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Environmental Product Declaration

Specific

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021

Glass Fibre Reinforced Concrete

Artic Concrete Glamour

Programme
EPD Square | www.epdsquare.com

Programme operator
EPD Square, s.r.o.

EPD Registration number
SQ 00-012

Publication date
25.09.2024

Valid until
24.09.2029

epd square .

General information

Product
Glass Fibre Reinforced Concrete

Program operator
EPD Square
Karadžičova 16, 811 09, Bratislava, Slovakia
Email: info@epdsquare.com

Registration number
SQ 00-012

Publication date
25.09.2024

Valid until date
24.09.2029

Owner of the declaration
Arabian Tile Company (ARTIC)
Contact person: Muhammad Rayees Uddin
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Manufacturer
Arabian Tile Company (ARTIC)
Eastern ring branch road, Between exit 12 and 13, Ar Rawdah, Riyadh, 13211, Saudi Arabia
Email: info@artic.com.sa
Website: https://artic.com.sa/

Place of production
Al-Kharj Industrial City, Saudi Arabia

Product Category Rules (PCR)
The CEN standard EN 15804+A2 serves as the core PCR.
In addition, EPD Square PCR v1.0, 2024 is used.

Declared unit
1 Tonne

Mass per DU
1000 kg

UN CPC code
375 - Articles of concrete, cement and plaster

Geographical scope
Middle East, Saudi Arabia

Year of study
2023

Comparability
EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in the context of the building.

EPD author
Sarah Curpen, Silvia Vilčeková, SALVIS s.r.o.

Verification type
Independent verification of the declaration and data, according to ISO14025:2006
Internal: ☐
External: ☒

Verified by
Daniel Satola, Daniel Satola Consulting

Satola Daniel

The owner of the declaration shall be liable for the underlying information and evidence.
EPD Square shall not be liable with respect to manufacturer, life cycle assessment data and evidence.

System boundaries

Cradle to gate with modules C1–C4 and module D. The LCA was carried out considering the product stage A1-A3, modules C1–C4, module D.

Modules declared and geographical scope

	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	✓	✓	✓	MND	✓	MND	MND	MND	MND	MND	MND	MND	✓	✓	✓	✓	✓
Geography	KSA	KSA	KSA	MND	ME	MND	MND	MND	MND	MND	MND	MND	ME	ME	ME	ME	ME

**ME: Middle East*

Description of Organization

Established in 1975, the Arabian Tile Company (ARTIC) as part of Al-Aggad Investment Company (AICO), ARTIC is a premier manufacturer and distributor of interior and exterior Flooring and Cladding solutions in the Gulf region. ARTIC's extensive catalogue of products serves both the functional and aesthetic requirements of government, corporate as well as individual customers, yielding stunning architectural expressions.

The company has ten production lines, four in Riyadh, two in Jeddah, and four in Al-Kharj and a strong wholesale distribution network covering Saudi Arabia and GCC countries.

The success of ARTIC is based on four major strategic pillars:

- Commitment to quality and innovative products,
- Excellent product know-how, accumulated over 40 years,
- Unparallel capacity of executing big and high end projects,
- Commitment to invest in human capital.

Product information

Product name
Glass Fibre Reinforced Concrete (GFRC)

Product description
Glass fibre reinforced concrete is a cement-based composite material reinforced with alkali-resistant glass fibres. The glass fibres act as reinforcement in concrete adding flexural, tensile and impact strength. This makes the product versatile and durable.

Product application
The product has various applications and is primarily used for architectural panels and cladding. It can also be used for decorative elements such as outdoor vases and pots.

Product specification
Density: 2000 kg/m^3
Flexural Strength: 7- 18 Nmm^2
Thickness: 200-300 mm

Standards:
GRCA, "Specification for the Manufacture, Curing & Testing of Glass fibre Reinforced Concrete (GRC) Products." (2021)
GRCA, "Methods of Testing Glass fibre Reinforced Concrete (GRC) Material". (2021)
PCI MNL 128, 4th Edition, "Recommended Practice for GFRC Panels."
PCI MNL 130, 2nd Edition "Quality Control of Glass Fibre Reinforced Concrete."

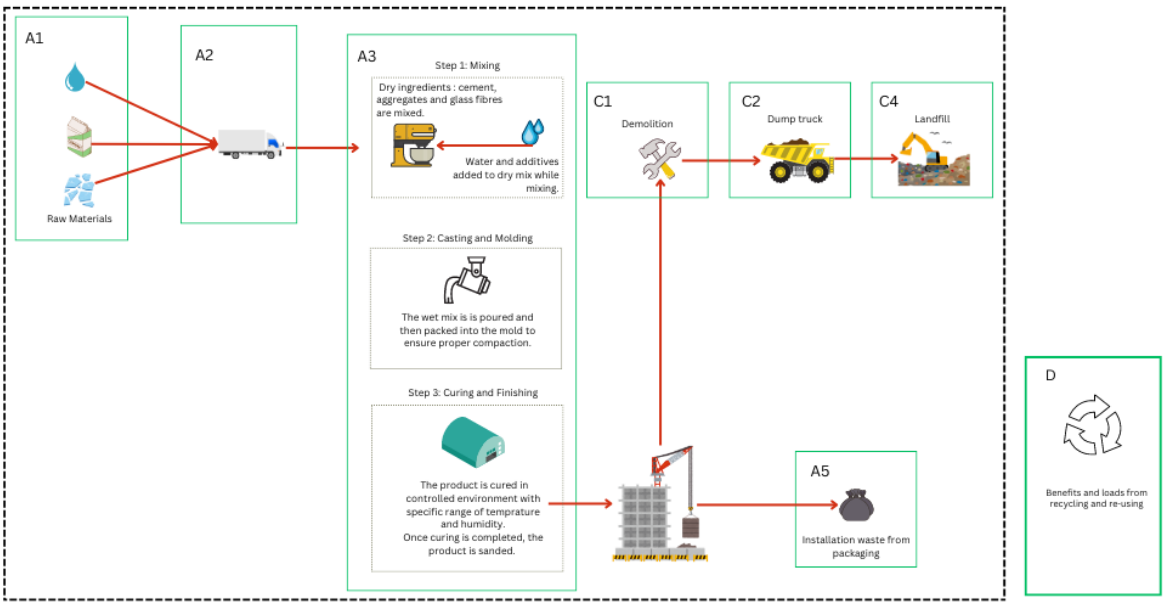
Geographical scope
Middle East

Product contents information

Product components	Weight, kg	Post-consumer material, weight-%	Renewable material, weight-%
White Portland-limestone cement	406	0	0
Portland cement	3.81	0	0
Silica sand	423	0	0
Glass Fibre	34.8	0	0
Additives	10.9	0	0
Water	122	0	0
TOTAL	1000	0	0
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	
Plastic film	0.489	0.0489	
Polystyrene foam slab	1.96	0.196	
Plywood	4.46	0.446	

TOTAL	6.91	0.691

Manufacturing process



Boundary System Diagram

The manufacturing process (A3) for GFRC is as follows:

Material Preparation:
Cement: Use Portland cement or a blend suitable for the desired properties like strength, color, and durability. Aggregates: Fine sand is typically used for GFRC, with a maximum size of around 2mm. Silica sand is a common choice due to its good strength and workability. Glass Fibers: Alkali-resistant glass fibers are crucial for reinforcing the concrete and preventing cracks. Different fiber types and lengths can be used depending on the application's requirements. Additives: Various admixtures can be added to modify the GFRC's properties, such as superplasticizers for improved workability, retarders for extended setting time, and pigments for coloring. Water: Clean water free of impurities is essential for proper hydration and setting of the cement.
Mixing:
Dry ingredients like cement, aggregates, and glass fibers are thoroughly mixed in a suitable mixer. Water and any admixtures are gradually added while mixing continues to achieve a homogeneous and workable mix. The mixing time and sequence can affect the GFRC's properties, so following the manufacturer's recommendations is crucial.
Molding:
GFRC can be molded in various ways, including casting, spraying, and hand-packing. Molds are typically made from rigid materials like fiberglass, polyurethane, or ABS plastic. The mold surface should be clean, sealed, and treated with a release agent to prevent sticking. The mixed GFRC is poured or packed into the mold, ensuring proper compaction and avoiding air pockets.
Curing:
After molding, the GFRC needs to cure properly to develop its strength and durability. This usually involves storing the molded pieces in a controlled environment with specific temperature and humidity conditions. Curing times can vary depending on the mix design, thickness, and ambient conditions.
Finishing:

Once cured, the GFRC can be finished as needed. This may involve sanding, grinding, or polishing to achieve the desired surface textuure. Sealing or painting the GFRC can enhance its appearance, protect it from environmental elements, and improve its durability.

Life cycle assessment (LCA)

Cut-off criteria

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

Allocation, estimations, and assumptions

Allocation is based on annual production rate and made with high accuracy and precision. The values for 1 tonne of the products which are used within this study are calculated by considering the total product weight per annual production. In the production plant, several kinds of products are produced; since the production processes of these products are similar, the annual production percentages are taken into consideration for allocation. According to the ratio of the annual production of the declared product to the total annual production at the factory, the annual total energy consumption, packaging materials and the generated waste per the declared product are allocated. Subsequently, the produced products output fixed to 1 tonne and the corresponding amount of product is used in the calculations.

Database(s) and LCA software

This EPD has been created using One Click LCA Pre-Verified EPD Generator. Ecoinvent v3.8 and One Click LCA databases were used as sources of environmental data.

LCA Scenarios and additional technical information

Manufacturing (A1-A3)

The raw materials are brought from the city of Riyadh to Al-Kharj manufacturing plant, 100 km away by lorry. The raw materials are mixed with water, molded and allowed to cure in a controlled environment. All equipment involved is powered by electricity.

Manufacturing energy scenario

Electricity data source and quality	Electricity, Saudi Arabia, residual mix, IEA, OneClickLCA 2024
Electricity CO2e / kWh	1.12

End of Life (C1, C2, C3, C4)

The fuel usage involved in the deconstruction and dismantling process is estimated based on the reference background process available in Ecoinvent v3.8 designed for this specific task. At this stage, the transport of the dismantled product system is also taken into account, with an assumed distance of 50 km to the disposal site. No reuse or recycling of the product is anticipated. In module C4, the waste disposal scenario involves sending 100% of the product to inert landfill.

	Value	Unit
Collected separately	0	kg
Collected as mixed construction waste	0	kg
Reuse	0	kg
Recycling	0	kg
Energy recovery	0	kg
To landfill	1000	kg

LCA results

Mandatory impact category indicators – EN 15804+A2, PEF 3.0

Indicator	Unit	A1	A2	A3	A1-A3	A5	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	4.6E+02	1.8E+01	7.1E+01	5.4E+02	1.4E+00	3.3E+00	1.3E-02	0.0E+00	5.3E+00	-2.5E+00
GWP-fossil	kg CO2 eq.	4.6E+02	1.8E+01	7.1E+01	5.4E+02	2.9E-01	3.3E+00	1.3E-02	0.0E+00	5.3E+00	3.3E+00
GWP-biogenic	kg CO2 eq.	0.0E+00	6.8E-03	7.4E-02	7.4E-02	1.1E+00	6.1E-04	5.0E-06	0.0E+00	3.4E-03	-5.8E+00
GWP-LULUC	kg CO2 eq.	5.5E-01	7.2E-03	6.1E-03	5.6E-01	4.0E-04	3.3E-04	5.3E-06	0.0E+00	5.0E-03	-6.5E-05
ODP	kg CFC11 eq.	3.2E-05	3.9E-06	9.3E-06	4.6E-05	9.6E-09	7.1E-07	2.9E-09	0.0E+00	2.1E-06	-3.2E-07
AP	mol H^+ eq.	2.0E+00	7.3E-02	3.9E-01	2.5E+00	1.1E-03	3.4E-02	5.4E-05	0.0E+00	5.0E-02	-2.4E-03
EP-freshwater	kg P eq.	8.6E-03	1.5E-04	2.6E-04	9.0E-03	8.4E-06	1.1E-05	1.1E-07	0.0E+00	5.5E-05	-1.3E-06
EP-marine	kg N eq.	4.6E-01	2.1E-02	7.5E-02	5.5E-01	3.0E-04	1.5E-02	1.6E-05	0.0E+00	1.7E-02	-2.6E-04
EP-terrestrial	mol N eq.	5.1E+00	2.4E-01	7.9E-01	6.2E+00	3.1E-03	1.7E-01	1.7E-04	0.0E+00	1.9E-01	-2.8E-03
POCP	kg NMVOC eq.	1.4E+00	7.2E-02	2.6E-01	1.7E+00	9.5E-04	4.6E-02	5.3E-05	0.0E+00	5.5E-02	-2.3E-03
ADP-M&M	kg Sb eq.	1.5E-02	6.1E-05	1.1E-05	1.6E-02	2.5E-06	1.7E-06	4.5E-08	0.0E+00	1.2E-05	-8.2E-07
ADP-fossil	MJ	3.4E+03	2.6E+02	2.3E+02	3.9E+03	2.0E+00	4.5E+01	1.9E-01	0.0E+00	1.4E+02	-5.8E+01
WDP	m^3	7.1E+01	1.1E+00	1.0E+01	8.3E+01	5.8E-02	1.2E-01	8.3E-04	0.0E+00	4.6E-01	1.4E-01

GWP-total: Global Warming Potential; GWP-fossil: Global Warming Potential fossil fuels; GWP-biogenic: Global Warming Potential biogenic; GWP-LULUC: Global Warming Potential land use and land use change; ODP: Depletion potential of the stratospheric ozone layer; AP: Acidification potential, Accumulated Exceedance; EP-freshwater: Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional requirements" for indicator given as PO4 eq. EP-marine: Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-terrestrial: Eutrophication potential, Accumulated Exceedance; POCP: Formation potential of tropospheric ozone; ADP-M&M: Abiotic depletion potential for non-fossil resources (minerals and metals); ADP-fossil: Abiotic depletion potential for fossil resources; WDP: Water deprivation potential, deprivation weighted water consumption

Additional voluntary impact indicators – EN 15804+A2, PEF 3.0

Indicator	Unit	A1	A2	A3	A1-A3	A5	C1	C2	C3	C4	D
PM	Disease incidence	1.8E-05	1.5E-06	3.4E-06	2.3E-05	1.0E-07	9.2E-07	1.1E-09	0.0E+00	1.0E-06	1.9E-09
IRP	kBq U235 eq.	1.5E+01	1.2E+00	1.9E+00	1.8E+01	1.4E-02	2.1E-01	8.8E-04	0.0E+00	6.5E-01	-6.3E-03
ETP-fw	CTUe	7.6E+03	2.4E+02	4.4E+02	8.3E+03	1.0E+01	2.7E+01	1.7E-01	0.0E+00	9.4E+01	-1.6E+01
HTP-c	CTUh	1.9E-07	6.6E-09	1.5E-08	2.2E-07	1.0E-09	1.0E-09	4.9E-12	0.0E+00	2.4E-09	4.4E-10
HTP-nc	CTUh	9.2E-06	2.2E-07	2.1E-07	9.7E-06	6.6E-09	1.9E-08	1.6E-10	0.0E+00	6.2E-08	1.4E-08
SQP	Dimensionless	2.5E+03	1.8E+02	2.3E+01	2.7E+03	2.5E+00	5.8E+00	1.3E-01	0.0E+00	3.1E+02	-1.4E+00

PM: Particulate matter emissions; IRP: Ionising radiation, human health; ETP-fw: Ecotoxicity (freshwater); ETP-c: Human toxicity, cancer effects; HTP-nc: Human toxicity, non-cancer effects; SQP: Land use related impacts / soil quality

Resource use indicators

Parameter	Unit	A1	A2	A3	A1-A3	A5	C1	C2	C3	C4	D
RPEE	MJ	2.0E+02	3.0E+00	7.6E+00	2.1E+02	2.1E-01	2.5E-01	2.2E-03	0.0E+00	1.3E+00	-4.8E-02
RPEM	MJ	0.0E+00	0.0E+00	4.5E-02	4.5E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	-4.5E-02	0.0E+00
TPE	MJ	2.0E+02	3.0E+00	7.6E+00	2.1E+02	2.1E-01	2.5E-01	2.2E-03	0.0E+00	1.2E+00	-4.8E-02
NRPE	MJ	3.2E+03	2.6E+02	9.8E+02	4.4E+03	2.0E+00	4.5E+01	1.9E-01	0.0E+00	1.4E+02	-5.8E+01
NRPM	MJ	2.2E+02	0.0E+00	9.6E+01	3.2E+02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	-3.2E+02	0.0E+00
TRPE	MJ	3.4E+03	2.6E+02	1.1E+03	4.7E+03	2.0E+00	4.5E+01	1.9E-01	0.0E+00	-1.7E+02	-5.8E+01
SM	kg	6.7E-01	8.4E-02	1.2E-02	7.7E-01	7.9E-03	1.7E-02	6.2E-05	0.0E+00	3.0E-02	2.1E-05
RSF	MJ	2.1E-02	1.1E-03	1.5E-02	3.8E-02	6.5E-05	5.7E-05	8.0E-07	0.0E+00	7.9E-04	2.7E-06
NRSF	MJ	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
W	m^3	1.9E+00	3.0E-02	2.1E-01	2.2E+00	1.2E-03	2.7E-03	2.2E-05	0.0E+00	1.6E-01	-7.4E-03

RPEE: Renewable primary energy resources used as energy carrier; RPEM: Renewable primary energy resources used as raw materials; TPE: Total use of renewable primary energy resources; NRPE: Non-renewable primary energy resources used as energy carrier; NRPM: Non-renewable primary energy resources used as materials; TRPE: Total use of non-renewable primary energy resources; SM: Use of secondary materials; RSF: Use of renewable secondary fuels; NRSF: Use of non-renewable secondary fuels; W: Use of net fresh water

Waste indicators

Parameter	Unit	A1	A2	A3	A1-A3	A5	C1	C2	C3	C4	D
HW	kg	1.7E+01	3.7E-01	4.9E-01	1.8E+01	3.0E-02	6.0E-02	2.7E-04	0.0E+00	0.0E+00	-1.9E-02
NHW	kg	4.3E+02	5.9E+00	8.4E+00	4.4E+02	3.7E-01	4.2E-01	4.3E-03	0.0E+00	1.0E+03	6.2E+00
RW	kg	9.2E-03	1.7E-03	2.7E-03	1.4E-02	5.7E-06	3.1E-04	1.3E-06	0.0E+00	0.0E+00	-5.6E-06

HW: Hazardous waste disposed; NHW: Non-hazardous waste disposed; RW: Radioactive waste disposed

Output flow indicators

Parameter	Unit	A1	A2	A3	A1-A3	A5	C1	C2	C3	C4	D
CR	kg	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MR	kg	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MER	kg	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.1E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
EEE	MJ	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
ETE	MJ	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

CR: Components for reuse; MR: Materials for recycling; MER: Materials for energy recovery; EEE: Exported electric energy; ETE: Exported thermal energy

Information describing biogenic carbon content at factory gate

Biogenic carbon content	Value	Unit
Biogenic carbon content in product	0	kg C
Biogenic carbon content in the accompanying packaging	0.290	kg C

Specific data (GWP-GHG) and data variation for A1-A3

Specific data and data variation	
Specific data	>90%
Variation - product	Not relevant
Variation - site	Not relevant

Hazardous substances

☒ The product does not contain any REACH SVHC substances in amounts greater than 0.1 %.

Contact information

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LCA software
OneClickLCA

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EPD Square PCR v.1.0, 2024

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Ecoinvent database v3.8 (2021) and One Click LCA database

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Annex

Environmental impacts – EN 15804+A1, CML/ISO 21930

Indicator	Unit	A1	A2	A3	A1-A3	A5	C1	C2	C3	C4	D
GWP	kg CO2 eq.	4.5E+02	1.7E+01	6.9E+01	5.4E+02	3.0E-01	3.3E+00	1.3E-02	0.0E+00	5.2E+00	3.3E+00
ODP	kg CFC11 eq.	2.6E-05	3.1E-06	7.3E-06	3.7E-05	8.2E-09	5.6E-07	2.3E-09	0.0E+00	1.7E-06	-2.5E-07
AP	kg SO_2 eq.	1.6E+00	5.7E-02	3.2E-01	1.9E+00	8.8E-04	2.5E-02	4.2E-05	0.0E+00	3.7E-02	-2.1E-03
EP	kg PO_4 eq.	5.7E-01	1.3E-02	3.4E-02	6.2E-01	2.9E-03	5.7E-03	9.6E-06	0.0E+00	8.1E-03	6.4E-04
POCP	kg C_2H_4 eq.	6.8E-02	2.3E-03	2.5E-02	9.6E-02	9.1E-05	5.4E-04	1.7E-06	0.0E+00	1.6E-03	-2.3E-04
ADP-M&M	kg Sb eq.	2.9E-03	6.0E-05	3.5E-05	3.0E-03	2.4E-06	1.7E-06	4.4E-08	0.0E+00	1.2E-05	-8.7E-07
ADP-fossil	MJ	3.4E+03	2.6E+02	1.1E+03	4.7E+03	2.0E+00	4.5E+01	1.9E-01	0.0E+00	1.4E+02	-5.8E+01

Environmental impacts – GWP-GHG

Indicator	Unit	A1	A2	A3	A1-A3	A5	C1	C2	C3	C4	D
GWP - GHG	kg CO2e	4.6E+02	1.8E+01	7.1E+01	5.4E+02	2.9E-01	3.3E+00	1.3E-02	0.0E+00	5.3E+00	3.3E+00

GWP- GHG: Global Warming Potential, greenhouse gases