



Figure 3: Elements in a warm climate in the UAE.

# Durable architectural façades with GRC

*Glass-fibre-reinforced concrete (GRC) is a very versatile cladding material for both new buildings and renovations, which provides unique design options for both architects and builders. Its list of benefits is long and includes fire resistance, the ability to create complex shapes, low weight, durability and a positive environmental impact.*

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**M**ore and more architects are joining in the praise for GRC. As it has reached building material maturity over the past few years, its many benefits for façade cladding become ever clearer.

One of the reasons for this rising popularity is a focus on long-lasting buildings, with low maintenance outweighing initial low-cost buildings. The market accepts slightly higher initial costs as the long-term economy and environmental impact are more important.

New tools make it easier to view and understand a building's total budget, again helping to show the benefits of using GRC and other long-lasting materials.

## Formable

For architects, the freedom to design is perhaps the distinctive feature that first draws them to GRC. The ability to be moulded into thin, lightweight panels with an extensive variety of different shapes, colours, structures and surfaces is second to none. Curves, returns, patterns, etc. are almost inherent properties of the material. This is the architectural tool to make gorgeous renovations and exceptional new buildings.



Figure 1: 3D curved elements for project in Bratislava and Billund.

Not only is it ideal for creating great details, but also it ensures strength in corners and edges. Using the spray technique is the best way forward when creating these special shapes and surfaces (see Figure 1).

## Durable

The material has been heavily tested – it does not rot, erode or dissolve. The only thing that theoretically breaks down GRC is the acid in the air – and this would take a very long time.

It has been used around the world for small and large projects for more than 50 years and a non-scientific estimate is that façades will last for more than 100 years.

In both warm climates, as in the Middle East, and cold climates far to the north, the material offers durable façades. Freeze-thaw damage never happens with properly produced GRC and such façade elements easily withstand earthquakes (see Figures 2 and 3).

Table 1 – Fire classification of cladding materials. When produced correctly, GRC is a Euroclass A1 material

Class	Performance description	Fire scenario and heat attack		Examples of products
A1	No contribution to fire	Fully developed fire in a room	At least 60kW/m <sup>2</sup>	Products of natural stone; concrete, bricks, ceramic, glass, steel and many metallic products
A2	No contribution to fire	Fully developed fire in a room	At least 60kW/m <sup>2</sup>	Products similar to those of class A1, including small amounts of organic compounds
B	Very limited contribution to fire	Single burning item in a room	40kW/m <sup>2</sup> on a limited area	Gypsum boards with different (thin) surface linings Fire-retardant wood products
C	Limited contribution to fire	Single burning item in a room	40kW/m <sup>2</sup> on a limited area	Phenolic foam, gypsum boards with different surface linings (thicker than in class B)
D	Acceptable contribution to fire	Single burning item in a room	40kW/m <sup>2</sup> on a limited area	Wood products with thickness ≥ about 10mm and density ≥ about 400kg/m <sup>3</sup> (depending on end use)
E	Acceptable contribution to fire	Small flame attack	Flame height of 20mm	Low-density fibreboard, plastic-based insulation product
F	No performance requirements	–	–	Products not tested (no requirements)

### Non-combustible

GRC concrete is also a non-combustible building material. It does not burn or emit smoke when exposed to fire. When produced correctly and with specialised polymer, GRC can be classified as A1 or A2 according to European Standard EN 13501-1<sup>(1)</sup>. With this classification it is suitable for high-rise construction and can be part of non-combustible constructions and guards against wind and rain (see Table 1).

### Low weight

Typically, façade elements are produced in 12mm thicknesses, giving a weight per square metre of approximately 25kg (see Figure 4). The low weight, combined with the high strength of the material, decreases the substructure and number of supporting brackets. This also decreases the total weight of the façade and in turn creates less stress on the load-bearing construction, which in the end means less total cost and better total façade economy for most projects.

The low weight ensures easier and faster installation, as the elements are manageable on-site without heavy-duty equipment. The mounting system is often adapted to the project in question in order to make the installation fast and easy for the installer.

### Environmentally friendly

Producing the façade elements requires very little energy. The greatest energy input in creating the material comes from cement production. However, due to the normal thickness of 12mm, very little cement is used and so the energy expended is negligible on

the environmental impact of the building.

GRC is based on naturally occurring oxides that are used to produce both the cement and glass fibres, together with small amounts of additives. Washwater is the main waste product from the creation of GRC elements. This washwater is alkaline due to the cement. As most waste in the sewer system is acidic, it can be a helpful to add the washwater from GRC production to the system. However, all responsible manufacturers use filtration chambers before releasing the waste into the sewer system.

Production quality is extremely important. The craftsmanship going into the production is higher than for most other façade materials. So when choosing a supplier of such elements, it is very important to choose a producer with thorough and externally verified quality system, factory control, and documented material strength.

GRC has a positive impact with building certification systems such as LEED, DGNB, BNB and BREEAM.

The selection of glass-fibre-reinforced concrete as a façade material typically starts with an architectural desire to create beautiful unique buildings. And when this is combined with the long-term economic benefits of choosing the material, it is little wonder that builders, contractors and developers are joining the growing clamour in praise of GRC. ■

#### Reference:

1. BRITISH STANDARDS INSTITUTION, BS EN 13501. *Fire classification of construction products and building elements. Part 1 – Classification using data from reaction to fire tests*. BSI, London, 2018.



Figure 2: Elements in a cold climate in Denmark.



Figure 4: The typical thickness of GRC for façades is 12mm.