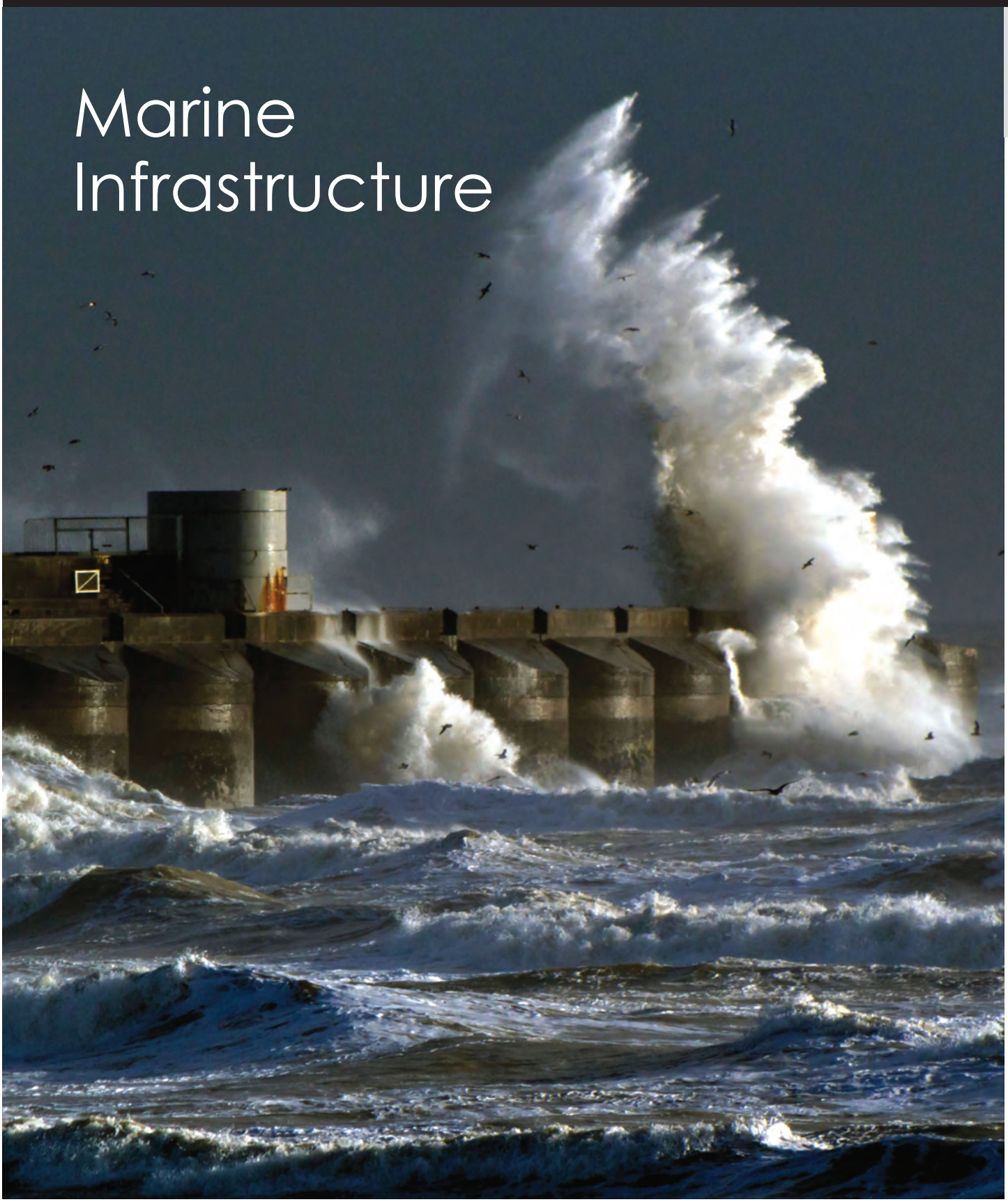
Marine Infrastructure



Weber Technical Mortars for the Construction Industry

Technical • Engineered • Strength

A solution for every application

weber SAINT-GOBAIN

About **Weber**

As a recognised manufacturer and innovator of easy-to-apply products in the technical mortars, facades, flooring systems and tile-fixing markets, **Weber** is a leading player in the construction products industry.

The natural synergy between these specialist activities enables **Weber** to provide integrated solutions for a wide range of projects from building renovation and refurbishment to new building developments and major civil engineering.

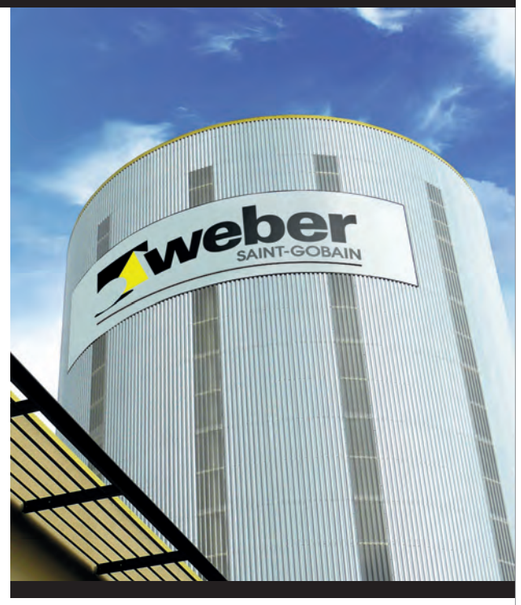
Weber does not sell only products but the complete solution which includes the services that go with the products; technical support and training. Based on its strong knowledge and experience of the market, the **Weber** training programmes meet the needs of its customers. **Weber** provides specifiers, developers and contractors across the board with substantial technical support, both before, during and after contract periods.

About **Saint-Gobain**

Weber is part of **Saint-Gobain**, one of the world's leading industrial groups with activities in construction products, flat glass and packaging, high performance materials and building distribution.

Saint-Gobain is an international group employing around 193,000 people in over 64 countries worldwide. Established in France in 1665, **Saint-Gobain** is one of the world's largest industrial groups, with an annual turnover of €43.1 billion.

Some of the UK and Ireland's most respected companies and brands in the construction sector are part of **Saint-Gobain**, including **British Gypsum**, **Glassolutions**, **Isover**, **PAM**, **Artex**, **Celotex**, **Ecophon** and **Pasquill**. Together these businesses offer an unrivalled range of products and innovative material solutions that give architects and designers the ability to respond to the latest trends, whilst meeting the most exacting performance and legislative standards.



Weber's Technical Mortar Range

Repairs of Marine Infrastructure are highlighted in this brochure but **Weber** also offer solutions to the Construction Market in the sectors of Concrete Repair & Protection, Precision Grouts and Bedding Mortars.

Concrete Repair & Protection – Weber has a wide portfolio of products designed to facilitate repair and protection of concrete in most circumstances, ranging from hand placed materials for localised non-structural repairs, to flowable or spray solutions for mass structural replacement.

Precision Grouting – Reliable transfer of loads from structure to supporting foundations is a vital element of design in any civil engineering project. **Weber's** high performance precision grouts offer excellent dynamic load carrying capacity, are extremely durable and provide good chemical resistance.

Bedding Mortars - Weber offers a range of materials for fast installation of ironwork bedding solutions for trunk roads, motorways and airports, where high performance characteristics are paramount. These products are designed for long lasting reinstatement.

The above brochures highlight the main products that are referred to in this Marine Infrastructure brochure.

Introduction

Coastlines

The geography of the UK coastline consists of a variety of natural features. These consist of islands, bays, headlands and peninsulas.

The coastline of Great Britain is 11,073 miles (17,820 km). If the larger islands are added, the coastline extends to 19,491 miles (31,368 km).

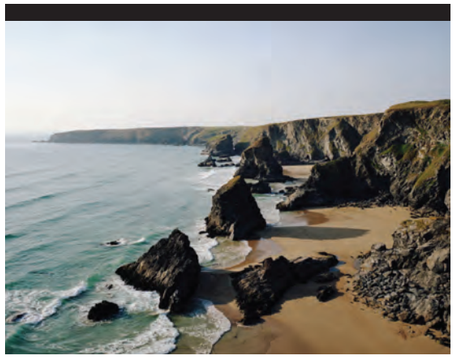
Nowhere in the UK is more than 70 miles (113 km) from the coast. It is estimated that around 3 million people (out of 60 million) live on the coast of the UK.

The total coastline of the Isle of Ireland is 1,980 miles (3,170 km) of which the coast of Northern Ireland is 405 miles (650 km) in length.

The total length of the world's coastline is in the region of 217,490 miles, roughly equal to the distance from the Earth to the Moon. It is estimated that thousands of miles of coastline are eroded globally each year which can either lengthen or shorten the total length of coastline making it impossible to be more accurate.

The sea plays an important part in our lives. Many people live by the coast, and most of the world's largest cities are in coastal regions.

The sea provides us with energy (oil, gas, wave power) as well as leisure activities, transport routes, and food.

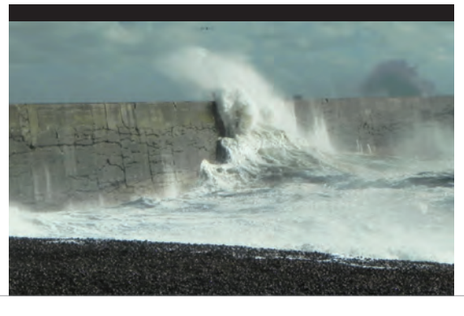


Storm damage

Some of the best-loved beauty spots along Britain's coast suffered years' worth of damage in the space of weeks or even hours during the winter storms.

The gale force winds and violent waves that battered the shorelines and have left parts of white chalk cliffs crumbling, destroyed access to beaches and the storms and high tides caused two years of erosion in just one afternoon.

Several metres of coast were lost in some areas, as thousands of tonnes of sand have been washed off beaches, exposing vulnerable foundations of seawalls.



Marine problem areas

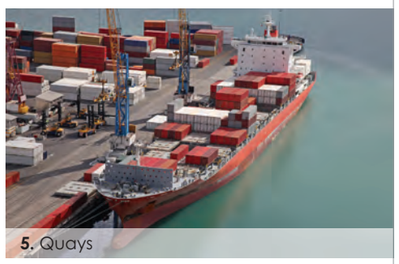

15. Cliff stabilisation


1. Lighthouse


2. Flood alleviation


3. Lock wall repairs


4. Riverbank stabilisation


5. Quays


14. Lifeboat slipways

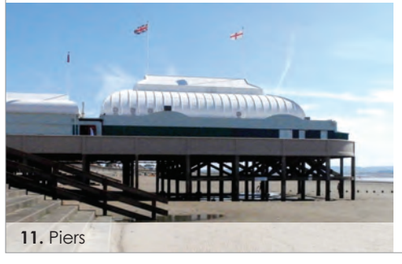

6. Jetties


13. Seawalls


7. Jetty repairs


12. Seawall repairs


8. Marinas


11. Piers

10. Dockside cranes


9. Breakwaters

Coastal protection by hard engineering

Sea walls

Walls are made of rock, stone blocks or mass concrete, built at the base of a cliff or at the rear of a beach and are used to protect against erosion or flooding. They are usually about 3–5 metres high. Modern seawalls divert wave energy resulting in reduced turbulence.

Sea walls can cause sandy beaches to disappear, due to the stronger wave backwash but are the second most traditional method used in coastal management.

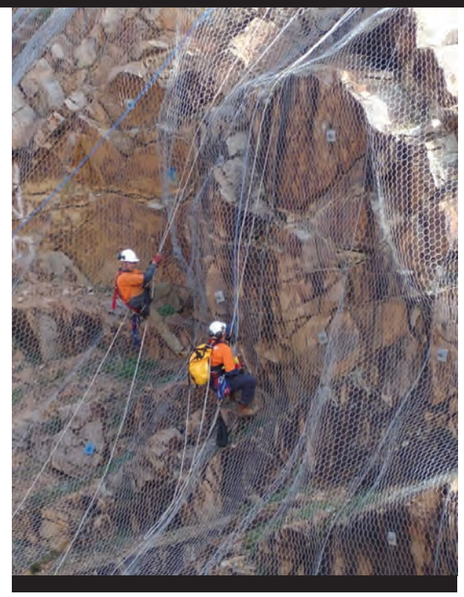
Breakwaters

Enormous concrete blocks and natural boulders are sunk offshore to alter wave direction and to filter the energy of waves and tides. The waves break further offshore and therefore reduce their erosive power. This leads to wider beaches, which absorb the reduced wave energy, protecting cliff and settlements behind.

The precast reinforced concrete dolosse has replaced the use of concrete blocks because the dolosse being of interlocking design, is much more resistant to wave action and requires less concrete to produce a superior result.

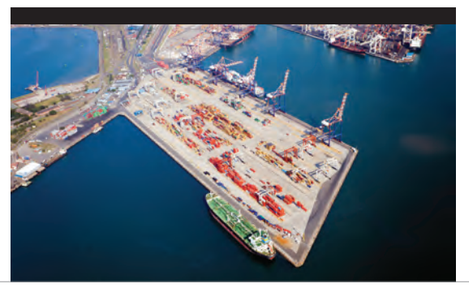
Cliff stabilization

Cliff stabilization can be accomplished through drainage of excess rainwater, terracing, and planting, but these days rock anchoring and sprayed concrete is used to hold cliffs in place. This prevents landslides, cliff erosion and other localized damage.



Harbour walls

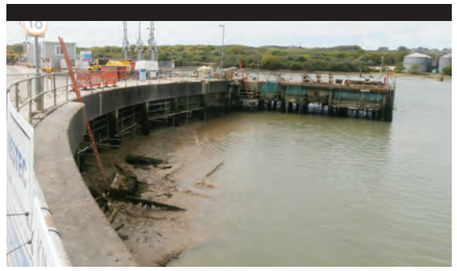
Rock or concrete walls are built to reinforce a river estuary. The walls help to stabilise and deepen the channel which benefits harbour navigation, flood management and riverbank erosion but can occasionally cause coastal erosion due to containment of longshore drift.



Jetties

Jetties, piers and other marine structures constructed in exposed locations require careful assessment of their hydraulic loads. Increasingly trade economics are leading to larger ship sizes and existing and new port locations for these vessels require longer jetties in significantly deeper water.

In these instances construction of protective breakwaters becomes substantially more expensive, so in some cases jetties or their approach trestles are being constructed in exposed locations without breakwater protection.



Tides

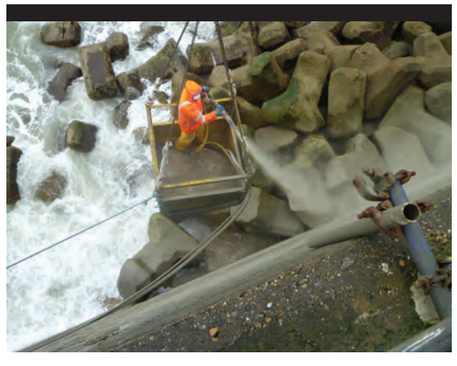
Repairs to shoreline structures have to take into account the local tide patterns because the windows available for work to progress are very variable. The designer and contractor need to take this account when pricing for a job.

Tides are the rise and fall of sea levels caused by the combined effects of the gravitational forces exerted by the Moon and the Sun and the rotation of the Earth.

The times and amplitude of the tides at a particular location are influenced by the alignment of the Sun and Moon, by the pattern of tides in the deep ocean and by the shape of the coastline and near -shore bathymetry.

While tides are usually the largest source of short-term sea-level fluctuations, sea levels are also subject to forces such as wind and barometric pressure changes, resulting in storm surges, especially in shallow seas and near coasts.

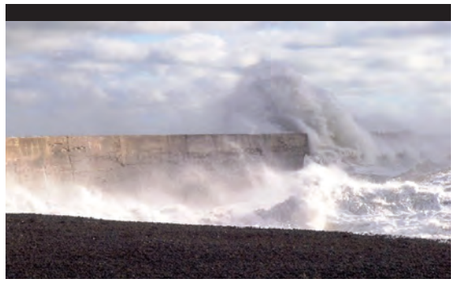
Tide tables are available for a wide variety of locations in the UK and worldwide.



Wave action

It is important to understand the basics of wave action as this can have a significant effect on the integrity and durability of marine structures.

The power of waves is one of the most significant forces of coastal change. Waves are created by wind blowing over the surface of the sea. As the wind blows over the sea, friction is created - producing a swell in the water. The energy of the wind causes water particles to rotate inside the swell and this moves the wave forward. The size and energy of a wave is influenced by the strength of the wind, how long the wind has been blowing and how far the wave has travelled.



Destructive waves are created in storm conditions. They occur when wave energy is high and the wave has travelled over a long fetch, has a stronger backwash than swash and has a short wave length and is high and steep.

Destructive waves tend to erode the coast and can structurally damage seawalls, jetties and other marine structures in a number of ways:

Hydraulic action
Air may become trapped in joints and cracks in cliffs and seawalls and when a wave breaks, the trapped air is compressed which weakens the structure and causes erosion.

Abrasion
Fragments of rock and sand carried by the waves grind down concrete and cliff surfaces like sandpaper.

Attrition
Waves smash rocks and pebbles on the shore into each other, and they break and become smoother.

Solution
Acids contained in sea water will dissolve some types of rock such as chalk or limestone.

Salinity

Salt water is corrosive.

Salt water contains chloride and sulphate ions and a number of other ingredients that can attack concrete but it is the steel reinforcement in concrete structures or steel piles and columns in a pier or jetty that corrode in a marine environment.

Concrete contains cement which is alkaline and forms a thin passive film that protects the steel.

But if chloride ions are allowed to penetrate the concrete down to the steel, a corrosion cell could be initiated if there are any weaknesses in the protective passive film. The chlorides, being electrolytic, exacerbate the corrosion process.

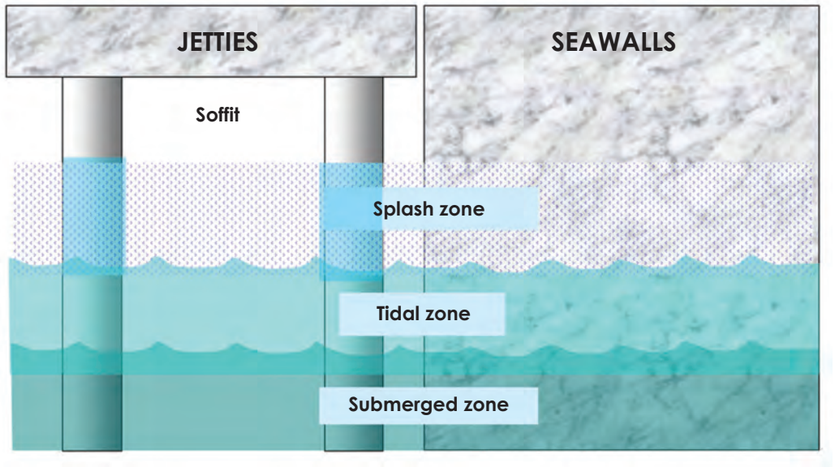
When steel corrodes, the rust expands in volume and this will cause cracking along the steel and eventual spalling of the concrete cover.

Exposed steel corrodes quickly and can lead to dangerous structural failure.

Seawater composition (by mass) (salinity = 3.5%)

Element	Percent	Element	Percent
Oxygen	85.84	Sulfur	0.091
Hydrogen	10.82	Calcium	0.04
Chloride	1.94	Potassium	0.04
Sodium	1.08	Bromine	0.0067
Magnesium	0.1292	Carbon	0.0028

Marine structures



Location	Condition	Level of Corrosion
Submerged zone	Oxygen depleted but still active	2 : Some. Black rusting
Tidal zone	Constant wetting and drying	5 : Maximum
Splash zone	Occasional wetting and drying	4 : Very High
Soffit zone	High atmospheric salty moisture	3 : High
Inland 50 km	Normal : 20˚C and 65% RH	1 : Low

Factors affecting the durability of the reinforced concrete in seawater

Disintegration of concrete and corrosion of reinforcement is the sign of deterioration of marine concrete structure. Many researchers have identified, after laboratory investigation and extensive studies on existing marine structures, a number of factors affecting the deterioration of reinforced concrete in such an aggressive environment. Some of these important parameters are stated below:

1 **Aggregate type:** the aggregates should be dense, non-shrinking and alkali resistant.

2 **Cement:** Ordinary Portland cement with PFA or GGBS or sulphate resisting cement are used in marine concrete construction and the minimum cement content of concrete is usually specified.

3 **Water-cement (w/c) ratio:** The water-cement ratio influences both the strength and durability of concrete and even a small increase of w/c ratio can increase the concrete permeability greatly, as it controls the diffusion of aggressive salt-ions into the concrete. Standards dictate a maximum w/c ratio of 0.45.

4 **Influence of cracking:** Reinforced concrete structures develop unavoidable cracks during their service life as a result of initial and drying shrinkage, settlement and loading during normal service. Vibration, impact, flexure, stress reversal, torsion, and shear can all initiate cracks which will offer a path to the steel reinforcement for salt water.

5 **Depth of cover to the reinforcement:** The thickness of the concrete cover to the steel is an important factor regarding rebar corrosion in an aggressive environment. It affects the time taken for the salts to penetrate to the steel, and the subsequent rate of arrival of oxygen at the steel surface as in the case of permeability.

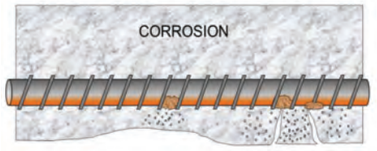
6 **Diffusion of salts under pressure:** The harmful salt ions can be absorbed into concrete at various depths under hydrostatic pressure and this can lead to weakening of the concrete matrix, allowing chloride ions to contact with steel.

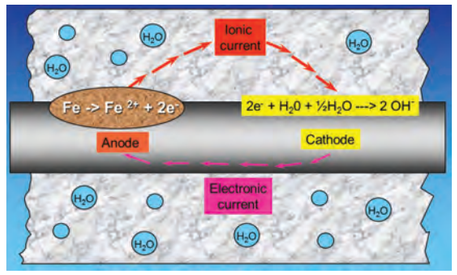
7 **Wetting and drying cycles:** In a marine environment, the structural concrete in the tidal zone is subject to alternate wetting and drying due to tidal action and hence is at most risk of steel corrosion damage.

Requirements for marine infrastructure repairs

Corrosion of reinforcing bars induced by chloride ion ingress is a major cause of damage in marine environments.

Reinforcement corrosion causes a reduction in the service life of reinforced concrete structures, therefore a regular schedule for maintenance and repair is of fundamental importance in ensuring safe and efficient use of a structure.





Structural surveys

A detailed investigation to determine the extent and cause of degradation requires to be carried out by an experienced corrosion engineering practice. Only then an assessment of corrosion damage can lead to the selection of effective repair schemes.

BS EN 1504 "Products and systems for the protection and repair of concrete structures- Part 9: General principles for the use of products and systems" outlines in Clause 4.3 the necessary steps to be taken in carrying out an assessment of the defects in the concrete structure, their causes, and of the ability of the concrete structure to perform its function.

This takes into account the following :

a) the visible condition of the existing concrete structure;

b) testing to determine the condition of the concrete and reinforcing steel;

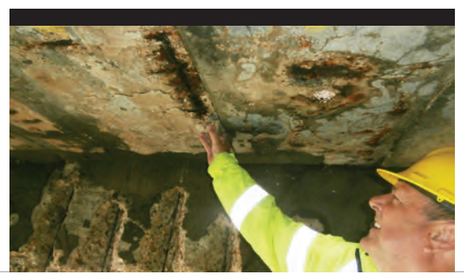
c) the original design approach;

d) the environment, including exposure to contamination;

e) the history of the concrete structure, including environmental exposure;

f) the conditions of use, (e.g. loading or other actions);

g) requirements for future use.



Protection of the structure

Clause 5.2 presents the various options that can be considered:

a) do nothing for a certain time but keep monitoring the structure;

b) re-analyse the structural capacity, possibly leading to downgrading in function;

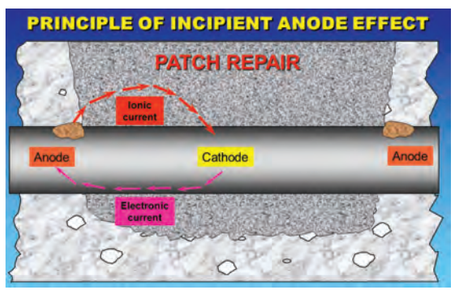
c) prevent or reduce further deterioration;

d) strengthen or repair and protect all or part of the concrete structure;

e) reconstruct or replace all or part of the concrete structure;

f) demolish all or part of the concrete structure.

Clause 6 specifies the basic principles which shall be used, separately or in combination, to protect or repair concrete structures. The principles of protection and repair are based on chemical, electrochemical or physical principles that can be used to prevent or stabilise the deterioration of concrete or electrochemical corrosion on the steel surface, or to strengthen the concrete structure.



Principles 1 to 6 cover defects in the concrete or concrete structures that may be caused by mechanical: e.g. impact, overloading, movement , chemical and biological: e.g. sulphate attack, alkali aggregate reaction and physical: e.g. freeze-thaw action, thermal cracking, moisture movement, salt crystallization and erosion.

Marine structures are mainly subject to reinforcement corrosion which is covered by Principles 7 to 11. Corrosion caused by the ingress of chloride ions is more difficult to treat than corrosion caused by carbonation.

Treatment of local areas of concrete that are contaminated by chloride ion can be successfully carried out by patch repair that removes all the contaminated concrete. However, where contamination is extensive, treatment of areas of damage alone will not provide a lasting repair solution. Areas repaired with new mortar or concrete can initiate corrosion in adjacent areas of contaminated concrete (often termed incipient anode or ring anode effect). In these situations, additional methods will need to be considered if corrosion is to be arrested, such as those given in Principles 7 to 11 (See over page).

Common causes of defects and their solutions

BS EN 1504 Standard provides the user with eleven principles of concrete repair and protection to be used for concrete repair.

Defects in concrete

PRINCIPLE	BS EN 1504	PROBLEM	BS EN 1504 REFERENCE
1	**Protection against ingress**	Concrete is a porous material and is exposed to aggressive chemicals or contaminated water.	**PI**
2	**Moisture control**	Excessive water penetration can cause damage to reinforced concrete.	**MC**
3	**Concrete restoration**	Restoring the original concrete after spalling and delamination.	**CR**
4	**Structural strengthening**	Increasing or restoring the structural load-bearing capacity after excessive loads or weakened structure.	**SS**
5	**Increasing physical strength**	Increasing physical resistance to impact damage, abrasion and wear and tear.	**PR**
6	**Resistance to chemicals**	Increasing resistance of concrete surface to chemical attack.	**RC**

Remediation of reinforcement corrosion

PRINCIPLE	BS EN 1504	PROBLEM	BS EN 1504 REFERENCE
7	**Preserving or restoring passivity**	Restoring the concrete to a highly alkaline condition to protect steel rebar.	**RP**
8	**Increasing resistivity**	Increasing the resistivity of the concrete to prevent rebar corrosion.	**IR**
9	**Cathodic control**	Preventing corrosion of rebar reinforcement.	**CC**
10	**Cathodic protection**	Reducing or preventing the corrosion reinforcement.	**CP**
11	**Control of anodic areas**	Creating conditions for the steel rebar not to be subject to corrosion.	**CA**

BS EN 1504 Principle 10 is concerned with cathodic protection of the concrete structure. This is appropriate where chloride contamination is significant or carbonation has reached the reinforcement resulting in a high risk of corrosion.

Impressed current cathodic protection applied in accordance to BS EN 12696 can control corrosion, counteract the incipient anode effect and can limit the amount of concrete removal.

Specifying to BS EN 1504

Products and systems for the protection and repair of concrete structures.

Concrete repair strategy

1 Assess the damage
- Examine original design approach
- Survey present conditions
- Consider the environment
- History of use

2 Choose options
- Consider intended use
- Design life of structure
- Performance of systems
- **Weber** can advise on the best options for the structure

3 Choose repair principle
- BS EN 1504 provides eleven repair principles
- Contact **Weber** for help in selecting the correct repair principle

4 Choose method
- **Weber** can advise on the correct method of repair or protection to meet BS EN 1504 repair principle

5 Choose materials
- Select correct **Weber** materials appropriate to type of repair

6 Specification
- **Weber** can help compile a project specification to repair or protect the structure

Regular inspections after repair work are necessary to ensure satisfactory performance of repair systems. In addition, field investigations of repaired concrete structures are necessary to develop guidelines for the adequate selection of concrete repair systems, improved repair procedures, extended durability of rehabilitated structures and evaluation of discrepancies between laboratory results and field performance.

Product selection

Products used for remediation of marine structures should comply with the requirements of BS EN 1504 Parts 2 to 7 and in accordance with EU directives and should be CE marked where appropriate.

In order to be suitable for use in marine tidal situations, certain products should be rapid setting and should be able to resist the ingress of chloride ions at early stages of their strength development.

In some cases, consideration should be given to applying thicker sections of new concrete cover as sacrificial layers to arrest the progress of chloride ion penetration to the steel reinforcement.

Cathodic protection is especially appropriate where chloride contamination is significant, or carbonation to the depth of the reinforcement is extensive, resulting in a high risk of corrosion of reinforcement.

Impressed current cathodic protection applied according to BS EN 12696 can control corrosion regardless of the level of chloride contamination in the concrete and limits the amount of concrete removal to that physically damaged by corrosion of underlying reinforcement. Its long term effectiveness depends on adequate monitoring and maintenance.

Cathodic protection is effective for achieving long-term corrosion control and counteracts the incipient anode problem and the effect of concrete contamination (see BS EN 12696).

There are many different types of anode systems used in cathodic protection, some of which use an impressed current from an external power source, while others use galvanic (sacrificial anode) action.

Recent developments include a hybrid anode system based on the use of a sacrificial metal in both an impressed current and sacrificial anode role where an impressed current is driven from the anode to the steel using a temporary power supply.

Where contamination of the concrete is extensive, but it is not possible to remove all contaminated concrete, incipient anode formation can be controlled by treating the surface of the reinforcement in the patch repair to prevent corrosion. Coatings can be applied directly to the reinforcement where it is exposed as part of concrete restoration. These coatings can contain active pigments, which may function as anodic inhibitors or by sacrificial galvanic action.

Other types of coatings can form barriers on the surface of the reinforcement. This method can only be effective if the reinforcement is prepared to be free of corrosion and the coating is complete (i.e. the bar must be completely encapsulated and the coating is defect-free). The method should not be considered unless the whole of the circumference of the reinforcing bar can be coated. The effect of the coating on bond between the reinforcement and concrete should also be considered.

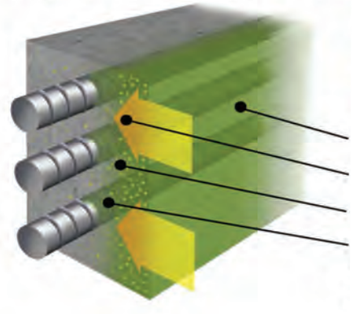
Alternatively, corrosion inhibitors can be used that chemically change the surface of the steel or form a passive film over it. Corrosion inhibitors can be introduced either by addition to the concrete repair product or system, or by application to the concrete surface followed by migration to the depth of the reinforcement.

Inhibitors that are applied to the surface of the concrete must penetrate the concrete down to the level of the reinforcement to take effect. There is currently no standard for inhibitors, so evidence of the effectiveness of any such product should be obtained before specifying its use.

Note that some corrosion inhibitors work by control of both anodic and cathodic areas. An example of this is the ambiodic **weber.tec guard MCI**.

weber.tec guard MCI

Liquid migrating corrosion inhibitor



MCI® Transport Mechanisms in Concrete

Capillary absorption

Vapour diffusion

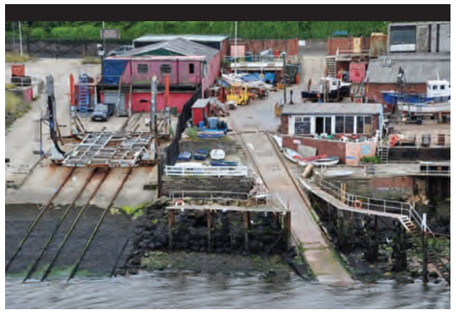
Physical adsorption

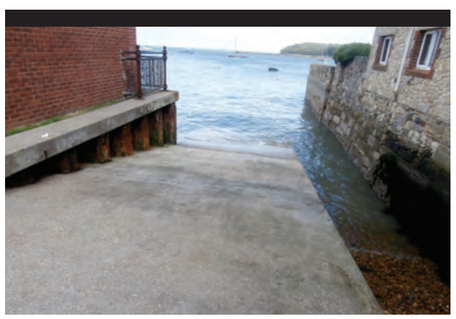
This ambiodic inhibitor forms a mono-molecular layer on the steel and supresses anodic and cathodic reactions

In-sea reinforced concrete structures

Jetties, piers, lifeboat ramps, slipways, concrete pontoons

PROBLEM AND REQUIREMENT	POSSIBLE SOLUTION	**WEBER** SYSTEM OR PRODUCT
General corrosion of reinforced concrete structure due to salts ingress	Inspect. If small areas, carry out patch repairs in accordance with BS EN 1504 Part 10 Clause 8.2.2 *(Hand applied mortar and concrete)*. If decay is extensive, employ corrosion specialist to carry out an electrochemical survey and consider cathodic protection systems in accordance with BS EN ISO 12696:2012 *(Cathodic protection of steel in concrete)* and BS EN 12473:2000 *(General principles of cathodic protection in sea water)*.	**weber.cem concrete repair system** that complies with BS EN 1504. Contact Technical Services for specific details.
Spalling concrete support columns and beams : steel corrosion visible : recasting option	Refer to general principles above. Consider cathodic protection by use of a titanium mesh or ribbon anode system, embedded powered anodes, sacrificial anodes, or corrosion inhibitors. Cut out damaged concrete by hydrodemolition technique, prepare reinforcement in accordance with BS EN 1504 Part 10 Clause 7.3, provide watertight shutters and replace with flowing microconcrete.	**Five Star Repair Concrete** - Class R4 recasting concrete to BS EN 1504 part 3.
Extensive spalling of concrete columns, soffits and beams	Refer to general principles above. Consider cathodic protection by use of a titanium mesh or ribbon anode system, embedded powered anodes, sacrificial anodes, or corrosion inhibitors. Cut out damaged concrete by hydrodemolition technique, prepare reinforcement in accordance with BS EN 1504 Part 10 Clause 7.3, and apply a sprayed concrete, suitable for the conditions.	**weber.cem spray DS** - Class R4 sprayed concrete or **weber.cem spray RS** - Rapid setting Class R4 sprayed concrete or **weber.cem spray CP** - Low resistivity Class R4 concrete, all three complying with BS EN 1504 :3.
General damage: small patches up to 600mm square	Inspect. Cut out square and carry out patch repairs in accordance with BS EN 1504 Part 10 Clause 8.2.2 *(Hand applied mortar and concrete)*. Fill with a polymer-modified mortar.	**weber.cem HB40** - Class R3 mortar to BS EN 1504 : 3.
Concrete deck or ramp : general damage: small patches up to 1m square	Cut out square and fill with a rapid setting mortar.	**weber.cem pyrapatch** - Rapid-setting mortar for small areas, complying with BS EN 1504 :3 as a Class R4 mortar.
Concrete deck or ramp : abrasion damage: large areas	Cut out and fill with a fast setting concrete topping.	**weber.cem pyratop** - Rapid-setting concrete for large areas, complying with BS EN 1504 :3 as a Class R4 mortar.
Concrete deck or ramp : spalled joint edges and damaged arises	Cut out and reform with fast setting mortar.	**weber.cem pyrapatch** - Fast-setting repair concrete for pavement patch or full-depth repairs complying with BS EN 1504 : Part 3 Class R4.
Concrete deck or ramp : narrow or wide cracks : moving	Create a joint : cut a chase along crack and form joint.	Contact Technical Services for joint details.





Marine structural works

Sea defences: seawalls, breakwaters, dolosses, cliff stabilisation, rock anchoring

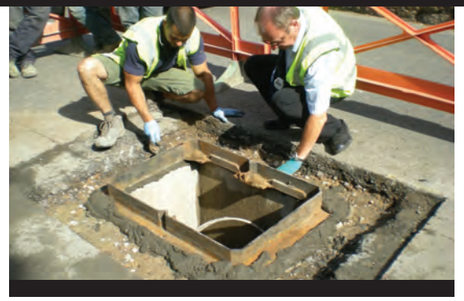
Docks: dock and harbour walls, quays, berths, fenders, capstans

PROBLEM AND REQUIREMENT	POSSIBLE SOLUTION	**WEBER** SYSTEM OR PRODUCT
General corrosion of reinforced concrete structure due to salts ingress	Inspect. If small areas, carry out patch repairs in accordance with BS EN 1504 Part 10 Clause 8.2.2 *(Hand applied mortar and concrete)*. If decay is extensive, employ corrosion specialist to carry out an electrochemical survey and consider cathodic protection systems in accordance with BS EN ISO 12696:2012 *(Cathodic protection of steel in concrete)* and BS EN 12473:2000 *(General principles of cathodic protection in sea water)*.	**weber.cem concrete repair system** that complies with BS EN 1504. Contact Technical Services for specific details.
Spalling concrete seawalls : steel corrosion visible : recasting option	Refer to general principles above. Cut out damaged concrete by hydrodemolition technique, prepare reinforcement in accordance with BS EN 1504 Part 10 Clause 7.3, provide watertight shutters and replace with flowing microconcrete.	**Five Star Repair Concrete** - Class R4 recasting concrete to BS EN 1504 part 3.
Extensive abrasion damage of concrete walls due to wave action : sprayed concrete option	Refer to general principles above. Cut out damaged concrete by hydrodemolition technique, inspect, fix additional mesh reinforcement and apply a sprayed concrete, suitable for the conditions.	**weber.cem spray DS** - Class R4 sprayed concrete to BS EN 1504 part 3. **weber.cem spray RS** - Rapid setting Class R4 sprayed concrete to BS EN 1504 :3
Concrete walls : general damage: small patches up to 600mm square	Inspect. Cut out square and carry out patch repairs in accordance with BS EN 1504 Part 10 Clause 8.2.2 *(Hand applied mortar and concrete)*. Fill with a polymer-modified mortar.	**weber.cem HB40** - Class R3 mortar to BS EN 1504 : 3.
Cliff faces unstable, need rock anchoring	Drill and anchor metal rods into rock face. Fix mesh reinforcement and apply sprayed concrete.	**Five Star Grout SP** **weber.cem spray DS**
Timber fenders : need to anchor bolts	Pump in a fast setting resin grout for between tides. Pump in an epoxy grout.	**weber.tec anchor grout** **weber.tec EP TAG** (thixotropic anchor grout)
Capstans need refixing	Re-bed on fast setting mortar. Grout bolts with fast set grout.	**weber.tec mortar** **weber.tec grout FG**

Waterside infrastructure

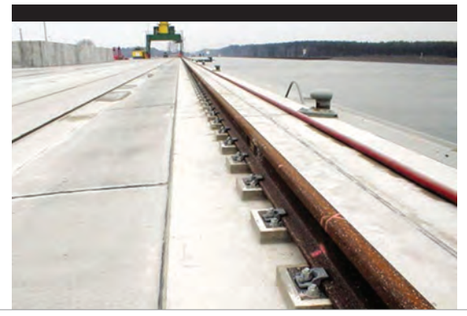
External paving on quays and berths, manhole renewal, crane rail installations, fenders, capstans, security fencing and barriers

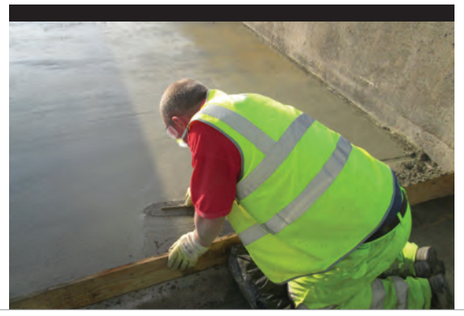
PROBLEM AND REQUIREMENT	POSSIBLE SOLUTION	**WEBER** SYSTEM OR PRODUCT
Concrete paving : fine cracks <2mm, non-structural	Fill cracks with a penetrating sealer.	**weber.tec mulsibond sealer**
Trafficked concrete surfaces : cracks >2mm : moving	Create a joint : cut a 20mm chase along crack and form joint using a proprietary sealant.	Contact Technical Services for joint details.
Trafficked concrete surfaces : general damage: small patches up to 1m square	Cut out square and fill with a rapid setting mortar.	**weber.cem pyrapatch** - Rapid-setting mortar for small areas, complying with BS EN 1504 :3 as a Class R4 mortar.
Trafficked concrete surfaces : abrasion and frost damage: large areas	Cut out and fill with a fast setting concrete topping.	**weber.cem pyratop** - Rapid-setting concrete for large areas, complying with BS EN 1504 :3 as a Class R4 mortar.
Trafficked concrete surfaces : spalled joint edges and damaged arrises.	Cut out and reform with fast setting cement-based mortar. For heavy traffic, use an epoxy mortar.	**weber.cem pyrapatch** **weber.tec EP mortar**
Concrete slab movement, rocking, ground shrinkage	Drill and pump grout under slab to stabilise.	**weber.cem grout**
Concrete block paving : movement between blocks	Seal small gaps <1mm. Grout larger gaps.	**weber.tec mulsibond sealer** **weber.cem grout**
Concrete block paving unstable : voids under blocks	Pump a fluid grout under blocks to stabilise them.	**weber.cem grout**
Manhole frames loose : need re-bedding	Re-bed using fast setting mortar complying with HA 104.	**weber.tec bedding mortar** or **weber.cem 104 mortar** (an eco-friendly bedding mortar using HCT*)
Manhole frames badly corroded or damaged : need replacing	Re-bed new frames using fast setting bedding mortar.	**weber.tec bedding mortar** Contact Technical Services for details of frames.
Traffic calming : loose bollards	Refix with grout.	**weber.cem grout**
Traffic calming : sleeping policemen need fixing to asphalt or concrete road	Stick down with (a) fast setting adhesive and bolt down with (b) fast setting grout.	(a) **weber.tec mortar** (b) **weber.tec anchor grout**
Traffic calming : kerbstones need bedding and fixing to road	Use fast setting bedding mortar.	**weber.tec mortar** or **weber.tec bedding mortar**



PROBLEM AND REQUIREMENT	POSSIBLE SOLUTION	**WEBER** SYSTEM OR PRODUCT
Traffic calming : cats-eyes need fixing onto road surface	Use fast setting adhesive.	**weber.tec mortar**
Crane rail installation	Rail installation must be carried out by a specialist contractor.	Contact Technical Services.
Crane rails : concrete bearing plinths damaged	Cut out and replace : up to 100mm deep, use (a) epoxy grout. Above 100mm use (b) special structural concrete.	(a) **weber.tec EP pourable grout** (b) **Five Star Repair Concrete**
Crane rails : holding down bolts need anchoring	Fast repairs, annular gap < 6mm use polyester grout. For most applications use an epoxy grout.	**weber.tec anchor grout** or **weber.tec grout FG** **weber.tec EP pourable grout**
Crane rails : soleplates need to be grouted	Bed thickness from 5mm to 75mm. Above 75mm, use a rapid concrete mix to form a 60mm base then use the epoxy grout.	**weber.tec EP pourable grout** **weber.cem pyratop** and then **weber.tec EP pourable grout**
Dock and canal gates leaking : need reseating in concrete channels	Shutter and reform concrete channels with flowing concrete.	**Five Star Repair Concrete**
Timber fenders : need to anchor bolts between tides	Pump in an epoxy resin grout.	**weber.tec EP TAG** (thixotropic anchor grout)
Timber fenders : minor surface damage : knots and splits	Seal with a fast setting water resistant mortar.	**weber.tec mortar**
Capstans need refixing	Re-bed on fast setting mortar. Grout bolts with fast set grout.	**weber.tec mortar** **weber.tec grout FG**
Security fencing : posts and barriers need fixing	Set into fast setting concrete.	**weber.cem pyracrete**

* HCT : Hybrid Cement Technology, a **Weber** Innovation

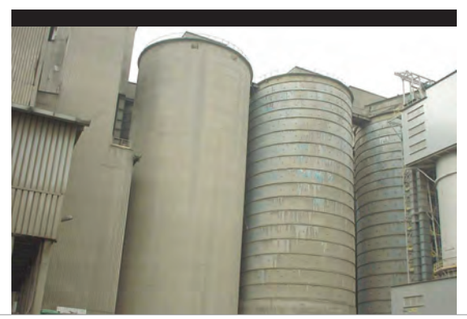


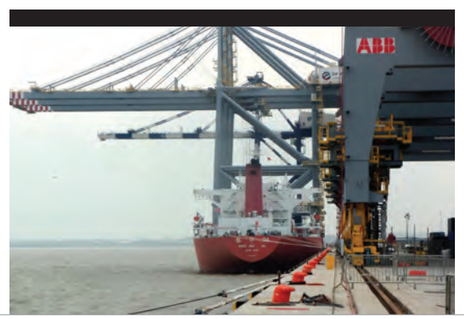


Shoreline structures

Storage silos: grain, aggregates, flour, sugar, sand etc.
Pipework racks and supports

PROBLEM AND REQUIREMENT	POSSIBLE SOLUTION	**WEBER** SYSTEM OR PRODUCT
General corrosion of reinforced concrete structure, as listed in the title, due to salts ingress	Inspect. If small areas, carry out patch repairs in accordance with BS EN 1504 Part 10 Clause 8.2.2 *(Hand applied mortar and concrete)*. If decay is extensive, employ corrosion specialist to carry out an electrochemical survey and consider cathodic protection systems in accordance with BS EN ISO 12696:2012 *(Cathodic protection of steel in concrete)* and BS EN 12473:2000 *(General principles of cathodic protection in sea water)*.	**weber.cem concrete repair system** that complies with BS EN 1504. Contact Technical Services for specific details.
Spalling concrete support columns : steel corrosion	Refer to general principles above. Cut out damaged concrete, prepare reinforcement in accordance with BS EN 1504 Part 10 Clause 7.3, provide watertight shutters and replace with flowing microconcrete.	**Five Star Repair Concrete** - Class R4 recasting concrete to BS EN 1504 part 3.
Extensive spalling of concrete walls, columns, soffits or beams	Refer to general principles above. Cut out damaged concrete by hydrodemolition technique, inspect, fix additional mesh reinforcement and apply a sprayed concrete, suitable for the conditions.	**weber.cem spray DS** - Class R4 sprayed concrete to BS EN 1504 part 3. **weber.cem spray RS** - Rapid setting Class R4 sprayed concrete to BS EN 1504 :3.
Concrete walls : general damage: small patches up to 600mm square	Inspect. Cut out square and carry out patch repairs in accordance with BS EN 1504 Part 10 Clause 8.2.2 *(Hand applied mortar and concrete)*. Fill with a polymer-modified mortar.	**weber.cem HB40** - Class R3 mortar to BS EN 1504 : 3.
Flaking of existing protective coatings on concrete	Grit blast and apply protective anti-carbonation decorative coating.	**weber.cote EC** (elastomeric coating). **weber.cote smooth** coating.
Steel support columns to pipelines need re-grouting	Remove existing grout and provide temporary support. Use a precision grout appropriate for the conditions : (a) Cement grout for static conditions. (b) Epoxy grout for dynamic conditions and extra chemical resistance.	(a) **Five Star Grout** (b) **weber.tec EP pourable grout**

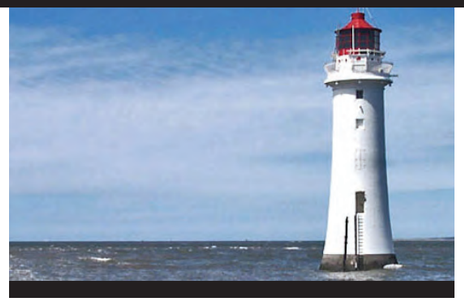




Maritime buildings

Lighthouses, lifeboat stations, radar stations, coastguard stations, warehouses

PROBLEM AND REQUIREMENT	POSSIBLE SOLUTION	**WEBER** SYSTEM OR PRODUCT
Masonry façades		
Dirty brick, stone or concrete façade	Clean by power washing with detergent and algicide.	**weber CL150**
Cracked external rendering	Remove and replace, form a key with **weber.rend aid** stipple to finish and render with **weber.rend OCR** 20mm in thickness.	**weber.rend OCR**
Debonded hollow render	Re-bond and seal.	**weber.tec mulsibond**
Cracks in masonry facade	Inspect. Inject with resin mortar.	**weber.tec EP TAG**
Loose pointing mortar	Repoint with durable mortar.	**weber.rend OCR**
Paint flaking off stable surface	Remove paint and recoat with smooth finish.	**weber.sil P**
Paint flaking off masonry subject to movement	Remove paint and recoat with smooth finish.	**weber.cote EC**
External cladding and insulation needs upgrading	Fix external insulation system and provide render system with synthetic coating system.	**weber.therm XM** External Wall Insulation system including **weber.rend PTC**
Concrete structures		
General corrosion of reinforced concrete structure due to salts ingress	Inspect. If small areas, carry out patch repairs in accordance with BS EN 1504 Part 10 Clause 8.2.2 *(Hand applied mortar and concrete)*. If decay is extensive, employ corrosion specialist to carry out an electrochemical survey and consider cathodic protection systems in accordance with BS EN ISO 12696:2012 *(Cathodic protection of steel in concrete)* and BS EN 12473:2000 *(General principles of cathodic protection in sea water)*.	**weber.cem concrete repair system** that complies with BS EN 1504. Contact Technical Services for specific details.
Spalling of concrete columns, beams, sills or lintels	Inspect. Cut out square and carry out patch repairs in accordance with BS EN 1504 Part 10 Clause 8.2.2 *(Hand applied mortar and concrete)*. Fill with a polymer-modified mortar, standard setting.	**weber.cem HB40** - Class R3 mortar to BS EN 1504 : 3.
Flaking and worn concrete coatings	Grit blast and apply protective anti-carbonation coating.	**weber.cote smooth** or **weber.cote EC**



PROBLEM AND REQUIREMENT	POSSIBLE SOLUTION	**WEBER** SYSTEM OR PRODUCT
Flooring		
Concrete floor in offices: uneven surface subject to foot traffic	Prepare floor area and apply self-levelling screed.	**weber.floor 4150 fine flow**
Concrete floor in warehouses : uneven surface subject to wheeled traffic	Prepare floor area and apply industrial grade screeds.	**weber.floor 4600 industry base** and **weber.floor 4610 industry top**
Concrete floor : impact damage: small indentations	Fill flush to surface with a fast setting infill mortar.	**weber.tec mortar**
Concrete floor : abrasion damage: small patches up to 300mm square	Cut out square and fill with a durable mortar.	**weber.tec EP mortar**
Concrete floor : abrasion damage: large areas	Cut out and fill with a fast setting concrete topping.	**weber.cem pyrapatch**
Concrete floor : fine cracks, non-structural	Fill cracks with a penetrating sealer.	**weber.tec mulsibond sealer**
Concrete floor : narrow or wide live cracks and movement joints	Cut a chase along crack or joint and use a proprietary floor joint system.	Contact Technical Services for joint details
Concrete floor : spalled joint edges and damaged arises	Cut out and reform with durable impact resistant resin mortar.	**weber.tec EP mortar**
Concrete floor : debonded cement screed	Check integrity and if good, drill holes and apply penetrating re-bonding sealer.	**weber.tec mulsibond**
Cold room floor surface : small spalled patches	Cut out, tent, and replace with fast setting mortar.	**weber.tec mortar**
Loading bays : impact damage : spalled edges	Cut out and reform with durable impact resistant resin mortar.	**weber.tec EP mortar**
Worn concrete or stone stair treads and risers	Cut out and repair with fast setting durable mortar.	**weber.tec mortar**

Weber products and properties

PRODUCT NAME	DESCRIPTION
Concrete repair products	
Five Star Repair Concrete	Shrinkage-compensated, high strength, flowing recasting repair concrete complying with BS EN 1504 : Part 3 Class R4
weber.cem bondcoat	Polymer-modified cementitious bonder for repair mortars complying with BS EN 1504 : Part 3
weber.rep fer	Anti-corrosion primer for steel reinforcement complying with BS EN 1504 : Part 7
weber.cem HB40	Acrylic-polymer modified, highbuild structural repair mortar complying with BS EN 1504 : Part 3 Class R3
weber.cem pyracrete	General-purpose, rapid-setting, cement-based bedding concrete complying with BS EN 1504 : Part 3 Class R4
weber.cem pyrapatch	Fast-setting repair concrete for pavement patch or full-depth repairs complying with BS EN 1504 : Part 3 Class R4
weber.cem pyratop	Rapid strength-gain repair concrete for thin bonded pavement repairs complying with BS EN 1504 : Part 3 Class R4
weber.cem spray CP	Low-resistivity, dry-spray, structural repair concrete complying with BS EN 1504 : Part 3 Class R4
weber.cem spray DS	Polymer-modified, high quality dry-spray structural repair concrete complying with BS EN 1504 : Part 3 Class R4
weber.cem spray RS	Rapid-setting, polymer-modified, dry-spray concrete complying with BS EN 1504 : Part 3 Class R4
weber.tec EP mortar	High-strength epoxy resin mortar for repairs, bedding and fixing complying with BS EN 1504 : Part 3 Class R4
Protection products	
weber CL150	Masonry biocide
weber.cote EC	High-performance, elastomeric, anti-carbonation coating for external surfaces complying with BS EN 1504 : Part 2
weber.cote smooth	Protective and anti-carbonation coating complying with BS EN 1504 : Part 2
weber.sil P	A high performance mineral paint

PRODUCT NAME	DESCRIPTION
Precision grouts	
Five Star Grout	General-purpose, shrinkage compensated, cementitious grout for dry packing, grouting, bolt fixing and bedding of machinery complying with BS EN 1504 : Part 3 Class R4
Five Star Grout SP	High-flow, high-strength, shrinkage-compensated, cementitious precision grout complying with BS EN 1504 : Part 3 Class R4
weber.cem grout	Cost-efficient non-shrink general purpose cementitious grout for non-critical applications
weber.tec anchor grout	Fast-set polyester resin compound for anchoring and fixing
weber.tec EP pourable grout	High-strength, better flowing chemically-resistant grout
weber.tec EP TAG	High-strength anchoring for horizontal bars or bolts
weber.tec grout FG	Fast-setting, high-strength flowing grout
weber.tec mortar	Fast-setting, multi-purpose mortar
weber.tec mulsibond	Sealer for hairline cracks in concrete and treatment of hollow floor screeds
Bedding mortars	
weber.cem 104 mortar hybrid	High performance cement hybrid bedding mortar complying with HA104/09
weber.tec bedding mortar	Polyester-based mortar for bedding and fixing manhole frames, kerb stones, airport lighting bases, ducting, drains and highway fixtures
Flooring products	
weber.floor 4150 fine flow	A pump-applied floor screed designed for application at a thickness of between 4 – 30 mm.
weber.floor 4600 industry base	A rapid hardening, pumpable levelling compound
weber.floor 4610 industry top	A pumpable, rapid hardening, self-levelling screed for use as a surface layer on industrial flooring
Façade products	
weber.rend OCR	Pre-blended single coat application render
weber.rend PTC	A polymer-modified, dry powder cement-based mortar for use as a render top coat
weber.therm XM External Wall Insulation system BBA Energy Saving Trust recommended	Lightweight external wall insulation system incorporating a thin-coat polymer render and mesh-cloth reinforcement

Case Studies

Project: Chertsey Lock, River Thames

Product: **weber.cem spray DS**
Client: The Environment Agency
Contractor: Jackson Civil Engineering
Applicator: Currall Lewis & Martin (Construction) Limited

In the refurbishment of Chertsey Lock, on the River Thames, **Weber** supplied high specification **weber.cem spray DS** structural repair concrete.

After removal of the concrete, resin injection works to 200 linear metres of cracked walls was carried out. The freshly sprayed walls were dragged back with a feather edge rule to level the material and lightly sprayed with water after the initial set of around one hour, to provide a good surface for the final pass of 30-40mm of **weber.cem spray DS**. A further process of levelling was required before sealing the surface to the specified finish.

weber.cem spray DS has been especially designed for dry process spray application to give high early strength in 2 – 3 hours, reduced rebound and maximum application thickness.


Before


After

Project: Allington Lock, River Medway, Kent

Products: **Five Star Repair Concrete, weber.cem HB30** and **weber.cem keycoat**
Client: Environment Agency of Worthing
Main Contractor: Jackson Civil Engineering of Maidstone, Kent
Specialist Contractor: Structural Renovations Ltd of Slough
Consulting Engineers: Atkins of Woodcote Grove, Epsom

Constructed in 1937 the Allington Sluice lock gate is the last on the River Medway before it becomes tidal. Areas of failed surface concrete that had spalled due to years of weathering were repaired to match the existing finishes.

The major repair areas required shuttering before pouring in the flowing recasting concrete **Five Star Repair Concrete** which is a pre-blended cementitious material conforming to BS EN 1504 : 3 as a Class R4 mortar.

Smaller damaged areas of the sluice structure were repaired with **weber.cem HB30**, an acrylic-polymer modified, high-build façade repair mortar that complies with BS EN 1504 : 3 with Class R4. Damaged areas were cut away and any steel reinforcement was cleaned and coated with **weber.cem keycoat** prior to the application of the **weber.cem HB30**.

Project: Spinnaker Tower, Portsmouth

Products: **weber.cem grout** & **Five Star Grout**
Client: Portsmouth Harbour UK Millennium Commission
Contractor: Mowlem Construction Southern
Specifier: Scott Wilson

Designed by Scott Wilson, the £38m Spinnaker Tower is the focal point of Portsmouth Harbour's UK Millennium Commission sponsored Renaissance project.

Weber specified the **Five Star Grout** and **weber.cem grout** for the base plates and foundation areas of the cofferdam foundations.

Five Star Grout is a pre-mixed cementitious grout developed for applications where an economical grout with good flow and strength is required. **weber.cem grout** is designed primarily as a pourable grout but can also be used at a plastic or dry pack consistency.

Project: Terminal Muelle Prat, Barcelona

Products: **weber.tec EP pourable grout**, supplied as Gantrex EP Grout Class R4 epoxy grout to BS EN 1504:3
Client: Barcelona Port Authority, El Prat de Llobregat (Barcelona)
Grouting Contractor: Gantrex (Espana), Gantrex (Belgium), Gantrex (UK)

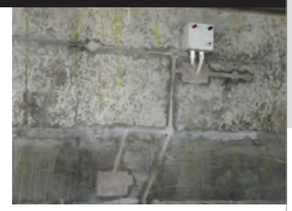
A new container wharf at the port of Barcelona required a new crane rail system to be installed. The rails were about 960m in length with 400mm and 600mm wide continuous soleplates. Other rails were designed to have discrete bearing plates.

The grouting application used a feed-hopper and the mixed grout was poured into the hopper with a good level of grout maintained to ensure a good smooth flow of the grout under the soleplates.

The ambient air temperature was around 30OC so the mixed grout flowed very freely into the 50mm gap under and across the soleplates. The grout was also used to anchor the holding-down bolts to a depth of 300mm.

Project: Braefoot Marine Terminal West Jetty, Fife

Products: **Five Star Repair Concrete**, **weber.cem HB40** and **weber.cem bondcoat**
Client: Shell Expro and Exxon
Contractor: Balfour Beatty Construction Services UK, Leeds, West Yorkshire



The Braefoot Marine Terminal consists of two jetties, located on the north shore north of Incholm Island. Products produced at the Mossmoran Plant in Fife are exported at the Braefoot Marine Terminal. The jetty was suffering from deterioration of the reinforced concrete structure due to marine salt corrosion of the steel. The contractor had to overcome problems with rising tides and consequent sequencing of breakout and repairs.

Recommendations for the repairs were provided by **Weber** who supplied specialist products and gave technical support during the repair phase of the contract. An innovative cathodic protection system using hybrid Duoguard anodes from CPT was used to protect the steel reinforcement with the anodes fixed into the soffits. **weber.cem HB40** mortar was used to fill the cable chases.

Project: Kingston Wharf, Cowes, Isle of Wight

Products: **weber.cem spray DS** and **weber.cem pyratop**
Client: Cowes Harbour Commission
Contractor: Prestec, Staffordshire
Consulting Engineers: Ramboll, Southampton

Kingston Wharf, one of many jetties on the banks of the River Medina estuary in Cowes, was built in the 1950's and is of reinforced concrete construction. It has been used for delivery of fuels to the nearby power station and to the island. The jetty was suffering from deterioration of the reinforced concrete structure due to marine salt corrosion of the steel. The contractor had to overcome problems with poor condition of the structure and consequent sequencing of breakout and repairs. Defective areas on concrete were removed by ultra-high pressure water jetting which also cleaned the corroded steel. The volume of defective concrete was found to be much higher than estimated from initial surveys. A cathodic protection system using Patchguard anodes from CPT were used to protect the steel reinforcement with the anodes fixed into the soffits and beams. Over 60 tonnes of **weber.cem spray DS**, a Class R4 concrete to BS EN 1504:3 was used to repair and reinstate the concrete structure. **weber.cem pyratop**, a rapid setting Class R4 concrete for external paving, was used to repair concrete roadways and ramps.

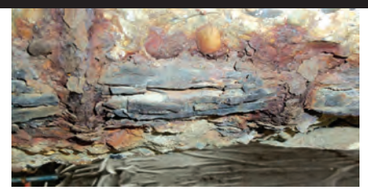

Before

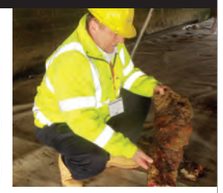

After

Project: River Jetty Refurbishment

Products: **weber.cem spray DS**, **weber.cem spray RS** and **weber.tec guard MCI**

Contractor: Topbond plc Group, Sittingbourne, Kent





Many of the concrete beams were in a poor condition due to corrosion of the bottom reinforcement. In some cases, the covercrete had spalled and fallen off. The cutting out and preparation was done by hydro-demolition. The steel which appeared to be badly corroded showed up as fully functional after blasting and cleaning.

Replacement of the concrete was achieved by the concrete spray technique using **weber.cem spray DS** and in places subject to early tidal action, **weber.cem spray RS** the rapid setting version. **weber.tec guard MCI** was applied on the soffits between the beams to mitigate further corrosion.

Project: Hunterston B Power Station Jetty, Scotland

Products: **weber.cem spray DS** and **weber.cem spray CP**

Client: EDF Energy

Contractor: Balfour Beatty Construction Services, Leeds

Image provided by Apollo Cradles Ltd www.apollocradles.co.uk

The jetty was suffering from deterioration of the reinforced concrete structure due to marine salt corrosion of the steel. Previous attempts at repair failed due to access difficulties but the contractor overcame these problems and was rewarded with the Construction News Concrete Specialist of the Year award 2014. Recommendations for the repair were provided by Weber who supplied specialist products and gave technical support during the repair phase of the contract. An impressed current CP system was used to protect the steel reinforcement with sacrificial anodes fixed into the soffits to provide additional protection.

Hydro-demolition was used to breakout the spalled and cracked concrete, to wash out surface chlorides and to clean the corroded steel reinforcement.

weber.cem spray DS, a Class R4 concrete to BS EN 1504 : part3 was used as an overlay to the impressed current CP system, to build up a new protective cover and for repairs to the structure to required profiles and **weber.cem spray CP** (Class R4 to BS EN 1504 : part3) was used to embed the sacrificial anodes and for small patch repairs where a more conductive mortar was required.

Project: Meadfoot Seawall, Torquay, Devon

Products: **weber.cem spray DS**, **weber.cem spray RS** and **weber.cem conspray**

Client: Torbay Council

Contractor: Millennium Marine Contractors Ltd, Newton Abbott, Devon

Consulting Engineers: CASE Consultants, Torquay, South Devon

The reason for the repair was an already failing revetment made worse by the winter storms of 2013. The revetment protects the toe of the seawall and the highway behind housing the underground utilities. Over 10,000 tonnes of sand were washed out to sea during the storms. This exposed the seawall by as much as 3 metres and many defects were found below the usual sand level, the most significant was the damage to the seawall foundations/revetment.

This required infilling with mass concrete supplied by ready mixed trucks.

weber.cem spray DS sprayed Class R4 concrete was used to re-profile the revetment to a depth of around 250mm. In some cases, water from the cliffs beyond was weeping through cracks in the walls and the rapid setting **weber.cem spray RS** Class 4 concrete was then used to seal the leaks and build up a new protective cover.

Project: Newhaven Seawall, East Sussex

Products: **weber.cem spray DS** and **weber.cem spray RS**

Client: Newhaven Port & Properties Ltd & Environment Agency

Contractor: AJC Contractors Tarring, Worthing, W Sussex

Consultant Engineer: Tony Mackin, UK Concrete Repair Ltd, Portsmouth

The sea-wall fortification of the Outer Bight offers critical protection to the navigation channel of Newhaven Harbour. Recent storms have caused damage to concrete with weak surface areas being eroded and substantial lateral and vertical cracks being opened to further wave and water damage. Fissures up to 500mm deep, running for several metres along the wall face, have had to be repaired to avoid the real possibility of a major breach of the defences.

Nearly 500 tonnes of **Weber's** sprayed concretes was used to repair and reinstate the concrete structure. **weber.cem spray RS**, the ultra-rapid setting version of the popular **weber.cem spray DS** was used to seal the fissures during high tides and then to provide a durable skin over the steel mesh that was fixed to the existing concrete wall. Both concretes are Class R4 to BS EN 1504 : part 3

Project: Port Qasim Iron Ore and Coal Berth Jetty, Pakistan

Products: **weber.cem spray DS** and **weber.cem spray RS**
Client: Port Qasim Authority
Contractor: EKON Yapi Onarim Koruma, Istanbul, Turkey

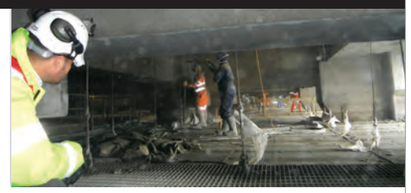
The jetty was built in 1979 of RC construction, but was badly damaged by corrosion of the steel reinforcement. Results of the survey and testing indicated that the depth of chloride contamination was up to 80 mm into the concrete, which meant ineffective cover, therefore severe corrosion of the main reinforcement. The problem was worse on pile caps carrying the structure. The cutting out and preparation was done by hydro-demolition. The steel which appeared to be badly corroded showed up as fully functional after blasting and cleaning. Replacement of the concrete was done by the concrete spray technique using **weber.cem spray DS** and in places subject to early tidal action, **weber.cem spray RS** the rapid setting version which was used on the pile caps and the standard DS was used for sections outside the tidal zone. **weber.tec aquapel WR** was applied on the soffits between the beams to limit absorption of seawater.


Before


After

Project: Teesport jetty

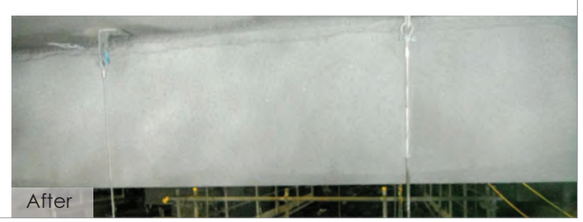
Product: **weber.cem spray DS**
Client: PD Ports, a Brookfield Ports Company
Contractor: Balfour Beatty Construction Services, Leeds
Consulting Engineers: SC Consulting Engineers, Billingham, Stockton-on-Tees



The jetty was suffering from deterioration of the reinforced concrete structure due to marine salt corrosion of the steel. The contractor had to overcome problems with rising tides and consequent sequencing of breakout by hydrodemolition and repairs. Recommendations for the repairs were provided by **Weber** who supplied specialist products and gave technical support during the repair phase of the contract. A CP system using Patchguard anodes from CPT was used to protect the steel reinforcement with the anodes fixed into the soffits and overlaid with sprayed concrete protection.

Hydro-demolition was used to breakout the spalled and cracked concrete, to wash out surface chlorides and to clean the corroded steel reinforcement. **weber.cem spray DS** concrete, the premium Class R4 product complying with the requirements of BS EN 1504 : part 3 was used as an overlay to the CP system to build up a new protective cover and for repairs to the structure to required profiles.


Before


After

References

Weber Concrete Repair and Protection brochure

Weber Precision Grouting brochure

Weber Bedding Mortars brochure

BS EN 1504 Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity

- BS EN 1504 Part 2 : Surface protection systems for concrete
- BS EN 1504 Part 3: Structural and non-structural repair
- BS EN 1504 Part 8: Quality control and evaluation of conformity
- BS EN 1504 Part 9: General principles for use of products and systems
- BS EN 1504 Part 10: Site application of products and systems and quality control of the works

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Acknowledgements

We acknowledge the assistance given by the following companies in the production of this brochure:

AJC Contractors, 1-3 South Street, Tarring, Worthing, West Sussex BN14 7LG
www.ajccontractors.com

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www.apollocradles.co.uk

Balfour Beatty Construction Services UK, 2200 Century Way, Thorpe Park, Leeds LS15 8ZB
www.balfourbeattycsuk.com

Concrete Preservation Technologies, Enterprise Lab, Sir Colin Campbell Building, University of Nottingham Innovation Park, Triumph Road, Nottingham NG7 2TU
www.cp-tech.co.uk

CRL, Cathite House, 23a Willow Lane, Mitcham, Surrey CR4 4TU
www.concrete-repairs.co.uk

Jackson Civil Engineering, Mereworth Business Centre, Danns Lane, Mereworth, Kent ME18 5LW
www.jackson-civils.co.uk

Millennium Marine Contractors Ltd, Heathfield Industrial Estate, Newton Abbot, Devon TQ12 6SG
www.millenniummarinecontractors.co.uk

Newhaven Port & Properties, Administration Office, East Quay, Newhaven, East Sussex BN9 0BN
www.newhavenportauthority.co.uk

Prestec UK Ltd, 168 Birmingham Road, Shenstone Wood End, Staffordshire WS14 0NX
www.prestecuk.com

Topbond PLC, Oyster Quay, Castle Road, Sittingbourne, Kent ME10 3EU
www.topbond.co.uk

Technical Support and Services

Weber has built a reputation for its technical support, both at design and on site during the application programme.

Qualified civil engineers and experienced specialists are available in the field to provide important design and preparation advice to specifier and contractor and support to applicators as the project progresses.

While these teams can assist when problems develop, their main purpose is to address issues vital to the successful completion of a project before the problems occur and assist all involved in reaching the 'right first time' goal.

Training

Based on its strong knowledge and experience of its market, the **Weber** training programmes meet the needs of its customers. **Weber** has invested in dedicated training facilities which offer the opportunity for both theoretical and practical training with conference room and purpose designed practical areas.

One-day courses for training on repair and maintenance techniques are undertaken at our Flitwick head office. Subjects include structural concrete repair, bedding, grouting and composite strengthening.

Interest in the availability of training should, in the first instance, be directed to your local Sales Manager or **Weber** direct on 08703 330070 or email: mail@netweber.co.uk

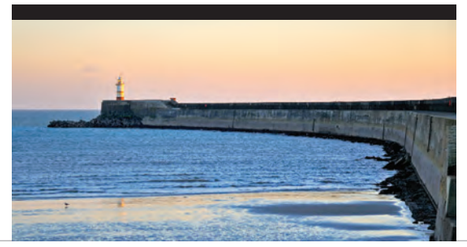
Recognised & Recommended Applicators

Experienced labour is more and more difficult to locate, especially in the application of technical products where the standard of work left reflects directly on specifier indemnity. **Weber** will put specifiers and clients in touch with specialist applicators that have shown they can produce good quality work. A selection of Recognised and Recommended Applicators can be supplied for major projects detailing their range of specialities, skills and resources, all will have experience in successfully applying **Weber** materials.

Quality Assurance & Guarantees

Totally committed to quality, customer service and the ongoing development of high performance materials, **Weber** provides a Ten Year Materials Guarantee. The **Weber** Ten Year Guarantee covers all **Weber** products as long as they have been applied in accordance with the company's specification, instructions and good working practice. This guarantee does not affect your statutory rights.

Quality Assurance in manufacture is maintained through the use of modern plant and stringent quality testing. All facilities have regularly monitored quality systems and procedures in place and **Weber** has made considerable investment in achieving and maintaining the highest possible standards available. BS EN ISO standards are an important measure and control of the company's determination to follow these key drivers. All sites currently operate to BS EN ISO 9001:2000 and BS EN ISO 14001.



Standards

The **Weber** products listed in this guide have all been tested and adhere to the relevant parts of the industry requirement of BS EN 1504 standard (Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity), where relevant. These include:

- BS EN 1504 Part 2 - Surface protection systems for concrete
- BS EN 1504 Part 3 - Structural and non-structural repair
- BS EN 1504 Part 6 - Anchoring of reinforcing steel

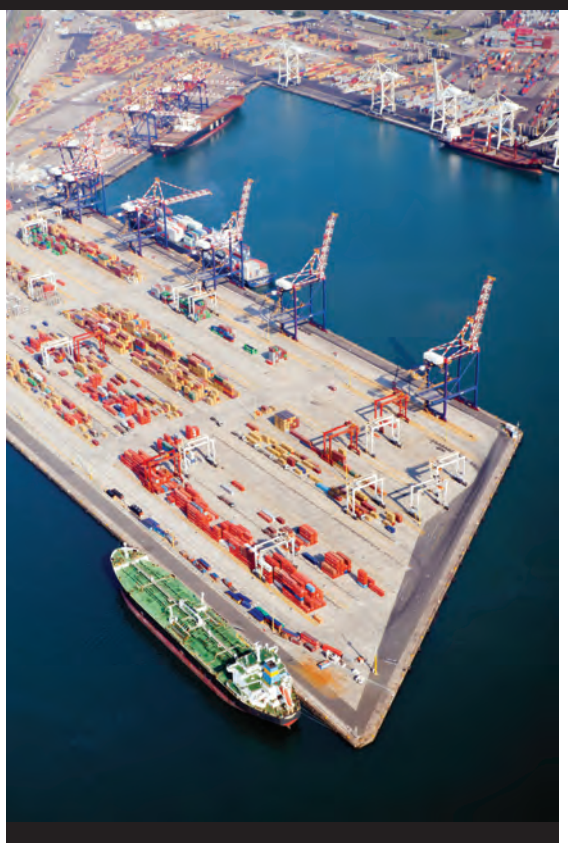
Sustainability

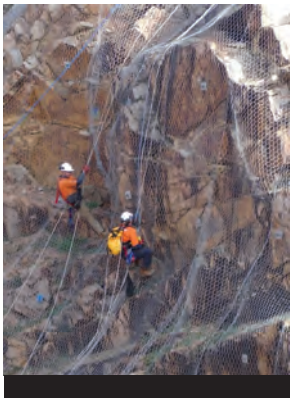
Weber takes the issue of sustainable development very seriously. In the UK and Ireland, we approach sustainable development in line with the Group's global strategy, but tailored to local requirements and circumstances. As part of the world leader in designing, manufacturing and distributing construction materials, we are committed to meeting some of the most fundamental challenges faced by the world today.

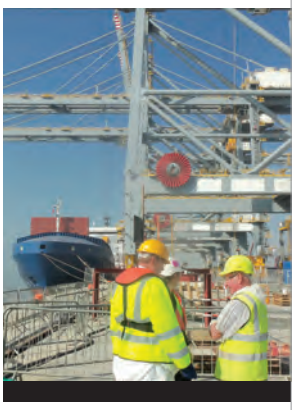
These are:

- Reducing energy consumption
- Limiting our impact on the environment
- Creating a new generation of buildings which are safe, comfortable and energy efficient.

Weber is continually investigating innovative concepts for materials and exploring methods of production that are aimed at reducing its impact on the world's natural resources and involve lower risk to applicators in use.







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