

SPECIFICATION FOR ROADMARKING PAINTS

1. SCOPE

1.1 Application

This Specification sets out the requirements for paints which are intended to be used as roadmarkings on road surfaces. This Specification is applicable to paints intended for use by spray application and intended to be incorporated with beads which give roadmarkings their retroreflective properties.

NZTA/NZRF T8 specifies the requirements of the applicators with which the paints of this Specification must be applied. AS/NZS 2009 describes the beads that are to be normally used with the paints of this Specification. There is provision for alternative bead types.

This Specification does not apply to "long-life" marking materials where "long-life" has the meaning implied by the descriptions contained within TNZ M/20.

1.2 Format

The format of this Specification is based around four main test areas. These are:

~ **Section 8 On-Road Performance Tests**

All paints shall undergo an assessment of on-road performance by means of a field trial. Paints shall undergo one of the two types of field trial either the:

- (a) Transverse field trial, or,
- (b) In-situ trial.

~ **Section 9 Laboratory Performance Tests**

This group of tests is seen as a measure of properties which are relevant to the markings' in situ performance but which can be assessed in the laboratory. Performance under these tests can then be used to screen paints prior to the field trial. These laboratory tests may also be applied from time to time to ensure that current production of the paint is achieving the required performance criteria.

~ **Section 10 Application Properties**

This group of tests is to assess the properties of the paint which will affect their application properties.

~ **Section 11 Quality Control Tests**

This group of tests are performed by the paint Suppliers/Manufacturers on a batch to batch basis to assure continued achievement of required performance criteria.

2. REFERENCED DOCUMENTS

The documents referred to in this Specification are listed in Appendix A.

3. DEFINITIONS

For the purpose of this Specification, the definitions of AS/NZS 2310 and the definitions below apply:

AADT: annual average daily traffic (flow).

30 Metre Geometry

Retroreflectivity measured using an instrument having an illumination (Entrance) angle of 88.76° and an observation angle of 1.05°, where Entrance Angle β is the angle between the illumination axis and the retroreflectometer axis and the Observation Angle α is the angle between the illumination axis and the observation axis.

Luminance Factor – the ratio of the luminance of the field of the pavement marking in the given direction to that of a perfectly reflecting diffuser identically illuminated, expressed as a percentage.

Retroreflectivity – RI

The property of reflecting illuminating light from a source, (usually vehicle headlights), back towards the source. The units of measure for retroreflectivity are millicandella/m²/lux – mcd/m²/lx.

4. PAINT CLASSIFICATION

For the purpose of this Specification, paint shall be classified according to its ability to withstand trafficking under one of two types of field trials.

4.1 Resistance to trafficking during transverse field trial

The paint will be classified based on its performance during transverse field trials according to the following table:

Average dry paint film thickness	Minimum number of vehicle passes withstood		
	1.000.000	1.500.000	2.000.000
180 μ m	A180	B180	C180
220 μ m	A220	B220	C220
300 μ m	A300	B300	C300

The Classification is A, B, or C is determined according to the number of vehicle passes withstood and is then suffixed with the film thickness at which the paint was trialed.

4.2 Resistance to trafficking during in-situ trial

The paint will be classified based on its performance during in-situ trials according to the following table:

Classification	A	B	C
AADT in test lane	Duration to minimum acceptable performance level		
600 – 1.500	12 months	18 months	24 months
1.500 – 3.000	10.5 months	16 months	21 months
3.000 – 6.000	9 months	14 months	18 months
6.000 – 10.000	7.5 months	12 months	15 months
10.000 – 15.000	6 months	9 months	12 months

The Classification is A, B, or C then suffixed with the film thickness at which the paint was trialled.

5. COMPOSITION

5.1 Glass Bead Composition

The glass beads shall comply with the requirements of AS/NZS2009, and when tested in accordance with NZTA T17 the heavy metal content in glass beads shall be less than or equal to the following limits:

Contaminant	Limit (mg/kg or ppm)
Arsenic	55
Antimony	50*
Lead	140
Mercury	10
Cadmium	12
Chromium	10

* Antimony limit: 50 ppm as an interim requirement, with a target of 15 ppm.

5.2 Paint Composition

All paints shall be lead-free. Lead free means less than three times the method detection limit.

All paints shall comply with current legislative requirements, in particular the Hazardous Substances and New Organisms Act 1996. The manufacturer shall provide evidence of classification and reference the Group Standard(s) applying to the material(s).

6. PACKAGING

Paints shall be packaged in sound, clean and dry containers constructed of a material which is inert to the contents, and sufficiently robust to withstand normal conditions of handling and storage without rupture or leakage. The container shall be capable of being readily resealed, and shall be gas-tight.

7. LABELLING

The following information shall be legibly and permanently marked on each container of paint or on a label permanently attached to each container of paint:

- (a) the name of the Supplier/Manufacturer;
- (b) the description "Roadmarking Paint" or equivalent wording;
- (c) the contents by volume, in litres;
- (d) production or batch number and date of manufacture;
- (e) storage and handling information required by regulatory authorities;
- (f) the colour of the paint film shall be specified (yellow/white);
- (g) its classification with respect to its ability to withstand trafficking; and
- (h) any classification or information relevant to the HSNO Act.

Suppliers/Manufacturers making a statement of compliance with this Specification for a paint (including statements on labelling, other packaging, or in promotional material) shall ensure that such statement is true and accurate and is supported by appropriate documentation and laboratory test results.

8. ON-ROAD PERFORMANCE TESTS

8.1 General

Paints will be subjected to one of two types of field trial, either as set out in Appendix B or as set out in Appendix C of this Specification. The minimum acceptable performance is an A Classification.

Suppliers, submitting paints for testing, may request that testing continue for a longer than the initial testing period with the aim of obtaining a higher classification for the paint as set out in Clause 4 "Paint Classification".

8.2 Degree of Wear

When assessed in accordance with the relevant of either Appendix B or Appendix C of this Specification the photographic rating shall be 4 or greater.

8.3 Luminance

When tested in accordance with either Appendix B or Appendix C of this Specification, after the rated number of vehicle passes the luminance factor of a test strip, in particular in the outer wheel-path, shall not be less than 45%.

8.4 Retroreflectivity

When tested in accordance with either Appendix B or Appendix C of this Specification, the retroreflectivity of a beaded test paint film after the required number of vehicle passes shall not be less than 100 mcd/m²/lux for white paint and 80 mcd/m²/lux for yellow paint (note: these retroreflectivity values are likely to be increased in 2007).

8.5 Colour

When tested in accordance with either Appendix B or Appendix C of this Specification the colour of the paint film shall not be less than a discolouration of 4 on the grey scale of *ISO 105-A 03* from:

- (a) Y35 (Off White) of *AS 2700S* for white paint film; or
- (b) Y13 (Vivid Yellow) to Y14 (Golden Yellow) of *AS 2700S* for yellow paint film.

8.6 Skid-Resistance

When tested in accordance with either Appendix B or Appendix C of this Specification, no less than seven days after paint application, the skid-resistance on the test paint film shall not be less than 45 BPN.

9. LABORATORY PERFORMANCE TESTS

9.1 Colour

When a test panel has been coated with paint and dried in accordance with Appendix C of *AS 4049.1*, and is assessed in accordance with *AS/NZS 1580.601.1* the colour match shall be as follows:

- (a) the colour shall be equal or "whiter" than Y35 (Off White) of *AS 2700S* for white paint film; or
- (b) the colour shall be equivalent to Y13 (Vivid Yellow) or Y14 (Golden Yellow) or any colour that lies between Y13 (Vivid Yellow) and Y14 (Golden Yellow) of *AS 2700S* for yellow paint film.

9.2 Specular Gloss

When a test panel has been coated with paint and dried in accordance with Appendix C of *AS 4049.1* and is assessed in accordance with *AS/NZS 1580.602.2* using a 60 degree exposure head, the specular gloss shall not exceed 20 gloss units.

9.3 Resistance to Bleeding

When a paint is tested in accordance with Appendix E of *AS 4049.1*, the colour of the paint film shall not be less than a discolouration of 4 on the grey scale of *ISO 105-A03*.

9.4 Dry Time "No Pickup"

The dry time will be tested in accordance with *AS/NZS 1580.401.8*. A roadmarking paint which has a no-pickup time greater than seven minutes shall have the actual time to no-pickup recorded on the paint Supplier's/Manufacturer's Certificate of Compliance.

9.5 Dry Through Time (Early Washout)

When tested in accordance with Appendix D of this Specification, a paint shall exhibit the stated resistance to early washout.

This test is relevant to water-borne paints only.

10. APPLICATION PROPERTIES

10.1 Condition in the Container

10.1.1 As Received

When the paint is first examined after delivery it shall be free from skin, lumps, gel and coarse particles, as assessed by visual examination in accordance with *AS/NZS 1580.103.1*.

10.1.2 After Storage

When the degree of settling of the paint is tested in accordance with *AS/NZS 1580.211.1* after being allowed to settle for four weeks the settling rating shall be not less than 8 and the paint shall show no sign of syneresis.

When the degree of settling of the paint is tested in accordance with *AS/NZS 1580.211.1* after storage in a sealed container at $23 \pm 3^{\circ}\text{C}$ for six months the settling rating shall be not less than 6.

10.2 Residue on Sieve

When washed over a sieve complying with *AS 1152*, of mesh 300 μm , with solvent recommended by the Supplier/Manufacturer, the whole of the paint shall pass through the sieve.

A recommended test method for determining the residue on a sieve is specified in Appendix E of this Specification.

10.3 Consistency

10.3.1 As Received

10.3.1.1 Solvent-Borne Paints:

When supplied, the paint shall have a consistency within the range 60 to 90 Krebs units when tested in accordance with *AS/NZS 1580.214.1*.

10.3.1.2 Water-Borne Paints:

When supplied, the paint shall have a consistency within the range 70 to 110 Krebs units when tested in accordance with *AS/NZS 1580.214.1*.

10.3.2 After Storage

After storage in a sealed container at $23 \pm 3^{\circ}\text{C}$ for six months from the date of manufacture, the consistency of the paint shall not have changed by more than ± 10 Krebs units from the supplied condition when tested in accordance with *AS/NZS 1580.214.1*.

11. QUALITY CONTROL TESTS

The quality control tests shall be performed by the Supplier/Manufacturer on each batch of paint produced. The equipment used for testing shall be in current calibration and operated by personnel who are deemed competent. The tests shall also be performed in a suitable environment.

11.1 Specific Gravity

When tested in accordance with the relevant of either *AS/NZS 1580.202.1* or *AS/NZS 1580.202.2*, the specific gravity shall be within $\pm 3\%$ of the Supplier's/Manufacturer's stated midpoint.

11.2 Consistency

When tested in accordance with *AS/NZS 1580.214.1*, the viscosity shall be within ± 10 Krebs units of the Supplier's/Manufacturer's stated midpoint.

An alternative equivalent measure of viscosity, as agreed between Transit New Zealand and the Supplier/Manufacturer can be used. However, the same principle shall apply, namely that the Supplier/Manufacturer nominates a target midpoint and an equivalent variation about that midpoint is allowed as for the Krebs viscometer above.

11.3 Fineness of Grind

The fineness of grind when tested according to *AS/NZS 1580.204.1* shall be within the Supplier's/Manufacturer's stated range. The Supplier's/Manufacturers' range and/or upper limit and the result shall be reported.

11.4 Colour

When a test panel which has been coated with paint and dried in accordance with Appendix C of *AS 4049.1* and is assessed in accordance with *AS/NZS 1580.601.1*, the colour match shall be as follows:

- (a) the colour shall be equal or "whiter" than Y35 (Off White) of *AS 2700S* for white paint film; or
- (b) the colour shall be equivalent to Y13 (Vivid Yellow) or Y14 (Golden Yellow) or any colour that lies between Y13 (Vivid Yellow) and Y14 (Golden Yellow) of *AS 2700S* for yellow paint film.

11.5 Luminance

White Marking Material

When tested in accordance with Appendix H of TNZ M/20 Specification, the luminance factor of white material on a Test Panel, shall be not less than 75%.

Yellow Marking Material

When tested in accordance with Appendix H of TNZ M/20 Specification, the luminance factor of yellow material on a Test Panel, shall be not less than 45%.

11.6 Non Volatile Content by Mass

When tested for percent solids content by mass according to *AS 1580.301.1* the volume solids content shall be within $\pm 3\%$ of the Supplier's/Manufacturer's stated midpoint.

Other equivalent validated test methods may be used for quality control purposes.

11.7 Reporting Quality Control Tests

A report of the Quality Control tests results and a *Paint Supplier's/Manufacturers' Certificate of Compliance* as shown in Appendix F of this Specification, for each batch of paint must accompany each delivery.

12. TYPE APPROVAL

Suppliers may obtain type approval for their paint and listing in the Notes attached to this Specification by providing satisfactory evidence that their paint meets the test requirements of this Specification.

Suppliers may submit additional results from continued testing of a paint with the aim of obtaining a higher classification for the paint as set out in Clause 4 "Paint Classification".

13. QUALITY SYSTEM

Suppliers must have a certified Quality Assurance system in place that complies with *AS/NZS ISO 9001*.

14. NON-COMPLIANCE

The Supplier is responsible for ensuring that its products continue to comply with this Specification. Any products found to have an unsatisfactory in- service performance, or any product for which samples are found not to comply with this Specification may be removed from the approved listing in the Notes attached to this Specification.

APPENDIX A

LIST OF DOCUMENTS APPLICABLE TO THIS SPECIFICATION

AS 1152	Specification for test sieves
AS 1580.102.1	Paints and related materials – Methods of test – Sampling procedure
AS 1580.301.1	Paints and related materials – Methods of test – Non-volatile content by mass
AS 2700S	Colour Standards for general purposes
AS 4049.1	Paints and related materials – Pavement marking materials – Solvent-borne paint – For use with surface applied glass beads
AS 4049.2	Paints and related materials – Pavement marking materials – Thermoplastic pavement marking materials – For use with surface applied glass beads
AS 4049.3	Paints and related materials – Pavement marking materials – Water-borne paint – For use with surface applied glass beads
AS/NZS 1580.101.1	Paints and related materials – Methods of test – Conditions of test – Temperature, humidity, and airflow control
AS/NZS 1580.103.1	Paints and related materials – Methods of test Examination and preparation of samples for testing
AS/NZS 1580.202.1	Paints and related materials – Methods of test – Density
AS/NZS 1580.202.2	Paints and related materials – Methods of test – Density of water-dispersed paints subject to foaming
AS/NZS 1580.204.1	Paints and related materials – Methods of test – Fineness of grind
AS/NZS 1580.211.1	Paints and related materials – Methods of test – Degree of settling
AS/NZS 1580.214.1	Paints and related materials – Methods of test Consistency – Stormer viscometer
AS/NZS 1580.401.8	Paints and related materials – Methods of test – No pick up time of road marking paints
AS/NZS 1580.601.1	Paints and related materials – Methods of test – Colour – Visual comparison
AS/NZS 1580.602.2	Paints and related materials – Methods of test Measurement of specular gloss of non-metallic paint films at 20 degrees, 60 degrees and 85 degree
AS/NZS 2009	Glass beads for pavement-marking materials
AS/NZS 2310	Glossary of paint and painting terms
AS/NZS ISO 9001	Quality management systems – Requirements

EN 1423	Road marking materials – Drop on materials – Glass beads, antiskid aggregates and mixtures of the two
EN 1436	Road marking materials – Road marking performance for road users
ASTM D1640	Standard Test Methods for Drying, Curing, of Film Formation of Organic Coatings at Room Temperature
Hazardous Substances and New Organisms (HSNO) Act	
ISO 105–A03	Grey scale for assessing staining
CoPTTM Code of Practice for Temporary Traffic Management, Transit New Zealand (New Zealand), 2004	
MOTSAM	Manual of Traffic Signs and Markings, Transit New Zealand and Land Transport Safety Authority (New Zealand)
TNZ M/20	Long–Life Roadmarking Materials
TNZ P/12	Pavement Marking
TNZ P/20	Performance–based specification for roadmarking
TNZ P/22	Specification for Reflectorised Pavement Marking
NZTA/NZRF T8	Roadmarking Paint Applicator Testing
LRMS Manual	Location Referencing Management System (LRMS) Manual SM051, Transit New Zealand, 2004

Instructions for using the portable skid–resistance tester, Road Note 27, Second Edition, Road Research Laboratory, Ministry of Transport (United Kingdom) 1969

Photographic standards. Laboratoire Central Des Ponts et Chaussées (LCPC).

APPENDIX B

ON-ROAD PERFORMANCE TESTS: TRANSVERSE FIELD TRIALS

B1. SCOPE

This Appendix sets out procedures for the field testing of roadmarking paints using test lines applied transverse to and crossing the trafficked lane. Properties assessed are wear, luminance, retroreflectivity, on-road colour and colour retention, and skid-resistance.

B2. PRINCIPLE

Paint is applied as beaded and unbeaded line markings, transverse to the traffic flow, on designated roads. At the end of a specified number of vehicle passes:

- the degree of wear of the paint film is assessed;
- the luminance of the paint film is assessed;
- the retroreflectivity of the paint film is determined;
- the colour of the paint film is assessed; and
- skid-resistance of the paint film is measured.

B3. TEST SITE

The test site location shall be a section of road, sufficiently far from intersections to avoid the effects of traffic turning, and carrying a total of 1,000,000 vehicles per lane within a period of more than three but less than nine months. The test site should be distant from activities such as quarries, which can induce excess dirt, gravel and the like to be tracked over the test area. The road surface shall be a stable chipseal of grade 3 preferably, or grade 4 or grade 2 chip which has been in place for at least six months, but not longer than eight years at the start of the trial, and the road surface shall be free of bitumen flushing at the location of the site and immediately preceding the site.

B4. APPARATUS REQUIRED FOR APPLICATION

The equipment listed below is required for paint application:

- Application equipment which complies with Type B of *NZTA/NZRF T8*.

At least four test panels, with nominal surface dimensions 200mm x 150mm x 1.0mm, prepared from zinc electroplated steel plate (Zintex or similar).

Means of measuring air and road temperature, relative humidity and wind velocity at the time of paint application.

Heavy paper or the like which can be used as a temporary surface when test spraying to adjust wet film thickness, rather than applying unwanted markings to any other surface at the test site.

Note: Bitumen impregnated paper, such as Sisal Kraft Grade 300, is noted in *AS 4049.1* as having been found to be suitable.

Signs, cones, etc as specified in *MOTSAM* and *CoPTTM* shall be used to control traffic and protect personnel and road users and for protection of applied line markings until trafficable.

All traffic control associated with the trial shall be in accordance with the requirements of *CoPTTM* or the local Road Controlling Authority's specific requirements.

B5. DRY FILM THICKNESS OF PAINT

The paint trial requires the application of paint at controlled thickness. Paint film thickness will be measured in accordance with the methods of TNZ P/22. The average thickness determined as below shall be 180 µm, 220 µm, or 300 µm ± 15 µm dependent on the nominated trial thickness. Thickness shall be taken as the average of 30 readings, 10 taken from each of three longitudinal zones along the plate.

The test plates shall be tested after being force-dried at 50°C for a minimum of 12 hours and up to a maximum of 24 hours.

B6. APPLICATION PROCEDURE

The procedure shall be as follows:

- Prepare and obtain approval for a *Traffic Management Plan* together with management of temporary traffic control for the test site in accordance with the requirements of *CoPTTM* or the local Road Controlling Authority's specific requirements.
- The trial is carried out in more favourable conditions than general painting. Ensure that the road surface is free of visible moisture such as rain, dew, frost and the like. Confirm that the air temperature is between 15°C and 30°C, the relative humidity is between 25% and 85%, the road surface temperature is less than 45°C and wind speed is less than 12m/sec. Record these results and any unusual features of the weather at the time of application or immediately following. Thoroughly clean all loose particles and foreign material from the test area.
- From the stated solids volume of the paint, calculate the wet film thickness needed to deliver the target dry film thickness of 180 µm, 220 µm, or 300 µm in one pass (if required, without applying any unwanted markings to any

permanent surface, test spray the paint to check then adjust the wet film thickness until the required wet film thickness is obtained).

- Place a pair of test panels at the centre and at the left hand edge of the first proposed line. Ensure that these test panels do not encroach upon the high-wear sections of the test site (such as in wheelpaths).
- Starting at the kerbside edge of the test site, apply a 100mm wide unbeaded paint line at the predetermined wet film thickness at a steady rate over the width of the whole test site.
- Starting at the kerbside edge of the test site, apply a 100mm wide beaded paint line, parallel to and using the same paint application setup as for the first two unbeaded lines. The beads shall comply with *AS 2009* and be dropped onto the test paint line at a rate of $275 \pm 10 \text{ g/m}^2$ for 180 μm dry film thickness lines, the same rate for 220 μm dry film thickness lines, and at a rate of $325 \pm 10 \text{ g/m}^2$ with a mixture of large and standard diameter glass beads applied to 300 μm dry film thickness lines. Care must be taken to ensure that a 1:1 ratio by weight of large to standard diameter beads is applied consistently.

Alternative systems (combinations of glass beads and varying paint film thicknesses) may be trialled for consideration for Approval as a unique paint system classification. Starting at the kerbside edge of the test site, apply a second 100mm wide beaded paint line, parallel to and using the same paint and bead application setup as for the first beaded paint line.

Place an identifying mark or number on the set of four test lines (thoroughly clean the spray gun prior to spraying any further test materials. Application of any further test materials shall follow the above steps.

On completion of application(s) work, visually inspect the paint lines for application anomalies including bleeding.

After applying the final paint line of the final test material at the test site, allow a drying time of at least ninety minutes before removing traffic control and allowing traffic to flow freely over the test site.

Using the measurement method described in Section B5 measure and record the dry film thickness of the test lines.

B7. EQUIPMENT REQUIRED FOR ASSESSMENT OF ROADMARKING PROPERTIES

B7.1 Assessment of Wear

The following aids are required:

- A set of four photographic standards, providing scale readings of 2, 4, 6, and 8, as supplied by the *Laboratoire Central Des Ponts et Chaussées (LCPC)*;

Soft bristle brush suitable for cleaning the test lines.

B7.2 Assessment of Retroreflectivity

A retroreflectometer in compliance with NZTA T16.

B7.3 Assessment of Colour

Assessment of colour will require colour cards in accordance with *AS 2700S*:

- Y35 (Off White) for white paint film;
- Y13 (Vivid Yellow) and Y14 (Golden Yellow) for yellow paint film.

Assessment of colour will also require: *ISO 105-A03*.

B7.4 Assessment of Luminance

1. Calibrated white standard reference tile – having a CIE \bar{Y} value greater than 75 and calibrated against a perfect reflecting diffuser.
2. Colorimeter or spectrophotometer suitable for use under the following conditions:
 - Diffuse illumination and viewing angle within 10° of the normal, or diffuse viewing with illumination within 10° of the normal
 - Illuminant D65 to ISO/CIE 10526, or illuminant C as described in CIE 15.2
 - Conforming to the CIE colour matching function \bar{Y}_{10} or \bar{Y} in CIE 15.2.

B7.5 Assessment of Skid-Resistance

This will require a portable skid-resistance tester, known as the British Pendulum Tester and as described in *Instructions for using the portable skid-resistance tester*, Road Note 27, Second Edition, Road Research Laboratory, Ministry of Transport (United Kingdom) 1969. The portable skid-resistance tester should be fitted with a TRRL rubber slider.

B7.6 Testing

Test instruments are to be in current calibration and must be operated by personnel who are competent.

B8. ASSESSMENT PROCEDURE

At each assessment, tests B8.1, B8.2, B8.3, B8.4 and B8.5 shall be carried out.

B8.1 Procedure for Assessment of Wear

The degree of wear of the unbeaded paint lines shall be assessed using the photographic method.

The assessment is performed as follows:

- Employing two assessors, assess the degree of wear at two positions within the high-wear sections of an unbeaded paint line (that is, within the wheelpaths), using the *Laboratoire Central Des Ponts et Chaussées (LCPC)* photographic reference standards to determine which photograph or pair of photographs most closely approximates the appearance of the unbeaded paint line. Intermediate ratings may be interpolated.

Record the result as the average of the two positions.

B8.2 Procedure for Assessment of Retroreflectivity

Retroreflectivity of the beaded test lines shall be measured in accordance with NZTA T16 and recorded at five positions, approximately 100mm apart, within the high-wear sections of the test lines (that is, within the wheelpaths). At each position, at least five readings shall be taken and these readings then reduced to a single arithmetic average.

B8.3 Procedure for Assessment of Colour

The colour of the roadmarking shall be assessed by comparing the colour of the unbeaded paint lines under diffuse sunlight with the standard colour card and discolouration scale, and identifying the extent of discolouration from the standard colour.

B8.4 Procedure for Assessment of Luminance

Determine the luminance of the marking in accordance with Appendix H of TNZ M/20 Specification.

B8.5 Procedure for Assessment of Skid-Resistance

The skid-resistance shall be measured on one of the unbeaded paint lines and on one of the beaded paint lines. The measuring shall be conducted using the instructions outlined in *Instructions for using the portable skid-resistance tester*, Road Note 27, Second Edition, Road Research Laboratory, Ministry of Transport (United Kingdom) 1969.

These measurements should be made between 24 and 48 hours after application.

B8.6 Optional test: Procedure for Assessment of Retroreflectivity Under Conditions of Wetness

Retroreflectivity of the beaded test lines may be measured and recorded in accordance with NZTA T16 Method 2.1 "Wet testing".

B9. ASSESSMENT INTERVALS

B9.1 Minimum Life

The assessment to determine minimum life shall be at 1,000,000 ± 35,000 vehicle passes.

B9.2 Extended Life (At Supplier's/Manufacturer's Request)

Assessments to determine extended life shall be undertaken after:

- 1,500,000 vehicle passes, in total; and/or
- 2,000,000 vehicle passes, in total.

Suppliers/Manufacturers seeking a classification for life extended beyond that of the C classification of Clause 4 of this Specification should submit their material for testing to *TNZ M/20*, which requires a higher level of performance after 3,000,000 vehicle passes.

B9.3 Trial Monitoring

Twenty four to forty eight hours after application retroreflectivity will be measured, the colour assessed and the skid resistance shall be measured. Two additional assessments will be made to monitor the progress of the trial. These shall be at 330,000 and 660,000 vehicle passes approximately.

B9.4 Independent validation

A minimum of one assessment must be carried out in conjunction with an independent body to verify test method, calibration results, and operator competency plus review of results to date.

B10. REPORTING

The report shall include the following information:

- Identification of the test paint
- Name of the testing laboratory, and the period over which the test was conducted
- Location of the test site
- Commencement and completion dates of the assessment period.

- Average monthly rainfall recorded at the closest relevant meteorological station during the assessment period
- Weather conditions at the time of application, including humidity, temperature and any abnormal conditions experienced at the time of testing
- Average monthly maximum daily temperature recorded at the closest relevant meteorological station during the assessment period
- The dry film thickness as the mean of two test plates
- The retroreflectivity of the beaded test line, expressed as the mean result for each line
- The degree of wear
- The luminance of the paint film
- The results of the assessment of colour
- The results of the skid resistance measurements.

APPENDIX C

ON-ROAD PERFORMANCE TESTS: IN-SITU FIELD TRIALS

C1. SCOPE

This Appendix sets out procedures for the field testing of roadmarking paints using longitudinal edgelines and centrelines that are part of the normal markings of the highway. Properties assessed are wear, luminance retroreflectivity, on-road colour and colour retention, and skid-resistance.

C2. PRINCIPLE

The intention of the in-situ testing is to apply the nominated product at its in-service application rates in accordance with roadmarking Contract specifications.

In-situ tests will provide relevant test data that shows the paint's ability to withstand both trafficking and weathering over time, with various vehicle densities, at given application rates. Testing at intervals during the trial period will:

- evaluate the degree of wear of the paint line;
- the luminance of the paint film is assessed;
- determine the retroreflectivity of the paint line;
- assess the colour of the paint line;
- measure the skid-resistance of the paint line.

C3. TEST SITE SELECTION

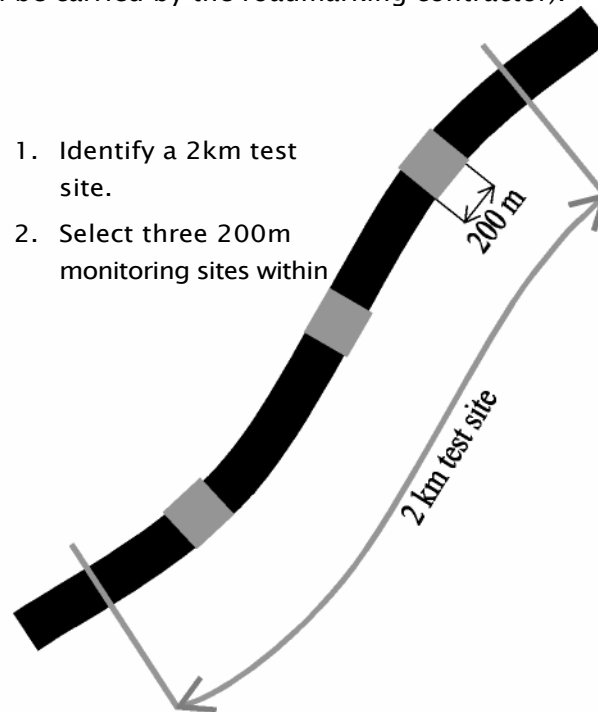
The test site location can be any road that the Supplier/Manufacturer has been given approved access to by the Road Controlling Authority with a minimum of 600 AADT in the test lane, provided that (at the time of application):

- the road is subject to a speed limit of 80, 90, or 100km/h;
- the road should be trafficked by a minimum of 5% heavy vehicles;
- for AADT between 600 and 6,000 in the test lane the road surface should be of chipseal (Grade 2 to 4) and for AADT greater than 6,000 in the test lane the road surface should be either chipseal (Grade 2 to 4) or open-graded porous asphalt.

The Supplier/Manufacturer shall have full written authority from the appropriate Road Controlling Authority and arrangements shall have been made such that:

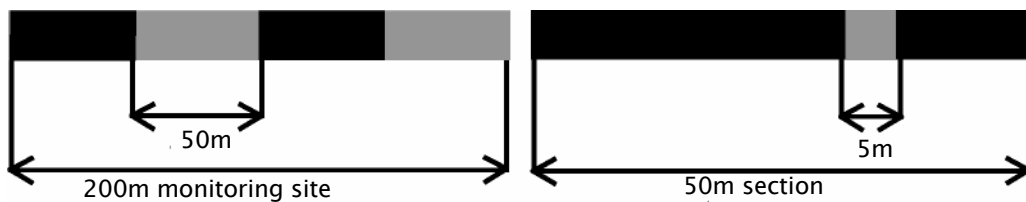
- The roadmarkings will not be re-marked for the duration of the trial provided that the roadmarkings comply with contractual requirements throughout the duration of the trial period; and

- The pavement at the test site will not be resurfaced for the duration of the trial provided that the condition of the pavement does not deteriorate to a condition requiring intervention throughout the duration of the trial period (the risk of the resurfacing of the pavement at the test site during the trial period shall be carried by the roadmarking contractor).



1. Identify a 2km test site.
2. Select three 200m monitoring sites within

3. Divide each 200m monitoring site into four 50m sections.
4. Select a 5m reading site within each 50m section.



The minimum continuous length for a material trial is to be 2km and there must be three 200m monitoring sites where the markings are subjected to medium wear. Medium-wear areas will typically occur on edgelines and centrelines on straighter sections of road. Test sites shall be selected to allow the testing of 150m of forward view. This observation must be in the direction of the traffic flow. If 150m forward visibility at the test site is obstructed by a curve, the observer may stand back from the start of the monitoring site to give the required 150m of view into markings within the test site.

Centreline of "no passing" highway segments shall not be used unless the information from the test is required for yellow paint lines.

Significant unforeseeable factors that may impact on the results of the trial and which occurred over the duration of the trial (such as roadworks or floods) shall be included in the report.

C4.1 Location of measurement positions within monitoring sites

Each 200m monitoring site is to be divided into four 50m sections. A 5m length reading site typical of each 50 m section shall be selected. The location of the 200m sections shall be described by route position as defined by the Transit New Zealand's LRMS Manual, or other equivalent detail if installation is not on a state highway.

Site selection must avoid any unusual site conditions or constraints which may influence the field testing.

C5. APPARATUS REQUIRED FOR APPLICATION

The equipment listed below is required for paint application:

- Application equipment which complies with NZTA/NZRF T8.
- Three test panels, with nominal surface dimensions 200mm x 150mm x 1.0mm, prepared from zinc electroplated steel plate (Zintex or similar), for each of the line types per site.
- Means of measuring air and road temperature, relative humidity, and wind velocity at the time of paint application.
- Signs, cones, etc as specified in *MOTSAM* and *CoPTTM* shall be used to control traffic and protect application personnel and road users and for protection of applied line markings until trafficable.

All traffic control associated with the trial shall be in accordance with the requirements of *CoPTTM* or the local Road Controlling Authority's specific requirements.

C6. DRY FILM THICKNESS OF PAINT

The paint trial requires the application of paint at controlled thickness. Paint film thickness will be measured in accordance with the methods of *TNZ P/22*. The average thickness determined as below shall be 180 µm, 220 µm, or 300 µm ± 15 µm dependent on the nominated trial thickness. Thickness shall be taken as the average of 30 readings, 10 taken from each of three longitudinal zones along the plate.

The test plates shall be tested after being force-dried at 50°C for a minimum of 12 hours and up to a maximum of 24 hours.

C7. APPLICATION PROCEDURE

The procedure shall be as follows:

- Lines will normally be applied over previous paint markings and not over *TNZ M/20* materials. Any areas of proposed marking where quality and adhesion of previous paint markings is suspect should be excluded from the trial. Markings may be applied over previously unmarked road.
- Prepare and obtain approval for a *Traffic Management Plan* together with management of temporary traffic control for the test site in accordance with the requirements of CoPPTM the local Road Controlling Authority's specific requirements.
- Confirm that the road surface and ambient conditions at the test site are suitable for application, in accordance with the paint Supplier's/Manufacturer's instructions and with *TNZ P/22*. Record these results and any unusual features at the time of application or immediately following.
- Record the road surface conditions, air temperature, relative humidity, road surface temperature, wind speed and weather conditions.
- From the stated solids volume of the paint, calculate the wet film thickness needed to deliver the target dry film thickness of 180 µm, 220 µm, or 300 µm in one pass.
- The beads to be used shall comply with *AS 2009* and be dropped onto the paint line at a rate of $275 \pm 10 \text{ g/m}^2$ for 180 µm dry film thickness lines, the same rate for 220 µm dry film thickness lines, and at a rate of $325 \pm 10 \text{ g/m}^2$ with a mixture of large and standard diameter glass beads applied to 300 µm dry film thickness lines. Care must be taken to ensure that a 1:1 ratio by weight of large to standard diameter beads is applied consistently.

Alternative systems (combinations of beads and/or varying paint film thicknesses) may be trialled for consideration for Approval as a unique paint system classification. For such systems the product application coating thickness shall be $\pm 15 \text{ µm}$ of the Supplier/Manufacturer's nominated rate and bead application rate shall be as nominated by the product Supplier/Manufacturer with a tolerance of $\pm 10 \text{ g/m}^2$ variance.

- One unbeaded test panel shall be taken at the beginning and at the end of test site, and one beaded plate shall be taken from within the test site.
- Protection of markings prior to trafficking shall be in accordance with product Supplier/Manufacturer instruction.

C8. EQUIPMENT REQUIRED FOR ASSESSMENT

C8.1 Assessment of Wear

The following aids are required:

- A set of four photographic reference standards, providing scale readings of 2, 4, 6, and 8, as supplied by the *Laboratoire Central Des Ponts et Chaussées (LCPC)*; and
- Soft bristle brush suitable for cleaning the test lines.

C8.2 Assessment of Retroreflectivity

A retroreflectometer in compliance with NZTA T16.

C8.3 Assessment of Colour

Assessment of colour will require colour cards in accordance with *AS 2700S*:

- Y35 (Off White) for white paint film;
- Y13 (Vivid Yellow) and Y14 (Golden Yellow) for yellow paint film.

Assessment of colour will also require:

- *ISO 105-A03*.

C8.4 Assessment of Luminance

1. Calibrated white standard reference tile – having a CIE \bar{Y} value greater than 75 and calibrated against a perfect reflecting diffuser.
2. Colorimeter or spectrophotometer suitable for use under the following conditions:
 - Diffuse illumination and viewing angle within 10° of the normal, or diffuse viewing with illumination within 10° of the normal
 - Illuminant D₆₅ to ISO/CIE 10526, or illuminant C as described in CIE 15.2
 - Conforming to the CIE colour matching function \bar{Y} or \bar{Y}_{10} in CIE 15.2.

C8.5 Assessment of Skid-Resistance

This will require a portable skid-resistance tester, known as the British Pendulum Tester and as described in Instructions for using the portable skid-resistance tester, Road Note 27, Second Edition, Road Research Laboratory, Ministry of Transport (United Kingdom) 1969. The portable skid-resistance tester should be fitted with a TRRL rubber slider.

C8.6 Testing

Test instruments are to be in current calibration and must be operated by personnel who are competent.

C9. ASSESSMENT PROCEDURE

C9.1 Schedule of testing

At each assessment, tests B8.1, B8.2 and B8.5 shall be carried out. Tests B8.3, B8.4 and B8.6 may be carried out less frequently.

Degree of wear	one test per 200m section
Luminance	one test per 200m section
Retroreflectivity	average of 8 mean readings per 200m monitoring sites
Colour	one test per 200m section
Skid-resistance	one test within each of two 5m spots per 200m section

C9.2 Procedure for Assessment of Wear

The degree of wear of the unbeaded paint lines shall be assessed using the photographic method.

The assessment is performed as follows:

- Employing two assessors, assess the degree of wear at two positions within the high-wear sections of an unbeaded paint line (that is, within the wheelpaths), using the *Laboratoire Central Des Ponts et Chaussées (LCPC)* photographic reference standards to determine which photograph or pair of photographs most closely approximates the appearance of the unbeaded paint line. Intermediate ratings may be interpolated.
- Record the result as the average of the two positions.

C9.3 Procedure for Assessment of Retroreflectivity

Retroreflectivity of the beaded test lines shall be measured in accordance with NZTA T16 and recorded at five positions, approximately 100mm apart, within the high-wear sections of the test lines (that is, within the wheelpaths). At each position, at least five readings shall be taken and these readings then reduced to a single arithmetic average.

C9.4 Procedure for Assessment of Colour

The colour of the roadmarking shall be assessed by comparing under diffuse sunlight with the standard colour card and discolouration scale, and identifying the extent of discolouration from the standard colour.

C9.5 Procedure for Assessment of Luminance

Determine the luminance of the marking in accordance with Appendix H of TNZ M/20 Specification.

C9.6 Procedure for Assessment of Skid-resistance

The skid-resistance shall be measured on the paint line. The measuring shall be conducted using the instructions outlined in *Instructions for using the portable skid-resistance tester*, Road Note 27, Second Edition, Road Research Laboratory, Ministry of Transport (United Kingdom) 1969.

These measurements should be made between 24 and 48 hours after application.

C9.7 Optional test: Procedure for Assessment of Retroreflectivity Under Conditions of Wetness

Retroreflectivity of the beaded test lines may be measured and recorded in accordance with NZTA T16 Method 2.1 "Wet testing".

C10. ASSESSMENT INTERVALS

C10.1 Life expectancy assessments

There shall be a minimum of four assessments over the period of the trial. 24 to 48 hours after application retroreflectivity will be measured, the colour assessed and the skid resistance shall be measured.

C10.2 Independent validation

A minimum of one assessment must be carried out in conjunction with an independent body to verify test method, calibration results, and operator competency plus review of results to date.

C11. REPORTING

The format and information required for the reporting shall be approved in advance by Transit New Zealand. A sample report template is set out in Appendix G.

APPENDIX D

DRY THROUGH TIME (EARLY WASHOUT TEST)

A wet film thickness that achieves an average dry film thickness of the candidate paint of 180 μm , 220 μm , or 300 $\mu\text{m} \pm 15 \mu\text{m}$ where it is to be field trialled at these thicknesses, is applied to a metal plate. The coated plate is placed immediately in a humidity chamber maintained at 25.0oC $\pm 1.5^\circ\text{C}$ and 90% $\pm 3\%$ relative humidity shall have a "dry through" time no greater than 120 minutes, when tested in accordance with *ASTM D1640*, except that the pressure exerted will be the minimum needed to maintain contact between the thumb and film.

It is preferable that tests be carried out in a constant condition (25°C, 50% relative humidity) as this ensures that the side ports of the humidity chamber can be maintained at a constant opening width, to ensure that reproducible results are achieved.

APPENDIX E

RESIDUE ON SIEVE TEST METHOD

(RECOMMENDED PROCEDURE)

E1. SCOPE

This describes the method for assessing residue on a sieve.

E2. EQUIPMENT

- Certified test sieve complying with *AS 1152* of mesh 300 µm;
- 500 ml wash (toluene or water, dependent upon paint type);
- Beaker

E3. METHOD

- Place the test sieve over the beaker.
- Pour in 250ml of paint sample.
- Immediately wash through with 500ml of wash (solvent or water), until all paint has passed through the sieve.
- After assessing any residue, wash thoroughly clean.

E4. RESULTS

Record any residue left in the sieve.

APPENDIX F: PAINT SUPPLIER'S/MANUFACTURER'S CERTIFICATE OF COMPLIANCE

PAINT MANUFACTURER

ISO 9002	Yes/No	Company name	_____
Registration number	_____	Address	_____
Expiry date	_____	Phone	_____
		Facsimile	_____
Date of manufacture	_____	Certificate date	_____
Product description	_____	Colour	_____
Batch number	_____	Batch quantity	_____
Specification	NZTA M7	(Volume in litres)	_____
Classification	_____		

(According to NZTA M7, Clause 4)

TEST RESULTS

Batch test #	Test description	Requirement	Result
xxx	Viscosity	xx ± x Ku	xx Ku
xxx	Density	x.xx ± xx kg/L	x.xx kg/L
xxx	Fineness of grind	xx ± xx µm	xx µm
xxx	Volume Solid Content ¹	xx ± x %	xx.x %
xxx	% Non-Volatile by Mass	xx ± x %	xx.x %
Restrictions (if any):			

For example, the material has approval as a special classification, as a complete system with a nominated dry film thickness and specific quantity/type of glass beads.

Notes:

- The above tests refer only to tests undertaken at the time of manufacture.
- All tests reported above have been performed in accordance with the laboratory's terms of registration. The material has been manufactured to a formula approved by Transit New Zealand and the material conforms to the quality control requirements of the NZTA M7 Specification for Roadmarking Paints.
- Where required, the midpoint and range values must be stated.

¹ This may be calculated on a batch to batch basis, using the results of the tests for specific gravity (Clause 11.1) and non-volatile content by mass (Clause 11.6).

Approved signatory

APPENDIX G

IN-SITU MARKING PERFORMANCE REPORT

Test reference number:	
Applicator	
Applicator operator's name:	
Date of application:	Time of application:
Applicator type:	Relevant certification:
Product	
Product Name	
Product Supplier / Manufacturer:	
Colour: White / Yellow	Classification: A / B / C
Batch number:	Solids volume:
Additions	
Bead type:	Bead application rate:
Aggregate type:	Aggregate application rate:
Marking details	
Line type: Solid / Broken / Other	Line width:
Line position: Edgeline / Centreline / No overtaking	
Dry paint film thickness:	Number of plates taken:
Dry time:	
Site information: General	
Location:	
Map included: Yes / No	Route Position / GPS:
Average monthly rainfall (mm):	Average monthly temperature:
Comments:	
Site information: Traffic and road	
Test lane width:	Shoulder width:
AADT in test lane: 600-1,500 / 1,500-3,000 / 3,000-6,000 / 6,000-10,000 / 10,000-	
% heavy vehicles:	Speed zone: 80 km/h / 90 km/h / 100 km/h
Site information: Application surface and environment	
Surface type: Grade 2 chipseal, Grade 3 chipseal, Grade 4 chipseal, OGPA	
Surface age:	Surface condition: Bleeding/flushing
Surface preparation: Sweep / Air blow / Hand brush / Primer / Chemical clean / Nil / Other	
Detritus detail: Clean / Dirty / Normal / Nil	
Vegetation detail:	
Material of existing markings: Alkyd / Chlorinated rubber / Waterborne paint / Other	
Condition of existing markings: Old / New	
LCPC scale of wear of existing markings:	
Retroreflectivity of existing markings: mcd/m ² /lux	
Site information during application	
Surface temperature during application	Relative humidity during application
Air temperature during application	Wind speed during application

Weather during application: Wet / Dry / Overcast	
Abnormal conditions experienced: Yes / No	Time of protection prior to trafficking:
General comments and specification of "other" details	
Name of Lab	

ON-ROAD PERFORMANCE ASSESSMENTS

Name of Lab

Name of product

Test reference number:										
Assessment <i>Number</i>	Date of assessment	Age of roadmarkings <i>Months</i>	Skid- resistance <i>BPN</i>	Degree of wear	Colour <i>AS</i> <i>4049</i>	Luminance %, <i>m</i>	Dry retroreflectivity <i>mcđ/m²/lux</i>	Wet retroreflectivity <i>mcđ/m²/lux</i>	Rainfall Data: Weather Conditions Monthly max daily temperature	Signature of assessor
One		At application								
Two		3 months								
Three		6 months								
Four		9 months								
Five		12 months								
Six		18 months								
Seven		24 months								
Eight		30 months								
Nine		36 months								

APPENDIX H

LABORATORY ROADMARKING PAINT TEST CERTIFICATE

All tests detailed in this report were carried out under "routine" laboratory conditions as specified in *AS/NZS 1580.101.1*. Test samples were sampled in accordance with *AS/NZS 1580.102.1*.

Date of certification: _____ Product: _____ Batch: _____ Colour: _____	Date of manufacture: _____ Date of sampling: _____ Sample number: _____ Report number: _____
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Test and Method	Specification/ Tolerances	Result	Pass/Fail
Degree of settling (4 weeks)	Rating from <i>AS/NZS 1580.211.1</i>		
Degree of settling (6 months)	Rating from <i>AS/NZS 211.1</i>		
Assessment of colour	<i>AS 4049,</i> <i>AS/NZS 1580.601.1</i>		
Specular gloss (60° geometry)	<i>AS 4049,</i> <i>AS/NZS 1580.602.2</i>		
Fineness of grind	<i>AS/NZS 1580.204.1</i>	μ	
Density	<i>AS/NZS 1580.202.1</i>	kg/L	
Viscosity	<i>AS/NZS 1580.214.1</i>	KU	
Non-volatile content by mass	<i>AS/NZS 1580.301.1</i>	(NVCmass)	
Non-volatile content by volume	<i>AS/NZS 1580.30 1.2</i>	(NVCvol)	
No pick up time of roadmarking paints	<i>AS/NZS 1580.40 1.8</i>	(minutes:seconds)	
Condition in Container	<i>AS1580.103.1</i>		
Resistance to bleeding of roadmarking paint	<i>AS/NZS 4049.1 Appendix E</i>		

Tested by: _____ Signature: _____ Position: _____ Date: _____	Checked by: _____ Signature: _____ Position: _____ Date: _____
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