end of the maintenance period, the colour of the surfacing must remain recognisably red or green and be an approximate match to the initial colour. If the assessment or measurement is performed on an area cleaned for the purpose of assessment, the whole of the work must be so cleaned.

If you disagree with the Principal on colour assessment by the specified method of approximate match, an instrument such as a Minolta chromameter (CIE 1931, D65/45/0) shall be used for assessment and the colour of the surfacing must be within the approximate rectangular colour space with CIE (x,y) coordinates as follows:

- (a) The initial red colour must be defined within an approximate trapezoidal colour space with the coordinates:  
(0.47,0.38) ; (0.56,0.37) ; (0.45,0.32) ; (0.54,0.32)
- (b) During and at the end of the maintenance period the red colour must lie within the following space:  
(0.45,0.38) ; (0.56,0.37) ; (0.42,0.33) ; (0.54,0.32)
- (c) The Y value, brightness or reflectance, must lie within the limits 6–15.
- (d) The initial green colour must be defined within an approximate trapezoidal colour space with the coordinates:  
(0.32,0.50) ; (0.33,0.38) ; (0.30,0.36) ; (0.19,0.41)
- (e) During and at the end of the maintenance period the green must lie within the following space:  
(0.32,0.50) ; (0.33,0.38) ; (0.30,0.35) ; (0.19,0.41)
- (f) The Y value, brightness or reflectance, must lie within the limits 8–19.

## **7.5 NONCONFORMITY**

If a section or area of coloured surface coating fails to achieve conformity to Specification, initially or during the Defects Liability Period, such failure must constitute a “Nonconformity” under the Contract.

The nonconforming section or area of coloured surface coating must be rectified or replaced.

You must bear the cost of rectifying or replacing nonconformities, including any restoration work to any underlying or adjacent surface or structure, which becomes necessary as a result of such replacement. Materials removed from the site must be replaced with materials which conform to this Specification.

**ANNEXURE R110/A – DETAILS OF WORK**

Road: .....

Location: .....

Road Closure Dates: .....

Coloured surface coatings can be carried out between the hour of ..... and .....

<b>Job Details</b>		<b>Bus lane or Cycleway</b>	<b>Nominal Width (m)</b>	<b>Approximate Area (m<sup>2</sup>)</b>
	A			
	B			
	C			
	D			
	E			
	F			

Total area, including widenings (m<sup>2</sup>): .....  
(Approximate only and subject to final measurement)

Number of divisions of work requiring separate visits by your organisation:

.....

Dates between which section of work is to be done:

Minimum PAFV is ..... (Clause 7.2)

OR

\*Minimum SRV is .....

**\*NB: Minimum SRV should be 55.**

**ANNEXURE R110/B – MEASUREMENT AND PAYMENT**

Except as provided hereafter, payment will be made on the basis of 'area treated'. The unit of measurement will be square metre.

Payment will be made at the tendered rate for the area of pavement specified in Annexure R110/A or directed by the Principal actually treated under this Specification and will be subject to the rates of binder and aggregate application being achieved and recorded.

**Pay Item R110P1      Preparation of Surface**

**Pay Item R110P2      Supply and Apply Coloured Surface Coating (Including Priming)**

**R110P2.1    Red**

**R110P2.2    Green**

**ANNEXURE R110/C – SCHEDULES OF HOLD POINTS AND WITNESS POINTS AND IDENTIFIED RECORDS****C1      SCHEDULE OF HOLD POINTS AND WITNESS POINTS**

<b>Clause</b>	<b>Type</b>	<b>Description of Hold/Witness Point</b>
3.0	Hold	Submission of details for nominated design
4.0	Witness	Preparation of surface
5.10	Witness	Measurement of application rates

**C2      SCHEDULE OF IDENTIFIED RECORDS**

The records listed below are Identified Records for the purposes of RMS Q Annexure Q/E

<b>Clause</b>	<b>Description of the Identified Record</b>
4	Details of the nominated design
6.10	Work records

## **ANNEXURE R110/D – PLANNING DOCUMENTS**

Refer to Clause 1.3.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. The requirements of this Specification and others included in the Contract must be reviewed to determine additional documentation requirements.

- (a) Material Safety Data Sheets for all constituent materials (Clause 2.1)
- (b) Constituent Materials: Details for each of the nominated materials (Clause 2.2)
- (c) Testing frequency (Clause 2.5)
- (d) Nominated application rates (Clause 3)
- (e) Arrangements for the removal of loose and foreign materials from the existing pavement surface if any, and a statement that the pavement is considered suitable for coating (Clause 4)
- (f) Details of the plant and equipment and methods to be used for coloured surface coatings and the application and storage temperatures recommended by the manufacturer of the binder (Clause 5.2)
- (g) Method to determine the actual binder application rate (Clause 5.5)
- (h) Method to determine the actual aggregate spread rate (Clause 5.6)
- (i) Method, timing of removal of loose aggregate and traffic control to protect persons and property (Clause 5.7)
- (j) Method for the removal of surplus and waste materials (Clause 5.9)
- (k) Documented evidence of prior use and longevity for similar applications of the proposed coloured surface coating to no less than 6 years in heavily trafficked areas.

## **ANNEXURES R110/E TO R110/K – (NOT USED)**

**ANNEXURE R110/L – TESTING PROCEDURES****L1 MINIMUM FREQUENCY OF TESTING**

Attention is drawn to the requirements of RMS Q in respect of limits on lot size. In addition lot size must not exceed the area surfaced in one shift or one site.

<b>Clause</b>	<b>Characteristic Analysed</b>	<b>Test Method</b>	<b>Minimum Frequency of Testing</b>
2.3	Binder Thickness		In accordance with your written procedure
7.1	Surface Texture	RMS T240 RMS T192	One per Lot
7.2	Surface Friction	RMS T231	2 per 50 m <sup>2</sup>
7.3	Delamination and Ravelling		In accordance with your written procedure
7.4	Colour	AS 1580.601.1	One per Lot

## **ANNEXURE R110/M – REFERENCE DOCUMENTS**

Refer to clause 1.3.5

### **RMS Specifications**

RMS G10	Traffic Management
RMS Q	Quality Management System

### **RMS Test Methods**

RMS T192	Determination of the Texture Depth of Road Surfacing by the TRL Mini Texture Meter
RMS T240	Texture Depth of Coarse Textured Road Surfaces
RMS T231	Frictional Resistance by Pendulum Tester

### **Australian Standards**

AS 1580.601.1	Colour – Visual comparison
AS 2700S	Colour standards for general purpose
AS 1141.41	Polished aggregate friction value – Horizontal bed machine
AS 1141.42	Pendulum friction test (specification of rubber slider)