SYSTEM ROAD Stabi®

Instytut Badawczy
Dróg i Mostów

Road and Bridge
Research Institute

EkoSoil®
technologie

Technical Approval
STABI Drox

Stabilizer for strengthening and hardening road subgrades
in road, street and square construction.

IBDiM TECHNICAL APPROVAL
No AT/2006-03-2037

Road subgrade stabilizer
STABI DROX

Instytut Badawczy Dróg i Mostów – Road and Bridge Research Institute

Document translation:
Business Group
Management & Development Ltd.

EKOSOIL Technologie s.r.o č.p. 356, 742 65 Rybí, DIČ CZ06187609 IČ 061 87 609 Česká republika
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IBDiM TECHNICAL APPROVAL
No AT/2006-03-2037

Product name: **STABI DROX Road Subgrade Stabilizer**

Applicant: **FOSSE LIQUITROL POLSKA Sp. z o.o.**

Valid until: **10th May 2011**

A. GENERAL AND TECHNICAL STIPULATIONS

1. SUBJECT MATTER OF THE TECHNICAL APPROVAL

1.1 Technical identification of the construction product

The subject of the Technical Approval is STABI DROX road subgrade stabilizer, designed for application in the road construction, supplied by FOSSE LIQUITROL POLSKA Sp. z o.o., 58-309 Wałbrzych, ul. Broniewskiego 71/15, and manufactured by the said company, for whose compliance the responsibility is borne by FOSSE LIQUITROL POLSKA Sp. z o.o. in Wałbrzych, hereinafter referred to as the STABI DROX stabilizer.

The STABI DROX stabilizer is a liquid for substance, manufactured in a concentrated form as a liquid based on sulfone acids soluble in sulphuric acid. In its concentrated for, it is a caustic substance with strong, sulphuric smell. It is easily and fully soluble in water, and applied only diluted approx. 1:200. Therefore, it is a safe product, not affecting the natural environment.

The STABI DROX stabilizer is designed for cohesive and dusty soils of oxidic characteristics, defined in the manufacturer's manual. The STABI DROX stabilizer can be used together with hydraulic binders. The STABI DROX is a substance supporting the bonds between the particles of dusty soil grains and/or the binder.

The improvement of the physical and mechanical properties is documented by the comparison examinations of the mix for specific application conditions.

The STABI DROX stabilizer conforms with the hygiene requirements, in this respect meeting the demands of the Hygiene Attestation No. HK/B/1111/01/2004 issued by the National Hygiene Institute (Państwowy Zakład Higieny) in Warsaw.

1.2 Definitions

STABI DROX stabilizer – a liquid substance made from a mixture based on sulfone acids dissolved in sulphuric acid, and other compounds, which can be applied in the improvement of soils and stabilization of grounds, together with hydraulic binders.

Hydraulic binder – cement or a hydraulic road binder (HRB), compliant with a PN-EN standard or technical approval, appropriate for the STABI DROX stabilizer.

Soil – a cohesive or dusty soil, in accordance with the PN-S-02205:1998 standard, with an additional requirement as in Table 2, of oxidic characteristics, defined in the manufacturer's manual.

Soil improved with the STABI DROX stabilizer – a mixture of a composition established on the basis of laboratory tests, mixed with the soil and with an addition of a solution of the STABI DROX stabilizer, thickened and hardened as a result of the consolidation of the dusty particles of the soil.

Soil stabilized with hydraulic binders with an addition of the STABI DROX stabilizer – a mixture of a composition established on the basis of laboratory tests, mixed with the soil and with an addition of a solution of the STABI DROX stabilizer, further mixed with a hydraulic binder, thickened and hardened as a result of the interaction of binding the dusty particles of soil at the initial stage, finished in the process of the binder reaction.

1.3 Product classification

PKWiU: 24.66.48
PCN: 3824 90

2. PURPOSE, SCOPE AND CONDITIONS OF USE

2.1 Purpose and scope of use

The STABI DROX stabilizer can be used in road construction for improving the characteristics and stabilization of:

- subgrade soil of the embankments and all layers of the embankment after PN-S-02205:1998 standard,
- surface subbase after PN-S-02205:1998,
- auxiliary substructure stabilized with a hydraulic binder after PN-S-96012:1997 for traffic burden categories from KR1 to KR3 after "Katalog konstrukcji nawierzchni podatnych i półsztywnych" (Catalogue of susceptible and semi-stiff surfaces), taking into account design demands and the stipulations of p. 2 and 3,
- basic substructure stabilized with a hydraulic binder after PN-S-96012:1997 for traffic burden category KR1 after "Katalog konstrukcji nawierzchni podatnych i półsztywnych" (Catalogue of susceptible and semi-stiff surfaces), taking into account design demands and the stipulations of p. 2 and 3.

The STABID DROX stabilizer referred to in this Technical Approval is designed to improve and/or stabilize soils and natural aggregates in road construction. The STABI DROX stabilizer can be used in the making of construction layers of road surfaces of endurance up to 2.5 MPa, and even up to 5.0 MPa in justified cases, in accordance with p. 2 and 3.
Soils and natural aggregates stabilized with a hydraulic binder and the STABI DROX stabilizer can be used in the construction of auxiliary substructures, as well as strengthening ones, improved subgrades for main roads, distributor and access roads, forest and dirt roads, as well as in the construction of parking places, strengthening construction areas, temporary roads and cycle lanes.

2.2 Conditions of use

The basic condition for the use of the STABI DROX stabilizer is checking its effectiveness in view of the properties required by the technical design, technical and technological documentation, taking into account the specific features of the given soil. Checking the

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effectiveness consists in comparing the above properties with the use of the STABI DROX stabilizer and without it. Checking the effectiveness should be performed in a research laboratory which prepares the recipe.

The composition of the mixture, conditions for its preparation, research and requirements should comply with the technological instructions of the STABI DROX manufacturer.

The grounds for the application of the STABI DROX stabilizer will be determined by the person preparing the recipe. If in doubt, an experimental area should be set out on the construction site and the designed properties confirmed.

Methods of preventing frost cracking or frost damaging, and above all, possible crosswise cracks, should comply with the technological instructions from the STABI DROX stabilizer's manufacturer.
In justified cases, the improved layer may require covering with an additional transitory layer, which will provide the required, stable conditions of maximum load and settling. This layer can be made of a mechanically stabilized mixture of broken stone or smelter slag aggregate, or it could be stabilized with hydraulic binders, in accordance with PN standards or a technical approval.

3 TECHNICAL AND FUNCTIONAL PROPERTIES, REQUIREMENTS

3.1 Materials

3.1.1 STABI DROX Stabilizer

The STABI DROX stabilizer should meet the requirements in Table 1.

Table 1

No	Properties	Units	Requirements	Testing method
1	2	3	4	5
1	Form	-	liquid	visual
2	Colour	-	dark brown	visual
3	pH value	-	1.4	PN-89/C-04963
4	Density in + 20 °C	kg/l	1.55	PN-92/C-04504
5	Solubility in water	-	totally soluble	visual
6	Changes of certain properties in sample soil	-	as declared	manufacturer's procedures

3.1.2 Binders

In stabilization with the STABI DROX stabilizer, hydraulic binders defined in p. 1.2 can be applied.

3.1.3 Soil

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For improvement or stabilization, with or without hydraulic binders, with the use of the STABI DROX stabilizer, soils defined in PN-S-02205:1998 can be applied, with an additional requirement included in Table 2. Limiting those requirements from the top should result from stipulations included in p. 2, referring to the recipe and an experimental area.

Table 2

No	Properties	Units	Requirements	Testing method
1	2	3	4	5
1	Content of grains smaller than 0.075 mm, over	*% (m/m)*	20	PN-88/B-04481
2	Plasticity index, over	*% (m/m)*	5	PN-88/B-04481
3	Content of organic parts, no more than	*% (m/m)*	2	PN-88/B-04481

3.2 Properties of the mixture with the STABI DROX stabilizer

Requirements related to the properties of the mixture or a hardened mixture of the soil with a hydraulic binder or without a binder, contain technical specifications included in the technical design or defined in a PN standard. A recipe composed on the basis of those requirements justifies the use of such mixtures with the STABI DROX stabilizer, and in accordance with p. 2.

Additionally, Table 3 shows a recommended pressure endurance of the soil improved or stabilized with a hydraulic binder together with the STABI DROX stabilizer, depending on the kind of layer in the structure of road surface should conform with a PN standard requirements.

Table 3

No	Type of layer in the structure of road surface	Pressure endurance of samples soaked with water (MPa)		Frost resistance index R^{zo}_{28}/R_{28}
		after 7 days R_7	after 28 days R_{28}	
1	2	3	4	5
1	Basic substructure for KR1 or auxiliary substructure for KR1 to KR3	in accordance with the requirements in the technical design, taking into account requirements quoted in p. 2 and 3		
2	Upper part of the layer of improved soil subgrade at least 10 cm thick for KR1 to KR3, or upper part of the improvement of weak subgrade from dubious or heaving soils	from 1.0 to 1.6	from 1.5 to 2.5	0.6
3	Lower part of the layer of improved soil subgrade in the case of the surface structure	-	from 0.5 to 1.5	0.6

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	being based on subsoil from dubious or heaving soils			

R_7 - samples are stored in air-moisture condition for 7 days, after which they are soaked with water in a vacuum apparatus, or after a 3-day nurturing with protection against drying up, the samples should be immersed in water for 1 day at the depth of 1 cm, and then totally immersed in water for another 3 days.

R^m_{28} - samples are stored in air-moisture condition for the period of 14 days, and then 14 days in water.

R^{zo}_{28} - samples are stored in air-moisture condition for the period of 14 days and then are submitted to 14 cycles of freezing and defrosting in water.

Samples for the testing should be prepared in accordance with the PN-S-96012:1997 standard, and the testing methods should comply with the PN-S-96012:1997 standard.

4 GUIDELINES ON THE MANUFACTURING TECHNOLOGY, PACKAGING, TRANSPORT AND STORAGE, AS WELL AS METHOD OF MARKING A CONSTRUCTION PRODUCT

4.1 Manufacturing

The STABI DROX stabilizer is manufactured through weight dosage of its ingredients, in an installation designed for this purpose.

4.2 Transport

The STABI DROX stabilizer supplied to the construction site should not show any deviations from the requirements set forth by this Technical Approval.

4.3 Method of marking a construction product

The product should be marked with a construction sign, in accordance with the Ministry of Infrastructure regulation of 11th August 2004 concerning methods of declaring compliance of construction products, as well as methods of marking them with a construction sign (Journal of Laws No 198, pos. 2041).

When marking the STABI DROX stabilizer, the following information should be included:

- manufacturer's identification,
- product identification,
- manufacturing date,
- weight,
- application range,
- compliance system, after p. 5.1,
- quality check reference number,
- "B" construction sign,
- IBDiM Technical Approval number.

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Each batch should also be accompanied by the following data:

- despatch date,
- contractor's and/or recipient's data, contract number.

5 EVALUATION OF COMPLIANCE OF A CONSTRUCTION PRODUCT

5.1 Current evaluation compliance system

In accordance with Art. 4, Art. 5, par. 1, p. 3 and Art. 8, pos. 1 of the Law of 16th April 2004 concerning construction products (Journal of Laws No. 92, pos. 881), the product covered with this Technical Approval can be put up for sale and application in construction work in the scope of its application related to its functional properties and purpose, only if its manufacturer has performed its compliance evaluation, issued its national declaration of compliance with the IBDiM Technical Approval No. AT/2006-03-2037, and marked the product with the construction sign, in accordance with the current regulations.

According to the Ministry of Infrastructure regulation of 11th August 2004, concerning methods of declaring compliance of construction products, as well as methods of marking them with a construction sign (Journal of Laws No 198, pos. 2041), the evaluation of compliance with the Technical Approval No. AT/2006-03-2037 is performed by the manufacturer, with the application of the 2+ system.

In the case of the 2+ system of compliance evaluation, the manufacturer can issue a declaration of compliance with the IBDiM Technical Approval No. AT/2006/03-2037 on the basis of:

a) manufacturer's tasks:
- initial type-testing,
- in-house manufacturing control,
- tests on samples taken from the manufacturing plant, in accordance with a developed testing plan, if this is required additionally by the harmonized technical specification.

b) accredited unit's tasks:
- certification of the in-house manufacturing control, on the basis of: initial inspection of the manufacturing plant, and the in-house manufacturing control and constant supervision, evaluation and approval of the in-house manufacturing control.

5.2 Initial type-testing

The initial type-testing is designed to ascertain the required technical and functional properties, and it is done before putting it up for sale and application.

Initial type-testing covers:

- form,
- colour,
- pH value,
- density in temp. +20 °C,
- solubility in water,
- changes of certain properties in the sample soil, according to manufacturer's procedure.

The tests that were the basis for ascertaining the technical and functional properties in the approval procedure are the same as the initial test in the conformity appraisal.

5.3 Requirements for the in-house manufacturing control

The in-house manufacturing control should cover the following:

- specification and checking of the materials through the control of documents produced by their manufacturers and comparing their properties with the requirements in p. 3,
- control and testing in the manufacturing process, performed by the manufacturer in accordance with the procedures defined in the documentation of the in-house manufacturing control for the STABI DROX road subgrade stabilizer, and comparing the results with the requirements in p. 3.1.

5.4 Testing the finished product

5.4.1 Testing programme

The testing programme covers the following:

- current tests,
- supplementary tests.

5.4.2 Current tests

Current tests cover the check-up of the following:

- form,
- colour,
- pH value,
- density in temp. +20 °C,
- solubility in water.

5.4.3 Supplementary tests

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Supplementary tests cover the check-up of the change of specific properties on the sample soil in accordance with the manufacturer's procedures.

The ingredients of the STABI DROX stabilizer have to meet the requirements defined in p. 3. Appropriate procedures applied in the manufacturing process have to be used and documented.

5.5 Testing frequency

The current testing should be performed in accordance with the pre-developed testing plan, but for each batch of the product at least as often as the minimum testing frequency defined in Table 5.

Table 5

No.	Properties	Testing frequency
1	2	3
1	Form	once a month
2	Colour	once a month
3	pH Value	twice a month
4	Density in temp. 20 °C	twice a month
5	Solubility in water	once a month
6	Changes of specific properties on the sample soil	once a month

Batch sizes should be defined in the documentation of the in-house manufacturing control.

Supplementary tests should be performed at least every six months.

5.6 Testing methods

Testing should be performed in accordance with the standards defined in Table 1, 2 and 3. The pH reaction of the STABI DROX stabilizer in concentrated form is acidic, and when in direct contact with steel surfaces of containers, it causes corrosion.

5.7 Taking samples for testing

Samples for testing should be taken at random.
Samples should be taken at the final control points for the STABI DROX stabilizer, in accordance with the manufacturer's procedures.

5.8 Evaluation of the test results

A manufactured product can be deemed compliant with the requirements of this IBDiM Technical Approval No. AT/2006-03-2037 if all the test results are positive.

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6 FORMAL AND LEGAL STIPULATIONS

6.1 The IBDiM Technical Approval does not affect the right resulting from the Law of 30th June 2000 Right to industrial property (Journal of Laws No. 49 from 21st May 2001, pos. 508). Ensuring these rights are the responsibility of the manufacturers applying for the issue of an IBDiM Technical Approval.

6.2 The IBDiM Technical Approval No. AT/2006-03-2037 is a document certifying the usefulness of the STABI DROX road subgrade stabilizer in the transport engineering, in the scope defined in the stipulations of the Technical Approval.

6.3 The IBDiM Technical Approval No AT/2006-03-2037 is not a document approving the product for sale and application in construction.

In accordance with Art. 10 of the Construction Law (Journal of Laws No. 207, pos. 2016), the product that the present IBDiM Technical Approval No. AT/2006-03-2037 refers to, can be used in construction work only if the product in question has been approved for sale on the basis of separate regulations.

6.4 The IBDiM Technical Approval No. AT/2006-03-2037 is not a document authorising to mark the product with the construction sign before offering it for sale.

In accordance with Art. 5.1, p. 3 and Art 8, par. 1 of the Law of 16th April 2004 concerning construction products (Journal of Laws No. 92, pos. 881), the product is suitable for application in the construction work only if it is marked with the construction sign. Marking the product with the construction sign is permissible if the manufacturer has performed the compliance evaluation and issued, at their own and exclusive responsibility, a national declaration of compliance with the Technical Approval.

6.5 While issuing the Technical Approval, the Road and Bridge Research Institute in Warsaw does not take any responsibility for any possible violation of exclusive or acquired rights.

6.6 Any departures from the stipulations of the IBDiM Technical Approval require a written consent from the Road and Bridge Research Institute in Warsaw.

6.7 The IBDiM Technical Approval does not exempt the manufacturer from responsibility for the proper quality of the STABI DROX road subgrade stabilizer, or those performing the construction work from their responsibility for its proper application.

6.8 The Road and Bridge Research Institute in Warsaw reserves the right to withdraw the Technical Approval without justifying the reasons.

6.9 The Technical Approval does not replace construction authority permissions necessary for the performance of transport engineering works.

6.10 The applicant for the present IBDiM Technical Approval is obliged to supply those purchasing the STABI DROX road subgrade stabilizer with the official instructions manual in the Polish language, which will define conditions for its usage, storage and transport.

7 EXPIRATION

The IBDiM Technical Approval No. AT/2006-03-2037 is valid until 10th May 2010.

The validity of the IBDiM Technical Approval No. At/2006-03-2037 can be prolonged for further periods if the applicant or its formal successor applies for that to the Road and Bridge Research Institute in Warsaw not later than 3 months before the expiry date of the present document.

8 TESTS

Rys. 7. Próbki wykonane z gruntu 2 z hydraulicznym spoiwem drogowym (**G-C**)

Rys. 8. Próbki wykonane z gruntu 1 ze stabilizatorem oraz z hydraulicznym spoiwem drogowym (**G-S-C**)

Rys. 9. Próbki walcowe wykonane z gruntu 1 ze stabilizatorem (**G-S**) oraz z hydraulicznym spoiwem drogowym (**G-S-C**)

Rys. 10. Próbki walcowe wykonane z gruntu 1 ze stabilizatorem (**G-S**)

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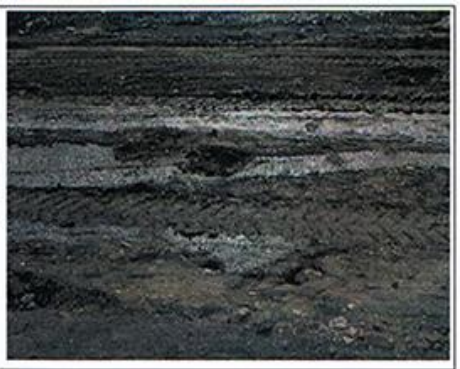
Oznaczenia materiałów: - grunt G, - stabilizator S, - hydrauliczne spoiwo drogowe C.	
poletko doświadczalne	
część nr 1	część nr 2
grunt 1	grunt 2
mieszanka gruntu 1 ze stabilizatorem	mieszanka gruntu 2 z cementem
mieszanka gruntu 1 ze stabilizatorem i z cementem	



Rys. 1. Oznaczenia materiałów i rodzaje mieszanek na poletku doświadczalnym

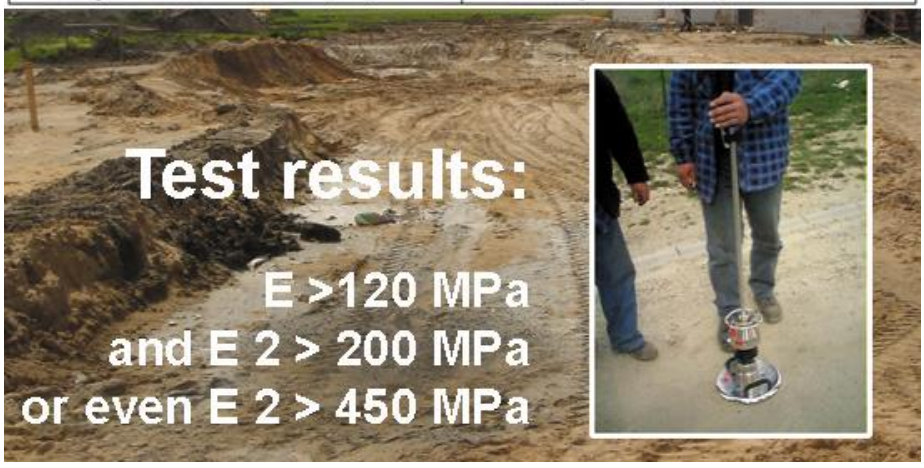
Rys. 2. Mieszanka gruntu 1 ze stabilizatorem (G-S)

Rys. 3. Rozścielanie spoiwa na mieszance gruntu 1 ze stabilizatorem (G-S)

Rys. 4. Ubijanie rozścielanego spoiwa na mieszance gruntu 1 ze stabilizatorem (G-S)

Rys. 5. Mieszanie ubitego spoiwa z mieszanką gruntu 1 ze stabilizatorem (G-S)

Rys. 6. Mieszanka gruntu ze stabilizatorem oraz ze spoiwem (G-S-C).



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B. ACCEPTANCE

On the basis of the Ministry of Infrastructure regulation of 8th November 2004 concerning technical approvals and organisational bodies authorised to issue them (Journal of Laws No. 249, pos. 2497), as a result of the approval procedure performed at the request of the company:

FOSSE LIQUITROL POLSKA Sp. z o. o.

the Road and Bridge Research Institute (Instytut Badawczy Dróg i Mostów) in Warsaw hereby issues a positive technical approval of the following construction product:

STABI DROX road subgrade stabilizer

as appropriate for application in transport engineering, in the scope defined in p. 2 of the present Technical Approval.

[Official round seal]

DIRECTOR
[illegible signature]
Prof. Leszek Rafalski, PhD, Eng.

Warsaw, May 2006.

C. ADDITIONAL INFORMATION

Key words: CHEMICAL SUBSTANCE, IMPROVEMENT, SOIL STABILIZATION

1 STANDARDS AND DOCUMENTS APPLIED

PN-88/B-04481 Construction soils – Testing soil samples

PN-92/C-04504 Chemical analysis – Testing the density of liquid and solid powdered chemical substances

PN-89/C-04963 Chemical analysis – Establishing pH of water solutions of chemical products

PN-S-02205:1998 Motor roads – Earth work – Requirements and research

PN-S-96012:1997 Motor roads – Substructure and improved subgrade from soil stabilized with cement

Hygiene Attestation PZH No. HK/B/1111/01/2004 for STABI DROX of 17th August 2004 issued for FOSSE LIQUITROL POLSKA Sp. z o. o. in Wałbrzych, Warsaw 2004

GDDP regulation No. 6 of 25th April 1997, concerning the introduction of the Catalogue of typical structures of susceptible and semi-stiff surfaces, IBDiM, Warsaw 1997

Catalogue of typical structures of susceptible and semi-stiff surfaces, IBDiM, Warsaw 1997

Law of 16th April 2004 concerning construction products (Journal of Laws No. 43, pos. 881)

Government Regulation of 2nd March 1999 concerning technical conditions to be met by public roads and their location (Journal of Laws No. 43, pos. 430)

Government Regulation of 3rd December 2002 concerning requirements related to the content of natural radioactive isotopes in raw materials and materials used in buildings to be inhabited by people or livestock, as well as industrial waste used in construction, as well as control of the content of those isotopes (Journal of Laws No. 220, pos. 1850)

Ministry of the Environment Regulation of 8th July 2004 concerning conditions to be met while discharging effluents to the waters and ground, as well as substances especially harmful to the water environment (Journal of Laws No. 168, pos. 1763)

Ministry of the Infrastructure Regulation of 11th August 2004 concerning methods of declaring compliance of construction products, as well as methods of their marking with the construction sign (Journal of Laws No. 198, pos. 2041)

2 DOCUMENTS USED IN THE APPROVAL PROCEDURE

Geotechnical ruling from the control testing of stabilization made with the use of the STABI DROX preparation from the FOSSE LIQUITROL POLSKA Sp. z o. o. Company by the BUDROMOS Company, of the Stokrotki Street surface (No. 13 and 15) in Legnica – performed by FOLTA Urban Design and Geology.

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Results of tests of the dynamic module of deformations with a defined secondary deformation module for the estate road in Stary Lubiń at Bacha Street. Performed by FOLTA Urban Design and Geology in Legnica, Id. 390-62-18-86, on 9th August 2005.

3 APPLICANT / MANUFACTURER

FOSSE LIQUITROL POLSKA Sp. z o. o.

4 IBDiM TECHNICAL APPROVAL TEAM

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