2023-03-24 ICS: 93.080

ELOT TS 1501-05-04-02-00:2023

ΕΛΛΗΝΙΚΗ ΤΕΧΝΙΚΗ ΠΡΟΔΙΑΓΡΑΦΗ

HELLENIC TECHNICAL SPECIFICATION

Διαγράμμιση οδικών έργων

Road marking

Pricing class: **8**

 HELLENIC ORGANIZATION FOR STANDARDIZATION 50, Kifisou Av., 121 33 PERISTERI

Preamble

This Hellenic Technical Specification revises and replaces ELOT TS 1501-05-04-02-00:2009

This Hellenic Technical Specification was prepared by Experts and checked and evaluated in its field by a Supervisor/Specialist - Expert, who assisted the work of the Technical Committee ELOT/TE99 “Specifications of Technical Works”, the secretariat of which belongs to the Directorate for Standardisation of the Hellenic Organization for Standardization (ELOT).

The text of this Hellenic Technical Specification ELOT TS 1501-03-07-06-01 was adopted on 2023-03-24 by ELOT/TE 99 in accordance with the Regulation on the drafting and publication of Hellenic Standards and Specifications.

The European, international and national standards referred to in the standardisation references are available by ELOT.

HELLENIC ORGANIZATION FOR STANDARDIZATION
50, Kifisou Av., 121 33 PERISTERI

Content

Introduction

This Hellenic Technical Specification (HTS) is part of the technical texts originally prepared by the Ministry for the Environment, Spatial Planning and Public Works and the Institute for Constructions Economy (IOK) and was subsequently edited by ELOT in order to be applied to the construction of national public technical works, with a view to produce works that are robust and capable of meeting and satisfying the needs which have dictated their construction, and be beneficial for the society as a whole.

Under a contract between NQIS/ELOT and the Ministry for Infrastructure and Transport (online publication number 6ΕΟΒ465ΧΘΞ-02Τ), ELOT was assigned the editing and update as 2nd Edition of three hundred fourteen (314) Hellenic Technical Specifications (HTS), in accordance with the applicable European Standards and Regulations and the procedures laid down in the Regulation on the drafting and publication of Hellenic Standards and Specifications and in the Regulation on the establishment and operation of Technical Standardization Instruments.

This Hellenic Technical Specification was prepared by the contractor of the restricted tender No 1/2020 for the award of the work “Revision of the 1st edition of 314 HTS” (online publication number ΩΕΕΑΟΞΜΓ-ΞΗΔ), checked and evaluated in its field by a Supervisor/Specialist - Expert and submitted for Public Consultation. It was approved by the Technical Committee ELOT/TE 99 “Specifications of Technical Works”, which was set up by the Decision of the Managing Director of the NQIS, Δν.Σ. 285-19/08-02-2019 (ΑΔΑ6ΩΛΡΟΞΜΓ-15Ξ).

This HTS covers the requirements arising from the EU law, the relevant New Approach Directives currently in force and the National Law, and refers to and is compatible with harmonised European standards.

Road marking

1 Objective

The purpose of this Technical Specification is to define the requirements for the implementation of temporary and permanent road marking, with continuous or dotted lines, messages or symbols.

2 Standardization references

This Technical Specification incorporates –by way of references– provisions of other publications, whether dated or not. These references refer to the respective parts of the text and a list of these publications is presented thereafter. In case of references to dated publications, any subsequent amendments or revisions thereof shall apply to this document when incorporated in it by means of amendment or revision. With regard to references to undated publications, their latest version shall apply.

ELOT EN 1423	*Road marking materials - Drop on materials - Glass beads, antiskid aggregates and mixtures of the two -- Προϊόντα οριζόντιας σήμανσης οδών - Προϊόντα επίπασης - Γυάλινα σφαιρίδια, αντιολισθητικά αδρανή και μίγματα αυτών*
ELOT EN 1424	*Road marking materials - Premix glass beads -- Προϊόντα οριζόντιας σήμανσης οδών - Γυάλινα σφαιρίδια προανάμιξης*
ELOT EN 1436	*Road marking materials - Road marking performance for road users and test methods -- Υλικά οριζόντιας σήμανσης οδών - Επιδόσεις διαγράμμισης στο οδόστρωμα για τους χρήστες οδών και μέθοδοι δοκιμής*
ELOT EN 1790	*Road marking materials - Preformed road markings -- Υλικά οριζόντιας σήμανσης οδών - Προδιαμορφωμένα υλικά οριζόντιας σήμανσης*
ELOT EN 1824	*Road marking materials - Road trials -- Υλικά οριζόντιας σήμανσης οδών - Δοκιμές πεδίου*
ELOT EN 1871	*Road marking materials - Paint, thermoplastic and cold plastic materials - Physical properties -- Υλικά οριζόντιας σήμανσης οδών - Χρώματα, θερμοπλαστικά και ψυχροπλαστικά υλικά - Φυσικές ιδιότητες*
ELOT EN 12802	*Road marking materials - Laboratory methods for identification -- Υλικά οριζόντιας σήμανσης οδών - Εργαστηριακές μέθοδοι για ταυτοποίηση*
ELOT EN 13197	*Road marking materials - Wear simulator Turntable -- Υλικά οριζόντιας σήμανσης οδών - Προσομοιωτής φθοράς*

ELOT EN 13459	*Road marking materials - Sampling from storage and testing -- Υλικά οριζόντιας σήμανσης οδών - Δειγματοληψία αποθηκευμένων υλικών και δοκιμές*

3 Terms and definitions

The following terms and definitions are used in this Technical Specification:

3.1 Temporary marking

Temporary is defined as the marking, which shall be applied on road surfaces providing for the laying of additional asphalt layers within a short period of time, as well as the marking aimed at temporary traffic arrangements (Figure 1).

3.2 Permanent marking

Permanent is defined as the marking which is applied on the final layer of the road and serves the normal operation of the road (Figure 2).

Figure 1 – Temporary marking

Figure 2 – Permanent marking

3.3 Marking systems

Marking systems are distinguished according to their performance during night driving under rain and humidity conditions in the following types:

- **Type I**, without any particular functional performance under rain and humidity conditions, with typically a smooth screed surface
- **Type II**, with improved properties for better functional performance under rain and humidity conditions. These properties are achieved either by an embossed layer or by the use of glass beads, the particle-size grading of which includes balls of dimensions d> 1 mm, and/or by the use of glass beads with an increased refractive index (n≥ 1.7).

3.4 Marking quality characteristics

3.4.1 Durability and good operation guarantee time

Durability refers to maintaining the strength of the marking material. Warranty time of good marking functionality is defined the length of time during, which the material meets the original performance requirements set out in the Contractual Issues of the Project.

3.4.2 Brightness (Luminance)

It is the property of the marking determined by the brightness of its colour. Standard EN 1436 provides 6 performance classes from Q0 to Q5.

3.4.3 Retro-reflectivity

The retro-reflecting of the marking characterises its functionality in conditions of night driving, rain and humidity. It is achieved by adding, where appropriate, premixing glass beads to the marking material. Its performance depends on the quality, quantity, method of application, cooperation of the glass sphere with the underlying material, etc.

Standard EN 1436 provides 6 performance classes for dry surfaces from R0 to R5 and 7 classes for wet surfaces from RW0 to RW6.

3.4.4 Chromaticity

The shade of the marking is determined on the basis of the chromatic coordinates x,y in the CIE (Commission Internationale de l'éclairage) chromatic diagram. The limits of the colour area for white and yellow permanent and temporary markings are defined in ELOT Standard EN 1436.

3.4.5 Anti-slip (Skid Resistance)

The skid resistance of the marking shall be determined using the British Pendulum in SRT units. ELOT EN 1436 provides 6 skid resistance classes from S0 to S5.

3.5 Alkyd road marking paint

It is a single-component solvent paint based on alkyd resins and chlorinated rubber. Solidify by evaporating the solvent. Its physical properties are defined in ELOT Standard EN 1871.

It is mainly available in white and yellow shades.

It should be noted that the application of alkyd paints has been limited due to significant disadvantages such as the yellowing of the marking and its reduced strength.

3.6 Acrylic road marking paint

It is a solvent colour of one or more components mixed together during application and creates a stable film with solvent evaporation and a chemical process of polymerisation of its constituents. Its physical properties are defined in ELOT Standard EN 1871.

It is mainly available in white and yellow shades.

3.7 Dispersion paints

They are mainly aqueous dispersion paints with a percentage of organic volatile components (VOC) & <3 % w/w. Their physical properties are specified in ELOT Standard EN 1871.

They are solidified by solvent evaporation and by a chemical process of polymerisation of their constituents.

3.8 Cold-plastic materials

Cold-plastics are high strength materials consisting of specific resins (methyl methacrylic composition referred to as MMA) and solidified by a chemical polymerisation process of their components by an exothermic reaction after adding a special reagent, dibenzoyl peroxide, which acts as a catalyst. Their physical properties are defined in ELOT Standard EN 1871.

Cold-plastics can be either sprained or sprayed. The available systems can be one, two or three components (except catalyst). A machine with one, two, or three pumps can be used to install these systems. The catalyst reagent may be in liquid form, solid form or coated in glass beads. They may contain premix glass beads.

When applying cold-plastics to an existing marking, they are likely to be detached due to incompatibility with the pre-existing marking. For this reason it is necessary to precede traction check before starting work.

3.9 Thermoplastic materials

They are solvent-free high-strength materials, available in the form of granules, powders or cubes, and are heated between 130 °C and 200 °C. They are cold stabilised. They may contain premix glass beads. Their physical properties are defined in ELOT Standard EN 1871.

When applying thermoplastics to an existing marking, they are likely to be detached due to incompatibility with the pre-existing marking. For this reason it is necessary to precede traction check before starting work.

3.10 Pre-configured tapes

Preformed reflective strips with a smooth or embossed surface 2-2.5 mm thick. They are applied either cold (self-adhesive or adhesive tapes), hot (heated with a flame), or with a cylinder in the fresh, still warm asphalt. They are mainly intended for temporary marking, due to their easy removal, or for permanent marking, e.g. on pedestrian crossings, due to their high strength. Their individual characteristics are defined in ELOT Standard EN 1790.

3.11 Dusting materials

Defined as glass balls or a mixture of glass beads and non-slip aggregates, with granules proportional to the thickness of the film applied. Sprayed or dispersed on the wet marking. Dusting materials increase the strength of the marking, are essential for the functionality of the marking in night or adverse driving conditions and for its skid resistance.

The surface of the glass beads is subject to various treatments such as:

(1) silicone coating to avoid agglomerations in case of moisture
(2) silane coating to improve adhesion with the underlying material
(3) organic silica coating to achieve better floating

(4) active glass beads acting as a catalyst for cold-plastic materials

Their individual characteristics are defined in harmonised ELOT Standard EN 1423.

4 Requirements

4.1 Solvent content

It is recommended to use materials and marking systems, the colours of which contain a low percentage of organic volatile components (Low VOC), for reasons of environmental and personnel safety.

The organic volatile solvent content of all marking materials shall not exceed 25 % w/w. The percentage of aromatic solvents classified in categories T+ (very toxic) and T (toxic) is required to be less than 0.1 % w/w, the proportion of those of category Xn (harmful) to be less than 1 % w/w.

4.2 Performance of markings

The performance of day and night markings and their skid resistance shall be categorised and determined in accordance with ELOT Standard EN 1436.

It should be noted that old carpets with obvious damage and high skid resistance affect the quality characteristics of the markings, as they help to reduce their expected performance.

The following requirements apply to the individual requirements.

4.2.1 Luminance factor Q_d

For the luminance factor Q_d in diffuse lighting conditions measured in dry and clean markings if not otherwise provided in the Study, it is recommended to apply Table 1.

The chromatic coordinates for white and yellow markings shall be within the colour ranges as defined in ELOT Standard EN 1463.

Table 1: Minimum recommended values of the luminance factor Q_d in diffuse lighting conditions

Permanent markings	**Initial condition(1)**		**Mode status(2)**	
	mcd · m^{-2} · lx^{-1}	**category**	**mcd · m^{-2} · lx^{-1}**	**category**
	160	Q4	130	Q3
Temporary markings	**Initial state and operation state**			
	mcd · m^{-2} · lx^{-1}		**category**	
	100		Q2	

(1) Initial status is defined as a period of 15 working days from the application of the horizontal marking

(2) Operating mode is defined as the period of time determined by the warranty time of good operation.

4.2.2 Retro-reflecting coefficient R_L

For the retro-reflecting coefficient R_L, measured in dry and wet markings, if not otherwise provided in the Study, it is recommended to apply Table 2.

Table 2: Minimum recommended values of the Retro-reflecting coefficient R_L in dry and wet markings for type I and II

Type I and II marking systems, dry				
Permanent/ temporary markings	**Initial condition(1)**		**Mode status(2)**	
	mcd · m^{-2} · lx^{-1}	**category**	**mcd · m^{-2} · lx^{-1}**	**category**
	200	R4	100	R2
Type II marking systems, liquids				
	Initial condition(1)		**Mode status(2)**	

Permanent/ temporary markings	mcd · m^{-2} · lx^{-1}	category	mcd · m^{-2} · lx^{-1}	category
	50	RW3	25	RW1

(1) Initial status is defined as a period of 15 working days from the application of the horizontal marking

(2) Operating mode is defined as the period of time determined by the warranty time of good operation.

4.2.3 Non-slip

The non-slip for all types of marking systems (Type I/II) and all marking classes (permanent/temporary) shall meet at least category S1 (≥ 45 SRT units) of ELOT Standard EN 1436 in both initial and on mode status. Exceptionally, type II and S0 road marking systems shall be accepted when the surface relief does not permit the application of the SRT method with reliability, in accordance with the above Standard (see also paragraph 3.4.5).

4.3 Requirements for embedded materials

4.3.1 The materials

The materials to be incorporated into the project must be unloaded on the Worksite with care to avoid damage, distortions, etc. and stored in a protected storage site in accordance with the manufacturer's instructions in order to ensure them against distortions, alterations or pollution.

The embedded materials may be:

(1) Paint system of solvent or water and glass beads, applied by spraying or injection.

(2) System of cold-plastic material and glass beads, applied by spraying or injection.

(3) System of thermoplastic material and glass beads, applied by spray injection or pulling.

(4) Adhesive or self-adhesive preformed tapes.

4.3.2 Acceptable materials

The Contractor must submit to the Competent Authority, for all materials it intends to use, a technical proposal, accompanied by a test report in accordance with ELOT Standard EN 1824 (from field tests) or ELOT Standard EN 13197 (from traffic simulator).

Test reports must come from recognised laboratories in the European Union and must be submitted by means of a technical translation into Greek.

The test reports submitted must at all times indicate:

(1) the producer, the type and trade name of all the materials in the marking system to be used and the type thereof;

(2) the application elements (painting thickness, dusting ratio, mode of application)

(3) the category of traffic (number of tracks P) for which the tests were carried out in accordance with ELOT Standard EN 1824 or ELOT Standard EN 13197 for field tests or traffic simulator respectively (Table 3)

(4) the category of luminance factor Q_d

(5) category of retro-reflecting factor R_L in dry markings for type I and II marking systems

(6) category of retro-reflecting factor R_L in wet markings for type II marking systems

(7) the non-slip class S

(8) the chemical properties of the material, i.e. % by weight of solvent and solids (only in paints and cold-plastics), KREBS viscosity (in paints only), % by weight of binder and TiO_2 ash residue according to ELOT Standard EN 12802.

The manufacturer and the code name of the marking system materials to be applied to the project must be identical to those indicated in the test report submitted. Any differentiation of the characteristics of even part of the marking system from those indicated in the test report shall automatically invalidate its approval.

4.3.3 Materials and traffic categories by road category

Table 4 sets out the requirements per road category for traffic categories (Table 3) and class materials, specified in paragraph 4.3.2.

Table 3: Traffic categories (Source: Tab. 4 of EN13197+A1:2014)

Traffic categories	Number of crossings
P2	100,000
P4	500,000
P5	1,000,000
P6	2,000,000
P7[(1)]	4,000,000

[(1)] only in a traffic simulator

Table 4 – Selection of materials and category of traffic by road category

Road class (according to OMOE-LKOD, Tab. 2-4)		Sprayed marking systems with an application film thickness ≤ 1.2 mm		All systems except paints with application film thickness ≥1.2 mm	Pre-configured marking
		Type I	Type II		
Urban					
BI & BII	Urban road & highway	(P6)	P6	P6, P7*	P7, (P7)
BIII & ΓIII	Arterial road & main collector road	P6, (P6)	P6		(P6)
BIV & ΓIV	Main collector road & pedestrian crossings	P5, (P5) P6, (P6)		P7	(P6) P7, (P7)
Long-distance					
AI	Motorway & highway	(P6)	P6	P6, P7*	P7, (P7)
AII	Road between counties/provinces	P5, (P5)	P6		(P6)
AIII	Road between provinces/settlements	P5, (P5)	P6		(P6)
AIV	Road between small settlements & collector road	P5, (P4)			(P6)

Remarks: 1. Parentheses are valid for temporary use

2. Where marked * it is recommended to apply to new road surfaces with an expected daily traffic load ≥ 10000 vehicles per lane or when it is planned to make a new traffic coating at least 4 years after application of the marking

4.3.4 Reflective pellets

Reflective balls shall comply with the requirements of harmonised ELOT Standard EN 1423 and must:

(a) bear a CE marking.

(b) be accompanied by the declaration of performance in accordance with Delegated Regulation (EU) No 574/2014 (OJ EEL159/41/28.05.2014) and a safety data sheet in accordance with the provisions of Regulation (EC) No 1907/2006, where necessary.

In addition, reflective balls must be accompanied by a certificate of constancy of performance (a system of assessment and verification of constancy of performance (AVCP) is foreseen).

The performance indicated on the CE marking and in the declaration of performance for reflective pellets shall follow the requirements of the Study and the specifications of the project. The design requirements and the specifications of the project are consistent with the performance of the essential characteristics of Annex ZA to ELOT Standard EN 1423.

The essential characteristics of reflective beads, in accordance with the Standard, are the following:

i. the reflectivity index

ii. the percentage by weight of defective pellets in the lot (packaging)

iii. the particle-size grading

iv. the presence of dangerous substances

v. the resistance to chemical agents.

In case of use of premixing glass beads, ELOT Standard EN 1424 applies.

5 Method of work execution

5.1 Work procedures to implement the marking

The implementation work of the marking shall include:

(1) Recording the relative humidity of the atmosphere and the ambient and road temperature.

i. As the moisture of the road surface has a decisive influence on the adhesion of the marking material, it is important that the marking work is carried out at road temperatures which exceed the dew point by at least 3°C.

ii. In any case, the most suitable conditions for successful execution of the markings are: ambient temperature between 10°C and 30°C, relative humidity between 40 % and 60 % and apnea or weak wind.

(2) Cleaning and dehumidifying, if necessary, the road surface, where the marking is to be applied, using mechanical means or manually.

(3) The pre-treatment of the marking (stimulation-picking) and the preparation of materials.

(4) Arranging traffic for the unhindered implementation of horizontal marking and taking measures to protect the marking workshop and fresh marking.

(5) The implementation of the marking as defined in the test reports of the embedded materials (type, quantity, method of dusting, etc.). The Contracting Authority shall have the right, in case of doubts, to carry out sample checks in accordance with the standards ELOT EN 13459, ELOT EN 1423, ELOT EN 1424 and checks on the identification of materials in accordance with ELOT EN 12802. The costs of the audits shall be borne by the Contractor of the project.

(6) The removal of protective measures after completion of the work and the complete solidification of the marking materials.

Markings on new bituminous road surfaces shall be made at least one week after they have been delivered to traffic, which is strictly necessary to remove the asphalt volatiles and to ensure good adhesion of the marking material with the asphalt.

5.2 Solidification time

The solidification time of the marking material shall be the period from its application on the road until the passage of a passenger vehicle no longer causes damage to the marking and the material does not attach to the wheels of the vehicle.

The solidification time is categorised according to ELOT Standard EN 13197 in Table 5:

Table 5 – Solidification categories

Category	Description	Solidification time
T1	extremely fast solidification	≤ 1
T2	fast solidification	≤ 10
T3	normal solidification	≤ 20
T4	slow solidification	≤ 30

5.3 Film thickness

For marking materials, the thickness of the film (without glass beads and non-slip aggregates) shall be determined by means of relevant equipment or calculations on sheet either as liquid film thickness for all colours or as dry film thickness for all other materials.

The thickness of the film shall in no case be less than 20 % of the thickness indicated in the test report submitted.

For marking paints the minimum thickness of liquid film during application and without the coating of glass beads shall be:

- 0.4 mm for type I marking systems
- 0.6 mm for type II marking systems.

During the first marking of new, tracheal road surfaces (open type pavements) it is necessary to double the thickness of the liquid film of the applied material. The application of the materials is carried out in two layers by patting glass beads on both layers.

For the rest of higher strength materials the minimum thickness of dry film after solidification and before glass bead tucking should be:

- 0.4 mm for sprayed type I cold plastics
- 0.6 mm for sprayed cold plastics type II
- 1.2 mm for sprayed thermoplastics type II
- 2.0 mm for all non-sprayed marking systems.

5.4 Marking strength and good operation guarantee time

The durability of the marking shall be determined by the percentage of the residual lined area relative to the initially marked area.

The minimum percentage of residual marked surface before the expiry of the warranty period (Table 6) must be 90 %.

Table 6 – Warranty times in years

Marking system	Permanent markings	Temporary markings
pre-configured marking type II	4	0.5

Marking system	Permanent markings	Temporary markings
sprayed systems with a thickness of dry film ≤ 0.8 mm	1	0.5
sprayed systems with a dry film thickness of 0.8 to 1.2 mm	2	0.5
all other marking systems	2	0.5

5.5 Geometry and tolerances

The dimensions and position of the markings (lines, characters and symbols), when they are in the original state, shall be in accordance with the OMOE-OSO (Horizontal Road Marking) and the Labelling Study. More specifically:

- The width of the lines must not deviate from the width provided for in the Guidelines more than ± 5 mm.

- In the case of dotted longitudinal markings, the length of the line shall not be 50 mm shorter and 150 mm longer than the length prescribed in the Study.

In the case of arrows, letters and numbers, the distance between the angular points shall not deviate from the image prescribed in the Directives by more than ± 20 mm in width and ± 50 mm in length. The dimensions of the markings may not be reduced on a permanent basis in relation to the OMOE-OSO or the marking drawings even within the above-mentioned limits.

5.6 Redrawing

Redrawing is recommended when the values of the luminance factor Qd or the retro-reflective factor RL show a 20 % reduction from the minimum requirements as defined in the Contractual Issues of the Project and the anti-slip is less than 45 SRT units.

In cases of re-alignment of road surfaces, the existing road marking shall be decisive and in no case may its design be altered or altered, unless provided for in the Study and a written order from the Competent Authority is given to change the shape and/or dimensions of the existing marking.

The re-alignment (old markings) must cover the existing marking to the maximum extent possible, so as to create an elegant and clear final picture and not to be altered (stroke markings), especially when blank sections of dotted lines are covered.

The acceptable deviations of the dimensions of lines, letters and symbols specified in 5.5 shall also apply to re-arrangements, even if these requirements are not met by the existing markings.

6 Acceptance criteria of completed work

Checks on receipt:

(1) Verification of the accompanying documents (declaration of performance, certificate of constancy of performance, test reports) of the marking materials as referred to in Chapter 4 hereof.

(2) Checking the geometric accuracy and compliance of the horizontal mapping carried out with the design plans and with those referred to in paragraph 5 hereof.

(3) Check the markings, messages and symbols to have a homogeneous and uniform surface with precise endings and a clear outline.

(4) Check compliance of the marking performance with on-the-spot checks and in accordance with paragraph 4.2 throughout the prescribed operational guarantee time (Table 6). Checks must be carried out on healthy and homogeneous asphalt pavements (without abnormalities, cracks, etc.).

The on-the-spot check shall be the sum of partial checks according to the size and type of the liner project as defined in Table 7;

Table 7 – Number of partial checks per liner project

Longitudinal markings length in km	Other markings on surface m^2	Number of partial checks
≤ 1	≤ 120	1
≤ 10	≤ 600	3
> 10 - 50	> 600 - 1200	4
> 50 - 100	-	6
> 100	-	8

The range of each partial check is defined as follows:

i. for longitudinal continuous markings, 50 m long

ii. for longitudinal dotted markings, in 3 lines

iii. for all other cases (zebra, crossings, letters, etc.) the partial check must be extended to at least 3 different symbols.

In any case, the arithmetic mean of the individual measurements at each partial check shall be within the prescribed requirements.

(1) In the event of non-compliance of the construction with the above, the Competent Authority shall have the possibility to cut or accept the construction under conditionality and to lay down the corrective measures to be taken by the Contractor in order for the marking to meet the prescribed requirements. Any necessary restoration of permanent markings with sprayed dry film thickness systems ≤ 1.2 mm extends the warranty time of good operation for 0,5 years, which certainly does not expire before the initial time specified in Table 6.

(2) Where the marking fulfils the above mentioned information the Contractor is obliged to remove the marking in accordance with the ELOT Standard TS 1501-05-04-01-00 (Removal of the existing horizontal marking).

7 Method of measurement of works

Measurement shall be made in square metres [m^2] of actual horizontal marking area based on the material used. In the case of implementation of a dotted line, gaps shall not be measured.

The above-mentioned measured units of works include:

(1) The supply of necessary consumables or non-consumable materials

(2) Their transport and temporary storage in the project

(3) The provision and employment of the personnel, equipment and means required to carry out the work in accordance with the terms of this Technical Specification

(4) Wear and deterioration of materials and depreciation and stoppage of equipment

(5) Cleaning of the application surface of the marking on the road surface by manual wiping

(6) The collection of waste of any kind resulting from the execution of the works and their transport for final

(7) Carrying out all required tests and checks in accordance with this Law, as well as taking corrective measures (work and materials) if non-conformities are found.

The work is divided into work carried out during the day or at night, by mechanical means (for axes and boundary lines) or manual (arrows, symbols, etc.), as defined in the Contractual Issues of the Project and measured accordingly.

Mechanical cleaning and dehumidification operations of the road surface shall not be included and shall be supplemented.

Annex A
(informative**)**

Health, Safety and Environmental Protection Conditions

A.1 General

During the execution of the works, the applicable provisions on Occupational Health and Safety Measures shall be met and employees shall be equipped with the necessary Personal Protective Equipment (PPE), as appropriate, which must comply with the provisions of Regulation (EU) 2016/425.

The provisions laid down in the approved Health and Safety Plan (HSP)/Health and Safety File (HSF) of the work, according to Ministerial Decisions ΓΓΔΕ/ΔΙΠΑΔ/οικ/889 (ΦΕΚ/16 Β'/14-01-2003) and ΓΓΔΕ/ΔΙΠΑΔ/οικ/177 (ΦΕΚ/266 Β'/14-01-2001) shall also be strictly met.

A2. Health and safety measures

In any case, the provisions of the project's Safety and Health Plan (SAP) shall be implemented.

Potential risks in the implementation of the markings shall be identified as those related to the handling of application machinery and chemicals.

Attention is drawn when carrying out the work in circulation for the following:

(1) implementation of site marking in accordance with the provisions in force for the protection of the staff of the crew carrying out the markings and the minimisation of traffic disturbances.

(2) protection of the fresh marking until it is hardened and has the strength required to give it to the traffic.

Marking materials (paints, thermo- and cold-plastics, dust additives) require handling according to the manufacturer's instructions. Their packaging must indicate the degree of chemical hazard, the method of mixing and the permitted application temperatures (German GEF Stoff V regulations for handling chemicals).

Where chemicals are used, protective measures are required, on a case-by-case basis, by the staff carrying out the work, in accordance with those specified in the Material Safety Data Sheet (MSDS).

Workers must in all cases be equipped with the required personal protective equipment (PPE), depending on the object and location of the work to be carried out and the type of equipment used. The PPE must be in good condition, free of damage, bear a CE marking and a declaration of conformity in accordance with the provisions of Regulation (EU) 2016/425 and fall under the following Standards:

Table A.1 — Requirements for PPE

Type of PPE	Relevant Standard
Respiratory protective devices – Filtering half masks to protect against particles — Requirements, testing, marking	ELOT EN 149
Protective gloves against mechanical risks	ELOT EN 388
Industrial safety helmets	ELOT EN 397
Protective clothing – General requirements	ELOT EN ISO 13688
Eye and face protection for use at work – Part 1: General requirements	ELOT EN ISO 16321-1
Eye and face protection at work – Part 3: Additional requirements for mesh type protectors	ELOT EN ISO 16321-3

A3. Measures of environmental protection

The Environmental Conditions of the project shall always apply.

Waste materials and packaging must be collected and transported to the assembly area for disposal on the site.

Bibliography

[1] Directive 2004/42/EC *of the European Parliament and of the Council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in decorative paints and varnishes and automotive refinishing products and amending Directive 1999/13/EC*

[2] Joint Ministerial Decision (JMD) 437/24-10-2006 *– aligning Greek legislation with Directive 2004/42/EC (Government Gazette, Series II, No 1641)*

[3] Regulation (EC) No 1907/2006 *of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Authorisation and Restriction of Chemicals (REACH, Registration, Evaluation, Authorisation and Restriction of Chemicals), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Regulation (EEC) No 793/93 Council and Commission Regulation (EC) No 1488/94 as well as Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC*

[4] Commission Regulation (EU) 2015/830 *of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)*

[5] Regulation (EC) No 1272/2008 *of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (CLP, Classification, Labelling and Packaging) , amending and repealing Directives 67/548/EEC and 1999/45/EC and amending Regulation (EC) No 1907/2006*

[6] Law 1568/85 *“Occupational health and safety” (Government Gazette, Series I, No 177)*

[7] Presidential Decree 396/94 *“Minimum health and safety requirements for the use by workers of personal protective equipment at the workplace, in compliance with Directive 89/656/EEC” (Government Gazette, Series I, No 220)*

[8] Presidential Decree 397/94 *“Minimum health and safety requirements for the manual handling of loads where there is a risk particularly of back injury to workers in compliance with Council Directive 90/269/EEC (Government Gazette, Series I, No 221)*

[9] Presidential Decree 105/95*, “Minimum requirements for the provision of safety and/or health signs at work, in compliance with Directive 92/58/EEC” (Government Gazette, Series I, No 67)*

[10] Presidential Decree 305/96 *“Minimum safety and health requirements at temporary or mobile constructions sites, in compliance with Directive 92/57/EEC”, in conjunction with Circular No 130159/7.5.97 of the Ministry for Labour and Circular No 11 (Protocol No. Δ16α/165/10/258/ΑΦ/ 19.5.97) of the Ministry for the Environment, Spatial Planning and Public Works regarding the above Presidential Decrees (Government Gazette, Series I, No 212).*

[11] Presidential Decree 338/2001*, “Protection of the health and safety of workers at work from the risks arising from chemical agents” (Government Gazette, Series I, No 227).*

[12] OMOE - SAO 2010, *Guidelines for Road Works Studies: Requirements and Marking Instructions on roads*

[13] K.O.K - *Road Traffic Code: Law 2696/23.03.1999 (Government Gazette, Series I, No 57) and updating Law 3542/02.03.2007 (Government Gazette, Series I, No 50) and Law 4530/30.03.2018 (Government Gazette, Series I, No 59)*

[14] Regulation (EU) 2016/425 *of the European Parliament and of the Council of 9 March 2016 on personal protective equipment and repealing Council Directive 89/686/EEC.*

[15] Zusätzliche Technische Vertragsbedingungen und Richtlinien für Markierungen auf Straßen (ZTV-M:2013).

[16] OMOE-OSO (2022) - *Road design guidelines: Horizontal Road Marking.*