RICKARD
ENGINEERING

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GRC & GRP

GLASS REINFORCED CONCRETE (GRC) AND PLASTIC (GRP)

RICKARD ENGINEERING

INTRODUCTION

Rickard Engineering is one of Australia's most sought-after GRC and GRP engineering firms having built a solid reputation through delivering quality, trust and innovation.

Rickard Engineering is providing Civil, Structural and Façade Engineering services in Australia and worldwide, with an emphasis on Glass Reinforced Concrete (GRC) and Glass Reinforced Plastic (GRP). The aim of the company is to provide top quality engineering services in terms of durability, stability, economy and constructability with our highly professional team with over 40 years' experience in business.

Our expert team is highly efficient in understanding project requirements and in collaborating with other stakeholders to deliver the design to meet architectural requirements.

Rickard Engineering is capable of analysing and designing the most complicated façade element and features using state of the art technology. By linking 3D CAD software and BIM platforms with FINITE element software, we are able to analyse and design façade or any other structural element in 3D mode.

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INTRODUCTION TO GRC

WHAT IS GLASS REINFORCED CONCRETE (GRC)?

Glass Reinforced Concrete (GRC), also known as Glass Fibre Reinforced Concrete (GFRC), is one of the most versatile building materials that has been developed at the end of the twentieth century and made a significant change to the façade industry.

Sprayed or premix GRC contains concrete and glass fibres, and can be formed to any shape to reflect the architectural intent. Products made from GRC can be formed into sections as thin as 8 mm; hence, the weight is much less than traditional precast concrete products.

The design and manufacture of GRC products is covered by international standards, and GRC products are manufactured in over 100 countries.

THE LANES STAGE 2
Gold Coast, Australia

WHY GRC?

GRC typically gives a panel weight of less than 50 kg per square metre. In comparison, conventional reinforced concrete weighs around 360 kg/sqm for a 150 mm thick panel. This means GRC panels can be more than seven times lighter than traditional concrete!

A single skin of GRC can achieve a fire rating of up to one and a half hours.

GRC is also extremely durable, with a typical compressive strength of 60 MPa, making it ideal for exposed applications.

There are virtually no limitations on the textures and features that can be built into GRC. The absence of coarse aggregate in the mix allows for very sharp lines and smooth surfaces.

Finally, GRC can be engineered to suit a wide range of applications, either framed with a backing steel or using integral GRC ribs.

GRC USES:

- Façades on new buildings.
- As an over-cladding on old façades.
- Permanent formwork on which concrete can be poured, thereby gaining a very durable, long-term soffit surface to the slab.
- Used to form sculptured structures: the 37-metre-high Merlion on Sentosa Island, Singapore or the Big Ram, the Big Prawn and the Big Oyster in Australia.
- Awnings or sunscreens on the face of a building.
- In or above-ground drainage pits, oil or grease separators.
- Street furniture and planter boxes.

A significant advantage of the material is that you can create a fire-resistant structural product to suit any shape, subject to an engineer's approval.

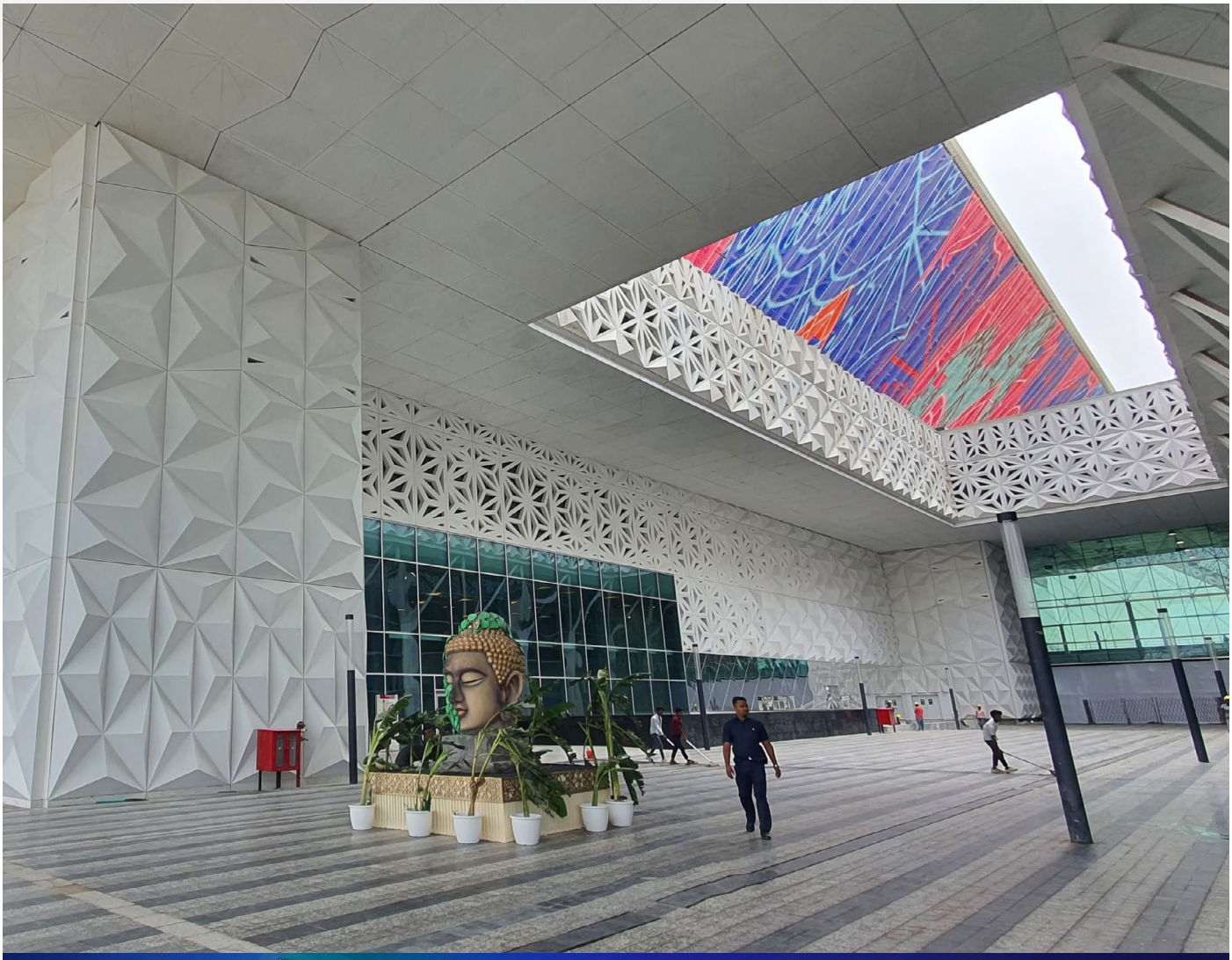
GRC is increasingly becoming a replacement for precast concrete and aluminium composite. GRC is second to no other cementitious material - this is why it is so popular for building façades.

GRC FEATURES:

- Lightweight and easier to handle and install
- Weather-resistant, durable, and crack-resistant
- Withstands high wind pressure
- Can be formed in any shape
- Reduce loading on buildings, leading to significant savings on the main structure.
- Wide range of surface finishes and textures
- Fire resistance
- Chemically resistant
- Environmentally friendly

INDIA INTERNATIONAL CONVENTION CENTRE (IICC)

Delhi, India



Rickard Engineering delivered the design for GRC solid and perforated panels for the façade and internal ceiling of three buildings in the complex.

THE RIBBON

Sydney, Australia

The iconic IMAX Theatre located in the centre of Darling Harbour, Sydney, underwent a major $700 million redevelopment renamed “The Ribbon.” Rickard Engineering coordinated and designed the podium entry of the new building for Grocon Pty Ltd.

THE LANES STAGE 2

Gold Coast, Australia

The Lanes Phase 2 is a residential development involving two towers on the waterfront of Mermaid Waters, Gold Coast. Rickard Engineering provided the engineering input, from concept and detailed design to certification, for the GRC podium panels and GRC fins up to the roof for this project. This is an appealing and complex project concerning all different 3D irregular curved shapes and, hence, variations in connections to cater to them. Transportation, lifting, and installation had their challenges because of the unique geometry and considerable panel size.

ST LEONARD'S COLLEGE

Melbourne, Australia

Rickard Engineering's scope of works was the Design and Certification of the GRC façade for the new buildings. The large, curved panels are designed to clad the buildings with a water tight joint in the GRC panel. Ten metre long GRC panels are strengthened with steel frames to withstand applicable wind loads.

DESTINATION

Gold Coast, Australia

Rickard Engineering completed the concept to design for the Glass Reinforced Concrete (GRC) podiums panels on this project. The GRC panels are up to 4 m long x 4 m wide. Transport, lift and installation had its challenges. GRC was shop drawn and manufactured by Precast Concrete Brisbane. The GRC panels are supported by a steel frame with a GRC skin. The façade consisted of all different shapes and sizes to meet the architectural intent.

MUSEUM OF CONTEMPORARY ART (MCA)

Sydney, Australia

Construction for a major extension to the MCA commenced in 2010 and opened in 2012. The design was chosen as a result of a competition. The panels included some of the largest GRC panels ever built in the world. 11.0 m by 3.4 m high, with a 1.5 m return on one end, they were supplied in a variety of 6 colours. The panels incorporated a unique design detail required to accommodate the high skin movements associated with such a large panel. The project was the subject of a paper presented by Charles Rickard at the GRCA World Conference in Istanbul, 2012.

18 INNOVATION WALK AT MONASH UNIVERSITY

Melbourne, Australia

18 Innovation Walk is one of the building at The Monash University in Melbourne. Rickard Engineering designed and certified the GRC cladding of the revamped building. A unique feature of the façade was that it did not require any access to the rear of the panels for erection. This allowed the building to remain occupied during construction of the entire façade.

INFINITY BY CROWN GROUP

Sydney, Australia

Asurco Contracting Pty Ltd in Adelaide contracted Rickard Engineering to provide the GRC cladding for the Green Square project, in particular the ski slope roof feature.

OMAN CONVENTION CENTRE (OCC)

Muscat, Oman

Rickard Engineering were contracted by Al Turki Enterprises to design and certify the iconic blue roof and glass of The Oman Convention & Exhibition Centre. The OCEC is an iconic landmark for the city of Muscat and the Sultanate, with the building being designed to accommodate world congresses, exhibitions, regional meetings, gala events, performances and concerts. The roof is made of GRC panels covered with tiles.

INTRODUCTION TO GRP

WHAT IS GLASS REINFORCED PLASTIC (GRP)?

Glass Reinforced Plastic (shortened as GRP or FRP – Fibreglass Reinforced Polymer) is made of synthetic resin as the main element of the matrix and glass fibre or other fibrous product as reinforced material, processed into a solid material by moulding, infusing, laying, or pultruding.

Due to its high strength, GRP can and has been used to create amazing architectural features that are much lighter and stronger than traditional concrete or even GRC structures. Low density of the material allows for the walls to be thinner than 5 mm, and the flexibility of moulding allows for the thickness to be increased wherever required, leading to truly optimised designs.

AHMAD BIN ALI STADIUM
Ar-Rayyan, Qatar

WHY GRP?

GRP is waterproof, making it ideal for all outdoor applications. It can be customised to be fire-retardant by using non-flammable resins.

With a variety of available finishes (from smooth surface to coarse, GRC-like finish), GRP is the perfect material for Architects realising their vision of the building façade.

GRP (excluding core and supporting frame) can be as light as 10 kg/sqm, making it a clear victor from the point of view of the panel's mass. This is due to a high strength-to-weight ratio, which means that even a thin piece of material can be really strong. In a pound-for-pound comparison, GRP can be stronger than steel!

As a highly durable material with a very long lifetime expectancy, GRP is ideally suited for a wide range of applications in various industries.

GRP USES:

- Façades on new buildings.
- Elements of the façade or sculptures that require an ultra-high level of detail.
- Elements subjected to the high loads where the weight has to be kept low.
- Structures in the high corrosivity zones.
- Used to form sculptured structures, monuments, and statues.
- Street furniture and planter boxes.
- Awnings or sunscreens on the face of a building.
- Proprietary standard products, such as cable ducting.

GRP is a material of the future – light and strong, with extremely high durability. With correct application, it can also be made fire-retardant, widening the range of applications.

Truelly great applications are GRP panels with a foam-formed core, allowing to reduce the mass of the façade element even more, while keeping the panels' slenderness and, considering GRP's durability, allowing for future generations to admire the final effect.

GRP FEATURES:

- Very high strength (greater than GRC)
- Lightweight, easy to handle and install
- Weather-resistant, durable, and extremely crack-resistant
- Possesses a certain level of ductility
- Withstands high wind pressure

ROSEWOOD

Doha, Qatar

Setting the benchmark for ultra-luxury hotels in the region, Doha's 'Rosewood' is a key focal point of the city's skyline. Rickard Engineering is proud to have provided the structural design for the striking GRP facades of the two towers, which were inspired by the coral reefs in the seas surrounding it. The complex will be one of the city's most dynamic culinary and hotel destinations and introduces 300 residences boasting modern luxury.

AHMAD BIN ALI STADIUM

Ar-Rayyan, Qatar

Rickard Engineering designed the GRP façade for the new 'Ahmad Bin Ali' Football Stadium in Qatar. The project is a fascinating GRP façade in regards to the differing GRP shape designs to supporting steel. The project included the façade of the main stadium and eight dune roofs.

OTHER GRC/GRP APPLICATIONS

ACOUSTICS

GRC and GRP are very efficient at blocking the passage of noise due to its high surface mass.

Both can be is being used internally and externally for acoustic barriers and screens for highways and railways for example. This is advantageous for the surrounding neighbourhood.

Bespoke and creative designs can be created so to enhance to aesthetics to the environment such as concert halls and auditoriums.

175 EAGLE STREET

Brisbane, Australia

Rickard Engineering designed the entrance curtain feature at 175 Eagle Street. The design uses GRC panels with a steel frame. The panels form a wave shape with a complex, uneven pattern, giving the entrance a unique character.

SCREENS

GRC and GRP can be used to produce architectural mouldings and features for visually appealing screens. The screens can be easy to handle and therefore to erect, visually appealing as well as functional.

CEREMONIAL COURT

Ar-Rayyan, Qatar

Charles Rickard first visited Qatar in 1980. His first project was a royal palace for the Emir. Working for White Young in London, Charles spent time in Rome working with architect Sandro Petti. The palace was built on a new island just off the coast of Qatar. The Ceremonial Court was part of a technical educational facility project for the Queen. Built by Redco, a local Qatar GRC company, Charles undertook the design on behalf of Rickard Hails Moretti in 2005.

LANDSCAPING AND FREE-FORM STRUCTURES

GRC and GRP are playing a major role in the area of landscaping due to its surface finish and the ability to modify shape and form. Examples such as statues, sculptors, signs, seating, planters, rockscapes and replica buildings are benefiting with the use of GRC, in particular in parks, zoos and theme parks.

GRC and GRP features

- Electrical resistance
- Design flexibility
- Fast erection on site
- Excellent thermal performance
- Easy to transport and install on site

MERLION

Singapore

In 1993, Charles created the 37-metre high “Merlion” in Singapore. Besides GRC, the statue involved very significant structural and civil engineering design. The base of the tower was surrounded in a very large water feature. The whole structure was piled. Finally, there was also dynamic design considerations. The light-weight nature of the tower combined with its 37-metre height created a relatively high natural frequency and consideration was given to installing a “damper”. GRC construction works by Glenn Industries, Adelaide.

BODY ZONE

London, UK

In 1999, Charles Rickard was responsible for the GRC component of the “Body Zone”, built as part of the Millennium celebrations in London. GRC constructions works by Glenn Industries, Adelaide. In the same year, Charles was also the technical editor for the development of the first Australian Code of Practice for GRC.

BIRD PARADISE WATERFALL AT SINGAPORE ZOO

Mandai, Singapore

Waterfall project at Singapore Zoo. The artificial rock is made of GRC. The complicated shapes of the rocks including caves, columns, planters, walls and ceiling were created using different structural systems. Some parts of the artificial rock is submerged in the water.

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