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Feature Article

Saving the Futuro House: In the 1960s, the western world had a utopian vision of a bright future for plastics as a solution to the post-war shortage of building materials and as a medium for audacious design.



Front Cover

This issue: The Futuro House reconstructed to a concours finish on its plot overlooking Marion Bay in South-East Tasmania.

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Technology keeping 10-15 **Saving the Futuro House** pedestrians safe

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allnex	PASSIKS	€ H.B. Fuller

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for composites in civil infrastructure

A pioneer of fibreglass

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President's Letter

Leona Reif **President**



tility infrastructure, including utility poles and access covers, has in the past relied heavily on legacy materials such wood and cast iron. It is heartening to read the articles in this edition documenting the journeys of a number of companies increasing market share of fibre reinforced composite technologies in these civic applications. A mission to improve the resilience of the electrical grid in regional communities in the wake of the unprecedented 2019/20 bushfire season was the impetus for Wagner CFT to develop and launch composites utility poles. The article on page 6 documents the personal journey for those who work in the company and live in the region.

Equally, our article on Dulhunty's engineered cement utility poles describes the journey of reducing bushfire risk by blending chemistry, engineering, cement and fibreglass.

The benefits of the technology extend to protecting utility assets from the effects of invasive species and the in-ground decay of acidic soils throughout the Pacific.

Our article on CME's guidance paving - 'Prem-Tac' tactiles - that are installed on public walkways to indicate the safest direction of travel for the visually impaired, is an inspiring use of composite technology. The product is also an uplifting outcome of using time during COVID lockdowns as an opportunity to develop and test new high volume offerings and to replace an otherwise imported product with one made in Australia.

Page 8 features an inspiring article on Terra Firma Industries that worked with Composites Australia and ACS – Australia to provide a voice for composites materials in the Australian standard access and trench covers. Their collaborative efforts are paying off, with composite access

covers being taken up by major utility providers.

'Saving the Futuro House' page 10 is a must-read that communicates how the aspirations of the early sixties were enabled by fibreglass. It was an era when plastics were seen as a solution to the postwar shortage of building materials and as a medium for audacious design, like prefabricated homes that could be manufactured off-site and subsequently transported, assembled and installed on-site.

Steve Brennan, Board member and Managing Director of BI Fibreglass, caps off the edition with an article on fibreglass, it's properties and versatility.

I trust you will all enjoy another interesting edition of the Connections magazine that shines a spotlight on our industry. Also keep and eye out for updates on our 2023 Conference, planned for 7th – 8th June in Adelaide.





wagner.com.au

Wagners CFT **Transforming community infrastructure**

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.

Australia's electricity networks extend about 918,000 km with more than seven million power poles – most of which are above ground and extend deep into the bush. These sections can be hard to access, expensive to maintain and are easily severed from the main grid by natural disasters.

he December 2019/January 2020 fires in Australia left thousands of kilometres of the network damaged with more than 5,000 power poles destroyed or requiring replacement. For Lachlan Nicol, Engineering Manager at Toowoomba's Wagners Composite Fibre Technologies (WCFT), the event was a lived experience. "You can't live in the area and not be touched by the fires. In 2019, smoke haze cloaked the Darling Downs for months. Water and power supply were compromised with many residents losing the service of both. While we'd been developing utility poles as an extension of our legacy cross arm range, the unprecedented bushfire season gave us confidence that our technology could improve the resilience of the electrical grid in regional communities."

High on the hill overlooking Wellcamp Airport is the ever increasing cluster of factories owned and operated by Wagner Corporation, inside each of which is composite production equipment that is actively transforming community infrastructure - from road bridges, marine piers and pedestrian structures to energy transmission assets. Its technology is a unique modified pultrusion process known as pull-winding which utilises resin injection. Wagner's technology provides superior mechanical properties than those of standard methodology using glass mats and a resin bath.

Foundational products such as the electrical crossarms for utility poles are now used across Australia and around the world with over 1.2 million supplied globally. Backed by a team of experienced engineers, technicians, trade staff and ongoing investment in automation, WCFT is now producing a crossarm - for low and high voltage distribution, transmission and sub-transmission requirements - every 69 seconds across a family of 200 designs. Associated electrical infrastructure products include certified live line lifting beams, hurdle frames, substation infrastructure, arm braces, stay insulators, riser arms, and isolation platforms.

For Wagners, owning and operating a range of sites including its own quarry and Business Park provided unique opportunities to test and monitor its proprietary products and technology. Rows of composite light poles stand as sentinels along the roads that circle the Wellcamp Airport and Business Park that opened on the outskirts of Toowoomba in 2014. Its utility poles, which were initially installed in the company's quarry, have now been rolled out into rural Australian bushland.

According to Lachlan, economic factors that have conventionally affected market acceptance of composites in the past have shifted with Australian energy networks moving expeditiously toward full

Gold Coast injection moulding specialists AMEC Plastics produces the top and bottom pole caps which were design by Wagners to specifically suit their utility pole profile sizes. composites poles over the next few years. "The additional cost of composites has always been an obstacle for asset owners. But stock of suitable timber has become problematic and unreliable as a result of the 2019-20 fires and ensuing floods. There is also uncertainty surrounding the state-run timber supply contracts and imported timbers."

The standard Wagners CFT utility pole offerings are typically 12.5 metre long and 300 millimetres in diameter with a 13.5 millimetre wall thickness. Its pull-winding technology ensures an exact unchanging parallel cross-section. The poles are glass fibre centric and specified to carry 6kN with a tip deflection of 5 per cent under service load; and while they are specified for 60 years, the testing completed on the product shows that the life span would far surpass this. Gold Coast injection moulding specialists AMEC Plastics produces the top and bottom pole caps which were design by Wagners to specifically suit their utility pole profile sizes.

Ensuring the long life span, each pole is coated with a specially formulated UV-resistant fluoropolymer coating to resist extreme weathering of direct sunlight and harsh marine environments. The harshness of the UV impact within the Australia environment is something that new players in the composites industry often don't fully appreciate which is why Wagner's coats all manufactured products and ensures maximum durability.

Research and development and testing have been done in-house within the company's Engineering Group. During the development phase, Wagner's geared up to undertake the necessary fire testing in house which helped with the iterative R&D work. Part of the client requirements was for the poles to achieve a BAL 40 fire rating in accordance with AS1530.8.1.

Coefficient of thermal expansion is 5.03 x10-6, which is about 50 per cent of the coefficient of expansion of steel - performance properties that have been engineered by allnex sophisticated resin technologies.

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The inventory of beneficial properties of our utility poles that include low-weight, high strength, UV resistant, non-conductive and non-corrosive provide a compelling whole-of-life procurement case for asset owners, particularly for areas prone to bush fires, termites, or aggressive soils. We hope to see the market for our utility poles increase to significant volumes over the next few years.

Lachlan Nicol

Main Pic. Each pole is coated with a specially formulated UV-resistant fluoropolymer coating to resist extreme weathering of direct sunlight and harsh marine environments.

Below. Wagners utility poles are low-weight, high strength, UV resistent, non-conductive and non-corrosive provide a compelling whole-of-lif procurement case for asset owners



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Terra Firma Industries

Collaborating to build new markets for composites in civil infrastructure

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.

Conventionally made from cast iron for over 300 years, manhole covers – as they were once called - could weigh up to 200 kilograms. Anchored by weight alone, their distinctive round design allowed users to roll them into place where needed. A prosaic and mundane necessity, they have played an important role in civil works projects for centuries, protecting a world of pipes, wires, conduits and drainage systems below our walkways, driveways, roads, freeways, docks, wharfs and runways, while providing convenient access for maintenance workers. As technology and community expectations and needs have grown, the humble access cover has until recently struggled to evolve.

ccess covers are designated by classes from A through to G according to load capacity with the 'typical use for class A' for areas accessible strictly by pedestrians and with an 'ultimate limit of 10 kN. At the heavy industrial end of the spectrum is Class G which is used in 'docks, wharfs and airway runways' and which allows a nominal wheel loading of 30,000 kg and an ultimate limit of 900 kN.

The relevant Australian Standard for Access Covers and Grates is AS 3996. Its original title - 'Metal access

covers, road grates and frames' - echoed legacy materials, with subsequent revisions allowing aluminium and to composite or polymeric products and only required a static load test for compliance, all of which stymied the development of the market for composite materials.

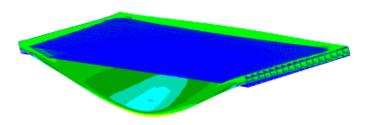
To compensate, Ashley Reid, Managing Director of the Melbourne based Access Cover and Pit Lid specialist firm Terra Firma Industries (TFI), had earlier adopted

concrete to be added to the list of acceptable metals. The 2006 version of the standard made no specific reference

the requirements of the European standard EN124-2015, which included a specific composites section (Part 5) and relevant materials testing for load, creep, high temperature, fatigue, UV and impact. But this was less

In 2018, Terra Firma partnered with Advanced Composite Structures Australia (ACS Australia), specialists in the design, analysis and manufacture of composite products, to develop the D240 Trench Cover. This was supported by the Victoria Government Advanced Manufacturing Voucher program. A lightweight pultruded composite panel was developed for the D240 Trench Cover which is rated to handle loads of 240 kN (~24 tons), suitable for trucks and other heavy vehicles. The design was successfully verified using Finite Element Analysis (FEA) simulation, and subsequent physical testing confirmed the trench covers passed AS3996 static strength and deflection testing for Class D criteria. Additional impact, durability, UV resistance, high temperature and sustained load testing was carried out to ensure the product was fit for purpose and could meet required performance standards. The pultruded composite design balances the requirement to be easily handled by maintenance personnel whilst still performing well within the limits of the standards.

After an announcement was made in 2018 to update the standard by Committee CE029 - the Australian Standards Committee responsible for AS 3996, and on which Composites Australia lobbied to become a member - TFI and Composites Australia stepped up their efforts to provide a voice for composites materials.



Composite access cover - maximum strain at ultimate load.

D-240 Trench Covers

durable under ongoing

construction traffic.

are required to be

Committee CE029 was made up of 12 representatives from 12 entities, most of which were resistant to new materials without the benefit of decades of data. "The committee was initially reticent to allow for composite covers. It then relented partly to allow composites for pedestrian applications. Eventually our evidence persuaded them to include composite or polymeric covers in the standard up to road covers rated to Class D. Testing regimes similar to EN124-5 were included although they mostly required higher levels of testing (e.g. Cyclic Load test EN124-5 100,000 cycles versus AS3996-2019 300,000 cycles)," recalled Ashley.



Our collaborative efforts are paying off, with composite access covers being taken up by major utility providers including Jemena, the Australian company that owns, manages or operates energy infrastructure assets in the eastern states of Australia, along with its delivery and maintenance service partner, Zinfra.

Ashley Reid



The committee ultimately agreed on the premise that there was a case for recognising 'a natural transition of products from the previous version of the standards,' and the revised and updated Australian Standard (AS3996) was published in March 2019 recognising composite materials in classes A up to D.

The transition, away from legacy materials began with trial retrofit installations at two existing zone substations using TFI's AS3996-2019 compliant D240 cable pit lids and trench covers which are designed with a Safe Working Load of 8,000 kilograms. Key considerations for installing the D-240 Trench Covers included the requirements to be produced and installed quickly to allow for the crane truck delivery of critical plant and equipment; easy access for the laying and connection of cables once a control room had been installed; and durability under ongoing construction

Working closely with Jemena's plant engineering team, TFI developed a labelling standard for each cover with safe workloads (SWLs) in addition to AS3996 Class loads for ease of recognition by maintenance operatives.

Major utility providers are making the switch to composite materials for their projects because they're finding them to be safer, more durable, and easier to



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mona.net.au

Saving the Futuro House A pioneer of fibreglass

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.

n the 1960s, the western world had a vision of a bright future for plastics, the promise of infinite potential to shape products into forms that were once inconceivable. Plastics were seen as a solution to the post-war shortage of building materials and as a medium for audacious design, like prefabricated homes that could be manufactured off-site and subsequently transported, assembled and installed on-site.

One of these homes, the elliptical prefabricated Futuro House designed by Finnish architect Matti Suuronen in the late sixties, is symbolic of the vision, architectural style and futuristic ambition of the era

Suuronen's initial brief for the Futuro House was said to be for a ski cabin that could sleep eight people, was quick to heat, and easy to transport and erect on a mountainside. The 35 year old architect came up with its aerodynamic shape as a practical solution to deflect the strong mountain winds and with a smooth surface to shed snow. The initial house had an area of 50 square metres (four metres high and eight metres in diameter) and divided by adaptable partitions. Made from fibreglass, the house was light enough to be transported on a flat-bed truck or flown in and lowered into position by helicopter.

Lauded as a cost effective prefabricated dwelling, the initial Futuro House became a prototype for a licensing model through which about 30 companies around the world – including Australia and New Zealand – purchased manufacturing rights, moulds and instructions. Futuro Homes (NZ) Ltd entered into a licensing arrangement with the original Finnish developers for the Pacific region. One of its early builds was proudly displayed at the gates of Queen Elizabeth ll Stadium during the Commonwealth Games, held in Christchurch in 1974.

Sadly, the aspirations of 'plastic houses' and the associated licensing model were victims of the chaotic and inflationary oil crisis in the mid-1970s. The houses that survive today are tracked by an enthusiastic mob of Futuro House spotters and coveted by collectors who see their historical importance, or who simply just like them.

The futuro house reconstructed on steel plated concrete footings on a plot overlooking Marion Bay in South-East Tasmania.

The entry door reminiscent of an aeroplane hatch that descends and turns into stairs, leading to the entrance hall and into a spacious living area.



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A pioneer of fibreglass





By working intimately on the project for over a year, I got to know the original architect, his reasoning and design logic. There was a lot of precision in the execution and I'm sure he had plenty of sleepless nights working through the design challenges.

David Mercer

Recognising the architectural and cultural value, David Walsh AO, owner and founder of the exceptional Museum of Old and New Art (MONA) purchased and relocated a Futuro House from New Zealand to Tasmania in 2018. Melbourne-based architect Nonda Katsalidis AM of Fender Katsalidis Architects, with whom Walsh has enjoyed a long creative partnership, designed and oversaw the restoration of the House for Walsh's personal collection and private use.

Penguin Composites, based on the north coast of Tasmania, was appointed to undertake the restoration and rebuild. According to David Mercer, then Manager at Penguin, the job was driven up from Hobart by four trucks and arrived in a veritable jigsaw of 140 pieces. The subsequent restoration project took three people 12 months to complete. The Futuro sphere is formed from two halves, joined by a seam around the girth. The top and bottom halves were each formed from eight fibreglass panels, totalling 16 sections. The floor was made from the smaller sections and laid onto laminated timber bulkheads.

- were made from very basic general purpose polyester

and e-glass and insulated with urethane foam. Many of the materials had aged and weathered, particularly the outer skin which despite its 2mm thickness was chalky from 60 years of exposure. According to John van der Woude, Managing Director of Penguin, every part - piece by piece - was prepped, primed and painted with 2 pack and baked in a paint booth. "The concours finish inside and out has an intense showroom finish - better than any other existing Futuro in the world. The fibreglass matt surface was kept raw and visible The original fibreglass panels – interior and exterior around the windows and on the ceiling as a nod to the building's origins."







David Mercer estimated that over 400 corroded bolts were replaced with stainless steel ones. The original 16 acrylic windows had weathered and were redesigned and replaced with bespoke domed glass, modern wind-out mechanisms and fly screens.

One of the innovative functional design features noted by Mercer was the internal joining flanges that acted as channels for a draining system that met at a holding and drainage tray under the floor to keep the house watertight.

As a living space, the Futuro House features an entry door reminiscent of an aeroplane hatch that descends and turns into stairs, leading to the entrance hall and into a spacious living area lined with fixed fibreglass seats fitted with denim coloured upholstery. The kitchenette now features bright red shelving and benchtops and is separated from the living area by an acrylic bench. The fibreglass module bathroom and toilet made from four moulds is also accessed from the entryway. The walls which morph into the ceiling are bright white, a theme mirrored in the bedroom furnished in a bold red and white print from the Finnish design house of Marimekko. The ellipsoid theme is carried through the design elements including windows, door handles, light fittings and power sockets.

Having been reconstructed in the Penguin Composites factory on the north coast, the 140 components of the Futuro House were once again dismantled and moved to south-east Tasmania, to be reconstructed on steel plated concrete footings on a plot overlooking Marion Bay.

Suuronen's futuristic ambitions were further realised with the installation of contemporary 'smart home' blue tooth technology that monitors and controls electronic functionality and a suite of appliances. Needless to say, the plumbing system is also more sophisticated than the original.

The Futuro House is an historic cache of materials and industrial practices and thinking. In a time before Computer-Aided Design (CAD) technology, Suuronen would have worked with a fine drafting pencil, a set square, protractor and scale ruler at a drafting board. Each original fibreglass mould, of which there were around 60, was unique and made by hand by master fabricators. It was a time before modern adhesives and sophisticated resins and additives. We are grateful for the vision, benevolence, genius and craftsmanship of all involved.

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- Locally produced and stocked

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AUSTRALIA

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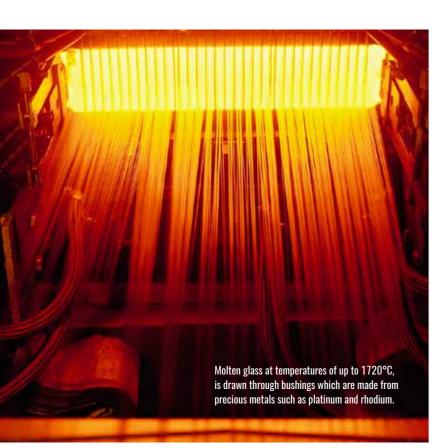
Bl Glass Fibre

Fibreglass

Continuing to reinforce Australian composites

Written by Steve Brennan, Managing Director, BI Glass Fibre.

Fibreglass, or glass fibre reinforcement, is possibly the ultimate reinforcement material ever developed. Now, ninety years after its invention in 1932, I doubt whether its creators would have imagined the breadth of materials and applications in which fibreglass would be used.



lass fibre and glass fibre products are now used to reinforce many different materials including thermoset resins, thermoplastics, polyurethanes, cement, concrete, gypsum, bitumen and just about every material that needs improved properties to meet existing standards or meet the requirements of new world developing

improved properties to meet existing standards or meet the requirements of new world developing standards. What other material can operate in harsh environments with formidably contradictory requirements: static strength or dynamic strengths, rigidity or flexibility, high acid or high alkalinity, buried or exposed, or high or low temperature?

Industries that have found solutions with glass fibre include construction, infrastructure, mining, automotive, marine, and leisure products, each of which has a diverse range of performance requirements in a world looking to make things bigger, stronger, lighter, more durable, more adaptable, more aesthetically appealing or more corrosion resistant.

There are many types of glass fibre reinforcement constructions including rovings, mats, chopped strands, veils, scrim, mesh, cloth, fabric and veils. In composite applications glass fibre can be sprayed, pultruded, wound, sprayed, hand laid, infused, pressed, injected or dosed. It is truly a unique material as many of the articles in this edition demonstrate.

TYPES OF GLASS FIBRE

Single-end rovings (Type 30).

Sometimes referred to as Direct Roving or Continuous Process Roving (CPR) which are constructed and used in pultrusion, filament winding and weaving.

Multi-end rovings (choppable).

Which are constructed and used for spray up roving, chop and drop roving and sheeting roving.

$Continuous\, filament\, mat.$

Sometimes referred to as Direct Roving or Which is constructed for use in closed Continuous Process Roving (CPR) which moulding or pultrusion applications.

Chopped strand mat.

Constructed for use in emulsion or powder bound.

Dry chopped strands.

Used in thermoplastic reinforcement.

Veil and non-woven mat.

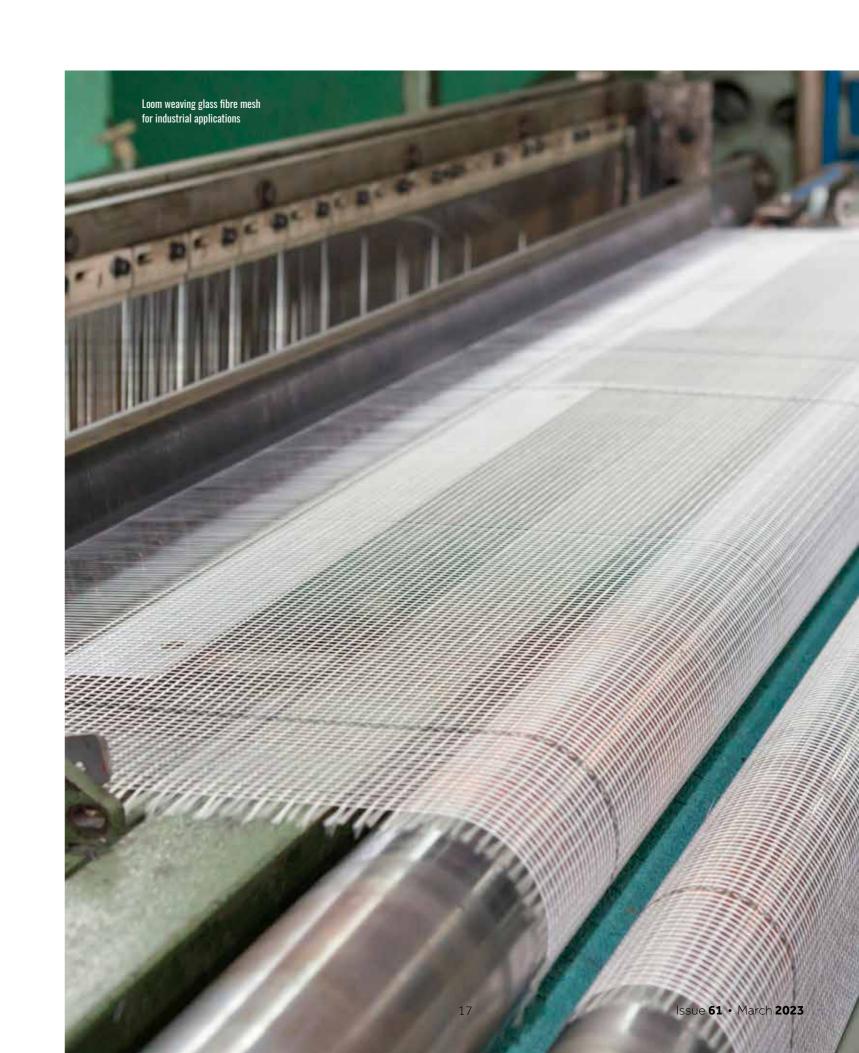
Which are constructed for use as a surface finish.

Fabrics

Either woven or stitched - are constructed fo use in closed moulding and hand layup.

Tape

Which are constructed for use in closed moulding and hand layup.



Continuing to reinforce Australian composites



Limitless versatility and performance can be engineered into the fibres. Initially, the diameter of each filament - which can be between 6 and 32 micron - affects fibre processing in wet out and wet through, chop ability and fuzz, as well as the final strength.

The number of filaments (not to be confused with 'tex') is determined by the number of holes in the bushing (see breakout box) and can vary from 2,400 to 5,800 in single end (direct) roving up to 8,000 filaments in multiend roving.

Performance can be engineered into the fibres during the final production stages by the application of proprietary chemistry by way of a chemical coating, or size (sizing) that may be lubricants, binders and/or coupling agents all developed to cause the fibre to perform a certain way and/or have an affinity for resin chemistry.

'Sizing' is probably one of the most important factors in glass fibre production and certainly the main IP that glass fibre manufacturers protect. Sizing is the chemistry applied to the glass fibre to make the inorganic fibre compatible with the organic resin matrix and to process acceptably. Chemical 'sizing' is designed for resin compatibility, static mechanical properties, dynamic mechanical properties (tensile, shear, flex, compression), fuzz, wet-out, dispersion and finally appearance.

A chemical 'binder' is an adhesive that is applied to glass fibre bundles to make them stick together to form a mat type product. 'Chopped strand mats' are referred to

as emulsion or powder bound mat, which identifies the type of binder used. Both the 'sizing' and 'binder' work in unison to improve conformability, wet-out, wet through and wet and dry strength, as well as the final appearance of the laminate.

Each product type is designed with specific strengths for a given end-use application, all with an ASTM standard and specification — A Glass, D Glass, E Glass, E-CR Glass, H Glass, R Glass, S Glass, AR Glass. The majority of the products seen in Australia are E-Glass (Electrical - low electrical conductivity) or E-CR Glass (Electrical — Corrosion resistant). A brief summary of some the types and properties are in the table below.

PROPERTIES OF VARIOUS GLASS TYPES

	Α	E	E-CR	S-Glass	R-Glass	AR
Mechanical	Low	Medium	Medium	Very High	Very High	Medium
Electrical	Low	Medium	Medium	High	High	High
Corrosion	Low	Medium	High	High	High	Very High
Thermal	Low	Medium	Medium	Very High	High	Medium
Cost	Cheap	Modest	Modest	Very High	High	High

With such a long history of innovation the glass fibre industry continues to look to future opportunities and challenges.





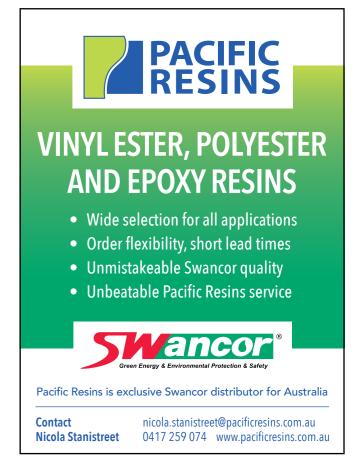
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THE END OF AN ERA

In 1999 the face of the Australian Composites industry changed with the closure of A.C.I.'s fibreglass manufacturing plant in Dandenong, Victoria. For many years, A.C.I. had piloted product development and innovation in glass fibre, working closely with Australian manufacturers to drive industry growth through shared knowledge and education on the use of fibreglass reinforcements.

The plant had a capacity of 7,000 to 9,000 metric tonnes per annum across a variety of product types which, at the time, was enough volume to supply the Australia and New Zealand markets.

Textile-grade glass fibres are made from silica (SiO2) sand, which requires temperatures of up to 1720°C to melt. Molten glass is drawn through a series of small orifices or bushings which are made from precious metals such as platinum and rhodium. These extreme operating temperatures, coupled with a short operating lifespan of around 10 years as well as the required precious metals, render furnaces an expensive proposition to install, replace or even rebuild for volumes of less than 100,000 metric tonnes.



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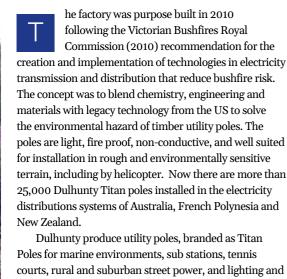


dulhuntypoles.com

Dulhunty Poles **Fibreglass reinforced cement poles**

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.

Operating from its factory in Moolap, just two hours south west of Melbourne, Dulhunty Poles is a manufacturer and distributor of a unique range of innovative engineered geopolymer cement poles for a raft of applications, but particularly, for utility power.



Poles for marine environments, sub stations, tennis courts, rural and suburban street power, and lighting and rural fencing, all with unique engineered properties. For example 'Communication Poles,' are hollow, steel free and non-conductive. They are both fire proof and engineered to ensure a high stiffness to reduce the risk of antenna movement in high wind conditions. Equally, marine poles - which are also lightweight, steel free, and resistant to corrosion - can be mechanically driven into prepared holes with smaller barges and lifting gear than other pile types. Made without the harmful chemicals used to conserve timber poles, Titan poles safeguard the environments within which they are installed. The poles are hollow so cables and wires can be internally run through the pole, improving electrical safety and security.

While the Dulhunty factory was commissioned under the encouragement of the Victorian government, initial commercial interest came from Electricite de Tahiti (EDT), which operates Tahiti's public energy service for the main island, as well as the surrounding islands in French Polynesia. EDT recognised the properties of Dulhunty's technology as a solution to the issues brought about by its unique environment.

Islands have double the number of invasive species of termites that continents do, with islands in the South Pacific the most invaded geographical region. As well as

the termites that eat both hard and soft wood, Tahiti's acidic soil causes in-ground decay of timber poles.

Transport and access is also problematic, as apart from a fertile coastal plain, the terrain of Tahiti is jagged and mountainous having been formed by volcanic activity from its two ancient volcanoes - Tahiti Nui and Tahiti Iti.

On the home front, product and material acceptance of the Titan technology took much longer than expected. Phil Scott, General Manager of Dulhunty since 2011 explains, "For good reason, asset managers are riskaverse and hesitant to specify alternative products. But this has led to some unconventional proof-of-concept testing including whether structural integrity would be affected by a whipper snipper or the corrosive effects of long term exposure to dog urine. We even had to test whether possums or koalas could grip the poles. It's taken over 300 tests over many years for the product to be accepted but now we are developing plans to increase our manufacturing footprint to keep up with the demand."

As with all new composites technologies, price also played a part in the push back from asset managers. "We're at least a third more expensive than timber poles. And it's taken just as long for acceptance that the extra cost of each pole is more than compensated by reduced installation, monitoring and whole-of-life costs," admitted Phil.

Dulhunty technology is based on a polymer modified cement using a Metakaolin which is a dehydroxylated form of the clay mineral kaolinite, sometimes known as China clay or kaolin and used in porcelain manufacture. It is used for high performance, high strength and lightweight structural concretes. Dehydroxylisation is a kiln process carried out between 500°C and 800°C in which kaolin is transformed to metakaolin. This material has strong pozzolanic (cementing) properties when added to cement, the particle size being much smaller than cement particles. Where metakaolin is used as a filler in high strength concrete applications it is considered to have twice the reactivity of most other pozzolans. Mixed with Portland cement, it produces a concrete mix with superior engineering properties which include increased durability,

compressive and flexural strength and resistance to acid and chemical attack as well as reduced permeability, efflorescence and shrinkage.

Each pole is manufactured by feeding the concrete slurry and rovings onto a vertical rotationally oscillating mandrel. The slurry mix is added uniformly from a bath as the glass fibre filaments are applied in accordance with a preset design program, until the desired wall thickness and reinforcement lay for the specified pole performance is reached. The fibreglass adds strength and flexibility which is engineered into the winding pattern, and acts as a conveyor system for the cement. Upon completion the pole is wrapped in a protective plastic coating for 24 hours, until the rapid first cure is complete, following which the mandrel and the protective coating are removed.

"Technically, concrete never stops curing. These minerals cure the concrete continuously which makes its chemical structure grow denser and stronger over time. This creates a much stronger, more durable concrete that actually gets better with age. The continuous fibreglass rovings provide tensile strength and corrects the poles when deflected and allow production of required combination of properties," advised Phil.

The Dulhunty Titan utility poles are unique in that they can be designed to meet specific customer needs for durability and strength while complying with 'AS/NZS 4676 Structural design requirements. Utility poles are characteristically specified to carry 5kN, 8kN, 16kN and up to 24kN. Unlike timber poles, strength, deflection and the location of the deflection can be engineered through capitalising on winding patterns and material properties for wind conditions, pole spacing and component loads be they crossarms, satellites and safety features.

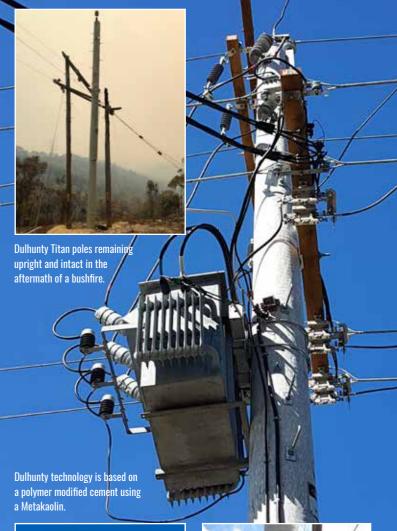
Uniquely, a whole of life Radio Frequency IDentification (RFID) is implanted into the pole during production. The RFID is itself insulated by the materials and protected from weather and fire ensuring ongoing identification is maintained for the pole life. It captures pole-specific information and event related data including exposure to weather or vehicle strike related events. A pole's complete life cycles, as well as those of the assets located on and in the pole are recorded for asset management purposes. Geospatial technology can locate individual poles within a network and evidence of inspection can be demonstrated by reading the RFID and downloading to computer.

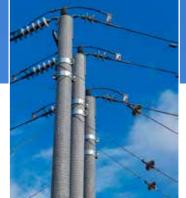
Dulhunty Titan poles are available in the desired kN rating in lengths of 7.2 metres to 12.5 metres as a single piece and 14 metres-18 metres are supplied preassembled as a two piece pole.

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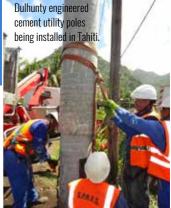
We've now manufactured thousands of poles ranging in length from 9 metres to 18 metres and strengths from 3kN to 24kN, covering almost the entire Island of Tahiti, many of which have valiantly survived tropical storms and cyclones.

Phil Scott





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CME's SMC Composite

Technology keeping pedestrians safe

Written by Kerryn Caulfield, Executive Director, Composites Australia Inc.

If you take public transport, pound the pavement or even simply cross the street for your morning coffee, you will have noticed the distinctive tiles with raised spots and strips imbedded into the asphalt or concrete of public walkways.

Known as 'tactile ground surface indicators' (TGSI), directional or hazard warning tiles act as an aid for visually impaired pedestrians, assisting in the navigation of public spaces. TGSIs are effectively a form of braille for the feet that communicates direction and hazards. The tile patterns indicate different safety conditions - raised dots or blisters for 'caution' and long parallel strips provide directional cues. They indicate a boundary between footpath and the road and act as silent signs on 'how close is too close' or to 'mind the gap' when waiting for a train.

Tactiles are designed in different colours to the footpaths and walkways that surround them to visually reflect a change in conditions or direction with TGSIs effectively screaming instructions to all pedestrians, but particularly to those who are visually impaired.

Once an imported product, TGSIs are now being made by Victorian firm Composites Materials Engineering (CME). With its three factories in east and south-east of Melbourne, CME used the extended pandemic lockdowns productively. Brian Hughes, Managing Director

of CME explained, "While our number one concern was keeping our workers safe during COVID, we embraced time during lockdowns as an opportunity to assess our product range and to research, develop and test new high volume offerings. tactile ground surface indicators—which were largely imported - are a natural fit for our capabilities."

With meories of the pandemic fading, CME Tactiles which are now branded 'PremTac' –comply with industry standards set out in AS/NZS 1428.4.1:2009 and now approved by all state-based road authorities. They are manufactured for use in a range of surfaces and floorings including concrete, asphalt, escalators and travellators, timber and engineered floor and carpet and meet the Australian Standard for slip resistance - AS 4586 - 2013

The PremTac tiles measure 300 millimeters x 600 millimeters and weigh 1.2 kilograms. The range is available in white, yellow, and black through most hardware stores. Installation is straightforward on pre-existing surfaces using screws supplied with purchase and Sika Flex 11-FC.

PremTac tiles are made using CME's Sheet Moulding Compound (SMC) processing technology. This UV stable materials technology was developed by CME specifically for the tactile product, and is consistent with CME's core technology for high volume and exacting part reproducibility. CME has evolved from being a key supplier to Australian automotive industry, where volume, quality and performance were key responsibilities to supply.

"The upfront set-up and tool costs for SMC are high, so high volume markets are the natural home for SMC technology. We're anticipating the TGSIs will be a high-volume business offering product extensions which we are keen to develop. Our other proprietary products such as the portable housing, shower bases and tile trays have grown exponentially in the years since the automotive industry shut down in Australia," advised Brian.

SMC is a high strength glass reinforced thermoset moulding material which is compression moulded in sheet form using a heated mould under high pressure. CME makes the compound in-house to its own set of formulations. The formulations always involve combining long glass fiber with polyester resin, fillers and additives on its automated compounding line. The fibreglass rovings are chopped in line to a length of typically 25cm which are then impregnated with the resin to produce the Sheet Moulding Compound (SMC)

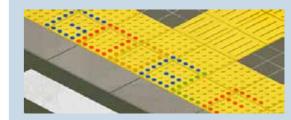
"When we did our research, it was clear the imported products were made with little knowledge of our Australian conditions, particularly inevitable UV fatigue on plastics. We've worked on the chemistry of our UV stabilisers and formulated our compound for harsh Australian conditions to provide the best performing product possible for tactiles to offer

prolonged exposure to UV and elevated thermal mass generated by aggregates. This has allowed us to offer our PremTac tiles with a 10 year (conditional) warranty," says Brian.

TURNING JAPANESE

Tactile ground surface indicators (TGSIs) were first introduced for pedestrian crossing in streets of Japan's Okayama City in 1967, before being made mandatory by the country's rail network a yea later. The panels, initially known as tenji blocks, were invented by the Japanese engineer Seiichi Miyake to assist a visually impaired friend navigate public spaces.

It wasn't until 1992, when the Australian Disability Discrimination Act (DDA) passed into law that made it unlawful to discriminate against any person with a disability, that Miyake's invention of bumpy or striped surfaces became commonplace in Australia.



The work of Seiichi Miyake was honoured with a Google Doodle in March 2019.



The tile patterns indicate different safety conditions - raised dots or blisters for 'caution' and long parallel strips provide directional cues

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