

SPECIFICATION FOR LONG-LIFE PAVEMENT MARKING MATERIAL APPLICATOR TESTING

1. SCOPE

This Specification describes technical, testing and certification requirements for mechanically controlled roadmarking applicators and associated equipment to be used for the application of long-life materials in compliance with NZTA M24 Specification for Audio Tactile Profiled Roadmarkings, NZTA P22 Specification for Reflectorised Pavement Marking, or NZTA P30 Specification for High Performance Roadmarkings.

Long-life materials are roadmarking materials as defined in NZTA M20 Specification for Long Life Roadmarking Materials.

2. PAVEMENT MARKING PERFORMANCE

The applicator is to be equipped such that it is capable of consistently achieving all of the requirements for reflectorised long-life pavement markings as specified by NZTA M24, NZTA P22, or NZTA P30.

2.1 Marking Material Application

The applicator shall be capable of producing clear definition and uniform spread of marking material over every mark without the use of masking shields or their equivalent. The finished line shall be free from light spots, long-life pavement marking material skin, stains and deleterious matter.

The line width and location tolerances are:

- (a) The applicator shall be capable of marking lines within a width tolerance as specified in NZTA M24, NZTA P22 or NZTA P30; and
- (b) The applicator shall be capable of marking within the tolerances specified in NZTA M24, NZTA P22 or NZTA P30 for location.

The applicator shall be capable of controlling material application so that the finished marking is as described in the associated schedule when demonstrating all marking tests.

2.2 Equipment Not Covered by This Specification

Manually propelled applicators do not comply with this Specification.

Equipment used for hand spraying or hand screeding does not comply with this Specification. Any uncertified equipment (e.g. handguns and/or long-life pavement marking material trolleys attached or mounted on applicators at the time of testing) will appear as an endorsement of the NZTA T12 (T12) Certificate. The endorsement shall state that the respective equipment does not comply with this Specification.

3. RELATED DOCUMENTS

AS/NZS 2009: Glass beads for roadmarking materials, Standards Australia

NZTA CoPTTM: New Zealand Transport Agency's Code of Practice for Temporary Traffic Management

NZTA M20: Specification for Long Life Roadmarking Materials, New Zealand Transport Agency (M20)

NZTA M24: Specification for Audio Tactile Profiled Roadmarkings

NZTA P20: Pilot Performance Based Specification for Roadmarkings, New Zealand Transport Agency (P20)

NZTA P22: Specification for Reflectorised Pavement Marking, New Zealand Transport Agency (P22)

NZTA P30: Specification for High Performance Roadmarkings

NZTA T17: Specification for Determination of Heavy Metal Content of Glass Beads Intended for Use in Pavement Marking Materials

NZTA T18: Specification for Roadmarking Raised Pavement Marker (RPM) Adhesive Heater and Thermoplastic Pre-Heater Testing.

4. DEFINITIONS

Agglomerate Marking: also known as *Structured Marking*. Irregular small agglomerates of material applied such that surface coverage is between 55 and 75% with maximum film build of the agglomerate of approximately 5mm. When viewed by a driver the line appears continuous. The line has significantly better wet-night visibility than conventional markings.

Applicator: machine intended for the application of long-life pavement marking material to a road surface. Applicator types related to this specification are as follows:

1. Type LA – an applicator which is principally designed for applying longer run longitudinal markings applied to State Highways such as edge-lines, centre-lines, etc, and cannot apply minor markings without the aid of templates, etc.
2. Type LB – an applicator which although can apply longitudinal markings is capable of applying minor markings such as arrows, limit lines, alphabetic and numeric characters, diagonal hatching, centre line before limit lines, etc.
3. Type LC – an applicator which although can apply minor markings such as arrows, limit lines, alphabetic & numeric characters, diagonal hatching, centre line before limit lines, etc, cannot automatically apply intermittent lines.

Audio-tactile: A pavement marking having raised portions aimed at providing both audio and tactile feedback when driven on. Also called raised-profile or profiled

markings. Produced using a range of materials including cold-applied-plastic and thermoplastic.

Cold-applied plastic (CAP): a cold hardening two-part poly methyl methacrylate (PMMA) resin material. The material may be either water or solvent based.

Issuing Officer: person with Registration Body authority as signatory for the issue of Initial NZTA T12 Certificates (Initial T12 Certificate).

Long-life material system types are defined as follows:

- *Machine Extrude:* mechanically propelled positive displacement device in conjunction with an extrusion head providing a ribbon of material under positive pressure
- *Machine Screed:* mechanically propelled screed box providing a ribbon of material directly onto the road surface under gravitational force
- *Machine Spray with Air Atomisation:* mechanically propelled pressurised material tank with atomising air at the spray gun
- *Machine Spray without Air Atomisation:* mechanically propelled positive displacement pump(s) with no atomising at the gun.

NZQA: the New Zealand Qualifications Authority

NZRF: the New Zealand Roadmarkers Federation Inc.

NZTA: the New Zealand Transport Agency

NZTA T12 Audit: (T12 Audit) the examination and verification of a T12 Testing Officer's records by a person appointed by the T12 Registration Body.

NZTA T12 Certificate: (T12 Certificate) the "Long-life Pavement Marking Applicator Certificate of Compliance" issued in accordance with this Specification.

NZTA T12 Register: (T12 Register) the national listing of current NZTA T12 certification status of registered long-life pavement marking applicators.

Registration Body: agency contracted by NZTA to manage revision of the NZTA T12 Specification (T12), approve Issuing Officers and maintain the NZTA T12 Register (T12 Register) for testing officers and applicators. Currently the Registration Body is the NZRF.

Roadmarker: a trading organisation with responsibility for qualification of roadmarking long-life pavement marking material applicators in compliance with this Specification.

Significant modification: any modification that has a considerable and demonstrable effect, either positive or negative, on the performance of the applicator. Examples of such changes would include but not be limited to addition or removal of long-life

pavement marking material pumps, replacement of sources of power or pumps with equipment with a greater than 10% decrease in capacity.

T12 Testing Officer: person with delegated authority to carry out inspections and testing of applicators following initial certification by an Issuing Officer.

Thermoplastic: a marking material consisting of a combination of light plasticised resin, aggregate, pigment and extender, which is heated for application to the pavement surface and which sets rapidly on contacting the road surface.

5. PROCESS

When a new or previously uncertified long-life pavement marking material applicator is to be brought into service, an Issuing Officer first inspects the roadmarking applicator. If the specifications and other requirements are met, an Initial T12 Certificate shall be issued.

Thereafter, the Testing Officer, who may be an employee of the Roadmarker, shall regularly conduct long-life pavement marking material applicator inspection and testing in accordance with this specification.

Any extension to any Schedule requires recertification by an Issuing Officer.

The Roadmarker is responsible for regularly submitting the long-life pavement marking material applicator inspection and testing results for T12 Certificate renewal.

Other responsibilities are outlined below.

6. RESPONSIBILITIES

6.1 General

While this NZTA specification describes the process of validation of the long-life pavement marking applicators it does not discharge the legal obligations of the owner/operator to maintain and operate it in compliance with New Zealand Law.

6.2 New Zealand Transport Agency

NZTA is responsible for:

- Appointment of the agency to act on its behalf as the Registration Body
- Approval of this Specification
- Approval of Issuing Officers in consultation with the Registration Body.

6.3 Registration Body

The Registration Body is responsible for:

- Development, implementation and review of this specification

- Approving Issuing Officers in consultation with NZTA
- Maintaining the T12 Register
- Registration of certificates
- Registration of T12 Testing Officers
- Management of the T12 testing audit process, including the resolution of non-compliances.
- Providing for review of certification status where requested
- Provision of interpretations in consultation with NZTA.

6.4 Roadmarker

The Roadmarker is responsible for compliance of long-life pavement marking material applicators with this Specification, including:

- Ensuring that the applicator complies with all of the requirements of the associated legislation
- Ensuring that the operation complies with the requirements of the NZTA requirements for temporary traffic control
- Provision of evidence of entry qualification for initial certification
- Engaging an Issuing Officer for initial certification of roadmarking applicators where required
- Selecting Testing Officers, whether in full time employment or on a contract basis, in compliance with this Specification
- Managing inspection and testing for annual certification in compliance with this Specification
- Managing associated activities for maintenance of compliance with this Specification
- Forwarding original certificate(s) to the T12 Registration Body for registration
- Maintaining procedures and records relevant to this Specification, including records of T12 Testing Officer qualifications, experience and approval, under a quality assurance system in compliance with NZTA requirements

- Advising the Register of the disposal or decommissioning of a registered applicator.

6.5 Issuing Officer

Issuing Officers are responsible for:

- Providing the inspection, testing and certification services under a quality assurance system certified to ISO 9001 or equivalent
- Inspection and testing of applicators in accordance with this Specification
- Issuing of Initial T12 Certificates on satisfactory completion of testing
- Forwarding original certificate(s) to the T12 Registration Body for registration

6.6 T12 Testing Officer

Testing Officers are responsible for:

- Conducting long-life pavement marking material applicator inspection and testing in accordance with this Specification
- Recording results and renewing Certificates of Compliance in accordance with this Specification.

7. ISSUING AND TESTING OFFICER CRITERIA

Applicators shall only be tested and certified by Issuing or Testing Officers who appear on the T12 Register.

7.1 Competency Criteria

The minimum competency criteria for Issuing and Testing Officers are:

- Evidence, through appropriate technical and/or management expertise, of competency in the interpretation and application of technical specifications
- Experience in plant and machinery operation
- Understanding of inspection and testing principles
- Familiarity with NZTA roadmarking specifications
- Being a current NZTA T8 Testing Officer.
- Training and competency in NZQA Unit Standards relating to NZTA Long-life Pavement Marking Applicator Testing.

7.1.1 Issuing Officer Criteria

Issuing Officers shall be approved by the Registration Body in consultation with NZTA for testing and issuing of initial NZTA T12 Certificates in accordance with this Specification.

7.1.2 Currency of Competency

Issuing and Testing Officers who have carried out no T12 testing over a period of five years shall be removed from the register of Issuing or Testing Officers.

7.1.3 Contact Details

Issuing and Testing officers shall keep the registration body advised of current contact details including postal and email address.

8. CERTIFICATION REQUIREMENTS

8.1 General

The T12 Certificate provides evidence of compliance testing of long-life pavement marking material applicators against the requirements of this Specification.

8.2 Certificate requirements

An electronic file version of the T12 Certificate is available from the Registration Body Website and is to be used by all Issuing and Testing Officers.

The following information must be provided:

- Applicator Type, i.e. LA, LB or LC, refer 11.2
- Confirmation of entry qualification in the case of an initial certificate, or the previous T12 certificate number for the applicator in the case of a renewed certificate
- Compliance details
- Endorsements e.g.
 - (a) additional equipment; or
 - (b) dispensations.
- Date of expiry of certification as twelve months after the final on-site testing day, or twelve months after the day the current T12 expires, if it expires within 30 days of the testing day
- Photo which clearly identifies the applicator. A $\frac{3}{4}$ view image taken from the front left hand side of the applicator in the case of an Operator Mounted Applicator, or a photo showing application equipment in the case of a Pedestrian Controlled Applicator
- Signature of Issuing or Testing Officer
- Identification of ability to apply minor markings.

8.2.1 T12 Test Schedules

Prior to the commencement of any initial certification, the applicator owner is to identify the requirements of the markings to be applied and identify the product description and the tolerances that are to apply. New Zealand Transport Agency Specifications such as NZTA M24, NZTA P22 or NZTA P30 are to be used wherever appropriate. For Licensed products and processes the product descriptions as contained in the Licence agreements.

The test schedule is to describe the product/process type and the NZTA T12 tests used to demonstrate the applicator capabilities. A photograph is to be used to describe the product being applied.

Test Schedules are used to cover the products/processes applicable for NZTA T12 testing, these are as follows:

- (a) Plain Flat Markings
Tolerances as specified in NZTA Specifications, Tests 12.4 and 12.5 and as described in Clause 14.2.
The tests are to cover the range in line widths.
- (b) Audio-tactile profile markings
Tolerances to be specified the Traffic Control Devices Rule or approved by NZTA and Test 12.6 as described in clause 14.2.10
The tests are to cover the range in line widths.
- (c) Agglomerate/Structured Markings
Tolerances as specified prior to commencement of Tests 12.4 and 12.5 and as described in Clause 14.2.
The tests are to cover the range in line widths.
- (d) Proprietary/Licensed Markings not covered above
Tolerances as specified prior to commencement of Tests 12.4 and 12.5 and as described in clause 14.2.

The tests are to cover the range in line widths for which the applicator is to be registered.

The generic type of marking material used for the tests (e.g. cold-applied plastic, thermoplastic) is to be clearly identified on the T12 Certificate.

8.3 Certificate Validity

T12 Certification is valid only where:

- Inspection, testing and certification procedures are conducted under a quality assurance system in compliance with NZTA requirements
- Compliance with testing personnel criteria can be demonstrated
- Certificates are completed and signed by an authorised person
- Certificates have been registered with the T12 Registration Body. This will be indicated by a stamp and the unique registration number issued by the Registration Body
- Appropriate records are maintained
- Certificate is issued in the name of a legal entity.
- The Testing Officer or Issuing Officer was not the operator of the applicator at the time of testing.

8.4 Entry qualification

A T12 Certificate shall be issued only where the nominated long-life pavement marking material applicator meets specified criteria for entry qualification.

Entry qualification may be obtained by either of the following methods:

- (a) TNZ E/4 Certificate, with an expiry date not earlier than 1 July 1994

Provided that the applicator meets the technical requirements of this Specification, the Roadmarker may record the TNZ E/4 details on the T12 Certificate and undertake the requirements for renewal of certification.

- (b) Initial T12 Certification by an approved Issuing Officer.
- (c) New "Initial T12 Certification" obtained after significant modifications to applicator.

8.5 Initial T12 certification

Before an initial NZTA T12 Certificate is issued the roadmarking long-life pavement marking material applicator shall be demonstrated, inspected and tested at a suitable test site by, or under the direct control of, an Issuing Officer.

The Roadmarker shall arrange the engagement of a person currently authorised by the Registration Body as an Issuing Officer for the purposes of initial certification.

The operator shall be provided by the Roadmarker to produce the markings required for the tests.

The Issuing Officer may require additional tests to be carried out to check compliance with this Specification. Under such circumstances the Registration Body requires a brief report covering the amended procedure and reasons for its adoption.

In the event of an applicator failing to comply with test criteria, the Issuing Officer shall arrange to inform the Roadmarker in writing and within one month supply copies of the test and inspection results. Where there is a significant delay in scheduling of continuation of testing, the Issuing Officer is to advise the T12 Registration Body.

Where compliance with this Specification is confirmed, the Issuing Officer shall complete the T12 Certificate in accordance with the requirements of this Specification.

8.6 Maintenance of compliance

The Roadmarker is responsible for the maintenance of compliance of roadmarking long-life pavement marking material applicators.

Once entry qualification criteria have been met, the Roadmarker may maintain T12 certification in compliance with this Specification on either an internal or external testing basis.

Testing for maintenance of compliance comprises:

8.6.1 Renewal of T12 Certificates

Renewal of certificates requires demonstration of applicator compliance with this Specification. The roadmarking long-life pavement marking material applicator shall be demonstrated, inspected and tested at a suitable test site by an appropriately qualified Testing Officer. The inspection and test procedures shall be performed in accordance with appropriate checklists.

Where compliance with this Specification is confirmed, the Testing Officer shall complete the T12 Certificate in accordance with the requirements of this Specification.

8.6.2 Confirmation of compliance

Regular tests for compliance with the Specification are to be carried out under the Roadmarker's quality assurance programme.

As a minimum, one set of tests shall be carried out at approximately six months from the issue date of a Certificate. In addition, appropriate tests shall be carried out following significant applicator modifications which may affect compliance with this Specification.

The tests for confirmation of compliance shall be sufficient to demonstrate the range of applicator capabilities required by the Specification. Modifications may be made to the specified tests, provided that the modified tests and records are documented.

8.7 Currency of Certification

Any applicator that has not been re-certified within a period of two (2) years from the Expiry date of the last T12 certificate shall require a T12 Audit at time of recertification.

8.8 Transfer of plant to new cab and chassis

Where application equipment has been transferred from one cab and chassis to another, T12 certification is required and this will be subject to T12 Audit.

8.9 Cancelled applicators

Where an applicator has been written off or has been withdrawn from certification the Roadmarker shall advise the registration body within three (3) months.

9. REGISTRATION AND REVIEW OF NZTA T12 CERTIFICATES

9.1 Register

A register of T12 Certificates shall be maintained by the Registration Body.

The T12 Register can be obtained from the Registration Body's Website.

Roadmarkers shall submit the original T12 Certificate for entry into, or updating of, the Register. The Roadmarker is responsible for ensuring the validity of such Certificates.

The T12 Registration Body is to register the valid certificates received. A stamp and unique form of numbering is to be used to indicate registration on the original before returning to the Roadmarker.

All applicators will remain on the T12 Register, whether with current certification or expired, until advice of its disposal is received from the owner.

9.2 T12 Audit

The T12 Registration Body is required to facilitate audits of T12 Testing Officers at a frequency determined in consultation with the New Zealand Transport Agency.

The Auditor will be selected on the basis of T12 testing and auditing experience and independence.

The Testing Officer selected for audit at the time of re-registration of their certificate(s) is to be advised in writing that they have five (5) working days to provide all records relating to the testing related to the certificate. Proof of the latest confirmation of compliance testing is also required.

The results are to be couriered to the Registration Body, or nominated Auditor. Courier costs are the Roadmarkers responsibility.

On receipt of the test records the Auditor is to conduct an audit and provide a report to the Registration Body which identifies any and all non-compliances.

The Registration Body is to advise the T12 Testing Officer of the audit findings and to facilitate effective close-out of the identified non-compliances. The related T12 Certificate(s) will not be registered until the non-compliances have been closed-out. Costs related to the close-out of the non-compliances are the Roadmarkers responsibility.

9.3 T12 Review

Interested parties may submit requests in writing to the T12 Registration Body for review of the validity of nominated T12 Certifications. Such requests are to be based on reasonable grounds.

In the event of a request for review, the Registration Body shall advise the relevant Roadmarker to provide copies of records related to initial certification and/or the current T12 Certificate to the Registration Body.

9.4 Audit and Review Non-Compliances

NZTA are to be advised by the Registration Body of any non-compliances identified by audits or review. The Registration Body will, in consultation with NZTA, identify the appropriate corrective actions required. All costs resulting from the identified non-compliance are to be borne by the Roadmarker.

Where a Roadmarker fails to provide adequate records to substantiate compliance with T12 certification requirements, the relevant certification record or records shall be removed from the T12 Register and relevant authorities advised in writing.

Where a Certificate record is removed from the Register as a result of a review or audit, the removal shall be recorded on the T12 Register until the expiry date of the relevant Certificate. Records of non-current certification shall be maintained by the Registration Body.

10. STATUTORY AND REGULATORY REQUIREMENTS

The Roadmarker shall ensure that the applicator complies with all of the requirements of the appropriate legislation, regulations and associated Codes of Practice.

10.1 Compliance with the Health and Safety in Employment Legislation

The Roadmarker shall ensure that the applicator complies with all of the requirements of the HSE Act 1992 and associated legislation, and relevant Transport Regulations including but not limited to the following:

- All pressure equipment is compliant with the requirements of the Health and Safety in Employment (Pressure Equipment, Cranes, and Passenger Ropeways) Regulations 1999. The Hazard Rating carried out in accordance with AS4343 is to be current.
- The exhausts of all motors on the applicator or pre-heater shall be directed such that fumes do not reach driver or operator. There shall be no danger of exhaust sparks or equipment above the auto ignition temperature coming into contact with thinners or other flammable vapours.
- All operating positions, catwalks and ladders shall be of adequate size and design for the security of operators, shall as far as possible be of non-skid construction and provide safe, convenient access to ground level.
- Fire control equipment meets the national and local authority requirements
- Gas-fired equipment is in compliance with the Gas (Safety and Measurement) Regulations.

10.2 Compliance with the Hazardous Substances and New Organisms Act and Regulations

The Roadmarker shall ensure that all vessels and systems associated with the storage, carriage and application of hazardous substances on the applicator complies with all of the requirements of the Hazardous Substances and New Organisms Act, Resource Management Act and associated legislation, including but not limited to:

- Vehicle and storage vessels are to be appropriately signed and or placarded
- Emergency Procedures are to be appropriate to the materials being handled and readily available
- Spill Response and Containment Kits are to be appropriate to the materials being handled and readily available.

10.3 Compliance with Transport Regulations

The Roadmarker shall ensure that the applicator complies with all of the requirements of the Land Transport Act 1998 and relevant Transport Regulations including but not limited to the following:

- Possess current registration
- Possess current and valid Warrant of Fitness or Certificate of Fitness as appropriate
- Possess current and valid Transport Service Licence
- Requirements for the carriage of Dangerous Goods are complied with regards to Dangerous Goods signage and availability of Dangerous Goods Information.

11. TECHNICAL REQUIREMENTS

11.1 General

A variety of applicators and associated support equipment is used to apply a diversity of long-life pavement marking material. This specification describes the performance requirements of this equipment while applying pavement markings having a performance greater than that normally achieved by painted markings.

11.2 Applicator Types

Three types of applicator machines are covered by this Specification:

1. Type LA – an applicator which is principally designed for applying longer run longitudinal markings applied to State Highways such as edge-lines, centre-lines, etc, and cannot apply minor markings without the aid of templates, etc.
2. Type LB – an applicator which although can apply longitudinal markings is capable of applying minor markings such as arrows, limit lines, alphabetic & numeric characters, diagonal hatching, centre line before limit lines, etc.
3. Type LC – an applicator which although can apply minor markings such as arrows, limit lines, alphabetic & numeric characters, diagonal

hatching, centre line before limit lines, etc, cannot automatically apply intermittent lines.

There is no constraint as to the design of the applicator, e.g. a Type LA or LB may be Operator Mounted or Pedestrian Controlled.

The following marking systems are covered by this specification:

1. Plain Flat markings
2. Audio-tactile profile (ATP)
3. Agglomerate/structured
4. Proprietary/Licensed Products not covered above.

Where an applicator requires specific support equipment (e.g. thermoplastic pre-heater) this shall be included in the plant description on the Test Schedule.

11.3 Identification

All applicators, associated long-life pavement marking material application and safety related items are to be appropriately identifiable.

11.3.1 Chassis Numbers

All applicators shall have a chassis number. For registered motor vehicles the chassis number shall be the chassis number recorded on the certificate of registration of the motor vehicle.

The chassis number shall be:

- (a) Permanently stamped or engraved into the chassis of the applicator;
- (b) Readily visible, clean and legible;
- (c) There shall be only one chassis number on the vehicle.

11.3.2 Equipment Serial Numbers

Each long-life pavement marking material pump and compressor shall have a serial number on it. The long-life pavement marking material pump or compressor serial number shall be either the manufacturer's number where this uniquely identifies the long-life pavement marking material pump or compressor or a number allocated by the Roadmarker or Testing Officer.

11.4 Requirements for All Applicators

11.4.1 Power and Control

The applicator shall have sufficient power and controls so that the uniform speeds required can be held on grades varying between +12%

and -12% when fully laden. The speed shall not vary by more than $\pm 10\%$ of each nominated marking speed when tested on varying grades and in varying directions.

The applicator shall have an effective park brake.

11.4.2 Instruments and Controls

All valves, controls and instruments shall be convenient to the driver and/or operator and clearly marked so that any predetermined application rate or line width can be accurately selected.

The applicator shall be fitted with a road speed indicator, marked with a serial number. The road speed indicator shall be positioned near the driver's line of sight to the guide arm so as to be read by the driver without parallax error.

The road speed indicator shall be accurate to within 10% over the normal operating speed range and be free of significant flutter at steady speeds. Analogue indicator scales shall be marked in increments with a minimum spacing of 3mm representing a change in speed of not more than 5% of the slowest marking speed. Digital readout devices shall be readable to 5% of the slowest marking speed.

The instruments necessary for control of the system shall be readily removable for repair and calibration.

11.4.3 Guide Arms

The applicator shall be equipped with a suitable guide to assist the operator in following the correct line. The guide arm shall be mounted or mountable on both sides of the vehicle, and in view of the operator from the normal driving position.

11.4.4 Marking Material Application Device

All applicators shall have material application devices mounted such that the application of material is not adversely affected by variations in load on the applicator or variations in the road surface.

11.4.5 Glass Bead and Aggregate Application Devices

All applicators shall be fitted with a glass bead application device. Where the addition of aggregate is required, the applicator shall be fitted with an appropriate device. Any and all devices fitted are to:

- Be located as closely as is practicable to the rear of the application point to ensure the beads are firmly embedded in and adhere satisfactorily to the marking material.
- Have sufficient control such that glass beads are satisfactorily embedded without significant bead entrapment below the material surface.

- Be capable of providing an even spread of beads across the markings.
- Have if necessary, adjustable time delays, which shall be used to ensure that all markings are beaded, for their entire length.

11.4.6 Long-Life Pavement Marking Material Tanks

Applicators shall have a system that ensures that long-life pavement marking material may be diluted or modified in accordance with the long-life pavement marking material manufacturer's instructions.

Applicators equipped with long-life pavement marking material supply tanks exceeding 20 litres long-life pavement marking material capacity shall have an accurate method of gauging in litres the quantity of long-life pavement marking material in each long-life pavement marking material tank. This method shall be described in the Roadmarker's Quality Assurance procedures.

11.4.7 Thermoplastic Pre-melting and Heating Systems

All thermoplastic pre-melting tanks and applicator heating tanks and their associated heating systems shall comply with the requirements of NZTA T18. A valid NZTA T18 Certificate is to be presented prior to T12 certification.

11.4.8 Traffic Management Equipment

The applicator and all support vehicles working with the applicator shall have facilities for intercommunication, warning devices and signs that comply with NZTA requirements for temporary traffic management. Compliance is to be judged against a Temporary Traffic Management Plan produced and approved in accordance with current NZTA requirements.

11.4.9 Intermittent Line Equipment

All applicators, with the exception of Type LC applicators, shall be capable of automatically producing intermittent lines. The maximum permitted dimensional tolerances shall be in accordance with NZTA P22 or NZTA P30.

11.5 Additional Requirements for Operator Mounted Long-Life Pavement Marking Material Applicators

11.5.1 Direction of Travel

The applicator shall be capable of producing all longitudinal markings along the road without travelling against the normal flow of traffic.

The applicator shall be equipped with dual control systems to enable the operator to steer and in all ways control the vehicle from the left and right sides of the cab during marking operations.

11.5.2 Cleaning Equipment

The applicator shall have cleaning equipment which shall be capable of removing dust and fine detritus from the test area in advance of long-life pavement marking material application.

The applicator shall be capable of having the pavement cleaning equipment in operation continuously during roadmarking operation.

11.6 Additional Requirements for Type LB and LC Applicators

11.6.1 Transverse Line Ability

Applicator shall be capable of marking transverse lines (e.g. limit lines) to within 300mm of the edge of a kerb or island. The standard kerb shall be assumed to be 150mm high with the distance from the front face to the nearest obstruction 1.0m.

11.6.2 Turn Arrow Ability

Applicator shall be capable of applying long-life pavement marking material turn lane arrows in compliance with the appropriate NZTA Specification.

12. METHODS OF TEST

The inspection and test procedure is divided into two phases, a visual inspection and demonstration of specified non-long-life pavement marking material application operations, followed by a demonstration of long-life pavement marking material application and associated features.

Where either the Roadmarker or Testing Officer considers that additional inspection and test procedures are required to establish compliance of an applicator with the Specification, the special requirements and additional inspection and test procedures shall be recorded.

12.1 Visual inspection

At the start of testing, the Testing Officer makes a visual inspection of the applicator, records relevant details and observes non-long-life pavement marking material application operation of the applicator.

The records of this inspection are to be made on the T12 checklist available from the Registration Body Website.

Digital photographs shall be taken to support the relevant items recorded on the checklist.

12.2 Demonstration of line application

Testing Officer shall only proceed with the testing of the applicators ability to apply the specified materials at the specified application rates following satisfactory completion of the visual examination.

The Roadmarker is to specify the application rate chosen for the test. The application rate cannot be altered without restarting the application tests.

12.2.1 Application materials

The long-life pavement marking material used shall have NZTA approval.

Beads shall comply with AS/NZS 2009 and NZTA T17.

Thinners or modifying agents, when used, shall be in accordance with the long-life pavement marking material manufacturer's instructions.

Long-life pavement marking material to be used for the tests shall be made available for checking in unopened containers at the time of the initial test. The applicant shall cooperate with the Testing Officer to enable checking of brand, batch number, thinners added etc.

12.2.2 Test Site

The test site shall be provided by the Roadmarker, who shall provide proof of authority to mark the test site.

The test site shall have a surface of chip-seal, concrete, or similar pavement material.

All materials shall be supplied by the Roadmarker.

The test site is marked with a test strip which is a straight line either 33m or 50m long with start and stop positions marked with transverse lines as shown in Figure 1.

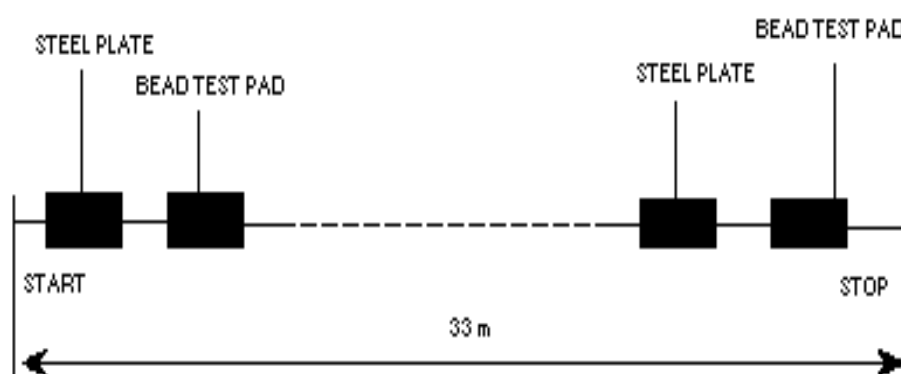


Figure 1: Test Site Layout

The plates and bead test pads shall be within 1.5m of the relevant start and stop positions.

Where applicator speeds are in excess of 10km/hr the length of the test track may be increased to 50m.

12.2.3 Test Requirements

Where an applicator employs more than one material application system, at least one test line shall be applied using each system.

Where an applicator employs more than one long-life pavement marking material system then at least one test type shall be run on each separate system.

Operator mounted applicators shall have at least one test carried out using alternative operating sides.

Tests shall be conducted for each of the line widths to be certified. For applicators having intermittent line capability, at least one line width is to be demonstrated. The Testing Officer shall nominate the pattern to be tested.

The operator is to nominate the speed at which the vehicle will do each test. It is a requirement for all tests that the speed of the applicator be uniform and at the speed nominated.

12.3 Continuous Line Test (For all plain and structured lines)

In this test the operator is required to demonstrate the applicator's ability to mark a continuous line at the nominated application rate/thickness.

Steel test plates, and Kraft paper pads for structured lines, are placed in accordance with Figure 1.

An offset straight datum line is marked for the entire length of the test strip.

Operator mounted applicators shall operate the cleaning system for the entire length of the test strip.

The applicator shall apply material only to the start test plate/Kraft paper, and both material and beads to the stop end plate/Kraft paper.

Specific criteria for passing the test are:

- (a) The average centre-line of the marked line shall not deviate from the datum line by more than that allowed for in the tolerances for location and dimension as specified by NZTA P22 or NZTA P30
- (b) The applicator must pass the cleaning test (operator mounted applicators only)
- (c) The marking on both the start and stop end test plates must meet the

requirements of NZTA P22 or NZTA P30 for width, surface texture, edge definition and splatter.

- (d) The marking on the start end test plate shall meet the requirements for thickness. For structured, the weight of material on the Kraft paper shall match the nominated application rate.
- (e) The beads on the stop end plate shall meet the requirements of NZTA P22 or NZTA P30 for spread, embedment and retro reflectivity (to be tested prior to skid testing).
- (f) The skid resistance of both test plates shall meet the NZTA requirements.

12.4 Intermittent Line Test

In this test the operator is required to demonstrate the applicator's ability to automatically mark a segmented line to the specified thickness/application rate at nominated widths.

Two steel test plates, and Kraft paper pads for structured lines, are placed as in Figure 1.

The applicator shall apply material only to the start test plate/Kraft paper, and both material and beads to the stop end plate/Kraft paper.

The applicator is required to mark a segmented line for the full length of the test strip with the first segment commencing immediately after the start line.

The T12 Testing Officer shall specify the gap and segment lengths required.

Specific criteria for passing the test are:

- (a) The gap length between segments and the segment length shall meet the requirements of NZTA P22 or NZTA P30.
- (b) The marking on the test plates shall meet the requirements of NZTA P22 or NZTA P30 for width, surface texture, edge definition and splatter.
- (c) The marking on the test plates shall meet the nominated thickness requirements. For structured, the weight of material on the Kraft paper shall match the nominated application rate.
- (d) The beads on the stop end plate shall meet the requirements of NZTA P22 or NZTA P30 for spread, embedment and retro reflectivity (to be tested prior to skid testing).
- (e) The skid resistance of both test plates shall meet the NZTA requirements.

12.5 ATP Line Test

In this test the operator is required to demonstrate the applicators ability to produce audio tactile markings at nominated widths in accordance with NZTA requirements.

The T12 Testing Officer shall nominate the marking width.

Two 900mm long steel test plates are placed in accordance with Figure 1.

The roadmarking applicator shall pass along the test strip applying markings for the entire length of test strip and test plates while travelling at the speed nominated by the operator.

The applicator shall apply material only to the start test plate/Kraft paper, and both material and beads to the stop end plate/Kraft paper.

Specific criteria for passing the test are:

- (a) The marking on the two end test plates shall meet the NZTA M24 requirements for width, surface texture, edge definition, splatter and audio tactile block height, width, length and spacing.
- (b) The audio tactile characteristics i.e. block height, width, length and spacing, and base thickness shall meet the nominated (NZTA) requirements for the entire length of the test strip.
- (c) The beads on the stop end plate shall meet the requirements of NZTA P22, or NZTA P30 for spread, embedment and retro reflectivity (to be tested prior to skid testing).
- (d) The skid resistance of both test plates shall meet the NZTA requirements.

12.6 Other Tests

For proprietary marking systems, the roadmarker shall provide the Testing Officer with all relevant information prior to the test. An agreed testing system, including tolerances is to be developed prior to the tests being carried out.

12.6.1 Demonstration of power and control

The applicator shall have sufficient power and controls so that the uniform speeds required can be held on grades varying between +12% -12% when fully laden.

The ability of the applicator to maintain marking speeds to within 10% of nominated marking speed shall be tested over a course or section of road that varies between +12% and -12% grade. The indicated speed shall lie between the upper and lower limits of the nominated speed over the full test distance. The highest and lowest nominated marking speeds shall be demonstrated.

12.6.2 Demonstration of ability to apply long-life pavement marking material turn arrow

The applicator shall be capable of applying long-life pavement marking material both right and left turn lane arrows in accordance with the requirements of the Traffic Control Devices Rule and NZTA P22 or NZTA P30 Specification. The direction of the arrow to be demonstrated is to be specified by the Testing Officer.

Specific criteria for passing the test are:

- (a) The arrow dimensions must be within the tolerances specified in NZTA P22 or NZTA P30 for location of the specified setting out dimensions;
- (b) The applicator must not track over any part of the long-life pavement marking material surface during the application of long-life pavement marking material;
- (c) The arrow must meet the Specification requirements for long-life pavement marking material surface texture, edge definition and splatter.

Note: The Certificate for all Long-life Applicators which are incapable of marking turn arrows without the aid of a template shall be endorsed.

12.6.3 Transverse Line Ability

The applicator shall be capable of applying long-life pavement marking material both transverse markings in accordance with the requirements of the Traffic Control Devices Rule and NZTA P22 or NZTA P30 Specification.

The specific requirements for passing the test are:

- (c) The limit line marking dimensions must be within the tolerances specified in NZTA P22 or NZTA P30 for location of the specified setting out dimensions;
- (d) The limit line is applied to within 300mm of the edge of a kerb or island. The standard kerb shall be assumed to be 150mm high with the distance from the front face to the nearest obstruction 1.0m;
- (e) The applicator must not track over any part of the kerb during the application of long-life pavement marking material;
- (f) The marking must meet the Specification requirements for long-life pavement marking material surface texture, edge

definition and splatter.

Note: The Certificate for all Long-life Applicators which are incapable of marking transverse markings shall be endorsed.

12.7 Additional tests

The Issuing Officer or Testing Officer may require additional tests to be carried out to check compliance with this Specification.

12.8 Verification of results

The results of the testing determined by the Testing Officer shall be verified by a person, independent of the testing, who has sufficient knowledge and experience to enable adequate review of calculation and determination of findings.

Records of the verification are to be maintained.

13. RECORDS

13.1 Test records

Records of T12 testing shall be uniquely identified in a manner such that they are readily traceable to the particular tests conducted, including:

- Applicator
- Date of testing
- Tests conducted
- Issuing or Testing Officer
- Location

T12 Certification records shall include as a minimum:

- Completed T12 checklists
- Digital photographs which support all relevant check items on the T12 checklist and which demonstrate compliance with test requirements
- Test plates and bead test pads
- Records of materials used
- Records of test runs, including test runs producing non-complying test results
- Copy of T12 Certificates
- Records of special applicator requirements and additional inspection and test procedures.

13.2 Retention and access

The Issuing Officer shall retain records pertaining to initial certification testing.

The Roadmarker shall be responsible for all records conducted by Testing Officers.

Test plates and bead test pads for certification shall be retained for a minimum period of twelve months.

Other test plates and bead test pads related to maintaining compliance with T12 Certificates shall be retained by the Roadmarker for at least two (2) years.

Records shall be readily accessible, so as to be available for client surveillance or auditing purposes.

T12 records constitute part of Roadmarker quality records and as such shall be made available to third party auditors conducting quality system certification assessments.

14. TEST MEASUREMENT REQUIREMENTS

14.1 General

This section describes the measurement methods used to determine individual applicator performance parameters for tests of line application. In addition, responsibilities for maintaining consistency and reliability of measurement methods are defined, together with outlines of particular reliability considerations.

14.2 Measurement methods

The following measurement methods shall be applied in testing compliance of roadmarking long-life pavement marking material applicators in accordance with this Specification.

14.2.1 Cleaning tests – Operator mounted applicators only

(a) required performance capability

The applicator shall be capable of removing 125 grams of silica sand from an area of 500mm by 150mm of pavement while marking. To pass the test the applicator shall remove the sand while applying the required marking such that no sand remains beneath or within the long-life pavement marking material film.

(b) acceptance criteria

The dried or set material shall not exhibit:

- sand remaining trapped in the long-life pavement marking material
- indication of discontinuities in long-life pavement marking material surface due to loose sand being removed after marking material application

(c) apparatus required

The weight of sand shall be determined with a balance with an accuracy of ± 1 gram in the range of 100 to 150 grams.

(d) test materials

Silica sand weighed into 125 gram lots.

Bead test pad (see following measurement method) or alternative material having similar surface texture characteristics.

Note: The reverse side of rejected test pads from the bead application test may be used for the sand clean test.

(e) procedure

The protective sheeting or alternative is securely fastened to the test track surface at the location indicated by Figure 1, with at least 480mm exposed.

The 125 grams of sand is spread uniformly over the length of the exposed pad to a width of 150mm.

The sand must not be disturbed prior to the applicator passing over the pad during the cleaning test.

The applicator cleaning apparatus must be operated continuously in conjunction with long-life pavement marking material operation for the full length of the test track.

The test pad is examined for sand retention.

(f) calculation and reporting

No calculation necessary. Rejected test pads may be disposed of. Test pads from successful test runs to be retained.

14.2.2Bead application tests**(a) required performance capability**

The bead application equipment shall be capable of producing a uniform coverage of glass beads on the markings with minimal waste at an application rate nominated by the contractor such that the marking has a retroreflectivity value greater than $180 \text{ mcd.lux}^{-1} \text{ m}^{-2} \pm 30\%$.

(b) acceptance criteria

Test plates shall not exhibit disturbed material or bead application.

The beaded test plate shall exhibit a uniform spread of beads both across the line width and in the longitudinal direction.

The measured retroreflectivity value shall be within $\pm 30\%$ of the nominated target.

(c) apparatus required

Retroreflectivity shall be assessed by a retroreflectometer that has 30m geometry, i.e. entrance angle 88.76° , observation angle 1.05° and a white light source.

Retroreflectometer is to be standardised against national standards, or, in the absence of such, against a mutually agreed reference.

(d) test materials

Test Plates: flat electro-galvanised steel plates, at least 1.5mm thick, 300mm long and at least 50mm wider than the nominal width to be tested.

The surface of the plates shall be sufficiently clean to facilitate material and bead adhesion.

(e) procedure

The application rate of beads shall be calculated by applying material and beads on to the second test plate on one material application run with speed and application rates maintained constant.

The test plates shall be securely attached such that the entire length of the plate remains uncovered and available for material

and bead application. If nails or similar are used, they shall be positioned where they will not adversely affect material or bead application.

Test plates exhibiting disturbed material and/or bead surfaces shall be rejected.

The test plates shall be examined for uniformity of bead distribution and retroreflectivity. Results may include wet testing in addition to the dry testing.

(f) calculation and reporting

A minimum of 20 readings shall be taken. The calculated mean and standard deviation is to be recorded for each retroreflectivity determination.

The resultant value is compared with the acceptance criteria. Complying value is to be recorded.

The conformance of uniformity of spread and embedment is to be recorded.

14.2.3 Material application tests when measured on steel plates

(a) required performance capability

The applicator shall be capable of controlling application such that the finished film thickness of long-life pavement marking material is within 10% of the thickness aimed for. The thickness aimed for is to be selected from the relevant NZTA Specification or Manufacturers Specifications.

(b) acceptance criteria

The finished film thickness of material shall be within 10% of nominated thickness when demonstrating all plain material line application work.

The finished lines shall be free from thin areas, breaks, stains and deleterious matter.

Film surface texture, edge definition and splatter will be judged acceptable or otherwise by reference to the Specification requirements.

(c) apparatus required

The film thickness shall be measured with a non-destructive thickness gauge. Suitable gauges are Elcometer 355, digital marking gauges satisfying EN 13197 or EN 13212 or similar.

The thickness gauge shall have an accuracy of $\pm 3\%$ in the range of thickness 0.5mm to 13.0mm when calibrated at zero and either end of the range.

Film instruments shall be calibrated with standard shims having calibration traceable to National Standards and with a range of values relevant to the expected film thickness being measured.

(d) test materials

Test Plates: flat electro-galvanised steel plates, at least 1.5mm thick, 300mm long and at least 50mm wider than the nominal width to be tested.

The surface of the plates shall be clean and in as new condition, i.e. free from dents, scratches, rust and significant variations in coating thickness.

(e) procedure

Test plates shall be placed on the pavement surface centrally over the line of the proposed marking and covered with material as part of an application run.

When the surface is sufficiently cool and hard, the T12 Testing Officer shall measure and record the average film thickness along each zone on the test plate. Thickness criteria must be met by each zone average for the plate to pass the test.

The film thickness instrument shall be used in accordance with the manufacturer's instructions.

(f) calculation and reporting

The average film thickness shall be determined from at least 20 readings taken along each zone on the test plate. The average value for each zone shall be recorded.

A measurement zone is the area of the plate within 5mm of a straight line, drawn lightly with a soft pencil on the material surface of the test plate, in the direction of applicator travel. The centre zone shall be established by bisecting the material line. The outer zones are established by drawing parallel lines to the centre zone at the following mandatory positions:

<u>Line width</u>	<u>Zone separation</u>
100mm	35mm
150mm	60mm
200mm	80mm

Where there is visual evidence of uneven material distribution across the line profile, the T12 Testing Officer shall select

additional zones between the inner and outer zones to be tested. Where the average film thickness in such additional zones does not meet the acceptance criteria, the test plate shall be rejected.

Note: Where the material applied contains glass beads or similar as a catalyst which present an uneven top surface, the material thickness is to be measured using a measuring anvil of at least 25mm in diameter

14.2.4 Material application tests when measured on smooth pavement surfaces

This test method is to be used in addition to 14.2.3 or when steel test plates are unavailable or impractical.

(a) required performance capability

The applicator shall be capable of controlling application such that the finished thickness of the raised block and the baseline of the long-life pavement marking material are within 25% of the thickness aimed for. The thickness aimed for is to be selected from the relevant NZTA Specification or Manufacturers Specifications.

(b) acceptance criteria

The finished material thickness shall be within 25% of nominated average zone thickness when demonstrating material line application work.

The finished lines shall be free from thin areas, breaks, stains and deleterious matter.

Film surface texture, edge definition and splatter will be judged acceptable or otherwise by reference to the Specification requirements.

(c) apparatus required

The material thickness shall be measured with an apparatus consisting of a cross bar, plus two calibrated wedges. The wedges shall be marked in intervals of not greater than 0.5mm.

(d) procedure

When the film surface is sufficiently cool and hard, the T12 Testing Officer shall measure and record the average material thickness. The test procedure consists of placing the cross bar on top of the material to be measured. The height of the material is determined by sliding the calibrated wedges under the two overhanging ends of the cross bar, until the crossbar is raised.

(f) calculation and reporting

The average material thickness shall be determined from at least 10 readings taken along each 300mm long zone. The average value for each measurement shall be recorded, and the average of the zone reported. For audio-tactile markings a minimum of two readings shall be made on each raised block. Separate values are required for the raised blocks and baseline.

14.2.5 Width determination**(a) required performance capability**

The applicator shall be capable of controlling the width of the material application work so that completed test lines are within + 10% - 5% of the nominal line width.

(b) acceptance criteria

The width of the line on the test plates when sufficiently cool and hard shall be measured and comply with NZTA P22.

Width variation of the applied line within 15mm of the leading and trailing edges of the plates is to be excluded.

(c) apparatus required

Steel rule having the required accuracy.

Note: Steel rules manufactured in accordance with British Standards and Japanese Industrial Standards (JIS) meet these requirements.

(d) test materials

None required

(e) procedure

The minimum and maximum widths of each of the set material and beaded test plates are to be determined.

Where the edge definition of the applied line is either very poorly defined or obscured by excessive splatter, the test plate shall be rejected.

(f) calculation and reporting

The minimum and maximum line widths on each complying plate are to be recorded.

14.2.6 Speed determination**(a) required performance capability**

The applicator shall be capable of being maintained to within 10% of the nominated speed over the normal operating speed range and be free of significant fluctuation at steady speeds.

- (b) **acceptance criteria**
Test plates shall be accepted only where the observed speed is within 10% of the nominated speed.
- (c) **apparatus required**
Stop watch having an accuracy of better than 0.6%
30m or 50m measuring tape having an accuracy of better than 0.06%, i.e. 20mm over 33 metres.
- (d) **test materials**
None required
- (e) **procedure**
The distance between the start and stop positions of the test track shall be 33 metres \pm 200mm.

The start and stop positions shall be clearly identified such that the traverse time can be readily determined by T12 Testing Officer.

The time taken by the applicator to traverse the test strip is determined by starting and stopping the stop watch as the applicator traverses the respective start and stop positions.

- (f) **calculation and reporting**
The speed (in km/h) for the run is calculated by dividing 118.8 by the elapsed time in seconds.

The speed determined for each line application test run shall be recorded.

14.2.7 Intermittent marking spacing

- (a) **required performance capability**
The applicator shall be capable of automatically producing intermittent lines. The maximum permitted dimensional tolerances shall be in accordance with NZTA P22 or NZTA P30.
- (b) **acceptance criteria**
All applied segments and intervening gaps on the test strip shall be within the values specified in NZTA P22 or NZTA P30.

- (c) **apparatus required**
30m or 50m measuring tape having an accuracy of better than 0.06%, i.e. 20mm over 33 metres.
- (d) **test materials**
None required
- (e) **procedure**
The T12 Testing Officer shall nominate the specified values for the segmented line.

The test strip shall be prepared in such a manner that the T12 Testing Officer can readily determine the positions of the start and stop of each segment down the length of the test strip. The T12 Testing Officer shall measure each segment and gap for the whole test line.

- (f) **calculation and reporting**
The position of start and stop of each segment is to be recorded.
The lengths of each segment and gap are to be determined using the position of the respective segment start and stop positions.

14.2.8 Intermittent bead application tests

- (a) **required performance capability**

The bead application equipment shall be capable of producing a uniform coverage of long-life pavement marking material intermittent markings for their entire length with minimal waste.

- (b) **acceptance criteria**

Test samples or photographs shall not exhibit disturbed long-life pavement marking material or bead application.

The beaded stripe shall exhibit a bead start point of no more than 150mm after the commencement of the stripe, and if the beading finishes before the end of the stripe, a bead end point of no more than 150mm from the end of the stripe.

- (c) **apparatus required**

Steel rule having the required accuracy.

Note: Steel rules manufactured in accordance with British Standards and Japanese Industrial Standards (JIS) meet these requirements.

(d) test materials

A variety of materials may be used to record the bead delay i.e.:

1. Test Pads: 6mm thick low density (33kg/m³) expanded cross-linked polyethylene foam pads measuring 300mm by 500mm
2. Heavy Kraft paper, heavy unbleached Kraft paper having a density of 200 to 300 grams/m³ measuring 300 mm by 500mm
3. Test Plates: Flat electro-galvanised steel plates, at least 0.6mm thick, 150mm long and at least 50mm wider than the nominal width to be tested.

The surface of the material shall be sufficiently clean to facilitate long-life pavement marking material and bead adhesion.

(e) procedure

The delay of application of beads onto intermittent lines shall be determined by spraying long-life pavement marking material plus beads on to a clean surface in one long-life pavement marking material application run with speed and long-life pavement marking material application maintained at a constant rate.

The test surface shall be securely attached such that the entire length of the material remains uncovered and available for long-life pavement marking material and bead application. If nails or similar are used, they shall be positioned where they will not be covered with long-life pavement marking material.

Test surfaces exhibiting disturbed long-life pavement marking material and/or bead surfaces shall be rejected.

Following long-life pavement marking material and bead application the test surface is retrieved without disturbing either long-life pavement marking material or beads.

The bead delay shall be obtained by measuring the distance from the commencement of the long-life pavement marking material marking and the point at which the beads are consistently and uniformly embedded into the long-life pavement marking material.

(f) calculation and reporting

The resultant value is compared with the acceptance criteria. Complying value is to be recorded.

The conformance of uniformity of spread and embedment is to be recorded.

Evidence of compliance shall be retained. This could either be photographic evidence or a retained sample of marking on test pad, construction paper or test plate or similar.

14.2.9 Straightness**(a) required performance capability**

The applicator shall be capable of marking within the tolerances specified in NZTA P22 or NZTA P30 for location.

(b) acceptance criteria

The applied line shall be within 15mm of the pilot line.

(c) apparatus required

String line
Steel rule

(d) test materials

None required

(e) procedure

A string line is strung from one end of the strip to the other in the longitudinal direction in such a manner that it provides guidance to the operator without impinging in the material surface. The string line is to be tensioned and secured such that it provides a nominally straight line.

The operator uses the string line for guiding the applicator for material application.

The deviations of the average centre line of the applied marking from the string line are measured using a steel rule. The line is not to be altered or interfered with between marking and measuring the location of the line.

(f) calculation and reporting

The maximum deviation in both directions is to be determined and recorded.

14.2.10 Audio Tactile Marking Block Dimensions

(a) required performance capability

The applicator shall be capable of controlling application such that the characteristics of the finished audio tactile marking meet the geometric requirements of NZTA M24.

(b) acceptance criteria

(i) Spacing

The spacing of the blocks, when measured from leading face to leading face, shall be +30% -20% of the specified/nominated values.

(ii) Width of Blocks

The width of the blocks shall be +30% -20% of the specified/nominated values.

(iii) Length of Blocks

The length of the blocks shall be +30% -20% of the specified/nominated values.

(c) apparatus required

The spacing of the blocks shall be measured using a steel tape measure having an accuracy of better than 0.06%.

The length of the blocks shall be measured by a steel rule manufactured in accordance with British Standards or Japanese Industrial Standards (JIS).

(d) test materials (when tested on test plates)

Test Plates: flat electro-galvanised steel plates, at least 1.5mm thick, 900mm long and at least 50mm wider than the nominal width to be tested.

The surface of the plates shall be clean and in as new condition, i.e. free from dents, scratches, rust and significant variations in coating thickness.

(e) procedure

Test plates may be placed on the pavement surface centrally over the line of the proposed marking and covered with material as part of an application run.

When the surface is sufficiently cool and hard, the T12 Testing Officer shall measure and record the block and spacing dimensions. The dimensional tolerances shall be met for each 900-mm test plate or zone.

(f) calculation and reporting

The average block spacing shall be determined from all readings taken along the test strip. Each measurement shall be recorded, and the average calculated and reported.

The average block width shall be determined from a minimum of four blocks, taken from randomly selected locations along the test strip. Three width measurements shall be taken on each block. Each measurement shall be recorded, and the test strip average reported.

The average block length shall be determined from a minimum of 4 blocks, taken from randomly selected locations along the test strip. Three length measurements shall be taken on each block. Each measurement shall be recorded, and the test strip average reported.

14.2.11 Agglomerate/Structured (Cold-applied-plastic)**(a) required performance capability**

The applicator shall be capable of controlling application such that the characteristics of the finished agglomerate/structured marking meet the geometric requirements of the relevant NZTA Specification or Manufacturers Specifications.

(b) acceptance criteria**(i) Material Application Rate**

The application rates are to be within $\pm 10\%$ of stated minimum material application rate kg/m^2 , with

(ii) Coverage

The materials shall be applied such that the surface applied to is covered by between 55 and 75%, and

(iii) Appearance.

The marking shall appear to be continuous when sitting in a passenger car.

(c) apparatus required

The material application rate shall be determined with a balance with an accuracy of ± 5 gram in the range of 300 to 600 grams.

(d) test materials

Heavy Kraft Paper pads: heavy unbleached Kraft paper having a density of 200 to 300 grams/m^3 measuring 100mm wider than the line width being marked by 1000mm long. Pads to be cut to the 1000mm length to within 3mm.

Note: Material may be sourced as Sisalkraft 300.

The paper strips shall be clean and free of extraneous material, holes or surface imperfections.

Test Plates: Flat electro-galvanised steel plates, at least 0.6 mm thick, 500mm long and at least 50mm wider than the nominal width to be tested.

The surface of the plates shall be sufficiently clean to facilitate material adhesion.

(e) Procedure

(i) Material Application Rate

The Kraft paper test pads are weighed immediately prior to being placed on the test track. The weight is recorded on the paper using permanent marker.

The Kraft paper pads shall be securely attached such that the entire length of the pad remains uncovered and available for material application. If nails or similar are used, they shall be positioned where they will not be covered with marking material.

Test pads exhibiting disturbed material and/or bead surfaces shall be rejected.

Following material application the test plates and bead test pads are retrieved without disturbing the marking material.

The test plates are set aside to allow the marking material to set.

The two test pads are carefully rolled up in such a manner to facilitate weighing while ensuring that material is not lost. A plastic bag may be used to retain the sample provided the weight is determined and recorded prior to its use.

The material application rate shall be obtained from the difference in the weight of the test pad after having material applied to it from that of its original weight.

(ii) Coverage

The test plates shall be examined for coverage. The percentage coverage of the surface is determined by the use of a grid overlay or similar system.

- (iii) **Appearance**
The test plates (or test line) are to be observed from the seated position of a passenger car.

(f) calculation and reporting

The weight of 1000mm of marked line is determined by subtracting the marked weights of the test pad from the unmarked weights of the test pads.

The application rate for in gm/m^2 is determined by multiplying the weight for 1000mm by the factor relating to the width of the marking, e.g. multiplying by five (5) for a 200mm wide line.

The average value is determined by averaging the application rate as determined by each of the plates.

The resultant value is compared with the acceptance criteria. Complying value is to be recorded.

The conformance of percentage of cover, uniformity of spread and embedment of beads is to be recorded.

14.2.12 Skid Resistance Testing

(a) required performance capability

The applicator shall be capable of controlling application such that the skid resistance of the finished material meets the NZTA requirements for newly applied long-life markings.

(b) acceptance criteria

The finished thickness of the line for skid resistance testing shall be within 10% of the nominated thickness. The test plate shall be representative of the finished marking.

The finished lines shall be free from thin areas, breaks, stains and deleterious matter.

Film surface texture will be judged acceptable or otherwise by reference to the Specification requirements.

The skid resistance of the finished film when measured in accordance with TRL Road Note 27 shall be in the range of NZTA requirements for newly applied long-life markings.

(c) apparatus required

A TRL Pendulum Skid Resistance Tester meeting the requirements of TRL Road Note 27 having a valid IANZ calibration.

(d) test materials

Test Plates: flat electro-galvanised steel plates, at least 1.5mm thick, 300mm long and at least 50mm wider than the nominal width to be tested.

The surface of the plates shall be clean and in as new condition, i.e. free from dents, scratches, rust and significant variations in coating thickness.

(e) procedure

Test plates shall be placed on the pavement surface centrally over the line of the proposed marking and covered with material as part of an application run.

When the surface is sufficiently cool and hard, the T12 Testing Officer shall measure and record the skid resistance on each test plate. Skid resistance criteria must be met by each plate to pass the test.

The skid-testing instrument shall be used in accordance with the manufacturer's recommendations.

(f) calculation and reporting

The average skid resistance shall be determined from at least five readings taken on each plate. The mean value for each plate shall be determined from the five successive readings that do not differ by more than three units. If the range is greater than this, the testing must be repeated until three successive readings reach a constant value.

14.2.13 Retroreflectivity Testing**(a) required performance capability**

The applicator shall be capable of controlling application such that the retroreflectivity of the finished material meets the NZTA requirements for newly applied long-life markings.

(b) acceptance criteria

The finished thickness of the line for skid resistance testing shall be within 10% of the nominated thickness. The test plate shall be representative of the finished marking.

The finished lines shall be free from thin areas, breaks, stains and deleterious matter.

Film surface texture will be judged acceptable or otherwise by reference to the Specification requirements.

The retroreflectivity of the finished film when measured in accordance with Appendix K of AS4049.4 shall be in the range of NZTA requirements for newly applied long-life markings.

(c) apparatus required

Retroreflectivity shall be assessed by a retroreflectometer that has 30m geometry, i.e. entrance angle 88.76°, observation angle 1.05° and a white light source. Retroreflectometer is to be standardised against national standards, or, in the absence of such, against a mutually agreed reference.

(d) test materials

Test Plates: flat electro-galvanised steel plates, at least 1.5mm thick, 300mm long and at least 50mm wider than the nominal width to be tested.

The surface of the plates shall be clean and in as new condition, i.e. free from dents, scratches, rust and significant variations in coating thickness.

(e) procedure

Test plates shall be placed on the pavement surface centrally over the line of the proposed marking and covered with material as part of an application run.

When the surface is sufficiently cool and hard, the T12 Testing Officer shall measure and record the retroreflectivity on each test plate. Retroreflectivity criteria must be met by each plate to pass the test.

The retroreflectometer instrument shall be used in accordance with the manufacturer's recommendations and the requirements of Appendix K of AS4049.4.

(f) calculation and reporting

The average retroreflectivity shall be determined from at least fifteen (15) readings taken on each plate. The mean value is to be reported to the nearest millicandella/square metre/incident lux for each direction along with the variance or a statement of estimated uncertainty of measurement.

14.3 Reliability of measurement methods

14.3.1 General

The Roadmarker shall identify and control the characteristics having significant influence on test results. The Testing Officer shall take responsibility for reliability of measurement in carrying out test procedures.

The reliability of test methods is dependent on the steps taken to minimise the influence of relevant characteristics on the parameter being determined. To provide reliable results, the Testing Officer needs to understand those influences and control them appropriately.

The characteristics which influence the reliability of measurement commonly relate to the:

- i) Article being measured, e.g. hardness of long-life pavement marking material
- ii) Instrument being used, e.g. readability of scale
- iii) Standard against which an instrument is calibrated, e.g. quality of test shims
- iv) Person making the measurement e.g. test consistency, transcription accuracy
- v) Environment in which the measurement is made e.g. air movement.

Minimum requirements for measurement reliability are specified within the measurement methods.

The Testing Officer shall take particular account of the characteristics which may influence long-life pavement marking material and surface dressings application rates.

14.3.2 Dry film thickness measurement

The control aspects required to maintain reliability of measurements include:

Long-life pavement marking material hardness:

- (a) plates to be at normal ambient temperature
- (b) marking material surface to be sufficiently hard, such that Elcometer probe does not leave any visible impression on surface
- (c) confirming measurements to be taken at least 12 hours after initial measurements.

Variation in film thickness:

- (a) A minimum of twenty (20) readings uniformly spaced down the length of zone shall be taken
- (b) Where the readings vary by more than 50 microns on a zone, a minimum of thirty readings uniformly spaced down the length of the zone shall be taken.

14.3.3 Bead application rate measurement

The control aspects required to maintain reliability of measurements include:

Bead application pressure:

With high bead application pressures, beads may be inadequately trapped in the long-life pavement marking material line.

The application of beads shall be observed by the Testing Officer to detect beads being deflected by the bead test pad. If this occurs, an alternative means of securing bead test pads and/or application equipment re-orientation shall be trialled with the aim of improving reliability.

Bead adhesion:

- (a) The pads shall be allowed to dry for at least one hour prior to final determination.
- (b) The pads shall be inverted and tapped lightly on the reverse side to dislodge loose beads.
- (c) The pads shall not to be subjected to beating, scraping or other handling which may displace beads from the long-life pavement marking surface.

14.3.4 Audio Tactile Dimension Measurement

The control aspects required to maintain reliability of measurements include:

Long-life pavement marking material hardness:

- (a) plates to be at normal ambient temperature
- (b) marking material surface to be sufficiently hard, such that wedges or measuring device does not leave any visible impression on surface
- (c) confirming measurements to be taken at least 12 hours after initial measurements.

Geometry of block:

- (a) A minimum of three (3) readings uniformly spaced across and along the block length of zone shall be taken
- (b) Spacing (pitch) to be measured from both leading and trailing edges.

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