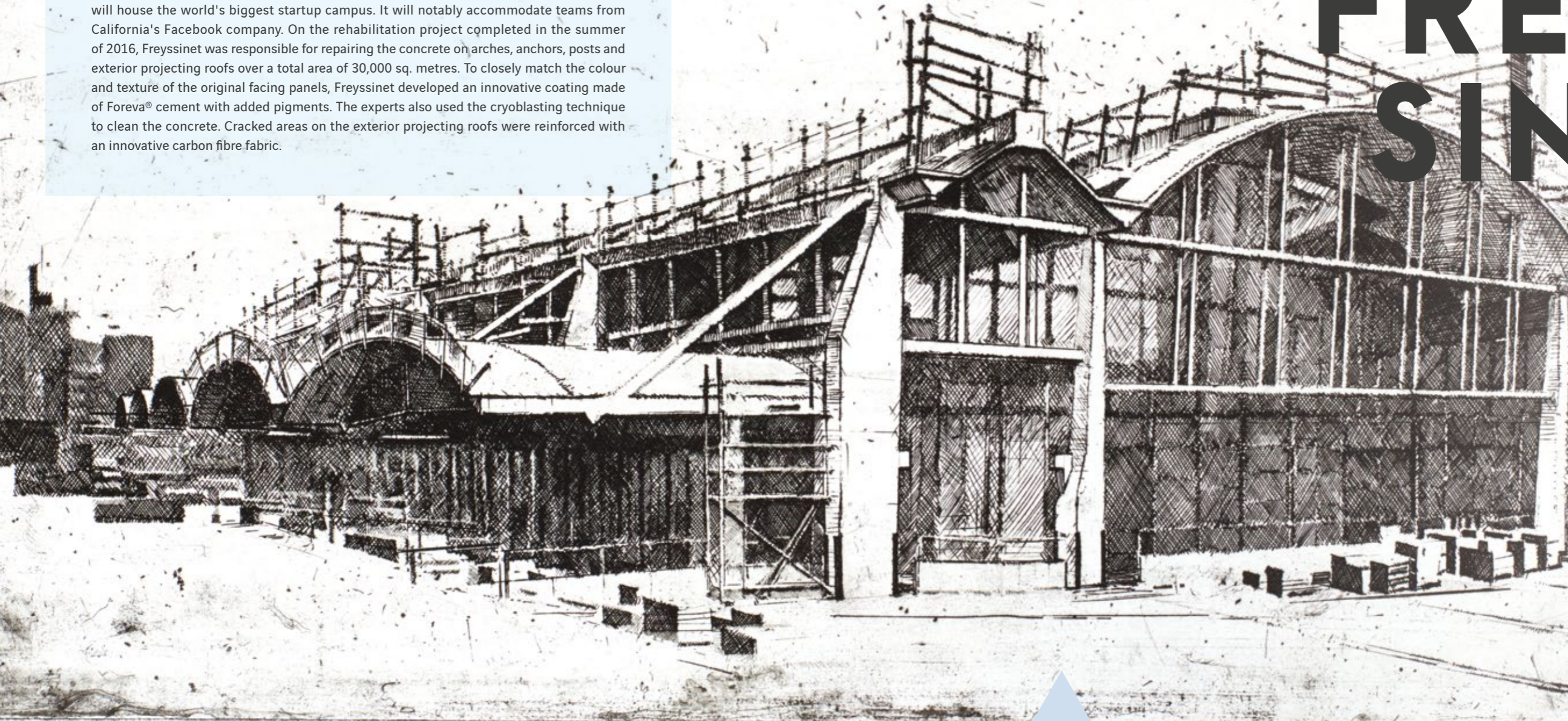


Station F
Paris, France

Freyssinet moves towards the future in the footsteps of its founder

Designed by Eugène Freyssinet at the dawn of the patented prestressing era, the eponymous building (Halle Freyssinet), which is included in the supplementary list of historic monuments, will house the world's biggest startup campus. It will notably accommodate teams from California's Facebook company. On the rehabilitation project completed in the summer of 2016, Freyssinet was responsible for repairing the concrete on arches, anchors, posts and exterior projecting roofs over a total area of 30,000 sq. metres. To closely match the colour and texture of the original facing panels, Freyssinet developed an innovative coating made of Foreva® cement with added pigments. The experts also used the cryoblasting technique to clean the concrete. Cracked areas on the exterior projecting roofs were reinforced with an innovative carbon fibre fabric.

FREYS- SINET





PATRICK NAGLE
Chief Executive Officer,
Freyssinet

Providing earlier and earlier client support

Was 2016 another growth year for Freyssinet?

Activity held steady at a high level. In 2015, we had signed several large contracts. In 2016, Freyssinet's global network of subsidiaries carried out these projects and undertook new ones. On 26 August 2016, the third Bosphorus crossing, the Yavuz Sultan Selim hybrid cable-stayed suspension bridge was inaugurated in Turkey. It set several records and introduced a number of innovations (see page 59). Other sources of satisfaction were the cable-stayed roof of the Vodafone Arena in Istanbul, Turkey, the prestressing for the Hebron Oil Platform in Canada, the 12km deck for Line 1 of the Ho Chi Minh City metro in Vietnam and our work on the TMCLK viaduct in Hong Kong and the Santa Monica (Train II) wind turbines in Brazil, which is ongoing. These diverse projects illustrate Freyssinet's ability to apply its expertise in different sectors, ranging from engineering structures and buildings, to energy and transport infrastructure. Another noteworthy highlight was the expansion of our repair activity. The Ewijk bridge in the Netherlands, the Ayala bridge in the Philippines, the port of Melbourne in Australia and the Viceroy building in Dubai are examples of our teams' commercial and technical responsiveness in the field of rehabilitation and reinforcement.

Cause for satisfaction in 2016?

Having had an opportunity on several occasions to share the successes of our teams around the world.

A priority for 2017?

Safety. We have an absolute duty, both collective and individual, to protect people on our sites. I will do my utmost to keep this a reality everywhere.

Your commitment in 2017?

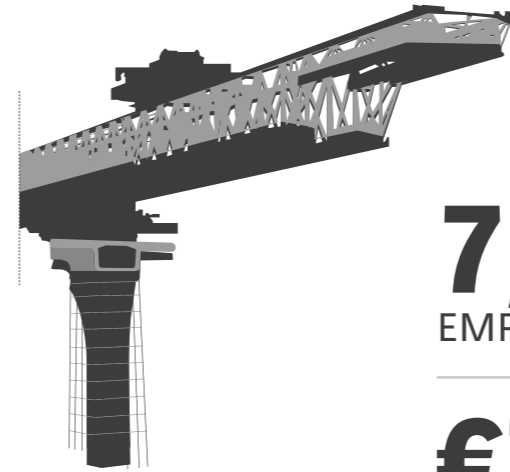
To look beyond the need initially expressed by the client in terms of expertise, products and services.

Is repair a promising business for the future?

We have a dual strategic focus. First, we are consolidating our core business, namely prestressing and stay cables. We will strengthen our positions by concentrating on projects with strong technology content. Second, we are concentrating on repair work, which already accounts for more than 40% of our overall volume of activity and up to 90% in mature markets such as France, the United Kingdom and Australia. More and more contracting authorities want to maintain or reinforce their existing assets rather than build new infrastructure. This activity ranges from basic repairs to high-end technical solutions. Lastly, Freyssinet is developing a new range of ready to build structures which notably include very tall concrete wind turbine towers.

Could you give an example of these high-end solutions?

The patented ElevArch® technique was trialled in the United Kingdom in 2016. Hundreds of bridges across railway lines in the United Kingdom have arches that are too low to accommodate the overhead power lines being installed to electrify the rail network. →



7,500
EMPLOYEES

€750 m
MANAGED REVENUE*

* Revenue including the share of revenue in jointly controlled companies

World benchmark in construction and repair of structures

Post-tensioning, construction methods, cable-stayed structures, structural accessories, structural reinforcement, concrete repair, reinforcing steel protection, earthquake protection and specialised maintenance – the Freyssinet Group makes its specialist services available in two major fields: construction and structural repair. Covering the design of structures, the production of materials and equipment and their implementation on site, the Group offers integrated technical solutions for a wide variety of structures.

NEW ORDERS

- Extension of the Tsentralnyi Stadion (central stadium), Volgograd, Russia
- Repair and cathodic protection of oil tanker quays in Port Bonython, Australia
- Repair of the Pánuco tunnel along the Durango-Mazatlán motorway, Mexico
- Reinforcement of a car park at Gatwick airport, London, United Kingdom
- Rehabilitation of bridges along Interstate 895 – Arthur V. Sheridan Expressway, New York, United States
- Heavy handling operations (Autoripage®, Autofonçage®) on several structures along the future Grand Paris Express line, France

→ After closely analysing the requirements with the client, Freyssinet UK devised and patented a technique that involves cutting the arch free from its abutments and wing walls so it can be jacked skywards to enlarge the space below it. The solution was successfully trialled in October 2016. This low-cost system has been developed to considerably reduce the amount of time during which a line has to be closed to a few hours rather than the several weeks it would take to completely rebuild the bridge or lower the rail line. I am confident that this bridge lifting system will be applied in many places around the world.

You were appointed Chief Executive Officer of Freyssinet in July 2016. What are your impressions as head of the Group?

I am resolutely optimistic. I have been with the Group for several years but taking the helm changes your perspective. I have visited a large number of subsidiaries around the world over the past few months to meet our teams. Everywhere I went, I saw potential for expansion. We have excellent employees, our network has a good presence on all continents and our ranges of technologies and services are outstanding assets. The world construction and repair markets will continue to grow in coming years.

Will you be emphasising organic growth?

We will not limit ourselves to that. We will look for opportunities to acquire companies that make strategic sense. At the end of 2016, we acquired the Carpi company, which specialises in waterproofing geomembranes for hydraulic dams and canals (see page 8). That acquisition creates strong synergies with our business lines and opens up a new market. But Freyssinet is not attempting to expand in all directions. Our priority, in my view, remains adapting our business model, which must evolve to enable us to provide our clients with earlier project support, and continuing our innovation efforts to provide an increasing number of solutions. To do this, Freyssinet has the support of a rock-solid organisation and in particular its project managers and teams of supervisors working around the world.



THE INTEGRATED APPROACH: THE INNOVATIVE COMMON FEATURE



Innovation consists in devising, designing and marketing a high value-added breakthrough product. At a time when contracting authorities are seeking comprehensive turnkey solutions, from design studies to project closeout, Freyssinet focused on integrated innovation in 2016. This is the combination of innovations in design, equipment and construction methods that defines the company's added value and makes it possible to deliver high quality structures on time, with optimised costs and quantities of materials.

Serving operational excellence

In designing viaducts for the Northern Marmara Highway project in Turkey, Freyssinet teams reduced the quantities of materials used by 45% while accelerating the pace of construction. The quantity of concrete was cut by 35% and steel 50%. This was achieved by using an innovative seismic design suited to the specific features of the structure, which has 80-metre-high piers, and the incremental launching method to build the deck, which is rarely employed at these heights, as well as viscous dampers in the abutments. In 2016, the integrated innovation method was used in several areas of activity, including cable-stayed stadium roofs, ultra-high performance fibre reinforced concrete (UHPFRC) repairs, and earthquake-proof structures.

Integrated service: structure, products, methods and works

For the Çallı bridge in Antalya, the teams once again combined innovations. For the project, which was handed over in a record seven months, Freyssinet proposed an extrados based alternative solution combined, for the first time, with a special deck and tower isolation system. The use of elastomer isolators with lead cores limits the forces transmitted in the extrados cables. Another innovation on this viaduct was the use of extrados 1,960 MPa strand stay cables. This unusual steel grade was first used in the construction of the Yavuz Sultan Selim Bridge. Inaugurated on 26 August 2016, the structure earned Freyssinet a number of records: the highest towers (322 metres), widest deck (59 metres) and longest span for a combined road and rail bridge (1,408 metres). Further innovations, such as special dampers and deviator saddles, were also devised for the project. In 2016, Freyssinet continued to innovate by introducing new cathodic protection systems and stay cables with unprecedented fire and blast resistance. The potential of these technologies will only be fully exploited when they are integrated in a virtuous circle of innovations that offer clients technical and implementation capabilities.



Ömer Güzel - Yapı Merkezi Construction and Industry Inc.
General Structural Design Coordinator

"The Awash-Kombolcha-Hara Gebaya (AKH) line is an important railway project that will link the central part to the northern part of the country. This project will reflect the identity of Ethiopia and will be an exemplary model for Africa with a potential volume of 17 million passengers in 2030. Freyssinet's Turkish subsidiary Freysaş has provided comprehensive support with fast and efficient solutions for a creative and optimal design of the seven bridges, responding in particular to seismic demands. All solutions are provided under the coordination and thorough validation of the Freyssinet Technical department. The steel piers are connected to the reinforced concrete pedestals via Freyssibar which provide a safe and time-efficient solution. The superstructures are isolated with the utilisation of PDS devices which provide a quantitative efficiency on the substructure. The longest viaduct with a length of almost 615 metres and a radius of 800 metres in the superstructure was erected with ILM over 52-metre-high steel piers."

“
A
creative
and
optimal
design
”

TMCLK viaduct
Tuen Mun - Chek Lap Kok, Hong Kong



2,639
SEGMENTS

That is the number of prefabricated segments that will be erected by Freyssinet for the viaduct that will connect Lantau Island to an artificial island, currently under construction to extend Hong Kong's International Airport. Freyssinet will also supply and install 7,000 tonnes of post-tensioning, bearings and movement joints. In 2015, Freyssinet commenced the deck erection, and on 12 January 2017, the 1,000th segment of viaduct was completed. Specially-designed equipment was used, notably two launching gantries, each 200 metres long, and two pairs of lifting frames. Precise planning for each task was required, since the viaduct passes over roadways and railway lines, and is in a flightpath, which means restrictions on the use of marine cranes and short suspension in traffic (four hours) to allow placement. To meet the challenges of a restricted and busy site requires erecting segments in several places simultaneously, with the appropriate number of mobile, multi-skilled teams, capable of operating in different environments with various construction methods. This viaduct is one of the two major contracts being undertaken by Freyssinet in Hong Kong, along with the Liantang 3 (LT3) viaduct.



Clemenceau Medical Centre
Amman, Jordan

The biggest repair project within the Middle East

In the Al Abdali neighbourhood of Amman, Freyssinet's Jordanian subsidiary is working with the Major Projects department to design, supply and carry out the strengthening works for a 125-metre-high tower, its ancillary buildings and four underground levels. Between February and December 2016, the Freyssinet teams helped transform the residential building into a specialised medical complex. The work involved 25,000 linear metres of bonded carbon fibre fabric (Foreva® TFC-H) structural strengthening and 2,000 tonnes of dry shotcrete. Freyssinet also carried out the preliminary overall structural studies focused on behaviour and stability and helped define the repair and demolition schedule. To meet safety, productivity and quality requirements, the teams designed, as a "shotcrete lifting platform", a concrete handling and supply system for the shotcrete machines. The technical and logistical innovation made it possible to pump the dry

mixture through pipes to a height of nearly 125 metres, with the double advantage of having equipment that could be used in a limited site footprint with expected storage capacity (containers, compressors, air tanks and dryers, silos, etc.) and facilitating day-to-day coordination with the partners and the other companies working at the site.



Nouvelle Route du Littoral coastal highway viaduct
Reunion Island, France

At the end of 2018, the offshore new coastal highway viaduct will become France's longest structure of its kind. Freyssinet is helping to build the seven consecutive decks making up the major structure on Reunion Island by installing post-tensioning systems. In order to minimise risks and climate contingencies related to marine works and to maximise environmental protection, special construction methods are being used and 95% of the structure is being prefabricated on dry land. The piers and special segments are transported and installed offshore using a self-elevating megabarge named Zourite. By the end of 2016, all the segments of the first viaduct had been prefabricated and installation work was under way. The first of the 48 spans was completed in January 2017 with the prestressing of some 100 tonnes of strands. Meanwhile, Freyssinet is designing, supplying and installing the cathodic prevention system to protect the 48 viaduct spans from corrosion. Freyssinet experts, assigned full-time to provide support for the project now in full swing, designed the system, which involves flush point anodes for submerged areas and ribbon anodes embedded in the surface coating for tidal areas.

5,400 METRES

Caltex refinery
Kurnell, Australia



Professionalism and attention to detail

These were the two main qualities that oil company Caltex Australia Limited identified in the teams from Freyssinet's Australian entity, when it picked the company for remedial maintenance at its Kurnell oil terminal. In 2016, Freyssinet Australia staff began carrying out weekly surveillance and maintenance operations on the pipelines which carry high-pressure liquid petroleum products from the Kurnell refinery to its various terminals in Newcastle, thus saving some 45,000 trips by tanker truck per year. The contract covers patrols, surveys, repairs and work supervision for third party activities, meaning Freyssinet can demonstrate its technical expertise on a weekly basis in terms of cathodic protection, painting, blasting, and coating, and prove its dedication to meet the safety and reliability demands in the fuel distribution sector. As the first three-year maintenance contract won by Freyssinet Australia, this operation opens fresh prospects for growing remedial and repair activity, notably in the petrochemical sector.

Becoming a major player in renewable energy infrastructure

In Brazil, Freyssinet continued work on the Trairi II wind farm. The company designed and built the foundations and 36 prefabricated prestressed concrete wind turbine towers, which reach a height of 120 metres. Each tower is made up of 32 precast concrete segments, cast using a match-casting technique, and assembled on site using a special lifting device that erects the tower in sections in an inverted manner (the lower tower sections are inserted below the upper tower sections once the latter have been assembled and lifted). Experts in the Technical department developed the innovative lifting device, called Eolift®. The result is a faster construction method that is less sensitive to the effects of wind. After segments erection, the towers are fitted with external post-tensioning cables and electromechanical components, some of which (ladders, platforms, lifts and cable supports) being designed, supplied and installed by Freyssinet. The site teams designed the precast yard, precasting moulds and other specific equipment, and defined the main operating procedures on site. The last lifting operation took place on the Ouro Verde 5 tower on 9 December 2016.

Trairi II wind farm
State of Ceará, Brazil



US 131 – Bridge over the Muskegon River
Big Rapids, Michigan, United States

10 November 2016: Freyssinet received an award from the International Concrete Repair Institute (ICRI) in recognition of the excellence of its rehabilitation work on a bridge

Built in 1982, over the Muskegon River in Michigan, this 180-metre box girder bridge was showing signs of deficiencies. Freyssinet proposed several remedial measures, including modification of the piers, supply and installation of eight flat jacks, diaphragm retrofits, crack injection, external post-tensioning within the box girders, articulating concrete blocks, joints and epoxy overlay. This alternative solution, involving flat jacks, concrete corbels composed of steel reinforcement, 45 MPa concrete, and external post-tensioned steel bars, added strength and load carrying capacity, thus allowing the bridge's lifespan to be extended without having to replace structural elements. The Freyssinet teams made their technical expertise available to deliver a project with controlled costs, delivered ahead of schedule, and carried out in close cooperation with local authorities. Meticulous scheduling of the work made it possible to reduce the number of scheduled traffic detours required to complete repair and strengthening work on the bridge that is part of a popular travel route taken by thousands of weekend vacationers.