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EUROPEAN TECHNICAL ASSESSMENT

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**Technical Assessment Body issuing the European Technical Assessment: UBAtc.
UBAtc has been designated according to Article 29 of Regulation (EU) No 305/2011 and is member of EOTA (European Organisation for Technical Assessment)**

Trade name of the construction product:	3M™ Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600 with and without various combinations of process colour and overlay film
Product family to which the construction product belongs:	Microprismatic retro-reflective sheeting for traffic signs
Manufacturer:	3M Deutschland GmbH Carl Schurz Strasse 1 D- 41453- Neuss - Deutschland
Manufacturing plant(s):	3M Innovation Singapore Pte Ltd. 2 Tuas Link 4 Singapore 637321 SG – Singapore 3M Brownwood 4501 Highway 377 South Brownwood, Texas 76801 USA
Website:	www.mmm.com
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	European Assessment Document (EAD): 120001-01-0106
This European Technical Assessment contains:	19 pages, without any annexes.

European Organisation for Technical Assessment

Legal bases and general conditions

1 This European Technical Assessment is issued by UBAtc (Union belge pour l'Agrément technique de la construction, i.e. Belgian Union for technical Approval in construction), in accordance with:

- Regulation (EU) No 305/2011[1] of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC
- Commission Implementing Regulation (EU) No 1062/2013[2] of 30 October 2013 on the format of the European Technical Assessment for construction products
- European Assessment Document (EAD) : 120001-01-0106

2 Under the provisions of Regulation (EU) No 305/2011, UBAtc is not authorized to check whether the provisions of this European Technical Assessment are met once the ETA has been issued.

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4 Depending on the applicable Assessment and verification of constancy of performance (AVCP) system, (a) notified body(ies) may carry out third-party tasks in the process of assessment and verification of constancy of performance under this Regulation once the European Technical Assessment has been issued.

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7 This European Technical Assessment is not to be transferred to other manufacturers, agents of manufacturers, or manufacturing plants other than those indicated on page 1 of this European Technical Assessment.

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13 Subject to the application introduced, this European Technical Assessment is issued in English and may be issued by the UBAtc in its official languages. The translations correspond fully to the English reference version circulated in EOTA.

14 This European Technical Assessment was first issued by UBAtc on 17 April 2020.

[1] OJEU, L 88 of 2011/04/04

[2] OJEU, L 289 of 2013/10/31

Technical Provisions

1 Technical description of the product

1.1 General

The product consists in a micro-prismatic retro-reflective sheeting made of optical prismatic lenses elements formed in a transparent synthetic resin, sealed and backed with a pressure sensitive adhesive to form a durable bond to the sign substrates. The sheeting has a smooth surface with a distinctive interlocking seal pattern and may or may not have orientation marks, visible from the face.

The product is supplied as a single coloured sheet whose trade name is "3M™ Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600", or with various combinations of Process Colour and Overlay Film as outlined in table 1.1..

1.2 Components of 3M™ Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600 and Combinations with Process Colour and Overlay Film

An overview of the complete set of components of "3M™ Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600" and combinations with Process Colour and Overlay Film is presented in Table 1.1. The mixing ratio of the Piezo Inkjet Ink for the various traffic colours has been deposited with UBAtc.

The manufacturer's specification of the initial daylight chromaticity and luminance factor is given in table 1.2 by means of a colour box in the 1931 CIE (2°) system.

The manufacturer's specification of the daylight chromaticity and luminance factor 'in-use' (or after the durability test) is given in table 1.3 by means of a colour box in the 1931 CIE (2°) system.

Components	Trade name	Colours/code		Characteristics
Microprismatic retro-reflective sheeting	3M™ Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600	White	7610	Nominal Thickness: 0.23 mm Rolls in various length and widths
		Yellow	7611	
Process Colour	3M™ Process Colour Series 880 I or N*	Yellow	884 I or N	20-25 mg/l
		Red	882 I or N	
		Blue	883 I or N	
		Green	888 I or N	
Process Colour	3M™ Process Colour Series 990	Yellow	990-04	20-25 mg/l
		Red	990-12	
		Blue	990-10	
		Green	990-08	
Process Colour for digital printing	3M™ Piezo Inkjet Ink Series 8800 UV or 8900 UV**	Yellow		18-20 mg/l
		Red		
		Blue		
		Green		
		Dark Green		
		Orange		
		Brown		
3M™ Protective Overlay Film		Clear	1140	Combined Thickness: 0,4 mm

*3M™ Process Colour Series 880I and 880N are variations of the same basic ink formulations. Both ink series use identical pigments. The difference between 880I and 880N is the solvent package, providing different drying characteristics. 3M sells and markets both ink series as equal alternatives with the same durability and warranty provisions. The basis for this ETA has been generated with version 880I.
** 3M Piezo Ink Jet Ink Series 8800UV or 8900UV are variations of the same basic ink formulations. The difference between Series 8800 and 8900 are the dispersant and stabilizer packages to make the ink suitable for the different printer models and printheads. The curable components are similar. 3M markets both ink series as equal alternatives with the same performances.

Table 1.1: Complete set of Microprismatic retro-reflective sheeting covered by this ETA

Colours		Chromaticity Coordinates				Luminance Factor ß
		1	2	3	4	
White	**x**	*0.305*	*0.335*	*0.325*	*0.295*	*≥ 0.35*
Tolerance Sphere*	**y**	*0.315*	*0.345*	*0.355*	*0.325*	
Yellow	**x**	*0.494*	*0.470*	*0.513*	*0.545*	*≥ 0.27*
Tolerance Sphere*	**y**	*0.505*	*0.480*	*0.437*	*0.454*	
Red	**x**	*0.735*	*0.700*	*0.610*	*0.660*	*≥ 0.05*
Tolerance Sphere*	**y**	*0.265*	*0.250*	*0.340*	*0.340*	
Red on Yellow	**x**	*0.735*	*0.700*	*0.610*	*0.660*	*≥ 0.05*
Tolerance Sphere*	**y**	*0.265*	*0.250*	*0.340*	*0.340*	
Blue	**x**	*0.130*	*0.160*	*0.160*	*0.130*	*≥ 0.01*
Tolerance Sphere*	**y**	*0.090*	*0.090*	*0.140*	*0.140*	
Green	**x**	*0.110*	*0.170*	*0.170*	*0.110*	*≥ 0.04*
Tolerance Sphere*	**y**	*0.415*	*0.415*	*0.500*	*0.500*	
Orange	**x**	0.631	0.560	0.506	0.570	*≥ 0.17*
Tolerance Sphere	**y**	0.369	0.360	0.404	0.429	
Brown	**x**	*0.455*	*0.523*	*0.479*	*0.558*	*0.03-0.09*
Tolerance Sphere*	**y**	*0.397*	*0.429*	*0.373*	*0.394*	
Grey	**x**	*0.305*	*0.335*	*0.325*	*0.295*	*0.11-0.18*
Tolerance Sphere*	**y**	*0.315*	*0.345*	*0.355*	*0.325*	
Dark Green	**x**	*0.313*	*0.313*	*0.248*	*0.127*	*0.01-0.07*
Tolerance Sphere	**y**	*0.682*	*0.453*	*0.409*	*0.557*	
* Chromaticity Coordinates are similar to EN 12899-1:2007 Class CR2						

Table 1.2: Manufacturer's specification for initial daylight chromaticity and luminance factor

Colours		Chromaticity Coordinates				Luminance Factor ß
		1	2	3	4	
White	**x**	0.355	0.305	0.285	0.335	*≥ 0.35*
Tolerance Sphere*	**y**	0.355	0.305	0.325	0.375	
Yellow	**x**	0.545	0.487	0.427	0.465	*≥ 0.27*
Tolerance Sphere*	**y**	0.454	0.423	0.483	0.534	
Red	**x**	0.735	0.674	0.569	0.655	*≥ 0.05*
Tolerance Sphere*	**y**	0.265	0.236	0.341	0.345	
Red on Yellow	**x**	0.735	0.674	0.569	0.655	*≥ 0.05*
Tolerance Sphere*	**y**	0.265	0.236	0.341	0.345	
Blue	**x**	0.078	0.150	0.210	0.137	*≥ 0.01*
Tolerance Sphere*	**y**	0.171	0.220	0.160	0.038	
Green	**x**	0.007	0.248	0.177	0.026	*≥ 0.04*
Tolerance Sphere*	**y**	0.703	0.409	0.362	0.399	
Orange	**x**	0.631	0.560	0.506	0.570	*≥ 0.17*
Tolerance Sphere	**y**	0.369	0.360	0.404	0.429	
Brown	**x**	*0.455*	*0.523*	*0.479*	*0.558*	*0.03-0.09*
Tolerance Sphere*	**y**	*0.397*	*0.429*	*0.373*	*0.394*	
Grey	**x**	0.350	0.300	0.285	0.335	*0.11-0.18*
Tolerance Sphere*	**y**	0.360	0.310	0.325	0.375	
Dark Green	**x**	*0.313*	*0.313*	*0.248*	*0.127*	*0.01-0.07*
Tolerance Sphere*	**y**	*0.682*	*0.453*	*0.409*	*0.557*	
* Chromaticity Coordinates are similar to EN 12899-1:2007 Class CR1						

Table 1.3: Manufacturer's specification for daylight chromaticity and luminance factor 'in-use'

2 Specification of the intended use(s) in accordance with the applicable EAD

2.1 Intended uses

The construction product is used to manufacture sign faces for traffic signs.

The intended use includes, for example:

- retro-reflective signs,
- retro-reflective and trans-illuminated signs,
- trans-illuminated traffic bollards,
- road delineators with retro-reflective devices,
- variable message signs.

The envisaged substrates or structures are commonly, but not only, based on aluminium, galvanised steel or processed polymers. The test specimens for this ETA have been prepared on smooth aluminium panels, according to EAD 120001-01-0106, Annex 1.

The assumed intended working life of the product is 7 years, provided that it is subjected to appropriate use and maintenance. The indications given as to the working life of the product cannot be interpreted as a guarantee given by the manufacturer or by the Technical Assessment Body.

2.2 Assumptions under which the fitness of the product(s) for the intended use was favourably assessed

2.2.1 Manufacturing directives

The "3M™ Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600" and combinations with Process Colour and Overlay Film, shall correspond, as far as their composition and manufacturing process is concerned, to the products subject to the assessment tests. A manufacturing process has been deposited with UBAtc.

2.2.2 Installation

2.2.2.1 General

It is the responsibility of the ETA holder to guarantee that the information about design and installation of the systems as described in clause 1.1 of this ETA, are effectively communicated to the concerned people. This information can be given using reproductions of the respective parts of this ETA. Besides, all the data concerning the execution shall be indicated clearly on the packaging and or the enclosed instruction sheets using one or several illustrations.

In any case, it is suitable to comply with national regulations and particularly concerning national traffic code.

Only the components described in clause 1 of this ETA may be used for the systems.

2.2.2.2 Design

Users are urged to carefully evaluate all substrates for adhesion and sign durability. "3M™ Flexible Engineer Grade Prismatic Reflective Series 7600" is designed primarily for application to flat substrates.

2.2.2.3 Application

"3M™ Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600"

The recognition and preparation of the substrate as well as the generalities about the application of this product series, which is fully described in the current version of the ETA holder catalogue, it technical bulletins and web site www.3M.com/TSS, shall be carried out in compliance with national regulations, if any.

"3M™ Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600" sheeting incorporate a pressure sensitive adhesive and shall be applied to the sign substrate at room temperature (18°C) or higher by any of the following methods: mechanical squeeze roll applicator, hand squeeze roll applicator, hand application. If the heater is needed to warm to the minimum application temperature of 18°C, it must be directed at the substrate only.

Users are urged to carefully evaluate all substrates for adhesion and sign durability. "3M™ Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600" is designed primarily for application to flat substrates. Sign failures caused by the substrate due to improper surface preparation are not the responsibility of the ETA holder.

3M™ Process Colour Series 880 I or N and Series 990

For screen processing, the equipment and set-up are the following: proper colour and durability is achieved by using a high-grade polyester, monofilament screen fabric mesh size P.E. 157. Other size screen fabrics do not produce satisfactory colour and durability. Screen printing should be accomplished using the off-contact screening method. Direct contact screen printing should not be used. Be sure that screens, sheeting, plus screening and drying areas are dust, dirt and lint free.

For the mixing and thinning, it is important that the colours and sheeting be brought to normal ambient room temperature and humidity of the screen printing area before processing. Thin sparingly using 3M™ Thinner of the same series as the process colours. Do not use extenders, drying agents, or other materials as they will adversely affect performance life.

Air Drying: processed sheeting for air drying must be placed on open racks to allow adequate air circulation. High volume fans must be directed through the racks. Drying times will be increased by high humidity, low temperature, poor air circulation, heavy colour coat, and excessive thinning. Addition of drying agents is not recommended. Sheeting processed with screenprint Process Colour must be air dried for a minimum of 3 hours per colour.

Oven drying: Processed sheeting for oven drying must be placed on open racks individually with sufficient open space for unobstructed air flow.

All inks should not be stored at elevated temperatures and shall be used within one year after the date of purchase or within the indicated shelf life.

3M™ Piezo Inkjet Ink Series 8800 UV or 8900 UV

3M Piezo Ink Jet Ink Series 8800 UV or 8900 UV are designed as part of the 3M MCS™ (Matched Component System) for application using the Durst Rho 161TS / 162TS / 163TS and EFI H1625RS Printer onto 3M Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600 BEFORE mounting the sheeting onto a sign substrate. These UV-curable inks are durable, weather-resistant, and have excellent colour retention when used in combination with 3M Protective Overlay Film 1140 as an overlaminate.

Detailled printing guidelines in order to achieve traffic sign colours according to this ETA can be obtained in the latest Product Bulletin for 3M Piezo Ink Jet Ink Series 8800 UV or 8900 UV.

3M Piezo Ink Jet Ink Series 8800UV or 8900 UV should not be stored at elevated temperatures. It must be used within the indicated shelf life.

3M™ Protective Overlay Film 1140

Protective Overlay film shall be stored in a cool, dry area at 18-24°C and 30 – 50 % RH, and shall be used within one year from date of purchase.

3M Protective Overlay Film 1140 must always be applied, following below instructions:

To avoid a silvering artifact (trapped air between ink layer and overlaminate), the lamination process should be conducted under a controlled set of conditions.

Recommended laminator specifications and set-up:

- Roll diameter: max. 350 mm; Roll weight: approximately 80 kg; Roll width: 1400-1600 mm
- Core size: 3 inches; 2 Take-up shafts; 2 Supply shafts
- Heatable top roller: min. 45°C; Pressure: > 8 bar

2.3 Recommendations

2.3.1 Recommendations on packaging, transport and storage

The sheeting must be stored in a cool, dry area, preferably at 18-24°C and 30-50% RH, and should be applied within one year from delivery. Rolls should be stored horizontally in the shipping carton. Partially used rolls should be returned to the shipping carton or suspended horizontally on a rod or pipe through the core.

Unprocessed sheets should be stored flat. Finished signs and applied blanks should be stored on edge.

Package for shipment must prevent movement and chafing. Store sign packages indoors on edges. Panels or finished signs must remain dry during shipping and storage. If packaged signs become wet, unpack immediately and allow to dry.

3 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

Essential Characteristics of the product Basic Works Requirement 4: Safety and accessibility in use			
No	**Essential Characteristic**	**Clause**	**Product Performance**
	Visibility Characteristics		
1	Daylight Chromaticity and Luminance Factor	3.x.1	Value (average of three samples)
2	Night-time colour	3.x.2	No performance assessed
3	Coefficient of Retro-reflection	3.x.3	Value (average of three samples)
4	Rotational symmetry	3.x.4	Value (Ratio)
	Durability		
5	Impact resistance	3.x.5	EN 12899-1:2007
6	Temperature resistance	3.x.6	No performance assessed
7	Daylight Chromaticity and Luminance Factor after accelerated artificial or natural weathering	3.x.7.1	Value (average of three samples)
8	Coefficient of Retro-reflection after accelerated artificial or natural weathering	3.x.7.2	Value (average of three samples)
9	Adhesion	3.x.8	No performance assessed

3.1 3M Flexible Engineer Grade Prismatic Reflective Sheeting Series 7600

The result of the test is given as average of three samples.

3.1.1 Daylight Chromaticity and Luminance Factor

The characteristics of initial daylight chromaticity and luminance factor have been determined according to EAD120001-01-0106, clause 2.2.1.

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White Tolerance Sphere	***x***	***0.305***	***0.335***	***0.325***	***0.295***	***≥ 0.35***
	y	***0.315***	***0.345***	***0.355***	***0.325***	
White 7600	x	0.311				0.68
	y	0.328				
Yellow Tolerance Sphere	***x***	***0.494***	***0.470***	***0.513***	***0.545***	***≥ 0.27***
	y	***0.505***	***0.480***	***0.437***	***0.454***	
Yellow 7611	x	0.488				0.39
	y	0.466				

3.1.2 Night-time colour

No performance assessed.

3.1.3 Coefficient of Retro-reflection

The Coefficient of Retro-reflection has been determined according to EAD120001-01-0106, clause 2.2.3. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Geometry of measurements		Colour	
α	β_1 ($\beta_2 = 0$)	White	Yellow
12'	**+5°**	173	82
	+30°	108	51
	+40°	81	39
20'	**+5°**	83	45
	+30°	76	38
	+40°	67	33
2°	**+5°**	12	8.4
	+30°	4.2	3.4
	+40°	3.1	2.5

3.1.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-01-0106, clause 2.2.3 “rotational symmetry”. The rotation angle ε has been set to 0° according to the manufacturer's specification.

Rotational symmetry	
#	Ratio
White	
Average of three Samples	1 : 1,86
Yellow	
Average of three Samples	1 : 1,34

3.1.5 Impact resistance

The Impact resistance has been determined according to EAD120001-01-0106, clause 2.2.4.

Sample	Test Result
White 7600	No apparent cracking or delamination observed
Yellow 7611	

3.1.6 Temperature Resistance

No performance assessed.

3.1.7 Visibility after accelerated artificial weathering

The accelerated artificial weathering has been done according to EAD 120001-01-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer. Test specimens with the dimension of 5.5 x 10 cm have been used.

3.1.7.1 Daylight Chromaticity and Luminance Factor after accelerated artificial weathering

The daylight chromaticity and luminance factor, verified according to EAD120001-01-0106, clause 2.2.1, tested after accelerated artificial weathering. The result of the test is given as average of three samples.

Colours		Chromaticity Coordinates				Luminance Factor ß
		1	2	3	4	
White Tolerance Sphere	***x*** ***y***	**0.355** **0.355**	**0.305** **0.305**	**0.285** **0.325**	**0.335** **0.375**	***≥ 0.35***
White 7600	x y	0.314 0.334				0.70
Yellow Tolerance Sphere	***x*** ***y***	**0.545** **0.454**	**0.487** **0.423**	**0.427** **0.483**	**0.465** **0.534**	***≥ 0.27***
Yellow 7611	x y	0.485 0.466				0.41

3.1.7.2 Coefficient of Retro-reflection after accelerated artificial weathering

The Coefficient of Retro-reflection after accelerated artificial weathering tests has been determined according to EAD 120001-01-0106, clause 2.2.6.4, with an observation angle α = 0.33° and α = 1.0° and entrance angle $\beta 1$= 5° and 30°. The rotation angle ε has been set to 0° according to the manufacturer's specification.

The result of the test is given as average of three samples.

Geometry of measurements		Colour	
α	**β_1 (β_2 = 0)**	**White**	**Yellow**
20'	**+5°** **+30°**	63 54	45 33
1°	**+5°** **+30°**	53 11.2	39 10.2

3.1.8 Adhesion

No performance assessed.

3.2 3M Flexible Engineer Grade Prismatic Reflective Sheeting 7610 printed with 3M Process Colour Series 880I or N

3.2.1 Daylight Chromaticity and Luminance Factor

The characteristics of initial daylight chromaticity and luminance factor have been determined according to EAD120001-01-0106, clause 2.2.1.

The result of the test is given as average of three samples.

Colours		Chromaticity Coordinates				Luminance Factor ß
		1	2	3	4	
Yellow Tolerance Sphere	***x*** ***y***	***0.494*** ***0.505***	***0.470*** ***0.480***	***0.513*** ***0.437***	***0.545*** ***0.454***	***≥ 0.27***
Yellow	x y	0.527 0.455				0.35
Red Tolerance Sphere	***x*** ***y***	***0.735*** ***0.265***	***0.700*** ***0.250***	***0.610*** ***0.340***	***0.660*** ***0.340***	***≥ 0.05***
Red	x y	0.632 0.323				0.08
Blue Tolerance Sphere	***x*** ***y***	***0.130*** ***0.090***	***0.160*** ***0.090***	***0.160*** ***0.140***	***0.130*** ***0.140***	***≥ 0.01***
Blue	x y	0.144 0.145				0.06
Green Tolerance Sphere	***x*** ***y***	***0.110*** ***0.415***	***0.170*** ***0.415***	***0.170*** ***0.500***	***0.110*** ***0.500***	***≥ 0.04***
Green	x y	0.144 0.459				0.14

3.2.2 Night-time colour

No performance assessed.

3.2.3 Coefficient of Retro-reflection

The Coefficient of Retro-reflection has been determined according to EAD120001-01-0106, clause 2.2.3. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Geometry of measurements		Colour			
α	β_1 ($\beta_2 = 0$)	Yellow	Red	Blue	Green
12'	**+5°** **+30°** **+40°**	94 60 48	39 24 18.3	14.2 8.0 6.1	41 25 19.5
20'	**+5°** **+30°** **+40°**	48 45 41	21 18.2 15.8	6.9 5.4 4.9	20 17.2 15.8
2°	**+5°** **+30°** **+40°**	7.8 3.1 2.1	3.1 1.1 1.0	1.6 0.5 0.2	3.9 1.5 0.8

3.2.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-01-0106, clause 2.2.3 “rotational symmetry”. The rotation angle ε has been set to 0° according to the manufacturer's specification.

Coefficient of retroreflexion (cd · lx $^{-1}$ · m^{-2}) Rotational symmetry	
Colour	**Ratio**
Yellow	1.49
Red	1.44
Blue	1.63
Green	1.61

3.2.5 Impact resistance

The Impact resistance has been determined according to EAD120001-01-0106, clause 2.2.4.

Sample	Test Result
Yellow	No apparent cracking or delamination observed
Red	
Blue	
Green	

3.2.6 Temperature Resistance

No performance assessed.

3.2.7 Visibility after accelerated artificial weathering

The accelerated artificial weathering has been done according to EAD 120001-01-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer. Test specimens with the dimension of 5.5 x 10 cm have been used.

3.2.7.1 Daylight Chromaticity and Luminance Factor after accelerated artificial weathering

The daylight chromaticity and luminance factor, verified according to EAD120001-01-0106, clause 2.2.1, tested after accelerated artificial weathering. The result of the test is given as average of three samples.

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
Yellow Tolerance Sphere	***x*** ***y***	***0.545*** ***0.454***	***0.487*** ***0.423***	***0.427*** ***0.483***	***0.465*** ***0.534***	***≥ 0.27***
Yellow	x y	0.505 0.470				0.42
Red Tolerance Sphere	***x*** ***y***	***0.735*** ***0.265***	***0.674*** ***0.236***	***0.569*** ***0.341***	***0.655*** ***0.345***	***≥ 0.05***
Red	x y	0.616 0.327				0.09
Green Tolerance Sphere	***x*** ***y***	***0.007*** ***0.703***	***0.248*** ***0.409***	***0.177*** ***0.362***	***0.026*** ***0.399***	***≥ 0.04***
Green	x y	0.148 0.456				0.13
Blue Tolerance Sphere	***x*** ***y***	***0.078*** ***0.171***	***0.150*** ***0.220***	***0.210*** ***0.160***	***0.137*** ***0.038***	***≥ 0.01***
Blue	x y	0,142 0,149				0,07

3.2.7.2 Coefficient of Retro-reflection after accelerated artificial weathering

The Coefficient of Retro-reflection after accelerated artificial weathering tests has been determined according to EAD 120001-01-0106, clause 2.2.6.4, with an observation angle α = 0.33° and α = 1.0° and entrance angle β1= 5° and 30°. The rotation angle ε has been set to 0° according to the manufacturer's specification.

The result of the test is given as average of three samples.

Geometry of measurements		Colour			
α	**β_1 (β_2 = 0)**	**Yellow**	**Red**	**Blue**	**Green**
20'	**+5°** **+30°**	51 40	19.2 14.8	6.6 4.8	17.4 13.4
1°	**+5°** **+30°**	46 9.9	17.5 3.3	4.5 1.2	12.7 3.7

3.2.8 Adhesion

No performance assessed.

3.3 3M Flexible Engineer Grade Prismatic Reflective Sheeting 7610 printed with 3M Process Colour Series 990

3.3.1 Daylight Chromaticity and Luminance Factor

The characteristics of initial daylight chromaticity and luminance factor have been determined according to EAD120001-01-0106, clause 2.2.1.

The result of the test is given as average of three samples.

Colours		Chromaticity Coordinates				Luminance Factor ß
		1	2	3	4	
Yellow Tolerance Sphere	***x*** ***y***	***0.494*** ***0.505***	***0.470*** ***0.480***	***0.513*** ***0.437***	***0.545*** ***0.454***	***≥ 0.27***
Yellow	x y	0.510 0.470				0.40
Red Tolerance Sphere	***x*** ***y***	***0.735*** ***0.265***	***0.700*** ***0.250***	***0.610*** ***0.340***	***0.660*** ***0.340***	***≥ 0.05***
Red	x y	0.661 0.322				0.08
Blue Tolerance Sphere	***x*** ***y***	***0.130*** ***0.090***	***0.160*** ***0.090***	***0.160*** ***0.140***	***0.130*** ***0.140***	***≥ 0.01***
Blue	x y	0.145 0.105				0.04
Green Tolerance Sphere	***x*** ***y***	***0.110*** ***0.415***	***0.170*** ***0.415***	***0.170*** ***0.500***	***0.110*** ***0.500***	***≥ 0.04***
Green	x y	0.152 0.441				0.14

3.3.2 Night-time colour

No performance assessed.

3.3.3 Coefficient of Retro-reflection

The Coefficient of Retro-reflection has been determined according to EAD120001-01-0106, clause 2.2.3. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Geometry of measurements		Colour			
α	**β_1 ($\beta_2 = 0$)**	**Yellow**	**Red**	**Blue**	**Green**
12'	**+5°** **+30°** **+40°**	80 47 37	29 17.7 13.6	5.1 3.0 2.2	41 24 18.6
20'	**+5°** **+30°** **+40°**	39 34 32	15.7 13.4 11.8	2.5 1.9 1.8	20 17.7 15.5
2°	**+5°** **+30°** **+40°**	6.7 2.8 1.6	2.4 0.8 0.7	0.6 0.2 0.1	3.8 1.5 0.7

3.3.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-01-0106, clause 2.2.3 “rotational symmetry”. The rotation angle ε has been set to 0° according to the manufacturer's specification.

Coefficient of retroreflexion (cd · lx $^{-1}$ · m^{-2}) Rotational symmetry	
Colour	**Ratio**
Yellow	1.45
Red	1.38
Blue	1.68
Green	1.57

3.3.5 Impact resistance

The Impact resistance has been determined according to EAD120001-01-0106, clause 2.2.4.

Sample	Test Result
Yellow	No apparent cracking or delamination observed
Red	
Blue	
Green	

3.3.6 Temperature Resistance

No performance assessed.

3.3.7 Visibility after accelerated artificial weathering

The accelerated artificial weathering has been done according to EAD 120001-01-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer. Test specimens with the dimension of 5.5 x 10 cm have been used.

3.3.7.1 Daylight Chromaticity and Luminance Factor after accelerated artificial weathering

The daylight chromaticity and luminance factor, verified according to EAD120001-01-0106, clause 2.2.1, tested after accelerated artificial weathering. The result of the test is given as average of three samples.

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
Yellow Tolerance Sphere	***x*** ***y***	***0.545*** ***0.454***	***0.487*** ***0.423***	***0.427*** ***0.483***	***0.465*** ***0.534***	***≥ 0.27***
Yellow	x y	0.503 0.474				0.42
Red Tolerance Sphere	***x*** ***y***	***0.735*** ***0.265***	***0.674*** ***0.236***	***0.569*** ***0.341***	***0.655*** ***0.345***	***≥ 0.05***
Red	x y	0.646 0.324				0.07
Green Tolerance Sphere	***x*** ***y***	***0.007*** ***0.703***	***0.248*** ***0.409***	***0.177*** ***0.362***	***0.026*** ***0.399***	***≥ 0.04***
Green	x y	0.163 0.427				0.17
Blue Tolerance Sphere	***x*** ***y***	***0.078*** ***0.171***	***0.150*** ***0.220***	***0.210*** ***0.160***	***0.137*** ***0.038***	***≥ 0.01***
Blue	x y	0.146 0.104				0.03

3.3.7.2 Coefficient of Retro-reflection after accelerated artificial weathering

The Coefficient of Retro-reflection after accelerated artificial weathering tests has been determined according to EAD 120001-01-0106, clause 2.2.6.4, with an observation angle α = 0.33° and α = 1.0° and entrance angle β1= 5° and 30°. The rotation angle ε has been set to 0° according to the manufacturer's specification.

The result of the test is given as average of three samples.

Geometry of measurements		Colour			
α	**β_1 (β_2 = 0)**	**Yellow**	**Red**	**Blue**	**Green**
20'	**+5°** **+30°**	52 35	16.0 11.8	2.7 1.9	24 19.3
1°	**+5°** **+30°**	48 9.9	15.3 2.9	1.6 0.5	17.9 5.2

3.3.8 Adhesion

No performance assessed.

3.4 3M Flexible Engineer Grade Prismatic Reflective Sheeting 7610 + 3M™ Piezo Inkjet Ink Series 8800 or 8900 UV + 3M™ Protective Overlay Film 1140

3.4.1 Daylight Chromaticity and Luminance Factor

The characteristics of initial daylight chromaticity and luminance factor have been determined according to EAD120001-01-0106, clause 2.2.1. The result of the test is given as average of three samples.

Colours		Chromaticity Coordinates				Luminance Factor ß
		1	2	3	4	
White Tolerance Sphere	***x*** ***y***	***0.305*** ***0.315***	***0.335*** ***0.345***	***0.325*** ***0.355***	***0.295*** ***0.325***	***≥ 0.35***
White	x y	0.312 0.332				0.70
Yellow Tolerance Sphere	***x*** ***y***	***0.494*** ***0.505***	***0.470*** ***0.480***	***0.513*** ***0.437***	***0.545*** ***0.454***	***≥ 0.27***
Yellow	x y	0.488 0.471				0.38
Red Tolerance Sphere	***x*** ***y***	***0.735*** ***0.265***	***0.700*** ***0.250***	***0.610*** ***0.340***	***0.660*** ***0.340***	***≥ 0.05***
Red	x y	0.637 0.330				0.10
Blue Tolerance Sphere	***x*** ***y***	***0.130*** ***0.090***	***0.160*** ***0.090***	***0.160*** ***0.140***	***0.130*** ***0.140***	***≥ 0.01***
Blue	x y	0.141 0.132				0.06
Green Tolerance Sphere	***x*** ***y***	***0.110*** ***0.415***	***0.170*** ***0.415***	***0.170*** ***0.500***	***0.110*** ***0.500***	***≥ 0.04***
Green	x y	0.158 0.465				0.08
Orange Tolerance Sphere	***x*** ***y***	***0.631*** ***0.369***	***0.560*** ***0.360***	***0.506*** ***0.404***	***0.570*** ***0.429***	***≥ 0.17***
Orange	x y	0.571 0.394				0.21
Brown Tolerance Sphere	***x*** ***y***	***0.455*** ***0.397***	***0.523*** ***0.429***	***0.479*** ***0.373***	***0.558*** ***0.394***	***0.03-0.09***
Brown	x y	0.519 0.398				0.06

3.4.2 Night-time colour

No performance assessed.

3.4.3 Coefficient of Retro-reflection

The Coefficient of Retro-reflection has been determined according to EAD120001-01-0106, clause 2.2.3. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Geometry of measurements		Colour						
α	β_1 ($\beta_2 = 0$)	White	Yellow	Red	Blue	Green	Brown	Orange
12'	**+5°** **+30°** **+40°**	146 91 68	81 45 32	32 17 12	14.2 7.6 5.2	17.1 9.2 6.3	24 12.5 8.7	52 29 21
20'	**+5°** **+30°** **+40°**	77 66 56	49 33 27	19 13 11	8.2 5.4 4.3	10.3 6.7 5.3	14.5 9.4 7.5	31 22 17.6
2°	**+5°** **+30°** **+40°**	11.1 5.5 4.8	9.6 4.1 3.3	3.5 1.6 1.4	1.4 0.6 0.4	2.1 0.9 0.7	2.8 1.2 1.0	5.6 2.5 2.1

3.4.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-01-0106, clause 2.2.3 “rotational symmetry”. The rotation angle ε has been set to 0° according to the manufacturer's specification.

Coefficient of retroreflexion (cd · lx $^{-1}$ · m^{-2}) Rotational symmetry	
Colour	**Ratio**
White	1.59
Yellow	1.35
Red	1.33
Blue	1.44
Green	1.32
Orange	1.40
Brown	1.32

3.4.5 Impact resistance

The Impact resistance has been determined according to EAD120001-01-0106, clause 2.2.4.

Sample	Test Result
White	No apparent cracking or delamination observed
Yellow	
Red	
Blue	
Green	
Orange	
Brown	

3.4.6 Temperature Resistance

No performance assessed.

3.4.7 Visibility after accelerated artificial weathering

The accelerated artificial weathering has been done according to EAD 120001-01-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer. Test specimens with the dimension of 5.5 x 10 cm have been used.

3.4.7.1 Daylight Chromaticity and Luminance Factor after accelerated artificial weathering

The daylight chromaticity and luminance factor, verified according to EAD120001-01-0106, clause 2.2.1, tested after accelerated artificial weathering.

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White Tolerance Sphere	***x*** ***y***	***0.355*** ***0.355***	***0.305*** ***0.305***	***0.285*** ***0.325***	***0.335*** ***0.375***	***≥ 0.35***
White	x y	*0.313* *0.333*				*0.70*
Yellow Tolerance Sphere	***x*** ***y***	***0.545*** ***0.454***	***0.487*** ***0.423***	***0.427*** ***0.483***	***0.465*** ***0.534***	***≥ 0.27***
Yellow	x y	0.484 0.474				0.40
Red Tolerance Sphere	***x*** ***y***	***0.735*** ***0.265***	***0.674*** ***0.236***	***0.569*** ***0.341***	***0.655*** ***0.345***	***≥ 0.05***
Red	x y	0.627 0.332				0.09
Green Tolerance Sphere	***x*** ***y***	***0.007*** ***0.703***	***0.248*** ***0.409***	***0.177*** ***0.362***	***0.026*** ***0.399***	***≥ 0.04***
Green	x y	0.160 0.468				0.09
Blue Tolerance Sphere	***x*** ***y***	***0.078*** ***0.171***	***0.150*** ***0.220***	***0.210*** ***0.160***	***0.137*** ***0.038***	***≥ 0.01***
Blue	x y	0.140 0.139				0.06
Orange Tolerance Sphere	***x*** ***y***	**0.631** **0.369**	**0.560** **0.360**	**0.506** **0.404**	**0.570** **0.429**	***≥ 0.17***
Orange	x y	0.564 0.397				0.20
Brown Tolerance Sphere	***x*** ***y***	***0.455*** ***0.397***	***0.523*** ***0.429***	***0.479*** ***0.373***	***0.558*** ***0.394***	***0.03-0.09***
Brown	x y	0.516 0.401				0.07

3.4.7.2 Coefficient of Retro-reflection after accelerated artificial weathering

The Coefficient of Retro-reflection after accelerated artificial weathering tests has been determined according to EAD 120001-01-0106, clause 2.2.6.4, with an observation angle α = 0.33° and α = 1.0° and entrance angle $\beta 1$= 5° and 30°. The rotation angle ε has been set to 0° according to the manufacturer's specification.

The result of the test is given as average of three samples.

Geometry of measurements		Colour						
α	β_1 ($\beta_2 = 0$)	White	Yellow	Red	Blue	Green	Brown	Orange
20'	**+5°**	73	50	18	8.3	11.1	15.3	31
	+30°	61	36	12.4	5.8	7.6	10.4	22.6
1°	**+5°**	63	42	16	6.3	9.0	12.9	27
	+30°	16.4	13.8	4.7	2.2	3.0	4.0	8.1

3.4.8 Adhesion

No performance assessed.

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with Regulation (EU) N° 305/2011, Article 65, Directive 89/106/EEC is repealed, but references to the repealed Directive shall be construed as references to the Regulation.

The system of assessment and verification of constancy of performance, specified in the Decision of the Commission 1996/579/EC of 1996/06/24[3], as amended by Commission Decision 1999/453/EC of 1999/06/18[4], is specified in the following Table.

Table 2 – System of assessment and verification of constancy of performance

Product(s)	Intended use(s)	Level(s) or class(es)	Assessment and verification of constancy of performance system(s)*
Road traffic signs	For circulation areas	Any	1
* See Annex V to Regulation (EU) N° 305/2011			

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

5.1 Tasks for the ETA-holder

The cornerstones of the actions to be undertaken by the manufacturer of the product in the process of assessment and verification of constancy of performance are laid down in European Assessment Document 120001-01-0106, clause 3.2.

The manufacturer is allowed to use similar test or control methods, using different equipment and test samples under different conditions, as long as the manufacturer ensures constant product performances, but the frequency of control shall be respected.

5.2 Tasks of notified bodies

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for corrugated bitumen tiles are laid down in clause 3.3 of the European Assessment Document 120001-01-0106.

6 Reference documents

See European Assessment Document 120001-01-0106, clause 4.

NOTE: The editions of reference documents given above are those which have been adopted by the UBAtc for its specific use when establishing this ETA. When new editions become available, these supersede the editions mentioned only when confirmed by the UBAtc.

UBAtc asbl is a non-profit organization according to Belgian law. It is a Technical Assessment Body notified by the Belgian notifying authority, the Federal Public Services Economy, SMEs, Self-Employed and Energy, on 17 July 2013 in the framework of Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC and is member of the European Organisation for Technical Assessment, EOTA (www.eota.eu).

This European Technical Assessment has been issued by UBAtc asbl, in Sint-Stevens-Woluwe, on the basis of the technical work carried out by the Assessment Operator, COPRO.

On behalf of UBAtc asbl,

Peter Wouters, director

Benny De Blaere, director

On behalf of the Assessment Operator, COPRO, responsible for the technical content of the ETA,

Dirk Van Loo, director

The most recent version of this European Technical Assessment may be consulted on the UBAtc website (www.ubatc.be).

[3] see OJEU L 254, 8.10.1996, p. 52

[4] see OJEU L 178, 14.7.1999, p. 50