



# Measurement of the retroreflection of road signs in Europe using a RetroSign GRX



## The Vienna convention

The Vienna convention on road signs and signals entered into force in June 1978 and was ratified by 15 states and signed by an additional number of 35 states. These states are placed mainly in continental western Europe

The road signs defined in the Vienna convention are shown in annex A, which illustrates that the road signs are based on symbols while text is used mainly for names of locations. These are the road signs in use with, however, national modifications and additions.

## Retroreflection of road signs

CIE 54.2:2001 “*Retroreflection: Definition and measurement*” defines measures for retroreflection and angular systems.

The retroreflection of road signs is described by the coefficient of retroreflection  $R_A$  with the unit of  $\text{cd}\cdot\text{lx}^{-1}\cdot\text{m}^{-2}$ .

The angular situations are described by:

- The observation angle  $\alpha$ ,
- The two components  $\beta_1$  and  $\beta_2$  of the entrance angle  $\beta$ ,
- The rotation angle  $\varepsilon$ .

However, the component of the entrance angle  $\beta_2$  and the rotation angle  $\varepsilon$  are both  $0^\circ$ , leaving only the observation angle  $\alpha$  and the component of the entrance angle  $\beta_1$ . See figure 1.

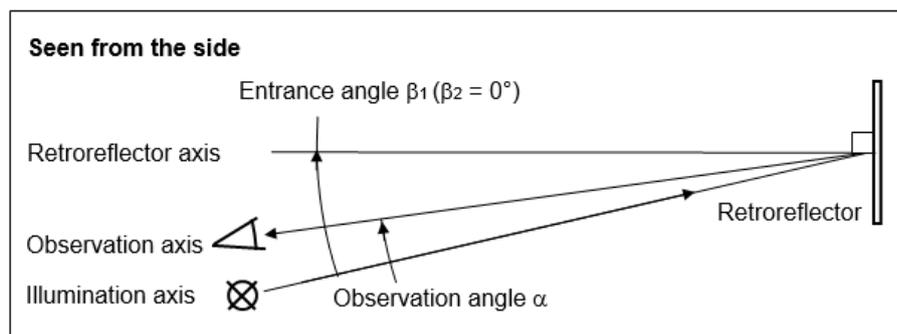


Figure 1: The geometry for road signs.

CIE 54.2 also gives advice regarding laboratory measurements, including maximum apertures, in a clause 6.

## European standards for the retroreflection of road signs

The only European standard for road signs is EN 12899-1: 2007 “*Fixed, vertical road traffic signs - Part 1: Fixed signs*”.

This standard specifies the geometries for testing the durability of retroreflective sheeting materials and signs that are shown in table 1. It is obvious to use these geometries for the measurement of retroreflection of installed road signs.

	Geometry 1	Geometry 2
$\alpha$	$0,33^\circ$	$0,33^\circ$
$\beta_1$	$5^\circ (\beta_2 = 0^\circ)$	$30^\circ (\beta_2 = 0^\circ)$

Table 1: Geometries defined in EN 12899-1.

## Needs for testing the retroreflection of installed road signs

A road administration is responsible for the performance of the road signs on its roads and may want to test the  $R_A$  values of:

- a) road signs installed in accordance with a contract at the end of the warranty period. The requirement may for instance be that the  $R_A$  values shall not be reduced by more than 20 % compared to the  $R_A$  values of the contract. The warranty period is typically 5 years in Europe.
- b) old road signs to address the possible need for replacement.

Tests may not include all the relevant road signs, but only a selection.

In case a), the roads signs should be cleaned before measurement. In case b), it may be desirable to measure both before and after cleaning.

## Measuring equipment

The RetroSign GRX is a handheld instrument that measures the retroreflection of surfaces at angular combinations given in standards and regulations.



Figure 2: The RetroSign GRX.

The GRX uses a lens to provide a virtually infinite measuring distance and well-defined apertures of illumination and measurement. These apertures comply with the maximum apertures of CIE 54.2.

The calibration standards are calibrated at the laboratory at DELTA with accreditation by DANAK (the national accreditation body in Denmark).

For this purpose, the equipment needed is a GRX-1 with  $\alpha = 0,33^\circ$ , a CEN calibrator and an adaptor EN 12899+30.

NOTE: It may be considered to measure only at geometry 1 as this is the more critical geometry and as measurements are reduced to half. If so, the adaptor EN 12899+30 is not needed.

In case a road sign has a text thinner than 25 mm, a CEN Ø10 calibrator for thin lines should be included. This applies of cause only, when the text is retroreflective – not when it is black or otherwise not retroreflective.

Additionally, an extension pole with a remote display is needed for cases where a sign cannot be reached from the ground.

The GRX has:

- a) GNSS for location identification and mapping,
- b) Camera for taking photos of signs,
- c) Camera for scanning of barcodes and QR codes for asset management,
- d) Wireless communication.

## Preparations, measurements, and report

### Preparations before leaving

- a. Identify the road signs whose  $R_A$  values are to be measured,
- b. Collect the measuring equipment that is needed,
- c. Include an extension pole and/or a ladder,
- d. Charge the GRX,
- e. Bring cloths, water, and a mild detergent in case the road signs need to be in the cleaned state,

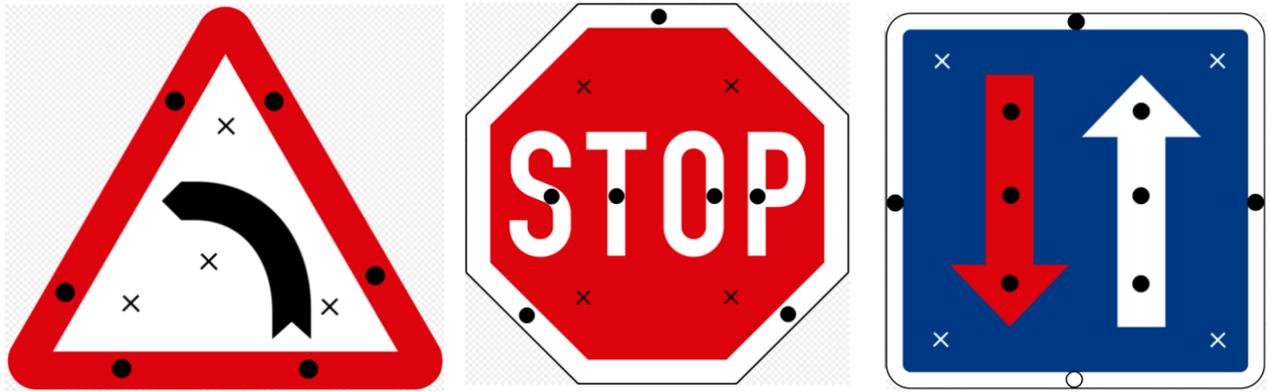
### Preparations at a location

- a. Decide if it is safe to get to the road sign even when using an extension pole and/or a ladder,
- b. Clean the road sign if it needs to be in the cleaned state and allow time for it to dry,
- c. Note the type of road sign and the colours of the background and the legends,
- d. Turn the GRX on, check the calibration and recalibrate, if necessary,
- e. Check that the GNSS signal is received (if used),
- f. If the extension pole is needed, mount the GRX on the extension pole and prepare the remote display.

### Measurements

- a. Measure the  $R_A$  values of each retroreflective color of the sign at a small number of locations while positioning the GRX vertically and ensuring full contact,
- b. Check if the  $R_A$  values of each of the retroreflective colors are realistic and reasonably uniform and redo measurements at the locations where the  $R_A$  values seem unrealistic.

Examples of measuring locations are shown in figure 3.



✕ Background  
 ● Legend

Figure 3: Examples of measuring locations.

**Report**

The report should be based on the output from the facilities of the GRX. Additionally, unusual events should be recorded.



# Annex A: Road signs in accordance with the Vienna convention

Danger warning sign				
Give way sign				
Stop sign				
Priority road and end priority road				
Priority for oncoming traffic				
Standard Priority				
Parking prohibited				
Stopping prohibited				
End of prohibition				

Standard mandatory



Special regulation signs



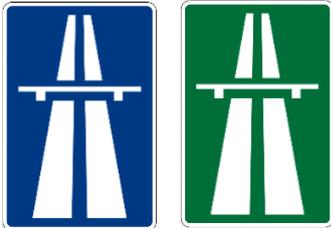
Information, facilities, or service signs



Informative signs



Motorway signs



Temporary signs



Additional panels

