



# ENVIRONMENTAL PRODUCT DECLARATION

*In accordance with ISO 14025  
and EN 15804:2012+A2:2019/AC:2021 for:*

**MAPEPLAN T TU**  
(TPO/FPO waterproofing membrane for tunnelling)



An EPD should provide current information and may be updated if conditions change. The stated validity is, therefore, subject to the continued registration and publication at [www.environdec.com](http://www.environdec.com).

Programme: <b>The International EPD® System;</b> <a href="http://www.environdec.com">www.environdec.com</a>	Programme operator: <b>EPD International AB</b>	EPD registration number: <b>S-P-01106</b>	Publication date: <b>2017-04-06</b>	Valid until: <b>2028-07-19</b>	Revision date: <b>2023-07-20</b>	Geographical scope: <b>Global</b>
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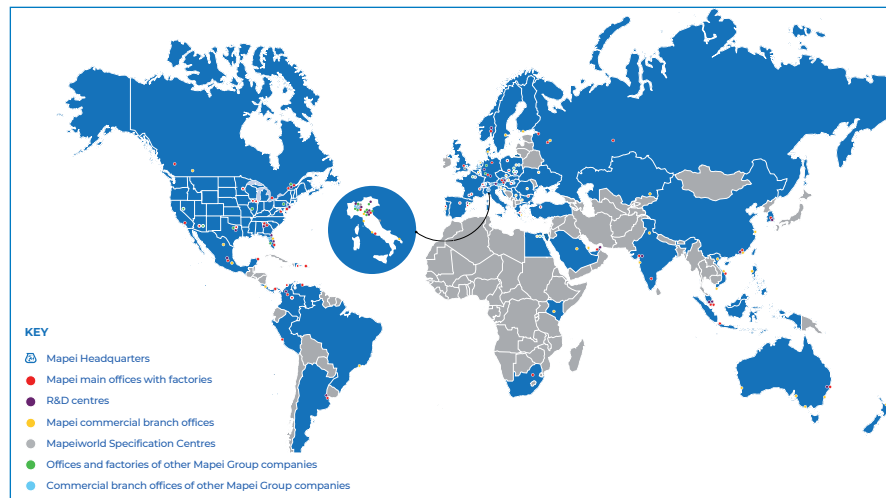


## 1. COMPANY DESCRIPTION / GOAL & SCOPE

Founded in 1937 in Milan, Italy, Mapei produces adhesives and complementary products for laying all types of floor, wall and coating materials, and also specializes in other chemical products used in the building industry, such as waterproofing products, specialty mortars, admixtures for concrete, cement additives, products for underground constructions and for the restoration of concrete and historical buildings.

There are currently 100 subsidiaries in the Mapei Group, with a total of 86 production facilities located around the world in 36 different countries and in 5 different continents. Mapei also has 32 central laboratories. Most locations are ISO 9001 and ISO 14001 or EMAS-certified.

Mapei invests 12% in its company's total workforce and 5% of its turnover in Research & Development; in particular, 70% of its R&D efforts are directed to develop eco-sustainable and environmentally friendly products, which give important contribution to all major green rating systems for eco-sustainable buildings such as LEED and BREEAM.



**LEED V4.1** is the latest version of Leadership in Environmental and Energy Design, an American protocol that enables buildings to be certified as eco-sustainable according to parameters

and credits described in the most widely adopted green building criteria in the world. Issued by the GBC US, it is mandatory for all LEED projects registered after October 2016.

Numerous changes have been made to the previous version: Mapei products play a part in obtaining important credits thanks to their EPD's (type III environmental declarations) and their products with very low emission of VOC.

Launched in the UK in 1990, **BREEAM** (BRE Environmental Assessment Method) is a protocol for sustainable building practices adopted mainly in the United Kingdom and in Scandinavian countries with the version **BREEAM NOR**.

By adopting this protocol, thanks to their EPD's and very low emission of VOC, Mapei products help towards obtaining relative credits.

Furthermore, Mapei has developed a sales and technical service network with offices all over the world and offers an efficient Technical Assistance Service that is valued by architects, engineers, contractors and owners.

The goal of the study is to provide necessary data and documentation to produce an EPD according to the requirements of PCR Environdec (version 1.11, 2021-02-05) under EN 15804:2012+A2:2019/AC:2021 and to have more comprehension about the environmental impacts related to **Mapeplan T TU** manufactured in Ponte di Piave (TV-Italy). Polyglass S.p.A. is part of MAPEI Group since October 2008.

Target audiences of the study are customers and other parties with

an interest in the environmental impacts of **Mapeplan T TU** and its auxiliary materials (Polydren PP HT, Mapeplan T disk and Mapeplan T waterstop). This analysis shall not support comparative assertions intended to be disclosed to the public.

## 2. PRODUCT DESCRIPTION

**Mapeplan T TU** is a flexible polyolefin TPO/FPO waterproofing membrane produced in one multi-extrusion coating process, with high quality raw materials. It is used for underground structures, open cut, drill and blast tunnel.

**Polydren PP HT** is a 100% polypropylene woven-non-woven geotextile, used as compensation, levelling, protection and filter layer.

**Mapeplan T disk** is a TPO fixing element to apply the waterproofing membrane and provides a temporary support.

**Mapeplan T waterstop** is a TPO/FPO profile designed to waterproof joints.

**Mapeplan TTU** membrane is compliant with EN13491 ("Geosynthetic barriers. Characteristics required for use as a fluid barrier in the construction of tunnels and associated underground structures").

Products involved in this study are supplied as follow:

- **Mapeplan T TU**: wooden pallet with rolls containing 20m of product (588m<sup>2</sup>) wrapped with LDPE
- **Polydren PP HT**: no standard packaging exists; it depends on customer requests. In this study it has been considered a

wooden pallet with rolls with 20m of product (as Mapeplan T TU) wrapped with LDPE.

- **Mapeplan T disk**: LDPE wrapped wooden pallet with 24board boxes which contains 250 disks apiece.
- **Mapeplan T waterstop**: no standard packaging exists; it depends on customer requests. No packaging materials have been considered for this component in this study (see § 5 "Cut-off criteria").

## 3. CONTENT DECLARATION

The main components and ancillary materials of **Mapeplan T TU** are the following:

*Table 1: Composition referred to 1 kg of finished product with packaging*

Materials	Percentage (%) by mass
TPO/FPO Compound	< 97%
Pigments	< 5%
Other additives	<1%
Packaging	Percentage (%) by mass
Pallet (WOOD)	< 5%
Cardboard	< 3%
Plastic PP	< 3%
Plastic PE	< 0,5%

The product does not contain a concentration higher than 0,1% (by unit weight) of either carcinogenic substances or substances of very high concern (SVHC) on the REACH Candidate List published by the European Chemicals Agency.

## 4. DECLARED UNIT AND REFERENCE SERVICE LIFE

The declared unit (DU) is 1 m<sup>2</sup> of finished product having a 2,0 mm thickness, including ancillary components necessary for a suitable installation and packaging.

The following table contains the detailed quantities used for the DU.

*Table 2: Amount of single component used for DU.*

Product	Quantity (kg)	Percentage (%)
Mapeplan T TU	2,000	61
Polydren PP HT	0,990	30
Mapeplan T disk	0,120	4
Mapeplan T waterstop	0,155	5
TOT.	3,265	100

## 5. SYSTEM BOUNDARIES AND ADDITIONAL TECHNICAL INFORMATION

The approach is “cradle to gate” (A1–A3) with modules C1–C4 and module D and optional modules (A1–A3 + A4 – A5 + C + D):

- A1, A2, A3 (Product stage): extraction and processing of raw materials and packaging (A1), transportation up to the factory gate (A2), manufacturing of the finished product (A3).
- A4 – A5 (Construction process stage): transport of the finished product to final customers and installation into the building.
- C1, C2, C3, C4 (End of Life stage): With a collection rate of 100% as C&D waste, the transports are carried out by lorry over 100 km (C2). The recycling ratio (C3) is considered as 0% and the 100% is landfilled (C4).
- D (Resource recovery stage): reuse, recovery and/or recycling potentials, expressed as net impacts and benefit

Table 3: System boundaries

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X
Geography	EU	EU, IT	IT	EU	EU	-	-	-	-	-	-	-	EU, IT	EU, IT	EU	EU	IT
Specific data	> 90%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	Not-relevant					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not-relevant					-	-	-	-	-	-	-	-	-	-	-	-

MND: Module Not Declare

A brief description of production process is the following:

The production process of TPO/FPO waterproofing membranes is a multi-extrusion coating process. TPO/FPO granulate is stored in silos and sent to multi-extrusion plant. The hot melt compound comes out from the extruders where the reinforced material is combined and totally encapsulated. The membrane is cooled and finally sent to the packaging area, ready to ship.

Figure 1: Production process detail

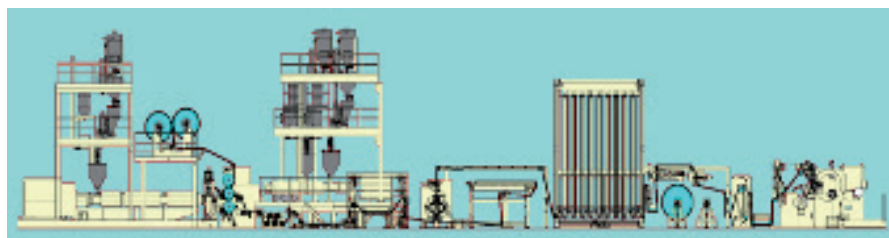


Table 4: Transport to the building site (A4)

Scenario information	Value	Unit
Means of transport: truck-trailer euro 5, gross weight 34-40 t, payload capacity 27 t		
Diesel consumption	0,002	l/100km
Transport distance (truck)	1300	km
Transport distance (ship)	500	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	-	kg/m <sup>3</sup>
Capacity utilisation volume factor	1	-

Table 5: Installation into the building (A5)

Scenario information	Value	Unit
Ancillary materials for installation	1,27	kg
Water use	0	m <sup>3</sup>
Other resources use	0	kg
Electricity for installation	0,0345	MJ
Material loss (membrane)	3	%
Overlaps (membrane)	5	%
Waste materials on building site before waste processing, generated by the product's installation (specified by type)	0,0238 (paper) 0,0144 (PP) 0,00149 (PE) 0,0233 (wood) 0,03 (Membrane Loss)	kg
Output materials (specified by type) as result of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	0,093 (Incineration)	kg
Direct emission to ambient air, soil and water	0	kg

Table 6: End of Life (C1-C4)

Scenario information	Value	Unit
Collected separately	1	kg
Collected with mixed construction waste	0	kg
Reuse	0	kg
Recycling	0	kg
Energy recovery	0	kg
Landfill	1	kg
Transport to recycling	-	km
Transport to landfill	150	km



## 6. CUT-OFF RULES AND ALLOCATION

Criteria for the exclusion of inputs and outputs (cut-off rules) in the LCA, information modules and any additional information are intended to support an efficient calculation procedure. They are not applied in order to hide data. Cut-off criteria, where applied, are described in Table 7.

Table 7: Cut-off criteria

Process excluded from study	Cut-off criteria	Quantified contribution from process
A3: finished product packaging	Packaging materials of Mapeplan T waterstop	Sensitivity study demonstrates a relative contribution lower than 0,5%
A3: Production (auxiliary materials)	Less than $10^{-5}$ kg/kg of finished product	Sensitivity study demonstrates a relative contribution lower than 0,5%
A3: production (particle emissions to air)	Less than $10^{-4}$ kg/kg of finished product	Sensitivity study demonstrates a relative contribution lower than 0,5%

For the allocation procedure and principles consider the following table (Table 8):

Table 8: Allocation procedure and principles

Module	Allocation Principle
A1	All data are referred to 1 kg of product A1: electricity is allocated to the specific production line
A3	All data are referred to 1 kg of packaged product A3-wastes: all data are allocated to the whole production plant

## 7. ENVIRONMENTAL PERFORMANCE AND INTERPRETATION



**GWP**

### Climate change

GWPTotal - Global Warming Potential refers to the emission/presence of GHGs (greenhouse gases) in the atmosphere (mainly CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>) which contribute to the increase in the temperature of the planet.

GWP-total considers:

- GWP-fossil
- GWP-biogenic
- GWP-luluc (land use and land use change)



**ODP**

### Ozone Depletion

Ozone Depletion Potential refers to the degradation of the stratospheric layer of the ozone involved in blocking the UV component of sunrays. Depletion is due to particularly reactive components that originate from chlorofluorocarbon (CFC) or chlorofluoromethane (CFM).



**AP**

### Acidification

Acidification Potential refers to the emission of specific acidifying substances (i.e. NO<sub>x</sub>, SO<sub>x</sub>) in the air. These substances decrease the pH of the rainfall with predictable damages to the ecosystem.



**EP**

### Eutrophication

Eutrophication Potential refers to the nutrient enrichment, which determines unbalance in ecosystems and causes the death of the fauna and decreased biodiversity in flora.

It considers:

- EP-freshwater: aquatic freshwater
- EP-marine: aquatic marine
- EP-terrestrial



**POCP**

### Photochemical ozone formation

The Photochemical Ozone Creation Potential is the ozone formation in low atmosphere. This is quite common in the cities where a great amount of pollutants (like VOC and NO<sub>x</sub>) are emitted every day (industrial emissions and vehicles). It is mainly diffused during the summertime.



**ADP  
minerals&metals**

### Depletion of abiotic resources – minerals and metals

Abiotic Depletion Potential elements refers to the depletion of the mineral resources.



**ADP - fossil**

### Depletion of abiotic resources – fossil fuel

Abiotic Depletion Potential fossil fuel refers to the depletion of the fossil fuel resources.



**WDP**

### Water use

It expresses the potential deprivation of water, that consists in not having the water needs satisfied.



The following tables show the environmental impacts for the products considered according to the requirements of EN15804:2012+A2:2019/AC:2021. The results are referred to the declared unit (see § 4). The additional environmental indicators are not declared.

## MAPEPLAN T TU

(1 m<sup>2</sup> of finished product)

Table 9: MAPEPLAN T TU: Potential environmental impact – mandatory indicators according to EN 15804 referred to 1 m<sup>2</sup> of finished product

Indicator	Unit	A1 – A3	A4	A5	C1	C2	C3	C4	D
<b>GWP<sub>TOTAL</sub></b>	(kg CO <sub>2</sub> eq.)	4,58E+00	1,40E-01	6,38E-01	0,00E+00	2,12E-02	0,00E+00	2,64E-02	0,00E+00
GWP <sub>FOSSIL</sub>	(kg CO <sub>2</sub> eq.)	4,59E+00	1,39E-01	2,88E-01	0,00E+00	2,10E-02	0,00E+00	2,62E-02	0,00E+00
GWP <sub>BIOGENIC</sub>	(kg CO <sub>2</sub> eq.)	-1,54E-02	4,01E-04	3,50E-01	0,00E+00	7,44E-05	0,00E+00	8,83E-05	0,00E+00
GWP <sub>LULUC</sub>	(kg CO <sub>2</sub> eq.)	3,49E-03	7,02E-04	5,15E-06	0,00E+00	1,43E-04	0,00E+00	4,84E-05	0,00E+00
ODP	(kg CFC 11 eq.)	1,94E-07	8,33E-15	1,37E-13	0,00E+00	2,08E-15	0,00E+00	6,16E-14	0,00E+00
AP	(mol H <sup>+</sup> eq.)	1,66E-02	1,24E-03	1,60E-04	0,00E+00	1,15E-04	0,00E+00	1,86E-04	0,00E+00
EP <sub>FRESHWATER</sub>	(kg P eq.)	6,49E-04	3,79E-07	4,46E-08	0,00E+00	7,57E-08	0,00E+00	4,44E-08	0,00E+00
EP <sub>MARINE</sub>	(kg N eq.)	3,37E-03	4,83E-04	6,01E-05	0,00E+00	5,56E-05	0,00E+00	4,75E-05	0,00E+00
EP <sub>TERRESTRIAL</sub>	(mol N eq.)	3,52E-02	5,33E-03	6,83E-04	0,00E+00	6,18E-04	0,00E+00	5,22E-04	0,00E+00
POCP	(kg NMVOC eq.)	1,40E-02	1,05E-03	1,57E-04	0,00E+00	1,08E-04	0,00E+00	1,44E-04	0,00E+00
ADP <sub>MINERALS&amp;METALS</sub> *	(kg Sb eq.)	3,40E-05	1,10E-08	2,84E-09	0,00E+00	2,13E-09	0,00E+00	2,69E-09	0,00E+00
ADP <sub>FOSSIL</sub> *	(MJ)	1,42E+02	1,85E+00	2,42E-01	0,00E+00	2,78E-01	0,00E+00	3,43E-01	0,00E+00
WDP*	(m <sup>3</sup> world eq.)	3,14E+00	1,15E-03	3,66E-02	0,00E+00	2,37E-04	0,00E+00	2,88E-03	0,00E+00

**GWP<sub>TOTAL</sub>**: Global Warming Potential total; **GWP<sub>FOSSIL</sub>**: Global Warming Potential fossil fuels; **GWP<sub>BIOGENIC</sub>**: Global Warming Potential biogenic; **GWP<sub>LULUC</sub>**: Global Warming Potential land use and land use change; **ODP**: Depletion Potential of the stratospheric Ozone layer; **AP**: Acidification Potential; **EP<sub>FRESHWATER</sub>**: Eutrophication Potential, freshwater; **EP<sub>MARINE</sub>**: Eutrophication Potential, marine; **EP<sub>TERRESTRIAL</sub>**: Eutrophication Potential, terrestrial; **POCP**: Formation potential of tropospheric ozone; **ADP<sub>MINERALS&METALS</sub>**: Abiotic Depletion Potential for non-fossil resources; **ADP<sub>FOSSIL</sub>**: Abiotic Depletion Potential for fossil resources; **WDP**: Water Deprivation Potential.

\* the results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is a limited experience with the indicator

Table 10: MAPEPLAN T TU: Potential environmental impact – additional mandatory and voluntary indicators referred to 1 m<sup>2</sup> of finished product

Indicator	Unit	A1 – A3	A4	A5	C1	C2	C3	C4	D
<b>GWP-GHG</b>	(kg CO <sub>2</sub> eq.)	4,37E+00	1,37E-01	2,88E-01	0,00E+00	2,07E-02	0,00E+00	2,58E-02	0,00E+00

**GWP-GHG**: The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Table 11: MAPEPLAN T TU: Use of resources referred to 1 m<sup>2</sup> of finished product

Indicator	Unit	A1 – A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	4,61E+00	9,63E-02	9,02E-02	0,00E+00	1,93E-02	0,00E+00	5,16E-02	0,00E+00
PERM	MJ	1,71E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	6,32E+00	9,63E-02	9,02E-02	0,00E+00	1,93E-02	0,00E+00	5,16E-02	0,00E+00
PENRE	MJ	1,42E+02	1,85E+00	2,42E-01	0,00E+00	2,79E-01	0,00E+00	3,44E-01	0,00E+00
PENRM	MJ	1,47E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,43E+02	1,85E+00	2,42E-01	0,00E+00	2,79E-01	0,00E+00	3,44E-01	0,00E+00
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m <sup>3</sup>	7,34E-02	1,09E-04	8,91E-04	0,00E+00	2,23E-05	0,00E+00	8,73E-05	0,00E+00

**PERE:** Use of renewable primary energy excluding renewable primary energy resources used as raw materials; **PERM:** Use of renewable primary energy resources used as raw materials; **PERT:** Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); **PENRE:** Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **PENRM:** Use of non-renewable primary energy resources used as raw materials; **PENRT:** Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials); **SM:** Use of secondary material; **RSF:** Use of renewable secondary fuels; **NRSF:** Use of non-renewable secondary fuels; **FW:** Net use of fresh water.

Table 12: MAPEPLAN T TU: Waste production and output flows referred to 1 m<sup>2</sup> of finished product

Indicator	Unit	A1 – A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	3,82E-03	8,75E-12	2,25E-11	0,00E+00	1,48E-12	0,00E+00	1,77E-11	0,00E+00
NHWD	kg	3,15E-03	2,57E-04	3,85E-02	0,00E+00	4,55E-05	0,00E+00	1,76E+00	0,00E+00
RWD	kg	1,88E-04	2,27E-06	2,38E-05	0,00E+00	5,18E-07	0,00E+00	3,83E-06	0,00E+00
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	9,99E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

**HWD:** Hazardous waste disposed; **NHWD:** Non-Hazardous waste disposed; **RWD:** Radioactive waste disposed

Table 13: MAPEPLAN T TU: Information on biogenic carbon content at the factory gate referred to 1 m<sup>2</sup> of product with packaging

Biogenic Carbon Content	Unit	Quantity
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	3,94E-02

## MAPEPLAN T TU

(1 m<sup>2</sup> of finished product + accessories)

Table 14: MAPEPLAN T TU + accessories: Potential environmental impact – mandatory indicators according to EN 15804 referred to 1 m<sup>2</sup> of finished product plus accessories

Indicator	Unit	A1 – A3	A4	A5	C1	C2	C3	C4	D
<b>GWP<sub>TOTAL</sub></b>	(kg CO <sub>2</sub> eq.)	7,41E+00	2,35E-01	8,25E-01	0,00E+00	3,65E-02	7,37E-06	4,55E-02	0,00E+00
<b>GWP<sub>FOSSIL</sub></b>	(kg CO <sub>2</sub> eq.)	7,48E+00	2,33E-01	3,74E-01	0,00E+00	3,62E-02	0,00E+00	4,52E-02	0,00E+00
<b>GWP<sub>BIOGENIC</sub></b>	(kg CO <sub>2</sub> eq.)	-7,42E-02	6,72E-04	4,51E-01	0,00E+00	1,28E-04	7,37E-06	1,52E-04	0,00E+00
<b>GWP<sub>LULUC</sub></b>	(kg CO <sub>2</sub> eq.)	3,98E-03	1,18E-03	7,37E-06	0,00E+00	2,46E-04	0,00E+00	8,35E-05	0,00E+00
<b>ODP</b>	(kg CFC 11 eq.)	2,18E-07	1,40E-14	2,28E-13	0,00E+00	3,59E-15	0,00E+00	1,06E-13	0,00E+00
<b>AP</b>	(mol H <sup>+</sup> eq.)	2,32E-02	2,07E-03	2,14E-04	0,00E+00	1,99E-04	0,00E+00	3,21E-04	0,00E+00
<b>EP<sub>FRESHWATER</sub></b>	(kg P eq.)	7,39E-04	6,35E-07	6,75E-08	0,00E+00	1,30E-07	0,00E+00	7,66E-08	0,00E+00
<b>EP<sub>MARINE</sub></b>	(kg N eq.)	4,96E-03	8,10E-04	7,91E-05	0,00E+00	9,59E-05	0,00E+00	8,20E-05	0,00E+00
<b>EP<sub>TERRESTRIAL</sub></b>	(mol N eq.)	5,21E-02	8,94E-03	8,97E-04	0,00E+00	1,07E-03	0,00E+00	9,01E-04	0,00E+00
<b>POCP</b>	(kg NMVOC eq.)	2,09E-02	1,76E-03	2,07E-04	0,00E+00	1,86E-04	0,00E+00	2,49E-04	0,00E+00
<b>ADP<sub>MINERALS&amp;METALS</sub>* </b>	(kg Sb eq.)	3,90E-05	1,85E-08	4,60E-09	0,00E+00	3,68E-09	0,00E+00	4,63E-09	0,00E+00
<b>ADP<sub>FOSSIL</sub>* </b>	(MJ)	2,40E+02	3,10E+00	3,74E-01	0,00E+00	4,80E-01	0,00E+00	5,92E-01	0,00E+00
<b>WDP*</b>	(m <sup>3</sup> world eq.)	4,01E+00	1,93E-03	4,79E-02	0,00E+00	4,09E-04	0,00E+00	4,96E-03	0,00E+00

**GWP<sub>TOTAL</sub>**: Global Warming Potential total; **GWP<sub>FOSSIL</sub>**: Global Warming Potential fossil fuels; **GWP<sub>BIOGENIC</sub>**: Global Warming Potential biogenic; **GWP<sub>LULUC</sub>**: Global Warming Potential land use and land use change; **ODP**: Depletion Potential of the stratospheric Ozone layer; **AP**: Acidification Potential; **EP<sub>FRESHWATER</sub>**: Eutrophication Potential, freshwater; **EP<sub>MARINE</sub>**: Eutrophication Potential, marine; **EP<sub>TERRESTRIAL</sub>**: Eutrophication Potential, terrestrial; **POCP**: Formation potential of tropospheric ozone; **ADP<sub>MINERALS&METALS</sub>\*** : Abiotic Depletion Potential for non-fossil resources; **ADP<sub>FOSSIL</sub>\*** : Abiotic Depletion Potential for fossil resources; **WDP**: Water Deprivation Potential.

\* the results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is a limited experience with the indicator

Table 15: MAPEPLAN T TU + accessories: Potential environmental impact – additional mandatory and voluntary indicators referred to 1 m<sup>2</sup> of finished product plus accessories

Indicator	Unit	A1 – A3	A4	A5	C1	C2	C3	C4	D
<b>GWP-GHG</b>	(kg CO <sub>2</sub> eq.)	7,18E+00	2,30E-01	3,74E-01	0,00E+00	3,58E-02	0,00E+00	4,45E-02	0,00E+00

**GWP-GHG**: The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Table 16: MAPEPLAN T TU + accessories: Use of resources referred to 1 m<sup>2</sup> of finished product plus accessories

Indicator	Unit	A1 – A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	1,06E+01	1,61E-01	1,51E-01	0,00E+00	3,32E-02	0,00E+00	8,89E-02	0,00E+00
PERM	MJ	2,72E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,33E+01	1,61E-01	1,51E-01	0,00E+00	3,32E-02	0,00E+00	8,89E-02	0,00E+00
PENRE	MJ	2,40E+02	3,10E+00	3,74E-01	0,00E+00	4,81E-01	0,00E+00	5,93E-01	0,00E+00
PENRM	MJ	2,22E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	2,42E+02	3,10E+00	3,74E-01	0,00E+00	4,81E-01	0,00E+00	5,93E-01	0,00E+00
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m <sup>3</sup>	9,57E-02	1,83E-04	1,18E-03	0,00E+00	3,84E-05	0,00E+00	1,51E-04	0,00E+00

**PERE:** Use of renewable primary energy excluding renewable primary energy resources used as raw materials; **PERM:** Use of renewable primary energy resources used as raw materials; **PERT:** Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); **PENRE:** Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **PENRM:** Use of non-renewable primary energy resources used as raw materials; **PENRT:** Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials); **SM:** Use of secondary material; **RSF:** Use of renewable secondary fuels; **NRSF:** Use of non-renewable secondary fuels; **FW:** Net use of fresh water.

Table 17: MAPEPLAN T TU + accessories: Waste production and output flows referred to 1 m<sup>2</sup> of finished product plus accessories

Indicator	Unit	A1 – A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	3,83E-03	1,47E-11	3,44E-11	0,00E+00	2,55E-12	0,00E+00	3,05E-11	0,00E+00
NHWD	kg	3,30E-02	4,31E-04	4,96E-02	0,00E+00	7,84E-05	0,00E+00	3,03E+00	0,00E+00
RWD	kg	1,40E-03	3,80E-06	4,07E-05	0,00E+00	8,94E-07	0,00E+00	6,60E-06	0,00E+00
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	9,99E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

**HWD:** Hazardous waste disposed; **NHWD:** Non-Hazardous waste disposed; **RWD:** Radioactive waste disposed

Table 18: MAPEPLAN T TU + accessories: Information on biogenic carbon content at the factory gate referred to 1 m<sup>2</sup> of product with packaging

Biogenic Carbon Content	Unit	Quantity
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	6,28E-02

To calculate results for different thickness (2,1 mm), please use following multiplicative coefficients for the environmental indicators considered (Elx):









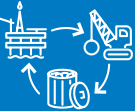

























Table 19: Calculation rules for Environmental Categories of different thickness

	2,0 mm thickness	2,1 mm thickness
Mapeplan T TU	El <sub>2,0</sub> * 1	El <sub>2,1</sub> * 1,05

El<sub>2,0</sub>: Environmental Indicator for Mapeplan T TU with 2,0 mm thickness

Module A1 has the highest contribution for each impact category and weights up to 90% of the total impact in the whole system boundary. In particular, TPO/FPO compounds, reinforcing materials, which are the main components in **Mapeplan T TU** formulations, carry a significant impact for all environmental categories. Electricity consumption in the production process considerably affects the GWP<sub>TOTAL</sub>, ADP (fossil) and ODP values. In terms of GWP<sub>100</sub>, module A5 and wastes gives an important contribution too, considering that, during the installation phase it is necessary to take into account the membrane overlap around 5,5%.

Table 20: Some environmental impacts of Mapeplan T TU plus accessories

ENVIRONMENTAL IMPACT	 A1-A3	 A4	 A5	 C1	 C2	 C3	 C4	 D	 TOT
CLIMATE CHANGE (TOTAL) 	 7,41E+00	 2,35E-01	 8,25E-01	0,00E+00	 3,65E-02	 7,37E-06	 4,55E-02	0,00E+00	<b>8,56E+00</b> kg CO <sub>2</sub> eq.
ACIDIFICATION 	 2,32E-02	 2,07E-03	 2,14E-04	0,00E+00	 1,99E-04	0,00E+00	 3,21E-04	0,00E+00	<b>2,61E-02</b> mol H <sup>+</sup> eq.
DEPLETION OF ABIOTIC RESOURCES (FOSSIL) 	 2,40E+02	 3,10E+00	 3,74E-01	0,00E+00	 4,80E-01	0,00E+00	 5,92E-01	0,00E+00	<b>2,44E+02</b> MJ
WATER USE 	 4,01E+00	 1,93E-03	 4,79E-02	0,00E+00	 4,09E-04	0,00E+00	 4,96E-03	0,00E+00	<b>4,06E+00</b> m <sup>3</sup> world eq.

More details about electrical mix used in this EPD, is shown below:

	Data source	GWP-GHG	Unit
Residual electricity grid mix (IT) – 2021	AIB	0,524*	kg CO <sub>2</sub> -eqv/kWh

\*CML2001 – Aug. 2016



## 8. DATA QUALITY

Table 21: Data quality

Dataset & Geographical reference	Database (source)	Temporary reference
<b>A1; A3</b>		
TPO compounds	Ecoinvent 3.8 Database	2021
Polymers	Sphera Database	2021
Additives	Ecoinvent 3.8	2021
Residual electricity grid mix (IT)	AIB; Sphera Database	2021
Packaging (EU)	Sphera Database & Ecoinvent 3.8	2005 - 2021
Diesel mix (EU)	Sphera Database	2018
<b>A2</b>		
Truck transport (27ton payload – GLO)	Sphera Database	2021
Diesel for transport (EU)	Sphera Database	2018
<b>A4</b>		
Truck transport (27ton payload – GLO)	Sphera Database	2021
Diesel for transport (EU)	Sphera Database	2018
Ocean ship (27500 DWT payload – GLO)	Sphera Database	2021
Heavy fuel oil for ship transport (EU)	Sphera Database	2018
<b>A5</b>		
Commercial waste in municipal waste incineration plant (EU)	Sphera Database	2021
Electricity grid mix (EU)	Sphera Database	2018
<b>C1 – C4</b>		
Truck transport (9,3 ton payload – GLO)	Sphera Database	2021
Diesel for transport (EU)	Sphera Database	2018
Construction waste dumping (EU)	Sphera Database	2021

All data included in table above refer to a period between 2005 and 2021; the most relevant ones are specific from supplier, while the others (i.e. transport and minor contribution dataset), come from European and global databases.

All datasets are not more than 10 years old according to EN 15804 §6.3.8.2 “Data quality requirements”. The Quality level concerning datasets used in the EPD can be considered as “very good” or “good” according to Annex E of the EN 15804 (current version); the only exception is represented by a packaging component which has a quality level classified as “poor” in terms of time representativeness. Primary data concern the year 2021 and represent the whole annual production.

## 9. ADDITIONAL INFORMATION

The finished product is potentially suitable for disassembly through selective demolition.

## 10. DIFFERENCES VERSUS PREVIOUS VERSION

In this version, new primary data referred to 2021 has been adopted. New modelling in application stage (A5) has been developed and added in chapter 5. Moreover, additional data quality information has been included in chapter 8. Chapter 9: Disassembly, has been added. Minor editorial changes have been made in the document. Since new version of GPI and PCR have been considered, results have been revised and updated.

## 11. VERIFICATION AND REGISTRATION

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

CEN standard EN15804 served as the Core Product Category Rules (PCR)	
PCR:	PCR 2019:14 Construction products (EN 15804:A2), Version 1.11, 2021-02-05, UN CPC code 54
PCR review was conducted by:	The Technical Committee of the International EPD® System. See <a href="http://www.environdec.com/TC">www.environdec.com/TC</a> for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat <a href="http://www.environdec.com/">www.environdec.com/</a> contact.
Independent third-party verification of the declaration and data, according to ISO 14025:2006:	<input checked="" type="checkbox"/> EPD Process Certification <input type="checkbox"/> EPD Verification
Third party verifier:	Certiquality S.r.l. Number of accreditations: 003H rev15
Accredited or approved by:	Accredia
Procedure for follow-up of data during EPD validity involves third-party verifier	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

## 12. REFERENCES

- EN 13491 GEOSYNTHETIC BARRIERS. CHARACTERISTICS REQUIRED FOR USE AS A FLUID BARRIER IN THE CONSTRUCTION OF TUNNELS AND ASSOCIATED UNDERGROUND STRUCTURES
- EN 15804: SUSTAINABILITY OF CONSTRUCTION WORKS - ENVIRONMENTAL PRODUCT DECLARATIONS - CORE RULES FOR THE PRODUCT CATEGORY OF CONSTRUCTION PRODUCTS
- EUROPEAN DIRECTIVE 2008/98/EC
- EUROPEAN RESIDUAL MIXES VERSION 1.0, 2022-05-31 (AIB: ASSOCIATION OF ISSUING BODIES)
- GENERAL PROGRAMME INSTRUCTIONS OF THE INTERNATIONAL EPD® SYSTEM. VERSION 3.01
- ISO 14025 ENVIRONMENTAL LABELS AND DECLARATIONS - TYPE III ENVIRONMENTAL DECLARATIONS - PRINCIPLES AND PROCEDURES
- ISO 14044 ENVIRONMENTAL MANAGEMENT – LIFE CYCLE ASSESSMENT – REQUIREMENTS AND GUIDELINES
- PCR 2019:14 CONSTRUCTION PRODUCTS (EN 15804: A2), UN CPC CODE 54; VERSION 1.11

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