



**Transport**  
Roads & Maritime  
Services

# Test method T1414

## Photometric properties of retro-reflective materials

NOVEMBER 2012



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## Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		Reformatted and Revision Summary Added	D.Dash	June 2001
Ed 2/ Rev 0	All	Reformatted RMS template	J Friedrich	November 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T1414 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

# Test method T1414

## Photometric properties of retro-reflective materials

### 1. Scope

This method sets out the procedure for determining the retro-reflectivity of sheeting or other materials and is based on the requirements of AS 1906.

### 2. Apparatus

- (a) Photometer complying with the requirements of AS 1906.1 consisting of -
  - (i) Goniometer to accommodate samples mounted in both vertical and horizontal positions
  - (ii) Collimated light source (Illuminant A)
  - (iii) Photocell to measure both incident and reflected light
  - (iv) Movable carriage to accommodate the photocell for measurement of reflected light at all required observation angles. (See Appendix I)

#### Note

- (a) The light source and the photocell shall both be at a distance (d metres) from the sample. It is preferable for d to be 15 metres
- (b) The apparatus shall be calibrated with reference panels every six months

**Optional:** A personal computer with OPEN ACCESS software, and a suitable printer

### 3. Procedure

- (a) Switch on the light source and the detector at least one hour before any measurements are made
- (b) Check the alignment of the goniometer using a plane mirror, according to Appendix II. This check shall be made weekly
- (c) Measure the colour temperature of the light source using a calibrated colour temperature metre. Adjust the voltage supplied to the light source if necessary to achieve a colour temperature of 2856K. This measurement shall be made weekly
- (d) Attach the photocell to the centre of the goniometer and record the incident light reading ( $R_i$ ) with the goniometer set at zero entrance angle
- (e) Attach the photocell to the movable carriage and measure the background readings for each of the specified combinations of entrance and observation
- (f) Mount the specimen on the goniometer and take a series of readings at the specified combinations of entrance and observation angles. ( $R_1$  to  $R_n$ )
- (g) Measure the area (A) of all retro-reflective sheeting samples in square metres

### 4. Calculations

#### 4.1 Retro-reflective Sheeting

The coefficient of luminous intensity per unit area (CIL/m<sup>2</sup>) is calculated as follows:

$$\text{CIL/m}^2 = \frac{(R - Z) \times d^2}{R_i \times A}$$

## 4.2 Delineators and Markers

The coefficient of luminous intensity (CIL) is calculated as follows:

$$\text{CIL}/\text{m}^2 = \frac{(R - Z) \times d^2}{R_i \times A}$$

R = Reflectivity reading

R<sub>i</sub> = Incident reading

Z = Background reading

d = Distance between sample and photocell (metres)

A = Area of sample (square metres)

Alternatively enter the raw data into the computer using the OPEN ACCESS "MAIN\_PHO" programme. (See Appendix C).

## 5. Reporting

Report the CIL or CIL/m<sup>2</sup> for each of the specified entrance, observation angle combinations. Alternatively print the report using the Open Access Database as set out in Appendix D.

## Appendix A: Control Of Movable Carriage

The carriage is moved to the observation angles required by use of a stepping motor and controller where:

1 mm = 20.47 units  
Since 1° = 266.7 mm of travel  
then 1° = 5459 units

The number of controller units between each set observation angle is as follows:

	<b>0.33°</b>	<b>0.5°</b>	<b>1.0°</b>	<b>2.0°</b>
0.2°	710	1638	4367	9826
0.33°	-	928	3658	9117
0.5°	-	-	2730	8189
1.0°	-	-	-	5459

## Appendix B: Alignment of Goniometer

### B.1 Procedure

- (a) Mount the square plane mirror onto the centre of the goniometer mounting plate
- (b) Look towards the light source from behind and just to the left side of the goniometer.
- (c) By adjusting the horizontal and vertical angles position the reflected image centrally over the light source.
- (d) Read the horizontal and vertical angles on the respective vernier scales. Use these values to correct all goniometer settings. Alternatively adjust the heights and/or positions of the goniometer and light source so that the corrections are reduced to zero.

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## Appendix C: Use of Open Access “MAIN\_PHO” Programme

- (a) The "MAIN\_PHO" programme is performed as follows.

<u>KEYSTROKES</u>	<u>SCREEN SHOWS</u>
SWITCH ON COMPUTER	TAKE CHARGE! MAIN MENU
TYPE "O"	TODAY'S DATE
PRESS <ENTER>	OPTIONS
TYPE "P"	PROGRAMMER
PRESS <F2>	PROGRAMMER MENU
TYPE "P"	PERFORM WHICH FILE
TYPE "MAIN_PHO", <ENTER>	PHOTOGRAPHICMEASUREMENT MAIN MENU
FOLLOW INSTRUCTIONS ON SCREEN.	

- (b) The "MAIN\_PHO" programme is exited as follows.

- (a) SELECT "QUIT" and press <ENTER>
- (b) PRESS <F2>
- (c) TYPE "O"
- (d) TYPE "O"
- (e) TYPE "P"
- (f) SWITCH OFF Computer

## Appendix D: Printing of Results

### KEYSTROKES

Switch on Computer

TYPE "O"

PRESS &lt;ENTER&gt;

TYPE "D"

TYPE "R"

### SCREEN SHOWS

TAKE CHARGE! MAIN MENU

TODAY'S DATE

OPTIONS

DATA BASE MAIN MENU

DATA RETRIEVAL METHOD

Choose the appropriate method of retrieval and retrieve the required data from one of the following screen form files.

Retro-reflective Sheeting  
measured according to  
AS1906.1 (1976)

"SHEETING"

Retro-reflective Sheeting  
measured according to  
AS1906.1 (1990)

"NEWSHEET"

Raised Pavement Markers  
DELINEATORS

"MARKER"

"DELINEAT"

PRESS &lt;F2&gt;

TYPE "O"

TYPE "NUMBER, SAMPLE"

PRESS &lt;ENTER&gt;

PRESS &lt;F2&gt;

TYPE "P"

PRESS &lt;F4&gt;

DATABASE OPERATIONS

SORT RECORDS

ORDERED RECORDS

DATABASE OPERATIONS

FILE SPECIFICATION

LIST OF PRINT FORM FILES



SELECT the appropriate printform file for the data retrieved and PRESS <ENTER>	
(g) SHEETWR"	Retro-reflective sheeting measured according to AS1906.1 (1976) where ÿ rotation and/or simulated rainfall measurements were done.
(h) "SHEETING"	As for (a) above, but without rotation measurements.
(i) "NEWSHEETWR"	Retro-reflective Sheeting measured according to AS 1906.1 (1990) where rotation measurements are made.
(j) "NEWSHEET"	Retro-reflective Sheeting measured according to AS 1906.1 (1990) but without rotation measurements.
(k) "MARKER"	Raised Pavement Markers.
(l) "DELRO"	Delineators, printing out the results of rotation only.
(m) "DELIN"	Delineators for printing out photometric properties: new delineators, rotation effects not included.

PRESS &lt;ENTER&gt;

SWITCH ON PRINTER

SELECT OUTPUT

PRESS &lt;&lt;ENTER&gt;&gt;

OUTPUT DEVICE SELECTION

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