



# REPAIR AND STRENGTHENING

The Benchmark for Specialised Civil Engineering



# INTRODUCTION

Freyssinet Limited, since its inception in 1950, has been at the forefront of providing specialised civil engineering technology, consultancy and installation for projects large and small.

As part of the Soletanche Freyssinet Group, Freyssinet is respected worldwide for delivering innovative solutions and pushing the envelope of civil and structural engineering achievement.

Originally a specialist in bridge components and post-tensioning, Freyssinet has successfully expanded its portfolio of products and services into repair, protection and strengthening of structures, specialising in diagnostic surveys, repairs, refurbishment and cathodic protection to reinforced concrete in the building, civil and marine sectors.

In 2007 the Freyssinet Group adopted the 'Sustainable Technology' tagline. Our products and services offer high value added solutions which are synonymous with sustainability, our aim is "to do more with less materials and energy", setting us apart from conventional solutions.

Years of experience in the design, construction, testing and monitoring of structural systems has equipped Freyssinet with exceptional insight and resources in the field of repair and strengthening.

Freyssinet's resources in repair and strengthening include a wide range of proven products and techniques, and the expertise to combine principles and methods to innovate bespoke solutions.

## Concrete Enhancement

- Concrete Repair
- Concrete Replacement
- Hydrodemolition
- Wall Sawing
- Diamond Coring

## Strengthening

- External Post-Tensioning
- High-Tensile Bars - Freyssibar
- TFC Carbon Fibre
- Plate Bonding

## Bearing Replacement

- Lifting / Jacking / Propping
- Specialist Expansion Joint Replacement

## Structural Enhancement Techniques

- Cathodic Protection
- Coatings
- Resin / Grout Injection
- Wax Injection



**FREYSSINET**  
SUSTAINABLE TECHNOLOGY

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# CONCRETE ENHANCEMENT

Freyssinet clients have access to a complete range of concrete assessment, repair and strengthening resources. These are applied and managed to the highest standards throughout our 'one-stop-shop' contracting service.

**Diagnosis, prevention and cure**  
**Concrete repair**  
**Concrete replacement**  
**Coatings and complementary services**

We work closely with the major material suppliers to ensure our concrete repair and strengthening solutions benefit from the latest materials engineering.

## **Diagnosis, prevention and cure**

Freyssinet offers a comprehensive range of tests to enable clients to accurately evaluate concrete structure problems and identify appropriate repair strategies. Testing techniques include cover surveys, half cell testing, dust sampling, chemical analysis, defects surveys and other state-of-the-art diagnostic methods. Freyssinet has dedicated resources of highly qualified engineers and technicians offering structural evaluations and 'health checks' using the latest computer-aided diagnostic techniques and equipment.

In-service monitoring of bridges, buildings and other structures provides asset owners with vital information on their condition.

Early detection of defects or of unseen, potentially damaging changes enables clients to implement repair and treatment to prolong design life and minimise the long-term cost of maintenance.



## **Concrete repair**

Repair of spalled, cracked, honeycombed or otherwise damaged concrete is achieved using the latest methods and materials including:

- Modified mortars for patch and thin bond repairs
- Pressure and/or vacuum resin injection using epoxy, polyester and cementitious grouts
- Sprayed concrete
- Leak sealing

## **Concrete replacement**

Replacement may be the only viable answer to poor concrete condition or strength. Freyssinet can provide removal by conventional breaking out or hydrodemolition techniques performed by their own in-house teams, followed by replacement using high performance repair concretes and mortars. Required falsework, shuttering, propping and jacking are all part of Freyssinet's concrete repair capabilities.



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### Coatings and complementary services

Corrosion inhibitors, anti-carbonation coatings, waterproofing membranes, paints, other sealants and decorative finishes are among the specialist restorative coatings and concrete treatments provided by Freyssinet. Concrete repair is frequently undertaken alongside other strengthening and remedial work such as repair and strengthening of bridges, buildings, car parks and industrial structures in the public and private sectors.

# STRENGTHENING

Freyssinet has amassed a wealth of experience and technology in the strengthening of structures aimed at prolonging service life or facilitating a change of use. Project expertise includes bridge deck strengthening, column reinforcement, upgrading floor slab load capability and strengthening work to post tensioned structures.

**External post-tensioning**  
**High-tensile bars - Freyssibar**  
**Carbon fibre**  
**Steel plate bonding**  
**Ultra-high strength fibre reinforced concrete**  
**Design and calculation for strengthening work**

## External post-tensioning

Particularly applicable to bridge deck strengthening, Freyssinet offers the design and installation of additional post-tensioning to existing structures. For large span box girder bridges, tendons are often retrofitted inside the structure, for smaller span structures, it may be appropriate to fit tendons to the exterior. The effect in both cases is to introduce extra compression in areas subject to excessive tensile forces, allowing the structure to carry higher loads. The technique has many benefits, but is most effective in upgrading circular storage tanks or strengthening bridges.

## High-tensile bars - Freyssibar

Developed by Freyssinet, Freyssibar is a pre-stressing system comprising of a wide range of fully threaded bar and complementary anchoring, coupling and extension devices. It is used for post-tension cables and pre-stressed ground anchors and can also be transferred to any application involving temporary or permanent tie rods.

Freyssibar is often used to introduce pre-stress into existing areas with high stress concentrations or subject to bursting forces.



## Carbon fibre

Freyssinet is able to formulate, design and install many carbon fibre applications, including:

- Column wrapping
- Beam strengthening
- Floor slab strengthening
- Reinforcement around new structural openings

## Steel plate bonding

Plate bonding is another proven technique within Freyssinet's first class engineering portfolio for increasing the load bearing capacity of beams and floor slabs. The process involves the bolting and/or bonding of steel plates, of precision-calculated length and cross section, to the tension zone of the structural component using high performance epoxy adhesive. The steel acts compositely with the beam or slab to achieve an increase in section and consequently in load carrying capability.



“Freyssinet’s capability in engineering naturally embraces the full range of services needed in defining economic and effective programmes for strengthening.”

#### **Ultra high strength fibre reinforced concrete (UHSFRC)**

Freyssinet is a leader in the use of UHSFRC for strengthening and improving structures. Using UHSFRC techniques, Freyssinet is able to design, supply and install highly innovative and efficient solutions for a variety of structural problems.

#### **Design and calculation for strengthening work**

Freyssinet’s capability in engineering naturally embraces the full range of structural assessment, calculation and consultation services needed in defining economic and effective programmes for strengthening. All these resources are available in-house, enabling us to service clients with a complete design-and-install package for the strengthening application.

# BEARING REPLACEMENT

Freyssinet has extensive experience in bearing, jacking and sliding technology, and in the management of health, safety and logistics of these often very complex, high risk projects.

**Bearing assessment**  
**Bearing replacement**  
**Jacking and sliding**

## **Bearing assessment**

As a leading specialist in bridge bearing design and manufacture, Freyssinet is eminently qualified in the assessment of in-service bearings. Consultation includes bearing inspection and testing, identification and confirmation of the design specification from archived drawings. We provide clients with advice and recommendations for bearing refurbishment or replacement, together with cost estimates and photographic material to support client's project planning.

Freyssinet has developed a wide range of bearings, both mechanical and elastomeric and is able to provide the right solution to meet its customers' needs for every type of structure.

All of Freyssinet's bearings are designed by our in-house technical team to ensure compliance with current standards and project specifications. Following assessment, we are able to modify bearing arrangements to make replacement easier, and also undertake the refurbishment of existing bearings.



## **Bearing replacement**

Freyssinet offer bearing replacement as principle contractor or on a subcontractor basis. This one-stop-shop service combines our proven expertise in bridge bearing design with knowledge of jacking operations and specifically construction chemicals. An extensive range of repair and strengthening services are available where bearing work is accompanied by other structural needs. Hydrodemolition, wall sawing and diamond drilling are carried out by our in-house teams to complete the package.





“As a leading specialist in bridge bearing design and manufacture, Freyssinet is eminently qualified to support client’s project planning.”

### **Jacking and sliding**

Freyssinet is able to offer clients a variety of jacking techniques. These skilled applications effectively overcome problems in both new construction and existing structures. Principally using flat jack and conventional hydraulic jack techniques, we are able to complete critical procedures to lift, slide and realign structures. As experts in bearing manufacture, we have pioneered the additions of PTFE and elastomer sliding surfaces to the jack head to accommodate limited vertical and horizontal movement to permit bridge deck jacking under live traffic.

# EXPANSION JOINTS

As a structural accessory specialist, Freyssinet is at the forefront of related technology, installation and maintenance of bridge bearings, high tensile bar and expansion joints.

**Expansion joint design**  
**Expansion joint installation**

## Expansion joint design

Freyssinet has extensive experience in the design and production of expansion joints and is able to offer an integrated service which includes inspection, design, manufacture and expert installation.

Designed to enable continuous traffic between two structures, expansion joints are necessary to absorb movement, accommodate changes in temperature and creep and shrinkage effects on structures.

Many of the joints that were installed on bridges in the UK over 40 years ago are now at the end of their life, as a result of fatigue, corrosion or structural movement, causing a significant issue for the UK's highways network.

Freyssinet has a full range of accredited joints available, including surface mounted, composite and steel finger joints and is able to develop products to meet the specific site, climate and operational conditions of a structure.



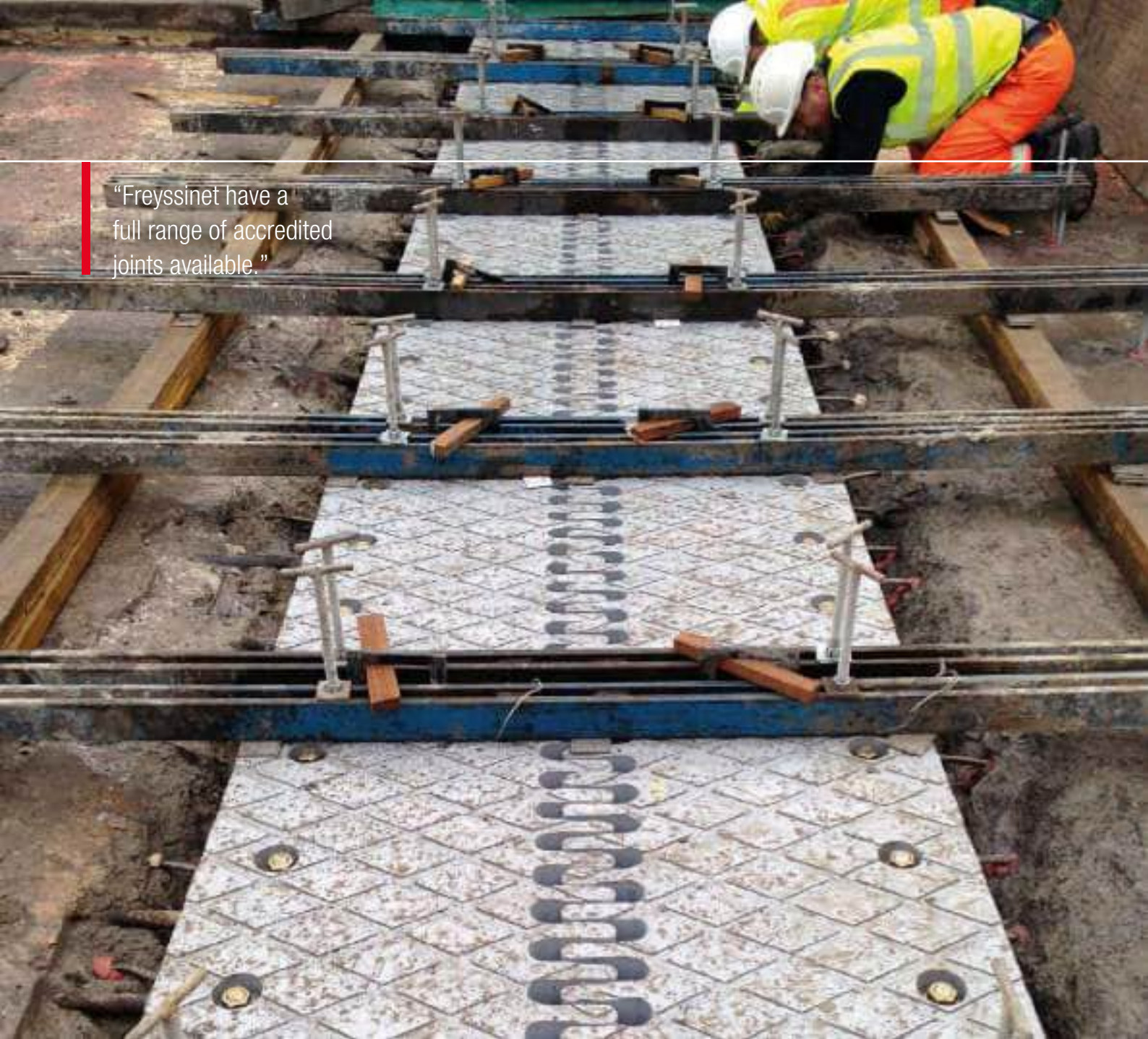
## Expansion joint installation

Freyssinet has been installing expansion joints to structures all over the world for more than 40 years.

The installation of expansion joints requires crucial planning, preparation and attention to detail on the finishing touches. Our experienced specialists regularly review all aspects of joint installation to guarantee our products performance and durability.

When replacing an expansion joint in an existing structure, a number of different techniques are used. To begin with, the existing joint is broken out using either manual or machine mounted breakers or hydrodemolition.

The surfaces are prepared and the joint is hung to line and level using bespoke hanger brackets. Reinforcement steel will have been prepared and placed in the receiving area prior to placing the joint modules.



“Freyssinet have a full range of accredited joints available.”

Once the joint anchors are set in place, the concrete is added and allowed to go off. The anchors are then tensioned and the run off surfaces are completed using either a bituminous or cementitious material (Requirements differ depending on where the joint is being installed).

Finally, the hanging props are removed after the concrete is at sufficient strength and the anchor bolts on the joint are stressed.

# ELECTROCHEMICAL & ASSOCIATED TECHNIQUES

Freyssinet has been applying longer life treatments to structures suffering from corrosion, cracking, voids, tensile forces and compression forces for over 30 years.

**Cathodic protection**  
**Resins and grouts**  
**Coatings**  
**Slab connectors**

## Cathodic protection

Reinforcement corrosion, exacerbated by reduced alkalinity of the surrounding concrete, is a major cause of concrete deterioration. The two main mechanisms behind this deterioration, evidenced by cracks, spalling and delamination, are carbonation (from atmospheric carbon dioxide) and chloride attack (from seawater, marine aggregates and de-icing salts).

Overtaking the use of traditional patch repair on damaged concrete are a range of techniques providing effective treatment, such as corrosion inhibitors, re-alkalisation, chloride extraction and cathodic protection. The latter provides on-going corrosion protection by the addition of a small electric current through the reinforcement layer.

Offering significant benefits over other techniques, Freyssinet has developed an integrated service in the design and installation of cathodic protection in partnership with sister company Corrosion Control Services Ltd (CCSL).

## Resins and grouts

Resin and cement based media can be used for numerous structural and non-structural void filling applications. These include injection into fine cracks within reinforced concrete structures as well as mass stabilisation of voided sub-strata. Using high and low pressure injection equipment in conjunction with the latest vacuum assisted grouting technology, polyester epoxy and polyurethane resins, Freyssinet provide a comprehensive service of injection techniques.

## Coatings

Freyssinet offers a full range of coating treatments including corrosion inhibitors, anti-carbonation, waterproofing and chemical resistant applications. We provide solutions for waterproofing, flexibility and chemical attack, all having long life expectancy and low maintenance costs.



## Slab connectors

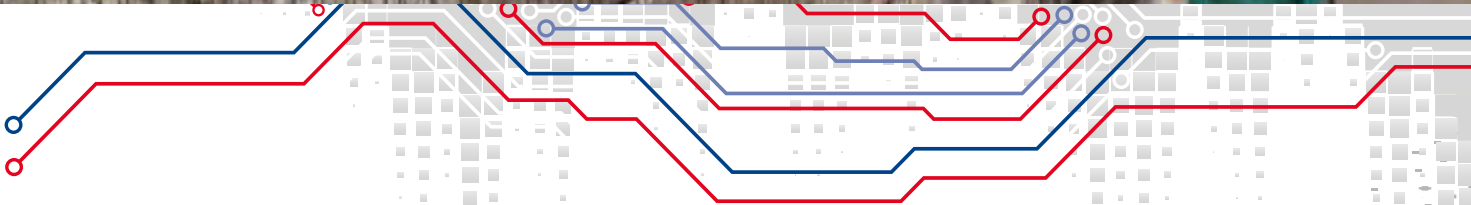
The component assembly, design principle and installation method of the Freyssinet slab connector combine to create a visually neat, simply installed and cost-effective solution to slab joint failure. Cast iron, steel and elastomer components interact to provide a high performance connector for the management of vertical loads, horizontal expansion and contraction movement. Freyssinet slab connectors are sized for numerous applications, including industrial flooring, road carriageways, airport runways and aprons.

## Wax injection

From post-tensioning to ground anchors and cable stay systems, Freyssinet increasingly adopts wax in favour to traditional grouts. These modern semi-solid bonding agents are more flexible to work with and corrosion resistant. We provide plant for wax bonding anything from 2 litre 'top hat' caps to 2000 litre capacity cable stay sheaths on bridge decks.



“Reinforcement corrosion, exacerbated by reduced alkalinity of the surrounding concrete, is the major cause of concrete deterioration.”



# HEALTH, SAFETY, ENVIRONMENT & QUALITY

Freyssinet Limited is wholly committed to meeting its legal and ethical responsibilities. This applies to the health and safety of its employees and clients, the environments in which they work and the quality and sustainability of the products and services which the company provides.

**Safety and Environment**  
**Quality**  
**Clients**

## Safety and Environment

Freyssinet's number one priority on all projects is safety: for our employees, clients, subcontractors and the public. Our 24/7 safety initiative is based on the principle that 'everyone must get home safe at the end of the working day'. Therefore, this is always at the forefront of scheme planning.

Freyssinet works to an environmental management system accredited to ISO 14001 and operates a 'sustainable technology' ethos, actively promoting sustainable construction and repair techniques that limit impacts on the environment as much as possible. Freyssinet aims to reduce the environmental and social impacts of all activities, in particular by concentrating efforts on preventing pollution, protecting natural habitats, managing and recycling waste and reducing greenhouse gas emissions. This is achieved by effective training of our personnel, appropriate environmental risk assessments, project planning, use of sustainable materials and innovative work methods.

## Quality

Freyssinet was amongst the first construction companies in the UK to be awarded BS EN ISO 9001 and has long known that complete client satisfaction with our products and services is the only way to ensure repeat business. Our certificate includes full scope for repair and strengthening works, and recognises the in-house design facility that Freyssinet is able to provide. Freyssinet employ a full time Quality Manager to ensure both internal and external quality expectations are met and exceeded.



## Accreditations

Freyssinet holds Constructionline Gold, CHAS and RISQS accreditations, as well as BS ISO 44001 certification in collaborative business relationships.



## Additional association memberships include:

- Bridge Joint Association
- Corrosion Prevention Association
- Post Tensioning Association
- Water Jetting Association
- Concrete Repair Association





“Freyssinet’s health, safety, environment and welfare standards stand positive comparison with recognised good practise within the construction industry at all times.”



Cert No. 15662



Cert No. 15662



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Supplier No: 060626



**Other services offered by Freyssinet:**

- Bridge Bearing – Design & Manufacture
- Post Tensioned Systems – Design & Installation
- Cable-stayed Structures
- Reinforced Earth Structures



**FREYSSINET**  
SUSTAINABLE TECHNOLOGY

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