



# REPORT

issued by an Accredited Testing Laboratory

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## Test in accordance with European Standard EN 12899-1 of retro reflective materials for road signs

SP Technical Research Institute of Sweden has performed testing of two retro reflective materials in accordance with European Standard EN 12899-1:2007 "Fixed, vertical road traffic signs-Part 1: Fixed signs".

### Identification

Your reference: Scott Horne  
Delivery date: June 2013  
Delivery status: The materials were without complaint  
Type of material: AURA<sup>®</sup> 150 Metalized HIP Prismatic in three colours:  
White, Lot #: 1060W150, Sample 1—4;  
Yellow, Lot #: 1778Y150, Sample 1—4;  
Red, Lot #: 1785R150, Sample 1—4;  
Measurement date: June 26—July 11, 2013

### Measurement methods and procedures

The measurements are performed in applicable parts in accordance with EN 12899-1:2007 and SP method No 1849.

The materials were delivered in 100x100 mm samples on aluminium substrates.

### Measurement conditions

The measurements were performed in a temperature stabilized laboratory with the temperature + 21°C ±2°C. The tested material was stabilized in the laboratory one hour prior to the measurement.

### Results

The results in this report are only valid for the samples tested.

The results are presented in the tables and diagrams below. Sample orientation angle  $\epsilon=0^\circ$ . For each colour and orientation, the mean, maximum and minimum values of 4 samples are presented.

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Table 1: Coefficient of retro-reflection in  $\text{cd}\cdot\text{m}^{-2}\cdot\text{lux}^{-1}$  for white material AURA 150 1060W150. Requirements according to Table 4, EN 12899-1:2007.

Observation angle $\alpha$		Entrance angle $\beta_1(\beta_2=0)$		
		5°	30°	40°
0,20°	Mean	540	383	276
	Max	548	396	294
	Min	533	368	254
	<i>Req.</i>	250	150	110
0,33°	Mean	265	204	189
	Max	284	211	199
	Min	240	189	171
	<i>Req.</i>	180	100	95
2,0°	Mean	7,2	7,2	5,4
	Max	7,3	7,3	5,6
	Min	7,1	7,1	5,2
	<i>Req.</i>	5	2,5	1,5

Table 2: Coefficient of retro-reflection in  $\text{cd}\cdot\text{m}^{-2}\cdot\text{lux}^{-1}$  for yellow material AURA 150 1778Y150. Requirements according to Table 4, EN 12899-1:2007.

Observation angle $\alpha$		Entrance angle $\beta_1(\beta_2=0)$		
		5°	30°	40°
0,20°	Mean	342	206	122
	Max	381	224	130
	Min	309	197	119
	<i>Req.</i>	170	100	70
0,33°	Mean	195	114	86
	Max	228	131	95
	Min	174	103	80
	<i>Req.</i>	120	70	60
2,0°	Mean	5,0	4,1	3,4
	Max	5,3	4,3	3,9
	Min	4,9	3,9	3,2
	<i>Req.</i>	3	1,5	1,0

Table 3: Coefficient of retro-reflection in  $\text{cd}\cdot\text{m}^{-2}\cdot\text{lux}^{-1}$  for red material AURA 150 1785R150. Requirements according to Table 4, EN 12899-1:2007.

Observation angle $\alpha$		Entrance angle $\beta_1(\beta_2=0)$		
		5°	30°	40°
0,20°	Mean	135	105	69
	Max	144	108	73
	Min	127	100	66
	Req.	45	25	15
0,33°	Mean	57	60	51
	Max	60	63	55
	Min	50	57	48
	Req.	25	14	13
2,0°	Mean	1,6	1,8	1,3
	Max	1,6	1,9	1,4
	Min	1,5	1,6	1,2
	Req.	1	0,4	0,3

Table 4: Colour coordinates and luminance factor (mean of four samples). Required luminance factor ( $\beta$ ) according to Table 1 of EN 12899-1:2007 is given within parenthesis.

Sample	x	y	$\beta$
White 1060W150	0,305	0,315	0,29 (0,27)
Yellow 1778Y150	0,510	0,449	0,17 (0,16)
Red 1785R150	0,648	0,337	0,06 (0,03)

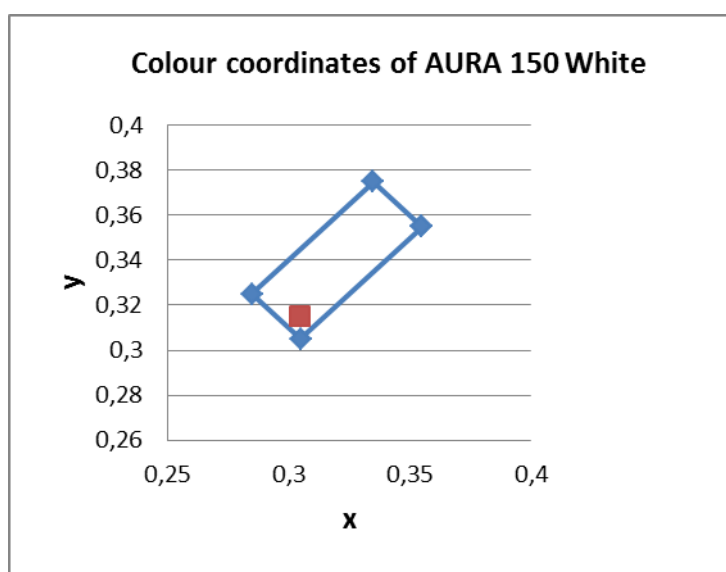


Diagram 1: Daylight chromaticity of white material AURA 150 1060W150. The specified area is according to Table 1 of EN 12899-1:2007.

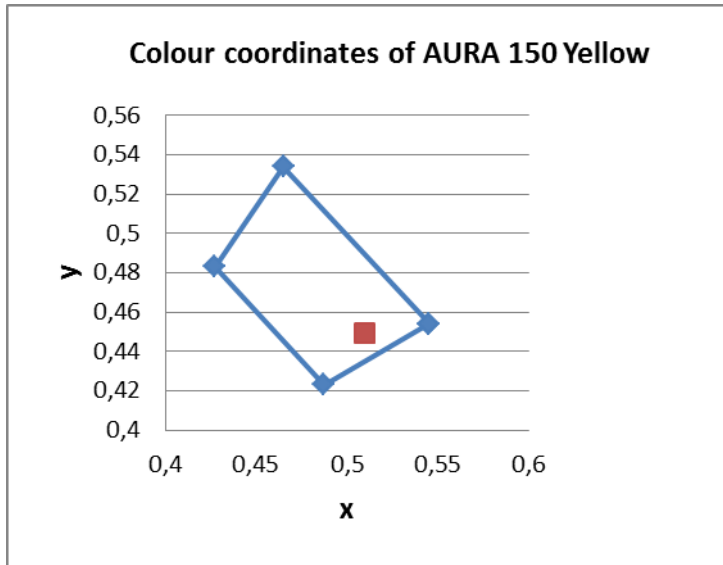


Diagram 2: Daylight chromaticity of yellow material AURA 150 1778Y150. The specified area is according to Table 1 of EN 12899-1:2007.

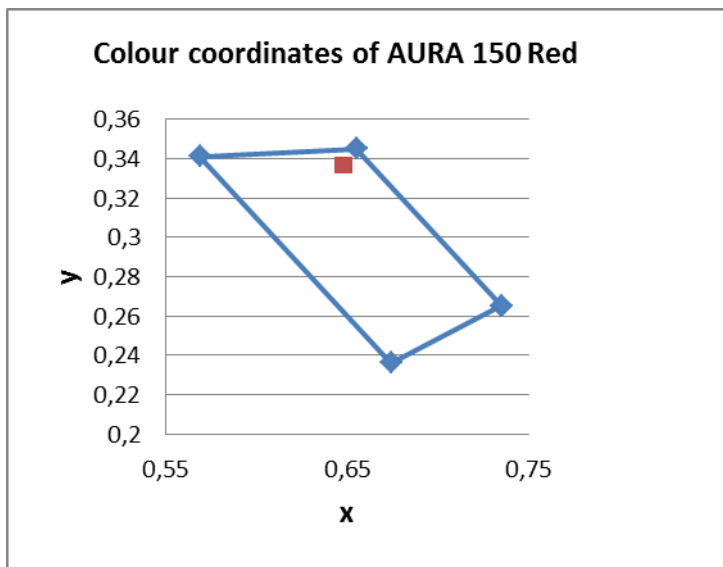


Diagram 3: Daylight chromaticity of red material AURA 150 1785R150. The specified area is according to Table 1 of EN 12899-1:2007.

### Measurement uncertainty

- Retroreflective level:  $\pm 5\%$  but not smaller than  $0,5 \text{ cd}\cdot\text{m}^{-2}\cdot\text{lux}^{-1}$
- Observation angle:  $\pm 0,01^\circ$
- Incidence angle:  $\pm 0,5^\circ$
- Chromaticity coordinates:  $\pm 0,005$
- Luminance factor:  $\pm 0,02$

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with EA Publication EA-4/02 (formerly EAL-R2). The long term stability of the calibrated object is not included in the reported expanded uncertainty of measurement.

## Equipment

Xenon-lamp with D65-filter, SP inv.no. 502959  
Photometer Pritchard PR 1980, SP inv.no. 500721  
Photometer Spectrascan PR-735, SP inv.no. 901491

## Comments

The requirements for retro-reflection before environmental tests of Class RA2 materials according to EN 12899-1:2007 and DIN 67520:2008 are fulfilled for AURA<sup>®</sup> 150 Metalized HIP Prismatic White, Yellow and Red.

The requirements of colour and luminance factor for new materials are fulfilled according to EN 12899-1:2007 and DIN 6171-1:2003-08 for AURA<sup>®</sup> 150 Metalized HIP Prismatic White, Yellow and Red.

## SP Technical Research Institute of Sweden Measurement Technology - Communication

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