

ENVIRONMENTAL PRODUCT DECLARATION

subor[®]

In accordance with ISO 14025 and EN 15804:2012+A2:2019 for
Glassfiber Reinforced Plastic (GRP) Pipes
from Subor Boru San. ve Tic. A.Ş.



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 **EPD**[®]
THE INTERNATIONAL EPD[®] SYSTEM

 **EPD**[®]
TURKEY
ENVIRONMENTAL PRODUCT DECLARATIONS



Programme Information

Programme	EPD Turkey, a fully aligned regional programme	The International EPD® System
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Product Category Rules (PCR): Construction Products, 2019:14, Version 1.11

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

EPD process certification

✓ EPD verification

Third party verifier: Prof. Ing. Vladimír Kočí, Ph.D., MBA

Approved by: The International EPD® System

Procedure for follow-up of data during EPD validity involves third party verifier:

Yes

✓ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs for construction products are primarily intended for use in B2B communication, but their use in B2C communication under certain conditions is not precluded. For EPDs intended for B2C communication, refer to ISO 14025. EPDs of construction products may not be comparable if they do not comply with EN 15804.

About SUBOR

SUBOR, founded in 1996 with the purpose of manufacturing and trading GRP (Glass Fiber Reinforced Plastic) pipes using the Advanced Continuous Filament Winding Technology worldwide, is a partnership of Yapı Merkezi Holding and Amiantit Group of Companies.

Having the privilege of being the first technological facility in Turkey in the field of GRP pipe production using its own R&D and developed technology, SUBOR offers solutions for different infrastructure applications for over 25 years with its wide variety of products and service portfolio, ranging from circular pipes to non-circular pipes, from jacking pipes to biaxial pipes.

SUBOR has an annual production capacity of 1000 km GRP pipes today with its 4 production lines, 3 at Sakarya Plant and 1 at Şanlıurfa Plant. Depending on the project conditions, SUBOR is capable to provide optimum customized solutions with its fully integrated quality approach to meet the engineering requirements, in compliance with the world's most fundamental and acknowledged industry standards such as AWWA, ASTM, ISO, EN, DIN and BS.

By manufacturing pipes in a range from 200 mm to 4000 mm diameter, and from 1 bar to 40 bar pressure and its fittings, SUBOR provides accurate solutions for a wide variety of projects such as:

- Potable water projects,
- Irrigation projects,
- Power plant projects,
- Manufacture of "jacking" pipe which allows trenchless installations,
- Wastewater and storm water projects.



About SUBOR

Offering its products for use also in the global markets ever since the beginning of its production activity, SUBOR has gained pace in its export activities in the recent years, and exports 70% of its production worldwide today. SUBOR now conveys water to the future with confidence in 55+ countries throughout 5 continents including the Balkans, the Middle East, Africa, Russia, Far East, USA, New Zealand and the CIS countries.

SUBOR, growing into an important and globally preferred brand in its sector, takes pride in delivering water, the most fundamental value of life, in a healthy and safe way to the world and contributing to its conveyance to the future generations.

Today, SUBOR is amongst the leading GRP pipe manufacturers and has created a reputable brand name in the world through its successful references. SUBOR will continue to improve its global presence by creating value to its partners and to enhance the quality of people's lives.

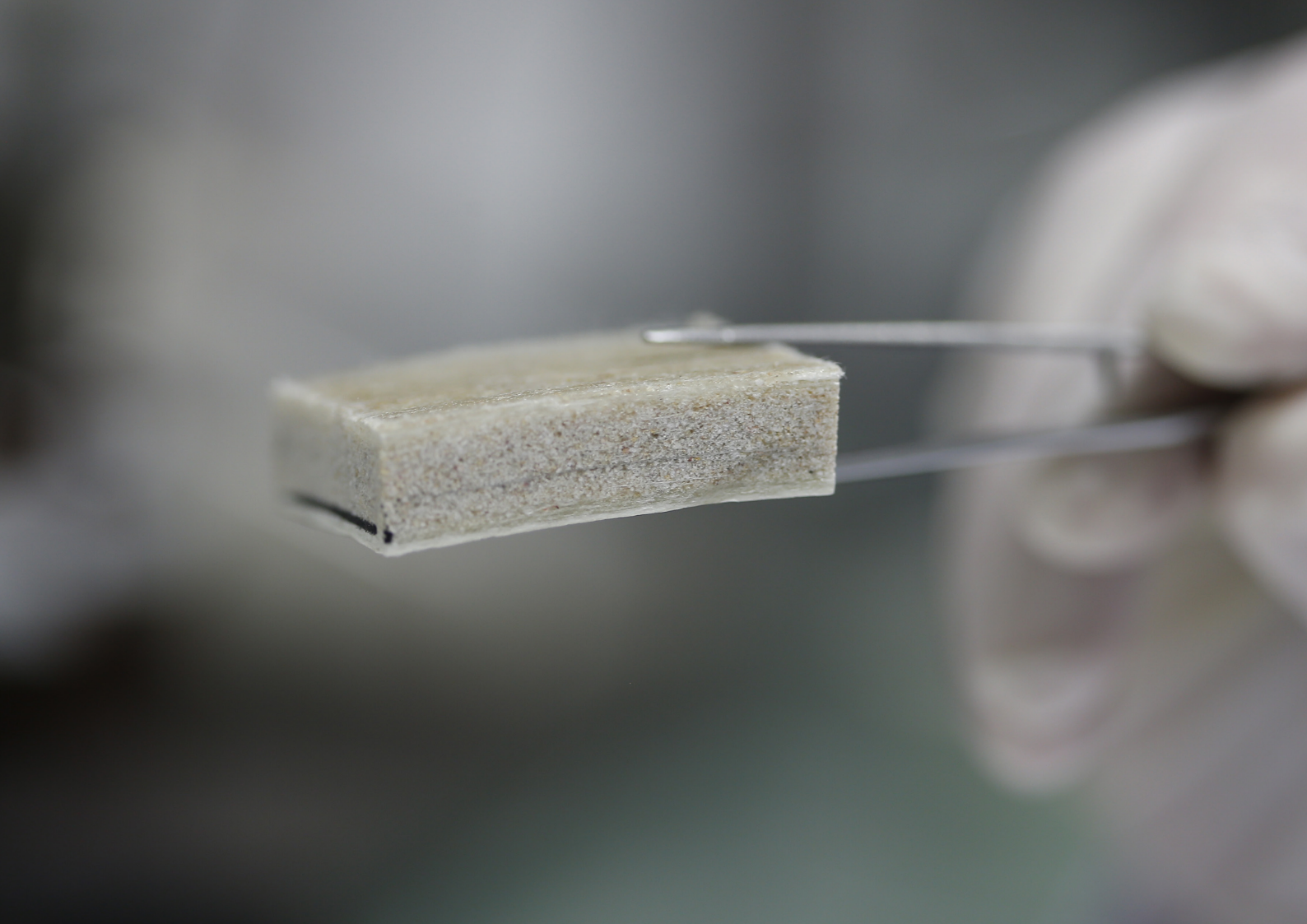
Our successful track record and strong experience make us your "GLOBAL SOLUTION PARTNER IN PIPE SYSTEMS".

How SUBOR Defines Sustainability?

SUBOR's approach to a more sustainable business to undertake today's projects with respect to future generations' needs. Sustainable development must consider the effects it has on the economy, society, and environment as a whole. SUBOR, as a pipe manufacturer calculates the influence of its outputs on these elements at every step of its decision-making process for a sustainable business.

The superior properties of GRP in terms of excellent hydraulic characteristics resulting in higher energy productivity and less pumping energy, high efficient production and transportation methods together with its long life cycle enable SUBOR to offer the utmost quality with better sustainability to the future. As a result of having very low environmental impact compared to conventional pipe technologies due to its high level of material efficiency, SUBOR GRP products have low carbon footprint and offer the best choice for the environment.





SUBOR GRP Technology

A composite material is a combination of two or more materials together in order to create a unique material with superior properties of individual components.

SUBOR GRP Pipes and Fittings are composite materials and have all the superior properties of the technology. GRP composites are used in more and more applications due to the high strength and low weight in combination with the corrosion resistance.

The World's Advanced GRP Pipe Technology: Continuous Filament Winding Process

SUBOR has been manufacturing pipes and fittings using Continuous Filament Winding Technology, for more than 25 years.

Continuous Filament Winding Technology is the computer controlled method that involves the winding of the glass fibers around a continuous rotating structure called mandrel. The glass fibers wound around the internal and external resistance layers to ensure the pipe's pressure resistance and rigidity, and the chopped glass fibers used on all layers to ensure axial resistance are bound by the thermoset polymerization reaction of the polyester. The filling material (silica sand) is used on the central layer to enhance the pipe rigidity in a cost effective way.





The Advantages of SUBOR GRP

LIGHTWEIGHT: SUBOR GRP Pipes weigh 1/10 of concrete and 1/4 of steel pipes. The lightweight structure not only eliminates the need for expensive handling equipment, but also offers fast and easy installation. The GRP pipes of different diameters are shipped using special packaging as a nested set without detriment to their hydraulic properties and inner surface smoothness. This also provides enormous savings in shipping costs.

SUPERIOR HYDRAULIC PROPERTIES: The hydraulic properties of SUBOR GRP Pipes provide stability throughout the operating lifespan as courtesy of their smooth interior surface that prevents the formation of lime and sediment. Unlike conventional pipe systems, this property allows the passage of the same flow rate through smaller pipe diameters in the long run. Besides reducing the energy consumption for pumping at the pumping lines with minimum hydraulic loss, this property allows for an increase in energy generation at the power plants.

LONG SERVICE LIFE: SUBOR GRP Pipes are designed according to the results of "Long Term Tests" with respect to the relevant international standards performed at its own accredited laboratories. Hence, SUBOR Pipes preserve their initial performance criteria even after a 50-year service life.

CORROSION RESISTANCE: The composite structure of the SUBOR GRP Pipes offers perfect corrosion resistance. The lack of corrosion eliminates the pipes' need of cathodic protection and supplemental coating material, thus eliminating operating difficulties and expenses. Another important advantage offered by SUBOR pipe manufacturing technique is the ability to use project specific resins in the inner liner of the pipe against highly corrosive environments or chemical effects.

FAST AND EASY INSTALLATION: With the advantage of using Double Bell Reka Type Coupling, there will be no need for high-qualified workers and welding equipment. As an average, 300 meters of DN1.200 mm diameter pipe can be installed by one team in a day.



About Product

SUBOR GRP PIPES

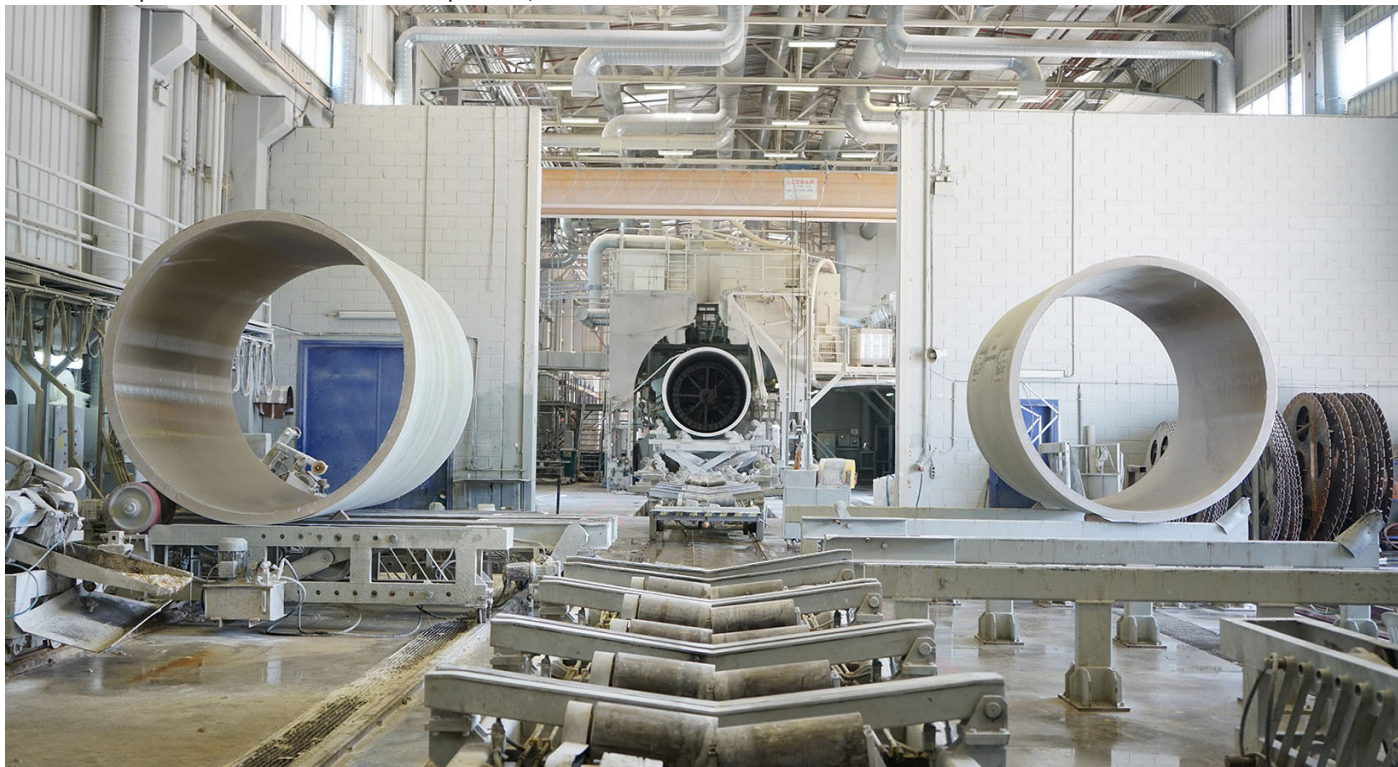
SUBOR GRP pipes are offered in following technical specifications:

- Up to 15 meters pipe length
- Diameter up to 4.000 milimeters
- Pressure classes up to 40 bar
- Stiffness classes up to SN1.000.000

SUBOR GRP pipes are used in below applications:

- Drinking water transmission lines and networks
- Irrigation projects transmission and distribution lines
- Waste water transfer, treatment plants and sewer lines
- Storm water lines
- Raw water intake, discharge and cooling water lines of power plants
- Transmission and penstock lines of hydroelectric power plants
- Industrial plants such as desalination, chemical, firefighting systems etc.
- Renovation of current lines by slip-lining
- “Jacking” pipes enabling trenchless installation
- Tank and silo production

*Customized products are also available upon request.



About Product

TYPES OF PIPES

•Pressure Water & Sewer Pipe

SUBOR pipe with main reinforcement in the hoop direction.

Used in applications without end thrust, e.g. pressure mains and penstocks.

- Diameter range (DN): 200 – 4.000 mm
- Pressure (PN): Up to 40 bar
- Standard lengths: 6-12 meters
- Stiffness (SN): 2.500, 5.000 and 10.000

•Gravity (Non-Pressure) Sewer Pipe

SUBOR pipe designed for exceptional acid resistance.

Typically used for sewer and storm water applications.

- Diameter range (DN): 200 – 4.000 mm
- Pressure (PN): 1 bar
- Standard lengths: 6-12 meters
- Stiffness (SN): 2.500, 5.000 and 10.000

•Biaxial Pipe

SUBOR pipe reinforced in the hoop and axial directions to resist pressure end thrust and bending loads.

Common uses are cooling water, desalination and other industrial applications.

- Diameter range (DN): 200 – 4.000 mm
- Pressure (PN): Up to 32 bar
- Standard lengths: 1-12 meters
- Stiffness (SN): 2.500, 5.000 and 10.000

•Jacking Pipe

SUBOR pipe designed to withstand high jacking forces.

Typically used for jacking under structures like railways and roads.

- Diameter range (DN): 275 – 4.000 mm
- Pressure (PN): Up to 16 bar
- Standard lengths: 1-12 meters
- Stiffness (SN): 20.000+

•Non Circular Pipe

SUBOR pipe designed and developed for use in buried installations and commonly to reline existing non-circular pipelines.

Used in sanitary sewer and old city sewer relining, storm water conveyance and chemically aggressive sewerwater.

- Diameter range (DN): Up to 4.000 mm
- Pressure (PN): 1 bar
- Standard lengths: Up to 3 meters



About Product

SUBOR GRP COUPLINGS

•Pressure Coupling

Common applications include irrigation, water supply, pressure sewer and HPP penstock systems.

- Diameter range (DN) : 200 - 4.000 mm
- Pressure (PN): 40 bar

•Sewer Coupling

Commonly applications include sewer and storm water systems.

- Diameter range (DN): 200 - 4.000 mm
- Pressure (PN): 1 bar

•Angled Coupling

Cost effective coupling solution for increased angular deflections up to 3°C.

- Diameter range (DN): 200 - 4.000

•Biaxial Lock Joint

Common applications include industrial cooling and desalination systems.

- Diameter range (DN): 200 - 2.000 mm
- Pressure (PN): Up to 32 bar

•Blue Tape Coupling

In order to prevent EPDM Gaskets from direct UV effect of the sunlight, it is recommended to supply them separately and store in a proper place.

SUBOR's new innovative product "BLUE TAPE" offers a perfect solution for the installers and avoids the need for storage place together with long-lasting protection against both UV and environmental effects such as dust and dirt.

SUBOR GRP FITTINGS

SUBOR offers a wide fitting range with over 200.000 different types of standard and customized design (i.e: Concentric Reducer, Eccentric Reducer, Elbows, Concentric & Tangential Tee, Wye, Flange & Blind Flange).



LCA Information

Declared Unit:	1 tonne of GRP pipe with coupling
Time Representativeness:	2020
Database(s) and LCA Software Used	Ecoinvent 3.5 SimaPro 9.0

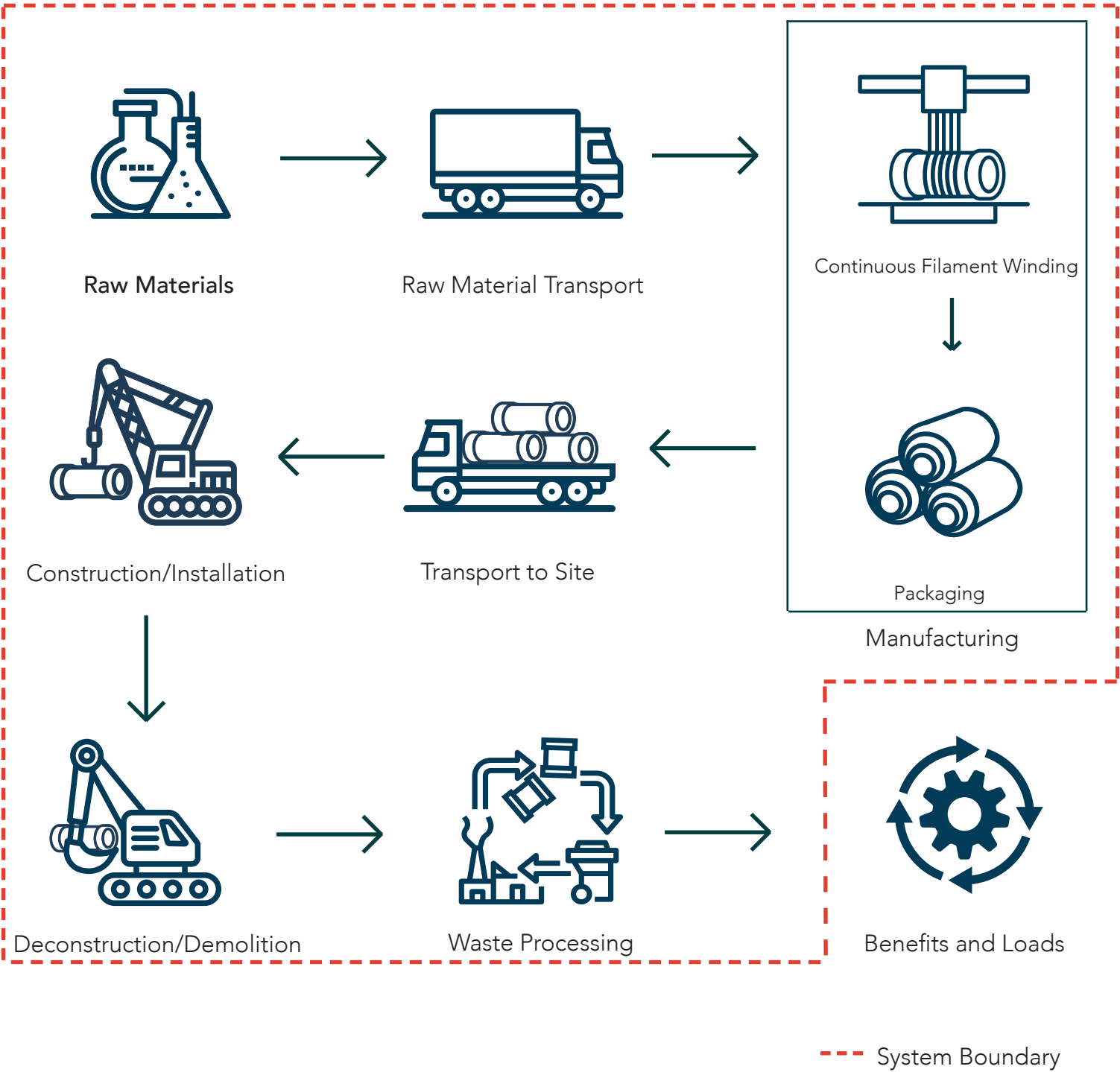
The inventory for the LCA study is based on the 2020 production figures for SUBOR’s production plant in Sakarya, Turkey .

This EPD’s system boundary is cradle to gate with options covering A1 - A5, C1-C4, and D stages.

Product Stage			Constrcution Process Stage		Use Stage							End of Life Stage				Benefits and Loads
Raw Material Supply	Transport	Manufacturing	Distribution	Construction / Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction / Demolition	Transport	Waste Processing	Disposal	Future reuse, recycling or energy recovery potentials
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X

X = Included in LCA, ND = Not Declared

System Boundary



System Description

A1: Raw Material

The production starts with raw materials. Raw material stage includes raw material extraction/preparation and pre-treatment processes before production.

A2: Raw Material Transport

The transport is relevant for delivery of raw materials and other materials to the plant and the transport of materials within the plant. The transport of raw materials to production site is taken as the weight average values for transport from raw materials supplier for the year of 2020.

A3: Manufacturing

GRP pipes are produced with continuous filament winding method. The process starts with the preparation of resin and fibers. After the preparation of the resin mix, composite pipe production starts. Then, the final products are quality checked and packaged for delivery.

A4: Transport to Site

The transport of final product to construction site is taken as the weight average values for transport to plant for 2020.

A5: Construction / Installation

This stage includes the installation of GRP pipes in the construction site. For installing 1 tonne of GRP pipe, (average length is assumed as 12 m), 20 minutes installation time is assumed by using a mobile crane which consumes 18 L of diesel per hour. The depth where the pipes were installed was assumed as 3.5 m, and the required area was assumed to be digged in 1 hour by a mobile crane which consumes 15 L diesel per hour.

C1 : Deconstruction / Demolition

For the demolition of 1 tonne of GRP pipe, (average length is assumed as 12 m), 20 minutes of installation time is assumed by using a mobile crane which consumes 18 L of diesel per hour. The depth where the pipes were installed was assumed as 3.5 m, and the required area was assumed to be digged in 1 hour by a mobile crane which consumes 15 L diesel per hour.

C2 : Transport to Disposal Site

This stage includes the transportation of the discarded pipes to final disposal. The average distance from demolition site to waste processing site for final disposal is assumed to be 100 km.

C3 : Waste Processing

As the waste is going to landfill, there is no need for any waste process.

C4 : Disposal

The disposal is the final stage of product life. Composite pipes may be disposed of with any disposal scenario after construction and demolition as their final fate and modelled as such for this EPD. It is assumed that 25% of the waste is used as inert filler, and the rest of the waste is sent to the landfill.

D : Benefits and Loads

In this stage, benefits from the inert filler specified in the disposal stage were calculated.



More Information

The results of the LCA with the indicators as per EPD requirement are given in the LCA result tables. All energy calculations were obtained using Cumulative Energy Demand (LHV) methodology, while fresh water use is calculated with selected inventory flows in SimaPro according to the PCR.

There are no co-products in the production. Hence, there is no need for co-product allocation.

Energy consumption and transport datasets were allocated based on the average production figures for 2020, and weighted average of environmental impacts for the GRP pipes were presented.

Accordingly, hazardous and non-hazardous waste amounts were also allocated based on the average waste arisings for the period of 2020.

GRP pipes are theoretically outlasting/lifetime products. However, when they are scrapped or discarded, they are disposed as per Waste Management Plan of SUBOR in accordance with Turkish laws and regulations.

No substances included in the Candidate List of Substances of Very High Concern for authorization under the REACH Regulation are present in the product, either above the threshold for registration with the European Chemicals Agency or above 0.1 % (wt/wt).



LCA RESULTS

GRP PIPE

Environmental Impacts for 1 tonne of GRP Pipes with Coupling									
Impact Category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP - Fossil	kg CO ₂ eq	1.74E+3	190E+0	72.6E+0	72.6E+0	21.5E+0	0	45.1E+0	-9.64E+0
GWP - Biogenic	kg CO ₂ eq	-44.4E+0	46.5E-3	12.0E-3	12.0E-3	4.32E-3	0	344E+0	-7.34E-3
GWP - Luluc	kg CO ₂ eq	2.15E+0	57.7E-3	6.17E-3	6.17E-3	7.54E-3	0	6.47E-3	-4.85E-3
GWP - Total	kg CO ₂ eq	1.69E+3	190E+0	72.6E+0	72.6E+0	21.5E+0	0	389E+0	-9.66E+0
ODP	kg CFC-11 eq	211E-6	43.0E-6	16.4E-6	16.4E-6	4.77E-6	0	2.49E-6	-1.95E-6
AP	mol H+ eq	10.7E+0	963E-3	761E-3	761E-3	86.2E-3	0	94.1E-3	-86.9E-3
EP - Freshwater	kg P eq	610E-3	15.5E-3	3.33E-3	3.33E-3	1.96E-3	0	6.80E-3	-1.54E-3
EP - Freshwater	kg PO ₄ eq	1.87E+0	47.3E-3	10.2E-3	10.2E-3	6.01E-3	0	20.8E-3	-4.72E-3
EP - Marine	kg N eq	2.07E+0	260E-3	330E-3	330E-3	24.3E-3	0	1.08E+0	-23.9E-3
EP - Terrestrial	mol N eq	22.4E+0	2.86E+0	3.63E+0	3.63E+0	268E-3	0	282E-3	-266E-3
POCP	kg NMVOC	9.85E+0	851E-3	996E-3	996E-3	81.6E-3	0	164E-3	-74.4E-3
ADPE	kg Sb eq	6.89E-3	536E-6	24.2E-6	24.2E-6	84.6E-6	0	11.1E-6	-27.4E-6
ADPF	MJ	31.8E+3	2.87E+3	1.05E+3	1.05E+3	321E+0	0	211E+0	-142E+0
WDP	m³ depriv.	730E+0	19.5E+0	5.66E+0	5.66E+0	2.24E+0	0	5.33E+0	-15.5E+0
PM	disease inc.	85.9E-6	12.9E-6	19.9E-6	19.9E-6	1.32E-6	0	1.28E-6	-833E-9
IR	kBq U-235 eq	131E+0	13.7E+0	4.89E+0	4.89E+0	1.56E+0	0	1.39E+0	-796E-3
ETP - FW	CTUe	44.1E+3	2.05E+3	594E+0	594E+0	236E+0	0	2.06E+3	-119E+0
HTTP - C	CTUh	2.62E-6	60.0E-9	20.4E-9	20.4E-9	7.84E-9	0	13.6E-9	-6.65E-9
HTTP - NC	CTUh	63.3E-6	2.32E-6	519E-9	519E-9	264E-9	0	674E-9	-140E-9
SQP	Pt	8.11E+3	1.86E+3	133E+0	133E+0	186E+0	0	396E+0	-97.0E+0
Acronyms	GWP-total: Climate change, GWP-fossil: Climate change- fossil, GWP-biogenic: Climate change - biogenic, GWP-luluc: Climate change - land use and transformation, ODP: Ozone layer depletion, AP: Acidification terrestrial and freshwater, EP-freshwater: Eutrophication freshwater, EP-marine: Eutrophication marine, EP-terrestrial: Eutrophication terrestrial, POCP: Photochemical oxidation, ADPE: Abiotic depletion - elements, ADPF: Abiotic depletion - fossil resources, WDP: Water scarcity, PM: Respiratory inorganics - particulate matter, IR: Ionising radiation, ETP-FW: Ecotoxicity freshwater, HTP-c: Cancer human health effects, HTP-nc: Non-cancer human health effects, SQP: Land use related impacts, soil quality.								
Legend	A1: Raw Material, A2: Raw Material Transport, A3: Manufacturing, A1-A3: Sum of A1-A3 stages, A4: Transport to Site, A5: Construction/Installation C1: Deconstruction/Demolition, C2: Transport to Disposal Site, C3: Waste Processing, C4: Disposal, D: Benefits and Loads Beyond the System Boundary.								
Disclaimer: EP-freshwater indicator has also been calculated as “kg P eq” as required in the characterization model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://epca.jrc.ec.europa.eu/LCDN/developerEF.xhtml) in addition to “kg PO ₄ eq” as stated in the standard.									



Resource Use for 1 tonne of GRP Pipes with Coupling									
Impact Category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	1.88E+3	29.9E+0	6.08E+0	6.08E+0	3.76E+0	0	7.33E+0	-3.09E+0
PERM	MJ	0	0	0	0	0	0	0	0
PERT	MJ	1.88E+3	29.9E+0	6.08E+0	6.08E+0	3.76E+0	0	7.33E+0	-3.09E+0
PENRE	MJ	31.8E+3	2.87E+3	1.05E+3	1.05E+3	321E+0	0	211E+0	-142E+0
PENRM	MJ	0	0	0	0	0	0	0	0
PENRT	MJ	31.8E+3	2.87E+3	1.05E+3	1.05E+3	321E+0	0	211E+0	-142E+0
SM	kg	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0
FW	m³	13.0E+0	480E-3	92.1E-3	92.1E-3	53.7E-3	0	194E-3	-374E-3
Waste & Output Flows for 1 tonne of GRP Pipes with Coupling									
Impact Category	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	774E-3	0	0	0	0	0	0	0
NHWD	kg	56.6E+0	0	0	0	0	0	0	0
RWD	kg	0	0	0	0	0	0	0	0
CRU	kg	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0
EE (Electrical)	MJ	0	0	0	0	0	0	0	0
EE (Thermal)	MJ	0	0	0	0	0	0	0	0
Acronyms	PERE: Use of renewable primary energy excluding resources used as raw materials, PERM: Use of renewable primary energy resources used as raw materials, PERT: Total use of renewable primary energy, PENRE: Use of non-renewable primary energy excluding 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, SM: Secondary material, RSF: Renewable secondary fuels, NRSF: Non-renewable secondary fuels, FW: Net use of fresh water, HWD: Hazardous waste disposed, NHWD: Non-hazardous waste disposed, RWD: Radioactive waste disposed, CRU: Components for reuse, MFR: Material for recycling, MER: Materials for energy recovery, EE (Electrical): Exported energy electrical, EE (Thermal): Exported energy, Thermal.								
Legend	A1: Raw Material, A2: Raw Material Transport, A3: Manufacturing, A1-A3: Sum of A1-A3 stages, A4: Transport to Site, A5: Construction/Installation C1: Deconstruction/Demolition, C2: Transport to Disposal Site, C3: Waste Processing, C4: Disposal, D: Benefits and Loads Beyond the System Boundary								

Result per funtional declared unit		
Biogenic Carbon Content	Unit	A1-A3
Biogenic carbon content in product	kg C	0
Biogenic carbon content in packaging	kg C	0

References

/GPI/ General Programme Instructions of the International EPD® System. Version 3.0.

/EN ISO 9001/ Quality Management Systems - Requirements

/EN ISO 14001/ Environmental Management Systems - Requirements

/ISO 45001/ Occupational Health & Safety Management System - Requirements

/ISO 14020:2000/ Environmental Labels and Declarations — General principles

/EN 15804:2012+A2:2019/ Sustainability of construction works - Environmental Product Declarations — Core rules for the product category of construction products

/ISO 14025/ DIN EN ISO 14025:2009-11: Environmental labels and declarations - Type III environmental declarations — Principles and procedures

/ISO 14040/44/ DIN EN ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework (ISO14040:2006) and Requirements and guidelines (ISO 14044:2006)

/PCR for Construction Products and CPC 54 Construction Services/ Prepared by IVL Swedish Environmental Research Institute, Swedish Environmental Protection Agency, SP Trä, Swedish Wood Preservation Institute, Swedisol, SCDA, Svenskt Limträ AB, SSAB, The International EPD System, 2019:14 Version 1.1 DATE 2019-12-20

/The International EPD® System/ The International EPD® System is a programme for type III environmental declarations, maintaining a system to verify and register EPD®s as well as keeping a library of EPD®s and PCRs in accordance with ISO 14025. www.environdec.com

/Ecoinvent / Ecoinvent Centre, www.ecoinvent.org

/SimaPro/ SimaPro LCA Software, Pré Consultants, the Netherlands, www.pre-sustainability.com

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