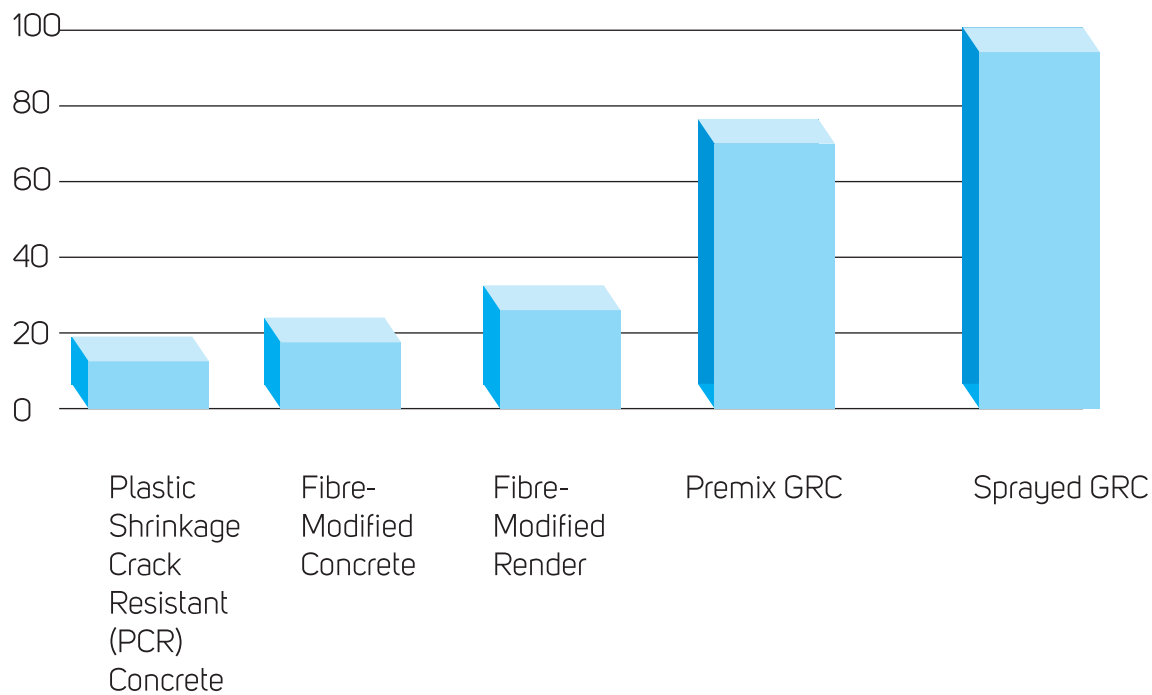


GRC is a family of materials that can be defined by the addition rate of alkali resistant glass fibre. At one end of the spectrum low dosages of dispersible fibres are used to control plastic shrinkage cracks in normal concretes (PCR). At the other end, integral fibres are used at high dosage levels to reinforce cement-rich mortars (GRC)

Fibre contents for different GRC product types (kg of fibre per m³ of concrete)



Most GRC products are manufactured by one of two processes-Vibration Casting and Spraying.

The vibration cast form is normally referred to as "Premix GRC". Premix GRC is produced in a two stage process. A mixture of cement, sand, water and chemical admixtures is first prepared in a high speed mixer. Fibres are added in the second stage with a slower speed. The Premix GRC is then poured into moulds and compacted by vibration.

Sprayed GRC is sometimes called "Hand Spray GRC" or "Machine Spray GRC" depending on the method of manufacture. A mixture of cement, sand, water and chemical admixtures is prepared in a high shear slurry mixer. This is then placed in a machine that conveys the slurry to a special spray gun where the fibres are added at the nozzle as the GRC material is sprayed onto a mould.

A third production process called "Spray Premix" is also often used for the manufacture of smaller elements and the application of renders.

The strength of Sprayed GRC is generally higher than Premix GRC.

The table below shows typical values for Sprayed GRC and Premix GRC manufactured with 5% and 3% (by weight of mix) alkali resistant glass fibre.

Property	Hand or Machine Spray GRC	Vibration Cast Premix GRC
Glassfibre Content by Weight of Mix	5%	3%
Bending:		
Ultimate Strength (Modulus of Rupture-MOR) MPa	20-30	10-14
Elastic Limit (Limit of Proportionality - LOP) MPa	7-11	5-8
Tension:		
Ultimate Strength (Ultimate Tensile Strength-UTS) MPa	8-11	4-7
Elastic Limit (Ben Over Point-BOP) Mpa	5-7	4-6
Shear:		
Interlaminar Shear Strength MPa	3-5	N.A.
In-plane Shear Strength MPa	8-11	4-7
Compressive Strength MPa	50-80	40-60
Impact Strength kj/m ²	10-25	10-15
Elastic Modulus GPa	10-20	10-20
Strain to Failure %	0.6-1.2	0.1-0.2
Dry Density Tonne/m ³	1.9-2.1	1.8-2.0

Hand Spray GRC



Spraying Premix GRC render



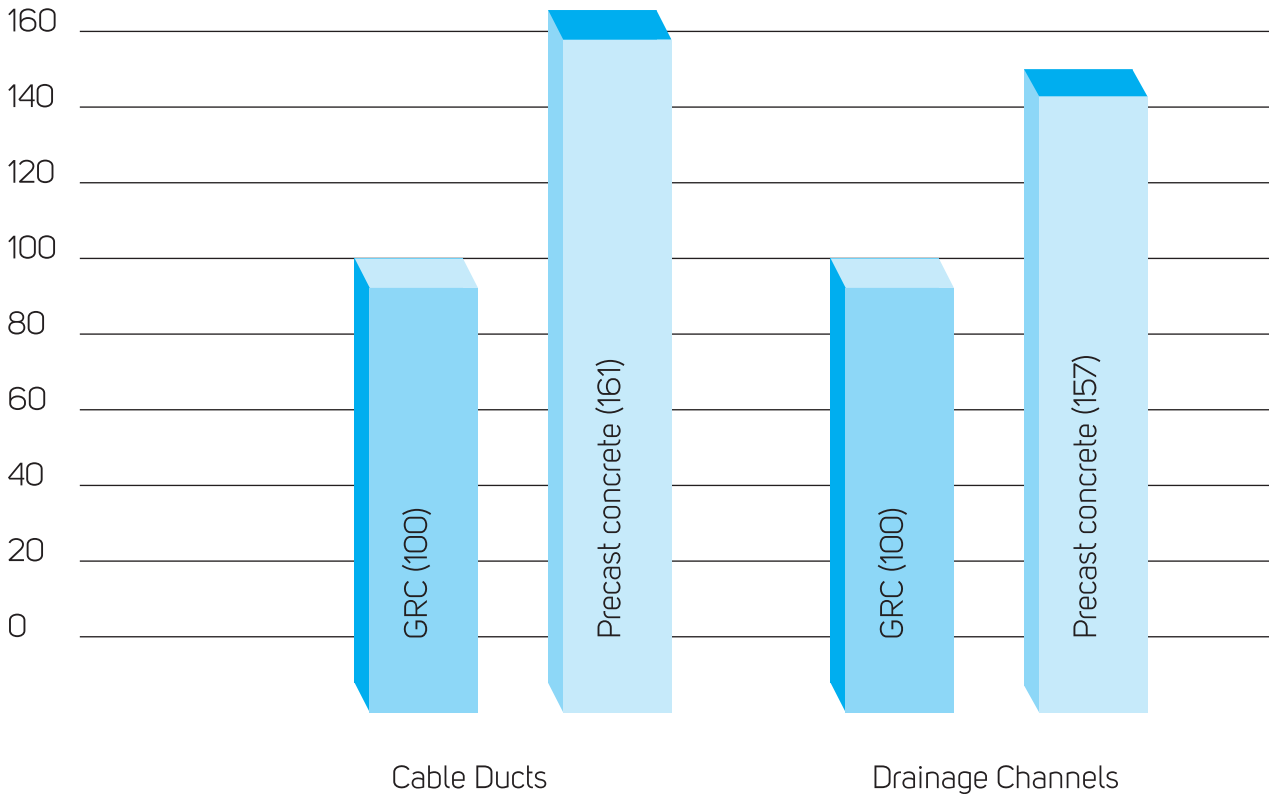
Vibration Cast Premix GRC



GRC and the Environment

The main constituents of GRC are based on the naturally occurring earth oxides that are used in the manufacture of cement and glass fibres. These are not generally regarded as pollutants. Wash water from the manufacturing process contains cement and this is alkaline. It is normal for factories to have settlement tanks so that solids do not enter the drainage system.

Eco-95 Weighted average environmental impact



The reduced weight of GRC compared to steel reinforced concrete products does provide environmental benefits. An assessment carried out as part of UK government DETER/Concrete Industry Alliance 'Partners in Technology' project compared two precast concrete and GRC products that fulfil the same function. The results show that GRC has a lower environmental impact.

The main reasons for the reduced environmental impact of GRC compared to traditional precast concrete are:

Reduced cement usage per product

Reduced transport costs.