

**MINISTRY OF TRANSPORT
AND INFRASTRUCTURE**

**MINISTRY OF
INTERNAL AFFAIRS**

**MINISTRY OF DEVELOPMENT,
PUBLIC WORKS AND
ADMINISTRATION**

No:...../.....

No:...../.....

No:...../.....

ORDER

**for the approval of the Technical Regulation ‘Technical instructions for road markings’,
reference number AND 616-2022**

Having regard to the provisions of Article 10(2) of Law No 10/1995 on quality in construction, republished, as subsequently amended and supplemented,

Pursuant to the provisions of Article 57(h) of Government Ordinance No [43/1997](#) on the regime of roads, republished, as subsequently amended and supplemented, of Article 9(4) of Government Decision No 370/2021 on the organisation and functioning of the Ministry of Transport and Infrastructure, as subsequently amended and supplemented, Article 7(5) of Government Emergency Order No 30/2007 on the organisation and functioning of the Ministry of Interior and Administrative Reform, as subsequently amended and supplemented, and Article 12(6) of Government Decision No 477/2020 on the organisation and functioning of the Ministry of Public Works, Development and Administration, as subsequently amended and supplemented,

the Minister for Transport and Infrastructure, the Deputy Prime Minister, the Minister for Internal Affairs and the Minister for Development, Public Works and Administration, hereby issue the following:

ORDER

Article 1. Approval of the Technical Regulation ‘Technical instructions for road markings’, reference number AND 616-2022, set out in the Annex which forms an integral part of this Order.

Article 2. This order shall be published in the Official Gazette of Romania, Part I and shall enter into force 60 days after its date of publication.

Annex to the Order of the Minister for Transport and Infrastructure

No /

Order of the Deputy Prime Minister, Minister for Internal Affairs

No /

and Order of the Minister for Development, Public Works and Administration

No /

**TECHNICAL INSTRUCTIONS FOR ROAD MARKINGS,
REFERENCE NUMBER AND 616-2022**

CHAPTER I

General provisions

Article 1. - Road signs, as a means of ensuring safe and efficient road traffic, are mainly carried out by road signs (vertical signage) and road markings (horizontal signage); complementary to these are retroreflecting road studs, guard rail retroreflectors, guide poles and demarcation marker posts of various kinds, the median and marginal guard rail (with the role of protection, but also visual guidance of the road alignment, etc.), various autonomous lighting installations or integrated into ITS platforms, etc.

Article 2. - 1. According to the Highway Code, where the road marking coexists, it shall be subordinated and strengthens the meaning of road signs. If during the day there are usually sufficient other elements to visually guide road users (see list above), at night – especially in rainfall or damp conditions – the functionality of the road marking is essential in ensuring safe road traffic.

2. This leads to the prioritisation and selection of a subset of appropriate road marking materials and technologies. The emphasis must always be placed on solutions that offer maximum visibility and recognisability, in unfavourable conditions for road traffic (night traffic, wet road surface, road geometry and safety side spaces). A balance must be maintained between the graphic information provided through the marking and the perception and compliance effort required from road users, as more marking does not necessarily mean increased road safety. Excessive systematisation through road markings can lead to a false sense of safety and decrease the attention that drivers pay to the surrounding space (distributed attention).

Article 3. - The applying of markings on the roadway (performed or executed ‘in situ’) as a replica of the symbolism of road signs installed at the same location or alphanumeric inscriptions is intended to strengthen the meaning of the vertical signage; a situation of limited visibility for vertical signage shall not be considered resolved by strengthening the signage with replicated ground markings, the functionality of the vertical signage must be ensured at all times. The functional and performance requirements of the road marking are specified in standard SR 1848-7.

Article 4. - This instruction contains technical principles for road markings. This Technical Regulation applies to motorways, express roads, European national roads (E), main national roads, secondary national roads, county roads, municipal roads and streets.

Article 5. - According to SR 1848-7, the road marking represents the materialisation on the road side of traffic flow separation lines, prohibited traffic spaces, stopping places, giving way, crossings for

pedestrians or cyclists, symbols and inscriptions, as well as the applying to obstacles of coloured surfaces and devices to highlight them (emphasis added).

CHAPTER II

Types of materials used to make road markings

SECTION 1

Detailing the physico-chemical characteristics of the types of marking materials

Article 6. - Technological advances and increased environmental compatibility requirements make today the spectrum of materials and application techniques for reflective road markings very wide.

Article 7. - The basic classification retains in situ marking systems (component mixture/on-site material preparation), prefabricated marking systems and spraying materials.

Article 8. - Road marking systems are composed of fluid (or fluidisable) marking products and additive/spreading materials.

Article 9. - 1. According to SR 1848-7, the commonly used types of paints/marketing materials are the following:

- a) **Single-component marking paint with organic solvent**, which forms a film by air drying;
- b) **Single-component water-based marking paint**, which form a film by air drying;
- c) **Bicomponent products** based on methyl methacrylate (MMA) for thin layer by spraying and/or thick layer cold application – smooth, structured marking (agglomerated, spot/multidot) and resonator, forming a film by hardening following the chemical reaction between the components;
- d) **Thermoplastic products** for hot application in thin layer (by spraying) or in thick layer (by extrusion) – smooth, structured (spot/multidot) marking and resonator, forming a film by cooling;
- e) **Anti-skid products** for manual application of bicomponent (based on methyl methacrylate – MMA) or thermoplastic products. They are applied hot or cold at average thicknesses from 3 mm to 5 mm, with texture depths from 0.5 mm to 2.00 mm. Anti-skid products contain high hardness aggregates that ensure increased rolling adhesion. The film is formed by reaction between the components or by cooling. The minimum value of SRT is 60 (S4) according to SR EN 1436. The minimum value of the mean depth of MTD texture and macrotexture is 1.2 mm determined according to SR EN 13036-1;
- f) **Markings by arrows, inscriptions, figures and other small surface markings** can be made by hand, in thin/thick layer, cold and hot applied plastics, using appropriate templates or prefabricated thermoplastic elements. Retro-reflection is ensured by glass microbeads applied to the surface of the marking.

2. Marking paint is a liquid product that contains suspended solids in an organic solvent or water. It can be delivered in single-component or multi-component systems. When applied with the brush, roll, by spraying or any other appropriate method, the paint forms an adhesive film through the solvent evaporation process and/or a physical (cooling) or chemical (polymerisation) process.

3. Thermoplastic paint is a marking product that is applied by hot liquefaction without solvent and can be supplied in block, granule or powder form. It is heated to the molten state and then applied with an appropriate manual or mechanical device. By cooling, it forms an adhesive film.

4. Prefabricated marking products are based on ready-made material delivered in the form of plates, rolls, strips and for which adherence to the substrate is achieved with adhesive, by heating (material and/or substrate), by pressing, etc. This category includes MMA film with or without neutral substrate (aluminium foil, textile fabric, etc.) and thermoplastic preforms. This may also include materials such

as applied or recessed plastic road studs in accordance with SR EN 1463-1 and applied graphic symbols (replication of road sign symbols or inscriptions) on the road surface, which are not covered by these instructions.

5. The additive materials are substances used to increase adhesion ('primer'), adhesives, thinners, retro-reflective material, anti-skid material or adhesion-retroreflective mixtures.

6. Given that the marking materials (in pure state) have a low own roughness and the retro-reflective microbeads are smooth on the surface, obtaining an acceptable roughness of the final marking can be done by adding additive material (e.g. Al₂O₃). Account must be taken of the fact that increasing the amount of anti-skid material in the mixture may lead to a decrease in the retro-reflection of the marking and the luminance coefficient (daytime visibility).

7. The various marking materials listed above are available for Type I or Type II markings (with increased retro-reflectiveness at night in rain conditions) – but not all combinations (marking type/material type) are possible or desirable (increasing the diameter of microbeads increases wet-time retro-reflection in the case of traditional thin-layer paints, at the expense of roughness/adhesion and drastically limiting the life of the marking).

8. Each of the listed marking products shall be used according to the type of marking (type I or type II) and the required performances (durability, wear resistance, visibility under any conditions), the area and the calendar period during which the markings are made, the specific recommendations in the data sheet.

9. The European standard SR EN 1871 sets out the physical properties of road marking products used for 'Horizontal marking'.

SECTION 2

Characterisation of road markings

SUBSECTION 1

Lifetime

Article 10. - At the request of the beneficiary, road markings shall be carried out on a permanent or temporary basis:

- a) **Permanent marking** is the functional lifetime marking for which a performance guarantee is granted and is made with white marking products and red, yellow, green colours. It shall be made after a minimum of 14 days or according to the technical data sheet of the marking product, after the execution of periodic maintenance works, asphalt paving, bituminous layers, treatments, so that the volatile organic compounds contained in the bitumen and the marking products do not combine and do not cause degradation of the road marking.
- b) **Temporary marking** is the marking whose functional lifetime is limited, no guarantee for execution can be established and is made with yellow or white marking products (for works of return to service and rehabilitation works).
- c) **Removable markings**, a sub-class of permanent markings are markings carried out on the road side showing traces of substances/materials used to combat frost and snow removal, those applied on treatments with gravel, pavements, treatments with non-wetted or very rough materials, old used concretes, degrading of the running surface, polished, intersections, in the area of access to agricultural lands, requested during the use of snow removal machines (snow plug/snow blade, especially those that do not have rubber elements with metallic insertion), rolling of tracked equipment or other mechanical interventions. These markings have no functional lifetime and regardless of the type of marking material or application technology chosen, their resistance over time is limited by the stability of the substrate. There is no performance guarantee for them.

SUBSECTION 2

Retro-reflection properties

Article 11. - 1. Nighttime visibility could only be improved after spraying retro-reflective additive materials – mainly glass microspheres with a 0.1-2 mm granulation. Retro-reflection is achieved through a combination of reflection and refraction of incident light generated by cars headlights, which causes part of it to be reflected back to the driver. Retro-reflection is a mandatory feature for road marking on extra-urban public roads in all moving traffic areas. For urban areas with sufficient public lighting, the road manager/designer may provide non-reflective road markings (an intense public lighting cancels the retro-reflection effect of microbeads on the marking surface, the contrast being too small to help highlight the marking line in the background ratio).

2. In the usual road markings, the retro-reflection effect of the glass microbeads is diminished until total dwindling with the increase of moisture on the ground, when the surface layer of the marking is covered with water; it fills the spaces between the retro-reflective (microbeads) bodies on the surface of the marking, changing the way the incident light is reflected, which is spatially dispersed in all directions and the retro-reflection disappears. Thus, precisely in situations where the marking would be most necessary for correct traffic guidance (by night, during rain), the marking can ‘disappear’ entirely from the field of vision.

3. To remove this shortcoming, spray materials of larger diameter may be added or marking materials that allow structured or profiled application may be used. In the latter case, retro-reflection is also possible in the presence of water, because the surface of the marking has a larger vertical dimensional component, which water generally does not fully cover. The retro-reflection may also be improved when the water marking is fully covered, if microbeads with a modified refractive index are used, but the result is accompanied by a decrease in surface roughness index (SRT).

4. Markings whose surface is flat (smooth) and which do not have notable nocturnal retro-reflection values in wet weather are defined as type I markings. Road markings with a sharp retro-reflection in night and rain conditions are called Type II markings. In the literature, they are named after geometry and method of execution, profiled markings, crowded type markings, structured markings, etc. (multi-dot, stochastic, rumble-strip).

SUBSECTION 3

Special uses

Article 12. - Sound-effect markings and resonator-effect markings

- a) in addition to the visual effect, by choosing an appropriate geometry, it is possible to obtain an additional warning effect – by vibration and/or sound – when the wheel of the vehicle passes over the marking;
- b) depending on the geometry and structure, a road marking may also have a vibrational and/or audible warning effect when the wheel of the vehicle runs above it, the intensity of the effect being directly proportional to the speed of travel and the height to the road of the protrusions in the marking structure. It is not possible to achieve effects of this type using classic thin-layer markings – solvent-based paint or dispersions with water in thicknesses of up to 1200 microns, plastic spray (cold bicomponent or thermoplastic), etc. The additional acoustic and/or vibration warning effect is often found in Type II markings, with the indication that there are Type II markings with no resonator effect and partially also without noticeable acoustic effect);
- c) in the absence of standardised technical procedures for the effective measurement of the vibratory and/or acoustic effect, the validation of these parameters may be done by means of field testing, using a standard vehicle running at the maximum permissible speed for that road sector, over the test section that is usually marked at the beginning of each project, in the validation phase of the type of marking, by the Consultant;

- d) for the acoustic warning effect, it is necessary to develop a procedure setting a sound intensity threshold from which the driver's perceptiveness begins;
- e) for the resonator marking, the assessment is significantly more complex, the effect depending on the mass and gauge of the vehicle running over this type of marking. Aggressive warning markings (vehicle vibrations) have as their main inconvenience their propagation (vibrations) to nearby buildings, affecting the quality of life for those who occupy them and sometimes their structure. The use of resonator markings in residential areas is prohibited;
- f) in practice, the audible warning (typical for Type II markings) is considered sufficient to raise awareness of the trespassing of the marking line.

Article 13. - Anti-skid road markings

- a) anti-skid road markings are horizontal safety and signalling elements containing glass microbeads, anti-skid granules and mixtures of the two components, which are applied in the form of spraying/sprinkling products to the road marking products (such as paints, hot and cold applied plastics).
- b) anti-skid road carpets are executed as a surface treatment with a thickness of approximately 3-5 mm, with increased slip resistance, from road marking products and aggregates for such applications; They may be made from thermoplastic marking products with hot-applied mineral aggregates or cold-applied plastics incorporating a mixture of crushed granite aggregates and other mineral fillers;
- c) anti-skid road carpets shall be made in areas where good transverse stability of vehicles and/or a high friction coefficient must be ensured to reduce the braking space of vehicles, e.g. in dangerous corners, exits from motorways or express roads, pedestrian crossings, etc.;
- d) in order to highlight the dangerous area on which it is located, the anti-skid road carpet shall be made of intensely coloured material, usually red (to highlight the danger), green (for other specific applications, e.g. bicycle circulation areas), blue, black, etc.;
- e) other horizontal signs such as road markings serving to direct traffic and markings for warning or guidance of road users may be applied to these carpets;
- f) the material used contains modified polymer binders incorporating mineral aggregates. The thickness gradient of the film applied on the road is not less than 3000 µm (the difference between the lowest layer and the tip of the anti-skid elements), the structure of the material ensuring a very high adhesion on new or old bituminous surfaces, without degradation. A primer ('primer') shall be applied to cement concrete road surfacing to improve the adhesion of the marking to the substrate;
- g) information or warning signs or inscriptions of a different colour may be applied to anti-skid road markings;
- h) anti-skid road marking materials consisting of thermoplastic polymeric material are based on modified esters of wood rosin, incorporating a mixture of crushed granite aggregates and other mineral fillers. It is in the form of granulated powders, which are brought to a molten state by heating and applied at temperatures between 180 and 200°C, then applied manually. The application shall be carried out by evenly distributing the material in the molten state, using scrapers in the form of metal frames. By cooling, a cohesive film with thicknesses between 4 mm and 6 mm is formed, having a strong anti-skid effect;
- i) the application of carpets from bicomponent products shall be carried out with special construction devices – metal scrapers. The material intended for this application contains small granules of fillers, which also provide an anti-skid effect. By hardening, a cohesive film with thicknesses between 4 mm and 6 mm is formed, having a strong anti-skid effect, ensuring a minimum average depth of MTD texture and macrotexture of 1.2 mm, according to SR EN 13036-1.

SECTION 3

Material selection criteria

Article 14. - 1. For reasons of available manufacturing technologies as well as physical and chemical limitations, at the current level it is impossible to execute road markings that simultaneously offer maximum values for all desired visual performance and resilience characteristics (the main dichotomy is between roughness and night visibility). It is up to the specialist to find the optimal technical solution to ensure a functional road marking in the operating and environmental conditions (rainwater regime, annual temperatures, etc.) specific to each road segment. The choice of the type of marking, the material, the thickness of the application layer and the desired warranty period must be corroborated with the values of the intensity of the annual daily average traffic, the density of heavy traffic, the intensity of snow removal actions on the road sector, the type and condition of the infrastructure. Existing markings at different stages of wear as well as support surfaces are considered as infrastructure.

2. The application of the markings in thick layers, both bicomponent and thermoplastic, shall not be carried out on treatment road sectors, on road sectors with clogging on the alignment of the marking film, on road sections with cracks and crockery works, on road carpets with excess bitumen and on impoverished bitumen road sectors with polished aggregates.

3. Both traffic damage and special environmental conditions (e.g. in protection zones) must be taken into account in the selection and application of marking systems.

4. No more than two different marking systems shall be provided in one section or intersection.

5. On new or rehabilitated running surfaces it is recommended to apply a marking for putting into service in the following situations:

- a) when the optimal weather conditions are not achieved during the period during which the work is being carried out;
- b) on new running surfaces;
- c) after a surface treatment.

6. When selecting the marking system to be applied, the existing old marking (number of layers, change of system) must be carefully checked.

7. When applying new markings and for refreshing markings after the warranty period, the compatibility of marking materials must be taken into account:

a. Compatibility of solvent-based paints over:

- a.1) new asphalt: very good compatibility
- a.2) old asphalt: good compatibility
- a.3) concrete: good compatibility only with primer
- a.4) solvent-based paint: very good compatibility
- a.5) water-based paint: good compatibility
- a.6) bicomponent paint: good compatibility
- a.7) thermoplastic paint: ***incompatible***

b. Compatibility of water-based paints over:

- b.1) new asphalt: good compatibility
- b.2) old asphalt: good compatibility
- b.3) concrete: good compatibility only with primer
- b.4) solvent-based paint: good compatibility

b.5) water-based paint: very good compatibility

b.6) bicomponent paint: ***incompatible***

b.7) thermoplastic paint: ***incompatible***

Article 15. - Advantages and disadvantages in the use of solvent-based paints and respectively water-based paints.

1. Solvent-based paints have a much easier applicability, form a hard and much more resistant film than water-based paints.

2. Solvent-based paints can be applied directly (without primer) to asphalt carpets regardless of their age, while water-based paints require a primer to old asphalt carpets, as there is a risk of loss of adhesion with ease.

3. Due to the size of solvent-based resin particles that are much smaller than resin particles in water-based emulsions, the penetration of solvent-based paints into the substrate is much higher than in the case of water-based paints, resulting in superior adhesion to most types of support.

4. In the case of old asphalt supports, solvent-based paints also provide superior adhesion because the film solvents descend into the substrate and partially dissolve the bitumen, making a mixture that ensures good adhesion once the solvents evaporate.

5. The period of application of solvent-based paints (1st of April - 1st of December) is much longer compared to the period of application of water-based paints (15th of May -30th of September).

6. Road markings with bicomponents products or thermoplastic products may not be applied over a road marking made with water-based paint because of the following reasons:

a) bicomponent marking products have very poor adhesion over water-based paints, as monomers penetrate the water-based paint substrate causing the paint film to soften or even destroy. Also, monomers penetrate the particles of water-based paint polymers, remaining stuck there and the polymerisation process is no longer taking place and the water-based paint film is destroyed;

b) water-based acrylic paints have a degradation temperature lower than the temperature required to apply thermoplastic paints, which will lead to the destruction of the water-based film.

7. Over a road marking made with solvent-based paint, thermoplastic paint cannot be applied, as the application temperature of thermoplastic marking products causes the degradation of solvent-based resins.

8. Over the road marking made with solvent-based paint, bicomponent thick markings may be applied subject to the following essential conditions:

a) successive layers of thin-layer road markings have not been applied;

b) the film does not show cracks or loss of adhesion.

c. Compatibility of bicomponent markings with the following substrates:

c.1) on asphalt surfaces: very good adhesion without the use of primer;

c.2) on concrete surfaces: good adhesion only with the use of the primer;

c.3) over water-based markings: ***incompatibility***;

c.4) over thermoplastic materials: ***incompatibility***;

c.5) over solvent-based paint: good adhesion only with meeting the essential conditions mentioned above.

d. Compatibility of thermoplastic markings with the following substrates:

- d.1) on new asphalt surfaces: good adhesion without the use of primer;
- d.2) on old asphalt surfaces: only with the use of the primer;
- d.3) on new or old concrete surfaces: only with the use of the primer;
- d.4) over water-based markings: **incompatibility**;
- d.5) over thermoplastic materials: compatible;
- d.6) over solvent-based paint: **incompatibility**;
- d.7) over bicomponent markings: **incompatibility**.

SECTION 4

Technical requirements for application

Article 16. - 1. The marking shall be applied in accordance with the technical data sheet of the marking product. Before starting the work, the contractor must check that:

- a) the surface to be marked must be prepared for the execution of marking activities (cleaning, drying, rolling surface structure or markings to be renewed);
- b) the relative humidity limits of the air, the roadway temperature and that of the air shall be respected.

2. The execution of the marking is conditioned by the removal of non-sticky dirt, which can be done with the help of blowers. The removal of other types of dirt, as well as the need to dry the surface to be marked, shall be provided whenever necessary.

3. Marking substances and auxiliary substances – up to the content of the marking machine and heat kettle – must be delivered in the original packaging of the material manufacturer and prepared according to the processing rules so that they can be processed without defects.

4. A uniform distribution of the marking substance, compliance with the required layer thickness and geometry shall be ensured in all applications. Spraying products must be evenly distributed over the entire surface of the marking in the dosage recommended by the technical documents of the product. Manual application of spraying products is allowed only if there are no suitable devices.

5. If continuous longitudinal markings are more than 1.5 mm thick, then in places where rainwater should flow over the markings, interruptions shall be introduced in lengths of 50-100 mm at intervals of approximately 10-30 m, in order to allow rainwater to drain and avoid the occurrence of aquaplanation.

CHAPTER III

Technology for the execution of markings

SECTION 1

Marking equipment preparation

Article 17. - Prior to the commencement of work, the personnel involved in the use of equipment specific to each technology for applying markings must read the Manual of Technical Instructions and particularly the chapter containing safety indications. The respective equipment is always accompanied by this manual.

Article 18. - 1. For the execution of the road marking with **conventional paint** (based on organic solvents or water) – it shall be applied by compressed air spraying or in an airless system with marking machines capable of providing dosages of paint, microbeads, large balls or mixture of microbeads and granules for adhesion, under conditions of quality corresponding to the paint data sheet.

2. Before starting work, the proper functioning of the machinery shall be checked according to the instructions and operating manuals provided by the manufacturer, e.g. at least the following:

- a) the proper functioning of the compressor, paint guns – based on organic solvent or water – and those of microbeads, large balls and mixture of microbeads and granules for adhesion, gauges, speed and flow indicator;
- b) degree of cleanliness of component parts (hoses, tanks, pistols, etc.). Check that the inner clothing of the paint hose has not been degraded by the paint in organic solvent (the clothing becomes crumbly). On the outside, check that the hose is degraded due to UV rays or has been washed with organic solvent (it presents cracks or is crumbly). In particular, the hose clips shall be checked. The degraded hose shall be replaced immediately with a new hose;
- c) cleaning the air filter from the compressor;
- d) tightness of compressed air circuits (pipes, hoses, threaded joints);
- e) the proper functioning of the marker that performs the division of the band and different lane widths;
- f) the disks marker must ensure:
 - f.1) limitation of the marking band (width, edges reinforcement);
 - f.2) operation of paint dispensers, microbeads, large balls and microbeads (large balls) mixed with granules for adhesion, at the rate of dividing the marking strip, lifting and lowering the marker;
- g) operation of the electrical installation for starting signalling and lights. Defects such as loose connections, heat-affected cables must be remedied immediately;
- h) adjusting the position of the pistols according to the characteristics of the marking;
- i) the mandatory fitting of the marking machine with nozzles of dimensions corresponding to those recommended in the technical book of the equipment;
- j) fitting the machine with fire extinguisher that is within the shelf life and is in good working order.

2. It is forbidden to use the marking machine for other purposes (spraying of herbicides, towing other machines, etc.) than the one for which it was intended.

Article 19. - 1. For the execution of the road marking with **bicomponent systems** – it shall be applied in a thin layer (maximum 0.8 mm) in the airless system and thick layer (minimum 3 mm) in the extrusion system (smooth, structured and resonator) with specialised machines properly equipped to provide the recommended dosages of the two components, microbeads, large balls or mixture of microbeads and granules for adhesion, under the conditions specified in the technical documents.

2. Before starting work, check:

- a) the proper functioning of the compressor, pumps, pistols for applying the two components and microbeads, manometers;
- b) degree of cleanliness of tanks and parts of routes (pipes, hoses, pistols, pumps, etc.);
- c) degree of cleanliness of the air filter from the compressor;
- d) the operating condition of the control devices in the marking machine endowment;
- e) the tightness of compressed air circuits;
- f) operation of the electrical installation for starting signalling and lights and the orange revolving light;
- g) adjustment of the position of pistols;
- h) adjusting the machine ensuring its operation at a constant application speed and pressure.

Article 20. - 1. Thermoplastic marking materials used for the execution of road marking with **thermoplastic material** are products that are applied at high temperatures (ca. 200 °C), thin layer (by

spraying no more than 1.5 mm) or thick (by extrusion to a minimum of 3 mm) – smooth, structured (spot/multidot) marking and resonator. The material shall be heated in specialised equipment (preheaters with mixing system) until it reaches the molten state, keeping under shaking so that the temperature is uniform throughout the material mass. The molten material shall be transferred to the marking machine (for mechanised application) or can be applied manually, with frame-type devices made of metal.

2. Before starting work, check:

a. For the preheater:

- a.1) operation of the electrical installation for starting signalling and lights and the orange revolving light in the truck's endowment;
- a.2) the proper operation of the hydraulic pump and manometers;
- a.3) degree of cleanliness of the tank and routes (pipes, hoses, etc.);
- a.4) degree of cleanliness of the oil filter of the hydraulic pump;
- a.5) the integrity of the electrical circuits;
- a.6) the correct operation of the fuel ignition plant turbine and injector;
- a.7) the tightness of the thermal, lubrication and hydraulic oil and fuel supply circuits.

b. For the marking machine:

- b.1) the proper functioning of the compressor, material and microbeads application pistols, manometers;
- b.2) degree of cleanliness of the tank and parts of the routes (pipes, hoses, pistols, etc.);
- b.3) degree of cleanliness of the air filter from the compressor;
- b.4) tightness of the compressed air and oil circuits;
- b.5) operation of the electrical installation for starting signalling and lights and the orange revolving light;
- b.6) adjustment of the position of the pistols according to the technological process of application (spraying or extrusion).

Article 21. - 1. For the execution of the road marking with **hot rolled anti-skid material**, the material shall be heated in specialised equipment (preheaters with mixing system) until it reaches the molten state, keeping under shaking so that the temperature is uniform throughout the material mass. The application shall be carried out manually, by uniform distribution of the material with the help of special construction devices – metal frames.

2. Before starting work, check the preheater for:

- a) operation of the electrical installation for starting signalling and lights and the orange revolving light in the truck's endowment;
- b) the degree of cleanliness and proper functioning of the preheater/preheaters;
- c) the degree of cleanliness of the oil filter, of the hydraulic installation that engages the mixer;
- d) the degree of cleanliness of the air filter from the auxiliary engine;
- e) the integrity of the electrical circuits;
- f) tightness of hydraulic oil and lubrication and fuel supply circuits.

Article 22. - When carrying out the road marking with **cold rolled anti-skid materials**, materials intended for the application of cold anti-skid carpets are bicomponents products in which the anti-skid mineral aggregates are directly embedded in component A or may be distributed on the surface of the marking immediately after its application to the substrate.

Article 23. - Regardless of the application technology, any work on electrical, hydraulic, pneumatic

and motor equipment of specialised equipment shall only be performed by a specialist.

Article 24. – In all cases, working staff must wear protective equipment.

SECTION 2

Premarking

Article 25. - It shall be carried out with topographical apparatus or manually, by drawing/marketing-out with paint a continuous reference line or determined landmarks and symbols, on the surface of the carriageway, which are intended to guide the executant for the correct realisation of the markings (using for this purpose the symbols set out in Annex 10), as follows:

- a) on sectors where the old marking is erased;
- b) on sectors where the old marking does not comply with the provisions of SR 1848-7;
- c) on sectors with new asphalt coating or new cement concrete.

Article 26. - The pre-marking shall be made for longitudinal markings using for this purpose the symbols set out in Annex 10.

Article 27. – Between the ends of the road sector in alignment (visibility is ensured), the pre-marking can be visually checked.

SECTION 3

In-service performance requirements

Article 28. - Road markings that can be distinguished by road users from distances of at least 75 m to more than 150 m (in the case of motorways and roads with increased traffic speed) shall be used. For appropriate visibility, minimum values are recommended for the coefficient $RL = 200 \text{ mcd m}^{-2} \text{ lx}^{-1}$ (performance class R4 according to SR EN 1436, and in certain situations even class R5) for dry carriageway and $RL = 50 \text{ mcd m}^{-2} \text{ lx}^{-1}$ (performance class RW3) for wet carriageway. Good visibility by nighttime (mainly due to retro-reflection) shall be supported by good day visibility, which technically translates into a minimum value $Q_d = 160 \text{ mcd m}^{-2} \text{ lx}^{-1}$ (performance class Q4).

Article 29. - A secondary physical characteristic of the road marking, derived from choosing the marking material and application technology, is the coefficient of adhesion (SRT). Good adhesion of tyres to the marked surface (mainly generated by the roughness of the marking) is an important factor for the safe running of vehicles on the carriageway. In both new condition and service life, the road marking surface reaches a minimum of 45 SRTs (class S1). For certain agglomerated type markings, measurement of the coefficient of adhesion is not feasible with standardised methods (high dispersion of results), which is why no determinations are usually made for this type of marking.

Article 30. - The specific layer thickness for each type of road marking (smooth, structured, resonator) is provided in SR 1848-7. Rainwater drainage ditches shall be provided for thick-layered markings in order to avoid aquaplaning.

Article 31. - A complete table of the minimum performance values required for efficient markings is given in Chapter 3.8 ‘Performance classes on the markings visibility’.

SECTION 4

Other functional requirements for road markings

Article 32. - In order to preserve the characteristics over time (during the period of operation), road markings must adhere well to the substrate (bituminous asphalt, road concrete, previously applied marking layers, etc.), be resistant to environmental factors and substances used to combat snow and

frost and show a resistance to wear appropriate to the intensity of traffic. Account must be taken of the fact that overloading on the axle, the use of snow ploughs (especially those without a protective strip), running tracked equipment or other mechanical interventions damage glass microbeads applied to the surface of road markings, resulting in a decrease in the visibility of the markings at night and may subsequently lead to accelerated wear or even complete destruction of the road marking. A special case is the temporary modification of the signalling plan in road repair interventions (signalling of works), in which case the change in the driving course of the vehicles may result in accelerated wear on portions of the permanent marking.

SECTION 5

Unmarking (deletion of existing marking)

Article 33. – In choosing the technology and marking material – in particular temporary technology – account must be taken of the available technologies relating to the deletion of the marking and their economic efficiency.

Article 34. - 1. The removal of a marking (permanent or temporary) shall be carried out by:

- a) cold milling – machinery must be equipped with fine and microfine milling drums;
- b) high pressure water jet milling – working pressures of 800-2600 bar are used;
- c) ball jet milling;
- d) thermal lance.

2. Removal of a marking should not be carried out by burning as this method contributes to the degradation of the road structure.

Article 35. - Coating with a new black marking layer is allowed only as an exception if none of the other technologies is available and it can be ensured that wear of the paint layer applied for masking will not bring to light “ghost” images of old markings, which could be misinterpreted by road users. In order to avoid such situations, these areas shall be kept under observation.

Article 36. - The shadows of the old marking must not interfere with the visibility and recognisability of the new marking.

Article 37. - In the cases set out above, masking with black marking paint is also acceptable, given that improperly marked surfaces are reduced and insulated (maximum 30 sqm). In this case, the amount of black paint consumed shall not be charged. Black marking paint must cover completely in a geometric shape (rectangle or square) and permanently the old marking.

Article 38. - Milling must be done on the entire surface of the framing rectangle of the marking to be removed, in order to limit the chance of the ‘ghost’ images appearing.

Article 39. - The material removed by milling must be collected immediately after the milling process and disposed of in accordance with the regulations governing the waste regime.

SECTION 6

Maintenance of road markings

Article 40. - The maintenance of markings involves partial restorations or additions in areas where the marking has been damaged.

Article 41. - The operations to be performed are similar to those of preparing the marking surface. The same type of marking material must be used, but there are situations where a change of the technical solution (application material and technology) is required, in such cases it is necessary to ensure compatibility of marking materials.

Article 42. - If the technical documentation of the marking/markings product does not specify the compatibility/incompatibility with certain products, the application of the new technical solution shall be made only after the compatibility tests of the new material with the existing marking have been carried out.

SECTION 7

Acceptance criteria

Article 43. - 1. Road marking performance (nighttime visibility, daytime visibility, contrast, adhesion and wear resistance) shall be tested both in the laboratory (according to the methods described in SR EN 1436 and SR EN 13197) and under real road conditions, on certain experimental sectors within the national road network. Laboratory testing shall be carried out by laboratories notified at European level, and in Romania by laboratories authorised by the State Construction Inspectorate – and accredited by the Romanian Accreditation Body – R.E.N.A.R.

2. From this derive tables of wear performance classes, which are not equivalent a priori (the results generated by tests on experimental sectors have a higher chance of being repeatable in the long-term operation of markings compared to turntable tests) but useful (inside a method) in comparing the materials of the various manufacturers. The classification itself is universal (millions of wheel crossings) and given in the following table:

Number of wheel crossings	Performance class
0.1 million	P2
0.5 million	P4
1.0 million	P5
2.0 million	P6
4.0 million	P7

SECTION 8

Classes of performance on the visibility of markings

Article 44. - The classes of performance on the visibility of markings are shown in the following table:

Current No		Marking	Value	Class
1.	Minimum values for daytime visibility, Q_d , $\text{mcd} \cdot \text{m}^2 \cdot \text{lx}^{-1}$	permanent markings at new stage	160	Q4
		permanent markings in use stage	130	Q3
		temporary markings at new/use stage	100	Q2
2.	Minimum values for	dry in new state (when applied)	300	R5

	night visibility – permanent markings for preformed markings/applied markings, $R_L, \text{mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$	dry in use (in service)	200	R4
		wet, in new state (when applied)	75	RW3
		wet, in use (in service)	35	RW2
3.	Minimum values for nighttime visibility – permanent markings for all other final markings, $R_L, \text{mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$	dry in new state (when applied)	200	R4
		dry in use (in service)	100	R2
		wet, in new state (when applied)	50	RW3
		wet, in use (in service)	25	RW1
4.	Minimum values for nighttime visibility – temporary markings, measurements taken in intervals: 91 days until the end of the warranty period, $R_L, \text{mcd} \cdot \text{m}^{-2} \cdot \text{lx}^{-1}$	Dry	150	R3
		Wet	35	RW2

CHAPTER IV

Execution of road markings

SECTION 1

Technical conditions

Article 45. - When executing the markings, the following must be complied with:

- a) these instructions and the specifications on the technical conditions for carrying out road markings;
- b) the pre-marking made in accordance with the film marking and the provisions of SR 1848-7.

Article 46. - The film of the road markings shall be drawn up by the road manager (examples in Annexes 11 and 12).

Article 47. - When making drawings related to the marking film, the following scales are used:

- a) For length 1:1000 scale;
- b) For width 1:500 scale;
- c) For intersections 1:500 and/or 1:250 scale as appropriate.

SECTION 2

Preparation of documents for work

Article 48. - 1. For starting the marking works within a road unit, a decision shall be issued which shall include the nomination of the SDN/Highways Section/DRDP responsible designated to keep track of the execution of the marking at all times.

2. The closure and diversion of traffic or the establishment of traffic restrictions and the provision of all conditions for their realisation shall take place only after the consent of the traffic police has been obtained. The signalling during the works shall be carried out in accordance with the 'Methodological rules on closing conditions and establishing traffic restrictions for the execution of works in the area of the public road and/or for the protection of the road', approved by Order No 1112/2000, published in the Official Gazette of Romania Part I No 397 of 24 August 2000.

SECTION 3

Preparations for starting the marking execution

Article 49. – The following measures must be taken before starting the marking execution:

- a) the road manager shall designate the road safety officer to supervise the execution of the markings and to control their achievement qualitatively and quantitatively;
- b) training of marking teams, to be led by a specialist, designated by the management of the unit of the executant;
- c) preparation of the marking machine in good working order;
- d) preparation of the marking surface;
- e) preparation of marking material and glass microbeads, large balls or mixture of microbeads (large balls) and granules for adhesion;
- f) providing materials for environmental protection and fire prevention and extinguishing (PSI);
- g) preparation of the means for signalling works and cones for the protection of the marking that must exist in the endowment of the working team.

SECTION 4

Establishment of the working unit

Article 50. - When carrying out the road marking with **thermoplastic material**, the working transport unit shall consist of:

- a) the team, consisting of minimum 5 persons:
 - a.1) the operator of the marking machine, who is the technical driver of the works;
 - a.2) at least 4 workers performing zone signalling operations, pre-marking, carrying out support preparation, supplying thermoplastic material and microbeads, feeding the marking machine and preheater/preheaters and lifting cones, moving the motor vehicle that closes the transport unit;
- b) machinery and equipment, comprising:
 - b.1) the machine equipped with brushes and/or washing plant for cleaning the working surface to which the road marking is applied;
 - b.2) marking machine;
 - b.3) the thermoplastic material preheater(s) placed on a truck with which the necessary materials are supplied;
 - b.4) the transport unit accompanying machine, equipped with appropriate signalling and road signs (fig. 'Road markings' according to SR1848-1) or electronically controlled mobile light warning panels (fig. 'Signalling of a moving working machine' according to SR18481-1) for the pre-signalling and signalling of the work;
 - b.5) a retro-reflection luminance and chromatic coordinates measuring apparatus or a contract with an approved laboratory for specific determinations, in accordance with Law No 10/1995 on quality in construction, republished, as subsequently amended and supplemented, officially

recognising the technical competence of laboratories to carry out analyses and tests specific to the construction field and the legal competence to issue valid documents for attesting the quality of construction works and Government Decision No 808/2005 approving the Regulation on the authorisation of laboratories for analysis and testing in construction activity.

Article 51. - When carrying out the road marking with **preformed material**, the working transport unit shall consist of:

c) the team, consisting of minimum 4 persons:

c.1) the team leader – the technical leader of the works;

c.2) at least 3 workers performing zone signalling operations, pre-marking, carrying out the work of preparing the support, handling packaging (cardboard boxes/sheets) containing the elements of preformed material, of positioning these elements in the execution area of the marking, of moving the utility vehicle which closes the transport unit.

d) machinery and equipment, comprising:

d.1) small equipment (turbo blowers, manual wire brushes, scraps) for preparing the work area;

d.2) propane/butane-fuelled flame burners;

d.3) the transport unit accompanying machine, equipped with appropriate signalling and road signs (fig. 'Road markings' according to SR1848-1) or electronically controlled mobile light warning panels (fig. 'Signalling of a moving working machine' according to SR18481-1) for the pre-signalling and signalling of the work;

d.4) a retro-reflection luminance and chromatic coordinates measuring apparatus or a contract with an approved laboratory for specific determinations, in accordance with Law No 10/1995 on quality in construction, republished, as subsequently amended and supplemented, officially recognising the technical competence of laboratories to carry out analyses and tests specific to the construction field and the legal competence to issue valid documents for attesting the quality of construction works and Government Decision No 808/2005 approving the Regulation on the authorisation of laboratories for analysis and testing in construction activity.

Article 52. - When carrying out the road marking with **anti-skid material**, with thermoplastic marking products, the working transport unit shall consist of:

e) the team, consisting of minimum 5 persons:

e.1) the team leader, who is the technical leader of the works and the person who actually applies the anti-skid carpet;

e.2) at least 3 workers who carry out the closure/opening of the area, carry out the pre-marking, carry out the work of preparing the support, feeding the preheater/preheaters, handling containers with anti-skid material from the truck with preheaters in the area of application of the carpet, lifting cones and moving the utility vehicle closing the transport unit;

e.3) the driver of the truck on which the preheaters are mounted.

f) machinery and equipment, comprising:

f.1) small equipment (turbo blowers, manual wire brushes, scraps) for preparing the work area;

f.2) the preheater(s) for anti-skid material, placed on a truck with which the necessary materials are supplied;

f.3) specialty vehicle/utility vehicle with preheater, which is also the transport unit closing vehicle, equipped with appropriate signalling and road signs (fig. 'Road markings' according to SR1848-1) or electronically controlled mobile light warning panels (fig. 'Signalling of a moving working machine' according to SR18481-1) for the pre-signalling and signalling of the work;

f.4) a device for determining the roughness of the SRT or MTD (sandbed).

Article 53. - When carrying out the road marking with **conventional paint**, the working transport unit shall consist of:

g) the team, consisting of minimum 4 persons:

- g.1) the operator of the marking machine, who is the technical driver of the works;
- g.2) minimum 3 workers performing zone signalling operations, pre-marking, carrying out the work of preparing the support, feeding the paint marking machine and microbeads and lifting cones, as well as moving the vehicle closing the transport unit;

h) machinery and equipment, comprising:

- h.1) the machine equipped with brushes and/or washing plant for cleaning the working surface to which the road marking is applied;
- h.2) marking machine;
- h.3) the transport unit accompanying machine, equipped with appropriate signalling and road signs (fig. 'Road markings' according to SR1848-1) or electronically controlled mobile light warning panels (fig. 'Signalling of a moving working machine' according to SR18481-1) for the pre-signalling and signalling of the work;
- h.4) an apparatus for measuring retro-reflection, luminance and chromatic coordinates or a contract with an approved laboratory for specific determinations, in accordance with Law No 10/1995 on quality in construction, republished, as subsequently amended and supplemented, officially recognising the technical competence of laboratories to carry out analyses and tests specific to construction sites and the legal competence to issue valid documents for attesting the quality of construction works and Government Decision No 808/2005 approving the Regulation on the authorisation of laboratories for analysis and testing in construction activity.

Article 54. - When carrying out the road marking with **bicomponent systems**, the working scale shall consist of:

i) the team, consisting of minimum 4 persons:

- i.1) the operator of the marking machine, who is the technical driver of the works;
- i.2) at least 3 workers performing zone signalling operations, pre-marking, preparing the support, feeding the marking machine with the two components (A and B) and microbeads and lifting cones, and moving the utility vehicle that closes the transport unit;

j) machinery and equipment, comprising:

- j.1) the machine equipped with brushes and/or washing plant for cleaning the working surface to which the road marking is applied;
- j.2) marking machine;
- j.3) the transport unit accompanying machine, equipped with appropriate signalling and road signs (fig. 'Road markings' according to SR1848-1) or electronically controlled mobile light warning panels (fig. 'Signalling of a moving working machine' according to SR18481-1) for the pre-signalling and signalling of the work.
- j.4) an apparatus for measuring retro-reflection, luminance and chromatic coordinates or a contract with an approved laboratory for specific determinations, in accordance with Law No 10/1995 on quality in construction, republished, as subsequently amended and supplemented, officially recognising the technical competence of laboratories to carry out analyses and tests specific to construction sites and the legal competence to issue valid documents for attesting the quality of construction works and of Government Decision No 808/2005 approving the Regulation on the authorisation of analysis and testing laboratories in construction activity.

Article 55. - When carrying out the road marking with type-marking products **bicomponent carpet**, the working transport unit shall consist of:

k) the team, consisting of minimum 4 persons:

- k.1) the team leader, who is the technical leader of the works and the person who actually applies the bicomponent carpet;
- k.2) at least 3 workers who carry out the closure/opening operations of the area, carry out the pre-marking, carry out the work of preparing the support in the area of carpet application, lifting cones and moving the utility vehicle which closes the transport unit.

l) machinery and equipment, comprising:

- l.1) small equipment (turbo blowers, manual wire brushes, scraps) for preparing the work area;
- l.2) a device for the manual application of the bicomponent anti-skid carpet;
- l.3) the transport unit accompanying machine, equipped with appropriate signalling and road signs (fig. 'Road markings' according to SR1848-1) or electronically controlled mobile light warning panels (fig. 'Signalling of a moving working machine' according to SR18481-1) for the pre-signalling and signalling of the work.
- l.4) a device for determining the roughness of the SRT or MTD (sandbed).

SECTION 5

Working mode

Article 56. - The following activities are required for the execution of road markings:

- a) closure of traffic (increased traffic, at intersections, on road sections where the execution of road marking works requires traffic closure and diversion) and establishing traffic restrictions with a view to carrying out works on the public road;
- b) installation of road marking pre-signalling elements (road signs and/or light-signalling devices – electronically controlled panels, beacons with flashing lamps);
- c) preparation of the marking machine;
- d) preparation of the working surface (cleaning by brushing, sweeping, blowing compressed air, washing, burning with flame burner, etc.);
- e) execution of the pre-marking;
- f) preparing and preparation of the marking material;
- g) determination of dosages when road marking is executed;
- h) execution of the marking itself;
- i) installation of protective cones to protect the applied marking;
- j) quality control of road marking and recovery of protective cones.

Article 57. - The working transport unit shall be marked with light warning signs specific to marking operations.

Article 58. - Marking works shall only be carried out in a safe manner for both performing staff and road users, so as to affect as little as possible the fluency of road traffic. Determination of paint dosages and glass microbeads, large balls or mixture of microbeads (large balls) and granules for adhesion shall be done at the beginning of each working day and shall be repeated during the day, as often as necessary, if the thickness and appearance of the marking have not been respected.

Article 59. - The markings shall be made to the dimensions according to the provisions of SR 1848-7 and shall have a clearly demarcated contour. Glass microbeads, large balls or mixture of microbeads (large balls) and granules for adhesion, must be evenly distributed over the surface of the marking.

Article 60. - During the execution of the road marking, checks shall be made on its geometry and measurements of the thickness of the wet paint film and glass microbeads, large balls or microbeads (large balls) mixed with granules for adhesion.

Article 61. - Failure to comply with the working dosages, the marking film, the specifications and SR

1848-7 requires the execution staff to correct and restore the marking at the executant's own expense.

Article 62. During the marking, film defects may occur. These defects require the personnel who execute the marking to proceed to the immediate elimination of the causes and to remedy the defects found.

Article 63. - 1. Annex 13 shows different types of film defects, the reasons causing them and how to remedy them.

2. The types of film defects in the thermoplastic marking applied by extrusion can be found in Annex 14.

3. The types of film defects in the thermoplastic spray marking can be found in Annex 15.

4. The types of defects in the application of microbeads can be found in Annex 16.

Article 64. - At the end of the daily marking operations, the head of the marking team shall draw up a working report endorsed by the responsible from the road manager (SDN/Highways Section/DRDP), which is a document for reception (Annex 1).

Article 65. - At the marking machine, product application devices and distributor of microbeads, large balls and microbeads mixed with granules to increase adhesion, must be cleaned at the end of working hours.

Article 66. - Compliance with the Labour Protection and Fire Prevention and Fire Control Rules is mandatory in accordance with Chapter 6 of this Technical Regulation.

Article 67. - The road marking is usually white, with other colours being used only under the conditions laid down in SR 1848-7 and the Highway Code.

Article 68. - The temporary marking applied for the signalling during the execution of the works shall be yellow in colour and shall prevail over the white marking. In order to ensure road safety, the yellow marking shall meet at least the same daytime and nighttime visibility characteristics as the permanent marking in the area, without necessarily involving the same wear resistance. The marking must retain its characteristics throughout the period of the enforcement of traffic restrictions.

Article 69. - When a fresh running surface is put into service (reconstruction of wear layer, upgraded/rehabilitated road, newly built road/highway), it is mandatory to apply a provisional white road marking with the role of 'road marking for opening under traffic', removable, reflective compatible with the future definitive marking, covering the period during which, for technical or weather reasons, permanent markings cannot be applied to ensure the required quality conditions. It shall, in particular, be executed in situations where:

- a) the environmental conditions or the season are not suitable for the execution of a long-term marking;
- b) the marking is made on bituminous asphalt, which requires several months under traffic to consume excess bitumen from the structure and thus allow good adhesion for the long-term marking;
- c) after a surface treatment of the running surface wear layer;
- d) on surfaces on which crib has been applied to increase roughness;
- e) on running surfaces made of cement concrete.

Article 70. - The introduction of additional colours for retro-reflective road markings is contraindicated; increasing the colour spectrum leads to overloading the driver's field of vision. In addition, the technically feasible retro-reflection for other colours (green, red, blue, etc.) is significantly lower than white (ratio 1:3 to 1:7), with the nighttime effect of coloured markings becoming negligible. The colours used in the execution of road markings are set out in SR1848-7.

SECTION 6

Limitations for the execution of road markings

Article 71. - Hot or cold/prefabricated paint/plastics road marking products shall only be applied when the running surface temperature is at least three degrees Celsius (3°C) higher than the dew point temperature of the air (to be obtained from the table below), the temperature (air and running surface) is within the minimum and maximum limits recommended by the manufacturer and the wind speed is less than 30 km/h.

Article 72. - Road marking products shall not be applied when the running surface is wet or the temperature of the air and support layer does not comply with the manufacturer's recommended limit of application temperatures, rain, snow, fog or visible water or ice film, or when the road shows traces of anti-skid material.

Air temperature (°C)	Relative air humidity (%)								
	100	90	80	70	60	50	40	30	20
0	0.0	-1.4	-3.0	-4.8	-6.8	-9.2	-12.0	-15.5	-20.3
2	2.0	0.5	-1.1	-2.9	-4.9	-7.3	-10.2	-13.7	-18.6
4	4.0	2.5	0.9	-1.0	-3.1	-5.5	-8.4	-12.0	-16.9
6	6.0	4.5	2.8	0.9	-1.2	-3.6	-6.6	-10.3	-15.3
8	8.0	6.5	4.8	2.9	0.7	-1.8	-4.8	-8.5	-13.6
10	10.0	8.4	6.7	4.8	2.6	0.1	-3.0	-6.8	-11.9
12	12.0	10.4	8.7	6.7	4.5	1.9	-1.2	-5.0	-10.3
14	14.0	12.4	10.6	8.6	6.4	3.7	0.6	-3.3	-8.6
16	16.0	14.4	12.5	10.5	8.2	5.6	2.4	-1.6	-7.0
18	18.0	16.3	14.5	12.4	10.1	7.4	4.2	0.2	-5.3
20	20.0	18.3	16.4	14.4	12.0	9.3	6.0	1.9	-3.6
22	22.0	20.3	18.4	16.3	13.9	11.1	7.8	3.6	-2.0
24	24.0	22.3	20.3	18.2	15.7	12.9	9.6	5.3	-0.4
26	26.0	24.2	22.3	20.1	17.6	14.8	11.3	7.1	1.3
28	28.0	26.2	24.2	22.0	19.5	16.6	13.1	8.8	2.9
30	30.0	28.2	26.2	23.9	21.4	18.4	14.9	10.5	4.6
32	32.0	30.1	28.1	25.8	23.2	20.3	16.7	12.2	6.2
34	34.0	32.1	30.0	27.7	25.1	22.1	18.5	13.9	7.8
36	36.0	34.1	32.0	29.6	27.0	23.9	20.2	15.7	9.5
38	38.0	36.1	33.9	31.6	28.9	25.7	22.0	17.4	11.1
40	40.0	38.0	35.9	33.5	30.7	27.6	23.8	19.1	12.7
42	42.0	40.0	37.8	35.4	32.6	29.4	25.6	20.8	14.4
44	44.0	42.0	39.8	37.3	34.5	31.2	27.3	22.5	16.0
46	46.0	43.9	41.7	39.2	36.3	33	29.1	24.2	17.6
48	48.0	45.9	43.6	41.1	38.2	34.9	30.9	25.9	19.2
50	50.0	47.9	45.6	43.0	40.1	36.7	32.6	27.6	20.8

Note: Intermediate values are obtained by linear interpolation.

CHAPTER V

Quality control of materials and road markings

Article 73. - The increase in road traffic intensity has led to the transition from the selection of markings based on the approved strength class to acceptance procedures in the guarantee related to the actual wear resistance over time, usually expressed as the ratio between the remaining marking area and the marking area covered when applied. In this context, the approved performance class must be seen as a necessary condition (for material selection) but not sufficient to demonstrate the performance of the marking (as a system) – this remains to be done in the field. Given the intrinsic characteristics of

a roadway in service – geometry deviations, uneven substrate material, variable wear, periodic accumulations of locally accumulated anti-skid material, climatic zone, etc. – the road marking is expected not to be perfect from the geometric or general appearance point of view; the assessment shall be carried out on the ability of the marking to transmit the correct information to road users. The remaining marking area on a road section, at the end of the warranty period, shall be at least 80 % of the original one. This condition can also be used in assessing the moment of intervention to complete/return a road marking in service (outside the warranty period).

Article 74. - In order to maintain the safety characteristics in service, the road marking shall be rebuilt in accordance with SR 1848-7 whenever the measured values for the performance classes – daytime visibility Q3, nighttime visibility R2 and nighttime visibility in wet environment RW1 respectively decreased by 20 % below the threshold values, i.e. when the SRT fell below 45.

Article 75. - The visibility of road markings must be ensured in all seasons, both at daytime and at nighttime. The visibility check shall be carried out with specific equipment, one-off after application and over the entire surface of the marking during the service life, the measurements shall be carried out with portable or vehicle-mounted appliances which determine the values at normal speeds and may be used for longer road sections than those used by portable appliances, but also when the use of portable appliances requires extreme precautions, in particular on motorways. The values obtained shall be related to the requirements of standard SR EN 1436.

Article 76. - Experience shows that the decrease of 20 % below the minimum threshold value of the nighttime visibility coefficient means that the marking can no longer be perceived by road users, with adverse consequences for traffic guidance and, implicitly, on road safety.

Article 77. - SR 13459 sets out the methods for obtaining representative samples of road marking products, intended for testing, and presents the appropriate test methods.

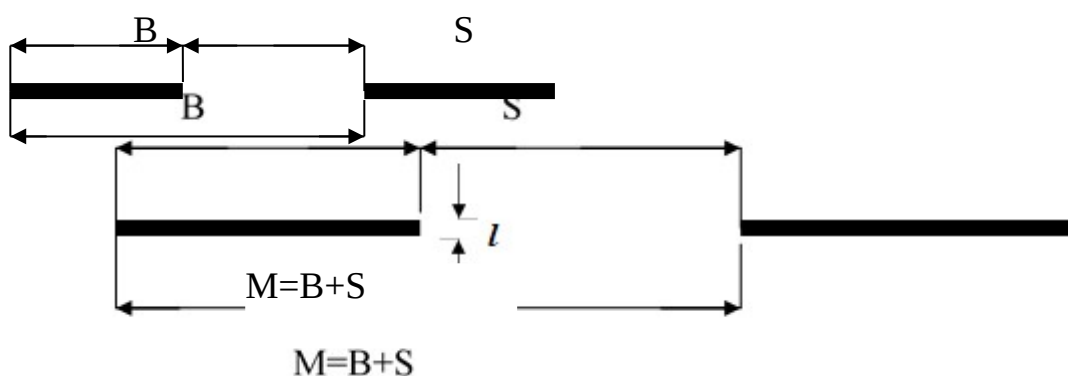
Article 78. - From the nominal dimensions given by SR 1848-7, deviations shall be allowed according to the maximum limits set out in the following table:

If a marking ‘M’ module is considered, then:

B = marking strip;

S = the interspace between two marking strips;

l = marking strip width.



Marking type	Strip deviation (A_B)	Interspace deviation (A_S)	Marking deviation (A_M)
1 : 1	± 5 cm	± 5 cm	± 10 cm
3 : 6	± 5 cm	± 5 cm	± 10 cm
3 : 9	± 5 cm	± 10 cm	± 15 cm
9 : 3	± 10 cm	± 5 cm	± 15 cm

12 : 3	± 10 cm	± 5 cm	± 15 cm
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A_B = longitudinal deviation of the marking strip;

A_S = longitudinal deviation of the interspace;

A_M = longitudinal deviation of the marking module;

A_L = deviation in the width of the marking strip ± 0.5 cm;

Deviations of no more than ± 1 % shall be permitted for transverse markings, by means of arrows and inscriptions.

CHAPTER VI

Occupational safety and fire prevention and firefighting rules

Article 79. - The following regulations shall be complied with:

- a) training of personnel in accordance with the provisions of the Labour Protection and Fire Prevention and Control (PSI) Rules (Law No 307/2006, republished, as subsequently amended and supplemented);
- b) equipping with protective equipment;
- c) equipping with hygienic-sanitary materials and protective nutrition in accordance with the regulations in force (Law No 319/2006, as subsequently amended and supplemented; Government Decision No 1425/2006, as amended; Government Decision No 300/2006, as amended);
- d) signalling of the working point (Joint Order of the Minister for Transport and the Minister of the Interior No 411/1112/2000);
- e) equipping with extinguishing means according to Fire Prevention and Fire Control (PSI) Rules.

Article 80. - Organic solvent-based marking paints have low flammability temperatures, compliance with Fire Prevention and Fire Control and Labor Protection Rules are very important to avoid fire or injury hazards. As fire-extinguishing agents: carbon dioxide, chemical foam, sand, filer or chemical dust shall be used.

Article 81. - In order to avoid the risk of explosion, the use of electrical equipment and tools that can cause sparks is prohibited (bronze tools and protected installations shall be used). Avoid contact with skin, eyes and nasal mucous membranes.

Article 82. - In case of skin contact, wash with soap and water and rinse very well, and in case of eye contact, rinse with plenty of fresh water for a few minutes and ask for a doctor. In the event of inhalation or swallowing, a doctor should be immediately requested for first aid.

Article 83. - During the handling of paints and microbeads, appropriate protective equipment (suits, gloves, glasses) shall be worn, and at execution, warning vests.

Article 84. - Measures shall be taken to eliminate static electricity.

Article 85. - The marking paint that falls on the marking machine shall be wiped with the cotton cloth wetted with the paint thinner.

Article 86. - in the case of organic solvent-based paints, the container that has been emptied of the paint shall be carefully handled because it contains flammable solvent vapours (especially if the lid has been fitted immediately after emptying). For this purpose, keep away from the sun or other dangers. The microbeads (large balls) that fall when handling the bags shall be swept in order to avoid people

slipping and falling.

Article 87. - If microbeads enter the eye, it is forbidden to rub the eye by hand. Remove the microbeads by washing with water. Consult your doctor immediately. The marking team must be equipped with a sanitary kit to provide assistance in case of need.

Article 88. - For cleaning or collecting paint, absorbent materials such as: sand, filer, sawdust etc. shall be used. These materials shall not be disposed of on the roadside, on agricultural land, in watercourses or in the sewage system, they shall be stored and destroyed only in containers and specially arranged places.

Article 89. - Preformed thermoplastic and thermoplastic marking products shall be applied at temperatures of approx. 200°C, this posing the danger of generating serious burns.

Article 90. - The accompanying machine of the working transport unit shall be equipped with appropriate signalling provided by reflective film panels and yellow lamps with flashing light for dynamic signalling.

Article 91. - Training of personnel working with marking materials shall be carried out in accordance with the following regulations:

- a) General labour protection rules;
- b) Labour protection rules for maintenance and repair work;
- c) First aid rules in the event of an accident;
- d) Prevention and extinguishing of fires.

CHAPTER VII

Acceptance of marking works at the end/expiration of the warranty period

Article 92. - The reception of marking works shall be carried out in two phases: **Preliminary reception – at the end of the works** and **Final acceptance – upon expiry of the guarantee period**

Article 93. - Preliminary reception – at the end of the works

1. The marking shall be received at the end of one or more marking routes, but no later than 30 days after the date on which the marking was made.

2. For roads of national interest, the reception shall be carried out by a reception commission at S.D.N. level. / Motorways Section, established and approved by decision by the Director of the Regional Directorate for Roads and Bridges (D.R.D.P.) The committee shall include:

- a) Chairperson: head of the National Roads Section (S.D.N.)/ Motorways Section (S.A.);
- b) members: head of National Roads Sector (D.N.) /motorways, responsible for traffic safety within the National Roads Section (S.D.N.)/ Motorway Section (S.A.); a representative of S.D.N. Quality Officer, Head of District or Technical Staff of the National Roads Section (S.D.N.)/ Motorways Section (S.A.);
- c) secretary.

3. The commissions shall also involve representatives of the road police from the County Police Inspectorate within the Road Service or, as the case may be, the Highway Police Brigade.

4. The representatives of the executant may not be part of the reception committee, as they have the capacity of guests.

5. The Reception Board shall verify:

- a) order to start road marking works and controls;
- b) daily reports completed at the end of each working day (Annex 1);
- c) the summary of daily reports of the execution of the road marking (Annex 2);
- d) summary of works on the execution of road markings during the period (Annex 3);
- e) the summary with results of road marking performance determinations (Annex 4);
- f) whether the prescriptions in these technical instructions, the technical documentation and the execution of the works according to the design, the specifications, the film of the marking have been complied with;
- g) the geometry of the marking strip (length and width) according to SR 1848-7;
- h) the continuity of the paint film and uniformity of glass microbeads, large balls or mixture of microbeads (large balls) and granules for adhesion, sprayed on the surface of the film;
- i) quality of the marking.

6. In addition to visual observations on the road marking, measurements shall also be made with specialised apparatus for the determination, retro-reflection, of the luminance coefficient under diffuse illumination.

7. If quality deficiencies in the road marking are found, as regards the appearance of the marking, paint dosage, glass microbeads, large balls or mixture of microbeads (large balls) and granules for adhesion, retro-reflection, luminance coefficient under diffuse lighting, adhesion and wear resistance to the minimum prescribed values, the Commission shall decide to correct the marking at the applicant's expense.

8. The remedy shall be carried out within the time limit set by the reception committee.

9. All the findings relating to the quality of the marking received, as well as the necessary remedies, shall be entered in the acceptance report (Annex 5 and respectively, Annex 6).

Article 94. - 1. Final acceptance – upon expiry of the guarantee period shall be performed as follows: at the end of the warranty period of a road marking.

2. The final receipt on expiry of the warranty period shall be performed near the expiry of the warranty period, not later than 15 days before the expiry of the warranty period, but no later than 15 days after the expiry of the warranty period. Deviations from these deadlines are allowed in special situations (unfavourable weather conditions).

3. Warranty periods for road markings made with single-component liquid paints (based on organic solvent or water), cold/warm plastics by extrusion, spraying (spray) or structured (agglomerated) are presented in Annexes 9, 9A, 9B, 9C and 9D.

4. The guarantee period shall be provided for in the contracts concluded between the parties and shall be specified in the tender specifications.

5. For roads of national interest, the final reception shall be carried out by a commission composed at D.R.D.P. level approved by the Director of the Regional Directorate for Roads and Bridges (D.R.D.P.). The committee may also be a member from C.N.A.I.R. with the approval of the Director General of C.N.A.I.R. – S.A.

a) The Chairperson: Director of Maintenance of National Roads (D.N.) and Highways

b) Members:

b.1) Head of Service/Head of Traffic Safety Office of the Regional Directorate of Roads and Bridges (D.R.D.P.);

b.2) Head of Service/Head of Quality Office of the Regional Directorate of Roads and Bridges (D.R.D.P.);

- b.3) Head of National Road Maintenance Service (D.N.) and Motorways in the Regional Directorate of Roads and Bridges (D.R.D.P.);
 - c) Head of Section of the National Roads Section (S.D.N.)/ Motorway Section (S.A.);
 - d) Responsible designated to supervise the execution of road marking works within the National Roads Section (S.D.N.)/ Motorway Section (S.A.);Secretary;
 - e) Invitees:
 - e.1) the representative of the County Police Inspector (IPJ) – Road Service/Highway Police Office;
 - e.2) representative of the Contractor.
 - e.3) other invitees from the Contracting Authority.
6. The Commission shall verify the marking accepted at the preliminary reception, in accordance with the prescriptions of the specification, road marking instructions, SR 1848-7.
7. When the Commission determines values of wear resistance, retro-reflection, luminance coefficient under diffuse lighting and adhesion of the marking lower than the values required by the specification, the road marking shall be rejected at the final reception and proposed for remediation.
8. The remedy shall be done at the expense of the executant or the value of the guarantee of the marking is withheld.
9. All findings relating to the quality of the road marking received, as well as the remedies and the time limit within which they must be executed, shall be entered in the final acceptance report upon expiry of the warranty period in Annex 7 and Annex 8 respectively. These operations shall be linked to the contractual clauses between the beneficiary and the executant.

CHAPTER VIII

Management and maintenance systems of road markings

Article 95. - The periodic assessment of the retro-reflectiveness and visibility of road marking on public roads is the basis for a good planning of maintenance expenditure repair and budgeting interventions.

Article 96. - The current procedure provides for the measurement of the performance of the road marking in a static manner, at the time of applying of the marking and subsequently at the time of expiry of the guarantee, with sampling covering a limited number of measurement points and the final measurement report being of little relevance to the overall description of the status of the marking.

Article 97. - The current level of technique (retroreflectometers mounted on the outside of the chassis of a standard car) allows dynamic measurement of the main performance parameters of the road marking at the running speed of a standard road vehicle and represents the next step in the efficient management of this field. The national road network today does not exceed 20 000 km of roads classified as National Road (D.N.), European Road (E) and Highway (A) at least annually inventory of the condition of the road marking is not only desirable, but also technically possible, without the need for substantial effort.

Article 98. - Marking status data, combined with GIS information provided by GPS equipment, would enable a database to be fed to underpin the planning of road marking maintenance and restoration, allowing for a dynamic allocation of available resources and a concentration on areas with high traffic and/or accident values.

CHAPTER IX

Reference documents

Article 99. - 1. When using these instructions, the following reference documents shall apply:

I. NORMATIVE ACTS

Current No	Reference
1.	Law No 10/1995 on constructions quality, republished, with subsequent amendments and completions.
2.	Government Decision No 766/1997 approving certain regulations on quality in constructions, as subsequently amended and supplemented
3.	Government Ordinance No 43/1997 on the road regime, republished, as subsequently amended and supplemented
4.	Order of the Minister of Transport No 1297/2017 approving the Rules on the classification of roads of national interest into categories
5.	Order of the Minister of Transport No 1296/2017 for approval of the Technical Rules on the design, construction and modernisation of roads
6.	Order of the Minister of Transport No 1295/2017 approving the Technical Rules on the establishment of the technical class of public roads
7.	Joint Order No 411/1112/2000 of the Minister of Transport and the Minister of the Interior approving the Methodological rules on the conditions for closing the traffic and establishing traffic restrictions in order to carry out works in the public road area and/or to protect the road
8.	Law No 319/2006 on safety and health at work, as subsequently amended and supplemented
9.	Government Decision No 1425/2006 approving the Methodological Norms for the application of the provisions of the Law on Safety and Health at Work No 319/2006
10.	Government Decision No 300/2006 on minimum safety and health requirements for temporary or mobile construction sites, as subsequently amended and supplemented
11.	Law No 307/2006 on fire protection republished, as subsequently amended and supplemented.
12.	Government Emergency Ordinance No 195/2002 on traffic on public roads, republished, as subsequently amended and supplemented
13.	Government Emergency Ordinance No 195/2005 on environmental protection, as subsequently amended and supplemented
14.	Government Emergency Ordinance No 92/2021 on the waste regime

Current No	Reference
1.	Directive 2009/104/EC of the European Parliament and of the Council of 16 September 2009 concerning the minimum safety and health requirements for the use of work equipment by workers at work (second individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC), original version.
2.	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, as amended
3.	Commission Delegated Regulation (EU) No 157/2014 of 30 October 2013 on the conditions for making a declaration of performance on construction products available on a website
4.	Commission Delegated Regulation (EU) No 568/2014 of 18 February 2014 amending Annex V to Regulation (EU) No 305/2011 of the European Parliament and of the Council as regards the assessment and verification of constancy of performance of construction products

5.	Delegated Regulation (EU) No 574/2014 of 21 February 2014 amending Annex III to Regulation (EU) No 305/2011 of the European Parliament and of the Council on the model to be used for drawing up a declaration of performance on construction products
6.	Commission Implementing Regulation (EU) No 1062/2013 of 30 October 2013 on the format of the European Technical Assessment for construction products
7.	Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE)

II. STANDARDS

Item No	Reference	Name
1.	SR 1848-1	Road signalisation. Road traffic signs and signalisation tools. Part 1: Classification, symbols and locations
2.	SR 1848-7	Road signalisation. Road markings
3.	SR EN 1423	Road marking products. Drop on materials. Glass beads, antiskid aggregates and mixtures of the two.
4.	SR EN 1424	Road marking materials. Premix glass beads
5.	SR EN 1436	Road marking materials. Road marking performance for road users and test methods
6.	SR EN 1790	Road marking materials. Preformed road markings
7.	SR EN 1871	Road marking materials. Paint, thermoplastic and cold plastic materials. Physical properties
8.	SR EN 1824	Road marking materials. Road trials
9.	SR EN 12802	Road marking materials. Laboratory methods for identification
10.	SR EN 13197	Road marking materials. Wear simulator Turntable
11.	SR EN 13212	Road marking materials. Requirements for factory production control
12.	SR EN 13459	Road marking materials. Sampling from storage and testing.
13.	SR EN 1463-1	Road marking materials. Retroreflecting road studs. Part 1: Initial performance requirements

(2) On the territory of Romania, for ‘*Technical instructions for road markings*’ the provisions of the documents referred to in this legislation shall also be taken into account, as follows:

- a) for dated references, only the cited edition applies;
- b) for undated references, the latest edition of the reference document shall apply;
- c) The standards shall be used together with, where appropriate, the national annexes, amendments and erases published by the national standardisation body.

CHAPTER X
Final provisions

Article 99. – Annexes 1 to 16 form an integral part of these instructions.

DAILY REPORT FOR THE EXECUTION OF THE ROAD MARKING

DATE _____

1. Beneficiary ____DRDP_____SDN_____

2. Entrepreneur _____

Name of the Applicator _____

ENDORSED,
HEAD OF SDN

*)

3 a. Executed pre-marking

DN (national road)	Position km	Marking type	Km.fiz. /sqm

3 b. Longitudinal markings and demarcation of the executed carriageway

DN (national road)	Position km	Marking type	Thickness/ width (μ/cm)	Km physical	Km equivalent	sqm

3 c. Cross markings and miscellaneous executed**)

DN (national road)	Position km	Marking type	Thickness μ	sqm

4. Atmospheric working conditions

Air temperature _____ °C

Running surface temperature _____ °C

5. Characteristics of the road

No of lanes

Type of road surfacing material

Humidity_____
Wind speed_____km/h
Cloudy nebulosity –cloudless/covered/temporarily cloudy

Age of road surfacing material	
--------------------------------	--

6. Type of road marking machinery _____

7. Means of cleaning the running surface_____

8. Type of road marking product used_____

a) _____

b) _____

9. Application dosage and applied quantity of road marking products used

Wet film thickness/width strip (μ/cm)	Application dosages (kg/sqm)		Quantities (kg/sqm)	
	Point 8a	Point 8b	Point 8a	Point 8b

10. Remarks

Executant*),

Responsible Sig. Circ*),

*) Surname, first name and signature and stamp (where applicable)

**) Paint/plastics applied hot or cold/prefabricated products

DAILY REPORTING SUMMARY OF THE ROAD MARKING PERFORMANCE

Current No	Date of application	SD N	DN (national road)	Position km	Road part (left/right)	Marking type	Thickness (μm)	Longitudinal / Roadside demarcation sqm	Transverse / diverse sqm	Milling sqm	Marking product type	Microbeads type	Unit price	Value Lei without VAT	Article code
	1	2	3	4	5	6	7	8	9	10	11	12	13	14=13*(8+ 9+ 10)	15
1.															
2.															
3.															
4.															
5.															
6.															
7.															

The reception committee,

Surname, first name

Chairperson:

Members:

Signature

Secretary:

Contractor:

SUMMARY OF WORKS ON THE EXECUTION OF ROAD MARKINGS DURING THE PERIOD

DRDP _____

SUMMARY

Annex to invoice _____ / _____

SDN	DN positions km	Longitudinal markings/carriageway demarcation				Transversal/diverse marking				Observation
		Km equivalent (km)	Gr/la (µm/cm)	Unit price (lei)	Total I (lei)	Sqm (m2)	Thickness (µm)	Unit price (lei)	Total II (lei)	
Total SDN										
Total DRDP										

DRDP DIRECTOR

Head of Sig Service. Circ. DRDP

CONTRACTOR

SUMMARY RESULTS OF ROAD MARKING PERFORMANCE DETERMINATIONS

Current No	SDN	DN (national road)	Position km (left/right)	Type of marking product	Marking type	Strip width (cm)	Date of application	R _L (mcd.m ² .lx ⁻¹)	Qd (mcd.m ² .lx ⁻¹)	SRT	Wear resistance
1											
2											
3											
4											
5											
6											
7											

The reception committee,			
Surname, first name		Signature	
Chairperson:	_____	_____	
Members:	_____	_____	Secretary:
	_____	_____	_____
	_____	_____	
	_____	_____	Contractor:
	_____	_____	_____

RECEPTION REPORT AT THE END OF THE WORKS

No _____ of _____

Regarding the work _____

performed under contract No _____ of _____, concluded
between _____ and _____
for the works of _____

1. The works were carried out on the basis of authorisation No _____ issued by
_____ dated _____ valid until
_____.

2. The reception committee carried out its work in the period _____,
consisting of:

(name and Surname).....
.....(role)

3. They also attended the reception:

_____ (name and surname).....
.....(role)

4. Findings of the Reception Commission:

4.1. From the written and drawn documentation required to be presented, the pieces listed in Annex 1 to this report were missing or incomplete;

4.2. The quantities of works listed in Annex 2 to these minutes have not been executed;

4.3. The works listed in Annex 3 to these minutes did not comply with the provisions of the tender specifications;

4.4. The value of the received work is _____ lei, excluding VAT;

4.5. Other findings specific to the type of the work received:

Road and kilometres of markings subject to reception:

Marking strip width _____

Type of:

–paint : _____

–microbeads; large balls; mixture of microbeads (large balls) with adhesion granules

Characterisation of the road:

–type of support: _____

–support roughness: _____

Marking layout according to SR 1848-7: _____

Time from the application of the marking: _____

If the marking has been checked during the application period:

–date: _____

–person who carried out the control: _____

Adhesion: _____

Retro-reflection: _____

Luminance coefficient under diffuse illumination: _____

Inadequate sectors: _____

5. The Reception Board, following the findings made, proposes: _____

6. The reception committee shall state the reasons for the proposals made by: _____

7. The acceptance committee hereby recommends the following: _____

...8. This minutes, containing _____ pages and _____ numbered annexes, with a total of _____ pages, was concluded today _____ on _____ in _____ copies.

Reception Board:		Signature.
Chairperson:	_____	_____
Members:	_____	_____
	_____	_____
	_____	_____
	_____	_____
Secretary:	_____	_____
Contractor:	_____	_____
	_____	_____
	_____	_____

ANNEX TO THE ACCEPTANCE REPORT AT THE END OF WORKS

ANNEX NO ____

TO THE RECEPTION REPORT AT THE COMPLETION OF WORKS NO _____ / _____

Current No	DN (national road)	Thick	Sector received	Marking type	Km equivalent	sqm	Type of road marking product	Microbeads type	Support type	Support roughness	Period of applying the marking	Road type	MZA	Guarantee according to CST (months)	Expiry date	Invoice amount (lei excluding VAT)	Observation
1.																	
2.																	
3.																	
4.																	
5.																	

Note – marking type: SSC*separation of traffic, dpc* delimitation of the road side, SBAS*separation of lanes of the same direction

The reception committee,			
Surname, first name			Signature
Chairperson:	_____		_____
Members:	_____		Secretary:
	_____		_____
	_____		_____
	_____		Contractor:
	_____		_____

FINAL ACCEPTANCE REPORT ON EXPIRY OF THE WARRANTY PERIOD

DRDP _____

SDN _____

No _____ of _____

Regarding the work

1. The reception committee carried out its work in the period _____,
consisting of: _____

(name and surname)

(role)

2. They also attended the reception:

(name and Surname)

(role)

3. Findings of the Final Reception Commission, following examination of the work and documents below

3.1. The works were completed on: _____

3.2. The observations made by the final acceptance committee are set out in the list of Annex
No _____.

3.3. The work behaved (did not behave) properly during the period from its end to
_____ until this day, i.e. for a period of _____ months, the Commission's findings
being listed in Annex No _____.

3.4. Other findings specific to the type of work received according to the list of Annex No
_____:

3.5 Road and kilometres of markings subject to reception:

DN: _____ according to Annex No _____

Width of the marking strip _____ in accordance with Annex No _____

Type of:

–paint : _____

–microbeads; large balls; mixture of microbeads (large balls) with granules for adhesion

_____ according to Annex No _____

Characterisation of the road:

–type of support: _____ according to Annex No _____

–support roughness: _____ according to Annex No _____

Appearance of marking according to SR 1848-7: _____ according to Annex No _____

Time from the application of the marking: _____ according to Annex No _____

If the marking has been checked during the warranty period:

– date: _____

– person who carried out the control: _____

Wear resistance (%): _____

Retro-reflection: _____

Luminance coefficient under diffuse illumination: _____

Adhesion: _____

Inadequate sectors: _____

5. The Final Reception Board, following the findings made, proposes:

6. The Final Reception Board shall state the reasons for the proposals made by: _____

7. The Final Reception Board recommends the following: _____

...8. This minutes, containing _____ pages and _____ numbered annexes, with a total of _____ pages, was concluded today _____ on _____ in _____. copies.

Reception Board:			Signature.
Chairperson:	_____		_____
Members:	_____		_____
	_____		_____
	_____		_____
Secretary:	_____		_____
Contractor:	_____		_____
	_____		_____

ANNEX NO ____
TO THE REPORT OF FINAL RECEPTION UPON THE EXPIRY OF THE WARRANTY PERIOD
NO _____ / _____

Current No	DN (national road)	Thickness	Sector received	Marking type	Km equivalent	sqm	Type of road marking product	Microbeads type	Support type	Support roughness	Period of applying the marking	Road type	MZA	Guarantee according to CST (months)	Expiry date	Invoice amount (lei excluding VAT)	Observation
1.																	
2.																	
3.																	
4.																	
5.																	

Note – marking type: SSC*separation of traffic, dpc* delimitation of the road side, SBAS*separation of lanes of the same direction

The reception committee,			
Surname, first name			Signature
Chairperson:	_____		_____
Members:	_____		_____
	_____		_____
	_____		_____
			Secretary: _____

				Contractor:

WARRANTY DURATION OF ROAD MARKING PERFORMED WITH SINGLE-COMPONENT LIQUID PAINTS BASED ON ORGANIC SOLVENT OR WATER (WET FILM THICKNESS 600 MM)

Current No	Type of road	Type of marking	Minimum thickness μm	Roads with 4-6 lanes				Roads with 2-3 lanes			
				MZA physical vehicles							
				≤5,000	5,001 – 7,000	7,001 – 10,000	> 10,001	≤5,000	5,001 – 7,000	7,001 – 10,000	> 10,001
1	Highways	Longitudinal roadway boundary marking near the median area	600	-	-	-	6 months	-	-	-	-
		Longitudinal roadside boundary marking near the emergency parking lane	600	-	-	-	6 months	-	-	-	-
		Longitudinal lane separation marking of the same direction	600	-	-	-	6 months	-	-	-	-
2	European DN Main DN	Longitudinal lane separation and lane separation marking of the same direction	600	12 months	10 months	8 months	6 months	10 months	8 months	7 months	6 months
		Longitudinal marking of roadway demarcation	600	12 months	10 months	8 months	6 months	10 months	8 months	7 months	6 months
3	Secondary DN	Longitudinal lane separation and lane separation marking of the same direction	600	-	-	-	-	10 months	8 months	7 months	6 months
		Longitudinal marking of roadway demarcation	600	-	-	-	-	10 months	8 months	7 months	6 months
4	Motorways, European DN,	Cross and Miscellaneous markings	600	12	10	8	6 months	10	8	7	6 months

	Main DN, secondary DN			months	months	months		months	months	months	
--	--------------------------	--	--	--------	--------	--------	--	--------	--------	--------	--

WARRANTY DURATION OF ROAD MARKINGS PERFORMED WITH COLD/HOT ROLLED PLASTIC PRODUCTS (THICKNESS 3000 MM)

Current No	Type of road	Type of marking	Minimum thickness µm	Roads with 4-6 lanes				Roads with 2-3 lanes			
				MZA physical vehicles							
				≤5,000	5,001 – 7,000	7,001 – 10,000	> 10,001	≤5,000	5,001 – 7,000	7,001 – 10,000	> 10,001
1	Highways	Longitudinal roadway boundary marking near the median area	3000	-	-	-	14 months	-	-	-	-
		Longitudinal roadside boundary marking near the emergency parking lane	3000	-	-	-	14 months	-	-	-	-
		Longitudinal lane separation marking of the same direction	3000	-	-	-	14 months	-	-	-	-
2	European DN Main DN	Longitudinal lane separation and lane separation marking of the same direction	3000	24 months	20 months	16 months	14 months	24 months	18 months	14 months	12 months
		Longitudinal marking of roadway demarcation	3000	24 months	20 months	16 months	14 months	20 months	16 months	14 months	12 months
3	Secondary DN	Longitudinal lane separation and lane separation marking of the same direction	3000	-	-	-	-	20 months	16 months	14 months	12 months
		Longitudinal marking of roadway demarcation	3000	-	-	-	-	20 months	16 months	14 months	12 months
4	Motorways, European DN,	Cross and Miscellaneous markings		20	16	14	12	20	16	14	12

[illegible]

**WARRANTY DURATION OF ROAD MARKING PERFORMED WITH COLD ROLLED PLASTIC PRODUCTS APPLIED BY SPRAYING
(SPRAY) (THICKNESS 800 MM)**

Current No	Type of road	Type of marking	Minimum thickness µm	Roads with 4-6 lanes				Roads with 2-3 lanes			
				MZA physical vehicles							
				≤5,000	5,001 – 7,000	7,001 – 10,000	> 10,001	≤5,000	5,001 – 7,000	7,001 – 10,000	> 10,001
1	Highways	Longitudinal roadway boundary marking near the median area	800	-	-	-	10 months	-	-	-	-
		Longitudinal roadside boundary marking near the emergency parking lane	800	-	-	-	10 months	-	-	-	-
		Longitudinal lane separation marking of the same direction	800	-	-	-	10 months	-	-	-	-
2	European DN Main DN	Longitudinal lane separation and lane separation marking of the same direction	800	16 months	14 months	12 months	10 months	12 months	11 months	10 months	9 months
		Longitudinal marking of roadway demarcation	800	16 months	14 months	12 months	10 months	12 months	11 months	10 months	9 months
3	Secondary DN	Longitudinal lane separation and lane separation marking of the same direction	800	-	-	-	-	12 months	11 months	10 months	9 months
		Longitudinal marking of roadway demarcation	800	-	-	-	-	12 months	11 months	10 months	9 months

**WARRANTY DURATION OF ROAD MARKINGS PERFORMED WITH HOT ROLLED PLASTIC PRODUCTS APPLIED BY SPRAYING
(SPRAY) – thickness 1500 µm**

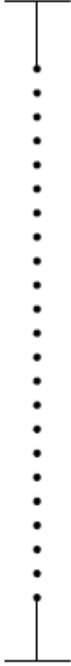
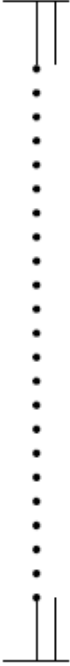
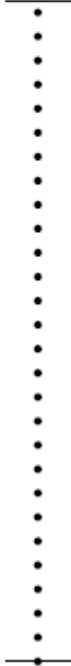
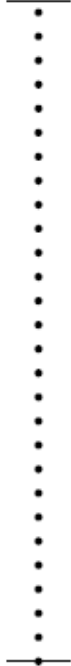
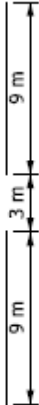
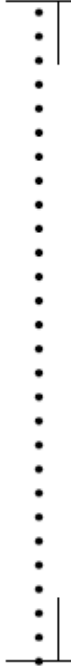
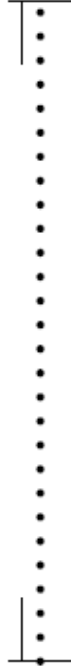
Current No	Type of road	Types and dimensions of the marking		Roads with 4-6 lanes				Roads with 2-3 lanes			
		Type of marking	minimum thickness	MZA physical vehicles							
				< 3500	3501-8000	8001-10000	>10001	< 3500	3501-8000	8001-10000	> 10,001
1.	Highways	Roadside boundary marking near the median area	1500 µm	-	-	-	12 months	-	-	-	-
		Roadside boundary marking near the emergency lane	1500 µm	-	-	-	12 months	-	-	-	-
		Longitudinal lane separation marking of the same direction	1500 µm	-	-	-	12 months	-	-	-	-
2.	European DN	Longitudinal lane separation and lane separation marking of the same direction	1500 µm	12 months			12 months	12 months	12 months	10 months	9 months
	Main DN	Roadside demarcation marking	1500 µm	12 months			12 months	12 months	12 months	10 months	9 months
3.	Secondary DN	Longitudinal lane separation and lane separation marking of the same direction	1500 µm	-	-	-	-	12 months		-	-
		Roadside demarcation marking	1500 µm	-	-	-	-	12 months		-	-

**WARRANTY DURATION OF ROAD MARKINGS PERFORMED WITH COLD/HOT ROLLED PLASTIC PRODUCTS APPLIED
STRUCTURALLY (THICKNESS 4000 MM)**

Current No	Type of road	Type of marking	Minimum thickness μm	Roads with 4-6 lanes				Roads with 2-3 lanes			
				MZA physical vehicles							
				≤5,000	5,001 – 7,000	7,001 – 10,000	> 10,001	≤5,000	5,001 – 7,000	7,001 – 10,000	> 10,001
1	Highways	Longitudinal roadway boundary marking near the median area	4000	-	-	-	14 months	-	-	-	-
		Longitudinal roadside boundary marking near the emergency parking lane	4000	-	-	-	14 months	-	-	-	-
		Longitudinal lane separation marking of the same direction	4000	-	-	-	14 months	-	-	-	-
2	European DN Main DN	Longitudinal lane separation and lane separation marking of the same direction	4000	24 months	20 months	16 months	14 months	20 months	16 months	14 months	12 months
		Longitudinal marking of roadway demarcation	4000	24 months	20 months	16 months	14 months	20 months	16 months	14 months	12 months
3	Secondary DN	Longitudinal lane separation and lane separation marking of the same direction	4000	-	-	-	-	20 months	16 months	14 months	12 months

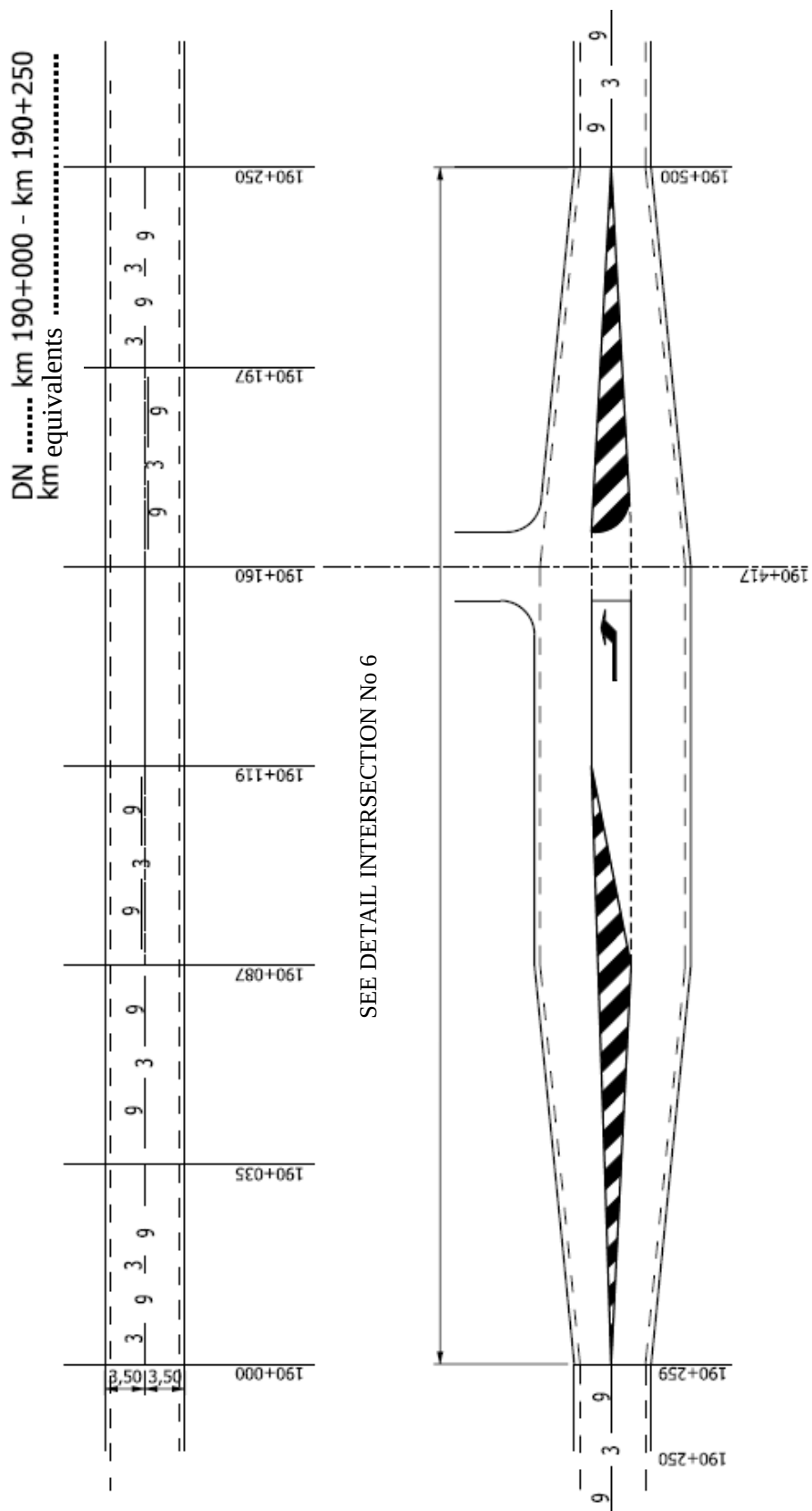
		Longitudinal marking of roadway demarcation	4000	-	-	-	-	20 months	16 months	14 months	12 months
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SYMBOLS FOR THE EXECUTION OF MARKINGS

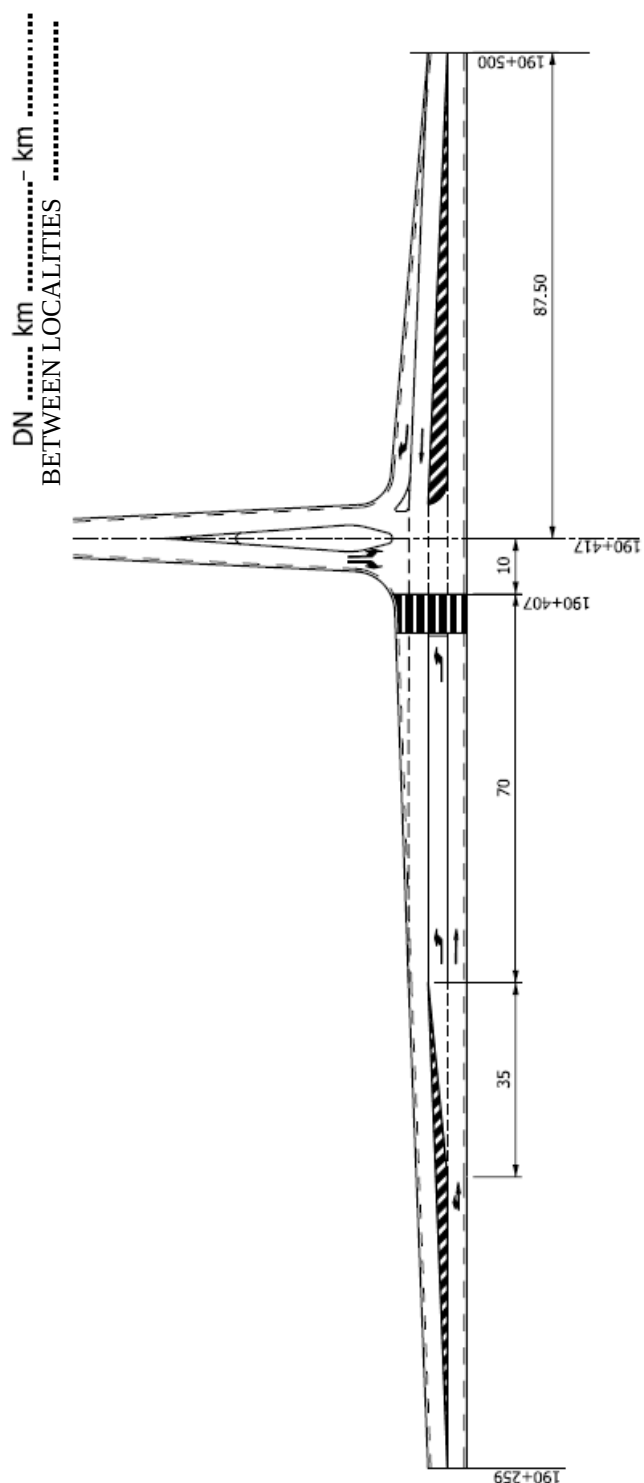
Symbol	
	
	
	
	
	
	

EXAMPLE

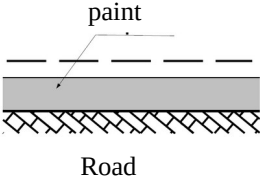
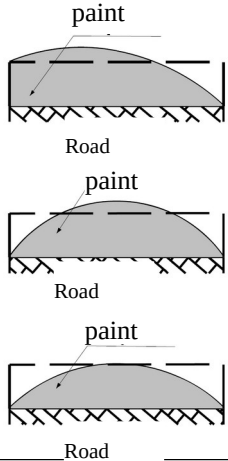
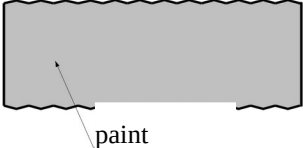
MARKING FILM

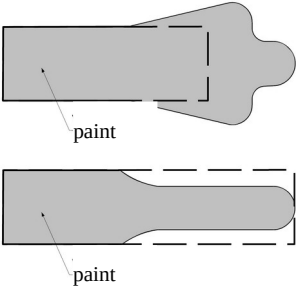
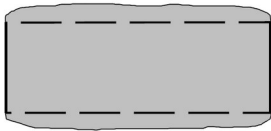
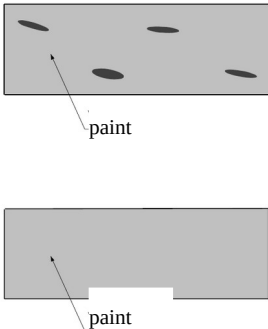


MARKING FILM



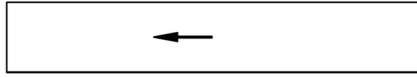
TYPES OF FILM DEFECTS

Current No	Film defects	Possible causes	Remedial mode
0	1	2	3
1.	Wet dosage lower than recommended dosage 	- Lock paint application equipment (clogging paint filter, clogging nozzles); - Deficiencies in the paint application gun; - Low pressure when spraying; - High viscosity; - Improper nozzle.	- Unlocking equipment; - Fix the position of the gun, raise or lower the gun; - Adjust the pressure; - The paint shall be diluted as recommended in the data sheet; - Nozzle change;
2.	Gun sprays more air than paint	- Insufficient paint in the paint tank	- Load the tank with paint;
3.	Gun sprays more air than paint 	- The gun is wrongly assembled; - The gun nozzle; - Pressure deficiency;	- Check the gun's distance from the road surface and the spray angle; - The nozzle of the gun shuttered or incorrectly fitted; - Increase the pressure and amount of air; - Remove impurities from the air to be used;
4.	The painted surface is flat, but the geometry of the line is not respected 4.1 Serrated line on the edge 	- Locking of discs; - Wrongly mounted pistol, splashes before or behind discs; - Large amount of paint applied; - Low viscosity paint;	- Unlock the discs; - Adjust the position of the gun; - Reduce the amount of paint at the recommended dosage; - Replace with paint having the appropriate viscosity. The can with improper paint is mixed in small quantities with undiluted paint;

Current No	Film defects	Possible causes	Remedial mode
0	1	2	3
	4.2 The end of the stripe is widened or narrowed 	- The paint gun closes after lifting the discs; - The gun sprays in front of the marking discs when they are on the ground; - The paint gun closes or opens too slowly; - Compressed air pressure is variable; - The working speed of the machine is high;	- Synchronisation of paint spray gun with marking discs; - Adjust the gun; - Adjust the compressed air equipment; - Decrease the working speed of the machine;
	4.3 Slightly rounded contour over the normal width of the paint strip 	- Low viscosity paint due to heat or solvent dilution;	- The viscosity of the paint shall be adjusted according to the ambient temperature or add undiluted paint to the diluted paint until an appropriate viscosity is achieved;
5.	The geometry of the paint strip is respected, but surface defects occur of the type:		
	5.1 Pits, blisters, hollows 	- Foreign particles in paint or paint crust that scratch the surface; - Condensation on the road or overheated paint;	- When the paint is inserted into the tank, it is sealed; - Before starting the marking, remove the dry paint from the spraying system; - Apply only on dry road. The paint container shall be stored in shady place;
	5.2 Missing portions of paint inside or on the edge	- Cold paint; - High working speed at marking; - Paint High – Solid applied in thin layer;	- Paint is applied according to atmospheric conditions; - Decrease the working speed of the machine; - Apply the paint to the thickness of the wet film included in the data sheet;
	5.3 Traces of droplets and end of strip with the appearance of used paint	- Foreign particles that block the gun's closure; - The pressure is inadequate;	- Remove the paint and clean the gun; - The pressure shall be remedied and the apparatus checked;
	5.4 Lines drawn on the outside of the marking strip	- Failures in the flatness of the road (corrugated road); - Marking device mounted at inadequate height;	- Repair of the road surface; - Adjusting the mounting height of marking devices;
	5.5 The marking tape has a corrugated appearance	- Uneven road; - Poor qualification of the operator;	- Repair of the road surface; - Work with a properly trained and instructed operator;
Current No	Film defects	Possible causes	Remedial mode
0	1	2	3

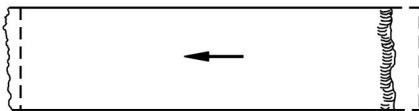
	5.6 Marking tape has different lengths	- Malfunctions in the spraying system; - The automatic device for making the marking is defective;	- Adjust the air pressure in the spray system; - Repair the automatic actuator of pistols and discs for interrupted lines;
	5.7 Lack of adhesion of marking paint to the road surface and formation of bumps at the beginning of the lane	- The temperature in the machine tank and the atmospheric tank is lowered; - Dirty road surface (dust, sand, oil, etc.); - The surface of the road side is too cold; - Old paint, incompatible with the new paint; - Oil present in the compressed air plant;	- No markings shall be made at temperatures prohibited by the paint data sheet; - The road surface shall be cleaned; - The road surface temperature is in accordance with the paint data sheet; - The new paint is compatible or the old paint is removed; - Cleaning and remediation of the compressed air installation;
6.	Uneven distribution of inorganic spraying material	- Inadequate pressure of the compressor; - The amount of inorganic spraying material; - Strong wind; - Locking the dispenser of inorganic spraying material; - Used or dirty distributor; - Inorganic agglomerated spraying material; - Foreign bodies in the tank;	- Pressure regulation; - Fill in the amount of inorganic spraying material; - Adjust the position of the gun; - Unblocking the distributor; - The distributor shall be cleaned or replaced; - Replace the material because it is wet or dirty. The material used is protected from moisture or dirt in storage and handling; - Remove the foreign bodies. The inorganic spray material is passed through the sieve before loading into the tank.

TYPES OF FILM DEFECTS AT THERMOPLASTIC MARKING APPLIED BY EXTRUSION



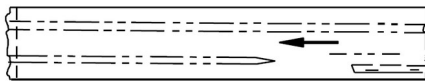
Marking made of thermoplastic material properly applied.

The marking tape is applied straight, the edges are straight, correspond to colour, width, thickness, adhesiveness to the support layer, and have uniform retro-reflectivity characteristics.



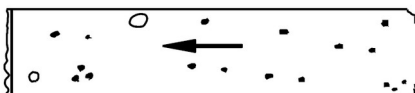
No adhesion (inflated at the beginning of the line):

1. The temperature of the material too low;
2. Marking speed too high;
3. The road too rough;
4. Too low temperature on the surface of the road.



Roughness, buried line:

1. Involvement of foreign objects;
2. Overheating forms crust;
3. Foreign objects trapped in the mould.



Air bubbles in the marking:

1. Moisture or solvent trapped in the marking;
2. The material is overheated.



Crumbly edges; Line breaks:

1. The material is too cold;
2. The marking speed is too high;
3. The thickness of the material is too small.



The width of the marking is dilated, asymmetrical and the beginning of the line is rounded:

1. The material is too hot.



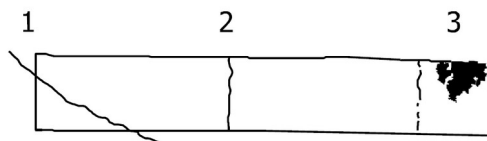
Traces of material on the edge of the marking line:

1. The road surface is uneven;
2. The mould does not step evenly on the stand.



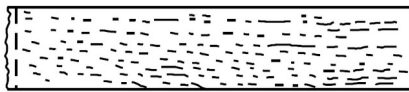
Windy line:

1. Pronounced convex curvature of the road surface;
2. Low ability of the operator to maintain the direction of the machine;
3. The road surface shows pronounced bumps.



Immediate or subsequent line cracks;

1. The road surface has cracks and/or cracks;
2. Temperature stress from overheating;
3. The applied material is too cold;
4. The applied material is too thin.



Non-stick edges; Rough surface:

1. The temperature of the material is too low;
2. The material is overheated or burned;
3. Wet road surface.



The line is serrated at the end; Droplets in interruptions:

1. The mould does not close properly;
2. Foreign objects trapped in the mould.

**TYPES OF FILM DEFECTS AT THERMOPLASTIC MARKING
APPLIED BY SPRAYING (SPRAY)**

Excessive spraying:

1. Too much atomisation pressure;
2. Air leaks.

Hesitation at startup:

1. Moisture or air in the spray line;
2. The material is either too hot or too cold.

Hulls in line:

1. The material is too cold, it comes out like bubbles.

TYPES OF DEFECTS IN THE APPLICATION OF MICROBEADS

Current No	Situation	Possible causes	Effects	Possibilities of Solving
1.	Microbeads pile up at the entrance to the gun.	Moisture deposited on microbeads	Sticking microbeads to each other (agglomeration).	Replacement with dry microbeads.
2.	Concentration of microbeads on one side of the line	The microbeads gun is clogged; Wrong positioning.	Non-uniform retro-reflection; Low performance.	Cleaning the hole of the gun and lens; Correcting the positioning of the gun; Storage and use of dry microbeads.
3.	Excess of microbeads	Decalibration of the gun muzzle; Too high air pressure.	Unsatisfactory quality/price ratio	Recalibration of the hole or replacement; Reduce tank pressure.
4.	Too many microbeads in the middle of the line	Incorrect alignment; Adjustment of the gun incorrectly; Low atomisation pressure.	Non-uniform retro-reflection; Low performance.	Adjusting the alignment, adjustment of the adjustment screw and the blade; Increased pressure.
5.	Microbeads are sinking.	The gun is too close to the marking; Too high pressure of the gun; The thickness of the marking too large; Too low viscosity of the binder.	Reduced retro-reflection; Low performance.	Adjust the height of the gun; Reduction of pressure; Adjustment of thickness; Adjusting the binder.
6.	Reduced incorporation of microbeads	The gun at too long distance from the marking; Strengthening the binder too quickly; The paint gun is not correctly aligned.	Reduced retro-reflection; Low performance.	Adjust the height of the gun; Adjusting the binder temperature; Adjust the alignment.
7.	Pulsatory application of microbeads	The pressure in the tank is insufficient; Locking in the tank pipe.	Non-uniform retro-reflection; Low performance.	Pressure adjustment and/or compressor check; Inspection and cleaning the pipe.