

NZTA M12-F:2022

FIELD TEST FOR RAISED PAVEMENT MARKERS

1 FOREWORD

Waka Kotahi NZ Transport Agency¹ requires Raised Pavement Markers² that have been awarded *Provisional Acceptance* as specified in NZTA M12 to be field tested as specified herein to ensure that the markers, together with the manufacturer specified adhesive and application methodology will exhibit an accepted in-service level of performance and measure of durability when installed on the New Zealand roading network.

Waka Kotahi seeks to adopt a marker field test methodology that requires a minimum of preparation, is easy to activate, efficient and consistent across various locations supervised by different Test Managers (Clause 3 herein). The *Performance Field Test*³ worksheet methodology avoids lengthy individual reports, at the same time ensuring that judgement of marker performance remains consistent.

The Field Test programme is completed as specified herein using the Test Worksheets introduced in Clause 6 herein but available in an electronically editable format in NZTA M12 *Certificates and Worksheets*. The objective of the Field Test is to provide final evidence that markers confirmed compliant with the AS/NZS 1906.3 Standard also prove suitable for use on road pavements under traffic conditions on the New Zealand roading network.

This new document will also enable *Field Test* managing organisations to have ready access to the Test Worksheets available in the electronically editable format in NZTA M12 *Certificates and Worksheets*.

2 SCOPE

The *Performance Field Test* programme is designed to standardise a methodology for field testing raised pavement markers in order to provide marker manufacturers reasonable assurance that all testing will be consistent and on sites that are as similar as it is practicable to achieve.

The programme seeks to ensure that the test site remains intact for the twelve month period without the need for detail marker examinations before final test measurements are required. It then enables results to be collated and certificates to be awarded without the need for written reports.

3 TEST MANAGER

The overall test must be managed by a Waka Kotahi approved organisation exhibiting knowledge and experience in the establishment of raised pavement marker programmes, referred to herein as the *Test Manager*⁴.

The Test Manager is required to:

- (a) Receive a *Test Summary Certificate* from the marker Manufacturer that confirms the marker to be tested has Provisional Acceptance. Then with these results complete the summary analysis using the Test Worksheets provided in the editable version at NZTA M12 *Certificates and Worksheets*.
- (b) Ensure that the test site for the white marker on-road test, typically on the Auckland Motorway network, is within the guidelines outlined in NZTA M12 *Specification*.
- (c) Download the editable *Performance Field Test* template pages from NZTA M12 *Certificate and Worksheet templates* for use during the test programme
- (d) If marker testing is to include coloured markers, ensure that the coloured markers will be located at a Waka Kotahi approved outdoor weathering exposure test site⁵

¹ Hereafter referred to as Waka Kotahi

² Hereafter referred to as RPM's or Category D markers. RRPM's or Category G or N will indicate that the marker is retroreflective.

³ Hereafter referred to as *Field Test* this will refer to both the on road testing for white markers and the outdoor weathering exposure testing for coloured markers

⁴ 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.

⁵ Refer to NZTA M12 Specification; Clause 7.4 Allunga Exposure Laboratory in North Queensland or an alternative Waka Kotahi accepted site in New Zealand – such location must have full daytime exposure to direct sunlight.

- (e) If the installer is not the current maintenance Contractor, ensure that the white raised pavement markers will be installed in accordance with M12 Specification Clause 8 and that the white marker infield test is installed by a recognised raised pavement marker installation Contractor.
- (f) Co-ordinate with the nominated installation Contractor for the white markers to ensure that a relevant Waka Kotahi approved Traffic Management Plan (TMP) and Temporary Traffic Management (TTM) appropriate for the type of installation is present and that weather and site conditions are appropriate for the contract to proceed
- (g) Confirm the specific location where the infield test will be installed with Auckland System Management (ASM), Waka Kotahi, Auckland and confirm what configuration of markers will be used:
 - (i) As a set of four where the test marker is in position 1 in the direction of travel (M12 Specification Clause 7.4.1 Figure 1) or
 - (ii) As a set of five with the test marker being set one metre in advance of the first marker in the set of four
 - (iii) Confirm need to replace a missing marker or marker that must be removed due to the potential hazard it may represent
 - (iv) Confirm status of test markers upon the conclusion of the test programme
- (h) Provide the Senior Safety Engineer, Auckland System Management (ASM), Waka Kotahi with assessment progress reports as required by NZTA M12 Specification
- (i) Ensure that the white marker Field Test site maintains a standard appropriate for the test to continue by supervising the first, second and final day/night, Interim Assessments using the Test Worksheets provided herein and as outlined in NZTA M12 Specification

The first, second and final day/night assessments are not expected to be too detailed. The specific objective is to ensure the test installation remains intact and suitable for purpose. Marker status recording will be relatively subjective (Table 1), seeking, in the main, to ensure that loss or damage rates are not above prescribed maxima. Marker ratings are to serve as a status reminder for the next site attendance.
- (j) Ensure that the outdoor weathering exposure test for any coloured markers remains valid.
- (k) Supervise the Final Assessment as outlined in NZTA M12 Specification. This assessment will be more detailed and will include the random selection of any markers needed to replace non-qualifying markers in the test thirty (30) plus the retrieval of any coloured markers for retroreflective testing.
- (l) Ensure that the retroreflectometer testing technician is approved by Auckland Systems Management, Waka Kotahi Auckland and that the retroreflectometer is specifically designed to test retroreflective markers and that it is in current calibration.
- (m) Complete the rating section of the Field Test sheets in order to arrive at a Pass/Fail conclusion
- (n) Confirm white and coloured marker Field Test results to Waka Kotahi recommending Type Acceptance status (or otherwise) should be awarded.
- (o) Upon such approval being confirmed issue the raised pavement marker manufacturer with two Type Acceptance certificates in PDF format, one of which must then be submitted to Waka Kotahi by the marker Manufacturer/Supplier
- (p) Provide the marker Manufacturer with a PDF format copy of the completed Performance Field Test, worksheets. The marker Manufacturer can then submit them to Waka Kotahi although typically Waka Kotahi will request these if required.
- (q) Confirm with Waka Kotahi when the Field Test outcome will be confirmed in writing and recorded in NZTA M12 Listing of Accepted Raised Pavement Markers to be posted to the Waka Kotahi web site at <https://www.nzta.govt.nz/resources/raised-pvmt-markers/>.

4 TEST PROGRAMME

4.1 General

The twelve (12) month Performance Field Test for white and coloured markers must be completed using the editable worksheets from NZTA M12 Certificate and Worksheet Templates as outlined herein. The marker Manufacturer's representative may attend the assessments and final examination.

The day after installation of the white markers becomes test day one. Coloured markers must have commenced the outdoor weathering testing programme prior to the white marker installation.

4.2 White markers (retroreflective or non-retroreflective)

For the on-road test the marker Manufacturer or Supplier must provide:

- (a) Sixty (60) each non-retroreflective white markers (e.g. Category D-W) or;
- (b) Sixty (60) each retroreflective, Class (to be confirmed)⁶, white, one way markers (e.g. Category G-B1-W).
- (c) Six (6) each retroreflective (or non-retroreflective) white, two way markers (e.g. Category G-B2-W)

Fifty (50) G-B1-W markers will be installed with the remainder being available should replacements be necessary (any not used may be returned to the Manufacturer). These markers should be selected at random from the Manufacturer's stockholding.

4.3 Coloured retroreflective markers

For the outdoor weathering exposure test the Manufacturer or Supplier must provide six (6) two-way coloured markers where marker body colour and lens colour are the same for each colour to be tested. These are to accompany the six (6) white markers noted in Clause 4.1 (c).

The marker Manufacturer must submit in writing that the marker body and lens colour is the only difference between the coloured markers and the white on-road test marker.

Five (5) of each colour markers will be located at the twelve (12) month outdoor weathering exposure site either at the Allunga Exposure Laboratory site in North Queensland, Australia or such alternative site in New Zealand accepted by Waka Kotahi.

The sixth will be held in a darkened location to act as a control sample maintained in original condition for end of testing comparison purposes. The objective is to test marker body and lens colour durability. The five (5) white and coloured test markers must remain in a position that assures maximum direct sunlight exposure without undue shading during daylight hours and be monitored at appropriate times throughout the twelve (12) months.

5 WHITE MARKER ON-ROAD TEST PROGRAMME

5.1 General

At this stage it is strongly advised that the reader downloads M12-C Certificate and Worksheet templates (editable) because the actual computer editable certificate and worksheet templates are not included in this instructional document. The stand-alone (editable) working M12 document includes the templates that can be computer edited and later issued as a PDF document.

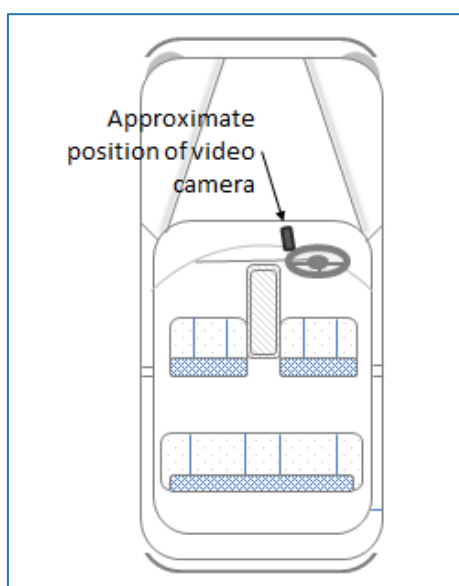
⁶ Although this example shows a marker with Class B retroreflective performance the manufacturer or supplier will confirm what Class retroreflectivity is being tested – A, B or C.

The white markers installed at the selected on-road test location will receive three (3) interim assessments during the twelve (12) month period in order to assure that the test is progressing as planned and is worthy of being continued:

- (a) First Interim Assessment – no sooner than 120 days or later than 140 days from day one⁷
- (b) Second Interim Assessment – no sooner than 240 days or later than 260 days from day one
- (c) Final Assessment – no sooner than 360 days or later than 380 days from day one
- (d) Retroreflective measurements – immediately upon confirmation that the final assessment confirms that the site has remained intact and remains a valid test site, closer examination of markers and retroreflective testing will be commenced

5.2 Interim Assessments: (Record results on the Test Worksheet)

All three Interim Assessments will be filmed⁸ using an appropriate video camera positioned on the approximate eyeline of the driver as shown in Figure 1. Each will consist of a daytime and a night time drive through to visually assess marker presence and indicative performance. During these assessments any markers that are missing must be noted including any that show sufficient damage to warrant removal for safety reasons.



The day and night assessment should be carried out in the same 24 hour period to identify typical marker condition or presence of retroreflectivity. The daytime assessment shall be carried out first to identify missing markers.

The assessment findings must be noted on the Test Worksheets by the Test Manager using the key letters noted in Table 1 below to record marker condition and status.

These three (3) assessments will act as a general overview to confirm that the test is progressing as planned and to check that the markers on site are still valid for the test to progress. These assessments may potentially end the test early if excessive markers are found to be missing or a major unforeseen event has impaired the tests integrity.

These assessments should be completed as a mobile operation at a speed considered practicable for an observer, other than the driver, to identify typical marker condition or presence of retroreflectivity (confirmed later by reviewing the film). This speed should not require an RCA approved Traffic Management Plan (TMP) and Temporary Traffic Management (TTM) but it may become a requirement in some conditions.

⁷ If for any reason the test is failed after an assessment, the following assessments and or the retroreflective measurement will be cancelled. Removal of test markers may be required. Waka Kotahi must be kept informed of this status. If a new white marker test is to be installed the coloured markers may remain in the outdoor test for the prescribed 12 months, if not the coloured markers will be returned to the manufacturer.

⁸ The video camera must be safely positioned (fixed not held) on the vehicle dash panel relatively close to the driver's line of sight in order to record an approximate driver's view. A front seat passenger must do the recording not the driver of the vehicle.

Key	Status	Condition Explanation
MP or ✓	Marker Present	<ul style="list-style-type: none"> Marker remains in place and in a condition suitable for the test to continue Marker may have minor damage or have shifted slightly but alignment and condition remain acceptable. (see DF) Signs of wear may be apparent, but marker remains affixed in place
DF	Daytime Failed (Non-functional)	<ul style="list-style-type: none"> Marker(s) has failed in some way other than loss of retroreflectivity e.g. poor structural condition, significantly shifted surface position, colour has changed/faded etc. Marker body damage is not dangerous and may remain in trial (see DR) Marker remains in place and remains classified in the trial.
DR	Damaged Removed (because of severe damage)	<ul style="list-style-type: none"> Daytime assessment failed condition - marker has been removed due to potential hazard condition. The DR markers are now essentially the same as a missing marker MM. If necessary to replace the marker the replacement must not be included as part of the trial. This rating removes it from having a retroreflective rating
MM / MR	Missing Marker (if replaced this becomes MR)	<ul style="list-style-type: none"> A missing marker becomes MM. If it needs to be replaced it will become a missing replaced (MR) marker. This replacement marker must not be included as part of the trial. The replacement cannot be used for any retroreflective rating.
RP	Retroreflectivity Present	<ul style="list-style-type: none"> Night time indicates a level of retroreflectivity is apparent – this does not have to be a suitable level of retroreflectivity Measurement of specific level of retroreflectivity (CIL- Coefficient of Luminous Intensity measured in mcd/lx) is not required at this time. This is only required after the 3rd assessment
RF	Retroreflective Failure (Non-functional)	<ul style="list-style-type: none"> No night time retroreflectivity is apparent; effectively the marker is non-functional at night. Marker must remain in the trial. Removal for damage is only a daytime situation. Measurement of specific CIL is not required at this time as this is only required after the 3rd assessment

Table 1: Notations for use on Test Worksheets

5.2.1 First Assessment:

The assessment of the on-road white markers should be a relatively quick “drive through” review of marker status with findings being recorded using the Test Worksheets:

(a) Daytime Assessment – Test Worksheet Page 2:

During the hours of daylight drive through the site, filming for later review, and recording basic daytime Marker Presence (MP or ✓) or any obvious daytime failure noting this on the worksheet using the key letters in Table 1.

NB: DRIVER MUST NOT BE RECORDING, HOLDING OR CONTROLLING THE CAMERA.

This daytime drive through will quickly assess the general condition of the markers relative to their adhesive integrity and general body condition – visible cracking or chipping, retroreflective lens condition and questionable body colour. Briefly note any such findings in “notes” on the Test Worksheet if necessary.

If a Missing Marker (MM) must be replaced the marker becomes Missing Replaced (MR). This marker position must remain being treated as a missing marker (MM) meaning that any replacement

marker must not be included in the trial. The position must be so recorded on the Test Worksheet using the appropriate marker replaced (MR) key which signifies that it will no longer be a test marker and it cannot be chosen as a retroreflective test marker.

A Daytime Failed (DF) rating indicates a marker that exhibits physical body or lens damage, excessive wear and/or colour fade or, still firmly affixed, it has shifted well out of position, or where damage suggests it is no longer daytime functional when viewed on the drive through. A failed or damaged marker is not to be removed unless damage is adjudged to be potentially hazardous, suggesting the marker will not last in place for the duration of the Performance Field Test.

In such instances it may need to be removed and may need to be replaced. If so it will be rated a Damage Removed (DR) marker effectively becoming similar to a missing marker (MM) this replacement can no longer be a test marker and it should be so noted on the worksheet.

Visit the outdoor weather testing location to confirm that markers remain in place.

(b) Night Assessment – Test Worksheet Page 2:

Enter any MR or DR marker(s) from the daylight assessment column into the night assessment column.

During the hours of darkness drive through the test site – headlights on dipped beam – filming and recording all markers where at least some, even a minimal level of nighttime retroreflective presence (RP) is evident. The camera should not be hand held. The front seat passenger must complete the worksheet. Also note markers that are non-functional where no observable retroreflective performance is noted – retroreflective failed (RF). It is not necessary to record the actual retroreflective (mcd/lx) value at this time.

Any white marker exhibiting zero retroreflectivity (RF) is effectively a non-functional marker at night but it must remain in the test and be included in the final total. Do not remove the RF marker unless its daytime condition is rated a hazard (DR). Record the observed retroreflective presence (RP and RF) of the markers.

5.2.2 First Interim Assessment Rating

This assessment will assure all concerned that the trial is progressing as planned. If the Test Manager recognises unforeseen issues have occurred, rendering the test unusable, the test must end (and be restarted again if applicable). For example, if one or more of the following conditions are met.

- (a) The test will end if a total greater than five (5) white markers are effectively missing, being recorded as either:
 - (i) MM (*Missing Marker*) or MR (*Missing Replaced*) - because the missing marker has been replaced, or;
 - (ii) DR (*Damage removed/replaced*) - where a marker must be removed due to damage rated a hazard or when the removed marker was replaced.
- (b) The test will end if a total greater than seven (7) white trial markers are determined to be non-functional, being recorded as either:
 - (i) DF (*Daytime Fail*) - still to remain in place but rated daytime non-functional
 - (ii) RF (*Retroreflectivity Fail*) - still to remain in place but rated retroreflective non-functional
- (c) The test will end if a total greater than nine (9) white test markers are effectively missing or non-functional, being recorded as either:
 - (i) MM, MR or DR as in (a) above,
 - (ii) DF still to remain in place but rated daytime non-functional as in (b) above
 - (iii) RF still to remain in place but rated retroreflective non-functional as in (b) above.

5.2.3 Second Assessment:

This Second Assessment is virtually a repeat of the first assessment using Test Worksheet Page 3.

Commencing the new Test Worksheet, populate the position of any MM, MR or DR markers from the first assessment (Page 2) that are not to be included as test markers and DF or RF markers and enter these on both the daytime and nighttime assessment columns.

Review the site, record and enter the now current status of the remaining markers to arrive at a new result, as at this assessment, in both the daytime and night time situations. Reference to the Test Worksheet Page 2 may be necessary.

Visit the outdoor weather test to ensure marker placement has been maintained.

5.2.4 Second Interim Assessment Rating:

This assessment should assure all concerned that the test is progressing as planned. However, if problems are occurring the test should be restarted. The rating shall be as for the First Assessment

5.2.5 Final Assessment:

This Final Assessment is virtually a repeat of the first and second assessments using Test Worksheet Page 4 except that it will be a mix of drive through and possible stationary examination as the assessing examiners see fit, with the relevant RCA approved TMP and TTM appropriate for the type of inspection activity deemed appropriate.

Slightly greater attention will be paid to the physical condition of the markers looking for signs of wear, damage and colour fading. These results will be entered on Test Worksheet Page 4.

This assessment is the final verification that the test site remains suitable for purpose prior to committing to the costs of retroreflective testing. If as with the first and second assessments the test markers meet the requirement for the test to continue, then the programme may continue to the final stage.

(a) Daytime Assessment: Test Worksheet Page 4

Commence the new Test Worksheet Page 4 referencing Test Worksheet Page 3 and populate the position of any MM, MR or DR markers from the first and second assessments that are no longer to be included as test markers and enter these in both the daytime and nighttime assessment columns.

After reviewing and filming the site assess the final status of all markers remaining after the twelve (12) month period, record the position of any additional MM, MR and DR markers since the second assessment. Care should be taken not to include any replacement markers in the performance test results.

(b) Night time Assessment – Test Worksheet Page 4

Position a vehicle in the typical line of travel, lights on dipped beam.

Moving forward and from a position approximating 50 ± 5 metres, the front seat passenger observer must record on the Test Worksheet all white markers that do not exhibit any, even a minimum of retroreflective presence (RP). This may involve two (2) or three (3) runs through the site.

Any marker, not exhibiting at least a minimal level of retroreflective performance shall be assessed Retroreflective Fail, (RF) night time non-functional, and be so recorded on the Test Worksheet. Do not remove these markers as they can still fall on a location selected for retroreflective measurement.

5.2.6 Final Assessment Rating:

This Final Assessment must rate the markers after the specified twelve (12) month test. If the markers have not performed as specified, the test can be ended before the formal retroreflective testing and detailed physical examination is commenced. The rating shall be as for the First Assessment

In a final daytime walk through, (under the relevant RCA approved TMP and TTM plan), examine the physical marker body integrity, body colour, adhesion and detail of all remaining white markers and record all DF markers on the Test Worksheet. Include markers assessed as DF daytime fail (non-functional) for any reason. No marker shall be removed unless it represents a hazard. This removal will have been recorded as a DR rating.

On the basis that this final assessment has been successful thus far the actual retroreflective performance evaluation and testing can commence to confirm that the markers meet the minimum retroreflective performance specified.

5.3 Selection of Markers for specific retroreflective (mcd/lx) testing

5.3.1 White on-road markers

Thirty (30) white markers will become the markers to confirm actual retroreflective 'R' performance recorded in mcd/lx. Marker positions 10 to 39 will become retroreflective test markers. If any in this sequence cannot be used as a test marker (MM, MR or DR) select an alternative at random from the remaining markers, but thirty (30) white markers must be measured.

5.3.2 Coloured outdoor weathering markers

All the markers must now be collected from the outdoor weathering test site plus the one control sample that has been kept in darkened conditions.

Place each of the five (5) weather tested markers alongside the non-weathered control sample and compare what colour fading or lens ageing may have become apparent.

To avoid the complexity of using laboratory testing to assess resultant colour strength and any possible colour change of the weathered samples, compare the weathered samples with the control sample. The colour condition of the weathered samples must remain such that, although potentially faded, the marker body is adjudged to still represent the original colour when viewed by the motorist.

The retroreflective lens must also maintain a strong colour resemblance and not show any physical damage such as cracking or lifting that may indicate a possible cause for concern. After colour assessment, retroreflective testing on both sides must confirm each coloured marker including white has maintained no less than the minimum 'R' mcd/lx indicated. (NZTA M12 Specification Clause 8 Table 2)

5.4 Retroreflective Testing – Trial Worksheet Page 5

Measure the coefficient of luminous intensity 'R' (mcd/lx) of the selected thirty (30) white markers in situ as installed. The Waka Kotahi accepted technical service specialist must use a recently calibrated hand held retroreflectometer made for raised pavement marker testing using geometry according to either AS/NZS 1906.3 or ASTM E1696.

The five (5) white and coloured markers from the outdoor weathering exposure test, although not installed on the road surface, will be measured on site in the same way by placing each marker onto a smooth section of pavement in the test vicinity.

Measurement of retroreflectivity from a specially equipped moving survey vehicle shall not be used for marker compliance testing.

5.4.1 Sample preparation

The selected sample of on-road tested markers (Clause 5.2) shall be prepared for testing as follows:

- (a) Simple water cleaning must be completed using a soft brush to ensure that random dust, dirt and film is removed
- (b) Dry the marker lens using a soft cloth, before testing
- (c) Test the retroreflective performance of the now dry marker (if a two way marker test both sides of the marker) and record the level of retroreflectivity 'R' (mcd/lx) on Worksheet Page 5.
- (d) Compare the actual 'R' values (mcd/lx) with the respective Class (A, B or C) min 'R' value noted on the worksheet.

5.4.2 Determination of retroreflectivity

Determine the retroreflectivity for the outdoor tested markers as follows:

- (a) Measure the retroreflectivity 'R' (mcd/lx) for each side of the white and coloured markers selected using the retroreflectometer according to the retroreflectometer manufacturer's recommendations. The retroreflectometer must be in current calibration.
- (b) Record the level of retroreflectivity 'R' (mcd/lx) for each white and coloured marker on the Test Worksheet Page 5.
- (c) Compare the actual 'R' values (mcd/lx) with the respective Class (A, B or C) min 'R' value noted on the form for both the white and coloured markers.

6 TEST WORKSHEETS

Download the stand-alone computer editable NZTA M12-C Certificate and Worksheet templates (editable).

The Test Worksheets record all the details of the Performance Field Test. This Clause outlines what is expected when completing the worksheets. The “editable” document includes the actual templates.

- (a) **First Page:** Includes detail that establishes the test, such as marker Manufacturer, the marker, its series number or letters, white and any colours submitted for inclusion, names the Test Manager managing the test project, confirms where the test is being held and the marker installation contractor.
- (b) **Page 2:** Records the results for the first daytime and night time assessments (Figure 2). In daytime this is an overview of the general condition of the markers in the test noting exceptions and questionable markers, especially noting missing markers and badly damaged, potentially hazardous markers, but most importantly confirming to Waka Kotahi that the test is approved to continue.
- (c) To record assessments, enter the condition key from Table 1 indicating an individual marker’s condition (e.g. MP (or ✓) for marker present as shown in positions W1-3 & W26, 27 & 29 with MM missing markers at position W4 & W28 as shown in the daytime column shown in Figure 2.

WHITE Markers					
*MP = Marker present; DF = Daytime fail; DR = Damage removed or replaced		MM = Missing marker; RP = Retroreflective Present;		MR = Missing marker replaced; RF = Retroreflective fail Non-functional;	
Marker Place #	Day Rating*	Night Rating*	Marker Place #	Day Rating*	Night Rating*
W1	MP		W26	MP	
W2	MP		W27	MP	
W3	MP		W28	MM	
W4	MM		W29	MP	

Figure 2: Showing day entries for markers where a Missing Marker (MM) occurs at W4 and W28

For night time this is an overview of the night time retroreflective performance of the markers – not in detail but the general overall test condition noting that markers do have some level of retroreflective presence or if exceptions are observed. Note any marker that rates retroreflective fail (RF) non-functional.

Note: in the night time column, (Figure 3) positions W4 & W28 also shows the MM missing markers. These marker positions must no longer be retroreflective tested.

WHITE Markers					
*MP = Marker present; DF = Daytime fail; DR = Damage removed or replaced		MM = Missing marker; RP = Retroreflective Present;		MR = Missing marker replaced; RF = Retroreflective fail Non-functional;	
Marker Place #	Day Rating*	Night Rating*	Marker Place #	Day Rating*	Night Rating*
W1	MP	RP	W26	MP	RP
W2	MP	RP	W27	MP	RP
W3	MP	RP	W28	MM	MM
W4	MM	MM	W29	MP	RP

Figure 3: Showing night entries for markers where a Missing Marker (MM) is also noted at W4 and W28

- (d) **Page 3:** (No Figure) Populate the MM, MR and DR detail recorded in the Page 2 assessment (above) into Page 3. Then record information for the second assessment period in the same manner used for the first assessment to arrive at a test status for the end of the second period.

Confirm to Waka Kotahi that the test site condition is suitable and that the test is to continue

- (e) **Page 4:** (Figure 4): After populating MM, MR and DR data from the first two assessments, record information for the final assessment in the same manner as used for Pages 2 and 3.

WHITE Markers *MP = Marker present; DF = Daytime fail; MM = Missing marker; MR = Missing marker replaced; DR = Damage removed or replaced RP = Retroreflective Present; RF = Retroreflective fail Non-functional;							
Marker Place #	Day Rating*	Night Rating*	'R' test Sample	Marker Place #	Day Rating*	Night Rating*	'R' test Sample
W1	MP	RP		W26	MP	RP	✓
W2	MP	RP		W27	MP	RP	✓
W3	MP	RP		W28	MM	MM	✗
W4	MM	MM		W29	MP	RP	✓
W5	MP	RP	✓	W30	MP	RP	✓

Figure 4: Test Worksheet Page 3: Headings show column identifying some of the thirty (30) white marker positions selected for retroreflective testing (note W5 has replaced W28).

Note: Page 4 (Figure 4) The thirty (30) markers selected from all markers remaining valid in the site including markers that may be exhibiting little or no retroreflectivity. If a chosen marker position includes a marker that cannot be selected (MM, MR or DR) the selection must be randomly selected from an adjacent marker not otherwise selected.

- (f) **Page 5:** Enter the retroreflective Class and the AS 1906.3:2017 Table number for the markers being tested.

Then in Section 1 (Figure 5) the Test Manager must confirm the marker positions that were selected in Page 4 (positions 10 to 39 with any changes necessary) and record the retroreflective performance of each of the thirty (30) white markers selected for testing. This then allows actual retroreflective 'R' mcd/lx values to be compared to the minimum 'R' values shown for the respective Class. 80% of the thirty (30) markers must exceed the min 'R' noted. Confirm Pass or Fail for each marker/position.

1		30 SELECTED - WHITE		New 'R' value by Class A: 70.0 mcd/lx B: 279.0 mcd/lx C: 600.0 mcd/lx			
Marker Place #	Retroreflective 'R' values in mcd/lx		P=Pass F=Fail	Marker Place #	Retroreflective 'R' values in mcd/lx		P=Pass F=Fail
	Actual 'R' Values	Min 'R'			Actual 'R' Values	Min 'R'	
W10	99.8	Class B: 31.0, Class C: 87.0	P	W25	100.6	Class B 31.0, Class C 87.0	P
W11	101.3		P	W26	100.1		P
W12	102.0		P	W5	99.5		P
W13	101.8		P	W28	102.7		P
W14	99.0		P	W29	86.1		F
W15	85.0		F	W30	100.5		P
W16	102.9		P	W31	99.9		P
W17	101.7		P	W32	100.1		P
W18	101.6		P	W33	101.5		P

Figure 5: Recording the actual retroreflective test results in Page 5 Section 1. Note Fail at W15 and W29 plus the W28 position is substituted by W5 because W28 was MM

Figure 5 shows Class C markers are recorded therefore they must be no less than the value 87.0 mcd/lx highlighted. For Class C this represents approximately 14.5% of the 'new' performance noted at the top of Section 1.

- (g) **Page 5:** (Figure 6): In Section 2 the Test Manager must add the retroreflective 'R' values for the five (5) white and five (5) coloured sample markers exposed in the outdoor weathering exposure test and compare the result with the min 'R' value shown for the respective marker class.

Note: It is to be anticipated that the retroreflective results for these markers should easily be above the minimum 66%, perhaps near their new 'R' values because they have not been exposed to traffic.

2 5 OUTDOOR EXPOSED WHITE & COLOURED MARKERS – Retroreflectivity – All markers must pass								
Colour	Min 66% 'R' Value			Actual 'R' Value mcd/lx equal to or greater than 66%				
	A	B	C	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
White	46.0	184.0	396.0	441.0	495.6	525.3	515.9	499.9
Yellow	23.0	110.0	238.0	348.1	355.8	351.4	349.9	341.4
Red	10.0	46.0	99.0	147.1	141.6	140.9	146.5	140.0
Green	15.0	61.0	130.5	189.3	189.7	179.2	177.0	180.1
Blue	4.5	18.5	39.5	53.6	53.1	55.9	57.6	55.0

3 5 OUTDOOR EXPOSED WHITE & COLOURED MARKERS – Colour – All five markers must pass = P						
Colour	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Notes
White	P	P	P	P	P	Minor discolouration sample 3
Yellow	P	P	P	P	P	
Red	P	P	P	P	P	Acceptable fading
Green	P	P	P	P	P	
Blue	P	P	P	P	P	Some slight fading marker body

Figure 6: Page 5 Section 2 records retroreflectivity and Section 3 records colour and condition for the markers from the outdoor weathering exposure test

- (h) **Page 5:** Section 3 (Figure 6) records the colour result after weathering for the 5 white and coloured markers (of each colour submitted) as a *Pass* or *Fail*. The *Test Manager* must visually adjudge that marker body colour and lens colour remains representative of the control colour. Fading is permitted as long as it does not risk typical day time colour recognition. It is a subjective measurement seeking to assure that the remaining colour is *suitable for purpose*.
- (i) **Page 6:** White Markers, *Performance Field Test* final summary.
 - (i) White markers Physical Rating - Line 1: From Page 4 day rating column, count and enter the number of white markers rated MM, MR plus DR. This number should not exceed the maximum permitted as shown in Figure 6.
 - (ii) White markers Physical Rating - Line 2: Again, from Page 4 night rating column count and enter the number of white markers rated DF and RF. Individual number should not exceed maximum permitted.

Final On-Road White Summary			
Marker Brand and Series ID	Randomlite 400 Series	Retroreflective Class	C
White Markers			
Physical rating		Actual Trial Outcome	Individual Max Permitted
1	White Marker - Total Markers Rated Missing: From Part 3 (MM, MR plus DR,)	3	5
2	White Marker - Total Markers Non-functional: From Part 3 (DF plus RF)	3	7
Retroreflective rating (A, B or C) 80% must exceed minimum mcd.lx		Number Pass 'R' mcd/lx <u>Actual Trial Outcome</u>	Number 'R' Fail mcd/lx <u>Actual Trial Outcome</u>
3	30 White Markers - Retroreflectivity 'R' Outcome From Part 4	27	3
WHITE MARKERS		Final Test Assessment:	PASS / FAIL =
			PASS

Figure 7: Final on-road white test summary. Entering and calculating final results for the white markers

- (iii) White markers Physical Rating: Figure 6, Lines 1 and 2 - The combined total of Line 1 plus Line 2 should not exceed the combined maximum permitted
- (iv) White markers Retroreflective Rating – Figure 6 Line 3: looking at Page 5 Section 1 (Figure 4) *Actual 'R' Values* count the number of white markers that equal or exceed the min 'R' value specified in mcd/lx (87.0 per Figure 4) and enter this number in the *Number Pass 'R'* column. Count and enter the number of markers that failed to meet the min 'R' value and enter this in *Number 'R' Fail* column.
- (v) White markers Line 3 Figure 6: % Compliant column: The number of white markers that exceed the minimum mcd/lx 'R' value expressed as a percentage of thirty (30) must equal or exceed 80%. Then, if Line 1, Line 2 and Line 3 of Page 6 (Figure 6) for white markers indicates, confirm a Pass or Fail for the white markers.
- (j) **Page 6: Coloured Markers: Performance Field Test** final summary
- (i) Line 4; Coloured markers Physical Rating (Figure 7): Refer Section 3 of Page 5 shown in Figure 5 then record number of markers that have passed or failed the colour judgement for each colour submitted and confirm an overall *Pass or Fail* for each colour.
- (ii) Line 5 Coloured markers Retroreflective Rating: From Section 2 of Page 5, (Figure 5) record the number of markers that have passed or failed the retroreflective 'R' mcd/lx value and confirm a *Pass or Fail* for each colour.

Final Outdoor Weathering Summary					
Physical rating including colour		Colour	Number <u>Pass</u> Actual Trial Outcome	Number <u>Fail</u> Actual Trial Outcome	Minimum 80% required to Pass
4	5 Colour Markers - Total Markers of each colour compliant From Section 3 of Page 4 Selected 5 of each colour must pass	White	5	-	Pass
		Yellow	5	-	Pass
		Red	5	-	Pass
		Green	5	-	Pass
		Blue	5	-	Pass
Retroreflective rating ('R') (A, B or C)		Colour	Number <u>Pass 'R'</u> Actual Trial Outcome	Number <u>Fail 'R'</u> Actual Trial Outcome	Minimum 80% required to Pass
5	5 Colour Markers - Retroreflective 'R' Outcome From Section 2 of Page 4 Selected 5 of each colour must pass	White	5	-	Pass
		Yellow	5	-	Pass
		Red	5	-	Pass
		Green	5	-	Pass
		Blue	5	-	Pass

Figure 8: Final Outdoor Weathering summary: Reviewing lines 4 and 5 will now confirm the overall Pass or Fail result for each colour.

At the completion of the *Performance Field Test*, the *Test Manager* adjudges the overall results and if successful the *Test Manager* is responsible for completing the *Certificate of Type Acceptance*.

The *Certificate of Type Acceptance* must be completed and signed by the *Test Manager* who issues two original PDF Format copies to the marker manufacturer or supplier. It is then the responsibility of the Marker Manufacturer (or supplier) to forward or present one of these two PDF originals to Waka Kotahi and request formal acknowledgement of *Type Acceptance*.

7 DOCUMENT INFORMATION

7.1 Document Ownership

Document Name	Field test for raised pavement markers
Document Number	M12-F
Primary Document	M12 Specification for the design, manufacture, installation and maintenance of raised pavement markers
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7.2 RECORD OF AMENDMENTS

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