the ultimate reinforcement for concrete in challenging applications
Pultron Composites

mateenbar™
Mateen means ‘strong and durable’ in Arabic

mateenbar™ is the ideal product for engineers who are working in environments with demands beyond the abilities of steel reinforcement

Pultron Composites, New Zealand
For 30 years, Pultron Composites has been working closely with engineers to develop a high performance FRP reinforcement with the engineering properties to solve problems beyond the abilities of traditional steel reinforcement.

In 1985, Pultron worked in conjunction with DuPont to develop a reinforcement system that eliminated the shortfalls of steel.

Since then, Pultron has worked with key market players, developing FRP reinforcement specific to their requirements.

An on-going commitment to research and development ensures that Pultron is always at the leading edge of technology.

Pultron Composites, United Arab Emirates
In 2008, Pultron Composites developed its new manufacturing plant in the Jebel Ali Free Zone, Dubai. This state of the art and LEED Gold certified factory, supplies mateenbar to the Middle East and surrounding markets.

Pultron sees a strong demand for mateenbar™ in the region due to the highly corrosive environmental conditions and a requirement for durable reinforcement.

mateenbar™ leads the composite rebar market in the Middle East with a combination of delivery speed, best strength, best value, best technology and a locally made product.
**mateenbar™** overview

**mateenbar™** is the latest generation composite rebar which offers significant advantages over traditional steel reinforcement:

- corrosion resistance
- high tensile strength
- non-magnetic & non-conductive
- cuts easily
- environmentally friendly
- cost effective

Local manufacture and ex-factory supply ensure:

- rapid delivery
- cost effectiveness
- local technical support

### Comparison to Steel Types

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th><strong>mateenbar™</strong></th>
<th>Steel</th>
<th>Stainless Steel</th>
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<td>Tensile Strength</td>
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*For design values for mateenbar sizes see our Technical Submittal.

### Our Product Family

- **mateenbar™** – ribbed reinforcement bar for concrete structures
- **mateenbolt™** – threaded rock-bolt for soil-nails & mining
- **mateendowel™** – smooth dowel for concrete joints & toggle bars
advantages

resistance to corrosion & chemicals

*mateenbar™* is highly resistant to chemical attack, and cannot rust. This makes it ideal for marine applications, chemical plants and other environments where steel is unsuitable. Design engineers working in such conditions select *mateenbar™* to achieve extended life-spans.

*mateenbar™* is the ideal material for applications where minimal concrete coverage is required - since its corrosion resistance eliminates leaching and rust stains which otherwise ruin the surface aesthetics.

non-conductive & non-electro magnetic

*mateenbar™* is non-conductive and thus stray electrical currents cannot cause induction problems. In areas of high electrical fields, significant power is lost due to induction into the surrounding steel reinforcement increasing operational costs.

Accelerated corrosion also occurs from eddy currents causing electrolysis of the steel reinforcement, requiring extensive earth grounding systems, insulation and increased concrete coverage.

Additional savings can be realised as *mateenbar™* reinforced structures can be located in the direct proximity of electric fields. As a result, transformer buildings can be smaller and high current equipment may be installed directly on the reinforced slab.
low thermal conductivity

The excellent insulation properties of mateenbar™ help to improve the insulation values of the concrete, reducing the thermal losses by replacing the highly conductive steel reinforcement and connectors in insulated sandwich walls.

cutting

In tunnelling projects, Pultron mateenbar™ is specified for soft-eyes in the cages of piles and diaphragm walls. A Tunnel Boring Machine (TBM) can cut through the soft-eyes easily without risk of damage to expensive cutting equipment. The saving in down-time and the total avoidance of additional ground injections are critical in helping engineers keep projects running on schedule and within budget.

non-magnetic

Close to magnetic apparatus - such as hospital MRI rooms, compass calibration areas and in certain high-voltage applications - steel reinforcement is unsuitable because the magnetic properties interfere with sensitive equipment.

These problems are avoidable by specifying mateenbar™ as the reinforcement for these applications.

minimum moisture absorption

Moisture absorption must be minimised to ensure longevity of composites. mateenbar™ moisture absorption rates are extremely low, ensuring mechanical properties are maintained to extend the project life.
superior material performance

research & development
Our materials research scientists and R&D capabilities ensure that mateenbar™ utilizes the highest performing raw materials.

mateenbar™ is manufactured from a proven epoxy backboned resin system to maximise corrosion resistance and increase inter-laminar shear strength. Carefully selected grades of glass fibre ensure immunity to alkaline attack, and long life.

tensile strength
Glass content, fibre straightness, and the bond between fibres and the resin matrix are carefully controlled to achieve the high tensile strength of mateenbar™.

Continuous quality control and a commitment to long term proven raw material suppliers ensure superior properties are maintained throughout the entire production batch.

modulus of elasticity
The modulus of mateenbar™ is near the theoretical limit for the glass fibre and resin matrix, ensuring maximum strength is achieved from the raw materials.

bond strength
The integral ribbed surface of mateenbar™ has improved durability as it does not rely on additional surface treatment or sand coatings. The rib shape and pitch has been designed to provide a superior bond strength compatible with commercial grades of concrete.
cost advantages

In applications where corrosion resistance is important, mild steel is unsuitable unless combined with an additional costly protection system such as:

- Bar Coating – galvanized or epoxy coating
- Increased concrete cover
- Cathodic protection
- Special concrete admixtures
- Paint or membrane water-proofing and protection of the entire structure.

Although these steel protection systems may delay the onset of corrosion, they increase costs, and cannot prevent the inevitable. They must be executed on-site 100% accurately to avoid premature failure.

High-grade stainless steel is an option where on-site workmanship can not be controlled. However, it is a very expensive material to use.

Steel based systems only treat the symptoms, mateenbar™ solves the problems and guarantees a corrosion free solution at 40% of the cost of high-grade stainless steel without construction risks.

life-span

mateenbar™ is formulated from some of the most highly corrosion resistant materials available.

Precise process control ensures optimum performance is achieved from these materials for maximum durability. This is most critical in harsh environments where performance of other materials may prove inadequate.
corrosion & marine
Dibba Harbour - Sharjah, U.A.E
A 600m long salt-water canal development using 2,000 pre-cast *mateenbar*™ reinforced concrete panels.

**benefit:** low concrete cover design possible while still meeting the projects 75 year design life with zero risk of corrosion.

**year:** 2011

**owner:** Sharjah Department of Public Works

**consultant:** Halcrow / VSL

**contractor:** Darwish Engineering

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**Marriott Hotel - Washington, U.S.A**

Deep foundation for the Marriot Hotel in Bellevue Washington using *mateenbolt*™ soil-nails to allow for future ‘cut and cover’ development on one side.

**benefit:** zero risk of corrosion in hotel foundations and future ‘cut and cover’ tunnel catered for by ability to easily cut through *mateenbolt*™. Light weight of *mateenbolt*™ soil-nails allowed for much safer and faster handling on-site.

**year:** 2013

**owner:** Marriott Hotel

**consultant:** Williams Form Engineering

**contractor:** Malcolm Drilling

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*mateenbar*™ is the ideal reinforcement for concrete members in corrosive environments and where a longer service life is required.

**applications**
- marine applications, quay walls, wharfs, canals & harbours
- marina pontoons
- bridge decks
- near surface mounted reinforcement
- water and sewerage tunnels and plants

Traditional solutions to increase durability – such as epoxy coated steel re-bars, special concrete admixtures, increased concrete cover, protective paint and cathodic protection – will only delay the outbreak of corrosion whereas *mateenbar* completely eliminates it.

The performance of *mateenbar*™ is comparable with higher grade stainless steel, but with a significant price saving.

A minor increase in initial project costs provides significant cost savings throughout the structure’s lifetime with no further expenses for maintenance, shut-downs or even reconstruction required.

Further savings when using *mateenbar*™ result from the ability to significantly reduce concrete cover and lower the concrete costs, as corrosion inhibitors and microsilica are not required. Reduced concrete cover provides weight saving benefits which can allow lower strength and lower cost supporting structures.

**project examples**
- Dubai Marina – U.A.E
- Katara Village - Qatar
- Sewerage Treatment Enhancement Project - Abu Dhabi, U.A.E
- Jubail Industrial Area - Saudi Arabia
- Adelaide Desalination Plant - Australia

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*mateenbar*™ is the ideal reinforcement for concrete members in corrosive environments and where a longer service life is required.
electro-magnetic

aluminium & copper smelters

upgrade project, London Overground

Emirates Aluminium – Abu Dhabi, U.A.E

powerstations, transformers & sub-stations
Emirates Aluminium, Abu Dhabi, U.A.E

The Emirates Aluminium (EMAL) smelter near Khalifa Port on the shores of the Arabian Gulf is one of the largest single site aluminium smelters in the world.

Year: 2012-2013
Owner: Emirates Aluminium (EMAL), Abu Dhabi
Consultant: SNC Lavalin
Contractor: Al Futtaim Carillion

**Benefit: mateenbar™ provided a non-conductive reinforcement to eliminate induction in transformer base slabs.**

**Applications:**
- aluminium & copper smelters
- power & substations
- sensitive electronic laboratories and calibration areas
- military applications
- electrical isolation breaks

**Project Examples:**
- Qatar Aluminium Smelter (Qatalum) - Doha, Qatar
- Eastlink M3 Tunnel - Melbourne, Australia
- London Rail Network - United Kingdom
- Penrose Substation - Auckland, New Zealand
- Islington Road Substation, Christchurch, New Zealand

**Obtain Image from Customer?**
tunnelling & cutting
Singapore MRT
The Singapore Mass Rapid Transport (MRT) system consists of 102 stations and 149 km of lines and carries over 2.6 million passengers per day.

benefit: during construction of the Singapore MRT underground stations, concrete walls and columns had to be built in the path of the Tunnel Boring Machine (TBM) prior to tunnelling.

The soft-eye technique allowed the TBM to quickly and safely drill through the mateenbar™ reinforced diaphragm walls.

year: 2002
owner: SMRT Trains
contractor: Alstom

Northside storage tunnel
The 20km long Northside Storage Tunnel was built in Sydney, Australia.

The tunnel was commissioned to collect storm overflows from the sewerage system to reduce contamination from raw sewerage entering Sydney harbour.

benefit: mateenbolt™ was specified after it was determined that stainless steel reinforcement could not give the required life-span in this harsh environment.

year: 1998-2000
owner: Sydney Water
consultant: Connell Wagner
contractor: MWH, Transfield

tunnel boring machine soft-eyes
mateenbar™ can be used as a reinforcement in diaphragm walls and bored piles as it can be easily cut by a Tunnel Boring Machine (TBM). This soft-eye technique provides significant cost, scheduling and safety benefits in tunnel projects.

The TBM can drill through underground shaft walls without becoming damaged or delayed as the mateenbar™ can be cut as easily as unreinforced concrete. With traditional steel reinforcement, the TBM has to be stopped before each shaft and the breakthrough has to be prepared manually, using hydraulic hammers and acetylene cutting equipment. When located below the groundwater, a manual breakout often also requires further time consuming works such as a ground-stabilising and waterproofing by jet-grouting injection to prevent water and soil flooding the pit.

Construction proceeds faster, costs are lowered, and site safety is improved when mateenbar™ is installed in the break-through zone.

traditional tunnelling
In traditionally driven tunnels, the broken-out areas are secured using shotcrete and Pultrons’ mateenbolt™ rock-bolts.

project examples
• Eastlink Tunnel - Melbourne, Australia
• Lusail expressway - Doha, Qatar
• Singapore MRT - Singapore
• Cross City Tunnel - Sydney, Australia
• Sewerage Treatment Enhancement Project - Abu Dhabi, UAE

Singpore MRT

The 102 stations and 149 km of lines carry over 2.6 million passengers per day.

benefit: during construction of the Singapore MRT underground stations, concrete walls and columns had to be built in the path of the Tunnel Boring Machine (TBM) prior to tunnelling.

The soft-eye technique allowed the TBM to quickly and safely drill through the mateenbar™ reinforced diaphragm walls.

year: 2002
owner: SMRT Trains
contractor: Alstom
roads & transportation

Muscat Airport - Sultanate of Oman

Superslab - New Jersey, U.S.A

MSE walls - Dubai Marina, U.A.E

mateendowel™ basket placement - Washington State Department of Transportation
**Central Corridor, Oman**

*mateendowel™* is cast into Mechanically Stabilized Wall (MSE) panels to provide a high strength anchor for textile straps. This ensures a strong and durable modular wall system.

**benefit:** the ability to use *mateendowel™* in direct contact with high salt content sand. The integrity of the MSE wall is ensured by the corrosion resistance of *mateendowel™*.

**year:** 2009

**owner:** Muscat Municipality

**consultant:** VSL / Parsons

**contractor:** Galfar Engineering & Contracting

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**mateenbar™** is the ideal reinforcement for concrete roads and bridges, as it is fully corrosion resistant and lightweight.

**applications**

- bridge decks & barrier walls
- expansion and contraction joints
- approach slabs
- mechanically stabilized earth (MSE) walls

When used in road and bridge slabs or in concrete barrier walls in aggressive environments, corrosion attack by de-icing salts, saline environment, weather and chemicals can be eliminated.

Structures with *mateenbar™* can be designed lighter as the concrete cover can be reduced, thereby reducing the strength required in other structural members.

*mateenbar™* is a quarter the weight of steel reinforcement. This allows construction to be safer and quicker by reducing the requirement for heavy lifting equipment on site.

Epoxy coated dowel bars have been found to be unsuitable due to nodal corrosion (aggressive corrosion concentrating at points) and have been banned by US Transportation authorities.

The significant costs in shutting down a transport network due to concrete failure lead to transportation authorities now budgeting based on whole-of-life costing rather than just upfront costs.

**project examples**

- Continuously Reinforced Concrete Road - Yreka, CA, U.S.A
- Lusail Expressway project - Qatar
- Shahama-Saadiyat Freeway packages 1 & 2 - U.A.E
- Dowel bars in Highway Project - France
- Messaieed Bridges - Qatar

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**Interstate 84, Idaho, USA**

In this major North American roadway project 70,000 *mateendowels™* were inserted by a dowel bar placement machine to provide a non-corrosive solution for contraction joints.

**benefit:** extended life through a corrosion free joint system reduces maintenance and enables a significant reduced cost of ownership to the Idaho Department of Transport.

**year:** 2010

**owner:** Idaho Department of Transport

**consultant:** Idaho Department of Transport

**contractor:** Concrete Placing Company
frequently asked questions

Q. When was GFRP developed?
A. During the second world war in the aerospace industry

Q. When was GFRP first used to reinforce concrete structures?
A. In 1983, the US Department of Transport used composites for the design and construction of bridges. FRP was employed to avoid the corrosive effect of de-icing salts, a significant advantage over epoxy coated steel being used at the time.

Q. What design codes are available?
A. The most commonly referenced design document for GFRP is ACI 440.1R-06 (based on ACI 318) “Guide for the Design and Construction of Structural Concrete Reinforced with FRP Rebar”

Q. GFRP is brittle and not as ductile as steel, how does this effect the design?
A. Ductility of the structure is important, not ductility of the individual components. The ductility of the structure is ensured by avoiding GFRP rupture (analogous to failure by steel yielding). To avoid this, design guides typically increase the design safety factors. In ACI 440.1R-06 only 55% of the design strength would be utilized to resist the Design Moment under a rupture failure mode. The use of large safety factors eliminates the possibility of failure due to GFRP’s lower ductility than steel. Ref: Section 8.2.3 & 8.2.4 of ACI 440.1r-06.

Q. Can GFRP rebars be bent on site?
A. MateenBar uses a high strength thermo-set resin, this can not be bent after manufacture. A bending schedule should be specified to allow bends to be manufactured to order in our factories.

Q. What is the replacement ratio of steel to GFRP?
A. As a rule of thumb, allow 1:1.75 by area for eModulus equalization for stainless steel to control crack widths under normal conditions. The non-corrosive nature of GFRP permits higher crack widths which can reduce the amount of GFRP required.
Pultron Composites would like to thank the following experts, companies and research institutions for their help in testing & developing **mateenbar™**

**Professor Greg Lucier**  
Manager Constructed Facilities Laboratory  
North Carolina State University, U.S.A

**Professor Alessandro Palermo**  
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United States of America

**Professor Mesfer M. Al Zahrani**  
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King Fahd University of Petroleum & Minerals  
Kingdom of Saudi Arabia

**Professor Tamer El Maaddawy**  
Department of Civil Engineering  
United Arab Emirates University, U.A.E

**Professor Farid Abed**  
Department of Civil Engineering  
American University of Sharjah, U.A.E

**Standards Measurements Laboratory**  
Industrial Research Ltd  
New Zealand

**Dr Moyeen Sawpan**  
Composite Material Research, New Zealand

**Owens Corning Research**  
United States of America

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**Composite Materials Research**

Pultron Composites has on-site research and quality assurance laboratory equipped with state-of-the-art instrumentation to provide analysis of raw materials, as well as finished product.

These instruments are utilised to develop new material systems, optimise performance and select the most appropriate resources for certain applications.

In addition, some of these instruments are used to ensure the quality of incoming raw materials and outgoing products are acceptable.

The laboratory is equipped with:

- Temperature Modulated Differential Scanning Calorimeter (TMDSC)
- Dynamic Mechanical Thermal Analyser (DMTA)
- Microscopic analysis
- Universal Testing Machine (UTM)
- Fatigue and creep testing equipment
- Inter-laminar shear strength testing instrument
- Accelerated environmental testing

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**Pultron Composites**

Research and testing
example projects

**mateenbar**, a trusted partner in over 150 projects

| Northside Storage Scheme, Australia | Qafay Island - Bridge, UAE | New Jersey State Department Highways, USA |
| Singapore MRT, Singapore | Bridge Interchange on Abu Dhabi - Al Sila Road, UAE | Marina repair / expansion, Queensland, Australia |
| EMAAR West Marina Infrastr. Package 3A, Dubai, UAE | R709/1 -/C 8 Jebel Ali Road Phase III, Dubai, UAE | Khalifa Port Interchange, Abu Dhabi, UAE |
| Halul Island, Qatar | R202 KAA Road: Package 5, Sharjah, UAE | IC6 Extension Al Raha Beach Develop., Abu Dhabi, UAE |
| Cross City Tunnel, Australia | King Abdul Aziz Interchanges, Package 2, Sharjah, UAE | Development Sectors 2 & 3 Al Reem Island, UAE |
| Salwa Interchange, Qatar | R479 Wast Road Improvements Phase III, Sharjah, UAE | Sheikh Ammar Bin Humaid Al Nuaimi Bridge - Ajman |
| Jaluit School Construction, Jaluuit Island, New Zealand | Islington rd Electrical Substation, New Zealand | Improvement of Al Hamidiya Interchange, Ajman |
| EMAAR West side Marina Package 3B & D, Dubai, UAE | Aligator Creek Electrical Substation, Australia | Dibba Seawall, Sharjah, UAE |
| Muniay Shawka Road, Sharjah, UAE | Shahama Saadiyat Freeway Package 1, UAE | Irish Bridge for NATO, Afghanistan |
| SMART Tunnel, Malaysia | Shahama Saadiyat Freeway package 2A, UAE | 4th NGL Train, Sea water System, Ruwais, UAE |
| Interchange at Jn. 14H & IC3, Sharjah, UAE | Roads New Industrial Area, Mussafah West, Contract 992, UAE | Port Rashid Extension, Dubai, UAE |
| 3rd Bridge Crossing Abu Dhabi, UAE | Reconstruction of Mafraq Interchange, Abu Dhabi, UAE | Consol Energy - Enlow Coal Mine, USA |
| Mosaieed Bridges, Qatar | Dual Laning of Al Fayah Road / Al Fayah, Abu Dhabi, UAE | Consol Energy - Shoemaker Coal Mine, USA |
| Dumb-Bell Interchange, Sharjah, UAE | Bridge & Tunnels at IP-44 and Sea Palace, Abu Dhabi, UAE | Katara Cultural Village, Doha, Qatar |
| Lane Cove Tunnel, Australia | Bahrainin map I/C, Bahrain | Linking Industrial Area to ICP - Phase I, Saudi Arabia |
| Al Hamara Village Development, RAK, UAE | Central Corridor, Muscat Municipality, Oman | Penrose Substation, Auckland, New Zealand |
| Interchange at Jn. 14E, Sharjah, UAE | Qatar Primary Route North Highway C2 & C3, Qatar | EMAL Aluminium Smelter - Potline 3, Abu Dhabi, UAE |
| Alternative Road from Sharjah to RAK Cont. No. 2, UAE | Mina Al Arab Phase 1, RAK, UAE | Lusail Expressway, Qatar |
| Al Itihad Interchange, Sharjah, UAE | Adelaide Desalination Plant, Australia | EMAL Aluminium Smelter - Phase II, Abu Dhabi, UAE |
| King Abdul Aziz Interchange Jn. 65A In 14G, Sharjah, UAE | Kwinana Desalination Plant, Australia | El Ain El Sokna - Thermal Power Station, Egypt |
| King Faisal Interchange, Sharjah, UAE | EMAL Aluminium Smelter - Phase 1, Abu Dhabi, UAE | Medinah Station, Haramain Railway, Saudi Arabia |
| Barr Al Jissah, Oman | Muscat Expressway, Oman | STEP Link Sewers Project - Abu Dhabi, UAE |
| Eastlink Tunnel, Sydney, Australia | I-84 Franklin to 11th, Idaho, USA | Marsden Substation, Whangarei, New Zealand |
| Seeb International Airport, Oman | 220 kV Switchyard, Auckland, New Zealand | Al Hadd, Madarakah, Masirah lighthouses & DGPS, Oman |
| Haymarket Cable tunnel, Sydney, Australia | New Jersey - Interstate (I) 84, Boise ID, New Jersey, UAE | QATALUM Pot line roadway, Qatar |
| R659-Jumeirah Lake Interchange, Dubai, UAE | Brisbane Airport Link, Australia | Roading Projects Socotras, France |
| Al Rawada Palace, Abu Dhabi, UAE | Chapman House Christchurch, New Zealand | Jubail Industrial Area Development, Saudi Arabia |
| R472 Khor Fakkan South Gartway, Sharjah, UAE | Alpha Natural Resources - Coal Mine, USA | Gridco Power Systems Reinforcement Project, Ghana |
product information

other members in the mateen family:

mateenbolt™
A cuttable dowel with a threaded surface finish to improve load transfer and head bond strength.

mateenbolt™ has the following advantages:
• high performance resin/glass materials
• FRP matrix with premium shear and torque strength
• high shear strength to resist high shear stress regimes
• hexagonal nut with primary breakout to ensure dowel insertion into hole at all times
• extra high head bond strength
• easy to insert with hand held installation method

mateendowel™

mateendowel™ is used extensively in concrete jointed roads and underpasses in extreme conditions subjected to de-icing salts & salty soils.

mateendowel™ has the following benefits:
• corrosion resistance
• longest life cycle of all dowel types
• high shear strength for load transfer efficiency
• light weight, fast installation
• significant savings over stainless steel dowels

available diameters

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Root Diameter (mm)</th>
<th>Outside Diameter (mm)</th>
<th>Nominal Area (mm²)</th>
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</table>

available diameters

mateenbar™ and mateendowel™ are available in these sizes:

• Standard lengths available 6/12m.
• Lengths up to 16m are available on request.
• Specific lengths can be manufactured to customer order to reduce wastage