



RICKARD
ENGINEERING

SYDNEY • LONDON • DUBAI



SKYE BY CROWN GROUP
North Sydney NSW

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AUSTRALIA 108
70 Southbank Blvd,
Southbank VIC



Charles Rickard is one of Australia's most sought-after engineers who has built a solid reputation through delivering quality, trust and innovation within his field.

Charles Rickard

MSc, CEng, FStruct.E, FIE (AUST), MIPENZ

PRINCIPAL

An industry leader and well-respected professional within his field.

Charles Rickard graduated from Surrey University, UK with a Master of Science (Distinction) in Structural Engineering in 1975, having completed a Bachelor of Science in Civil Engineering the previous year.

Charles undertook his initial three years of engineering training with Taylor Woodrow, the international engineering group. By 1982, after an 18 month stay with Alan Baxter & Associates, he had achieved the position of London Associate with White Young Consulting Group (now known as White Young Green). His major responsibility with them was the engineering design and site supervision of construction for the \$100 million (1980 value) Phase 2 Basildon town centre development in the UK. Charles also did a three month stint in Qatar, where he designed a new palace for the Emir.

In 1984, Charles moved to Australia and set up Rickard and Partners Pty Ltd, subsequently known as Bonacci Rickard, then Rickard Hails Moretti Pty Ltd. Over a period of 20 years, the company offered civil, structural, façade and building diagnostic consultancy services in two divisions, while utilising the very latest in design and drafting computer technology. The new company eventually enjoyed an annual fee income turnover in excess of \$3 million, with clients covering the public and private sector and project values ranging up to \$200 million.



*405 Bourke Street,
Melbourne VIC*

In 2004, Charles retired from that business and moved to Neutral Bay where he continued working as a sole practitioner. After four years, Charles opened a new office at 121 Military Road, Neutral Bay. Initially known as RH Consulting, Rickard Engineering has a highly experienced team of engineers with skills in Civil, Structural, Diagnostic, Façade, Aquatic Engineering and Building Dispute Resolution.

The Charles Rickard name is synonymous with quality. He is an industry leader and well respected professional within his field. In 2012, he became Chairman of the Multi-disciplinary Committee of the Institution of Engineers Australia. This role saw him provide recommendations to the NSW Government on the Standards of Certification in the building industry today.

While Charles has all round skills, he has developed extra special skills in façades, glass reinforced concrete and reinforced plastics. He was technical secretary (1999) to the National Precast Concrete Association for the development of the first Australian Code of Practice for Glass Reinforced Concrete (GRC).

Charles is also considered a special expert in swimming pool design; his expertise uniquely covering both fibreglass and concrete. He has designed over 20 Aquatic centres in Australia and Asia and in 1987, was technical secretary to the NZ/Australian Standards, AS1838 and AS1839.

Rickard Engineering undertakes building diagnostic work of an engineering nature (including dispute arbitration work) for the NSW Department of Commerce, the Office of Fair Trading and the NSW Department of Education.

Charles has written an engineering training course for graduate engineers. Known as Mentor-CSE, it concentrates on all the issues you learn from experience rather than at University and will be available in 2019.

Memorable Projects

1984 - 2004

by **Charles Rickard**

*140 Sussex Street,
Sydney NSW*





Ceremonial Court

Qatar

Charles Rickard first visited Qatar in 1980. His first project was a royal palace for the Emir built around 1980. 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. Since that time he has revisited Doha on many occasions.

In more recent years his involvement has been related to GRC. 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 Rickard Hails Moretti in 2005.



Norwest Business Park

Baulkham Hills, NSW

In 1992, Rickard and Partners completed the civil/structural design. Built by Grant Constructions, this is one of the major buildings in the complex, immediately adjacent to the lake.



*The Riverside Building
Builder: Grant Constructions*

Pacific Square

Maroubra, NSW

Completed in 2005, at a cost of approximately \$150 million, RHM Consulting Engineers was responsible for the structural and Façade engineering design of the Pacific Square Shopping Centre in the heart of Maroubra Junction, Sydney.





Pulau Ubin, Sir Stamford Raffles Replica Boat

Singapore

Rickard Engineering had an office in Singapore from 1992 to 1994. Principally this was to provide support during the construction of The Merlion.

At the same time we became involved in the creation of a full scale replica of the boat on which Sir Stamford Raffles arrived in Singapore in 1819. Above waterline, the structure was of timber with authentic ropes and rigging. The whole structure was founded on a concrete slab, set into the sand on the beach, all as part of the Outward Bound School.



Services

Structural Engineering
Civil Engineering
Façade Engineering
Diagnostics Engineering
GRC Specialist Design
GRP Specialist Design
Temporary Works
Value Engineering
Swimming Pools

WYNYARD WALK

*Western Portal, Clarence Street Portal
Client: Townsend Group*



5 HAMILTON STREET

Rose Bay, NSW

Client: Kimberley Securities

Structural Engineering

Our services cover all classes of buildings: commercial, residential, industrial, retail, car parks, pre-fabricated and modular structures, demountable buildings, education facilities and materials handling facilities. Works include design in steel, concrete and timber materials specialising in:

- Conceptual and schematic design
- Wind analysis review
- Lateral stability optimisation
- Earthquake engineering
- Detailed design and construction documentation
- Site support
- Peer reviews and value engineering

Our staff are trained to ensure that all structural design is appropriate for purpose and to be conscious both of construction cost and construction time.

With structural engineering we are particularly focused on the need to NOT overdesign.



Façade Engineering

The design of high rise building façades requires careful and detailed analysis. It is necessary to consider the “design intent” of the architect together with structural limitations and possible implications for construction. Concept design is essential to provide thermal analysis, ascertain likely wind loads, negative pressure, water-tightness and construction methodology and to work closely with owners, architects, contractors and other engineers.

Over many years we have become experts in the design of virtually every form of façade treatment including, but without being limited to:

The practice is renowned for its expertise in façades, in particular for curtain wall construction and the design of glass reinforced concrete cladding panels.

- Curtain wall and window design and certification
- Precast concrete and GRC
- Metal clad and rain-screen systems
- Stone and terracotta
- Structural glass
- Fibre composites
- Glass awnings and skylights
- Thermal analysis of façade systems



AL RAYYAN STADIUM

Doha, Qatar
Client: Al Tasnim

Glass Reinforced Plastic (GRP)

Since the 1990s, zero rated fibreglass has been available and has been used in such items as the Tangara train seats (for which we also designed the injection moulds) and other areas where fire rating is essential. The strength and flexibility of GRP allows for its use in façades and other indoor and outdoor applications.

GRP is used extensively for swimming pools. Rickard Engineering was responsible for designing the first free standing fibreglass swimming pool requiring no support from any soil or other structure.

GRP has the strength of steel but the stiffness of timber.

Other commissions have included the design of seats for a grandstand at Randwick Race Course, the canopy to the lookout tower in Newcastle and agitation tanks for the manufacture of gelatine.



MONASH UNIVERSITY
Melbourne, VIC
Client: Multiplex

Glass Reinforced Concrete (GRC)

Charles Rickard is an acknowledged world expert in the design and application of GRC technology. He was the Technical Secretary to the Cement & Concrete Association during the 1990s when he wrote the Australian Code of Practice for GRC. His pioneering use of continuous glass filament has led to much improved strength in façade structures and has been adopted as a standard throughout the world by the majority of GRC designers and fabricators.

Charles and his team are regularly invited overseas to provide GRC design services.

GRC is widely used in the Middle East and is quickly gaining popularity in Australia. It is the logical alternative to flammable composite aluminium cladding.



PORT BOTANY CONTAINER PARK

Client: PBCP Pty Ltd.

Temporary Works Support

Rickard Engineering regularly provides advice to building contractors on means of stabilising existing structures during major redesign and/or refurbishment works.

Temporary works may include design of back-propping, infill slabs, adjunct footings/foundations and the like.

Civil Engineering

Our team of professional engineers have disparate yet complementary skills enabling us to confidently design:

- Retaining walls
- Underground pits
- Deep trenches including ground stabilisation walls
- Concrete and steel tanks
- Foundations including piling and piers
- Pavements
- Civil works
- Storm water controls

Staff involvement in completed projects includes:

The new container parks in the Ports of Sydney and Brisbane, the runway pavement alterations at Sydney Airport, the design of the Dubai dry docks and the Newcastle coal terminal at Kooragang Island, the largest coal port in the world.



Mascot Engineering products
Pit Range



Compass Pools range

***If you need to make it,
we can design it.***

Product Development

Rickard Engineering has been involved in the design and the development of numerous products which are integral to construction and engineering both. We have designed a number of aluminium proprietary products for the exclusive use of contractors for use in building façades, a range of GRC drainage pits for Mascot Engineering and a fire resistant GRC decking for use in country bushland areas.

We have the design skills in-house to meet most challenges for the design of specific products.

Project Evaluation / Value Engineering

Project evaluation generally occurs post-design. *Value engineering* is generally conducted pre-design or during the design process.

Over design of structural engineering elements by some practitioners is, unfortunately commonplace. A peer review by an experienced structural engineer can identify whether a structure has in fact been over designed. Rickard Engineering's strict adherence to economical design within its own practice provides it with the ability to audit the work of others leading if necessary, to recommendations on design amendment and cost minimisation.

Rickard Engineering, both with project evaluation and value engineering, works in conjunction with Robert Hart who has over 50 years' experience working with architects, engineers (in all disciplines), builders and developers.



BOURKE STREET PUBLIC SCHOOL
Surry Hills, NSW

We have a proven track record of achieving optimum design solutions whilst minimising costs.

Diagnostic Engineering

Rickard Engineering has been providing engineering diagnostic services in Australia since 1984 and has strong ongoing relationships in the public sector, in particular, the NSW Department of Education.

Every year Rickard Engineering inspects an average of one school every calendar week. Rectification of cracking in old buildings requires pragmatism combined with a sound understanding of soil mechanics in relation to masonry and timber frame structures.

We also look at issues to do with residential strata when the enquiry is specifically to do with engineering. Such experience is also invaluable when evaluating the cause of building defects which become a matter of a building dispute.

Building Dispute Resolution

Lawyers know the law, we know building construction.

Building and construction litigation can be costly, stressful for both parties and often unnecessary. In the end, no one really wins in court except perhaps the lawyers. We have found that in reality, the root cause of a dispute can often be found in poor design or lack of effective supervision rather than in the execution of trades workmanship.

We have the proven expertise to unravel and understand complex problems and to separate and identify the design, management and construction responsibilities attaching to the particular dispute, without resorting to the law.

Our team of industry experts have the experience and skills to resolve your dispute quickly, fairly and cost effectively.

We confer with both parties to gain an understanding of the issues from their respective points of view. We then undertake a process known as "Early Neutral Evaluation" to guide our initial determination of the factual basis of a claim by claimant and defendant, both. When our review is complete we provide totally unbiased advice on how to resolve a dispute at a fraction of the cost of litigation.



DEE WHY RSL CLUB
Ocean Grove
Apartments, NSW



Client: Compass Pools



Client: Compass Pools

Swimming Pools

Charles Rickard has arguably the broadest experience in the design of swimming pools in Australia. Charles has enjoyed a professional relationship with Crystal Pools since 1984 – building concrete pools. If one considers the design of fibreglass pools, he has no peer.

He has acted for Compass Pools Australia since 1984. In 1987, Charles was technical secretary to Standards Australia for the major overhaul of the Fibreglass Pool Codes, AS1838 and AS1839. In 1993, he won an Australian Design Award for the first free standing fibreglass pool “Compass Maxi”.

A selection of aquatic projects include:

- Bradbury Swimming Pool, NSW
- Colmslie Aquatic Centre Brisbane, QLD
- Eagle Vale Swimming Pool, NSW
- Hilton Hotel Melbourne, VIC
- Mt Annan Leisure Centre, NSW
- Next Generation Club, ACT

When it comes to the design of swimming pools, Charles Rickard is an acknowledged expert in the field.

Featured Work

Royal Adelaide Hospital

The largest project in the southern hemisphere in the last ten years has been the new Royal Adelaide Hospital, at a cost of around \$2 billion.

Yuanda Australia were the façade contractor for all of the aluminium and glass componentry. Rickard Engineering was the independent certifying engineer for the façade project. Its involvement commenced in 2013. The last revisions were certified in 2017.





*Client: Yuanda Australia
Builder: Hansen Yuncken Leighton
Contractors
Services: Independent certifier for
glass and aluminium façade*

Picture Source: umowlai.com.au

*Client: Minesco
Builder: Multiplex
Architect: Fender Katsalidis
Services: Design and certification
of building façade*





Australia 108 Melbourne

The tallest building in the southern hemisphere, Australia 108 is a new residential development in Melbourne currently under construction by Brookfield Multiplex. Rickard Engineering is the façade engineers to Minesco who are supplying the aluminium and glass curtain wall.

The curved geometry of the façade and large displacement of the building meant it was essential for special considerations to be made with regard to façade/building movements and the interaction between the two.

The “Star Burst” design between Levels 69 and 72 is highly complicated and is constructed with aluminium panels and glazing panels installed on trusses.





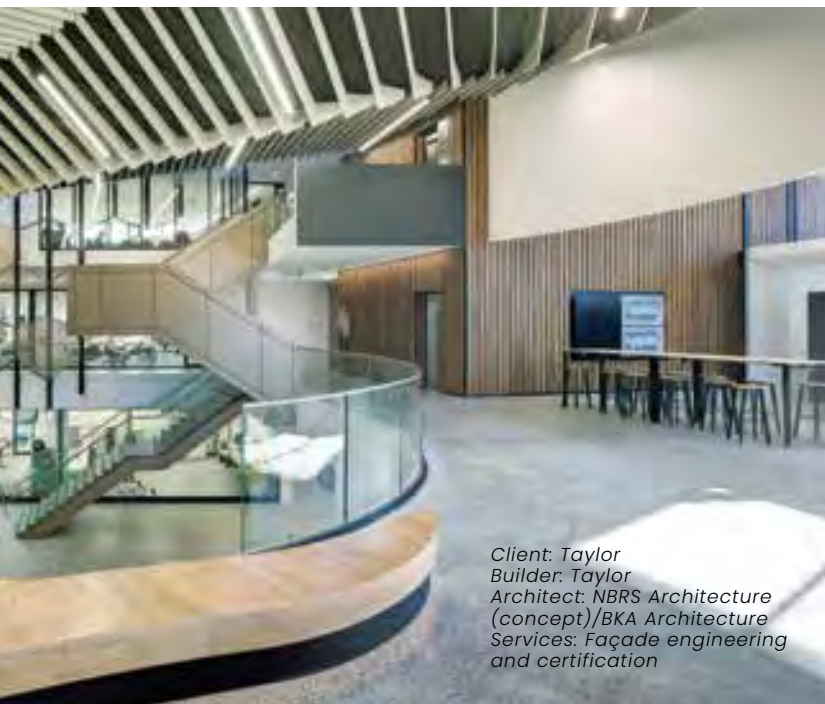
Taronga Zoo Institute of Science & Learning Sydney

Rickard Engineering was appointed by Taylor Construction as the design engineer for the façade at the Taronga Institute of Science and Learning.

It is a global centre of excellence for conservation science and learning and it is considered the first of its kind in the Southern Hemisphere. The original design concept was done by NBRS Architecture and further developed by BKA Architecture. Rickard Engineering worked closely with Taylor Construction, BKA Architecture and Locker Group to bring the architectural ideas to life.

Rickard Engineering was responsible for the design of the perforated hexagonal panels, glass balustrades, perforated horizontal and vertical sunshades. The biggest challenge was designing the hexagonal panels to achieve a 3D effect due to them not being on the same plane.

The facility achieved a 6 Star Green Star rating.



*Client: Taylor
Builder: Taylor
Architect: NBRS Architecture
(concept)/BKA Architecture
Services: Façade engineering
and certification*

Al Rayyan Stadium Doha, Qatar

Rickard Engineering provided the engineering input for the new 'Al Rayyan' Football Stadium in Qatar, together with the GRP roof panels for the 8 "dune" buildings which surround the Stadium, where the 2022 FIFA World Cup will be held. Al Rayyan is a fascinating and complex project with regard to the differing GRP shapes designed and hence variations in connections to cater for the variety of shapes.





*Client: Al Tasnim Enterprises LLC
Builder: Al Balagh - L&T JV
Architect: KSS
Services Design of GRP façade
for stadium and eight dune roofs*

Infinity by Crown Group Green Square, Sydney

Asurco Contracting in Adelaide engaged Rickard Engineering to design the GRC cladding, seats and planter boxes for the Green Square project, Infinity. This is a unique project, involving a curved ribbon shaped façade and ski-slope roof feature. Unique geometry and panel types are designed for construction, with a supported system on the slab edge.



*Client: Asurco Contracting
Builder: Crown Group
Architect: Koichi Takada Architects
Services: Design of GRC ribbons,
planter boxes and seats*





*Client: Gallery Façades
Builder: Brady Constructions Pty Ltd
Architect: Elenberg Fraser
Services: Design and
certification of the building
and podium façade.*





380 Melbourne

380 Melbourne is a recently commenced project located at 380 Lonsdale Street, Melbourne. Rickard Engineering is designing the complex curved curtain wall system for the 67 storey tower and podium of the building.

Oman Convention Centre Muscat, Oman

Rickard Engineering completed the design and certification of the GRC blue roof and glazing façade on the Oman Convention Centre. This was an extensive project comprising a GRC roof supported on a steel frame. The OCC is an iconic landmark for the City of Muscat, Oman.





*Client: Al Tasnim Enterprises LLC
Builder: Shapoorji Pallonji
Architect: SSH Design
Services: Design of GRC roof
and glazing façade.*

Client: Crown Group
Builder: Crown Group
Architect: Koichi Takada
Architects
Services: Façade engineering
and certification.





Skye by Crown Group North Sydney NSW

Skye by Crown was a fascinating project in North Sydney.

Rickard Engineering was responsible for designing the curvilinear façade with detailed aluminium tubular sections for the luxury apartments.

National Bank of Muscat, Oman

Rickard Engineering commenced its design for this project in 2016. The project involved large GRC ribbed external façade panels as well as intricate internal GRC balustrading. Design work was completed in late 2016. Manufacture and subsequent installation of the works continued through 2016-2017 with completion in early 2018.





*Client: Al Tasnim Enterprises LLC
Builder: Al Turki Enterprises LLC
Architect Ibrahim Jaidah
Services: Design of GRC façade
and internal features.*



*Client: Compass Pools
Builder: Compass Pools Dealers
Projects: All over Australia and New Zealand
Services: Rickard Engineering are the design consultants
for Compass Pools Australia*

COLMSLIE SWIM CENTRE
Brisbane Qld

*Client: Crystal Pools
Builder: Crystal Pools
Services: Structural engineer
design of the pools.*



Pools

When it comes to the design of swimming pools, Charles Rickard is an acknowledged expert in the field. His expertise covers both fibreglass and concrete pools, and his designs include over 20 Aquatic centres in Australia and Asia. Pictured are some examples of his designs.



*Client: A household in Melbourne
Builder: GRC Environments
Services: Structural engineer design of GRC.*





Airlie Bank Lane South Yarra Melbourne

A residential development in Bank Lane incorporates unique GRC façade panels built by GRC Environments and designed by Rickard Engineering in 2012.

SCG Stand Sydney

The North Stand at the Sydney Cricket Ground was designed by Cox Richardson Architecture and built by builder AW Edwards Pty Ltd. It was opened in 2014. The aluminium external façade was supplied by Townsend Group, design by Rickard Engineering.



Client: SGC Trust
Builder: AW Edwards Pty Ltd
Architect: Cox Richardson Architecture
Services: Façade designs.



Car Parks

Canberra Hospital / Liverpool Hospital /
Padstow Railway Station / Wollongong
Railway Station / Sydney Domestic Airport

Rickard Engineering has provided design support for a large number of car park projects throughout NSW and the ACT.

One example is the Canberra Hospital car park built in 2012. Others include the Liverpool Hospital car park built in 2012, Padstow Railway Station in 2015, Wollongong Railway Station in 2012, Revesby car park in 2012 and the Sydney Domestic Airport car park No. 3 built in 2013.

Rickard Engineering has designed aluminium/steel façades for a variety of clients, working with a number of different architects and builders. Rickard Engineering enjoyed a close relationship with Townsend Group on a whole range of different projects until the company sadly closed in 2017. Other significant manufacturers and installers whom we continue to work with are Minesco, Hitec, Façade Concepts, Gallery Façades, Windtech Façade Solutions, Lidco, Yintec, Aambianz and Concept Windows.

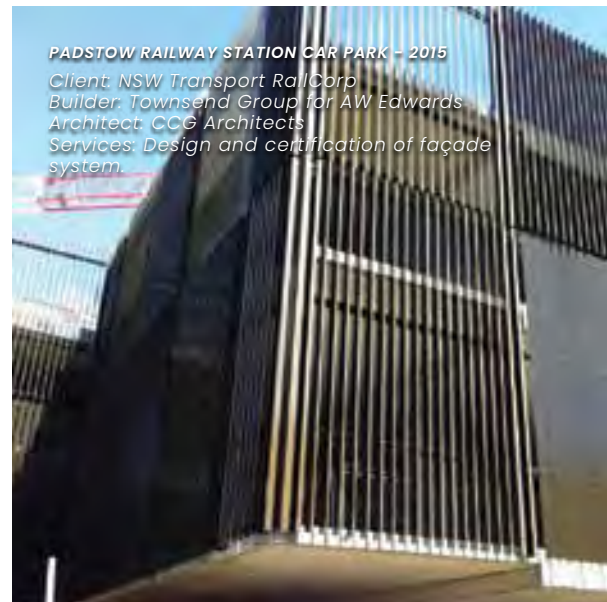
LIVERPOOL HOSPITAL CAR PARK - 2012

Client: NSW Health
Builder: Townsend Group
Services: Design and certification of
façade system.



PADSTOW RAILWAY STATION CAR PARK - 2015

Client: NSW Transport Rail Corp
Builder: Townsend Group for AW Edwards
Architect: CCG Architects
Services: Design and certification of façade
system.





CANBERRA HOSPITAL CAR PARK - 2012

*Client: ACT Health
Builder: Townsend Group
Services: Design and certification
of façade system.*



SYDNEY DOMESTIC AIRPORT CAR PARK - 2013

*Client: SACL
Builder: Townsend Group
Services: Design and certification
of façade system.*



WOLLONGONG RAILWAY STATION CAR PARK - 2012

*Client: NSW Transport RailCorp
Builder: Townsend Group
Services: Design and certification
of façade system.*

Museum of Contemporary Art (MCA) Sydney

Construction for a major extension to the Museum of Contemporary Art (MCA) commenced in 2010 and opened in 2012. The competition design winner was architect, Sam Marshall. A major feature of the building design was the GRC façade.

The main contractor was Watpac Constructions, the GRC panels were manufactured by Precast Concrete of Brisbane to design by Rickard Engineering. The panels were the largest precast GRC panels ever constructed in Australia, probably the world. 11m x 3.4m with a 1.5m return was the largest panel size, supplied in a variety of different sealed stained colours. The panels incorporated a unique fixing detail to accommodate the seasonal movement for such a large panel, developed specially by Rickard Engineering. They were the subject of a paper presented by Charles Rickard at the GRCA World Conference in Istanbul in 2012.

*Client: MCA Trust
Builder Watpac Constructions
Architect: Sam Marshall
Services Design of GRC façade*





THE MERLION

Client: Singapore Government
Builder: Caravelle Constructions
Architect: Architects Vista
Services: Full structural design
service including GRC.



BIG PRAWN

Client: Mokany Brothers
Builder: Glenn Industries
Services: GRC design



BODY ZONE

Client: Olympic Authority UK
Builder: McAlpine/Laing Joint
Venture/Glenn Industries
Architect: Richard Rodgers
Services: Design of GRC



BIG RAM

Client: Mokany Brothers
Builder: Glenn Industries
Services: GRC design



BIG OYSTER

Client: Mokany Brothers
Builder: Glenn Industries
Services: GRC design



Iconic GRC Projects

The Merlion / Body Zone /
Big Ram / Big Prawn / Big Oyster

Commencing in 1984 with the “Big Ram” in Goulburn NSW and continuing on with projects such as the “Big Prawn” in Ballina, the “Big Oyster” in Taree in 1987 and then in 1993 the 37 metre high “Merlion” on Sentosa Island in Singapore, Charles became recognised as the expert in free-form GRC resulting in him being responsible in 1999 for the GRC element of the “Bodyzone” in the Millennium Dome Greenwich London, as part of the Millennium celebrations.

Monument Park Melbourne

MAB Corporation has been responsible for a large part of the redevelopment of Docklands in Melbourne. Michael and Andrew Buxton have been responsible for many philanthropic projects including Monument Park in Docklands, Melbourne.

Artist Callum Morton individually covered all the major monuments in Melbourne with a sheet and then created a computer 3D model of the resulting shape. A contract was awarded to GRC Environments to build and install the monuments, designed by Rickard Engineering. The park was opened in 2014.



*Client: MAB Corporation, Michael & Andrew Buxton
GRC monument supply and installation by GRC Environments
Architect: McBride Charles Ryan
Artist: Callum Morton
Landscape Architects: Oculus
Services: Design of GRC*





108 Flinders Street Melbourne

108 Flinders Street is an office development in the heart of Melbourne. The panels do not contain any structural frame which highlights the unique ability of the GRC material to create fine detail. Designed by Rickard Engineering, the panels were built by GRC Environments for the building, which was completed in early 2014.

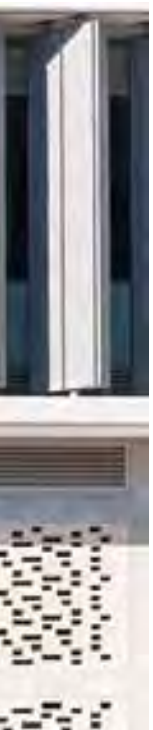


*Client: GRC Environments
Services: Design of GRC cladding*



*Client Abigroup
Builder: GRC Environments
Services: Design of GRC cladding*





Australian Catholic University, Melbourne

A new wing was created for the Australian Catholic University (ACU) campus in Fitzroy. The panels for the project, which was completed in 2012, were built by GRC Environments and designed by Rickard Engineering.

Wynyard Walk Sydney, NSW

Western Portal / Clarence Street Portal

Situated in Sydney's CBD, Wynyard Walk is a pedestrian walkway which connects Barangaroo with Wynyard train station. Rickard Engineering designed the glass, stainless steel, aluminium and sandstone cladding with provision for potential impact of a bomb explosion.

Some other design work included the glazed façade, awnings and perforated stainless steel façade of the Clarence Street building, including the glazed canopy, glass lift shaft and sandstone cladding of the Western Portal. We also designed the perforated stainless steel ceiling and glass balustrade of the Pedestrian Bridge over Sussex Street, alongside the perforated stainless steel ceiling of the main tunnel.





*Client: Townsend Group/CPB Contractors
Builder: CPB Contractors
Architect: Woods Bagot
Services: Façade engineering and certification.*





Alexander Apartments Barangaroo, Sydney

Alexander Apartments is positioned on the waterfront within the Barangaroo precinct. Rickard Engineering designed and detailed the curved sliding screen panels, adjustable louvres and the bifold sliding screens. We were responsible for the façade engineering and certification of both the Anadara and Alexander buildings at Barangaroo South.

Both buildings feature manually operated perforated sliding shutters on the balconies, which open inwards, thus not obstructing balcony space. Anadara building also has motorised sliding shutters. The most distinguished part of Anadara building is the Cloud – the curved portion of the building with façade comprising of manually operated sliding perforated screens which stack in parking bays. Rickard Engineering was also responsible for the vertical and horizontal adjustable louvres, as well as the wall and ceiling cladding.



*Client: Townsend Group/Lend Lease
Builder Lend Lease
Architect: FJMT (Anadara Building)
and PTW Architects (Alexander Building)
Services: Façade engineering and certification.*

GRC

Why GRC?

Glass Reinforced Concrete (GRC) was invented in the 1960s by the Building Research Establishment (BRE) in the UK, though it dates back to Ancient Greece and Rome who used horse hair to reinforce mortar. They found a way to coat glass fibre in “zirconia” to make it resistant to alkali attack. Pilkington Bros Ltd was the company which created a commercial product ready for market, but only after exhaustive testing around the world was completed.

GRC can be used as:

- Façade on a new building.
- Renovate as an over-cladding on an old façade on existing buildings.
- Permanent formwork on which you pour concrete, thereby gaining a very durable long-term soffit surface to your 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.
- Robust on the ground service ducts planter boxes .
- Street furniture.
- Computer flooring systems.
- A big attractive advantage of the material is that you can create a fire-resistant structural product to suit any shape, subject to engineer approval.

GRC advantages

It is typically made in a thickness of around 12mm, either framed with steel or using GRC integral ribs. This typically gives a panel weight less than 50 kilograms per square metre. You compare that with conventional reinforced concrete, which weighs 360kg per square metre from a 150mm panel. This means that the GRC panel will be seven times lighter.

GRC can achieve a fire rating. A single skin of GRC can achieve a fire rating of up to one and a half hours. A greater fire rating is achieved through introducing a Styropor (polystyrene beads, sand and cement) core to create a sandwich panel that can provide a fire rating of up to three hours. (Refer to PCI (USA), GRCA (UK) or NPCAA (AUS) codes for further details).

It is an extremely durable product: GRC has the compressive strength of typically 60mpa, which therefore makes it the perfect material for an exposed application. It has durability far better than most reinforced concrete and note, no steel reinforcement to create spalling. Credit Lyonnais Bank building in London has a GRC façade, built in the 1970s. When cleaned after 50 years in the UK climate, it was found to be in perfect condition.

GRC is made in a mould, so one can create any shape you wish within reason, dictated only by engineering design to utilise its inherent ability. In fact, the biggest restriction on the successful commercial use of GRC has been the fact that people too often try to emulate solutions possible in a different material, instead of aiming for a solution that is unique to the ability of the material. Recent developments in technology now allows the GRC product to be used in a full structural application, subject to engineering design. Note the energy footprint of a building can be significantly improved by an “overclad” in GRC.

The disadvantages of GRC

The material is relatively fragile and requires great care in transportation and erection. It is a labour intensive product and therefore is not cheap to manufacture.

It is very important to rationalise design to maximise repetition of shape.

Some key points that one should think about when utilising GRC:

1. Innovative design techniques utilising prestressing allows very thin elements of GRC to span large distances.
2. The lightweight nature of GRC enables it to be a very successful material for the use of over cladding on existing buildings. Generally, engineers will allow a 25% increase in load on existing building foundations subject to appropriate investigation and justification of the existing structure. The lightweight nature of GRC allows this to be added on the existing façade, subject to appropriate detailing without the need for expensive strengthening.
3. A very recent innovative development with GRC has been to design a new building utilising an inner skin to seal the building which can be done more rapidly than waiting for the final external skin to be added to the building. Thereafter, the external GRC skin is added off the critical path.

We recommend that the GRC be used generally as a rain screen with a ventilating cavity between the inner and outer skin. Recent developments have seen a fixing technique which does not require internal access to the rear of the GRC panels.



Who makes GRC in Australia?

There are five major manufacturers of GRC in Australia:

- Asurco have been manufacturing GRC in Australia since the 1980s. This company is headed by Mr Des Pawelski and based in Adelaide. Recent major projects by them include The Geelong Library, NRT Stations in Sydney and The Green Square project in Sydney.



- Precast Concrete in Brisbane makes all manner of precast which also includes GRC. This company is headed by Mr Colin Ginger and Mr David Raetz. A major project by them was the Museum of Contemporary Art project in Sydney in 2011 and they continue to service the market.
- GRC Environments, established in 2006, has already built a substantial reputation in its hometown of Melbourne. Significant projects include ACU, PLC School, Monument Park and 108 Flinders Street. They are the largest manufacturer of GRC bathroom floors in Australia.
- Mascot Engineering are based in Sydney but supply all over Australia. They have been making precast GRC pits since the 1980s. They have diversified their product into permanent formwork for concrete to cover the heaviest possible loading classifications. They also supply planter boxes.
- Robin Johnson Engineering (RJE) have evolved from the manufacturer of substations manufacture to be a general GRC supplier in the industry.

SINGAPORE ZOO, BIRD PARK WATERFALL

Owner: Mandai Project Development

Client: Pico Play Pty Ltd

Builder: Obayashi Singapore

Architect: RSP Singapore

*Services: Design and certification of GRC walls and features.
Design and certification of supporting steel frame.*



If you are looking for design assistance in GRC, Rickard Engineering is recognised to be one of the most experienced designers, not just in Australia, but also around the world. Based in Sydney, the company's principal Charles Rickard, has been designing GRC since the 1980s and was the Technical Secretary for the original publication of the National Precast Concrete Association of Australia document entitled "Design, Manufacture and Installation of Glass Reinforced Concrete (GRC)."

Rickard Engineering offer free tender support, subject to a written agreement that if the project goes ahead, then Rickard Engineering will be the consulting engineers for the GRC. Rickard Engineering not only support GRC manufacturing companies, but also architects and clients who are looking at different design options. The fee arrangement for that service is assessed on a job-by-job basis.

Rickard Engineering are now working with GRC manufacturers, not just in Australia, but also in the USA, Oman, UAE, Singapore, Bhutan, UK, Kazakhstan, China and India.

THE MERLION, SINGAPORE

So why GRC?

- There are five manufactures in Australia who can provide a competitive professional service in a tender situation.
- The material is lightweight and can be used, not only as a new façade, but as an overclad of an existing building.
- The material can be used for all manner of different products, such as drainage chambers, planter boxes, permanent formwork, sewer liners, street furniture as well as façades.
- The product is relatively expensive, unless one utilises its advantages to reduce overall costs. One needs to maximise repetition but more importantly, look for a finish in GRC that cannot be readily achieved in a different material.
- There is no limitation on the different textures/ features that can be built into GRC.
- The product is incredibly durable. The absence of aggregate in the mix means the lines of the panels are very sharp and the surface of the panels can be very smooth.
- The product can provide an immediate upgrade to an existing building as well as significantly improving the energy performance of that building.
- A popular use of the material has proved to be in creating “monuments” eg The Merlion in Singapore and Monument Park in Melbourne.

Besides the five major manufacturers of the product, design support is available from Rickard Engineering in Sydney, UAE and London.

RICKARD

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