



SPECIFICATION FOR PAVEMENT MARKING

1. SCOPE

This specification applies to the reflectorised and non-reflectorised marking of sealed and paved road surfaces in paint, thermoplastic and other types of roadmarking materials.

Thermoplastic application is limited to machine screeding, machine spray and machine extrusion. The manual application of pre-formed thermoplastic material is permitted for transverse markings and symbols.

Manual screeding and any other types of thermoplastic application are not covered by this specification and shall be specified separately.

Paint shall be applied by machine spray methods only.

2. QUALITY ASSURANCE REQUIREMENTS

The roadmarking work shall be carried out by a contractor who has in place, an approved quality assurance system, that has been certified by an approved agency and is available for inspection and review by the Engineer.

3. DEFINITIONS AND ABBREVIATIONS

In this specification the following definitions shall apply:

Approved quality assurance system means either the New Zealand Roadmarkers' Federation (NZRF) Quality Assurance Programme (QAP) or ISO 9002 incorporating the technical requirements of the NZRF QAP.

Approved agency for certification means either an IANZ accredited agency or an agency approved by Transit New Zealand.

Thermoplastic Roadmarking Material, where referred to in this specification may also include other long life roadmarking material approved by Transit New Zealand.

4. MARKING DETAILS

4.1 General

Markings shall be in accordance with the Transit New Zealand/Land Transport Safety Authority *Manual of Traffic Signs and Markings Part II: Markings* or as otherwise specified.

4.2 Unmarked Sections

The centreline or other markings may not be required to be marked in specific sections. These will be defined by the Engineer.

5. MATERIALS

5.1 General

The contractor shall provide all materials. Where materials are required to conform with specifications eg TNZ M/7 or TNZ M/20 or standards, eg AS2009, then the Contractor shall substantiate conformance via their QA system.

5.2 Roadmarking Material

5.2.1 Materials Type

The material used shall comply with either Transit NZ specification TNZ M/7 or TNZ M/20 and be a brand and type currently approved by Transit NZ.

5.2.2 Packing and Labelling

Material used shall have been packed and labelled in conformance with the requirements of TNZ M/7 or TNZ M/20.

5.3 Other Long Life Roadmarking Materials

Any alternative material not complying with TNZ M/7 or TNZ M/20 must receive the written approval from the Engineer prior to being accepted. Alternative materials may be considered for use only if they have undergone field trials to prove their durability and wear characteristics on New Zealand road surfaces or equivalent and accompanied by recognised international standard performance test results.

5.4 Approval of Paint

Prior to commencing work under this contract, the contractor shall nominate in the Contractor's QA plan, the brand and designation of the material intended for use. A particular type and class of material may be nominated by the Engineer in the specific contract documents.

The material used shall not be changed from that nominated in the QA plan without the written approval of the Engineer.

5.5 Glass Beads

Glass Beads shall comply with the Australian Standard 2009:1991.

5.6 Sampling of Materials

The Contractor shall co-operate fully with the Engineer to facilitate the sampling of materials from the applicator or other sources intended for use on the contract.

5.7 Paint Thinners

Thinners, when used in conjunction with paint application, shall be added according to the manufacturer's instructions.

5.8 Testing Costs

All testing performed by or on behalf of the Contractor for compliance with the quality assurance (QA) system shall be at the Contractor's expense.

Any testing performed by or on behalf of the Engineer as part of the contract quality surveillance shall be at the Engineer's expense unless the contract works tested are found to be defective, then this shall be at the Contractor's expense.

6. PLANT AND EQUIPMENT

6.1 General

The Contractor shall provide and maintain all plant and equipment required to fulfil the contract including all templates for marking and all signs and other warning devices required for the protection of the works and the safety of the public.

Roadmarking applicators applying paint or any long-life material shall comply with the following requirements:

- | | |
|--------------------|---|
| Paint | - TNZ T/8 Specification for Roadmarking Paint Applicator Testing. |
| Long-Life Material | - TNZ T/12 Specification for Long-Life Pavement Marking Applicator Testing. (or TNZ E/4 Specification for the Certification of Thermoplastic Roadmarking Applicators and Pre-Heaters until such time as TNZ T/12 is issued) |

The operator shall hold in the applicator (or an attendant vehicle for a type B) a current Certificate of Compliance issued in accordance with the relevant specification.

6.2 Certification at Time of Tender

6.2.1 QA Certificates

At the time of tender contractors shall forward copies of current QA certificates to the Engineer of the contract. The QA certification is to be kept valid for the period of the contract.

6.2.2 Paint Application

Unless the contract specification indicates otherwise both a type A and type B applicator as defined in TNZ T/8 will be required to complete the contract works. At the time of tender contractors shall forward copies of current T/8 certificates for the plant they propose to use on the contract. The applicator(s) certification is to be kept valid for the period of the contract.

6.2.3 Thermoplastic Application

Roadmarking contractors shall specify the type(s) of application (sprayed, screeded or extruded) they intend using to complete all aspects of the contract works. At the time of tender contractors shall forward copies of current T/12 (or E/4 until T/12 implementation) certificates for all of the plant they propose using on the contract, as well as information on any proposed pre-formed thermoplastic material they may intend using. The applicator(s) certification is to be kept valid for the period of the contract.

6.3 Outriggers

- (a) Use of outriggers to mark both centre line and edge line, or other similar widely spaced lines, at the same time is only permitted within a full lane closure.
- (b) Outriggers, bogeys or sighting equipment extending beyond the applicator shall comply with the relevant Motor Vehicle Regulations.

7. TRAFFIC AND PUBLIC SAFETY

7.1 Traffic Control

- (a) At all times during the work or activities included in this specification the Contractor shall take responsibility to ensure all traffic control is carried out in accordance with Transit New Zealand's requirements for temporary traffic management and the specific contract requirements.
- (b) When marking lanes on motorway through lanes or ramps, the road marking applicator shall not straddle the line being painted. When marking motorways having three lanes in the same direction the roadmarking applicator shall not travel in the centre lane.

- (c) When operating equipment that requires air, paint, or other products to be transported along flexible lines these lines shall not cross traffic lanes unless the lane is closed in accordance with Transit New Zealand's requirements for temporary traffic management.
- (d) Control and protection of urban worksites shall also ensure that pedestrians are not exposed to hazards from marking operations.

7.2 Paint Application

- (a) For reasons of safety, or where excessive traffic delays are likely to occur, the Engineer may direct the Contractor regarding the type of applicator (type A or type B) to be used for specific markings and the type of material to be applied.
- (b) At all times a type B applicator is operating, the operation shall be protected by cones and signs or by an attendant vehicle following within 20 m of the applicator.

7.3 Thermoplastic Material Application

- (a) At all times a thermoplastic applicator is operating, the operation shall be protected by cones or by an attendant vehicle following within 20 m of the applicator.

8. PROTECTION OF PAVEMENT MARKINGS

Freshly completed markings shall be protected by cones or other markers approved by the Engineer until the roadmarking is dry, and the beads securely held.

Any markings on adjoining pavement caused by mishap, or the transfer of wet marking material by tyres of passing vehicles shall be removed, with the Contractor being fully responsible for their removal. Only the removal methods specified in Clause 15 shall be used for this purpose.

9. SETTING OUT

9.1 General

- (a) Unless specified otherwise, new markings shall be placed at the same location as the previous markings. If the existing markings are obviously incorrect, clarification should be obtained from the Engineer before proceeding.
- (b) Location requirements for new marking with respect to specified location are;
 - (i) transverse location ± 20 mm

- (ii) longitudinal location ± 50 mm
- (iii) all lines shall appear by eye to be straight, or where designed as a curve, the smooth curve.

9.2 New Paint Markings

- (a) Before commencing roadmarking the contractor shall set out all markings with paint spots or other appropriate methods to ensure start, finish, and orientation is defined. These spots shall be at a spacing of 10 m or less.
- (b) Before commencing roadmarking the road surface shall be prepared according to the requirements of Clause 11.1.

9.3 New Thermoplastic Markings

- (a) All new thermoplastic markings where deemed necessary shall be applied to painted pilot markings having a thickness of less than 150 microns, unless otherwise directed by the Engineer.
- (b) If the Engineer directs roadmarking on new or unmarked surfaces, setting out shall be marked using appropriate methods, eg chalk lines and/or string lines. The alignment methods shall be used in a way which do not detrimentally affect the thermoplastic lines appearance or adhesion to the road surface.
- (c) Unless specified otherwise, new markings shall be placed at the same location as the previous markings. If the existing markings are obviously incorrect, clarification should be obtained from the Engineer before proceeding.
- (d) Before commencing roadmarking the road surface shall be prepared according to the requirements of Clause 11.2.

9.4 Paint Remarkings over Existing Painted Markings

Where paint remarking does not require setting out the paint shall be superimposed on the existing marking within the tolerances specified in Clause 10, Dimensional Tolerances. If the existing markings are obviously incorrect clarification shall be obtained from the Engineer before proceeding.

9.5 Thermoplastic Remarkings over Existing Paint or Thermoplastic Markings

Thermoplastic markings shall not be applied over existing paint or thermoplastic markings unless the existing markings are prepared, prior to application, in accordance with the thermoplastic manufacturer's recommendations for the satisfactory adhesion of the materials. If the preparation is to remove the existing marking then this must be accomplished by a process approved by the engineer.

Markings not required to be set out shall be superimposed on the existing markings within the tolerances specified in Clause 10, Dimensional Tolerances. If the existing markings are obviously incorrect clarification shall be obtained from the Engineer before proceeding.

10. DIMENSIONAL TOLERANCES

The maximum permitted dimensional tolerances shall be:

- (a) gap length between segments where;
 - (i) gap is 3.0 m or more ± 300 mm;
 - (ii) gap is less than 3.0 m but greater than 1.0 m ± 150 mm;
 - (iii) gap is 1.0 m or less ± 50 mm.
- (b) length of segments;
 - (i) segment is longer than 5.0 m ± 150 mm;
 - (ii) segment is shorter than 5.0 m but longer than 1.0 m ± 75 mm;
 - (iii) segment is 1.0 m or shorter ± 50 mm.
- (c) paint line width;
 - all line widths + 10 % - 5 %
- (d) thermoplastic line width:
 - all line widths + 10 % - 5 %
- (e) when markings already exist, within 15 mm of the average centreline of the existing marking;
- (f) for new markings when spotting out is provided by the Engineer, within 15 mm of the pilot line;
- (g) separation of centreline and no overtaking lines to be between 100 mm and 130 mm;
- (h) where raised pavement markers are placed between double yellow lines, the separation of the lines may be increased to a maximum of 130 mm;
- (i) where raised pavement markers are placed on paint lines the paint may be omitted for a length of 150 mm before and after the marker;
- (j) where raised pavement markers are placed on thermoplastic lines the thermoplastic may be omitted for a length of 300 mm before and after the marker;

- (k) any deviation beyond these permitted tolerances shall be corrected at the Contractor's expense.

11. PREPARATION OF ROAD SURFACE

11.1 Painted Roadmarkings

- (a) Marking of new chipseal may be carried out without removal of surplus chip, provided any loose chip has not accumulated along the line of marking.
- (b) For marking in situations other than that specified in Clause 11.1 (a) above, unless otherwise specified, accumulations of surplus chip or other coarse material shall be removed prior to marking. The road controlling authority is responsible for programming this removal.
- (c) The area of pavement to be marked shall be cleaned by the applicator with the certified equipment before marking.
- (d) No marking shall be carried out on a wet, frosty, or dirty surface.

11.2 Thermoplastic

- (a) The surface shall be free of moisture immediately prior to new thermoplastic material being applied. Care must be taken to ensure that the voids in open grade porous asphalt are free of moisture.
- (b) The surface shall be free of oil immediately prior to new thermoplastic material being applied.
- (c) All extraneous or loose material shall be removed from areas where the material is to be applied, immediately prior to roadmarking. Existing painted markings shall be free from flaking.
- (d) When remarking over painted markings greater than 150 microns thick, a site inspection with the Engineer is required to determine any additional preparation of the surface necessary to ensure adequate adhesion. Additional preparation may include measures such as mechanical abrasion and surface etching.
- (e) The area of pavement to be marked shall be cleaned by the applicator with the certified equipment before marking.

- (f) A resinous primer compatible with the thermoplastic material, (as indicated by manufacturer's recommendations and/or reports on successful applications with the thermoplastic material and road surface involved) and approved by the Engineer, shall be applied to concrete surfaces prior to roadmarking. If necessary, other surfaces may require a resinous primer to ensure satisfactory adhesion of the marking material. Records of the primer usage shall be included in the materials diary.

12. APPLICATION OF MATERIALS

12.1 Paint

- (a) The paint shall be thoroughly mixed before being poured into the paint container of the applicator. Where that paint container is of more than 20 litre capacity the paint shall be continuously agitated while the applicator is in operation, unless the paint manufacturer can provide evidence of no settlement for paint stored for a minimum three month period. The containers must be clearly marked with the date of paint filling.
- (b) All markings up to 200 mm wide shall be applied in one pass of the applicator. Wider markings shall be applied with the minimum number of passes possible using spray widths of up to 200 mm.
- (c) All markings shall have a uniform spread of paint, a clearly defined edge, and be free from light spots, paint skins, stains and other deleterious matter.
- (d) While marking edge lines, transverse lines and symbols, the road marking paint applicator shall travel wholly on the pavement and not on the shoulders, kerbs, or partly on each.
- (e) For all marking of reflectorised no overtaking lines, the road marking applicator shall travel in the traffic lane to which the no overtaking line applies; unless the applicator can demonstrate that a dual gun application system provides acceptable retroreflectivity results for both lines in the direction viewed by the oncoming traffic.

12.2 Thermoplastic Material

12.2.1 Preparation of Material on Site

- (a) To avoid discolouration and embrittlement due to overheating, the material shall be added to a pre-heating tank in pieces or lots, each weighing not more than 4 kg. Powder material may be fed from 25 kg bags in accordance with the manufacturers recommendations.

- (b) Thermoplastic materials shall not be applied to surfaces that are at a temperature of less than 5°C, or where moisture is present.
- (c) Sufficient pre-heating tanks shall be available such that continuous application is achieved without unnecessary delays.
- (d) The material shall be maintained within the manufacturer's recommended temperature range in the pre-heating tanks and applicator storage/heating tank, throughout its transfer to the point of application, and at the point of application to the road surface.
- (e) Thermoplastic material shall not be heated in excess of the manufacturer's recommended maximum temperature.
- (f) Thermoplastic materials shall be used within six hours of achieving application temperature. At the end of this period or if overheating above the manufacturer's maximum specified application temperature occurs, the material shall be discarded.
- (g) After the initial charge to the applicator's heating tank any additional material shall be added at a rate that allows mechanical stirring and temperature control to be maintained satisfactorily.
- (h) All markings up to 300 mm wide shall be applied in one pass of the applicator. Wider markings shall be applied with the minimum number of passes possible using widths of up to 300 mm. Multiple passes shall be butted, not overlapped.
- (i) All markings shall have a uniform spread of thermoplastic, a clearly defined edge, no signs of pulsing, and be free from blisters, streaks and other defects and/or deleterious matter.
- (j) While marking edge lines, transverse lines and symbols the road marking applicator shall travel wholly on the pavement and not on the shoulders, kerbs or partly on each.

12.2.2 Pre-formed Application

The pre-formed application shall be in accordance with the manufacturer's requirements for surface preparation and application.

12.3 Raised Pavement Markers

The contractor shall ensure that roadmarking material (including over spray) is not deposited on to the raised pavement markers. Should any be deposited, it shall be removed without damaging the raised pavement markers.

The contractor shall replace any raised pavement marker either damaged in the course of marking application or damaged in the removal of material from the raised pavement marker.

12.4 Reflectorised Lines

Reflectorised lines shall have drop-on glass beads dispensed with the pressurised glass bead dispenser so as to ensure the beads achieve optimum embedment.

The beads shall be applied in such a way that their optimum retroreflective characteristics are obtained when traffic is travelling towards them and there is coverage of beads on the total painted area.

13. APPLICATION RATES

13.1 Paint

- (a) The finished dry film thickness shall be 150 microns or greater as defined in (b) below.
- (b) When film thickness is measured on steel plates it shall be calculated as per Equation 1 in Appendix A.
- (c) Target paint usage rates shall be calculated for the purpose of comparison with actual paint usage. This information shall be available to the Engineer on request.
- (d) Other methods of testing application rates may be approved and/or used by the Engineer.
- (e) The contractor shall co-operate fully in whatever testing of application rates may be required by the Engineer, including evidence in the QA records to support application rates and methodology.

13.2 Thermoplastic Material

- (a) The finished cold film thickness of thermoplastic material shall fall within the range shown in the table below.

Description	Requirements
New markings	2.0 – 2.5 mm asphalt 2.0 – 3.0 mm chipseal
Remarking over existing thermoplastic	4.0 mm maximum
Joins and overlaps on lines	4.00mm
Joins and overlaps on letters and symbols	4.00 mm maximum

- (b) Where adjacent runs are required for markings wider than 200 mm, as with for example arrows, alphabetic characters, intercepts and joins of lines, the multiple passes shall be butted not overlapped unless the overlapped material is less than as specified in table 1.
- (c) For continuous markings an approximate 100 mm drainage gap is to be provided every 10 – 15 metres, or less if required, to allow water to drain from the high side of the markings.
- (d) When the thickness is measured on steel plates it shall be calculated as per Equation 1 in Appendix A. The zones shall be at least 250 mm long.
- (e) When measured on a steel plate the thickness requirement shall be met as defined in Appendix A.
- (f) Other methods of testing application rates may be used but the result must be equivalent to that provided by method (d).
- (g) The contractor shall co-operate fully in whatever testing of application rates may be required by the Engineer.

13.3 Drop-On Glass Beads

13.3.1 Drop-On Beads Applied to Paint

For reflectorised marking the beads shall be applied uniformly at the minimum rate of 275 grams/m².

13.3.2 Drop-On Beads Applied to Thermoplastic

For reflectorised marking the beads shall be applied uniformly at such a rate to achieve the retroreflection required in TNZ M/20.

14. SKID RESISTANCE

The skid resistance of the marking within 1 hour of application and thereafter shall be as follows:

Description	Requirements
Lines less than 0.9 mm thick without surface glass beads	30 BPN or greater
Lines less than 0.9 mm thick with surface glass beads	45 BPN or greater
Lines greater than 0.9 mm thick with or without surface glass beads	greater than 50 BPN but less than 65 BPN

15. NON-CONFORMING MARKINGS

15.1 General

The Contractor shall be responsible for identifying and correcting markings that do not comply with the contract conditions.

Records of non-conformance and remedial action shall be maintained.

15.2 Paint

15.2.1 Paint Removal

- (a) Any paint on the pavement surface as a result of the Contractor's operations outside the area of the specified markings and tolerances shall be removed before any payment is made.
- (b) On no account will the cover of such markings by paint, thermoplastic materials, bitumen or other material be accepted.

- (c) Any paint removal methods used by the Contractor must be approved by the Engineer before any paint removal is carried out.
- (d) No evidence of the paint shall remain after the process of paint removal has been completed.

15.2.2 Remedial Marking for Paint

If any test site is found to have paint application of less than the lower limit specified in this document the Contractor shall be responsible for developing and performing a suitable remedy. The methodology of this remedy shall be agreed by the Engineer before it is carried out.

For remedial marking the paint film thickness shall be at least 150 microns or as specified by the Engineer.

15.2.3 Bead Application

Where remarking of reflectorised work is required the application of paint and beads shall be as required for the initial application.

15.3 Thermoplastic Material

15.3.1 Thermoplastic Removal

- (a) Any thermoplastic material on the pavement surface as a result of the Contractor's operations outside the area of the specified markings and tolerances shall be removed before any payment is made.
- (b) On no account will cover of such markings by paint, thermoplastic material, bitumen or other material be accepted.
- (c) Any thermoplastic removal methods used by the Contractor must be approved by the Engineer, before any thermoplastic removal is carried out.

15.3.2 Remedial Markings for Thermoplastic

When carrying out remedial work to substandard markings any single thermoplastic application shall not be less than 1.5 mm thick.

Any length of marking in which the thermoplastic film thickness is greater than the upper limit may not require remedial action provided:

- (i) the difference in thermoplastic film thickness between any two zones on a plate does not exceed 0.5 mm; and
- (ii) any error in flatness across the width of marking is not of a concave nature.

All remedial markings shall be carried out in accordance with Clause 9.5.

Where remarking of reflectorised work is required the application of thermoplastic material and beads shall be as required in Clauses 13.2 and 13.3.2.

16. MATERIALS RECORD

The Contractor shall maintain a daily record as part of the quality records showing materials used, location and details of work completed. Details to be recorded include:

- (a) Time and date the applicator's paint storage tank(s) are filled;
- (b) volume, batch number and type of paint, including thinners, in tank prior to refilling;
- (c) volume of paint added;
- (d) time and date thermoplastic marking material is deposited in the pre-heating tank;
- (e) mass (in kilograms) of thermoplastic material added;
- (f) total time at which the material has been maintained at the manufacturer's recommended application temperature;
- (g) details of any primer that may be used;
- (h) paint manufacturer's name, paint designation (class and type), volume of paint used for roadmarking including percentage thinners if added, and whether recorded volume is before or after thinning;
- (i) thermoplastic material grade, manufacturer's name, batch number, resinous primers (if used), date of manufacture and mass of thermoplastic material used for roadmarking;
- (j) beads - manufacturer's name and bead designation;
- (k) location - by State Highway and reference to Transit New Zealand's route position system;

- (l) details of work, by line thickness width and length. Miscellaneous short markings may be grouped as such provided the location is identified;
- (m) surface preparation methods for thermoplastic;
- (n) temperatures as in Clause 12.2.1 (d).

This record shall be submitted in support of contractors' claims for payment, and shall be available for checking by the Engineer at all times.

17. PROGRAMMES OF WORK

The Contractor will be provided with a schedule to indicate the general location, type of work and the periods in which the work is to be carried out.

Based on this information the Contractor shall submit a detailed programme and shall obtain the approval of the Engineer before commencing work as specified in the contract documents.

18. MAINTENANCE OF THERMOPLASTIC MATERIAL

18.1 Maintenance Period

The maintenance period shall be six months commencing:

- (a) for contracts of three months or less the maintenance period will commence at the completion of all roadmarking;
- (b) for contracts longer than three months duration the Contractor may apply at three monthly intervals, to have the maintenance period commence for any completed section of marking.

18.2 Defects

Defects shall include, but not be limited to, the following:

- (a) Roadmarkings which exhibit signs of spalling, flaking, or any other form of deterioration (other than fair wear and tear) resulting in the roadmarking not complying with the specified requirements for width and thickness.
- (b) Roadmarkings which show signs of excessive wear.
- (c) Roadmarkings exhibiting lack of adhesion to the road surface.

18.3 Maintenance Requirements

Defective roadmarkings shall be located by the Contractor and remarked in accordance with this specification. This shall include, where necessary, removal of the defective markings (Clause 15), preparation of road surface (Clause 11), and remarking (Clauses 9.4 and 9.5).

The maintenance period for any section of roadmarkings repaired under this clause, shall be as specified in the contract documents.

Where the contractor can show that a breakdown of the road surface has caused the deterioration of the roadmarkings, reinstatement shall be as a variation under the standard conditions of contract.

19. BASIS OF PAYMENT

The unit rates, as specified in the contract documents, shall be in full compensation for supplying all labour, plant, equipment and materials (including application) and shall be deemed to include allowance for all such items as travel, overhead and contingencies as specified in the contract documents.

APPENDIX A**1. METHOD FOR MEASURING PAINT FILM THICKNESS ON PLATES**

Measurements shall be taken in three longitudinal zones across the plate. The zones should be approximately 30mm wide.

Ten readings shall be taken along each zone in a random pattern within the zone.

These thirty readings shall be used to produce:

- a mean film thickness for the plate
- a minimum thickness expressed as a factor of the standard deviation from that mean using the following formula:

$$\text{MPT} = \text{Pav} - (0.45 \times \text{Psd}) \quad (\text{Equation 1})$$

Where:

MPT = Minimum Paint Film Thickness (on a Plate)

Pav = Average of 30 readings on a plate

Psd = Standard Deviation of the 30 plate readings