



TECHNICAL SUITABILITY DOCUMENT: No. 569R/16

Generic area / Intended use:

WATERPROOFING OF VEHICLE TRAFFIC AREAS

Trade name:

POLYDAN ROAD TRAFFIC

Beneficiary:

DERIVADOS ASFALTICOS NORMALIZADOS, S.A.
(DANOSA)

Headquarters:

C/. La Granja, no. 3.
28108 ALCOBENDAS (Madrid). Spain.
Tel. (+34) 91 658 68 50 · Fax (+34) 91 652 57 66
www.danosa.com

Place of manufacture:

Industrial Estate Sector 9
19290 FONTANAR (Guadalajara). Spain,
Tel. (+34) 949 88 82 10

Validity From:
To:

September 19, 2016
September 19, 2021 (Conditioned
to annual monitoring)

This document consists of 23 pages



MEMBER OF:

EUROPEAN UNION FOR THE EVALUATION OF TECHNICAL SUITABILITY
UNION EUROPÉENNE POUR L'AGRÉMENT TECHNIQUE DANS LA CONSTRUCTION
EUROPEAN UNION OF AGRÉMENT
EUROPÄISCHE UNION FÜR DAS AGREMENT IN BAUWESEN

FERNANDA CANTALEJO MAESTRO
Traductora e Intérprete Jurada de INGLÉS

N.º 5263

«Doña Fernanda Cantalejo Maestro, Traductora-Intérprete Jurada de inglés nombrada por el Ministerio de Asuntos Exteriores y de Cooperación, certifica que la que antecede es traducción fiel y completa al inglés de un documento redactado en español.

En Cuéllar, a 31 de diciembre de 2016»

«Mrs. Fernanda Cantalejo Maestro, Sworn Translator and Interpreter of English appointed by the Spanish Ministry of Foreign Affairs and Cooperation, certifies that the preceding translation is a true and complete translation into English of a document written in Spanish.

In Cuéllar on December 31st 2016»

THE TECHNICAL SUITABILITY DOCUMENT (TSD) is, by definition, a favourable technical assessment by the Eduardo Torroja Institute of Construction Science, of the suitability for construction of non-traditional materials, systems and procedures intended for a specific and determined purpose.

Before using the material, system or procedure referred to in this Document, it is necessary to have full knowledge of it, for this reason it must be supplied by the owner in its entirety.

The modification of product characteristics or failure to comply with the conditions of use, as well as the observations of the Committee of Experts, shall invalidate this technical evaluation.

C.D.U.: 699.82
Impermeabilización
Étanchéité
Waterproofing

DECISION NO. 569R/16

THE DIRECTOR OF THE EDUARDO TORROJA INSTITUTE OF CONSTRUCTION SCIENCE (IETcc)

- Under Decree No. 3652 of December 26, 1963, of the Presidency of the Government, which empowers the Eduardo Torroja Institute of Construction Science to issue the TECHNICAL SUITABILITY DOCUMENT for non-traditional construction materials, systems and procedures employed in building and public works, and Order No. 1265/1988, dated December 23, of the Ministry of Justice and the Secretary of State for Justice Office regulating its concession;
- considering Article 5.2 (5) of the Technical Building Code (hereinafter TBC) on the compliance with the TBC of innovative products, equipment and systems, which establishes that a construction system should adhere to the TBC if it has a favourable technical evaluation of its suitability for intended use;
- considering the specifications established in the Regulation for the Monitoring of the TSD of October 28, 1998;
- considering the application submitted by the Company DANOSA, for the renewal of a TECHNICAL SUITABILITY DOCUMENT for the **System of waterproofing of vehicular traffic areas with POLYDAN ROAD TRAFFIC**;
- and taking into account the reports and results of the tests presented by the Eduardo Torroja Institute of Construction Science, as well as comments made by the Committee of Experts on July 4, 2016,

HAS DECIDED AS FOLLOWS:

To renew TECHNICAL SUITABILITY DOCUMENT number 569/11 for the POLYDAN ROAD TRAFFIC vehicular traffic waterproofing system.

The technical evaluation concludes that this Product is IN ACCORDANCE WITH THE TECHNICAL BUILDING CODE, provided that the complete content of this document is respected and in particular the following conditions:

GENERAL CONDITIONS

This TECHNICAL SUITABILITY DOCUMENT only evaluates the construction systems proposed by the beneficiary, and in accordance with the current regulations, each case must be accompanied by the mandatory construction project and be carried out by the corresponding construction supervision. It will be the construction project that supervises in each case the actions transmitted by the systems to the general structure, ensuring that these are admissible. In each case, the beneficiary, in view of the project to construct the waterproofing element carried out by the competent technician (architect or engineer) authorizing the project, will provide sufficient technical assistance concerning the systems (and at least the delivery of

this TSD), in order that calculation and sufficient definition for its execution may be undertaken, including all the necessary information regarding each one of the components.

Optionally, the technical project of the waterproofing can be supplied by the beneficiary, where its compliance with the current regulations will be justified, providing the corresponding calculation memory and the written documentation required in order to define the project. In general, all the requirements contained in the current regulations will be taken into account, both in the project and in the execution of the work; in particular, the TBC is cited as a reminder.

MANUFACTURING AND CONTROL CONDITIONS

This technical evaluation is valid provided that the product's identification characteristics are maintained and that the manufacturer systematically checks the uniformity of the product in accordance with the requirements laid down in this TSD and the conditions laid down in the **Monitoring Regulation for the TSD Granting and Processing** of 28 October 1998.

CONDITIONS OF USE AND IMPLEMENTATION

The systems evaluated in this document are intended for the resolution of structures with heavy vehicle traffic for new construction and rehabilitation, of all types of buildings, constructions and bridges, under the conditions of use and maintenance specified in the Technical Report. These systems do not contribute to the stability of the work. The implementation of these systems must be carried out by operators trained by and with the technical assistance of the beneficiary. The aforementioned companies shall ensure that the systems are operated under the conditions and fields of application covered by this document and in accordance with the comments made by the Committee of Experts. In particular, they shall ensure the use of special parts for single points, the application of appropriate performance standards, strict control of the quality of the sheet overlaps and the performance of the water tightness test (if applicable).

A copy of the updated list of recognized installation companies will be available at the request of the IETcc. Therefore, the conditions for execution of those works for which the specifications listed in this document are respected and that that have also been certified by the installer will be protected and. All necessary provisions shall be adopted concerning the stability of buildings during assembly, the risks of falling suspended loads, the protection of individuals and, in general, the provisions contained in the current Work Safety and Health Regulations, and in particular for each project the specifications indicated in the Health and Safety Plan.

VALIDITY

The present TECHNICAL SUITABILITY DOCUMENT number 569R / 16 is valid for a period of five years provided:

- that the manufacturer does not modify any of the characteristics indicated in the present Technical Suitability Document;
- that the manufacturer carries out a systematic self-monitoring of production as indicated in the Technical Report;
- that monitoring be carried out annually in order to establish compliance with previous conditions, and visiting, if deemed appropriate, some of the most recent operations.

With a favourable monitoring result, the IETcc will issue an annual certificate that must accompany the TSD in order to validate it. This document must be renewed before September 19, 2021.

Madrid, September 19, 2016

THE EDUARDO TORROJA INSTITUTE OF
CONSTRUCTION SCIENCE



Marta Castellote Armero

FERNANDA CANTALEJO MAESTRO
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TECHNICAL REPORT

1. OBJECTIVE

The "POLYDAN ROAD TRAFFIC SYSTEMS", which are the subject of this report, are intended for the waterproofing with modified bitumen sheets of concrete structures with vehicular traffic (1), both in new and restoration works.

These systems are used for the waterproofing of all concrete structures destined for vehicle traffic, such as concrete bridge boards, areas for parking and vehicular traffic, landscaped areas with vehicular traffic, public spaces on underground car parks, etc.

This waterproofing system can never be exposed to direct contact with vehicles or people and must be protected by concrete, asphalt (2), pavement or soil.

2. SYSTEMS DESCRIPTION

The main components of the systems depending on the feature to be waterproofed are:

BRIDGES. The waterproofing systems are defined according to use, their finishing layer and their slope (a monolayer solution between 0-15% and bilayer solution between 0-10percent). The single-layer solution is recommended for road bridges. The bilayer solution will be used in those works where large sealing requirements are required.

Road panels with asphalt finish

(Attached fig. 12.1.1):

- Priming: Curidan/Impridan 100.
- Bottom sheet (bilayer): Glasdan 30 P Elast.
- Main sheet: Polydan 60 TF Elast. This sheet can be replaced by Polydan 180-48 AP Canales and Polydan 180-60 / GP Elast Sheets.
- Wearing course: Bituminous mixtures (Asphalt).

Road panels with concrete finish

(Attached fig. 12.1.2):

- Priming: Curidan/Impridan 100.
- Bottom sheet (bilayer): Glasdan 30 P Elast.
- Main sheet: Polydan 48 P Parking This sheet can be substituted by Polydan 180- 60/GP Elast, Polydan 60 TF Elast and Polydan 180-48 AP Canales.
- Separating auxiliary layer (3): Geotextile DANOFELT PY 200.
- Wearing course: Concrete slabs

(1) The evaluation of these waterproofing systems with traffic, is valid for less demanding uses such as the movement of people

(2) UNE-EN 14695 refers to waterproofing of concrete structures finished in asphalt, this being the generic name. Hereinafter, the word asphalt shall refer to bituminous mixtures of hot application (asphaltic mixtures or asphaltic agglomerates).

(3) The DANOFELT PY 200 geotextile sheet is only used where the wearing course is a concrete floor. This layer will never be used when the wearing course is asphalt.

Asphaltic railroad board with asphalt protection

(Attached fig. 12.1.3):

- Priming: Curidan/Impridan 100.
- Main sheet: Polydan 60 TF Elast.
- Protection: Asphalt.

Railroad board with concrete protection

(Attached fig. 12.1.4):

- Priming: Curidan/Impridan 100.
- Main sheet: Polydan 48 P Parking. This sheet can be replaced by Polydan 180-60/GP Elast and Polydan 60TF.
- Geotextile DANOFELT PY 200 separating auxiliary layer (2).
- Protection: Concrete slabs.

OTHER ROAD SURFACES.

The waterproofing systems are defined according to their use, finishing layer and slope (monolayer solution between 1 - 15% and bilayer solution between 0 - 15%). The bilayer solution is always recommended. The monolayer solution will be used in those works where there is an exhaustive control of the laying of the finishing layer, and if repair of the membrane and the finishing layer is necessary, this does not generate significant economic costs.

Other surfaces with asphalt finish directly on the waterproofing (attached fig. 12.1.5):

- Main sheet (monolayer solution): Polydan 60 TF Elast. This sheet can be replaced by Polydan 180-60/GP Elast, Polydan 180-48 AP Canales and Polydan 48 P Parking.
- Bottom sheet (bilayer): Glasdan 30 P Elast or Glasdan 40 P Elast.
- Main sheet (bilayer solution): Polydan 60 TF Elast. This sheet can be replaced by Polydan 180-60/GP Elast and Polydan 48 P Parking.
- Wearing course: Asphalt.

Other surfaces with pavement finish (concrete, paving, asphalt, etc.) on a protective layer (attached fig. 12.1.6):

- Priming: Curidan/Impridan 100.
- Main sheet (monolayer solution): Polydan 48 P Parking. This sheet can be replaced by Polydan 60 TF Elast and Polydan 180-60 / GP Elast.
- Bottom sheet (bilayer): Glasdan 30 P Elast or Glasdan 40 P Elast.
- Main sheet (bilayer solution): Polydan 40 P Elast, Polydan 180-40 P Elast or Polydan 48 P Parking. These sheets can be substituted by Polydan 180-60/GP Elast y Polydan 60 TF Elast, Polydan 50/GP Elast Verde Jardín and Esterdan Plus 50/GP Elast Verde Jardín sheets.
- Separating layer (optional, only in case of thermal insulation): Danofelt PY 200.
- Thermal insulation (optional, only necessary where required by the Basic Structural Safety Document (DB-HE) of the Technical Building Code (TBC). Danopren/Danopren 500.

- Protection of waterproofing: Danofelt PY 200.
- Wearing course: Concrete slab or protective layer (mortar, concrete slab, etc.) + pavement (paving stones, tiles, asphalt, soil, etc.).

NOTE: The two cases of "other surfaces" solutions described are valid for surfaces accessible to light vehicle traffic (up to 2 tonnes per axis) and heavy vehicles (more than two tonnes per axis).

3. SYSTEM COMPONENTS

The main characteristics of each component of the system (provided by the manufacturer) are:

3.1 Waterproofing sheet

Its characteristics are shown in table 1.

Glasdan 30 P Elast: 3 kg / m² SBS asphalt bitumen sheet, with fiberglass felt reinforcement and plastic finish on both sides.

Glasdan 40 P Elast: 4 kg / m² SBS asphalt bitumen sheet, with fiberglass felt reinforcement and plastic finish on both sides.

Polydan 60 TF Elast: 6.0 kg / m² SBS asphalt bitumen sheet, with non-woven and finished polyester felt reinforcement and plastic finish on the underside and slate granule on the top

Polydan 40 TF Elast: 4 kg/m² SBS elastomer bitumen sheet with non-woven polyester felt reinforcement and plastic finish on both sides.

Polydan 48 P Parking. 4.8 kg / m² SBS elastomeric bitumen sheet, with non-woven polyester felt reinforcement and plastic finish on its underside and geotextile felt on top.

Polydan 180-60 GP Elast: 5.6 kg / m² SBS elastomeric bitumen sheet, with non-woven polyester felt reinforcement and with plastic finish on the underside and slate granule on top.

Polydan 180-48 AP Canales: 4.8 kg / m² APP asphalt bitumen sheet, with non-woven and finished polyester felt reinforcement and plastic finish on the underside and silica sand on top

Esterdan Plus 50 GP Elast Verde Jardín: 5 kg / m² SBS asphalt elastomeric bitumen asphalt sheet with reinforced and stabilized polyester felt, anti-root treatment and with a plastic finish on its underside and slate granule on top.

Esterdan Plus 50/GP Elast Verde Jardín: 5 kg / m² SBS asphalt bitumen sheet with non-woven polyester felt reinforcement, anti-root treatment and

plastic finish on its underside and slate granule on top.

Polydan 180-40 P Elast: 4 kg/m² SBS elastomer bitumen sheet with non-woven polyester felt reinforcement and plastic finish on both sides.

3.2 Geotextile

DANOFELT PY 200. Felt polyester geotextile, used as an auxiliary layer that is sandwiched between two layers of the waterproofing system in order to perform any of the following functions: puncture resistance, filtering and separating.

It has CE marking according to the ZA annex of the UNE-EN 13265 standard. The characteristics of these sheets are shown in Table 2.

Table 2. DANOFELT PY 200 characteristics

Properties	DANOFEL T PY 200	UNE-EN
Mass (g / m ²)	200 ± 10	ISO 9864
Thickness at 2 kPa (mm)	2.10 ± 0.20	ISO 9863
Tensile strength L/T (kN/m)	2.0 - 0.3	ISO 10319
Longitudinal elongation rupture (%)	90 ± 30	ISO 10319
Transversal elongation rupture (%)	80 ± 30	ISO 10319
Static puncturing (CBR) (kN)	0.4 - 0.2	12236
Dynamic drilling (cone tapping) mm	27 +3	ISO 13433
Water permeability (m/s)	0.03731, -0.005	ISO 11058
Water flow capacity on a flat surface (m ³ /s)	1.57 10 ⁻⁶ , -0.1 10 ⁻⁷	ISO 12958
Size of opening (µm)	90 ± 20	ISO 12956
Deterioration during installation	PND	ISO 10722
Efficiency of protection	12.0.10 ₃	13719
Weather Resistance	1 week	12224
Chemical ageing	occurs	14030
Micro-organisms	occurs	12225

3.3 Priming:

CURIDAN is an anionic, low viscosity, cold-application bituminous emulsion. It is formed by the dispersion of small bitumen particles with a lightweight anionic emulsifying agent that is very high in fluidity. Its characteristics are shown in table 3.

Table 3. CURIDAN characteristics

Properties	CURIDAN	UNE
Viscosity at 20°C (spindle 1, 20 r.p.m)	1 - 5	EN ISO 2555
Density at 20°C (g/cm ³)	0.9 - 1.1	104 28135

IMPRIDAN 100 is a cold application asphalt paint. It consists of a solution of modified asphalt bitumen and mineral fillers in a solvent -base. Its characteristics are shown in table 4.

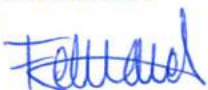
Table 4. IMPRIDAN 100 characteristics

Properties	IMPRIDAN 100	UNE
Viscosity a 25°C (Saybolt-Furol) sg.	15 - 30	104 281-5-5
Density at 25 °C	0.94 ± 0.05	104 28154

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Table 1. Sheet characteristics

Features	Polydan 60 TF Elast	Glasdan 30 P Elast	Glasdan 40 P Elast	Polydan 48 P Parking	Polydan 40 P Elast	Polydan 180-60/GP Elast	Esterdan Plus 50 GP Elast Verde Jardin:	Polydan 180-48 AP Canales	Polydan 50/GP Elast Verde	Polydan 180-40 AP Elast	UNE-EN	
Length and width (m)	8 x 1	12 x 1	10 x 1	8 x 1	10 x 1	8 x 1	8 x 1	8 x 1	8 x 1	10 x 1	-	
Grammage (kg/m ²) 5 %, +10	6.0	3.0	4.0	4.8	4.0	5.6	5.0	4.8	5.0	4.0	-	
Fire performance	E										11925-2; 13501-1	
Water tightness	occurs										1928	
Tensile strength L (N/5)	1000 ± 250	350 ± 100	500 ± 100	1000 ± 250	900 ± 250		700 ± 200	900 ± 250	900 ± 250		12311-1	
Tensile strength T (N/5)	750 ± 250	250 ± 100	400 ± 100	800 ± 250	650 ± 250		450 ± 150	650 ± 250	650 ± 250		12311-1	
Stretching L/T (%)	45 ± 15	PND			45 ± 15							12311-1
Root resistance	Does not						Occur	Does not	Occur	Does not	13948	
Static load resistance (kg)	>35	PND		>25	>25	>20	>15	>20			12730	
Impact Resistance (mm)	>2400	PND		>2000		>1500	>1000	>1500		>1000	12691	
Peel strength of overlap	PND										12316-1	
Overlap shear strength (N/5)	750 ± 250	PND	400 ± 100	650 ± 250			450 ± 150	650 ± 250			12317-1	
Low temperature flexibility	< -15										1109	
Moisture resistance factor	20,000										1931	
Durability flexibility (°C)	-5 ± 5										1109	
Creep durability (°C)	100 ± 10							120 ± 10	100 ± 10		1110	
Dimensional stability (%)	< 0.5	PND		< 0.5	< 0.5	< 0.6	< 0.3	< 0.5			1107-1	
High creep resistance T (°C)	100							130	100		1110	

3.4 DANOPREN 500 Insulation panels

Extruded polystyrene panels, with CE marking in accordance with annex ZA of UNE-EN 13164: 2009. Its characteristics are shown in table 5.

Table 5. DANOPREN 500 characteristics

Properties	D 500	UNE-EN
Thermal conductivity (W/mK)	0.034	12667 12939
Compressive strength (kPa)	≥ 500	826
Perpendicular traction on sides	> 100	1607
Total immersion water absorption	> 0.7	12087
Water absorption through	≤ 3	12088
Dimensional stability (%)	≤ 5	1604
Frost/thaw resistance (%)	≤ 1	12091
Fire performance	E	13501-1

3.5 Common accessories

- **REINFORCING STRIP E 30 P ELAST (0.32).** Lower reinforcement band in fixtures with vertical features. SBS 3 kg / m² elastomer bitumen sheet, plasticized on both sides, with non-woven polyester felt reinforcement. Made With ESTERDAN 30 P ELAST sheet cut to the measure of 32 cm.
- Lower reinforcing strip in expansion joints, made with modified bitumen sheets, ESTERDAN 40 P ELAST, width ≥ 45 cm.
- **JUNTODAN E edge.** Product for sealing joints. Made up of modified asphalt bitumen which comes in the form of cords of approx. 50 cm in length and in various diameters.
- EPDM drain housing with horizontal and vertical outlet, for drainage of rainwater. Made of EPDM rubber. They are of three types: vertical output, vertical siphon output and horizontal output.
- They are made of one item, constituted by a support base (wings) with relief to facilitate the penetration of the bitumen, and larger than 30 x 30 cm in size. The wings are always greater than 10 cm.

- The pipe connector, in the case of the vertical exit housing, is a conical shape in order for it to fit hermetically in the exit of the drainpipe and has a minimum size of 15 cm. In the case of horizontal outlet housings, it has a rectangular shape and a length of approximately 30 cm.
- Galvanized sheet metal edges, used as finishing of the waterproofing in masts and vertical walls, to avoid the detachment of the support sheet.

4. MANUFACTURING

4.1 Manufacturing plant

The waterproofing and geotextile sheets are manufactured by the beneficiary at the plant located at Industrial Estate Sector 9, 19290 Fontanar. Guadalajara (Spain). All other components are supplied by authorized suppliers.

There is no defined manufacturing frequency, but a safety stock to meet the demand for orders, and once this storage limit is reached, the following manufacturing lots are made.

This production centre has implemented a quality system according to UNE-EN ISO 9001: 2008 standards (no. ES044036-2).

The factory has several bays, the bay used in manufacturing is some 10,000 m² in size with an independent area for laboratory quality control and a distribution warehouse.

4.2 Manufacturing process

Manufacturing takes place according to a Manufacturing Order in which the process is defined, and phases, raw materials, procedure, precautions and monitoring specified.

Bituminous sheets. The asphalt bitumen is discharged into a 200 m³ capacity tank

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where it is kept at a temperature of 150°C to maintain it in a liquid state.

The next phase of the process is the mixing of the bitumen with the necessary additives, including synthetic rubber (SBS) and polypropylene (APP). In these mixing processes, there are no chemical reactions: the entire mixture of bitumen and integration of the SBS / APP is a mechanical (physical) process.

The apportioning of all components is carried out gravimetrically with calibrated equipment.

Once the aforementioned mixture has been formed, the mastic is transferred from the mixers to the production line bath. The production line is a continuous manufacturing process, which begins with the unwinding of the sheet framework.

This framework can be made of different materials (glass fibre, polyester) depending on the properties of the sheet to be manufactured. The framework passes through the bath containing the mastic and by adhesion is impregnated with a quantity of mastic, obtaining the necessary thickness by passing between two rollers regulated by the distance of the thickness from the product to be manufactured.

Once the sheet is obtained, the desired finish for each face (polyethylene film, slate, sand, geotextile felt) is added onto the still hot mastic.

The sheet undergoes a cooling process which ends in the winding machine where rolls are formed according to the desired length.

The rolls are transported by a roller system where they are weighed and sealed according to their weight and their type of framework, and by using colour coding. Later they are labelled by identifying the manufacturing machine, the date and the type of product, continuing until the palletiser where the pallets are shaped according to the order. Finally, the pallets are strapped and sheathed in shrink wrapping and transported to the automated warehouse to be protected from the elements.

Geotextile The production line consists of the following equipment: Opener, Mixing rooms, Card, Folding machine, Punching machine, Platform truck and Winding machine.

The raw material (polyester fibre) is introduced into the opener in compacted bullets, with the original format provided by the supplier.

This fibre decompresses in the opener, moving to the mixing rooms, where the different types of fibre are homogenized.

From the mixing rooms, the fibre is conveyed by ventilated air to the card, where it is automatically weighed, guaranteeing the continuity of the feeding process. Within the card, the preferential alignment of the fibres occurs,

obtaining a veil of material that forms the base of the final product.

The projecting veil of the card is folded as necessary to achieve the final weight of the manufactured product, the veils being conveyed towards the punching machines. In this phase a controlled stretch in the transverse direction is simultaneously produced to achieve the maximum degree of isotropy in both directions (longitudinal and transversal).

A build-up of geotextile sheet is produced in order to perform the winding process of each roll without stopping the line. After the winding of the sheet, the packaging and labelling of the product is carried out. Finally, the material is transported to the storage area.

4.3 Monitoring

The production process of the sheets and other components is carried out under controlled conditions to ensure the quality of the finished product, according to the integrated system of quality and environmental management.

Waterproofing sheets The scope, frequency and registration of the minimum monitoring of the raw materials, manufacturing process and finished product, established in internal self-monitoring procedures, adheres to the specifications indicated in the following Standard and Guide:

- UNE-EN 14.695 Bituminous sheets with reinforcement for the waterproofing of concrete bridge boards and other concrete areas for road traffic.
- Guide to UEAtc Assessment of Roof Waterproofing Systems made of Reinforced APP or SBS Polymer Modified Bitumen Sheets.

Geotextile

Raw Materials. The raw materials are received and identified by their name and a lot number. It is verified that they fulfil the technical specifications (by lot) listed in the supplier's certificate, and visual monitoring of the fibres and the bales in which these fibres come.

Manufacturing process

Specifications	Frequency
Appearance	Continuous
Weight	Continuous

Finished product

Specifications	Frequency
Weight	6 per shift
Thickness at break	Weekly
Tensile Strength and Elongation at break	Weekly
Static and dynamic puncture resistance	Weekly

Monitoring of other components. The components not manufactured by the beneficiary are subject to quality criteria agreed with the supplier or to incoming goods inspection according to the supplier certificate

for each batch, which ensures compliance with the characteristics stated in section 2.

5. TRANSPORTATION AND STORAGE

The constituents of this System are not toxic or flammable, so it is not necessary to follow any special safety instruction in their transport and storage.

Waterproofing sheets. They must be transported and stored in a dry place protected from rain, sun, heat and low temperatures. They shall remain in their original packaging until use, in an upright position on a flat and smooth support. The on-site collection will be made on no more than two pallets, one on top of the other and in areas where loading is carried out.

Geotextiles. They must be transported and stored on-site in the original packaging in order to ensure an adequate product quality. Whenever possible, they shall be stored in smooth, dry and clean places that are free of sharp and pointed objects. Rolls may be stacked on top of one another.

Remaining components. The recommendations of the beneficiary shall be followed for the remaining components and accessories,

6. PRODUCT PRESENTATION

6.1 Packing

Waterproofing sheets The product is presented in rolls of sizes and width according to the type of product, and is palletized by placing the rolls in a vertical position. Afterwards the rolls are strapped and a polyethylene cap is fitted by wrapping it with plastic in shrink packaging.

Geotextiles. They are presented in rolls of sizes and width according to type of product, and are protected individually with a polyethylene film. The most frequent sizes are rolls of 2.20x100 m.

6.2 Labelling

The labelling of the various products manufactured by DANOSA includes the name of the Company, product name and code, dimensions, date of manufacture and batch. The marking of the TSD will show that it refers to the complete system and not to each of the components separately.

7. IMPLEMENTATION

The use and implementation of these systems must be carried out by specialized companies. They shall ensure that the systems are operated under the conditions and fields of application covered by this TSD, in accordance with the comments made by the

Committee of Experts. In addition, the following factors must be taken into account:

- General Technical Specifications for road and bridge works of the Department for Highways (PG-3) (4).
- Standard 6.1-IC "Surface sections" (3).

7.1 Compatible Supports

Waterproofing systems may be installed on a structural concrete support (5), mortar or concrete layer, lightened concrete with light aggregates and old asphalt pavements.

7.2 Support Conditions

The support must possess the following qualities:

Design. It must be sized and designed to provide adequate performance in relation to deformations, vibrations, cracks or deterioration.

For those uses referred to within the Technical Building Code (TBC), these must conform to the Basic Structural Safety Document (DB-SE)

Stability and Resistance. The surface of the substrate must be strong, uniform and smooth, clean and dry and free of foreign matter. This requirement must be extended to the walls, passages or emerging features to which the connection or completion of the waterproofing is carried out.

It should not be applied on substrates that do not have the proper cohesion and can produce lack of adhesion to the support.

When the support is concrete lightened with light aggregates and it does not have a smooth, uniform and homogeneous surface, it must be finished with a layer of low retraction cement with a minimum thickness of 2 cm.

In the case of prefabricated concrete supports, all joints must be filled with low retraction mortar to smooth the surface.

In the case of panels (road and rail), waterproofing work will not be carried out until the surface of the concrete is older than 28 days. This time can be reduced to 14 days in the case of road panels provided that the surface drying of the support is verified.

If it is necessary to remove water from the support, a wet vacuum cleaner or other drying devices (infrared, for example) can be used.

Cleaning and flatness. Surfaces must be free from water, organic materials (mosses, plants, roots, etc.), oils, residues of grout cement

(4) As well as any other document that substitutes and / or modifies it.

(5) When concrete is used, it must comply with the SCS (Structural Concrete Standards).

injection, as well as of any substance that diminishes the adhesion between the support and the waterproofing.

The surface of the waterproofing shall not contain any material incompatible with bituminous materials, such as fats, oil-based (mineral or vegetable) products, tar and strong acids.

The surface where the waterproofing is to be applied should not present any irregularities or bumps that could pose a risk of puncturing the waterproofing membrane.

When the base support is made of concrete or cement mortar, its surface must be set and dry, with no holes or projections greater than 1.5 mm.

In the case of waterproofing of bridges (road and rail panels), hollows and projections of a maximum height of 1.5 mm are allowed.

7.3 Preparation of the support

If there are residues of grout cement injection, fats, oil-based products (mineral or vegetable), tar, strong acids, organic materials (mosses, plants, roots, etc.), or surfaces that are crumbling or not very uniform, a surface cleaning of the support will be carried out.

The cleaning of the support can be done by mechanical abrasion, shot blasting, milling, water jet, sand blasting or brushing with a steel barbed brush.

It is necessary to remove all burrs greater than (approximately) 1.5 mm from the concrete board. This process will be performed with some of the mechanical means discussed above.

If the surface has large irregularities that may pose a risk of puncturing, it must be repaired in advance with a suitable mortar (with sufficient adhesion to the concrete), eliminating the ridges. The same will be done with respect to any occasional holes that may exist in the support.

The existing cracks in the concrete slab will be treated with suitable products, depending on the type of crack. If they are active fissures, they will be treated as expansion joints, being filled with elastic materials. In case of passive cracks, they will be filled with mortars or resins in the case of superficial cracks, and by injection of resins in the case of deep cracks.

In the case of panels, if there are exposed frameworks, they will be treated and covered by suitable systems for this type of repair. The framework will be left uncovered, removing the rust from it until reaching level SA 2.5. Subsequently, they will be treated with a bonding bridge against oxidation and subsequently protected by a structural repair mortar. The same will be done in those

cases where the support of the waterproofing is slab.

Where waterproofing is carried out on an old asphalt pavement, the surface repairs and coverings of cracks and gaps will be made with asphalt mastics. If a levelling screed is required, it will be made from micro-asphalt.

7.4 Environmental conditions

Waterproofing should not be carried out when weather conditions may be harmful, particularly when there is snow or ice on the support, or when it rains or there is strong wind.

Nor will waterproofing work be carried out when the air temperature is less than - 5°C for the placement of sheets of modified bitumen and + 5°C for the placement of the primer.

7.5 Product Handling

The health and safety requirements established for the work must be adhered to.

There are no special considerations regarding product handling the indications described on the safety data sheets should be followed.

In addition, depending on the strength of the support, it may be necessary to evenly distribute the materials so as not to concentrate the loads.

7.6 Form of application

In the waterproofing of other road surfaces, as long as it is not stated otherwise in this document, the specifications relating to the laying of materials, the laying of auxiliary layers and protection, the resolution of single points, and welding and leak tests, of the Spanish DB HS1, or Framework Document for Energy Saving of the Technical Building Code (TBC) (whenever the project is subject to the TBC) or others such as UNE Standard 104401: 2013 "Waterproofing in the building on and under flush with modified bituminous sheets. Systems and on site installation" shall be adhered to.

Primers. To facilitate adhesion, a primer will be applied to the support before soldering the sheet. The primer shall be applied to the entire surface with a brush, roller or airless paint spray, with a yield of 0.2 - 0.3 kg / m² and at an application temperature of more than + 5°C. The primer may be solvent based IMPRIDAN 100 or water based CURIDAN.

Where the support is metallic, in the case of emergent steel sheet features (street lamps, pillars, fixed signs, etc.), the primer to be used will be IMPRIDAN 100. In this case, the yield will be 0.1-0.15 kg / m².

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Waterproofing membrane. The precautions for resistance, flatness, cleanliness, curing and moisture content of the carrier indicated in points 7.1, 7.2 and 7.3 shall be taken into account.

Once the primer is dry (minimum drying time of 8 hours at 21°C in the case of IMPRIDAN 100, and 24 hours in the case of CURIDAN), the process of torch welding the waterproofing sheets to the support will begin.

The welding is performed by applying torch heat to the underside of the sheet until the polyethylene film finish is melted and attaches to the support. At that point, the sheet is pressed onto the support, sticking to it.

The next sheet is then put in place. The overlaps of both sheets, both longitudinal and transversal, will also be welded with a torch. The bottom and top sheets will be fired in the overlap area until the finished polyethylene film is melted. At that time, the overlap zone is pressed to stick the sheets. Subsequently, the end of the edge of the top sheet is revised.

The sizes of the (transverse-longitudinal) overlaps shall be 8 ± 1 cm, except for self-protected sheets (ESTERDAN PLUS 50 / GP ELAST VERDE JARDÍN, POLYDAN 50 / GP ELAST VERDE JARDÍN, POLYDAN 180-60 / GP ELAST and POLYDAN 60 TF ELAST), as in the case of the sheet finished in geotextile POLYDAN 48 P PARKING, which will be transversely 12 ± 1 cm.

In monolayer and bilayer systems made with self-protected sheets with granules or finished with geotextile, the welding will always be done in the mastic zone and never in the granule / geotextile zone. In order to join the transverse overlap at the ends of the rolls, the granule / geotextile must be removed by preheating the transverse edge of the lower sheet in a 12 ± 1 cm strip, eliminating the protection (in the case of granules, embed them in the mastic) and then weld the end of the next piece. The same will be done in the longitudinal overlaps in which it is not welded on the overlap and in all those areas where the sheet is to be soldered on granule / geotextile.

The coinciding of the transverse overlaps of two consecutive rows of sheets will be avoided. The joining of more than three sheets in a single point will also be avoided.

If a bilayer system is used, the sheets of the second layer are welded with torch to the sheets of the first layer as indicated above. Torch heat is applied to the faces of both sheets until the terminating polyethylene film is melted. Once the film is melted, the top sheet is unwound, becoming attached to the lower one. The overlaps are also welded with a torch.

The sheets of the second layer are arranged as cover gaps, i.e. with their longitudinal overlaps such that they are displaced with respect to those of the first in a length approximately equal to half the width of the sheet, less the width of the overlap.

The dimensions of both transverse and longitudinal overlaps of the upper sheets will be those indicated above.

Bridges (road and rail panels). The primer and the sheets are placed according to section 7.6.

The sheets are arranged longitudinally in the direction of traffic, i.e. parallel to the longitudinal axis of the panel. This starts from the lowest point of the panel until reaching the top of it and the overlaps always in favour of water flow.

In the transverse direction, they are also arranged with the overlaps in favour of water flow.

Other road surfaces. The primer and the sheets are laid according to section 7.6.

Where there is a clear sense of the direction of traffic, the sheets are arranged parallel to the circulation starting also from the lowest point and with the overlaps in favour of water flow.

Where there is no clear sense of the direction of traffic, the sheets are arranged starting from the lowest point, parallel to the line of the structure's maximum slope. Overlaps are always placed in favour of water flow.

Geotextile The geotextile is only used when the layer above the waterproofing is mortar or concrete. This geotextile is never used when the layer above the waterproofing is an asphalt pavement.

The geotextile rolls may be arranged longitudinally or transversely on the tread surface. A DANOFELT PY roll is laid, and then the second roll is laid parallel to the previous one, leaving a minimum overlap of 20 cm.

Thermal insulation. The DANOPREN thermal insulation panel is placed on a dry surface, on the waterproofing membrane or on a geotextile separating layer.

The panels are laid one by one, joining each to the other in accordance with product's tongue-and-groove joint. They may be arranged longitudinally or transversely on the cover.

If it is necessary to cut pieces, these cuts can be made with a blade.

Wearing course. In general, the laying of the wearing course will be carried out as soon as possible, in order to avoid possible puncturing of the waterproofing membrane.



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The material will be collected in such a way that the waterproofing is not punctured, using the appropriate protection. In addition, this will be done in such a way that no unusual loads occur that may compromise the stability of the work.

Before placing the wearing course, special care must be taken not to work and / or to move on the waterproofing, to avoid possible mechanical damages in the waterproofing membrane. Otherwise adequate protections (mortar layers, puncture-resistant geotextile sheets, etc.) must be provided.

Concrete: Bridges (road and rail boards). The wearing course is a concrete slab that extends directly over the waterproofing, following the laying of a geotextile separating layer. The characteristics of type, thickness and installation of this slab will be defined in the Technical Specifications of the Work Project. In addition, in the case of highways, account should be taken of:

- the characteristics and the implementation of the concrete indicated in article 550-Concrete pavements of the General Technical Specifications for road and bridge works of the Highways Department Highways (PG-3), as well as any other document that replaces and / or modifies it.
- With respect to thickness and typology, the indications of the "Surface sections" 6.1-IC Standard Document, as well as those regulations complementing and / or replacing it will be followed.

In general, and in terms of waterproofing, the following measures should be taken:

- Prior to the placement of the concrete, the waterproofing membrane and its corresponding singular points (shells and parapets, sinks, expansion joints, etc.) will have been executed.
- The concrete should be placed on an auxiliary puncture resistant and non-stick geotextile layer.
- The concrete should be placed on the membrane following the direction of the overlaps of the longitudinal overlaps of the geotextile layer, to avoid the formation of folds in the geotextile and to avoid as much as possible the introduction of aggregates or grout inside the overlap.
- The pouring of the concrete must be carried out as soon as possible once the sheet is placed, to avoid possible damages to it.
- In the event of risk of damaging the membrane by transit, placing of mesh and / or spacers and applying the layer of concrete, is recommended to apply a layer of protective mortar (6) at least 4 cm above the geotextile.

⁽⁶⁾ This mortar shall have a mechanical strength \geq M5

Concrete: Other wearing courses. As in the previous case, the wearing course is a concrete slab that is laid directly over the waterproofing, following the laying of a geotextile separating layer. The characteristics of type, thickness and installation of this floor will be defined in the Technical Specifications of the Work Project.

In the case of works subject to PG-3, its instructions and Standard 6.1-IC "Surface sections" will be followed.

The minimum thickness of the concrete will be 8 cm, and it must undergo an electro welded mesh or another procedure that avoids its cracking.

It must be designed in such a way as to support the actions of the traffic to which it is subjected, taking into account that the support can be a thermal insulation (in the case that the construction feature located above this slab requires thermal insulation according to the DB HE, or Basic Structural Safety Document).

The pouring of the concrete can be undertaken by pumping or by concrete truck and dumpers. This last system is discouraged, since the movement of vehicles over the waterproofing can damage it. If this system is used, all necessary measures will be taken to avoid the traffic of vehicles above the waterproofing damaging it, the placement of a layer of protective mortar of at least 4 cm before the extension of the concrete being necessary.

The discharge of this layer of mortar will be done by pumping. This mortar protection layer must have an electro welded mesh or other procedure to prevent cracking.

With respect to waterproofing, the same precautions as those mentioned in point 7.6 must be taken.

Asphalt: Bridges (road and rail panels). The wearing course is asphalt, which is poured directly onto the waterproofing, whose characteristics of type, thickness and commissioning will be defined in the Technical Specifications of the Work Project. In addition, it must have its corresponding CE marking.

Furthermore, in the case of highways, account should be taken of:

- the characteristics and laying of asphalt under articles 542 - Hot bituminous mixtures of bituminous concrete and 543-Bituminous mixtures for rolling layers. Drainage and discontinuous mixtures, of the General Technical Specifications for road and bridge works of the Highways Department (PG-3), as well as any other document that substitutes and / or modifies it.

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- With respect to thickness and typology, the indications of the "Surface sections" 6.1-IC Standard Document, as well as those regulations complementing and / or replacing it will be followed.

In the case of road panels, the thickness of the asphalt shall be at least 7 cm (lower thickness may be provided whenever the manufacturer of the agglomerate justifies this).

In the case of railway panels, the thickness of the asphalt will be 3 cm and the roadbed shall extend above this.

In general, and in regard to waterproofing, the following measures should be taken:

- Prior to spreading of the asphalt, the waterproofing membrane and its corresponding singular points (shells and parapets, sinks, expansion joints, etc.) will have been executed.
- The pouring of the concrete must be carried out as soon as possible once the sheet is placed, to avoid possible damages being caused to it.
- The asphalt should be placed on the membrane following the direction of the overlaps of the longitudinal overlaps of the membrane to avoid it being pulled during the process of spreading.
- It is not necessary to apply an asphalt adhesion irrigation on top of the waterproofing system prior to the asphalt spreading. The asphalt can be extended in one or several layers, until achieving the thickness of the project.
- Movement on top of the waterproofing membrane must be avoided in order to avoid puncturing it. If it is not possible, a DANOFELT PY 200 geotextile layer and a mortar or protective layer of at least 4 cm prior to the asphalt spreading are recommended. This mortar protection layer must have an electro welded mesh or other procedure to prevent cracking.

With respect to the laying of the asphalt, the following precautions must be taken:

- The paver will be wheeled and in case of being equipped with caterpillar tracks, its studs must be made of rubber.
- The speed of circulation of the paver over the waterproofing will be less than 10 km / h, avoiding braking and sudden accelerations that could damage the waterproofing. Turns will be avoided when standing, and should be large in radius when executed.
- The compactor will move behind the paver, always moving over the layer of asphalt.

Asphalt: Other surfaces with asphalt finish directly on the waterproofing. The wearing course is asphalt, which is poured directly onto the

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waterproofing, whose characteristics of type, thickness and implementation will be defined in the Technical Specifications of the Work Project (7). It must also have its corresponding CE marking. In the case of works subject to PG-3, the indications thereof and Rule 6.1-IC "Surface sections" will be followed.

The minimum thickness of the asphalt will be 8 cm, although lower thicknesses may be provided whenever the manufacturer of the agglomeration so justifies.

If asphalt mastic (known as poured asphalt or cast asphalt) is used for the wearing course, poured at temperatures above 200°C, the thickness of the wearing course may be lower depending on the manufacturer of the wearing course material. In the case of works subject to PG-3, its instructions and Standard 6.1-IC "Surface sections" will be followed. In this case, a single-layer waterproofing membrane consisting of the sheets POLYDAN 180-48 AP CHANNELS or POLYDAN 180-60 / GP ELAST will be used.

With regard to waterproofing and the spreading of asphalt, the same precautions should be taken as those mentioned (7.6).

In order to protect the waterproofing, the laying of two layers is recommended. The first layer should be in contact with the waterproofing, and type AC 16 D (between 90% and 100% of the aggregate has a size of less than 16 mm) and with a minimum thickness of at least 3 cm. The thickness of the following layers will be designed according to the demands of the traffic.

Other floors: Other wearing courses. The pavement is placed on a protective layer (mortar or concrete), which must have an electro welded mesh or other procedure to prevent cracking (8).

The minimum thickness of this protective layer will be 4 cm, and when placed on a thermal insulation will be at least 8 cm thick concrete.

The pavement (wearing course) may be asphalt, tiles, ceramic tiles or natural or artificial stone, soil, etc., whose type and thickness features and pavement implementation will be defined in the Technical Specifications of the Work Project (9).

(7) The type of agglomerate used, its design and calculation is not the subject of this report. It must be designed in such a way as to support the actions of the traffic to which it will be subjected.

(8) Other protections may be used, but it should be ensured and guarantee that the waterproofing membrane is not punctured in the rolling / pavement laying works (extending and compacting of fills, laying of curbs, laying of pavements, etc.), or during the later use of layer rolling (traffic light-heavy vehicles).

(9) The design and calculation of the wearing course is not covered by this report. It must be designed in such a way as to support the actions of the traffic to which it will be subjected, bearing in mind that the support can be a thermal insulation where the construction element located above this slab requires thermal insulation as a consequence of the Basic Structural Safety Document (DB-HE).

The mortar or concrete of the protective layer shall be discharged following the instructions given in point 7.6.

Once the protection is executed, the pavement will be installed following the instructions of the material used.

7.7 Singular points

7.7.1 Bridges (road and rail boards).

Fixtures with vertical features. The waterproofing of the roof / ceiling consists of a bituminous primer (CURIDAN or IMPRIDAN

100) (10) up to a height of 15 cm above the wearing course, and an asphalt body finishing strip, attached to its entire height (in the case of road boards this height may be 10 cm).

This asphalt finishing strip consists of the same main sheet used in the horizontal section of the board, which will be completely welded to the vertical support and to the waterproofing of the main horizontal section.

The minimum sizes of this strip shall be 10 cm horizontally and vertically it shall rise 10-15 cm above the wearing course (depending on whether it is a road or rail panel, respectively),

Finally, to prevent rainwater or sliding water from filtering through the upper top of the waterproofing, the following can be done:

- An undercut of 3x3 cm (at least) in which the waterproofing is embedded and then sealed with a putty or a retraction-free mortar retraction (section 12.2.1 sol. 1).
- A recess with a depth with respect to the external surface of the vertical wall of 4 cm. Once the waterproofing has been completed, it is covered with a layer of retraction-free mortar and compatible with the waterproofing sheet (section 12.2.1. sol.1).
- A metal section fixed to the vertical element. The fastening will consist of an anchor and a galvanized steel screw (never a nail). The fastenings will be arranged every 25 cm. This metal section will be sealed at the top with elastic putty.

In the case of road panels with asphalt wearing course, where the guard or vertical feature is executed with a concrete of the same characteristics as the panel, the height of 10 cm indicated above can be reduced. In this case, a 3 x 3 cm undercut will always be carried out on the vertical element, where the finish sheet will be embedded in the body. Later this undercut will be secured with a layer of mortar

⁽¹⁰⁾ In the event that the emerging element is metallic (streetlamps, pillars, signs, etc.), the primer to be used will be IMPRIDAN 100.



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«Doña Fernanda Cantalejo Maestro, Traductora-Intérprete Jurada de inglés nombrada por el Ministerio de Asuntos Exteriores y de Cooperación, certifica que la que antecede es traducción fiel y completa al inglés de un documento redactado en español.

En Cuéllar, a 31 de diciembre de 2016»

«Mrs. Fernanda Cantalejo Maestro, Sworn Translator and Interpreter of English appointed by the Spanish Ministry of Foreign Affairs and Cooperation, certifies that the preceding translation is a true and complete translation into English of a document written in Spanish.

In Cuéllar on December 31st 2016»

waterproofing ⁽¹¹⁾. The asphalt will later be poured to the level of the undercut. In this case, in order to avoid water runoff by the vertical wall, it should be verified that the wall is properly stabilized and does not present a risk of cracking. See section 12.2.1.

Where there is no guard, the waterproofing will extend horizontally, to the edge of the board, lowering 15 cm down its edge.

Expansion joints. In general, the waterproofing of the expansion joints will be solved as shown in the details in section

12.2.2. These expansion joints consist of the following elements:

- A strip of elastomeric material centred on the joint, making bellows (in the event that the designer or the manufacturer of the expansion joint considers it necessary).
- Prefabricated expansion joint defined in project, set according to the manufacturer's instructions, usually on a levelling mortar.
- Transition mortar on each side of the prefabricated expansion joint.
- Waterproofing cut to the edge of the transition mortar or to the edge of the prefabricated expansion joint.
- Laying of asphalt.

The prefabricated expansion joints will meet the requirements of the document "The construction of new crossings. General concepts" or any document which replaces it and will be defined by the designer depending on the range of use (opening of the gasket), traffic to which they are going to be subjected, solicitations, etc. The sealing system of this feature will be defined by its manufacturer.

Sinks. In general, the waterproofing at this point will be solved as detailed in section 12.2.3.

The waterproofing of the panel will be connected to the sinks planned in the project. The connection of the waterproofing will depend on the system used and designed in project.

If prefabricated EPDM housings are used, a reinforcement of ESTERDAN 30 P ELAST sheet larger than 15 cm in size should be placed on the wings of the housing.

Where the housing is metallic, the reinforcing strip may be forgone, but its adhesion to the support ⁽¹²⁾ will be ensured and

⁽¹¹⁾ This mortar must be compatible with the waterproofing sheet, attach well to the concrete and not be retractable.

⁽¹²⁾ This can be achieved, for example, by reinforcing the ESTERDAN 30 P ELAST sheet of larger dimensions by 15 cm to the wings of the housing, by means of fastenings or by some other device that prevents movement of the housing.

Then the wings will be printed with IMPRIDAN 100.

Finally, the waterproofing of the horizontal section is constructed, and is later trimmed in the extraction area of the drainpipe.

In order to avoid reverse slopes and accumulations of water, lowering of the feature that supports the waterproofing in the area near the sinks is recommended.

All drains must be equipped with a suitable device (mesh strainer, sprinkler, drain basket, etc.) to retain any solid element that can block drainpipes.

7.7.2 Other wearing courses

The resolving of these points will be developed as discussed above, following TBC criteria (if the project is submitted to the TBC), and in a general way, unless the process is described differently.

Fixtures with vertical features. In general, the waterproofing at this point will be solved as it appears in the details of section 12.2.3.

12.3.1. The waterproofing of the body starts with the application of a bituminous primer (CURIDAN or IMPRIDAN 100) to a height of 20 cm above the wearing course and then welded with a lower reinforcing STRIP E 30 P ELAST (32 cm wide, 10 cm horizontal and 22 vertical) or with ESTERDAN 30 P ELAST, the size of which is sufficient to rise 15 cm above the wearing course.

The main waterproofing membrane will be welded onto the horizontal section of this reinforcing strip and then a finishing strip formed by the main sheet will be welded onto them.

This finishing strip shall have a minimum dimension of 25 cm horizontally and vertically shall rise 20 cm above the protective layer (this height may be 15 cm in those constructions not subject to the TBC). It will be completely welded to the vertical support and to the waterproofing of the main horizontal section.

Finally, to prevent rainwater or sliding water from filtering through the upper part of the waterproofing, the following can be done:

- An undercut of at least 3 x 3 cm in which the waterproofing must be embedded with a bevelled mortar forming approximately an angle of 30° with the horizontal, rounding the edge of the wall. Subsequently the undercut will be sealed with a mastic / putty or with a shrink-proof mortar.
- A recess with a depth with respect to the external surface of the vertical wall of

5 cm. Later this undercut will be covered with a layer of mortar

- A metal section fixed to the vertical feature. The fastening will consist of galvanized steel anchor and screw (never a nail). The fastenings will be arranged every 25 cm. This metal section will be sealed at the top.

This solution can be extended to any emergent elements, such as walls, fixtures with existing buildings, door thresholds, window sills or conduit passages.

If necessary, the fixture between the horizontal and vertical surfaces can be rounded off with a half column with a curvature radius of approximately 5 cm or bevelled by an analogous measurement. For the realization of this half column, the use of fast set mortar is recommended.

In fixtures with waterproofed surfaces in situ with mortars, the height of 15 or 20 cm indicated above may be reduced, considering that these mortars must be previously evaluated by means of a valid TSD or TSD plus, taking into account all the indications set out therein and that, in particular, the wall is properly stabilized and presents no risk of cracking.

In the event that the height of the wall does not exceed

20 cm, the waterproofing will extend horizontally, covering the top of the wall.

In the case of door thresholds, when the use requirements do not allow the placement of steps, one of these solutions can be chosen:

Option 1: With the waterproofing set back from the vertical surface 1 m minimum.

The floor up to the access should have a slope of 10% outwards and should be treated as the cover, except for access cases in balconies that pour the water freely without ledges, where the minimum slope is 1%.

Option 2: Arrange in front of the door and extending a minimum of 30 cm on both sides of the jambs, a gutter integrated in the skirt, with a depth ≥ 15 cm and a width ≥ 30 cm.

In the case of glazing that starts from the floor, the above-mentioned instructions can be followed for the thresholds of the doors.

The waterproofing of the horizontal section will connect with the perimeter basement wall of our structure. In the corner a reinforcement made with the REINFORCING STRIP E 30 P ELAST, ESTERDAN 30 P ELAST or SELF-ADHESIVE ESTERDAN

30 P ELAST is placed. Subsequently, the

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waterproofing of the deck on the side of the wall until the height of the edge beam of the flooring is exceeded by 10 cm (see detail in section 12.3.2).

Sinks. In general, the waterproofing at this point will be solved as it appears in the details of section 12.3.4.

Once the support is primed, a lower reinforcing piece that is larger in size by 15 cm than the wings of the EPDM housing is welded by torch with an overlap to it. The sheet used is ESTERDAN 30 P ELAST.

The EPDM housing is welded onto this lower reinforcing strip.

Following this, the waterproofing of the horizontal section is carried out, and is later trimmed in the extraction area of the drainpipe.

In order to avoid reverse slopes and accumulations of water, it is recommended to lower the feature that supports the waterproofing in the area near the sinks.

Suitable EPDM housings with vertical or horizontal outlet with wings will be used to construct these singular points.

All drains must be equipped with a suitable device (mesh strainer, sprinkler, drain basket, etc.) to retain any solid element that could block the drainpipes.

Expansion joints. The completion of the expansion joints will be carried out in accordance with the indications given in point 12.3.4.

The expansion joints can be solved using prefabricated joints or using sheet bellows. The decision of which type of joint to use will belong to the designer, who according to the different considerations of the project will evaluate the most appropriate system.

If using prefabricated expansion joints, see section 7.7.1 Expansion joints.

The resolution of the expansion joints will vary depending on the slope of the deck (<1% or ≥ 1%). They should be structural expansion joints or waterproofing support expansion joints (thermal insulation, slope material, etc.) and depending on the type of traffic and the possible movements of the structure.

Prior to the execution of the expansion joint, the support has been primed.

When the cover has a slope <1%, two adhesive strips are attached to the support with a torch, one on each side of the joint, with a minimum width of at least 25 cm. The sheet used is STRIP E 30 P ELAST. This adhesive strip is not necessary in the case of a structural joint when the cover has a slope ≥ 1%.

Subsequently a lower reinforcement joint strip is placed, centred on the joint and at least 45 cm wide, attached to the adhesive strip or the support, making a downwards bellows seal. The sheet used is ESTERDAN 40 P ELAST.

The waterproofing membrane is then applied until it reaches the edge of the expansion joint, ending when it reaches the expansion joint. The waterproofing is applied with a torch to the lower reinforcing strip. The expansion joint is filled with JUNTODAN.

Finally, an upper reinforcing joint strip is placed, centred on the joint and at least 50 cm wide, applied to the waterproofing with a torch, making an upwards bellows seal. The sheet used is the main one of the horizontal section.

The auxiliary expansion joint of the waterproofing support can also be made with reinforcing strips which are welded to the support and to each other with a torch, the adhesive strips (13) not being necessary in this case.

However, as mentioned in the UNE 104401 Standard, waterproofing support auxiliary joints are not necessary unless it is subject to large movements. In the event that it is necessary to make auxiliary joints for the waterproofing support, these can be solved with a REINFORCING STRIP AND 30 P ELAST or with a ESTERDAN 30 P ELAST strip cut to 30 cm.

These products are placed centrally on the joint and welded to the support. The waterproofing system is placed above it, attached to the aforementioned strip.

The base support shall respect the structural joint and its edges shall be blunt, at an angle of approximately 45° and the width of the joint shall be greater than 3 cm.

7.8 Repairs

In areas damaged by tearing or puncture, a piece of the same sheet will be welded, covering the entire affected area. It should be welded by following the same indications described in the implementation of the waterproofing membrane.

If there are bubbles due to lack of adhesion, this part will be removed, or an X-shape cut made in the bubble and these parts glued to the support.

Then a piece of sheet 15 x 15 cm larger than the removed piece is welded.

(13) According to Standard 104401, the lower sheet reinforcements that are placed on each side of the expansion joint are called adhesive strips.

In the case of repairs in solutions in which the asphalt has been poured directly onto the waterproofing, proceed as follows:

- The asphalt layer and the waterproofing are to be cut with a disk until reaching the support.
- The asphalt layer and the waterproofing are to be removed.
- The vertical edge of the existing asphalt is to be smoothed by mechanical means (milling machine, thermal lance, etc.) to improve the adhesion with the new asphalt.
- The surface of the horizontal support is to be prepared where it is to be re-waterproofed. It may be necessary to apply some type of mechanical treatment to prepare this adequately (shot blasting, sand blasting, etc.).
- The horizontal support is to be primed and a new waterproofing system is to be applied up to the existing asphalt.
- The fixture between the old asphalt and the new waterproofing system with bituminous mastic is to be sealed by means of the JUNTODAN profile or by melting mastic from the waterproofing sheets.
- The vertical edge of the existing asphalt is to be primed with melted mastic of the waterproofing sheets.
- The new asphalt is to be laid.

7.9 Service Testing

With regard to welding and waterproofing tests of waterproofed surfaces, whenever possible, two service tests will be carried out: one of them when the waterproofing is finished and another one when the entire work is finished.

The test consists of flooding the waterproofed area to a level of 5 cm above the waterproofing, and maintaining it for a period of between 24 and 48 hours.

Drainage elements shall be provided to allow water drainage in the event of rain.

In case of not being able to carry out the water tightness test through a flood, it will be undertaken by means of continuous irrigation over a period of between 48 and 72 hours.

8. WHERE USED

Until the date of application of the Technical Suitability Document, and according to the manufacturer's reference, the surface area has been approximately 400,000 m², with the following works being cited as a reference:

- Santiurde Viaduct. A-67 Meseta Motorway. Pesquera-Reinosa Subsection Santiurde (Cantabria). 13,000 m². 2007.

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- New high speed rail access to Levante. Section: Monóvar- Novelda. Alicante. 2 panels. 22,000 m². 2007.
- New high speed rail access to Galicia. Section: Lalín-Santiago de Compostela. Silleda subsection Pontevedra. 4 panels. 31,000 m². 2010.
- High speed railway line to Levante and the Murcia region. Villena-Sax section. Alicante. Various panels 35,000 m². 2010.
- Estate: Mercado de Abastos. Pza. Santa Bárbara, w/o number 01004 Vitoria (Alava). 1,800 m². 2005.
- Deck of Botanical Gardens car park. Florida Park 01008 Vitoria (Alava). 1,700 m². 2005.
- M-30 Tetuán Connection Underpass. Madrid. 15,000 m². 2006.
- Underground car park. Avda. de la Libertad, w/o number. 30009 Murcia. 8,200 m². 2010.
- SC-20 Underpass Cornes-Hórreo section, calle Hórreo, s/n. 15702 Santiago de Compostela (A Coruña). 11,000 m². 2011.
- Mercadona Puerto del Rosario Car Park. La Hondura Industrial Estate Calle los Alisios, s/n . 35600 Puerto del Rosario (Las Palmas). 4,000 m². 2011.
- C.C Gran Plaza 2 Majadahonda Car Park C/ de los Químicos, 2. 28222 Majadahonda (Madrid). 21,500 m². 2011.
- New Car Park Tenerife Airport North. San Cristóbal de La Laguna. Santa Cruz de Tenerife. 11,000 m². 2011
- Alicante General Hospital Car Park Av. Pintor Baeza, 12. 03010 Alicante. 9,500 m². 2011.
- High Speed railway line Vitoria-Bilbao/San Sebastián. Aramaio-Mondragón section. Álava. 16,000 m². 2012.
- High Speed railway line Palencia-León. Palanquinos section. Palencia. 19,000 m². 2012.
- High Speed railway line Galicia. A Vacariza-Realíño section. A Coruña. 41,000 m². 2012.
- C.C. Carrefour Oiartzun Car Park. Madrid-Irún Road Km. 469. 20180 Oiartzun (Guipúzcoa) 20,000 m². 2013.
- High Speed railway line Galicia. Realíño-Padrón section. A Coruña. 39,000 m². 2013.
- C.C Plaza Loranca 2 Car Park Avda. Pablo Iglesias, 17. 28942 Fuenlabrada (Madrid). 15,500 m². 2014.
- Alcampo El Ferrol Car Park Ensenada de la Gándara Industrial Estate. 15407 El Ferrol (A Coruña). 14,500 m². 2014
- High Speed railway line Madrid-Extremadura. Talayuela-Cáceres. Section: Cañaveral-Embalse de Alcántara. 30,600 m². 2014.
- Antequera Ctra High Speed Train Station MA-5406, Km.6. 29540 Antequera (Málaga). 13,200 m². 2015.
- High Speed railway line Vitoria-Bilbao/San Sebastián. Ezkio- Itsaso Section. Guipúzcoa. 22,000 m². 2015.
- High Speed railway line Galicia. Lánacara-Puebla de San Julián Section. Lugo. 19,000 m². 2015.

Some of these works have been visited by technicians of the IETcc, and in addition a survey has been carried out amongst system users regarding their behaviour, with satisfactory results.

9. TESTS

The following tests have been carried out at the Eduardo Torroja Institute of Construction Science, or in other laboratories, under its supervision.

9.1 Asphalt sheet

9.1.1 Sheet identification tests

The results of the identification tests obtained are within the tolerances given by the manufacturer and recorded in point 2.

9.1.2 Tests of sheet suitability and durability

External fire behaviour. See table 1.

Reaction to fire. Classification E, according to the UNE-EN 13501 standard.

Emission of dangerous substances. According to the manufacturer's declaration, the product does not contain hazardous substances according to the current EU data base.

Adhesion to the support (UNE-EN 13596). The two primer types given by the manufacturer were tested together with the two types of APP and SBS sheet and over the different finishes before and after ageing.

Sample	Primer	Initial (MPa)	Water ageing
SBS Sheet	Curidan	0.6	0.2
+ Concrete	Impridan	0.5	0.1
APP Sheet	Curidan	0.5	0.4
+ Concrete	Impridan	0.8	0.2
Slate Sheet	-----	0.75 / 0.5	0.2/--.
+ Mastic / Agglomerate	-----	1 / 0.8	0.2 / ---
Sand sheet	-----	1.2 / 0.2	0.05 / ---
+ Mastic / Agglomerate	-----		
Geotextile sheet + Mastic / Agglomerate	-----		

Solder shear test (UNE-EN 12317-1). The test is performed with the samples before and after ageing in water with the two different mastics.

Sample	Initial(N/5cm)	Water
Polydan 60 TF Elast (SBS)(L/T)	655 / 733	635 / 645
Polydan 180-48 AP Canales (APP) (L/T)	602 / 625	562 / 577

Dimensional stability (UNE-EN 1107-1). The sheets in contact with asphalt agglomerate will be measured at 160°C for 1 h, the rest 24 h at 80°C.

Sample	T °C	%
Glasdan 30 P Elast	80	0
Polydan 60 TF Elast:	80	0.1
Polydan 60 TF Elast:	160	0.6
Polydan 180-60 GP Elast:	80	0.2
Polydan 180-60 GP Elast:	160	0.3
Polydan 48 P Parking.	80	0.2
Polydan 48 P Parking.	160	0.9
Polydan 40 P Elast	80	0.2
Polydan 180-48 AP Canales:	80	0.1
Polydan 180-48 AP Canales:	160	0.3
Polydan 180-40 P Elast:	80	0.2
Esterdan Plus 50/GP Elast Verde	80	0.2

Water tightness (UNE-EN 1928). The sealing of the sheet is determined at a pressure of 0.6 bar on its overlap and the overlap once aged to the heat.

Sample	Initial	Heat
Membrane	Waterproof	Waterpr
Overlap	Waterproof	Waterpr

Creep (UNE-EN 1110). The creep was determined on the different mastic and reinforcement meshes, before and after heat ageing. The creep is less than 2 mm at the following temperatures

Membranes	Initial (°C)	Heat
Glasdan 30 P Elast	120	115
Polydan 60 TF Elast:	120	120
Polydan 180-48 AP Canales:	120	120
Esterdan Plus 50 GP Elast	120	120

Low Temperature Flexibility (UNE-EN 1109). The tests were carried out on major-minor mass sheets, with different types of mesh and mastics, before and after heat ageing.

Membranes	Initial (°C)	Heat
Glasdan 30 P Elast	≤ 20	≤ 15
Polydan 60 TF Elast:	≤ 15	≤ 15
Polydan 40 P Elast	≤ 20	≤ 15
Polydan 180-48 AP	≤ 20	≤ 20
Esterdan Plus 50 GP Elast	≤ 15	≤ 15

Determination of ability to bridge cracks (UNE-EN 14224). The test was carried out at -10°C.

Sample	Behaviour
Polydan 60 TF Elast:	Suitable
Polydan 48 P Parking.	Suitable
Polydan 180-60 GP Elast:	Suitable
Polydan 40 P Elast	Suitable
Polydan 180-48 AP Canales:	Suitable
Esterdan Plus 50 GP Elast Verde	Suitable
Polydan 180-40 P Elast:	Suitable
Esterdan Plus 50/GP Elast Verde	Suitable

Sealing under dynamic pressure (UNE-EN 14694). Sealing was determined after pre-treatment degradation.

Sample	Behaviour
Polydan 60 TF Elast:	Suitable
Polydan 48 P Parking.	Suitable
Polydan 40 P Elast	Suitable
Polydan 180-60 GP Elast:	Suitable
Polydan 180-48 AP Canales:	Suitable
Esterdan Plus 50 GP Elast Verde	Suitable

(14) The difference in dimensional stability at 160°C between the 4 sheets is due to the different weight of the inner reinforcement and in the case of the POLYDAN 48P Parking, also to the outer geotextile.

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Water absorption (UNE-EN 14223). Samples are immersed for 28 days in water at 23°C. This test was carried out on the various types of mastic and inner reinforcement mesh.

Sample	Water absorption
Polydan 60 TF Elast:	0.96
Polydan 48 P Parking.	1.2
Polydan 180-48 AP	0.7
Polydan 180-60/GP Elast	0.47

Resistance to compression of an asphalt layer (UNE-EN 14692 (method 2)). The asphalt mass (230°C) (UNE-EN 13375) is applied and compacted on the waterproofing sheet with a geotextile. The sheet is allowed to cool and the sheet is removed for visual inspection and leakproofness testing (UNE-EN 1928) at a pressure of 100 kPa (10 m) for 24 hours. It is only done on the sheets that will be in contact with the asphalt.

Sample	Appearance	Sealing
Polydan 60 TF Elast:	Good	Suitable
Polydan 48 P Parking.	Good	Suitable
Polydan 180-60 GP Elast:	Good	Suitable
Polydan 180-48 AP	Good	Suitable

Behaviour upon application of an asphalt mastic (UNE-EN 14693). The asphalt mastic is poured at 230°C (UNE-EN 13375) on the asphalt sheet for two minutes and allowed to cool for at least eight hours before removing the frame. It is then determined whether mastic particles have penetrated the membrane and what changes have occurred in the sheet's thickness. It is only done on the sheets that will be in contact with the asphalt.

Sample	Particles embedded in mastic	Mastic surface particles	Thickness change
Polydan 60 TF Elast:	None observed		
Polydan 48 P Parking.	None observed		
Polydan 180-60 GP	None observed		
Polydan 180-48 AP Canales:	None observed		

Compatibility by thermal ageing (UNE-EN 14691). The change in peel strength of a test piece (support + waterproofing sheet + asphalt) is determined when subjected to an accelerated thermal conditioning of 91 days at 50°C from the initial amount. The test was carried out with the different types of primers, mastics and finishes of the sheets.

Asphalt mastic (230 °C)	Peeled I / E (MPa)	% Compati
Polydan 60 TF Elast:	0.25 / 0.35	100
Polydan 60 TF Elast + Impridan 100	0.27 / 0.3	100
Polydan 48 P Parking + Curidan	0.3 / 0.45	100
Polydan 48 P Parking+ Impridan 100	0.35 / 0.5	100
Polydan 180-48 AP Canales +Curidan	0.59 / 0.56	100
Polydan 180-48 AP Canales+ Impridan 100	0.69 / 0.64	95
Asphalt agglomerate (160°C)	Peeled I / E (MPa)	% Compati
Polydan 60 TF Elast + Impridan 100	0.19 / 0.24	100
Polydan 48 P Parking + Impridan 100	0.2 / 0.23	100
Polydan 180-48 AP Canales + Impridan 100	0.22 / 0.27	100

Resistance to oxidation (UNE-EN 14575). The tensile-elongation properties are determined after subjecting the sample to 85°C for 90 days. The properties of the sheets have not been modified.

Resistance to microorganisms The test was carried out according to the UNE-EN 12225 standard for 30 weeks. No loss of tensile / elongation properties or loss of mass was observed.

Chemical resistance The compatibility of bituminous membranes is set out in UNE-EN 13969 and 13707.

Water resistance The sample is immersed in water for 21 days at T°C 22°C and the shear test of the joint and the adhesion to the support are performed immediately after removing the models from the water.

Thermal ageing (UNE-EN 1296). The sheets are aged 90 days at 70°C. The sealing of the joint was then determined, the folding at low T°C and creep.

9.2 Geotextile

The tests required for the evaluation of this geotextile were those made to obtain the CE marking in accordance with the ZA annex of the UNE-EN 13265 standard, such as protection geotextile.

9.3 Compatibility: system components

The compatibility of the system is achieved through the use of separation layers, which are compatible with the elements in contact.

10. EVALUATION OF SUITABILITY FOR USE AND DURABILITY

10.1 Compliance with national regulations

Security in case of fire. There is no requirement for these type of products in the TBC. The fire reaction rating of this product is E.

Hygiene, health and environment. Once installed, the systems evaluated do not release hazardous particles or toxic gases that could contaminate the environment.

The vapour permeability of the system is very low and should be considered as a vapour barrier.

The performance of this waterproofing system (static and dynamic puncture resistance, tear resistance, crack bridging capabilities, resistance to asphalt, etc.) are sufficient to withstand the stresses to which they will be subjected, wearing courses with the possibility of a large volume of heavy vehicles and guarantee the

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waterproofing of the bridge or any other wearing course where it has been installed.

The chemical resistance of bituminous waterproofing is detailed in Annex A of UNE-EN 13969 and 13707. In cases where the system comes into contact with another type or concentration of substances, consult the manufacturer.

Conclusions. The configurations of the systems for the waterproofing bridges and other wearing courses (concrete structures), which will be subjected to the traffic of vehicles, whether finished with asphalt, concrete, pavement or terrain, provided that they have been properly executed on site, prevent the passage of liquid water, thus avoiding the presence of moisture inside the work once completed, thanks to both the composition of the systems themselves, the nature of their main components and the resolution of the singular points through the opportune accessorial features.

From the set of tests, visits to works and to the factory, as well as from the tests carried out, no incompatibility between the components of the evaluated systems and the performance of the product has been observed during its service life.

These systems meet the Basic Requirement HS 1 for moisture protection set out in Article 13.1 of part 1 of the TBC and can be considered to achieve the degree of impermeability required for roofing.

10.2 Use Limitations

To avoid mechanical damage, it is recommended to protect the membrane as soon as possible. In addition, when using POLYDAN 40 P ELAST as a top sheet, the membrane cannot remain exposed to the weather.

SPEAKER:

Dr. J. Rivera Lozano
Chemical Sciences

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11. OBSERVATIONS BY THE COMMITTEE OF EXPERTS ⁽¹⁵⁾

The main observations made by the Committee of Experts (16), at a meeting held at the Eduardo Torroja Institute of Construction Science, on July 4, 2016, were the following:

- Particular attention should be paid to all products that are complementary to the sheet and which are required for the solution of the individual points.
- In the event of transit with vehicles crossing the waterproofing, this committee considers it necessary to protect the waterproofing before the application of the wearing course.
- The expansion joints of concrete bridge panels defined in paragraph 7.7.1 cannot be regarded as watertight, which should be taken into account if used in other uses.
- The repair proposed in point 7.8 in the event of the asphalt being poured directly onto the waterproofing does not guarantee the continuity of the waterproofing,
- Particular care must be taken in implementing the protection and / or finishing units on the waterproof sheet.

⁽¹³⁾ The purpose of the Committee of Experts in accordance with the DIT Regulation (O.M. 23/12/1988) is to advise on the test plan and the procedure to be followed for the technical evaluation proposed by the IETcc.

The comments and observations made by the members of the Commission do not in themselves constitute a technical endorsement or recommendation of preferential use of the evaluated system.

The responsibility of the Committee of Experts does not extend to the following:

- Intellectual property or patent rights of the product or system.
- Marketing rights of the product or system.
- Works executed or in execution in which the product or system has not been installed, used or maintained on its design, construction methods or training of intervening operators.

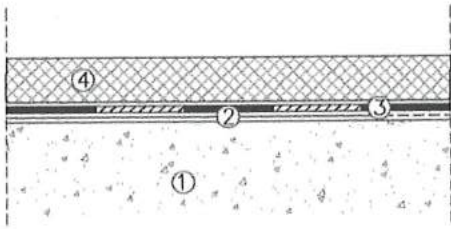
⁽¹⁴⁾ The Committee of Experts was composed of representatives of the following organizations and entities:

- AENOR.
- ACCIONA INFRAESTRUCTURAS S.A. ENGINEERING DEPARTMENT
- Higher Council of the Colleges of Architects of Spain. (CSCAE).
- FERROVIAL-AGROMÁN, S.A.
- Technical University of Madrid (UPM).
- Army Engineers Laboratory
- Higher Technical School of Civil Engineering
- Eduardo Torroja Institute of Construction Science (IETcc).

11. GRAPHIC DOCUMENTATION

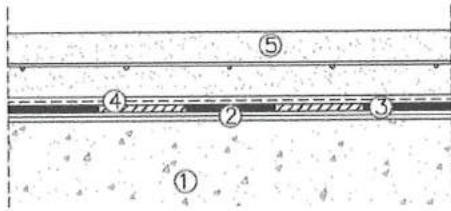
12.1 Systems: Main Section

12.1.1 Bridges (road plates with asphalt finish)



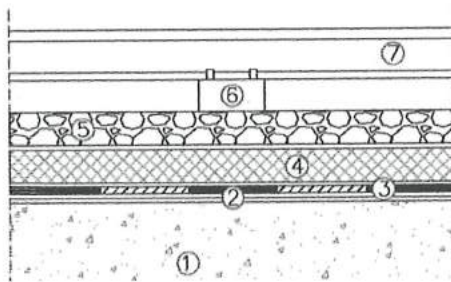
1. Plate
2. Primer
3. Waterproof Membrane
4. Asphalt Agglomerate (7 cm)

12.1.2 Bridges (concrete plates with concrete finish)



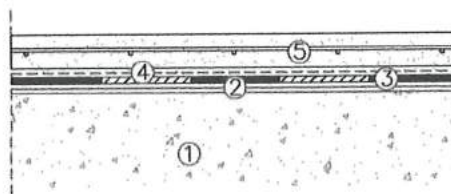
1. Board
2. Primer
3. Waterproof Membrane
4. Puncture resistant filter cover
5. Wearing course: Reinforced concrete

12.1.3 Bridges (railway panels with asphalt protection)



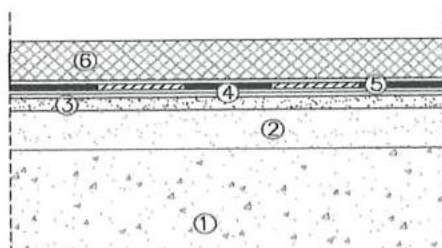
1. Panel
2. Primer
3. Waterproof Membrane
4. Protection: Micro-agglomerate
5. Roadbed
6. Sleepers
7. Rails

12.1.4 Bridges (railway panel with concrete protection)



1. Board
2. Primer
3. Waterproof Membrane
4. Puncture resistant filter cover
5. Protection: Reinforced concrete

12.1.5 Other wearing courses intended for vehicular traffic. Asphalt agglomerate directly on waterproofing

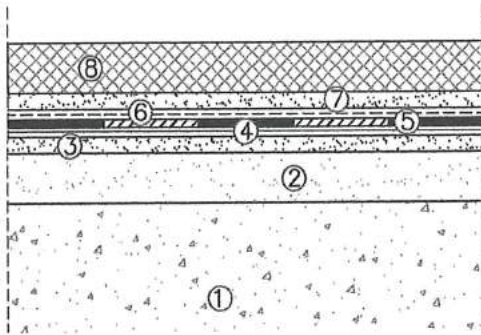


1. Support
2. Slope Material (if necessary)
3. Mortar layer (if necessary)
4. Primer
5. Waterproof Membrane
6. Asphalt agglomerate

Fernanda

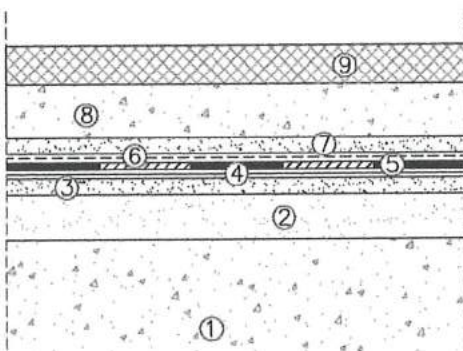
12.1.6 Other wearing course intended for vehicular traffic. Paved wearing course (concrete, slabs, asphalt agglomerate, etc.) on a protection layer

Solution 1. Without thermal insulation



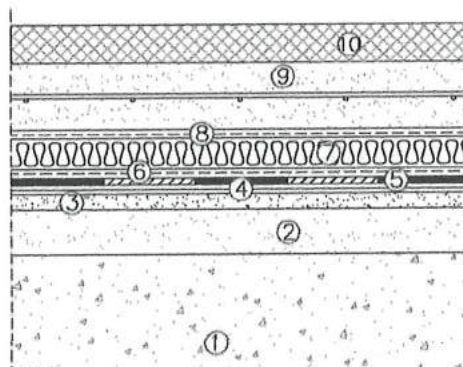
1. Support
2. Slope Material (if necessary)
3. Mortar layer (if necessary)
4. Primer
5. Waterproof Membrane
6. Puncture resistant filter cover
7. Protection
8. Wearing course

Solution 2. Without thermal insulation and with filler layer



1. Support
2. Slope Material (if necessary)
3. Mortar layer (if necessary)
4. Primer
5. Waterproof Membrane
6. Puncture resistant filter cover
7. Protection
8. Filler
9. Wearing course

Solution 3. Without thermal insulation

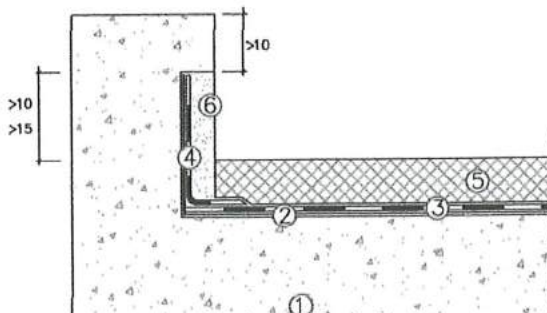


1. Support
2. Slope Material (if necessary)
3. Mortar layer (if necessary)
4. Primer
5. Waterproof Membrane
6. Puncture resistant filter cover
7. Thermal insulation.
8. Puncture resistant filter cover
9. Concrete slab.
10. Wearing course

12.2 Unique points bridge boards (road and rail)

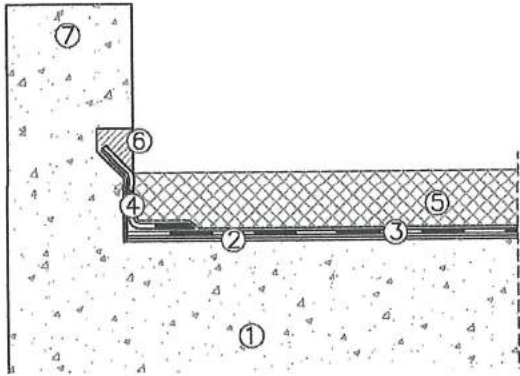
12.2.1 Fixture with vertical elements

Image 1



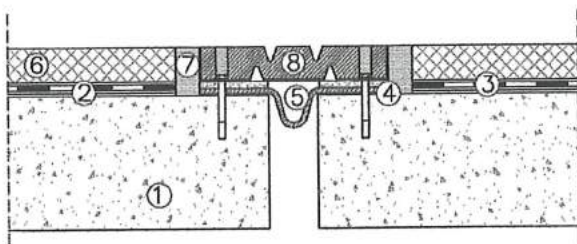
1. Support
2. Primer
3. Waterproof Membrane
4. Body Finish Strip
5. Agglomerated wearing course
6. Protection layer

Image 2



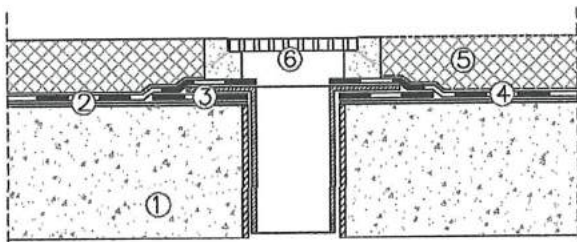
1. Support
2. Primer
3. Waterproof Membrane
4. Body Finish Strip
5. Agglomerated wearing course
6. Waterproofing mortar
7. Vertical concrete feature

12.2.2 Expansion joints



1. Support
2. Primer
3. Waterproof Membrane
4. Levelling (if necessary)
5. Elastic material (if necessary)
6. Agglomerated wearing course
7. Transition
8. Prefabricated joint

12.2.3 Sinks

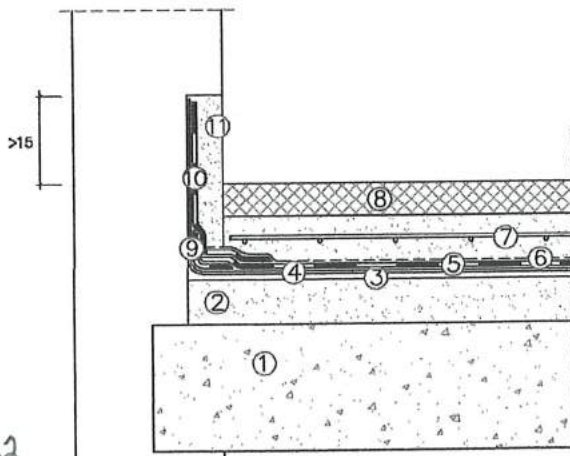


1. Support
2. Primer
3. Reinforcement strip. Esterdan 30 P ELAST
4. Waterproof Membrane
5. Agglomerated wearing course
6. Sink with grid

12.3 Singular points. Other wearing courses intended for vehicle traffic

12.3.1 Fixture with vertical elements

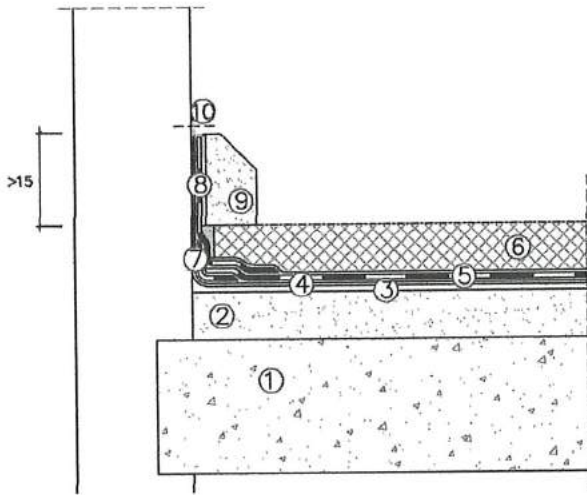
Image 1



1. Support
2. Slope Material (if necessary)
3. Mortar layer (if necessary)
4. Primer
5. Waterproof Membrane
6. Puncture resistant filter cover
7. Mortar / Concrete Layer
8. Wearing course
9. Reinforcement strip.
10. Wall finish strip
11. Protection layer

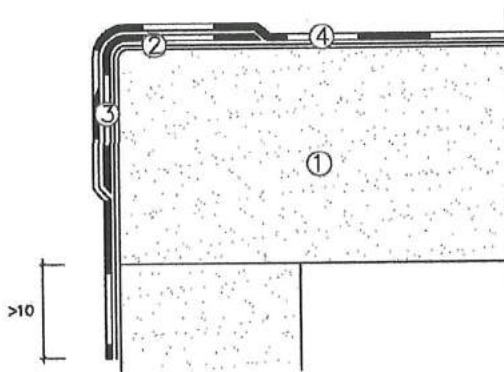
22

Image 2



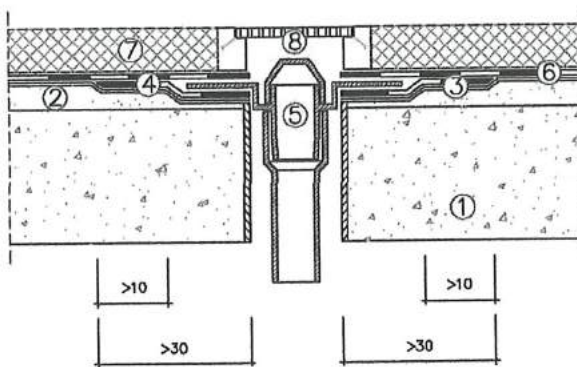
1. Support
2. Slope Material (if necessary)
3. Mortar layer (if necessary)
4. Primer
5. Waterproof Membrane
6. Asphalt agglomerate
7. Reinforcement strip.
8. Body Finish Strip
9. Curb
10. Sealing material

12.3.2 Fixture with perimeter wall



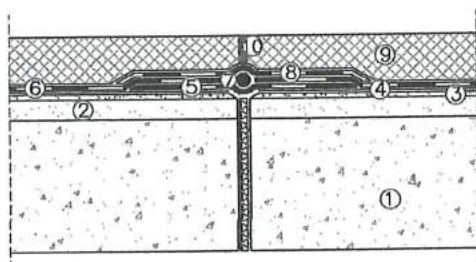
1. Support
2. Primer
3. Reinforcing strip.
4. Waterproof Membrane

12.3.3 Sinks



1. Support
2. Slope Material (if necessary)
3. Primer
4. Reinforcement strip.
5. Drain housing
6. Waterproof Membrane
7. Asphalt agglomerate
8. Mesh strainer

12.3.4 Expansion joints



1. Support
2. Slope Material (if necessary)
3. Mortar layer (if necessary)
4. Primer
5. Lower reinforcing strip in joints
6. Waterproof Membrane
7. Filler material
8. Lower reinforcing strip in joints
9. Asphalt agglomerate
10. Sealing material