ROAD AND BRIDGE RESEARCH INSTITUTE

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Warsaw, 28 December 2016

IBDiM TECHNICAL APPROVAL
No. AT/2016-02-3298

Pursuant to Art. 16.2 of the Regulation of the Minister of Infrastructure of 8 November 2004 on technical approvals and organisational units authorised to issue thereof (consolidated text: Journal of Laws of 2014 item 1040), after approval proceedings conducted upon request of the manufacturer:

SAFEROAD GRAWIL Sp. z o. o.

with its registered office in: **87-800 Włocławek**

ul. Komunalna 7

The Road and Bridge Research Institute

ascertains a positive technical assessment and suitability of the construction product named

Thermoplastic compounds, applied for horizontal road marking

under the trade name: **Graviplast Pro Struktura thermoplastic compound**

for use in the construction industry - in the communication engineering, within the scope and application areas and under conditions specified in this Technical Approval issued by the IBDiM.

For the product mentioned above the Road and Bridge Research Institute indicates the applicable **conformity assessment system 1**.

DIRECTOR

Prof. Leszek Rafalski, PhD, Eng.

Date of issue of this Technical Approval: **28 December 2016**
Expiry date of this Technical Approval **28 December 2021**

1 LEGAL BASIS FOR ISSUING THE TECHNICAL APPROVAL

This Technical Approval is issued based on:

1.1 the Construction Products Act of 16 April 2004 (Journal of Laws No. 92, item 881 as amended), hereinafter referred to as the “Act";

1.2 the Regulation of the Minister of Infrastructure of 8 November 2004 on technical approvals and organisational units authorised to issue thereof (Journal of Laws No. 249, item 2497 as amended), hereinafter referred to as the “Regulation";

2 TECHNICAL AND BRAND NAME AND TECHNICAL IDENTIFICATION OF THE CONSTRUCTION PRODUCT

2.1 Technical and brand name

Pursuant to Art. 5.1, the Road and Bridge Research Institute established the following technical name: **Thermoplastic compounds, applied for horizontal road marking**

and brand name: **Graviplast Pro Struktura thermoplastic compound**

for the construction product hereinafter referred to as: **Graviplast Pro Struktura compound.**

2.2 Customer name and address

The customer is the manufacturer named: **SAFEROAD GRAWIL Sp. z o.o** with its registered office in: **ul. Komunalna 7, 87-800 Włocławek.**

2.3 Place of manufacture of the construction product

The product is manufactured at:

SAFEROAD GRAWIL Sp. z o.o with its registered seat at: **ul. Komunalna 7, 87-800 Włocławek.**

2.4 Construction product technical identification

The Graviplast Pro Struktura compound is a dry mixture of the following components: pigments, fillers, aggregates, glass beads, auxiliary components and synthetic organic resins, which become homogeneous after heating up to the application temperature and mixing.
The combination of resins and plasticizers provides thermoplastic compound with appropriate durability, plasticity and very good adhesion to the substrate. Pigments used in production ensure the stability of white colour, also under UV radiation. The mixture of quartz aggregates and fillers provides roughness and abrasion resistance.

The road marking made with the Graviplast Pro Struktura compound is characterized by its good adhesion to the substrate, high abrasion and weather resistance, does not break during usage, and it is rough and resistant to sunlight and brine.

The road marking made with Graviplast Pro Struktura is clearly visible either in the daytime and at night. Good visibility at night is ensured by glass beads sprinkled on after applying the road

marking. The glass beads in the compound ensure retroreflectivity to be maintained during further use after the glass beads sprayed onto applied marking get worn out.

3 CONSTRUCTION PRODUCT PURPOSE, RANGE AND USE CONDITIONS

3.1 Purpose

The Graviplast Pro Struktura compound is designed for the communication engineering to make hot thermoplastic road markings on roadways, squares, parking places etc. paved with mineral and asphalt mixtures or cement concrete.

Due to good durability of coatings, it is recommended to use the Graviplast Pro Struktura compound to mark places of high traffic intensity. In particular, it is recommended to use the Graviplast Pro Struktura compound to make road marking in zones with heavy and intensive vehicle traffic, e.g. pedestrian crossings, stop lines, direction arrows as well as lane separating lines and pavement edges and horizontal marking at especially dangerous places.

The Graviplast Pro Struktura compound is used for making smooth-looking, structural, profiled and acoustic road markings of 2 mm to 5 mm in depth.

3.2 Field of application

Pursuant to Art. 5.1 of the Regulation, the Road and Bridge Research Institute ascertains suitability of the construction product named: **Thermoplastic compounds, applied for horizontal road marking - Graviplast Pro Struktura thermoplastic compound** for use in the communication engineering in compliance with its intended use described under 3.1 within the scope of:

3.2.1 **public roads without limitations**, within the meaning and in compliance with the conditions set out in the Regulation of the Minister of Transportation and Maritime Economy of 2 March 1999 on technical specifications to be met by public roads and its locations (Journal of Laws No. 43, item 430 as amended) and the Regulation of the Minister of Transportation and Maritime Economy of 16 January 2002 on technical and building regulations pertaining to toll motorways (Journal of Laws No. 12 item 116 as amended)

3.2.2 **internal roads**, within the meaning of the Public Roads Act of 21 March 1985 (Journal of Laws No. 14, item 60, consolidated text)

3.2.3 **horizontal road markings**, within the meaning and in compliance with technical specifications set out in Annex 2 to the Regulation of the Minister of Infrastructure of 3 July 2003 on detailed technical specifications for road signs and signals and road safety devices and its placement on roads (Journal of Laws No. 220, item 2181 as amended).

3.3 Conditions of use

The Graviplast Pro Struktura compound is applied manually or by machines onto a dry and clean substrate free of mechanical or organic contaminants at ambient and road surface temperature above 5°C and relative air humidity below 80 %. Before applying the compound, the existing painted road marking shall be removed.

Before use, the Graviplast Pro Struktura compound shall be heated up to melting point, but not higher than +210°C. Depending on application method, layer thickness and road surface temperature, the application temperature should be from +185°C to +210°C.

If the Graviplast Pro Struktura compound is used for horizontal marking on cement concrete pavement, it is necessary to prepare concrete before marking by mechanical cleaning (cement wash removal) and precoating. Do not speed up drying the precoat by using open flame as wet precoat is highly inflammable.

When making a smooth-looking marking by using an extruder or die shoe, it is recommended to apply the Graviplast Pro Struktura compound in a layer 2 mm to 5 mm thick, thus corresponding to spreading rate of 4 kg/m^2 to 10 kg/m^2. Freshly-applied compound shall be sprinkled with glass beads in accordance with PN-EN 1424 or a mix of glass beads and cristobalite (3 parts of glass beads and 1 part of cristobalite) in the amount of approx. 0.4 kg/m^2 as soon as possible, however not later than 5 s after application. The recommended fraction of glass beads for sprinkling is from 400 μm to 840 μm.

The road is passable within 10 minutes after application at ambient temperature of 20°C.

When making horizontal road markings with the Graviplast Pro Struktura compound the manufacturer's instructions should be strictly followed.

The construction product shall be used as intended and within the scope and conditions specified in the technical approval and construction regulations applicable to specific types of construction in the communication engineering. Before using this construction product in a manner inconsistent with construction regulations, you shall gain a permit for departure from these regulations in accordance with Art. 9 of the Building Code of 7 July 1994 (i.e. Journal of Laws of 2006, No. 156, item 1118 as amended)

4 PERFORMANCE AND TECHNICAL PROPERTIES OF THE CONSTRUCTION PRODUCT

Performance and technical properties of the construction product are listed in Table 1.

Table 1

No.	Properties	Unit	Requirements	Test methods according to
1	2	3	4	5
Laboratory tests - Graviplast Pro Struktura				
1	Density	*g/cm^3*	from 1.90 to 2.10	PN-EN 12697-6:2008
2	Binder content	*% (w/w)*	from 18 to 22	PN-EN 12802:2011
3	Softening point	*°C*	from 80 to 95 Class SP2	PN EN 1871:2003
4	Punch penetration at 20 °C	*min.*	from 6 to 20 Class IN4	PN-EN 1871:2003

No.	Properties	Unit	Requirements	Test methods according to
1	2	3	4	5
5	Impact resistance at 0 °C, 10 pieces	*number*	≥ 6	PN-EN 1871:2003

		samples	Class Cl 1	
6	Luminance coefficient β:	-	≥ 0.70 Class LF4	PN-EN 1436:2008 PN-EN 1871:2003
7	Chromaticity coordinates x, y	-	according to drawing	PN-EN 1436:2008
On-road testing[1)] - Graviplast Pro Struktura				
8	Retroreflectivity R_L of the marking: - Class R3 (roads with speed limit ≥ 100 km/h[2)]) - Class R3 (roads with speed limit ≤ 100 km/h))	*mcd-m^{-2} x lx^{-1}*	≥ 150 ≥ 100	PN-EN 1436+Al
9	Retroreflectivity R_L of wet structural road the marking: - Class RW3 (roads with speed limit ≥ 100 km/h[2)]) - Class RW2 (roads with speed limit ≤ 100 km/h)	*mcd-m^{-2} x lx^{-1}*	≥ 50 ≥ 35	PN-EN 1436+A1:2008
10	Luminance coefficient under diffused light Q_D of the marking (alternative to β): - Class Q3 (roads with speed limit ≥ 100 km/h[2)]) - Class Q2 (roads with speed limit ≤ 100 km/h))	*mcd-m^{-2} x lx^{-1}*	≥ 130 ≥ 100	PN-EN 1436+A1:2008
11	Luminance coefficient β of the marking: - white marking on asphalt surface (Class B2) - white marking on concrete surface (Class B2)	-	≥ 0.30 ≥ 0.40	PN-EN 1436+A1:2008
12	Chromaticity coordinates x, y	-	According to Table 2 and Figure 1	PN-EN 1436+A1:2008
13	Roughness index SRT	*SRT*	≥ 45 Class S1	PN-EN 1436+Al:2008
14	Durability LCPC	-	≥ 6	NF P 98-61 S d'Avril 1991

[1)] measurements shall be made on the road after 24 months of marking usage
[2)] or traffic intensity > 2,500 vehicles per day/ lane

Table 2

Corner point #		1	2	3	4
1	2	3	4	5	6
White marking	x	0.355	0.305	0.285	0.335
	y	0.355	0.305	0.325	0.375

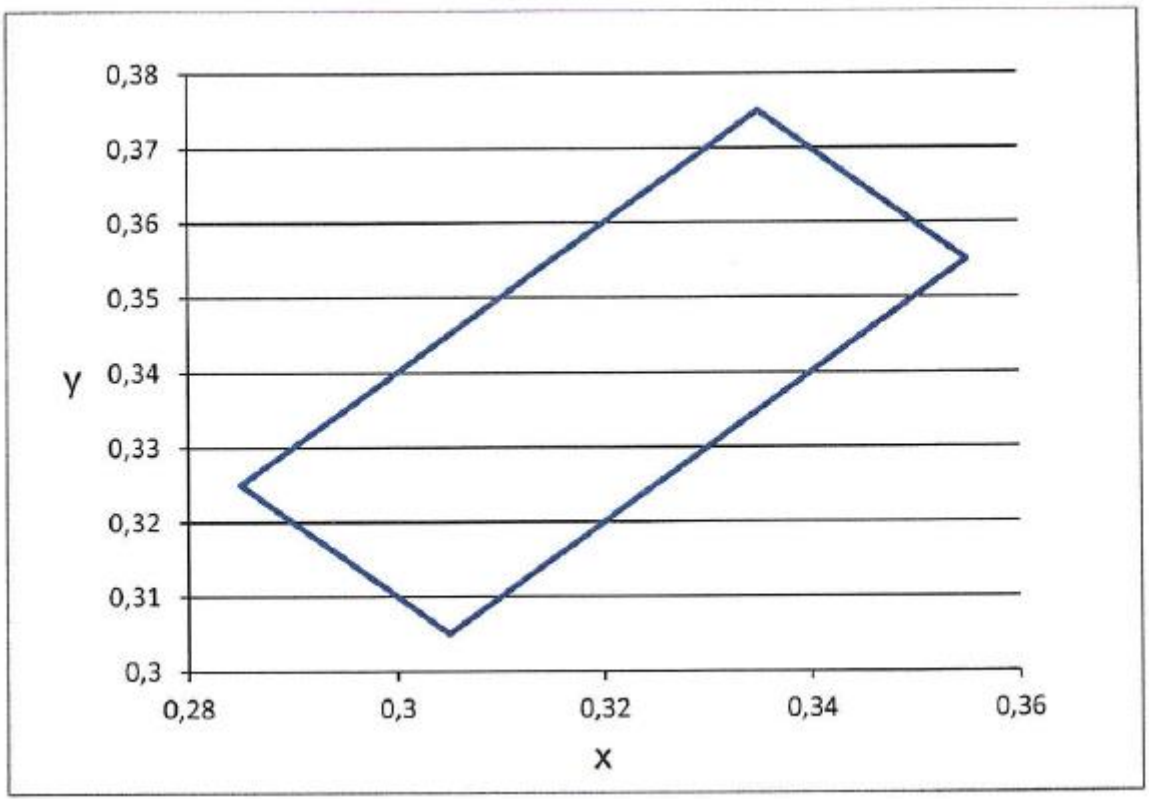

Figure **1-** Chromaticity coordinates x, y - the white colour field.

5 CONFORMITY ASSESSMENT

5.1 Applicable Conformity Assessment System

Pursuant to Art. 5 of the Regulation, the Road and Bridge Research Institute indicates the applicable **System 1 of conformity assessment** for the construction product mentioned above.

In **system 1 of conformity assessment**, the manufacturer can issue the national declaration of conformity with Technical Approval after certification of product conformity by an accredited certified body based on:

a) manufacturer's tasks:
   - factory production control,
   - supplementary testing of samples taken at the manufacturer's production plant, conducted by the manufacturer according to the agreed test plan,

b) accredited body tasks:
   - initial type examination,
   - initial inspection of the manufacturing plant and factory production control,
   - continuous production control monitoring, assessment and acceptance.

5.2 Initial type examination

The initial type examination is conducted before launching the product on the market to confirm its performance and technical properties.
The initial type examination includes the following tests listed in Table 1, regarding the basic safety requirements:

Initial laboratory tests:

- density (Table 1, item 1)
- binder content (Table 1, item 2)
- softening point (Table 1, item 3)
- punch penetration (Table 1, item 4)
- impact resistance (Table1, item 5)
- luminance coefficient β and chromaticity coordinates x, y (Table 1, item 6 and item 7)

Initial road marking tests:

- dry retrorefrectivity R_L (Table 1, item 8)
- wet retrorefrectivity R_L (Table 1, item 9)
- luminance coefficient under diffused light Q_D or luminance coefficient β of the horizontal road marking (Table 1, item 10 or item 11)
- chromaticity coordinates x, y (Table 1, item 12)
- roughness index SRT (Table 1, item 13)

The initial type examination shall be repeated if the results of previous test are questionable, in particular when the following changes were made: design changes to the product, changes to raw materials or components, significant changes to production technology or manufacturing conditions (e.g. replacement of manufacturing line, relocation of manufacturing plant, etc.).

5.3 Factory Production Control

The construction product covered by this Technical Approval should be manufactured in accordance with the the factory production control system.

The manufacturer shall establish, document, implement and maintain the factory production control system to ensure that the marketed product meets the requirements of this Technical Approval and declared values. The factory production control system should include:

a) procedures, instructions, technical specifications and standards,
b) technical description of the product,
c) regular inspections and testing of raw materials and materials,
d) regular inspections and testing of finished products,
e) quality assessment of finished products based on control and test results.

Regular control and testing of raw materials and finished products shall be documented with records in the factory production control system. The manufacturer should maintain the inventory of such documentation, including the forms used and records. The factory production control documentation should be updated whenever any changes are made to the product, manufacturing process or factory production control system.

The procedures or instructions should document the way of:
a) controlling documents and records,
b) controlling and confirming that raw materials and materials meet the specified requirements;
c) monitoring the manufacturing process as well as controlling and testing of products during their manufacture and finished products,
d) supervising the manufacturing equipment and machinery,
e) supervising the product measurement and test equipment, while maintaining the measurement traceability,
f) making assessments for conformity with this Technical Approval,
g) handling nonconforming products,
h) handling submitted claims related to the quality of finished products or raw materials and materials,
i) taking corrective and preventive actions,
j) conducting internal audits and management reviews,
k) personnel training.

The quality management system used according to PN-EN ISO 9001 can be considered as a factory production system if it also meets the requirements of this Technical Approval.

5.4 Testing of finished products

5.4.1 Test plan

The test plan of finished products covers:

a) ongoing testing,
b) supplementary tests.

5.4.2 Ongoing testing

Ongoing testing of finished products includes the following determinations:

- binder content (Table 1, item 2,
- softening point (Table 1, item. 3.

5.4.3 Supplementary tests

Supplementary tests include the laboratory checking for:

- density - Table 1, item 1
- impact resistance – Table 1, item 5
- punch penetration - Table 1, item 4
- luminance coefficient β and chromaticity coordinates x, y - Table 1, item 6, 7

and the in-situ (on-the-road) checking for:

- retrorefrectivity R_L - Table 1, item 8,
- wet surface retrorefrectivity R_L for structural markings - Table 1, item 9,
- luminance coefficient under diffused light Q_D or luminance coefficient β - Table 1, item 10 or item 11,
- chromaticity coordinates x, y - Table 1, item 12,
- roughness index SRT - Table 1, item 13,
- durability according to LCPC - Table 1, item 14.

5.5 Sampling

The test sample shall be taken in accordance with the procedure specified in the manufacturer's factory production control system.

The sample for ongoing testing shall be taken in compliance with the factory production control documentation.

The sample for ongoing testing shall be prepared by taking 2 kg of the compound from a randomly chosen packaging.

The sample for laboratory supplementary tests shall be prepared by taking randomly a brand packaging of the product, but not less than 5 kg.

The sample taken for initial type and in-situ supplementary testing shall be of at least 50 kg.

5.6 Testing intervals

The ongoing testing should be performed for each product batch according to the factory production control plan, but at least once a manufacturing day.
Laboratory supplementary tests shall be carried out at least every year.
Supplementary in-situ tests shall be carried out every 10 years.

5.7 Assessment of test results

The product shall be considered as conforming with this IBDiM's Technical Approval if the results of all tests are positive.

6 CLASSIFICATION ACCORDING TO SPECIFIC REGULATIONS AND POLISH STANDARDS

6.1 Polish Classification of Goods and Services (PKWiU): 24.30.22-55.15

6.2 Polish Combined Nomenclature of Goods in Foreign Trade (PCN): 3214 10900

7 GUIDELINES FOR MANUFACTURING, PACKAGING, TRANSPORTATION AND STORAGE AS WELL AS DETAILED MARKING OF CONSTRUCTION PRODUCT

7.1 Guidelines for manufacturing technology

The manufacture of the Graviplast Pro Struktura compound consists in mixing solid components, and then conditioning them in an appropriate packaging.

7.2 Guidelines for packaging, transportation and storage

The Graviplast Pro Struktura compound shall be packed in a packaging as agreed between the manufacturer and the customer, which properly protects the product and with dimensions according to the packaging dimensioning system specified in PN-O-79021.

The Graviplast Pro Struktura compound shall be stored in sealed containers away from any fire or heat sources, in indoor storage areas at 5°C to 25°C and protected from direct sunlight.

The usability of the Graviplast Pro Struktura compound stored as specified by the manufacturer is 6 months from the date of manufacture.

The Graviplast Pro Struktura compound shall be transported on covered means of transportation in packages protected against mechanical damages according to the transportation regulations (Journal of Laws No. 53 of 1984, item 272 as amended) and PN-C-81400.

7.3 Detailed method of identification of the construction product

The product shall be marked with a construction sign according to the Regulation of the Minister of Infrastructure of 11 August 2004 on the manner of declaring the compliance of construction products and the manner of marking them with construction marks (Journal of Laws No. 198, item 2041 as amended). The product bearing a construction sign shall also be attached with information containing the following by the manufacturer:

a) address of the manufacturer's registered office and address of the construction product manufacturing plant,
b) construction product identification containing: technical name, brand name, type, version, grade, according to the technical specification,
c) number and year of issue of this IBDiM's Technical Approval confirming the conformity of this product,
d) number and date of issue of the national declaration of conformity,
e) date of manufacture and expiry date,
f) name of the certification body if it participated in the applied construction product conformity assessment system.

This information shall be attached to the construction product in a such a manner that the product user is able to read it.

8 LIST OF DOCUMENTS USED IN THE APPROVAL PROCESS INCLUDING THE LIST OF CONSTRUCTION PRODUCT TEST REPORTS

The following standards were used in the approval process:

8.1 Polish Standards and other documents

a) PN-EN 1424:2005 Road marking materials - Premix glass beads
b) PN-EN 1436+A1:2008 Road marking materials - Road marking performance for road users
c) PN-EN 1871:2003 Road marking materials - Physical properties
d) PN-EN 12802:2011 Road marking materials - Laboratory methods for identification
e) PN-EN 13212:2011 Road marking materials - Requirements for factory production control
f) PN-EN 12697-6+A1:2008 Bituminous mixtures. Test methods for hot mix asphalt. Determination of bulk density of bituminous specimens - Part 6: Determination of bulk density of bituminous specimens
g) PN-EN ISO 9001:2009 Quality Management Systems - Requirements
h) PN-C-81400:1989 Varnished products - Packaging, storage and transport
i) PN-O-79021:1989 Packaging - Dimensioning system
j) Transport Law (Journal of Laws No. 53 of 1984, item 272 as amended)

8.2 Construction product test reports and others

- Test Report No. 94-1/14/TN3, IBDiM Chemistry and Environmental Protection Laboratory, Warsaw 2014 r.
- Test Report No. 94-2/14/TN3, IBDiM Chemistry and Environmental Protection Laboratory, Warsaw 2014 r.
- Test Report No. 94-5/14/TN3, IBDiM Chemistry and Environmental Protection Laboratory, Warsaw 2015 r.
- Test Report No. 94-6/14/TN3, IBDiM Chemistry and Environmental Protection Laboratory, Warsaw 2015 r.
- Test Report No. 94-9/14/TN3, IBDiM Chemistry and Environmental Protection Laboratory, Warsaw 2016 r.
- Test Report No. 94-10/14/TN3, IBDiM Chemistry and Environmental Protection Laboratory, Warsaw 2016 r.
- Product data sheet
- MSDS

9 INSTRUCTION

9.1 This Technical Approval is a document enabling a construction product to be marked before marketing.

9.2 This IBDiM's Technical Approval may be cancelled by the approving body on its own initiative or at request of the General Inspector of Building Control after the explanatory proceedings carried out in the presence of the applicant.

9.3 This IBDiM's Technical Approval is without prejudice to the rights arising from the Act of 30 June 2000 "Industrial Property Law" (Journal of Laws of 2003, No. 119, item 1117 as amended).

9.4 This IBDiM's Technical Approval may not be appealed.

cc:

1 The Manufacturer: **Saferoad Grawil Sp. z o. o.** with its registered seat in: Komunalna 7, 87-800 Włocławek.

- 2 copies

2 to file: Technical Assessment Unit at **the Road and Bridge Research Institute**, ul, Instytutowa 1, 03-302 Warsaw, phone: 22 614 56 59, (22) 39 00 414, fax: 22 675 41 27

- 1 copy