

NZTA M12-S: 2022

SPECIFICATION FOR THE DESIGN,
MANUFACTURE, INSTALLATION AND
MAINTENANCE OF RAISED PAVEMENT
MARKERS

1 FOREWORD

The objective of this revised NZTA M12-S *Specification for Raised Pavement Markers* is to provide up to date guidance for Manufacturers or Suppliers wishing to supply markers in New Zealand. The revision has been prepared by Waka Kotahi New Zealand Transport Agency¹ following the release of the AS/NZS 1906.3:2017 Standard *Retroreflective materials and devices for road traffic control purposes: Part 3 Raised pavement markers (retroreflective and non-retroreflective)*. This Standard replaced AS 1906.3:1992.

TNZ M12:1998 will be withdrawn on 30th June 2023 enabling time for markers currently in stock to be marketed. After this date all Raised Pavement Markers will be required to comply with AS/NZS 1906.3 and the *Performance Field Test*. (Clause 7.4).

The description, definitions and classification of marker types used in this specification reflect the content of AS/NZS 1906.3:2017.

The main changes to the Standard that are being incorporated into this specification include:

- (a) Revision of the classification system for markers
- (b) The inclusion of temporary markers
- (c) Introduction of a new retroreflective photometric performance
- (d) Revised retroreflective photometrics for a previously included marker
- (e) Introduction of colours green and blue
- (f) Introduction of new physical performance tests for markers
- (g) Introduction of retroreflective chromaticity values

Previous M12 documents being incorporated into the revised M12 Specification that will be withdrawn include

- (h) NZTA M12 Notes to the specification of RPMs
- (i) TNZ P14 Specification for the installation of RPMs
- (j) TNZ P14 Notes for the installation of RPMs

2 RELATED DOCUMENTS

2.1 Waka Kotahi

- (a) NZTA M12-F Field Test for Raised Pavement Markers² <https://www.nzta.govt.nz/resources/raised-pvmt-markers/>
- (b) NZTA M12-C Certificate and Worksheet Templates for Raised Pavement Markers (editable) <https://www.nzta.govt.nz/resources/raised-pvmt-markers/>
- (c) NZTA M12-L Listing of Accepted Raised Pavement Markers <https://www.nzta.govt.nz/resources/raised-pvmt-markers/>
- (d) NZTA T18 Specification for Roadmarking Raised Pavement Marker (RPM) Adhesive Heater and Thermoplastic Pre-heater Testing [T18 S Specification for Roadmarking Raised Pavement Marker \(RPM\) Adhesive Heater and Thermoplastic Pre-Heater Testing \(nzta.govt.nz\)](https://www.nzta.govt.nz/resources/t18-specification-for-roadmarking-raised-pavement-marker-rpm-adhesive-heater-and-thermoplastic-pre-heater-testing/)
- (e) Traffic Control Devices Manual Part 4 Traffic Control Devices for general use - at intersections [TCD Manual Part 4 Traffic control devices for general use - at intersections \[in Draft\]](https://www.nzta.govt.nz/resources/traffic-control-devices-manual/)
- (f) Traffic Control Devices Manual Part 5 Traffic Control Devices for general use - between intersections <https://www.nzta.govt.nz/resources/traffic-control-devices-manual/>
- (g) NZTA SM032 Network Outcomes Contract Volume 3 Basis of payment
- (h) NZTA SM032 Network Outcomes Contract Volume 4 Maintenance specification

2.2 Other

- (a) NZRF RPM Removal Guide <https://www.nzrf.co.nz/resources/rpm-removal-guide/>

¹ Hereafter referred to as Waka Kotahi

² Hereafter frequently referred to as Field Test

- (b) Standards New Zealand AS/NZS 1906.3: 2017, Retroreflective materials and devices for road traffic control purposes - Part 3: Raised pavement markers (retroreflective and non-retroreflective).
- (c) Standards New Zealand NZS ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories.

Note: Readers must comply with the most current publication of the document being referenced.

3 SCOPE

This specification covers the requirements that Manufacturers and Suppliers must comply with before Retroreflective and non-Retroreflective Raised Pavement Markers³ that are to be bonded directly to the road surface can be granted *Provisional* and *Type Acceptance* by Waka Kotahi thereby authorising their use on the New Zealand State Highway network. This revision also incorporates the previous NZTA M12 *Notes to the specification for raised pavement markers*, NZTA P14 *Specification for the installation of RPMs* (Section 10) and NZTA P14 *Notes to the specification for the installation of RPMs*. The listing of accepted raised pavement markers previously included within NZTA M12 *Notes* is now published as NZTA M12-L *Listing of accepted RPMs*.

Readers should also be familiar with and or have knowledge of:

- (a) Traffic Control Devices Manual Part 4 Traffic control devices for general use – at intersections
- (b) Traffic Control Devices Manual Part 5 Traffic control devices for general use - between intersections.
- (c) AS/NZS 1906.3 because this joint Australia and New Zealand Standard is the major supporting document for NZTA M12
- (d) NZTA T18 (Clause 2.1 (d) above) because this Specification describes technical, testing and certification requirements for temperature controlled raised pavement marker heaters to be used for work in compliance with Appendix D herein Specification for Raised Pavement Marker Installation
- (e) NZTA SM032 (Clause 2.1 (g) and (h) above) Network Outcomes Contract (NOC) documents Volume 3 Basis of payment and Volume 4 Maintenance specification

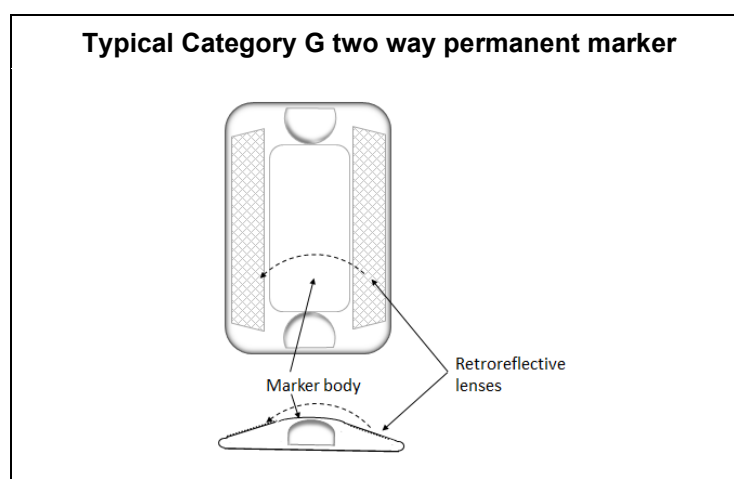


Figure 1: Retroreflective Raised Pavement Marker (RRPM)

The associated M12-L *Listing of Accepted RPMs* confirms those markers that have gained *Provisional Acceptance* after being tested at a Waka Kotahi accepted testing laboratory and *Type Acceptance* status after the outcome of the *Performance Field Test* as detailed by NZTA M12-F *Field Test for raised pavement markers*.

Note: Recognising a potential for the future installation of internationally available snow plowable and traffic detector markers, a maximum dimension of 180mm x 230mm will be restricted to these specialist markers providing height does not exceed 25mm.

³ Hereafter retroreflective raised pavement markers may be referred to as RRPMs or markers, non-retroreflective raised pavement markers as RPMs

4 DEFINITIONS

- (a) Flexural strength: Refers to the actual marker body being able to afford some bending deformity caused, typically, by heavy traffic that causes the road surface to deflect as a wave formed immediately in front of the tyre
- (b) Marker body: Refers to the actual physical moulding that is adhered to the road surface (Figure 1)
- (c) Marker lens: Refers to the actual strip of retroreflective material added to the face of a marker body designed to return vehicle headlights back to the motorist (Figure 1)
- (d) May: Term used to indicate something that is optional and may be considered for use
- (e) mcd/lx: Millicandela per lux – a measurement of retroreflectivity 'R'
- (f) Must: Term used to indicate something that is mandatory or required by law
- (g) Retroreflective: Describes a material or device that reflects light back to the light source being distinct from simple mirror reflection that beams light away from a light source in an equal but opposite direction to its direction of input
- (h) RCA: Road Controlling Authority. Roading authority responsible for the maintenance and management of the road in any specific region
- (i) RPM: A non-retroreflective raised pavement marker. Category 'D' markers such as ceramic domes.
- (j) RRPM: A raised pavement marker that includes a retroreflective lens in either one or two sides, hence retroreflective raised pavement marker
- (k) Shall: Term used to indicate something that is mandatory or required by law
- (l) Should: Term used to indicate a recommendation based on industry best practice
- (m) Specification: In this set of documents, the word "Specification" shall be interpreted as referring to NZTA M12-S: *Specification for Raised Pavement Markers*
- (n) Standard: In this specification the word "Standard" shall be interpreted as a Waka Kotahi approved national or international document that has been published by a recognised Standards organisation being used to provide a means of compliance with this specification. Standards must be identified by their Standards organisation and number, e.g. AS/NZS 1906.3.
- (o) Suitable for purpose (Suitability): A statement of overall daytime appearance and nighttime retroreflective performance referred to as being *Suitable for Purpose* is not a finite measurement but recognises that the degree of day and night visibility is deemed to be sufficient for a driver to view a marker and act in a safe manner, relative to the markers purpose.
- (p) Supplier: The entity, sometimes the actual manufacturer, that supplies the raised pavement marker to the installing contractor
- (q) Symbol 'R': Coefficient of retroreflection expressed in mcd/lx: the quotient of the coefficient of luminous intensity (CIL) of a plane retroreflecting surface and its area
- (r) Test Summary Certificate: The *Test Summary Certificate* is an abbreviated test report or cover page, issued by the testing laboratory, which summarises the results for each test completed. See clause 10: Appendix A: Test Summary Certificate.
- (s) Test Manager: The *Test Manager* is an individual employed by a Waka Kotahi approved organisation exhibiting knowledge and experience in the establishment of raised pavement marker programmes.

5 PROCESS

5.1 General

Waka Kotahi requires retroreflective, non-retroreflective and temporary raised pavements markers to be tested and confirmed compliant with AS/NZS 1906.3 before they can be applied to the New Zealand State Highway network. Refer to clause 8 *Marker Installation* herein.

A successful test must be completed before raised pavement markers are accepted for use on the New Zealand roading network. Raised pavement markers must initially obtain *Provisional Acceptance* (see Clause 7.3 below) in order to permit a *Field Test* to commence.

Ultimate *Type Acceptance* is conditional on a successful field test being completed and compliance with this specification demonstrated (see clause 7.4 below).

The sample selection of markers for the field testing and the methodology used for the field testing of pavement markers has been changed quite considerably with this revision of NZTA M12.

Provisional Acceptance permits the commencement of an on-road *Field Test* for the white marker plus an outdoor weathering exposure test for coloured (including white) markers as detailed in clause 7.4. Each of these tests are to be undertaken at designated sites, approved by Waka Kotahi, using the prescribed test worksheet templates specified in NZTA M12-F *Field Test for RPMs* and available in an editable format as NZTA M12-C *Certificates Worksheets for RPMs*. A successful *Field Test* results in a marker being awarded *Type Acceptance* which approves the marker for general use on the New Zealand roading network.

Provisional and *Type Acceptance* is confirmed in writing followed by inclusion in NZTA M12-L *Listing of Accepted Raised Pavement Markers*.

Markers will only be approved for the marker body and lens colour combinations that are approved for installation on the New Zealand roading network as specified in the TCD Manual Part 4 “*at intersections*” and Part 5 “*between intersections*”.

5.2 Pre-Introduction Planning requirement

Marker Manufacturers or suppliers are strongly advised to contact Auckland System Management, Waka Kotahi, Auckland, as soon as a decision is made to submit markers for AS/NZS 1906.3 laboratory testing.

In-field testing of pavement markers is typically completed on the Auckland motorway network where early notice is strongly recommended in order to co-ordinate marker field testing installations with other planned maintenance projects and or motorway closures.

6 MARKER CLASSIFICATION

Classification of markers is according to the following clauses in AS/NZS 1906.3, Section 2:

Category I.D. Code*	Matching description examples	Superseded I.D. Code
D-W Marker	<u>Daytime</u> colour non-retroreflective (frequently ceramic) <u>White</u> marker body (White is the only permitted colour)	B-W
G-A1-W Marker	<u>General</u> (day/night) retroreflective with daytime coloured body Class <u>A</u> retroreflective marker Type <u>1</u> One-way retroreflective lens <u>White</u> marker body, with <u>White</u> retroreflective lens	A-W
G-A2-W* Marker	<u>General</u> (day/night) retroreflective with daytime coloured body Class <u>A</u> retroreflective marker Type <u>2</u> Two-way retroreflective lens <u>White</u> marker body, with <u>White</u> retroreflective lenses	A-W
G-B2-W* Marker	<u>General</u> (day/night) retroreflective with daytime coloured body Class <u>B</u> retroreflective marker Type <u>2</u> Two-way retroreflective lens <u>White</u> marker body with <u>White</u> retroreflective lenses	A-WW
G-C3-YW** Marker	<u>General</u> (day/night) retroreflective with daytime coloured body Class <u>C</u> retroreflective marker Type <u>3</u> Two-way retroreflective lens two colours, <u>Yellow</u> marker body with <u>Yellow</u> and <u>White</u> lens colours	A-YW
* Single colour in code used when marker body and lens colour are the same. ** When two retroreflective colours are noted the first colour must also indicate the marker body colour.		

Table 1: Raised Pavement Markers classification coding examples

- (a) Clause 2.1 Categories – Day; Night and General (day and night; colour and retroreflective)
- (b) Clause 2.2 Retroreflective Class of marker – Class A, B or C

- (c) Clause 2.3 Types of Marker – One way, two way one colour and two way two colour
- (d) Clause 2.4.1 Abrasion Resistance – Glass faced or acrylic coating
- (e) Clause 2.4.2 Flexural Strength – absorbs some pavement movement from heavy transport
- (f) Clause 2.5.1 Colour of Markers – both Lenses and marker body

Marker body construction will be either solid plastic or consist of a plastic shell that is filled with a resin filler material.

7 MARKER ACCEPTANCE

7.1 Test documentation

Waka Kotahi recognises that testing laboratories provide their clients with a full and detailed test report for all tests completed. This detailed test report includes potentially confidential data and some highly complex results that can be difficult for a lay person to understand and adjudge.

For this reason, this specification requests that the testing laboratory complete the appropriate *Test Summary Certificate* (M12-C *Certificates Worksheets for RPMs*) using information from their clients detailed test report. After being signed, copies of the *Test Summary Certificate* are issued in PDF format to the manufacturer or marker supplier. A *Test Summary Certificate* template is designed for Permanent Raised Pavement Markers and a second version for Temporary Pavement Markers.

The marker manufacturer or supplier must then submit an original of this *Test Summary Certificate* in PDF format to Waka Kotahi. Waka Kotahi will not require the detailed test report to be provided unless this report is required for a specific purpose at which time Waka Kotahi reserves the right to request the report.

An accepted testing laboratory may not be responsible for or commissioned for all the tests required. In such instances the test laboratory completes the *Test Summary Certificate* for those tests but must enter “Not Tested” for all tests not completed prior to signing the *Test Summary Certificate*.

The *Test Summary Certificate* will not include actual performance results. It is designed to confirm only that each test listed has achieved either a *Pass* or *Uncertain* or *Not Tested* result enabling non-technical personnel to correctly record the manufacturers or supplier’s application for marker acceptance.

Each *Test Summary Certificate* may include only one marker series. Colours may be included only if all colours have been subjected to the same tests and have the same “*Pass*” or “*Uncertain*” or “*Not Tested*” result⁴.

For example, if four of five colours pass all tests but the fifth requires retesting for a specific test(s), the four passing colours can become a *Test Summary Certificate* with the fifth colour becoming a certificate on its own at a later date.

Subsequent to performing each individual test, the test laboratory is required to:

- (a) Confirm the result has passed the minimum performance requirements
- (b) Register a Pass or Uncertain or Not Tested or Not Applicable result in the Test Summary Certificate

The *Test Summary Certificate* must be signed and dated by the testing laboratory technician who completed the testing process and be approved by an authorised Laboratory Manager before being issued to the client as an original PDF format document.

At this point *Provisional Acceptance* permits a *Performance Field Test* to be initiated. This test should be commenced within six (6) months of the date of *Provisional Acceptance* and be managed by a Waka Kotahi approved *Test Manager* (refer NZTA M12-F *Field Test*) who exhibits knowledge in the installation of Raised Pavement Markers.

After the *Field Test* is completed the *Test Manager*⁵ will issue the resultant *Type Accepted Certificate* as a signed PDF document (NZTA M12-F *Field Test* and M12-C *Certificates Worksheets for RPMs*). Waka Kotahi will not accept any “changed”, “updated” or “altered” *Type Accepted Certificates*.

⁴ Appendix D AS/NZS 1906.3:2017 *Application of uncertainty of measurement* explains the protocol by which a testing laboratory is able to declare a “pass” result or issue a “fail” result subsequent to completing a specific test. It also explains the “uncertain” result, a situation where a result may be within the accuracy of the laboratory equipment and operating procedure. In such instance Waka Kotahi recognises that such a result is close to compliance and because of this Waka Kotahi will typically accept an uncertain outcome as a pass.

7.2 Test Procedure

Marker manufacturers (or suppliers) are required to obtain the following:

- (a) *Provisional Acceptance*: which is awarded by Waka Kotahi after receiving a *Test Summary Certificate(s)* to confirm from laboratory testing that the markers comply with AS/NZS 1906.3 and
- (b) *Type Acceptance*: follows *Provisional Acceptance* and is awarded upon the successful completion of a *Field Test* as outlined in NZTA M12-F *Field test for raised pavement markers*.

The marker (or marker range if more than one marker colour is included) must be specified as outlined in clause 6 herein together with the manufacturers name including any specific identity code such as series number with model number and or letters.

Marker body colours and lens colour variations approved for use on New Zealand roads shall comply with Traffic Control Devices Manual Part 5 and/or Appendix C herein.

To gain acceptance, manufacturers must comply with the process outlined herein and accept the expense of testing and reporting. All confirmations of compliance with AS/NZS 1906.3 testing shall be carried out by a laboratory accredited to NZS ISO/IEC 17025 for the specific tests or be an independent testing laboratory accepted by Waka Kotahi⁶.

Confirmation of actual marker compliance with AS/NZS 1906.3 shall be by way of a "*Test Summary Certificate*" signed by and issued by the independent testing laboratory in PDF Format. This *Test Summary Certificate* is not required to be endorsed as compliant with NZS ISO/IEC 17025. However, all testing shall be carried out in accordance with the laboratory's terms of accreditation.

The outcome of all tests completed must register a "*Pass*", "*Uncertain*" or "*Not Tested*" result for each individual test on the *Test Summary Certificate*. This certificate must be issued by the approved testing laboratory signed by an approved signatory. If multiple test results are adjudged "*Uncertain*" Waka Kotahi reserves the right to reject the results and require further supporting evidence of compliance before considering awarding *Provisional Acceptance*.

The *Test Summary Certificate* may include test results for more than one colour only if each individual colour noted has the exact same test results. Waka Kotahi will not accept detailed laboratory test reports on their own where Waka Kotahi staff may be required to adjudge actual compliance.

The detailed laboratory test reports need not be attached to the *Test Summary Certificate* but must be provided to Waka Kotahi if requested. Such detailed test reports shall carry the endorsement of the laboratory accreditation agency (i.e. such as IANZ endorsement).

7.3 Provisional Acceptance

Upon receipt of a *Test Summary Certificate* confirming compliance to AS/NZS 1906.3 Waka Kotahi will award *Provisional Acceptance* for the marker, including any coloured markers and non-retroreflective markers requested that also qualify in the specific range noted.

Manufacturers must attest that any coloured markers to be included with the white marker differ only by the colour of the marker body and lens. No other physical differences may exist. Coloured markers submitted for the outdoor weathering trial must be two-way examples and feature the same body and lens technology.

Waka Kotahi will accept that confirmation of compliance for the retroreflective markers and the matching lens colour will also include compliance for other marker body colour/lens colour configurations such as but not limited to yellow marker body with a white lens.

The *Test Summary Certificate* must additionally show the retroreflective performance value for the white lens, white marker body at observation angle $\alpha = 1.05^\circ \pm 0.05^\circ$, vertical entrance angle $\beta_1 = -1.24^\circ$ and horizontal entrance angle $\beta_2 = 0^\circ$ in order to facilitate the option for periodic in field assessments of raised pavement marker performance using a vehicle mounted retroreflectometer.

Provisional Acceptance will only become effective after being confirmed in writing followed by inclusion in NZTA M12 *Listing of Accepted RPMs*.

⁵ Typically but not necessarily this will be an Independent Consultancy specialising in road management, traffic safety and pavement markings. Hereafter referred to as the *Test Manager*. The infield measurement technician will be appointed by the *Test Manager*. Approval for both functions is to be confirmed by Waka Kotahi NZ Transport Agency.

⁶ Hereafter referred to as an approved testing laboratory.

Provisional Acceptance permits the commencement of up to three *Performance Field Tests*⁷, as specified in NZTA M12-F *Field Test for EMPs*, including assessments that must be completed using the required test worksheets introduced in NZTA M12-C *Certificate and Worksheet Templates for EMPs*.

Provisional Acceptance will be for twelve (12) months, but this may be extended to allow completion of a *Field Test* which will be at the manufacturers or suppliers expense and will be undertaken at a designated site approved by Waka Kotahi typically located on the Auckland motorway network but excluding the central motorway interchange (locally known as Spaghetti Junction and the South Western motorway tunnel). The tests are designed to confirm the performance and durability of the marker in New Zealand weather conditions and on the New Zealand roading network.

After a favourable conclusion at the completion of a *First Assessment* of the *Field Test* programme a marker manufacturer or supplier may request a second test site be established to act as backup against unforeseen circumstances rendering the first test site unusable.

7.4 Performance Field Test

7.4.1 Permanent markers

The test methodology for permanent markers will include an on-road test as specified in M12-F *Field Test for RPMs* for the white marker. It must be twelve (12) months duration and commenced no later than six (6) months after *Provisional Acceptance* is awarded.

7.4.2 White marker

The white marker on-road test is designed to prove the suitability, performance and durability of the physical properties of the marker body, using white to represent all colours, and the performance of the white retroreflective lens, representing all lens colours applied for.

Although the white marker test site will typically be located within the Auckland motorway network an alternative site may be approved by, or selected by, Waka Kotahi if circumstances require. Test sites will, as accurately as possible, represent similar road conditions, traffic volumes including heavy traffic percentages, road surfaces plus vertical and horizontal road geometry in order to treat each marker test as consistently as possible.

The white on-road marker test will:

- (a) Be a multi-lane divided motorway unless an alternative site is selected by Waka Kotahi
- (b) Be asphalt surfacing in good condition that should be at least 12 months old
- (c) Be installed on the lane line separating the extreme left lane (typically referred to as the “slow” lane) from the lane to the immediate right⁸
- (d) It should exclude any exit and entry ramps, splitter lanes and lane merges
- (e) Have typical daily traffic between 30,000 to 60,000 (AADT one way)
- (f) Have daily heavy vehicle flow approximately 3%
- (g) Be relatively free of any major entries and exits
- (h) Be coordinated with planned maintenance activities
- (i) Have typical motorway horizontal geometry.

When located on the Auckland motorway network the set out will harmonise with the current motorway configuration which, as at publication, has lane line markers installed in “sets” of four with each individual marker within the set spaced at 1.0m intervals. The test marker will be positioned either as the first marker in the set of four (in the direction of travel) or as a fifth marker set 1.0m in advance of the established set of four – thereby making a set of five (Figure 2).

The specified white test marker for field installation will be a general category, retroreflective Class C⁹, one-way, white marker body with white lens (Category G-C1-W) or on limited occasions a non-retroreflective white marker (Category D-W).

⁷ A second and maybe third Field Test may be permitted to insure against a test installation being damaged by an unforecast occurrence. If two or three Field Test installations are undertaken the first must be used if it remains undamaged.

⁸ The lane line selected must be a through lane

7.4.3 Coloured marker

All coloured markers, including the colour white, requested for inclusion in the test will be subjected to an outdoor weathering *Field Test* of twelve (12) months duration (outdoor exposure approximately 7,000 MJ/m²) designed to test marker body and lens colour durability. These markers will be a general category retroreflective Class C (or B) two way marker where lens and marker body are the same colour.

This colour marker exposure test may be managed and completed at the Allunga Exposure Laboratory site in north Queensland Australia or if requested by the *Test Manager*, at an alternative Waka Kotahi accepted site in New Zealand.

On-road retroreflective testing will be completed using a handheld retroreflectometer operated by a Waka Kotahi accepted agent using a fully calibrated retroreflectometer designed specifically for the testing of retroreflective raised pavement markers.

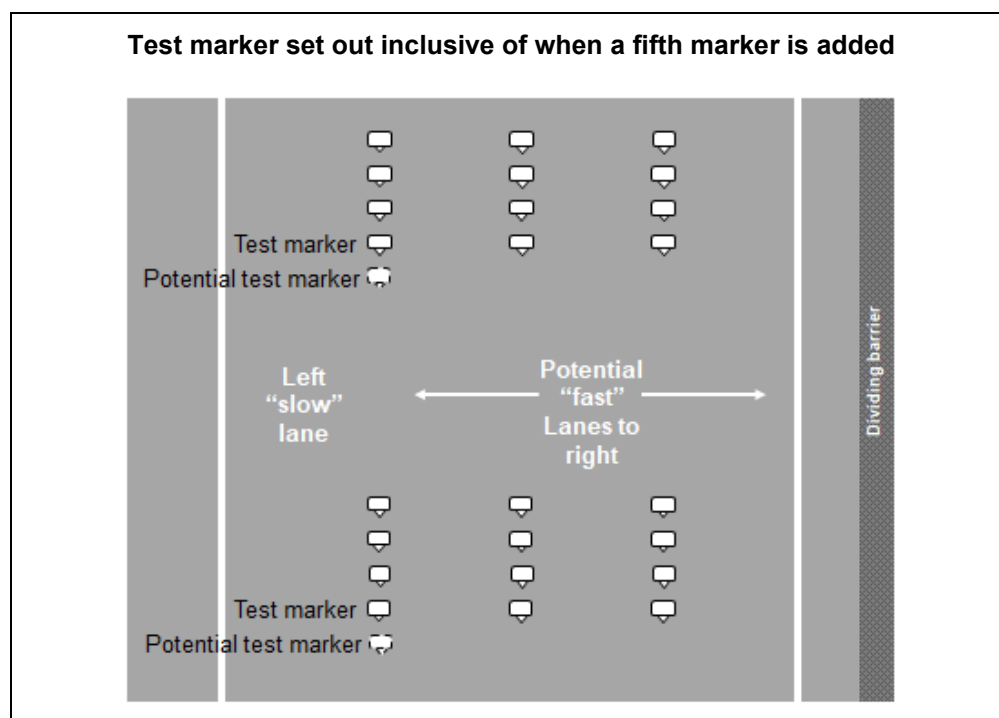


Figure 2: Test Marker Placement Alternatives

Prior to the commencement of the field test Waka Kotahi will require:

- (a) Coordination with and confirmation of site approval by Waka Kotahi (contact pavements@nzta.govt.nz) and the local Network Manager
- (b) Commencement date of the trial
- (c) Confirmation of adhesive to be used for the on road white marker testing.

During the on-road white marker *Field Test* programme, Waka Kotahi requires:

- (d) Confirmation to Waka Kotahi of test status after completion of the first assessment
- (e) Confirmation of test status after completion of the second assessment
- (f) Confirmation of *Field Test* completion after twelve (12) months prior to the completion of final retroreflective testing results.

Coordination and approval for a specific TTM plan when retroreflective pavement marker testing will be completed. (This can be forecast at the commencement of the test in order to harmonise with other routine motorway maintenance)

⁹ Example noted here refers to Class C as the retroreflective performance – test marker Class must be confirmed as Class B or C. Testing for Class A retroreflective performance may be tested in a different location.

7.4.4 Temporary Raised Pavement Markers (TRPMs)

Temporary raised pavement markers, either T_F (Temporary F-profile flat profile closely matches a standard RPM shape) or T_L (Temporary L-profile as shown in Figure 3) must confirm compliance with AS/NZS 1906.3 but are not required to undergo formal field testing.

The 1906.3 Standard defines the " T_L " TRPM dimensions as Height 55 ± 5 mm; Width 100 ± 5 mm¹⁰; Base 25 ± 5 mm. The " T_F " TRPM typically resembles and must meet the dimensions of a standard permanent marker that is installed flat on the roads surface. In both instances they must satisfy the contractor as to its suitability for purpose such that it will meet the requirements of the site where it is installed.

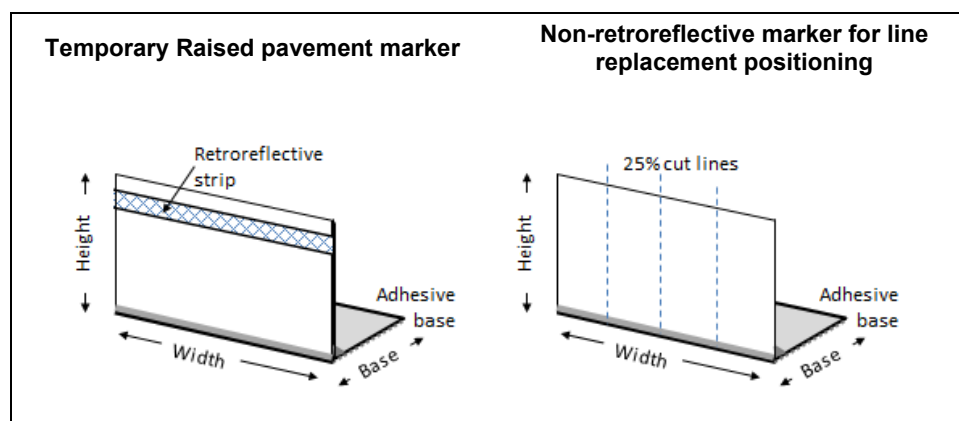


Figure 3: Temporary "L" profile markers. 100 or 150mm wide markers may be cut to create line re-marking position indicators

If the T_L temporary marker is installed to provide lane or centreline delineation it must exhibit a minimum of Class B retroreflective and be used without modification. If being used to indicate line position for remarking, a non-retroreflective " T_L " profile (T_L) marker, frequently referred to as a "stick and stomp" or "flickie" may be installed reduced in width to, or as a made for purpose marker, at 25 ± 3 mm.

7.5 Type Acceptance

Upon finalising confirmation of the successful completion of:

- (a) The on-road test of the white one way marker and
- (b) The outdoor exposure test of the two way marker colours including white

The *Test Manager* may seek Waka Kotahi *Type Acceptance* status for the markers by completing the *Certificate of Type Acceptance*. (NZTA M12-F *Field Test for RPMs*; and NZTA M12-C *Certificate and Worksheet Templates for RPMs* where editable worksheets and certificates are available).

Two original PDF copies will be required for the manufacturer, one of which must be filed with Waka Kotahi. *Type Acceptance* permits the markers to be installed on asphalt and chip seal roads throughout the New Zealand roading network.

Type Acceptance status becomes effective only after confirmation in writing from Waka Kotahi followed by inclusion in NZTA M12-L: *Listing of Accepted Raised Pavement Markers*.

Final *Type Acceptance* of the colours tested will also recognise additional marker lens/body colour combinations such as a yellow marker body with a white lens. Waka Kotahi will not require individual testing of the alternative body colour lens colour configurations. However colours and configurations will only be *Type Accepted* in accordance with the colours that are permitted in the TCD Manual Part 4 and Part 5

7.5.1 Continuance of Acceptance

Providing no changes are made to the marker, or to the manufacturing methodology, or country of origin, the marker may continue to be accepted by Waka Kotahi for a period of up to seven (7) years.

¹⁰ At time of publishing NZTA M12 it became apparent that 150mm (6 inch) line marking may in future become more commonplace in order to improve safety and potentially to accommodate machine type vision of lines for Advanced Driver-Assistance Systems. When line widths are 150mm (6 inch) the T_L marker may match the line width.

Prior to the expiration of the seven (7) years the marker Manufacturer or Supplier must initiate a meeting with Waka Kotahi (contact pavements@nzta.govt.nz) for a renewal of *Type Acceptance*.

Upon receiving written confirmation from the manufacturer or supplier that:

- (a) no changes have been undertaken to the manufacture of the marker and
- (b) no amendments or revisions to the AS/NZS 1906.3 Standard have ensued, and
- (c) Waka Kotahi considers the markers in-service performance to be satisfactory throughout the current *Type Acceptance* period, then
- (d) *Type Acceptance* may be renewed for an additional period of up to seven (7) years at the sole discretion of Waka Kotahi.

However, if Waka Kotahi has concerns regarding marker performance the marker may be required to be re-tested for compliance with this specification before *Type Acceptance* status can be extended.

If an amendment is published for the AS/NZS 1906.3 Standard that increases any performance requirement, the marker must be retested to this amendment. An appropriate time period will be awarded for this testing. If any amendment reduces such performance, retesting is not required. In either instance the markers may not require subsequent on-road or outdoor exposure re-testing.

If a manufacturer makes changes to the marker that could be considered to affect or alter previous test outcomes or changes the source or country of supply Waka Kotahi must be informed and subsequently, Waka Kotahi reserves the right to ask for renewed testing to be completed.

7.5.2 Addition to a current in-service marker range

If an additional marker (e.g. addition of a new body colour, new lens colour or an upgraded retroreflective lens performance) is to be introduced to a range or series currently in service that has been confirmed compliant with the AS/NZS 1906.3 Standard laboratory testing and the Manufacturer or Supplier declares, in writing, that the marker body and lens technology to be added exactly meets that of the range or series already tested and in service some testing may be cross complied.

Upon the approval of Waka Kotahi, the laboratory testing for the marker to be added may be limited to testing just the changed feature(s)¹¹. A copy of the *Test Summary Certificate* for the “marker currently in service” must be attached confirming previous testing and the new *Test Summary Certificate* will quote the supporting certificate number in the “Pass” column for any test not required for the new marker.

Limited in-service field testing may still be required for the added marker to ensure that lens and body durability can be confirmed.

- (a) White lens retroreflective performance or lens technology:

The Field Test; when adding a different white retroreflective lens performance or technology for a white marker body that is in current Type Accepted service, the test may be completed without a full formal *Field Test* being required upon the approval of Waka Kotahi.

After the laboratory testing *Test Summary Certificate* has confirmed the retroreflective performance (Clause 7.2 Procedure) this marker will be granted *Provisional Acceptance* for a maximum of three (3) installations of fifty (50) markers¹². At the completion of twelve (12) months in service the first site installed is to be used unless unforeseen circumstances have damaged the site¹³. At the qualifying installation the thirty (30) markers of the identified test fifty (50) – [minimum 45 remaining suitable for purpose] will be selected for in-field retroreflective testing to ensure that the retroreflective durability complies with Table 2 of clause 7.6 *Retroreflective durability* herein before *Type Acceptance* can be confirmed for the added marker.

- (b) Coloured lens retroreflective performance or lens technology:

The Field Test; when adding a different coloured retroreflective lens performance or technology (to the same body colour), where the white marker body and lens is in current Type Accepted service,

¹¹ A changed feature may require any or all of the following: Retroreflective performance; Chromaticity of daytime and retroreflected colour; UV exposure; Resistance to lens cracking; Abrasion resistance.

¹² If alternative site two or all three sites are consecutive the first 50 must be the first test site installed, the second 50 then the third 50.

¹³ If the first site cannot be used the second site can be selected or if damaged the third site. If the first site fails due to marker loss (max 5 markers) the second site may be selected. If this site fails due to marker loss then the test fails. If the first site is ruled out sites 2 and 3 are as for 1 and 2.

the test may be completed without a formal *Field Test* being required upon the approval of Waka Kotahi.

After the laboratory testing *Test Summary Certificate* has confirmed the retroreflective performance (Clause 7.2 *Test Procedure*) the coloured marker/lens will be granted *Provisional Acceptance for a period of twelve (12) months*.

During the twelve (12) months five (5) coloured sample markers with lens will be exposed, as specified, in an outdoor exposure M12-F *Field Test*, at a Waka Kotahi accepted outdoor weathering test site.

At the completion of twelve (12) months outdoor exposure the coloured retroreflective lens performance must comply with Table 2 of clause 7.6 herein and the colour must be deemed visually satisfactory before *Type Acceptance* can be confirmed.

- (c) Marker body and lens colour addition to an established white series:

The *Field Test*; when adding a new marker body and lens coloured marker to a white marker series that is in current Type Accepted service may be completed without a full *Field Test* being required upon the approval of Waka Kotahi.

After the laboratory testing *Test Summary Certificate* has confirmed the markers retroreflective performance and body colour (clause 7.2 *Test Procedure*) this marker will be granted *Provisional Acceptance for a period of twelve (12) months*.

During the twelve (12) months, five (5) coloured sample markers, body with lens, will be exposed, as specified in an outdoor exposure M12-F *Field Test*, at a Waka Kotahi accepted outdoor weathering test site.

At the completion of twelve (12) months outdoor exposure the coloured retroreflective lens performance must comply with Table 2 of clause 7.6 herein and the marker body with lens must be deemed visually satisfactory before *Type Acceptance* can be confirmed.

7.6 Retroreflective durability

At the completion of the white marker *Field Test*, the retroreflective performance of the white marker must be tested in field, as installed, using a hand held calibrated retroreflectometer to confirm that the markers have met the minimum retroreflective performance specified in Table 2.

Retroreflectivity of the white and coloured markers that have been at the outdoor weathering exposure site will be placed on a flat section of pavement next to the white installed markers and tested in the same manner as the white on-road tested markers using the same retroreflectometer.

Retroreflective Class	Min 'R' mcd/lx <i>On-road</i>	Approx % of New	Min 'R' mcd/lx <i>Outdoor exposure samples</i>					Approx % of New
	White		White	Yellow	Red	Green	Blue	
A	5.0	7.0	46	23.0	10.0	15.0	4.5	66.0
B	31.0	11.0	184	110.0	46.0	61.0	18.5	66.0
C	87.0	14.5	396	238.0	99.0	130.5	39.5	66.0

Table 2: Minimum marker retroreflectivity after field testing

Eighty per cent (80%) of the thirty (30) selected white markers installed on the road must exhibit a retroreflective performance no less than that shown in Table 2 when measured using the retroreflectometer at: $\alpha = 0.2 \pm 0.1^\circ$, $\beta_1 = -1.0 - 0.0^\circ$ and $\beta_2 = 0.0 \pm 0.1^\circ$.

Note: Some tolerance is given for minor on road variances that may exist.

Because the outdoor exposed markers have not been trafficked it should be accepted that their retained retroreflective performance will exhibit less deterioration than the white markers tested on the road. Additionally, all five sample markers for each colour must be no less than the percent (%) values in Table 2 above.

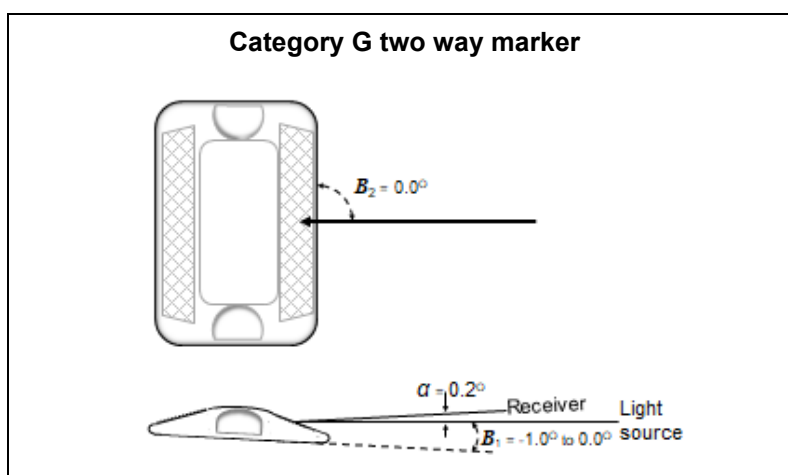


Figure 4: Retroreflectivity measurement geometry

7.7 Colour durability

At the completion of the outdoor weather testing, the marker body and retroreflective lens colour shall continue to exhibit an intensity of colour that is deemed suitable for purpose such that it is considered that the colour will readily be recognised as the colour intended in daylight and night time conditions.

When examined the retroreflective lens shall show no signs of cracking crazing or lifting.

8 MARKER INSTALLATION

TNZ P14:1995 *Specification for the installation of raised pavement markers* will be withdrawn on 31st May 2023 enabling time for markers currently in stock to be used and systems currently in force to be amended. As of 1st June 2023 all Raised Pavement Markers installed onto the New Zealand roading network will be required to demonstrate compliance with the AS/NZS 1906.3 Standard, NZTA M12-S *Specification for the design, manufacture, installation and maintenance of raised pavement markers* and NZTA M12-F *Field Test for RPMs*.

8.1 General

This section specifies the requirements that raised pavement marker installation contractors must comply with when installing Retroreflective and non-Retroreflective Raised Pavement Markers¹⁴ that are to be bonded directly to the road surface.

Waka Kotahi requires the Installation Contractor to ensure that retroreflective, non-retroreflective and temporary raised pavements markers have been confirmed compliant with this *Specification* before they can be applied to the New Zealand roading network.

The Installation Contractor is responsible for ensuring that any raised pavement markers being installed must have either *Provisional Acceptance* or *Type Acceptance* as required for the contract being completed.

Additional information relative to the use of RPMs and RRPMS is also available in the Traffic Control Devices Manual (TCD Manual) Part 4 “at intersections” and TCD Manual Part 5 “between intersections”.

8.2 Installation Definitions

The definition of any technical name or terminology used in this section can be found in Clause 4 Definitions herein. The reader is strongly advised to review these definitions.

¹⁴ Hereafter retroreflective raised pavement markers are referred to as RRPMS or markers; non-retroreflective raised pavement markers as RPMs

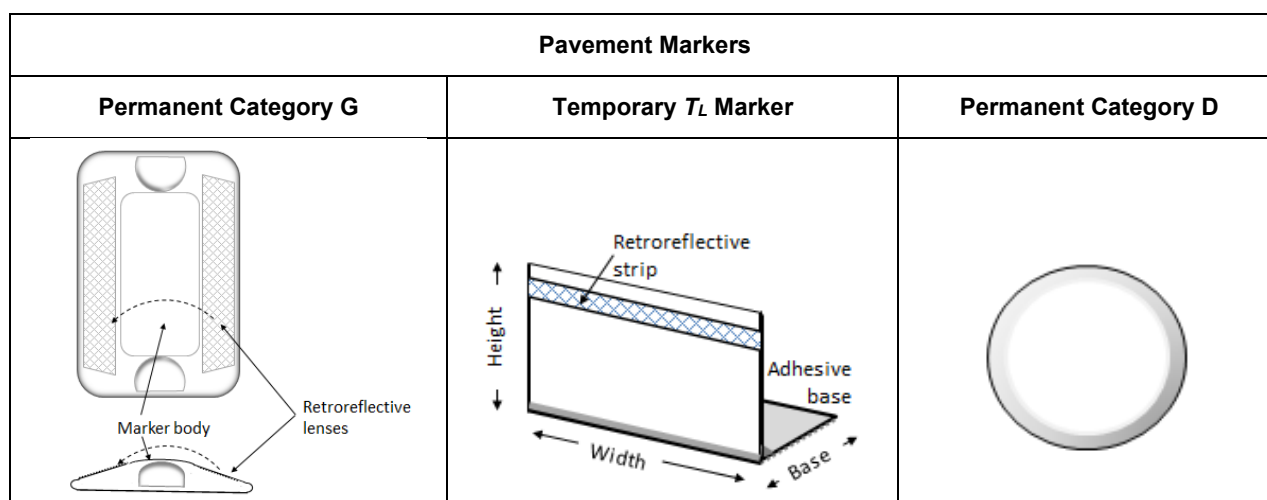


Figure 5: Raised Pavement Markers

8.3 Classification Summary

Classification of markers is according to the following clauses in AS/NZS 1906.3, Section 2:

- Categories – D=day colour only; N=night retro only G=General; day colour/night retroreflective
- Retroreflective Class of Marker – Class A (lowest), Class B or Class C (highest).
- Types of marker – 1=One way, 2=Two way or 3=Two way different lens colour each side
- Abrasion Resistance (AR) – lens has either glass (AR/G) or acrylic coating (AR/A) for lens durability
- Flexural Strength – flex absorption of wheel weight
- Colour of marker or lens, W=White; Y=Yellow; R=Red; B=Blue and G=Green

For further explanation refer to Table 1 Clause 6 herein showing examples of the new marker codes that should now appear in contract documents in conjunction with the relative marker description. For comparison the superseded code, also noted, should gradually be phased out of use.

Marker body construction can be either solid, typically a thermoplastic, or consist of a plastic shell that is filled with a separate resin filler material.

8.4 Marker set-out and tolerances

The set out arrangement of Category D (daytime only) and Category G (day colour/night retroreflective) markers should be as specified in the Traffic Control Devices Manual Part 4 *Traffic control devices for general use - at intersections* and Part 5 *Traffic control devices for general use - between intersections* <https://www.nzta.govt.nz/resources/traffic-control-devices-manual/>

Five types of set out are envisaged:

- Markers placed in conjunction with paint markings
- Markers placed without paint markings
- A motorway set out that installs markers in groups or sets of four.
- Full Contractor set out
- Full set out specified by the Road Controlling Authority (RCA) or their approved Engineer.

In all circumstances care must be exercised by checking that the set out regarding location or position on the road appears to be reasonable.

Each RCA should specify what circumstances constitute a raised pavement marker fail situation that will require the Contractor to action to remedy the situation. For example, five missing or heavily damaged markers in a placement of one hundred and/or five markers exhibit less than a minimum retroreflectivity of 5 mcd.

8.4.1 Markers Placed in Conjunction with Paint Markings

Where markers are to be placed in addition to normal paint markings the Contractor shall place the markers in relation to the paint markings.

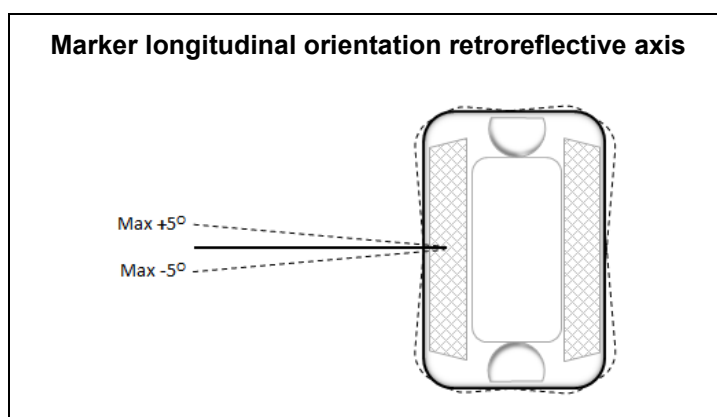


Figure 6: Retroreflective axis

- (a) For retroreflective markers the retroreflective axis shall be within 5° of the tangent to the line delineated (Figure 6)
- (b) Longitudinal position $\pm 300\text{mm}$ (Figure 7)
- (c) Transverse position when placed between continuous double lines $\pm 5\text{mm}$,
- (d) Transverse position when next to a continuous line $25\pm 5\text{mm}$ from the edge of the line,
- (e) Transverse position when not next to a line $\pm 20\text{mm}$ (Figure 7)

8.4.2 Markers Placed Without Paint Markings

Set-out should be according to the Traffic Control Devices Manual (TCD) Manual Part 4 or TCD Manual Part 5 or as specified by the RCA or their approved Engineer. In this case the tolerances shall be:

- (a) Longitudinal spacing between marker groups $\pm 300\text{mm}$ (Figure 7)
- (b) Transverse position $\pm 20\text{mm}$ relative to the apparent centre line (Figure 7)

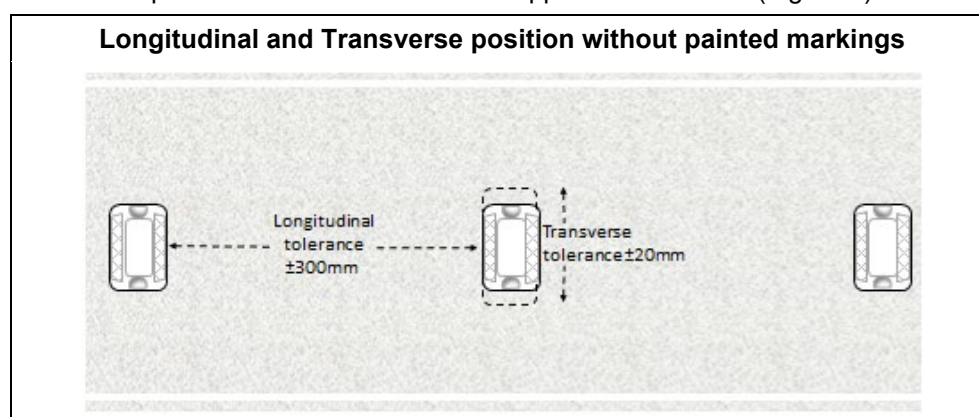


Figure 7: Longitudinal and Transverse position tolerance

- (c) For retroreflective markers the retroreflective axis shall be within 5° of the tangent to the line delineated (Figure 6)
- (d) All markers shall appear by eye to be straight or where designed as a curve to provide a smooth curve

8.4.3 Replacement markers

Unless specified otherwise, new raised pavement markers shall be placed in the same location as the previous markers, with minimal lineal or transverse variance (Clause 8.4.1 and Figure 6). The replacement position may vary as appropriate to avoid any potential pavement damage that could affect the adhesion durability of the replacement marker.

If the existing marker placement positioning is obviously incorrect, clarification shall be obtained from the Engineer before proceeding.

8.4.4 New Markers on new pavement, reseals and realignments

Where new markers are placed on freshly laid pavements instead of standard road marking (e.g. paint or thermoplastic etc), the Contractor shall set out all marker positions with paint spots, or other appropriate method, to ensure start, finish, spacing and orientation is defined using a detailed set out plan that includes spacing detail supplied by the Road Controlling Authority or the Engineer. The markings shall be placed along each line at not more than 20m intervals on straight sections and at 10m intervals on curve sections.

If there is no precedent for raised pavement marker position or location the Contractor will require the Engineer to provide pilot marks or the Contractor will install pilot marks as directed by the Engineer.

Before commencing the road surface shall be prepared according to the requirements of Clause 8.9.

8.4.5 Motorway set-out groups or sets of four

Where markers are to be placed in groups or sets of four, typically for placements on motorways, the spacing shall be:

- Longitudinal spacing between individual markers in a group $1000 \pm 100\text{mm}$ (Figure 8)
- Transverse position within the group of four markers $\pm 20\text{mm}$ (Figure 8)
- Longitudinal spacing between groups of four $7000 \pm 300\text{mm}$ (Figure 8)
- Retroreflective markers axis shall be within 5° of the tangent to the line delineated (Figure 6)

Overall completed look must ensure that the set out regarding location or position on the road appears to be reasonable within each group and that each group completes a reasonable alignment between groups.

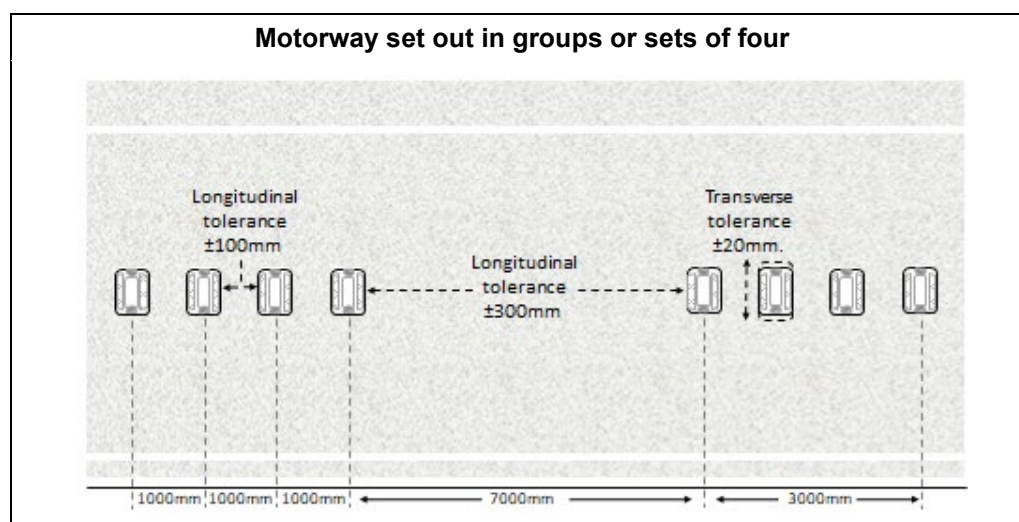


Figure 8: Transverse and Longitudinal position tolerance for markers

Note: In instances when a marker *Field Test* is being conducted, the motorway set out may require some sets of five markers because a test marker may be set immediately in front of the lead marker in the set of four.

8.4.6 Full contractor set-out

Raised pavement markers used instead of paint markings where the Contractor is required to provide all the set-out.

In this situation full plans of the set out must be provided by the Contractor as it is unacceptable for the contractor to make judgements on the alignment of the markers. Additional requirements on transverse position for the final location of all markers shall be within 50mm of the specified location and the line defined by the markers shall appear by eye to be straight or a true curve.

8.4.7 Road Controlling Authority specified special set out

In some instances, such as a marker *Field Test* set-out (Figure 1) or when a specific safety objective has been identified, the set-out required will be specified by the Road Controlling Authority (RCA) Engineer or their chosen Engineering Consultant¹⁵.

A safety objective could include a set out to be used on a curve or corner or number of corners that have a history of vehicles leaving the road such that a decrease in centreline and edge line marker spacing is to be trialled.

In such instances the RCA or Engineer must provide the contractor with a detailed set out plan that includes spacing detail. In such instances the Contractor shall place markers within ± 50 mm.

8.4.8 Non-conformance

Any markers placed outside the permitted tolerances shall be removed, the pavement repaired to the satisfaction of the Engineer, and a new marker installed in the correct location.

8.5 Markers

All markers shall have current *Type Acceptance*¹⁶ as specified herein and be listed in M12-L *Listing of Accepted markers*. This list of *Accepted* markers will be updated regularly as testing of new markers is completed and *Field Testing* is finalised.

Before commencing installation, the Contractor shall advise the Engineer in writing of the brand and classification (Clause 6 Table 1) of the marker to be installed. The brand and classification shall not be changed without written approval.

8.5.1 Marker body colour

Marker body colours must be limited to the colours approved in the TCD Manual Part 4 or Part 5.

Typically Category G markers with one way or two way white retroreflective lenses will have a white body colour just as Category G markers with one way or two way yellow retroreflective lenses will typically have a yellow marker body colour.

Category G two way markers with a different retroreflective lens colour on each side must have a body colour corresponding to one of the retroreflective lens colours.

In special circumstances where a marker body is made of aluminium no colour will be specified

8.5.2 Retroreflective lens performance

At the time of tender the Contractor shall confirm the retroreflective performance Class of the marker lens or lenses confirming Class A, Class B or Class C and the Type (1=one way, 2=two way or 3=two way two colour) if the RCA instructions fail to so specify.

8.6 Adhesive

The adhesive used can be a large proportion of the cost of an installed marker therefore it is necessary for the Contractor to ensure that an adhesive to be used in any tender meets the approval of the marker manufacturer especially if this is limited to the use of an epoxy system.

At time of tender the Contractor shall provide:

- (a) Written details of the adhesive proposed for fixing the markers to the pavement surface together with the method of handling, mixing, application and other relevant procedures; and
- (b) Written confirmation from the adhesive manufacturer that it is suitable for long term fixing of markers to road pavements.

Should an adhesive prove clearly unacceptable for long term fixing of markers to a pavement surface the Engineer may withdraw the approval and require the Contractor to obtain approval for an alternative adhesive with a proven record of use.

¹⁵ Hereafter referred to as the Engineer

¹⁶ Unless being installed in an authorised Field Test

The adhesive and method of use shall not be changed without the written approval of the Engineer.

8.6.1 Marker adhesive heaters

The heater shall be equipped such that it is compliant with the requirements of NZTA T18 and all relevant New Zealand legislation and be capable of consistently achieving all of the required heating requirements without adversely affecting the performance of the material being heated.

While the NZTA T18 specification describes the process of validation of the raised pavement marker adhesive heaters it does not discharge the legal obligations of the owner/operator to maintain and operate it in compliance with New Zealand Law.

The marker installation contractor must be fully aware of and in compliance with the NZTA T18 Specification.

8.7 Supply of labour plant and materials

The Contractor shall provide and maintain all plant and equipment required in order 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.

This shall also include the responsibility to operate and maintain a marker adhesive heater in compliance with NZTA T18.

8.8 Traffic control

At all times during the installation of markers included in this specification, the Contractor shall take responsibility to ensure all traffic control is carried out in accordance with current Waka Kotahi guidelines and specifications for traffic safety¹⁷

8.9 Preparation of road surface

Unless otherwise specified, or where markers are to be placed on new chip seal, it will be the Engineers responsibility to have any accumulations of coarse material removed from the site. All remaining loose material shall be removed by the Contractor before fixing the marker to the road surface. No markers shall be installed on a wet or frosty surface.

8.10 Fixing markers to the road surface

The following requirements shall be met:

- (a) Any voids in the base of the marker shall be filled with adhesive before placing the marker on the road surface unless written approval has been obtained from the Engineer to an amended procedure. Generally the Engineer will require a written recommendation from the marker Manufacturer to justify the amended procedure;
- (b) Excess adhesive shall be placed on the marker or the road surface such that after placing the marker on the road surface the following requirements are met:
 - (i) there are no voids in the adhesive beneath the marker
 - (ii) a small bead of adhesive has exuded from the full perimeter of the marker base
- (c) Should the bead of adhesive required in rise above the base of the marker on any edge beneath reflective elements the excess adhesive shall be removed
- (d) Any adhesive on the body or lens of the marker shall be removed without damaging the marker
- (e) Where stem type markers are installed the hole to accommodate the stem shall be filled with the same adhesive used to fix the marker to the pavement.

¹⁷ At the time of publication of this revision the Code of Practice for Temporary Traffic Management (CoPTTM) was being reviewed to become the New Zealand Guide for Temporary Traffic Management in conjunction with other product specifications e.g. a new "M" series Specification for high visibility garments.

9 MAINTENANCE

This section on maintenance shall be read in conjunction with respect to the specific current maintenance contract document or any Maintenance Alliance contract specifications. Where either of these two maintenance contracts differ from M12 it is most likely that they will take precedence over M12.

9.1 Maintenance period

The M12 maintenance period shall be six (6) monthly for day and night surveys commencing:

- (a) For “special works” contracts of three (3) months or less the maintenance period will commence at completion of fixing all markers to the road
- (b) Where the contract period exceeds three (3) months the Contractor may apply to have the maintenance period commence on any completed section of marking at three (3) monthly intervals
- (c) Reference must also be made to the requirement in SM032 noted above clause 6.7.1.4 that requires a ten percent (10%) sample to be surveyed monthly
- (d) In some circumstances the contractor will be guided by the requirements of a Maintenance Alliance.

9.2 Retentions

Ten percent (10%) of the value of work completed for fixing markers to the pavement shall be retained until the completion of the maintenance period for all the markers.

9.3 Defect types

There shall be two categories of defective markers:

9.3.1 Minor Defects

Minor defects shall include a marker body that is cracked or a circumstance where the lens is damaged such that the retroreflective performance is noticeably lessened but remains visible at 160m on high beam or 80m on low beam.

Such defects will also include a situation where, although still adhered to the pavement, the marker has been moved out of alignment to such a degree that it no longer serves in line with other markers or when retroreflective performance, although present at 160m on high beam or 80m on low beam as above, is noticeably reduced.

9.3.2 Major Defects

If a marker is totally missing this shall be deemed a major defect. A marker that has sustained damage to the extent that the marker is determined to be a safety risk is also deemed a major defect.

A marker that has moved so that its location no longer meets the requirements for dimensional tolerances specified in an RCA contract will be included as a major defect. Another major defect will include a circumstance where physical damage has reduced night time retroreflective performance such that it can be adjudged as not being suitable for purpose. Network Outcomes Contracts require the retroreflectivity to be present at 160m on high beam or 80m on low beam.

9.4 Maintenance requirements

Defective markers identified during a Road Controlling Authority (RCA) signs and/or marking survey or noted by the Contractor shall be replaced with new markers per contract requirements.

A Contractor operating within some operational performance measures will be required to survey markers at six monthly intervals including night and respond according to the operational performance specifications.

A defective marker is one that is deemed by the relevant RCA to be unsuitable for purpose, either from physical damage or age, or a marker that has fallen below the terminal retroreflective value shown in Table 3.5 Clause 3.3.1.4 AS/NZS 1906.3¹⁸. Measurement can be taken if necessary using a portable hand held

¹⁸ *mcd* at Observation angle $\alpha = 0.2^\circ$ Entrance angle $\beta_1 = -0.25^\circ$ and $\beta_2 = 0^\circ$: White -5.0; Yellow-3.0; Red-1.5; Green-1.5; Blue 1.0

retroreflectometer in calibration, designed for the measurement of raised pavement markers and operated by a technician accepted by Waka Kotahi.

The maintenance period for all markers in any section shall be deemed to continue until seven (7) days after all defective markers have been replaced and the Engineer has been advised in writing. The Contractor shall also replace any markers that fail during this period of seven (7) days.

Where two (2) or more consecutive markers have a major defect they shall all be replaced within 72 hours of notification of the general location.

Where the Contractor can show that a whole marker with its adhesive and pavement has broken away due to a road substrate failure, then replacement shall be at the Engineer's expense.

9.5 Removal of markers from pavement surface

The removal of raised pavement markers should be completed in accordance with the NZRF RPM removal Guide. [Introduction and Need for the Code \(nzrf.co.nz\)](https://www.nzrf.co.nz/)

Marker removal may be required for a number of reasons including but not limited to:

- (a) A marker is damaged such that it may be a danger to road users
- (b) A resealing project is scheduled
- (c) Road marking is to be re-aligned

Defective markers may remain on the pavement subject to the following:

- (d) Up to 2 defective Category G (retroreflective) markers in sequence may remain in place at any location of Category G markers. Should a third Category G marker at any fail, all 3 markers shall be removed prior to placement of the new markers
- (e) Where a defective Category G two way marker requires replacement the new marker shall be placed 1.0 m from the first failed marker, along the line of the markers
- (f) Where a defective Category G one way marker requires replacement the new marker shall be placed immediately in front of the failed marker.

Where a Category D daytime marker (typically a ceramic dome) has failed the remains of the marker, if any, shall be removed and the new marker fixed in the same location.

Where marker removal may damage the marker itself and /or the road surface the removal should endeavour to damage the road surface as little as practicable. The immediate area of the removal must be left clean and without any remaining pieces of the marker or loose stones that could become a projectile.

9.6 Repair of pavement surface

Where a marker has been removed:

- (a) By the Contractor; or
- (b) By traffic during the maintenance period, or
- (c) Subsequent to a decision during a marker Field Test

The pavement shall be promptly repaired to the satisfaction of the Engineer. Requirements for pavement repair will include ensuring that the pavement is waterproof and that the filling of any hole is completed using a material similar to the parent pavement being compacted as is appropriate.

9.7 Periodic maintenance of existing markers

This section applies to markers in place before the current contract commenced or those for which the Installation Contractor's maintenance period has ended.

9.7.1 General

Isolated defective markers shall be replaced by the current installation Contractor or an RCA maintenance Contractor as directed by the Engineer. Maintenance activity and reaction times may differ between specific contracts in effect, but the Contractor must be aware of such requirements.

9.7.2 Completion time

Periodic maintenance of existing markers shall be completed according to the urgency allocated by the Engineer:

- (a) Normal periodic maintenance shall be completed within three (3) weeks of advice of the requirement
- (b) Urgent work shall be completed within 72 hours of advice of the requirement.

Note: Timing may vary between maintenance contracts.

9.8 Contract diary

The Contractor shall maintain a diary showing date, location, general weather condition, marker brand and type, number fixed, and adhesive used. Where all these factors are constant diary records may be aggregated for lengths up to 4.0 km.

This diary shall be submitted in support of Contractor's claims for payment and shall be available for checking at all times

9.9 Urgent work

Urgent work applies to that work which may be required for new surfacing or other requirements defined by the Engineer to be urgent. Urgent work shall be completed by the Contractor within 72 hours of:

- (a) Completion of the new surfacing other than loose chip surfacing; or
- (b) For chip seal sites this will be 72 hours after sweeping; or
- (c) The time of notification that urgent work is required.

For new surfacing the Engineer will notify the Contractor of the estimated time of the surfacing construction and again when the construction date is firmly known, although the second advice may be at the time the construction commences. On receipt of the firm notification the Contractor shall notify the Engineer of the location of his work site at that time.

Replacement of failed markers required under maintenance (Clause 9.5) shall not be considered urgent work for payment purposes.

9.10 Programme of work

- (a) All markers shall be installed progressively along the length of the road. Where the contract abuts existing raised pavement markers the installation shall commence at this location.
- (b) 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 of work to the Engineer before commencing work.

9.11 Failure to complete requirements on time

Should the Contractor:

- (a) Fail to complete maintenance requirements (Clause 9.4) by the required time; or
- (b) Fail to complete periodic maintenance (Clause 9.7) within the periods specified; or
- (c) Fail to complete urgent work (Clause 9.9) within the 72 hours specified; or
- (d) Fail to repair the pavement surface promptly then the Engineer may have the work carried out by others and deduct the cost from payments due to the Contractor.

9.12 Basis of payment

This section on maintenance shall be read in conjunction with NZTA SM032 *Network Outcomes Contract* Volume 3 *Basis of payment* or with respect to any specific maintenance contract where the basis of payment may differ.

Historically the basis of payment rate stated "shall be per marker installed for each type of marker". Unit rates will be in full compensation for supplying all labour, plant and materials necessary to install and maintain the markers and repair the pavement surface if required.

For periodic maintenance of existing markers or urgent work an allowance for travel will be paid as detailed below. For all other work the unit rate shall include allowance for travel costs. The unit rate shall also include allowance for all such items as overheads and contingencies.

Contractors should be aware of alternative basis for payment that may exist and be guided by the requirements set out in these documents.

9.12.1 Travel

For periodic maintenance or urgent work an allowance for travel shall be paid on the whole distance in kilometres in addition to the unit rate for installation of the markers.

The amount paid shall be calculated on the distance travelled within the contract area by the shortest route from the current work site to the site of the markers requiring installation and return to the original work site.

9.12.2 Extra payment for urgent work

Payment will be made for each parcel of urgent work required. A parcel of urgent work may include several work sites. No payment will be made unless all the work in the parcel is completed within the required 72 hours. No time extension will be given for unsuitable weather if the road surface is suitable for installation of the markers for eight hours during the period of 72 hours without the Road Controlling Authorities express approval.

10 APPENDIX A: TEST SUMMARY CERTIFICATE

The *Test Summary Certificate* (Figure 9) is designed to enable a testing laboratory to provide a “cover page” that summarises the results for each test completed. This makes the report to Waka Kotahi easier to understand while maintaining the confidentiality of the manufacturer’s detailed report. A specific *Test Summary Certificate* is designed for Permanent Retroreflective and Non-retroreflective Raised Pavement Markers. Care must be taken to ensure that the markers is accurately and completely identified

The *Test Summary Certificate* templates are available to download from the Waka Kotahi website as NZTA M12-C *Certificate and Worksheet Templates for RPMs*. (Refer to hyperlink in Clause 2 Related Documents)

AS/NZS 1906.3 Test Summary Certificate			
Permanent Raised Pavement markers		Retroreflective Permanent	✓ → ✓
		Non-retroreflective Permanent	✓ →
Testing Laboratory	Reliable Materials Testing Limited	Address	14 Some Street East Markerton, Wellington
		Telephone	+64 4 123 4567
Test Laboratory Report Numbers	GC2180-20	Test Summary Certificate Number	20.5-2180A
		Certificate Date	30 May 2022
Client Name and Brief Address	Anon Markers Limited, 384 Marker Street, Somewhereon, Wellington		
Marker(s) Tested: Brand, Series ID, Category Retroreflective Class, Added Features	ANON Brand 2180 Series marker Category G Class C marker with glass abrasion resistant lens		
Test Colours: Body and Retro colour combinations ID	White Body, White lens, Yellow Body, Yellow lens Red Body, Red lens, Blue Body, Blue lens		
Line	Clause	Description	Pass/Uncertain/Not Tested/Not Applicable
1	3.2.1	Construction General	Pass
2	3.2.2	Dimensional Requirements	Pass
3	3.2.3	Marker Body Chromaticity Daylight colour	Pass
4	3.2.3	Marker Body Luminance Factor	Pass
5	3.3.1	Retroreflective performance (N & G only)	Pass
6	3.3.2	Chromaticity Reflective Colour (N & G only)	Uncertain
7	3.4.1	Water Resistance	Pass
8	3.4.2	Heat Test	Pass
9	3.4.3 (a)	UV Exposure retroreflective performance (N & G only)	Pass
10	3.4.3 (b)	Marker Body Colour and Luminance	Pass
11	3.4.4 (a)	Impact Resistance – Shell Fracture (N & G only)	Pass
12	3.4.4 (b)	Impact Resist. – Retroelement Delamination (N & G)	Pass
13	3.4.4 (c)	Impact Resist. – Fracturing of Retroelement (N & G)	Pass
14	3.4.5	Resistance to Lens Cracking (N & G only)	Pass
15	3.4.6	Compressive Strength	Pass
16	3.4.7	Additional Requirements	Pass
17	3.4.8	Abrasion Resistance (AR) (if marker promotes this)	Pass
18	3.4.9	Longitudinal Strength (if marker promotes this)	N/A
19	Section 5	Makers Name or Trademark and Serial Number	Pass
Performance measurement for White at $\alpha = 1.05^\circ \pm 0.05^\circ$, $\beta_1 = -1.24^\circ$, $\beta_2 = 0^\circ$			389 mcd/lx
Signature		Tested By	Approved By
		Print	
		Title	

Figure 9: Example of a completed *Test Summary Certificate*. Note detail required.

11 APPENDIX B MARKER RENEWAL OF ACCEPTANCE

11.1 General

This section applies to markers in current use as at publication of NZTA M12-S: 2022

11.2 Laboratory Testing

The cost of this retesting will be the responsibility of the marker manufacturer or supplier.

11.2.1 Class A and Class B Retroreflective markers – all colours

Marker Manufacturers or Suppliers of Class A (70mcd) and Class B (279mcd) retroreflective markers listed in TNZ M12: 2018 *Raised Pavement Marker Notes Type Approvals* that are in current use at the publication of NZTA M12-S: 2022 will be permitted to use 2018 compliance for renewal of acceptance with AS/NZS 1906.3:2017.

11.2.2 Class C Retroreflective markers – all colours

Class C (600mcd) retroreflective markers in current use must confirm retroreflective compliance to Class C AS/NZS 1906.3 performance from a recognised testing laboratory.

11.3 Field Testing

The cost of this retesting will be the responsibility of the marker manufacturer or supplier.

11.3.1 Class A retroreflective markers – all colours

Field Testing for renewal of acceptance of Class A retroreflective markers in current use may not be required, based on historic acceptance, and upon application to Waka Kotahi at pavements@nzta.govt.nz.

11.3.2 Class B and Class C retroreflective markers

Field Testing for renewal of acceptance of markers exhibiting Class B and Class C retroreflective performance in current use will maintain their current *Provisional Acceptance* or *Type Acceptance* status for a period of twelve (12) months after the publication of M12: 2022 revision.

During this twelve (12) month period these markers must complete a modified compliance *Field Test* in order to gain or regain *Type Acceptance*.

- (a) White markers (Lens and body)

Field Testing for renewal of acceptance of Class B and Class C white markers in current use will be permitted to use a current recognised contract installation that is between eleven (11) and thirteen (13) months old as the on-road *Field Test*. This site, if not a motorway site, should reasonably qualify as an approved site as noted in Clause 7.4.

The Class B and Class C renewal of acceptance test for white markers will be based solely on the final assessment process as specified in NZTA M12-F *Field Test* unless an obvious failure of the marker is apparent.

- (b) Page 4 for selected 30
- (c) Page 5 Section 1
- (d) Page 6 Section 1, 2 and 3

This renewal of acceptance will require satisfactory marker retention, marker colour and retroreflective measurement to be completed on site by an accepted organisation using a calibrated retroreflectometer designed to measure raised pavement marker performance. This testing does not require a formal process controlled by a *Test Manager* but it should be supervised by Waka Kotahi or an impartial nominee agreed by Waka Kotahi.

The marker testing nominee will complete the necessary sections of the *Field Test* templates as noted above.

- (e) Yellow markers (Lens and body)

Renewal of acceptance for Class B and Class C Yellow markers in current use will require retroreflective testing of ten (10) markers that have been in-service for between eleven (11) and thirteen (13) months¹⁹ at an appropriate location to ensure that retroreflective performance complies with Table 2 Section 7.6 and that marker body colour remains recognisably yellow.

(f) Red, Blue and Green marker colours (Lens and body)

All Category G retroreflective classes of Red, Blue, and Green markers **certified by the Manufacturer or Supplier** to be part of a series in current use will be awarded with *Provisional Acceptance* for twelve (12) months.

During the twelve (12) months a sample of these markers will either be:

- (g) Positioned at a Waka Kotahi accepted outdoor weathering installation for twelve (12) months and the results checked for reasonable colour retention and retroreflective performance as specified in M12-F Field Test. Upon successful confirmation of compliance with these tests the colours will become Type Accepted or
- (h) If a suitable installation of red markers have been in-service for between eleven (11) and thirteen (13) months five markers can be selected at random and tested for retroreflectivity and identified as having a recognisable marker body colour. Upon confirmation of compliance the marker will become Type Accepted.

¹⁹ Some variation can be made with the approval Waka Kotahi to suit if no appropriate site presents itself

12 APPENDIX C: FEATURES RECORDED FOR PROVISIONAL AND TYPE ACCEPTANCE LISTINGS

The *Provisional Acceptance* Table in Section A and *Type Acceptance* Table in Section B of NZTA M12-L *Listing of Accepted Raised Pavement Markers* will list those manufacturers or suppliers that have either *Provisional* or *Type Acceptance* from Waka Kotahi (NZTA M12-S clause 7) for the specific markers listed.

If *Acceptance* includes non-retroreflective or coloured markers, additional to the primary white marker, the coloured markers and white non-retroreflective markers gaining acceptance must also be listed. Where coloured markers are accepted, this acceptance will also apply to various other marker “body/lens” colour configurations but these alternatives do not need to be individually listed.

Manufacturers or suppliers of markers with *Provisional Acceptance* have approval to commence an NZTA M12 specified field test. Manufacturers or suppliers of markers with *Type Acceptance* may be released for general use of the New Zealand roading network.

Provisional and *Type Accepted* markers are each listed on a separate line using the following codes:

- (a) Marker Category:
 - (i) **Category D** = Non-retroreflective daytime body colour only;
 - (ii) **Category N** = Retroreflective only;
 - (iii) **Category G** = General use; retroreflective for night time and marker body colour for day
- (b) Marker Body and Lens Colour(s):
 - (i) **W**=White;
 - (ii) **Y**=Yellow;
 - (iii) **R**=Red;
 - (iv) **G**=Green;
 - (v) **B**=Blue.

An Accepted lens colour is automatically accepted in a one way or two-way configuration or in another marker body colour, i.e. yellow marker body with white lens.

- (c) Additional Features:
 - (i) Abrasion resistant lens – Glass = **AR/G**.
 - (ii) Abrasion resistant lens – Acrylic = **AR/A**.
 - (iii) Flexural strength = **FS**

Note: Entries in the *Provisional Acceptance* list must not be removed when *Type Acceptance* is awarded.

Provisional Acceptance expiry date is set twelve months after provisional acceptance has been awarded.

Type Acceptance renewal date confirms the date that a manufacturer or supplier must seek Waka Kotahi approval for *Type Acceptance* extension

Provisional Acceptance		Marker description					Marker Code Accepted by (Standards Year)	Provisional Acceptance Expiry Date (mm/yyyy)
Obtained By	Brand Model & Series ID	Marker Category	Retroreflective Class A, B or C	Body Colour	Lens Colour	Additional Features		
ANON Markers NZ Ltd	Anon Model 2010	G	B	W	W	AG/G	G-B1-W (17) G-B2-W (17)	Nov 2021

Type Acceptance		Marker description					Marker Code Accepted by (Standards Year)	Provisional Acceptance Expiry Date (mm/yyyy)
Acceptance Obtained By	Brand, Model & Series ID	Marker Category	Retroreflective Class A, B or C	Body Colour	Lens Colour	Additional features		
ANON Markers NZ Ltd	Anon Model 2009	G	B	W	W		G-B1-W (92) G-B2-W (92)	Nov 2027

Table 3: Example Provisional and Type Acceptance Table

13 DOCUMENT INFORMATION

13.1 Document Ownership

Document Name	Specification for the design, manufacture, installation and maintenance of raised pavement markers
Document Number	M12-S
Partnering Documents	M12-F Field Test for RPMs M12-C Certificates Worksheets for RPMs M12-L Listing of Accepted RPMs
Document Status	M12:2022 Replaces M12 1998 1st Edition - plus related separate Documents; M12 2017 <i>Specification notes</i> ; P14 1995 <i>Installation</i> ; and P14 1995 <i>Installation notes</i>
Document Authors	Julian Chisnall <i>Team Lead – Road Safety, Programme and Standards</i>
	Grant Bosma <i>Principal Surfacing Engineer, Programme and Standards</i>
	Alan Parker (ALANRO Consultants)
Document Availability	These documents are located in electronic form on the Waka Kotahi NZ Transport Agency's website at www.nzta.govt.nz
Document Owner	<i>Team Lead – Road Safety, Programme and Standards</i>

13.2 Record of Amendments

Edition Number	Subject of change	Effective Date	Updated by
1	Individual documents: TNZ M12:2018 <i>Specification for raised pavement markers</i> TNZ M12:2017 <i>Notes to the specification</i> TNZ P14:1995 <i>Installation of RPMs</i> TNZ P14:1995 <i>Notes to the installation</i>	1998 2018 1995 1995	
2	Revision becomes NZTA M12-S: 2022 <i>Specification for the design, manufacture, installation and maintenance of raised pavement markers – Incorporating M12 Notes; P14 Installation and P14 Notes for installation</i> Withdrawn TNZ M12:2017 <i>Notes to the specification</i> TNZ P14:1995 <i>Installation of RPMs</i> TNZ P14:1995 <i>Notes to the installation</i>	August 2022	Grant Bosma