

EXOLEAF®

REVOLUTIONARY  
ULTRA HIGH  
PERFORMANCE  
IMPROVEMENT  
FOR STRUCTURES



**exOLEAF**<sup>®</sup>  
Ultra High Performance Improvement for Structures

# WHAT IS EXOLEAF®?

## AN INTRODUCTION

EXOLEAF® IS AN INNOVATIVE PRODUCT, DESIGNED TO SOLVE STRUCTURAL STRENGTHENING AND ENHANCEMENT PROBLEMS SEEN ON A LOT OF EXISTING STRUCTURES

Concentrating largely on offsite construction, Freyssinet utilises ExoLeaf® in a number of different ways, from strengthening columns to bridge piers.

The properties of this product, combined with the engineering know-how of Freyssinet and the ability to turn ideas in to action, will ensure that structures once considered beyond economical enhancement or repair, can now be returned to better-than-original condition or enhanced to higher loading configurations.

ExoLeaf® is a novel utilisation of a specialist Lafarge-Holcim Ultra-High Performance Concrete (UHPC). It has been developed by Freyssinet and can be combined with other Freyssinet products, including post tensioning items and structural fixing components.

## THE KEY BENEFITS OF EXOLEAF®

- Can be used on vulnerable structures
- Installation of ExoLeaf® creates minimal vibration
- Quick and safe installation
- Minimal associated works
- Offsite manufacture
- Flexible range of shapes
- Aesthetically pleasing
- Exceptionally durable
- Can be pre-loaded
- Can be post-tensioned
- Can be built in situ or sprayed



## THE KEY CAPABILITIES OF EXOLEAF®

ExoLeaf® is able to improve the following:

- Compression capacity
- Shear capacity
- Bending capacity
- Durability
- Fire protection
- Impact protection
- Seismic protection
- Water abrasion protection

## KEY CAPABILITIES IN ACTION

01

### Increased structural capabilities

The impressive strengthening capabilities of ExoLeaf® means capacity can be increased considerably more than conventional systems. For example, a 40mm precast ExoLeaf® system applied to 450 tonne capacity column will give the ability to carry over 1,400 tonnes.



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### Preventing future corrosion issues

ExoLeaf® can be used to strengthen hollow construction bridge piers. It is a great alternative to concrete infilling and localised use of high tensile bars, which can present potential future corrosion issues.

03

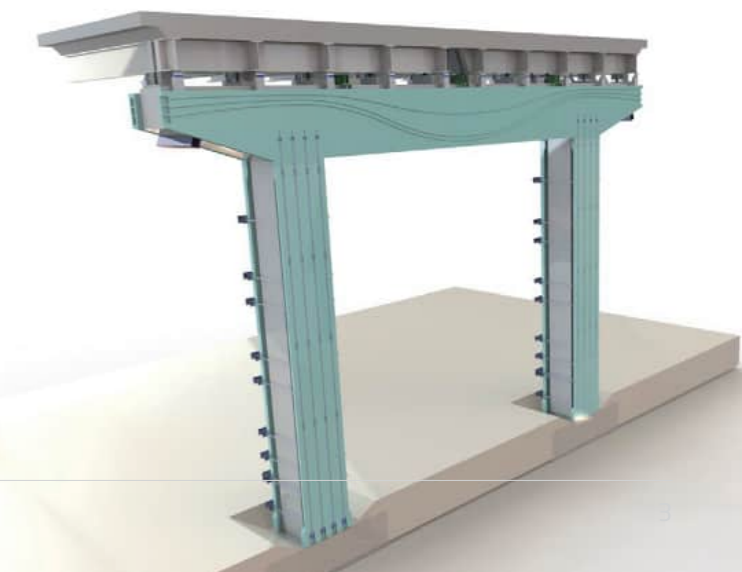
### No fire protection needed

ExoLeaf® does not suffer from fire protection issues. Fire protection is relative to thickness, as with traditional concrete. No additional protection is required.

04

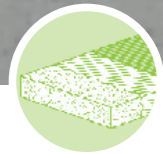
### Bespoke design

ExoLeaf® is a bespoke product; designed and manufactured on a project-by-project basis. Aesthetically, the material has an attractive finish, which can be tailored to any design required by architects.



# TECHNICAL DETAILS

## BESPOKE ELEMENTS OF EXOLEAF®



### Shell thickness

Shell thickness is defined by the need of the structure. Shells are generally no thinner than 40mm but can exceed 600mm if required.



### Shell connections

Each shell is custom-made, and neatly encases the structure. The shell connections are designed to match the project, taking into account strength, aesthetics and environment. The connections are waterproof for grouting.



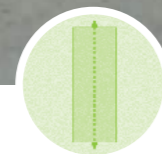
### Preparation of existing structure

The existing structure does not require any significant or intrusive preparation. Any loose material is removed and locally repaired if required.



### Connection to the existing structure

Connection to the existing structure is tailored to the specifications of each project – from a simple cleaning to in-depth shear connectors. Following thorough design and testing, the intention is always to keep the connection process as simple as possible to avoid unnecessary noise, dust and vibrations.



### In situ or Pre-cast?

Either option is possible. The pre-cast route offers many benefits, including an impressive speed of installation and easy offsite construction.

The in-situ option is ideal for larger applications or structures with access issues. The ultra-high strength concrete is applied using Freyssinet's specially designed pump. In addition, ExoLeaf® is also available in a sprayed form, which offers even greater flexibility.



### Post tensioning or preloading

Post tensioning ExoLeaf® is a viable option, giving the very strong material (150 – 180 MPa) even more beneficial design accomplishments.

Preloading ExoLeaf® can relieve stresses in the existing structure, without external propping.

## SITE OPERATIONS

EXOLEAF® IS USED IN THREE DIFFERENT FORMS, PRE-CAST, IN SITU AND SPRAYED.

### Pre-cast

The precast option is one of the most beneficial methods of utilising ExoLeaf® as it allows easy to control 'offsite' construction methods.

Once in place, the gap between the shell and the existing structure is grouted using high strength non-shrink grout.

### In-situ

Ultra High Strength Fibre Reinforced Concrete in its ExoLeaf® form can be installed in-situ.

The material is a high strength concrete with steel fibres, which is applied using Freyssinet's specially designed pump and ensures precise injection.

Freyssinet has extensive knowledge of hydraulics and fluid mechanics and is a leader in the field for pumped installation of this type of material.

Variable design batches can be mixed on site and Freyssinet's experienced operators are well-versed in the finishing of the material.

### Sprayed

ExoLeaf® in its sprayed form is ideal for structures with access issues and allows for even greater precision.



# CASE STUDY

## EASTBOURNE ARNDALE CENTRE

AN £85 MILLION REDEVELOPMENT OF THE ARNDALE SHOPPING CENTRE IN EASTBOURNE INCLUDED AN ADDITIONAL 22 RETAIL UNITS, SEVEN RESTAURANT UNITS, A MULTISCREEN CINEMA AND A SIGNIFICANT EXTENSION TO THE MULTI-STOREY CAR PARK.

An extensive upgrade of the Arndale Shopping Centre in Eastbourne, now renamed The Beacon, included a two-storey extension to the existing multi-storey car park. The existing concrete columns in the car park had to be strengthened in order to carry the additional loads.

Traditional methods of reinforcement were considered in the initial stages of the project, which would have included traditional jacketing, propping, partial demolition and installation of new in-situ concrete. This would have meant partial closure of the MSCP, and would have resulted in a minimum 47 week programme.

Freyssinet was instructed to carry out the full design, supply and installation of column strengthening to 84 columns in the MSCP.

By utilising its innovative ExoLeaf® system - an Ultra-High Performance Concrete (UHPC) in pre-cast form, Freyssinet was able to reduce the 47 week programme down to just 15 weeks, which included work on a number of special columns. As a result, the car park stayed open to the public for the majority of the works, which was crucial in the lead up to the Christmas period.

The use of high performance Ductal® UHPC material (Lafarge Holcim) was a particularly effective solution on this project where disruption to the structure needed to be minimised.

The expertise of Freyssinet in design and installation, combined with knowledge of our pre-caster led to an excellent result serving all of the Client's needs: safety, speed, aesthetics and quality.



THE USE OF ULTRA HIGH STRENGTH, HIGH PERFORMANCE FIBRE REINFORCED CONCRETE HAS BEEN APPLIED TO SIGNIFICANT PROJECTS BY FREYSSINET.



## ACCREDITATIONS



Certificate Number 15562  
ISO 9001  
ISO 14001  
OHSAS 18001



**FREYSSINET**  
SUSTAINABLE TECHNOLOGY

### **Freyssinet Limited | Head Office:**

Innovation House, Euston Way, Telford, TF3 4LT  
Tel: +44 (0) 1952 201901 | Fax: +44 (0) 1952 201753  
Email: [info@freyssinet.co.uk](mailto:info@freyssinet.co.uk)

[www.freyssinet.co.uk](http://www.freyssinet.co.uk)