Orchard metro station and associated tunnels Thomson-East Coast Line, Singapore

# New infrastructure to facilitate mobility

In Singapore, Soletanche Bachy's local subsidiary helped build the new Thomson-East Coast Line (TEL), part of the Mass Rapid Transit (MRT) system. In October 2016, it completed the foundations for the Gardens By The Bay station and the associated tunnels. Other work, carried out in conjunction with the Soletanche Bachy Major Projects division and Bessac, is now under way for the Orchard metro station: 100,000 sq. metres of diaphragm walls, 7,100 metres of bored piles, 8,500 cu. metres of materials excavated under the existing station and two tunnels built, for the first time in Singapore with a tunnel boring machine (TBM). This complex work is taking place under a busy thoroughfare and requires advanced geotechnical capabilities such as the use of a retractable microtunnel boring machine (MTBM) and innovative soil mixing techniques.



# INTERVIEW

**DIDIER VERROUIL** Chief Executive Officer, Soletanche Bachy

# e never leave site in the 2015-2016 period.

### An iconic project?

The Tower in Dubai. Soletanche Bachy is completing deep foundations for what is to become the world's tallest building.

## A reason to be proud?

Safety. Mentalities are changing: safety is increasingly recognised as a way to boost performance.

## A watchword for 2016?

Robustness. Initiated in 2016. the Soletanche Bachy strategic project will strengthen the fundamentals of our entrepreneurial culture.

# What is your view of 2016?

2016 cannot be looked at in isolation. With the world economy affected by the decline in oil and commodity prices, the Group nevertheless maintained a high level of activity and achieved a record order backlog. With increasing numbers of projects of all sizes, growth in revenue, improved income from operations, strategic acquisitions, progress in terms of safety and a large number of innovation awards, all indicators are positive

# What were the most significant projects in 2016?

We started one of Soletanche Bachy's largest-ever ground reinforcement projects as part of the construction of the three-runway system

at the Hong Kong International Airport. The project consists in reclaiming 650 hectares from the sea and calls for one of our patented processes, Geomix<sup>®</sup>. The work has to be carried out in height-restricted conditions and while the airport continues to operate. Other examples of projects in the transport sector are the Kuala Lumpur and Warsaw metros. The port projects in Colombia (Buenaventura), Trinidad and Tobago (La Brea) and France (Sète, Port-la-Nouvelle) illustrate our increasing presence in marine works. In water and sewer projects, there were the Thames Tideway Tunnel in London, the Ganay basin in Marseille and

other projects in Qatar, Chile and Georgia. And then there were dams, with major projects in Chile (Chacrillas), Peru (Antamina) and India (Subansiri). Lastly, we made substantial use of our expertise to build the foundations for high-rise towers, more particularly in Mexico City, Dubai and Sydney.

## How is Soletanche Bachy positioned in the outsized Grand Paris project?

We are already actively working on it. Apart from direct programme management of the Grand Paris project, our underground works expertise is called on for the extension of Line 14 of the metro (see page 29). We were also awarded, as part of *a joint venture, a works package for the* Grand Paris Express, covering the Fort d'Issy - Vanves -Clamart underground station. At the same time, our ability to deploy teams and offer innovative solutions has put us in a good position in tender procedures. In January 2017, we were awarded, within a joint venture, the first Grand Paris Express major works package for Line 15 South between Villejuif-Louis Aragon and Créteil L'Échat.

### How does your range of solutions and services stand out?

Infrastructure projects are increasingly complex and technical. In Paris as in Mexico City, a large



# 10,265 **EMPLOYEES**

€1.525 bn **MANAGED REVENUE\*** 

# €1.800 bn **ORDER BACKLOG\*\***

\* Revenue including the share of revenue in jointly controlled companies \*\* At end February 2017

# World benchmark in foundations and soil technologies

# NEW ORDERS

- Tanjong Rhu metro station and associated tunnels, Thomson-East Coast Line (TEL), Singapore
- C18 metro station, Warsaw, Poland
- Villa Coapa, Mexico City, Mexico
- Spire London, London,
- United Kingdom Eole project, France
- Extension of D quay, Port of Montevideo, Uruguay

28 | ACTIVITY REPORT



number of facilities must be built. often in a dense urban fabric that must not be disturbed. Our trademark ability is to offer innovative, customised geotechnical solutions with predetermined budgets and deadlines. Beyond our specialist expertise, we can provide general contracting or turnkey capabilities as part of an integrated range of services. But in fact, what really makes a difference is our approach: whatever happens, we never leave a site without having kept the commitment to excellence that we make to our partners.

# How can you expand this added value?

First we can boost our design office capabilities around the world. We have the major advantage of being able to bring powerful, collaborative engineering expertise to contracting authorities' constant quest for project optimisation. With this goal in mind, we stepped up recruitment of young talent in 2016. In parallel, the company is building increasingly innovative and efficient equipment. Thanks to networked management, we can deploy equipment around the world to meet requirements.

# Are you optimistic for 2017 and the following years?

Demand for transport infrastructure remains buoyant and global maritime traffic is steadily increasing, so that demand for port facilities and infrastructure can be expected to grow. Urban concentration is driving construction of an increasing number of skyscrapers and a race to build ever higher. And dams around the world are aging, so that major refurbishment works are in the offing. In all these areas, demand will not decline, on the contrary. Soletanche Bachy will confirm the momentum underpinning our order intake in 2016. We are already well established in more than 50 countries. We will be looking at new locations close to our future clients, notably in Latin America and Africa, to boost our ability to respond to growing demand.

# THE HYDROFRAISE® WITH GRIPPERS, **CUTTING THROUGH HARD ROCK**





Since Soletanche Bachy invented the Hydrofraise® in the 1970s, it has become the iconic machine used in special foundation works to drill into hard, deep geological horizons. Its greater drilling depth and power, optimised weight management, better stability in uneven terrain, and enhanced compactness to facilitate transport in containers and work in height-restricted conditions and in urban areas give the Hydrofraise® steadily increasing precision, reliability, agility and performance.



A Hydrofraise® suited to the **Grand Paris** project

INNOVATION



**François Lhomond - SYSTRA** Responsible for works package 2, project management of the northern extension of metro Line 14 (Paris, France)

"The Grand Paris Express project focuses on creating new lines and new stations to improve the daily lives of people living in the Greater Paris area. During the first phase of diaphragm wall works for the Mairie de Saint-Ouen station on the northern Line 14 extension, we had to cope with hard rock horizons that reduced our productivity. In the second phase, the Soletanche Bachy teams therefore brought in a novel piece of equipment, the Hydrofraise<sup>®</sup> with grippers, which enabled us to work at the planned rate,

limit wear on the tool and improve excavation efficiency. The resulting productivity gain enabled us to meet the tight project deadlines. The machine performed as expected thanks to its innovative excavation method, while maintaining verticality within RATP tolerances. This first project heralds even better results in upcoming Grand Paris Express projects where we may be called on to work together again."

# Innovation and value creation

Building on their confidence in their technological expertise, the Group's experts took the equipment to a new level to meet expected client requirements in increasingly complex projects. In 2016, the Hydrofraise® with grippers was launched to meet geological and commercial needs. By offering a solution for excavating very

Asia and Monaco, Soletanche Bachy in two years put into practice an idea first put forward 20 years ago. "The innovation was developed, as a collective ambition, at the instigation of top management in conjunction with the sales team, the technical design offices, the equipment department, the workshops and the works teams", says Technical Director Serge Borel. "Our integrated approach is the Group's best asset, since those who build the machines are the entrepreneurs that use them."

# hard rock (up to 100 MPa) in the Paris area, An innovative concept for a world first

The Hydrofraise® with grippers has brought about a profound change in the diaphragm wall construction process. The tool is able to drill to depths in excess of 70 metres thanks to its pendulum assembly, at panel thicknesses of 1.2 or 1.8 (x2.8 metres), and socket into hard terrain. Its design is unique: an anchor module with gripper caissons - that are opened hydraulically at the top by two actuators - capable of applying 120 tonnes of thrust on the cutting tool in addition to the weight of the cutter tool, and hydraulic dampers to limit the vibration. The system is designed so that motors, plates and drums can be replaced in a matter of minutes. In the operator's cab, the human-machine interface has been completely re-designed. The control panel is equipped with a console and a PC that serves as a display and records drilling parameters using touch controls. The more intuitive screen, which displays functions appropriate for the drilling mode selected, takes us a step further in the direction of the connected machine. The data measured can be better analysed, controlled and put to use (see page 22). The Hydrofraise® with grippers won the Trophée des TP (public works trophy) in France in the "equipment processes" category on 23 February 2017.

30 | ACTIVITY REPORT Soletanche Bachy

# **Port of Aguadulce, SPIA and Boscoal terminals** Buenaventura, Colombia



The Museum of the Second World War in Gdańsk was officially inaugurated on 23 January 2017. Soletanche Polska had excavated the site to a depth of 18 metres using a temporary thick slab cast under water, setting a world record. Meanwhile, the local Soletanche Bachy subsidiary began to work on a new project near the Pearl of the Baltic in March 2016. As part of the strategic EFRA – Effective Refining – Project, designed to maximise the volumes and quality of products obtained from each oil barrel, LOTOS, the oil exploration, production, refining and product distribution group, launched work to extend its refinery. The Italian KT – Kinetics Technology – group, main contractor in charge of building the coking and hydrogen generation units, awarded the contract to Soletanche Polska to build the 2,500 CFA (Continuous Flight Auger) piles required for both projects. The contract holds out prospects for further work in the demanding Polish oil and gas market.

LOTOS refinery

TEATO

Gdańsk, Poland

NG Buenaventura, Colombia's main Pacific port, is a strategic city. Most of the Andean country's exports and imports pass through it. The port upgrade is a benchmark for progress, competitiveness and sustainability in the entire region. Via the SBCC joint venture, Soletanche Bachy Cimas, Soletanche

Bachy International (the Group's Major Projects division) and Conconcreto took part in the project. Substantial technical capabilities went into designing and building the container terminal (SPIA), the bulk carrier terminal (Boscoal) and the associated reclaimed areas. Several innovations improved the efficiency and quality of the onshore and offshore works, optimised costs and accelerated the construction process. The project worked closely with the local population. Virtually the entire team was Colombian. On 2 December 2016, Boscoal received its first cargo ship carrying maize that had been loaded at the Louis Dreyfus terminal in the port of Bahia Blanca, Argentina – which Soletanche Bachy handed over five years ago.

32 | ACTIVITY REPORT Soletanche Bachy

**METRES LO** 

# Safe, durable oil infrastructure



## West < > East tramway line Nice, France

# Dai Quang Minh property complex Ho Chi Minh City, Vietnam

# Serving the ustainable city

In February 2016, ahead of the contractual schedule, Bachy Soletanche Vietnam completed the construction of about 26,900 sq. metres of diaphragm walls, 203 bored piles and 240 plunged-in steel columns. In an innovation in Vietnam, it built 62 shaft grouted barrettes and plain barrettes, of which some had 1.5 by 4 metre dimensions and 71 metre depths. The work was carried out for a mixed-use development in lot 5.5 of the new Thu Thiem area in Ho Chi Minh City. Developed by Dai Quang Minh Corporation, it will have four underground levels, a sevenstorey shopping centre and an 18-storey office tower. At a time when Vietnam's economic capital is reinforcing its urban renewal and sector planning strategy, the goal is to make this urban area into a new service sector hub in Ho Chi Minh City and to make the large Southeast Asian metropolis into a model sustainable city.



# Motorway and railway safety -

In British Columbia, Agra Foundations and Nicholson Construction, respectively Soletanche Bachy subsidiaries in Canada and the United States, worked to stop a landslide that was creating an obstacle to the operation of a railway and threatening Highway 99, the "Sea-to-Sky Highway". The two companies jointly designed and implemented a two-stage solution. Between June and October 2016, they installed 250 fully grouted micropiles and 30 strand passive anchors connected by a concrete waling beam. The mountainous topography made it necessary to carry out substantial prior earthworks to create access roads and work platforms. During the work, experts from Sixense monitored the slope in real time, using measurements to validate the effectiveness of the micropiles and anchors.





Fountain Slide British Columbia, Canada





Starting in 2018, it will take 26 minutes to travel from Nice Côte d'Azur Airport to the port in Nice via the city's new 11.3km tramway line with 20 stations. Soletanche

Bachy France, working with Soletanche Bachy Tunnels and Bessac as well as others within

the Thaumasia joint venture, is handling design studies and civil engineering works for the 3.2km underground section under a contract covering a 9.8 metre diameter bored tunnel, four underground stations, entrance and exit shafts, fitting and finishing, equipment and testing. The tunnel is being built to efficiently serve the city centre while safeguarding its architectural heritage. Soletanche Bachy faces the challenges of complex geology with highly variable soil and a small construction site in the centre of the city with shallow foundations and particularly sensitive built structures. To carry out the project, 150 workers are on site and 11 different rigs have been set up along the alignment. By the end of 2016, more than 75,000 sq. metres of walls and just over 1,440 linear metres of tunnel had been completed.

Patriotismo 230 tower Mexico City, Mexico

# A LEED certified project

After building the foundations and underground levels of the Insurgentes 838 tower for the ROUZ property group, Soletanche Bachy's subsidiary in Mexico was called on to apply its high-rise building expertise to the Patriotismo 230 project. The project has a surface area of 3,924 sq. metres and includes the construction of eight underground parking levels and the foundations of a 22-storey office building. The project has obtained the LEED high environmental quality label. The Cimesa teams proposed an alternative solution to replace conventional underground level construction: the top down method. They first demolished the walls of the existing underground levels, and then built 8,140 sq. metres of diaphragm walls around the perimeter with a capping beam. In the last phase, the core was excavated, provisional anchors were installed, 810 linear metres of piles were bored, 1,535 sq. metres of foundation barrettes were installed and post-tensioned underground floors were built together with Freyssinet.