## Annual Report 2005





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## **Profile**

Freyssinet is the world leader in specialist civil engineering and a subsidiary of the VINCI Group. It conducts research, carries out work and supplies highly technical products in its two main business areas, structures and soils. In 2005, Freyssinet recorded a consolidated turnover of 508 million euro and net profit after tax, VINCI share, of 22.2 million euro, giving a net margin of 4.4%. The Group has over 70 operating subsidiaries on all five continents, and employs around 3,700 people. Its structure is based on its business areas and geographical divisions, which give it both worldwide expertise and strong local roots. In all of its areas of activity, the Group fosters unparalleled know-how in the profession through an active research and development policy.

CHAIRMAN Bruno Dupety DEPUTY GENERAL MANAGER Jérôme Stubler

#### **EXECUTIVE COMMITTEE**

Jérôme Stubler DIRECTOR, STRUCTURES DIVISION

Philippe Zanker DIRECTOR, FRANCE DIVISION Patrick Nagle

DIRECTOR, UNITED KINGDOM/ NORTHERN EUROPE DIVISION

Jorge Moreno DIRECTOR, IBERIAN-AMERICAN DIVISION

Roger Bloomfield DIRECTOR, NORTH AMERICA DIVISION

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Bruno Dupety DIRECTOR, ASIA-PACIFIC DIVISION AND SOILS DIVISION

Yann Grolimund ADMINSTRATIVE AND FINANCIAL DIRECTOR

Claude Lascols HUMAN RESOURCES AND COMMUNICATIONS DIRECTOR

## I Message from the Chairman



#### Freyssinet's best year ever

We end the year with a net margin of over 6%, one year ahead of the target we set ourselves in our 4-5-6 action plan. 2005 was the best year ever recorded by Freyssinet, with consolidated turnover of 508 million euro, up 11% on the previous financial year. Our net profit after tax, VINCI share, comes to 22.2 million euro (4.4% of consolidated turnover) and puts us in the leading group of VINCI Construction companies. Cashflow has risen steadily to reach a record level of 30 million euro.

In positive markets, these good results also come from the recovery activities that we embarked on three years ago. The almost complete absence of major projects in 2005 - the largest operation being the repair of South Hook Jetty in the United Kingdom, worth 7 million euro - and the efficient management of all of our medium-sized sites bear witness to this will to improve our profits that is shared by all of the Group's employees. Furthermore, with the take-over on 6 September last year of Mecatiss, previously attached to VINCI Energies, we have supplemented and strengthened our offering in the three areas of sealing, fire protection and radiation protection.

We are embarking on 2006 with an order book full of new, top quality projects, 28% up on the beginning of last year. These include the start of the construction of the Dubai light rail system, where we will be laying the segments and carrying out some of the prestressing work on the 54 km of viaducts.

Having received the Grand Prize in the 2005 VINCI Innovation awards, this year we will once again continue with our research and development policy to improve our competitiveness and open the way to new markets. The challenges for 2006 relate mainly to our human resources policy (recruitment and training) in order to ensure that we have control of our development and can grow successfully.

We are therefore setting out confidently but also cautiously on the last phase of our 4-5-6 plan, the aims of which are clearly defined.

Bruno Dupety Chairman

## I Key figures

### Distribution of turnover by activity









Employees by categ	ory	
ngineers and managers	15 %	
echnicians	37 %	
Manual workers and staff employees48 %		

### Employees by division

France	508
Iberian-American	485
United Kingdom/Northern Europe	251
Structures	668
Soils	285
Asia-Pacific	1 224
North America	217

## Sustainability



Several years ago Freyssinet undertook a policy of sustainability. This policy is taking shape and has been spread to all of the subsidiaries, which are increasingly affected by the issues involved.

#### **Environmental performance**

With regard to environmental protection, in France Freyssinet took part alongside Sogea, GTM Construction, Eurovia and VINCI Energies in the drafting of the specifications for a site waste treatment system in the Île-de-France region, an initiative aimed at ensuring that 60% of waste is recycled at approved sorting centres and that the processing of such waste is traceable. Since April 2005, the five companies have thus been having much of their rubble processed and recovered as road-building materials. For its part, Freyssinet's Île-de-France/Normandy office has set up an «environmental control group» (GPE) to complete its ISO 14001 certification process. In the rest of the country, other environmental initiatives have also been launched; the Nantes, Nancy and Lyons offices have thus increased the sums allocated to site waste water and recovered oil treatment. All of the offices, and particularly Lyons and Marseilles, have made an effort to organise the storage of resins and sensitive products and to carry out a selective sort of waste on site, at warehouses and in the offices.

In Spain this year Freyssinet obtained UNE-EN-ISO 14001 certification and set up an environment management system in conjunction with Tierra Armada. Continuing on from this action, the two companies have defined and set up environmental indicators.

In the United States, DGI-Menard obtained approval from the New Jersey Department of Environmental Protection (DEP) for the installation of controlled modulus columns on contaminated land, having demonstrated that the technique does not lead to the penetration of pollutants into the waterbearing soil.

In South Korea, on completion of the atmospheric consolidation of a 350,000m<sup>2</sup> platform at the port of Kwang Yang using the Menard Vacuum method, the Sangjee-Menard subsidiary organised the recovery of the geotextile (35ha) and membrane used during the work and sent them to a recycling centre. For its part, in Pakistan Reinforced Earth has replaced almost its entire corporate fleet with less polluting vehicles that run on CNG (compressed natural gas).

#### Social responsibility

Placing people at the very heart of its structure and business, in 2005 Freyssinet pursued an active staff recruitment and training policy at all levels of the company.

#### Recruitment and training

At the end of 2005 the company had 3,638 employees, compared with 3,178 in 2004; this increase is explained by the external growth operations and the recruitment of new employees. Worldwide over the financial year, 1,417 people were recruited, 226 of whom to newly created posts, compared with 1,085 in the previous year.

The company also reduced its rate of temporary workers from 10 to 6%, preferring to enter into steady contracts. Once again this year considerable effort was put into attracting young people to the company, who represented 15% of new recruits. At the same time, the Group continued to participate in a number of national and local student forums and strengthened its partnerships with educational institu-

## Sustainability



 The Group pays particular attention to safety on all of its sites
2,234 employees received training in 2005

tions by organising site visits, offering placements and training contracts and awarding bursaries to certain students.

Worldwide in 2005, 2,234 employees received internal or external training, with a total of 29,504 hours of teaching over the year, increasing on the previous year (28,815 hours and 1,530 employees). Of these trainees, 128 attended courses given at the Eugène Freyssinet internal training centre in Perray-en-Yvelines (France), where 2,331 hours of training were given, 23% more than in 2004.

The financial year was also marked by the setting up of test «Prestressing Specialist» training sessions on an international scale, designed to harmonise knowledge of techniques within the Group. For example, the training, which is compulsory in France for employees performing prestressing work, was given in Romania in June. As part of its 4-5-6 action plan, Freyssinet also organised a massive internal training campaign during November and December. Seven training sessions on marketing and sales techniques, led by an external consultant, were held in France, Spain and the United Kingdom, for groups of around twenty people.

#### Safety

As a result of a sustained awareness campaign, the concept of safety is now firmly entrenched in people's minds. To bolster the existing system (the «Safety First!» process, the Vigiroute plan, non-negotiable provisions, etc.), in 2005 the Group embarked on a campaign for the prevention of the risks linked to the consumption of drugs and alcohol in the workplace. Posters on the theme giving the number of a drug support helpline were distributed to all subsidiaries in France.

Worldwide, other action worthy of mention includes Turkish subsidiary Freysas' production of a safety information manual and employee training. In Belgium and the Netherlands, all staff and management took VCA safety certification courses. In Belgium, a working group was also set up to prepare the office for certification in accordance with the VCA and ISO standards.

In France, Freyssinet's South Eastern regional office received certification from the Etang de Berre office of the MASE (a national organisation for the improvement of industrial health and safety) for one year in September, and UIC (chemical industries union) approval for three years in October, as part of a reference system relating to the organisation of safety by companies habitually involved in construction, maintenance and logistics at establishments classified as «upper tier» pursuant to the Seveso Directive.

Freyssinet France has been working on simplifying its safety data sheets, which are required to be delivered together with every product used on sites. The sheets are produced in conjunction with the Bouches-du-Rhône occupational medicine department and summarise the precautions to be taken when handling the products visually on a single page.

Emphasis is also constantly placed on the obligatory wearing of personal protection equipment (PPE), the precautions to take with regard to the environment and respiratory protection when handling certain products. In the United



States, DGI-Menard organised a number of safety training sessions for personnel in the field, and in particular 40-hour hazmat training focusing on hazardous materials given by the Occupational Safety and Health Administration (OSHA), the government health and safety body. Finally, in South Africa, eight out of thirteen employees attended a certified first aid course; the rest of the team should receive the training during 2006.

#### Quality

Over the course of the year, Freysas (Turkey), Salvarem (France) and Reinforced Earth (South Africa) obtained BE EN ISO 9001:2000 certification, whilst the ISO 9001:V2001 certification held by Freyssinet Nederland (Netherlands), the Freyssinet South Eastern regional office (France) and Austress Freyssinet (Australia) was renewed.

#### Social action

In 2005, Spanish subsidiary Tierra Armada linked up with the Aprocor foundation, which works with the psychical handicapped, to set up a support programme for integration into the world of work.

#### Knowledge sharing

The Group brought together over 220 employees in Dubai in January 2005 to spread and share knowledge internally. In addition, group companies have played an active part at a number of conferences, including the IABSE, FIB, Ache (Spain), Anipar (Spain), PTI (United States), etc., and on various committees, to present their technical advances and take part in the drafting or development of new regulations.

#### Innovation

The Freyssinet group has been linked from the start to the idea and values of innovation, and devotes more than 1.5% of its turnover to research and development. This year, its technical achievements have included the Cohestrand cable system applied to suspended bridges, which constituted a major innovation for Freyssinet with its first application on an industrial scale on the Kanne bridge (Belgium). The system guarantees a maintenance-free cable lifetime of over 100 years, and won the Grand Prize at the 2005 VINCI Innovation Awards.

 A dedicated time for exchanges and knowledge sharing: the Group brought together over 220 employees in Dubai in January.
In December, Freyssinet received the Grand Prize at the VINCI Innovation awards for its Cohestrand system applied to suspended bridges.

In the field of Reinforced Earth, Terre Armée developed and implemented the Omega connection on a first site near Morzine (France). The connection is a synthetic high tenacity polyester-based reinforcement strip made up of a continuous loop, the shape of which resembles the Greek letter that gives it its name. Partly cast into the panel during the prefabrication stage, this new corrosion-resistant fastener has other advantages, including simplifying the process of erecting walls, as it reduces the number of components delivered to site, an anchor that guarantees optimum pull-out strength, and compatibility with any type of concrete panel.

Finally, Ménard Soltraitement developed a new ballasted column machine equipped with rear legs that enable it to achieve record production rates of 500m per day (compared with 250m with a conventional machine) and establish the columns at depths of up to 16m due to increased thrust, thus improving the quality of the columns.

# Structures

64% of turnover The construction, repair and maintenance of structures represent two thirds of the Freyssinet group's business and remained at a high level in 2005 in all divisions. The company particularly stood out in the industrial sector, taking part in the construction of a number of liquefied natural gas (LNG) storage tanks and nuclear containment vaults. With regard to civil engineering structures, Freyssinet was mainly involved in the construction of decks using trusses in Asia and the implementation of its Autofonçage® sinking and Autoripage® sliding techniques in France.





1 Railway viaduct on the high speed line between Liège an the German border 2 Replacement of on the Saint-Cloud viaduct, France 3 In 2005. Freyssinet completed the installation of the prestressing on the Sioule Viaduct. France 4 Prestressing the Gaegok bridge, South Korea

## Construction Prestressing

Freyssinet's historical business, prestressing, remained at a high level this year thanks to the expansion of its use in building in particular in the Anglo-saxon countries.

#### **Civil engineering structures**

In the Auvergne Volcanoes National Park in France, Freyssinet completed the installation of the prestressing of the Sioule Viaduct (990m long and 150m high) on the A89 motorway. In Belgium, Freyssinet Belgium contributed to the construction of four railway viaducts on the high speed line between Liège and the German border. A total of 650 connecting prestressing bars between supports and beams, and 1,200t of cable in the supports, beams and sub-ballast slabs were installed. In Dubai (United Arab Emirates), Freyssinet Gulf was awarded the contract to supply and install the prestressing for the Ras Al Khor bridge (3,600t of steel), a six-lane, double-deck structure approximately 500m long.

In Asia, on the island of Singapore, PSC Freyssinet (S) Pte Ltd installed the external prestressing for the deck (300t of steel) of the Jalan Buroh overpass. On the Deep Bay site in Hong Kong, Freyssinet carried out the installation of the segments as well as the prestressing (1,500t). In South Korea, Freyssinet Korea carried out the entire construction, including civil engineering, of the Gaegok bridge, a 280m long, 20m wide structure; the subsidiary installed 220t of prestressing. In Indonesia, Freyssinet installed part of the prestressing (1,150t) on the Pasupati bridge, which links the east and west sides of the town of Bandung. Finally, near Texcapa in Mexico, on the motorway between Mexico City and Tuxpan, Freyssinet de México supplied and installed the prestressing (350t) for a 365m long bridge across a breccia over 100m deep.

#### Building

In Europe, British subsidiary Freyssinet Ltd confirmed its growth in the field of prestressed concrete floors by taking part in the construction of the Blenheim Centre in Hounslow, near London. The building complex required 55,000m<sup>2</sup> of prestressed floors. In Russia, Freyssinet installed 120km of tendons and 92 anchors on the saddle roof of the new Kolomna ice rink near Moscow. In Singapore, PSC Freyssinet (S) Pte Ltd installed the prestressing in an industrial building known as 8@TradeHub 21 (300t of steel) and a complex of 16 blocks of buildings (800t of steel).

Finally, across the Atlantic, in the Santa Fé district of Mexico City, Freyssinet de México contributed to the construction of the Mirage

#### LNG storage tanks: a quality offering

Reinvesting over 30 years' experience in the nuclear field, in 2005 Freyssinet moved with the growing market for liquefied natural gas (LNG) storage tanks, which are structurally identical to nuclear containment vaults, working on a number of projects. The methods and products developed by the Group for these applications include the 55C15 anchor, the strongest existing unit; thixotropic grouts; equal tension jacks; and the cryogenic prestressing system, specially developed for LNG storage tanks.

## Structures





 LNG storage tanks in Mugardos, Spain
The Blenheim Centre in Hounslow, England
Borg El Arab Stadium in Alexandria, Egypt



towers, a complex of three 17-storey buildings, supplying and installing the prestressing for  $57,300m^2$  of floors.

#### Industry

In the field of the industrial application of prestressing, 2005 was mainly marked by the nuclear containment vault and liquefied natural gas (LNG) storage tank projects.

On the Olkiluoto site in Finland, Freyssinet continued its work on the construction of the containment vault for the new generation EPR (European Pressure Reactor), in which 2,050t of steel and 540 anchors, will be installed.

In China, also in the nuclear field, Freyssinet supplied 490 prestressing anchors for the two containment vaults at the Tianwan power station in Jiangsu province, 382 anchors for the Ling-Ao power station phase II units 3 and 4, and 2,072 anchors for the Qinshan extension phase II. In India, prestressing work came to an end on the site of the two nuclear containment vaults at the Kudankulam power station in the state of Tamil Nadu, where Freyssinet installed 2,713t of steel. In Spain, the most notable project of the financial year in the industrial field was the construction of the two Mugardos LNG storage tanks in La Coruña (150,000m3 unit capacity, 76m in diameter and 45m high), which required 1,500t of steel.

At Fos-Cavaou in France, the company started the installation of 1,400t of prestressing on three 103,300m<sup>3</sup> storage tanks. In Asia, on the Russian island of Sakhalin, the Groups' British subsidiary Freyssinet Ltd contributed to the completion of two 130,000m<sup>3</sup> storage tanks in August, installing some 352t of cables. In China, having subjected its prestressing to cryogenic tests, the company started work on



the prestressing for the two Chengdu storage tanks (160,000m<sup>3</sup>), which will require 1,230t of steel. In the Persian Gulf state of Iran, 900t of prestressing were installed on four gas storage tanks with a total capacity of 200,000m3 built on the South Pars field. The financial year was also marked by the awarding on 4 July, as a subcontractor of VINCI Construction Grands Projets, of the contract for the supply and installation of 920t of prestressing on two 160,000m<sup>3</sup> LNG storage tanks to be built in Costa Azul, south of Tijuana, Mexico. In a completely unrelated field, at the end of the year, Freyssinet Gulf installed 184 Freyssibar threaded prestressing bars to hold down four cranes at the port of Jebel Ali in Dubai.

### Cabled structures

Although unlike 2004, 2005 wasn't marked with the completion of major international structures (the Charilaos Trikoupis bridge in Greece, the Millau Viaduct in France, etc.), the financial year contained a wealth of often innovative cable-stayed and suspended structures, such as the Kanne bridge in Belgium.

#### Stay cables

At the beginning of the year, in the Franche-Comté region of France, Freyssinet's teams completed the launching of the steel deck and installation of 32 stay cables on the Méchelle footbridge, a 250m long structure over the Meurthe river. A few months later on 13 July, the Millennium bridge near Podgorica (Montenegro) was opened; the structure is 173m long and is fitted with 300t of Freyssinet stay cables. In anticipation of the 2006 Africa Cup of Nations, an 80,000 seat football stadium

was constructed in Alexandria (Egypt) in 2005. The 37 stay cables on its roof were supplied and installed by Freyssinet. Work started for Freyssinet on the prestressing and cable staying of the Tabriz bridge near Lake Ourmia in the north of Iran; the structure is the country's first cable-stayed bridge. With a single 46m pylon, it is made up of two 57m spans supported by 32 stay cables split into four planes. On the Pasupati bridge in Bandung (Indonesia), the 19 stay cables (120t) supporting the central span (161m) of the main bridge were installed by teams from Indonesian subsidiary PT Freyssinet Total Technology, in conjunction with Freyssinet and Austress Freyssinet. In the town of Butterworth (Malaysia), the last stay cables supporting the 485m deck of the main Sungai Prai bridge were installed on 25 July.

During the second half of the year, the company commenced the installation of the cable staying of two other important structures, the Shenzhen Western Corridor in China, which will link China and Hong Kong (two planes of 13 cables), and the Bai Chay bridge in Halong Bay, Vietnam (see box below). The latter, which is 903m long, includes two pylons 137m high and a 435m central span supported by 112  LNG storage tanks in Altamira, Mexico
LNG storage tanks in Chengdu, China
Bai Chay Bridge, Vietnam

112 «landscaped» stay cables

In Halong Bay, Vietnam, the Bai Chay Bridge is fitted with 112 «landscaped» stay cables reminiscent of a sunset. To absorb vibrations, the stay cables are equipped with internal radial dampers (IRD), internal hydraulic dampers (IHD) and internal elastomer dampers (HDR).

## Structures



 Sungai Prai Bridge, Malaysia
Hegigio Bridge, Papua New Guinea
Kanne Bridge, Belgium



innovative Freyssinet low drag stay cables, the shaded yellow colour of which is reminiscent of a sunset. Finally, in South Carolina (United States), the Group completed the installation of the stay cables on the Arthur B. Ravenel Jr. bridge and fitted the structure with 128 dampers.

#### Suspension

Using the same or very similar techniques as cable-staying, over time the suspension of structures has become a dedicated area of research and development at Freyssinet that has culminated in the perfecting of the Cohestrand strand. Awarded the Grand Prize in the 2005 VINCI Innovation awards, in the same year Cohestrand was installed for the first time on an industrial scale on the Kanne bridge in Belgium, a 100m long, 21m wide structure that is the first suspension bridge built in Belgium since the 1960s. In Dole (France), Freyssinet formed part of a consortium to build a 76m suspended footbridge. In Papua New Guinea, Freyssinet built a bridge to carry an oil pipeline over the Hegigio gorge, a fault 420m long and 400m deep.

## Structural accessories

On the Sioule Viaduct in France, Freyssinet installed two rows of expansion joints, and fitted the safety barriers on the structure with eight Transpec paraseismic devices. In Kosovo, Freyssinet was given the job of building the Kacanik bridge, and supplied and fitted the structure with five Transpec SHA paraseismic devices. In the Balearics, Freyssinet's Spanish subsidiary supplied 54m of expansion joints for the Ferrerias bridge.

In Poland, 112 Tetron pot bearings were instal-



led on a steel structure in Wroclaw. 140 similar devices were installed in Asia on the Shenzhen Western Corridor viaduct. In Australia, 18m of expansion joints were fitted on a new viaduct across the Murray River between the towns of Robinvale and Euston (Victoria).

### Construction methods

In France, after the takeover of JMB Méthodes and its patents, in May 2005 Freyssinet was able to complete a pedestrian crossing under the railway at Villiers-sur-Marne using the Autofonçage<sup>®</sup> sinking system, and then in August the positioning of a 2,400t bridge in Saint-Chéron using the Autoripage<sup>®</sup> sliding technique. 35m long and with a 74.4 degree skew, the bridge was prefabricated close to its final location, and then slid over the ground on a lubricant bed using cables and three 1,000t jacks in just three hours.

In Morocco, on the Casablanca-El Jadida motorway route, Freyssinet supplied two mobile formwork travellers for the cantilever construction of twin bridges over the Oum er-Rebia. In Hong Kong, having completed the installation of the 113 spans of the Deep Bay viaduct using two trusses, between March and June Freyssinet carried out the lifting of the rear spans (2,000t) of the Western Shenzhen Corridor bridge. In South Korea, Freyssinet Korea took charge of the construction of the spans of the Hwaebuk 1 and 2 motorway bridges between Chungwon-gun and Chungcheongbuk-do. The two parallel decks 520 and 300m long were cast in situ using a MSS (movable scaffolding system).

Finally, in Mexico, the Group designed and supplied a mobile formwork traveller for the

casting of the segments for a 365m bridge culminating at over 100m above the Mexico City-Tuxpan motorway, near Texcapa.

## Prefabrication

At the port of Pusan (South Korea), where a new quay is to be installed in an area battered by the swell, the port authorities have decided to build a protective structure from prefabricated concrete elements. Freyssinet Korea, which is responsible for producing them, has manufactured 800 slabs, 100 prestressed concrete caissons and 500 vertical panels, using a total of 15,000m<sup>3</sup> of high-performance concrete.  Kacanik Bridge, Kosovo
Deep Bay Viaduct, Hong Kong
Oum er-Rebia bridge, Morocco
Positioning of the Saint-Chéron bridge using the Autoripage® sliding method



## Structures



 Application of cathodic protection to the Custom House Docks Development in Ireland
Strengthening of the car park of the Atlantic building using shotcrete, France
Complete rehabilitation of the Bono bridge, France

## Repair and maintenance Repair and maintenance

A world-renowned specialist in the field of structural repair, maintenance and strengthening, this year Freyssinet once again contributed to a number of projects around the world.

## Strengthening

In France, on the construction site of the LGV Est high speed line, Freyssinet France worked near Courmont to repair a cut-and-cover tunnel by applying shotcrete to a 5,500m<sup>2</sup> area. Near Paris, Freyssinet teams contributed to the strengthening of two car parks, one in Nanterre, which was not yet in operation, with the application of 500m<sup>2</sup> of carbon fibre fabric (TFC) on the cover slab, and the other in Clamart, with shotcrete. Also in mainland France, in Voreppe the group strengthened a grain storage silo around twenty metres tall. Each of its 12 cells was strengthened with shotcrete (2,900m<sup>2</sup>) before a protective coating was applied.

In the United Kingdom three of the group's subsidiaries, Freyssinet Ltd, Freyssinet France and CCSL, combined their expertise in August to restore the 2 km South Hook Jetty, Wales (see box p.15). In Ireland, CCSL applied cathodic protection to the concrete reinforcements for the Custom House Docks Development, the body responsible for the development of the international financial services centre at the port of Dublin. For its part, Hungarian subsidiary Pannon Freyssinet was involved on the site of a water treatment plant for the installation of 9t of additional prestressing to strengthen two digesters 17m high and 18m in diameter. In North Africa, Freyssinet strengthened the Jbel Oust cement works by applying 350m<sup>2</sup> of carbon fibre fabric (TFC); the work was successfully completed without interruption to the operation of the site. Near the town of Hai Van in Vietnam, during the financial year Freyssinet worked as part of a consortium to continue with and deliver part of the four tunnels that carry the Hanoi-Ho Chi Minh City railway over the Hai Van Pass. The work was carried out from a work train and consisted of renovating and securing the concrete on the walls. Finally, across the Atlantic, American subsidiary Freyssinet LLC strengthened a pipeline in Phoenix, Arizona.

## Rehabilitation

In the Morbihan region of France, Freyssinet's rehabilitation know-how was demonstrated through the complete reconstruction of the Bono bridge, a suspended structure built in 1840. In January 2005 in the Poitou-Charentes region, the company completed the general replacement of the retaining cable anchors on the deck of the Martrou transporter bridge, which has been classed as a historical monument since 1976. In the Pyrenees, the Pescadère bridge, a 24m structure built over the Gave in 1934, was strengthened using reinforced concrete, and its six bearings were replaced. In the Corrèze region, under the A89 motorway, Freyssinet repaired a culvert 190m long, 3m wide and 4.10m high, by grouting some 360m of cracks.

In Romania, Freyssinet carried out work on the Tomsani bridge (55m) and the Comanesti bridge (112m), where similar operations took place: the installation of additional prestressing with tendons and bars to establish the continuity of the decks; changing and reducing the number of expansion joints and bearings; and



the application of shotcrete to strengthen the structures and bring them into compliance with standards.

## Watertightness

The Group is a major player in water engineering and holds several qualifications, such as the Aquaplus label (which certifies the «environmental accountability of the water industry»), awarded to Freyssinet France, and once again this year it was involved in the strengthening and sealing of a number of structures.

In February 2005, almost 900m of cracks were bridged on the open-air reservoir in Dupail (Bouches-du-Rhône), a structure 30m in diameter and 6m deep. In July, Freyssinet's teams undertook the complete rehabilitation (levelling of the concrete, application of a PVC sealant and repointing of brickwork) of the 100m long, 18m high Muratte dam (Puy-de-Dôme). At the same time, the Group was using shotcrete and the application of a waterproof coating over 1,250m<sup>2</sup> to strengthen the Chocques water tower (Pas-de-Calais), which is 34m high. Some of the latest projects include the Saint-Thibault-les-Vignes purification plant (Seine-etMarne) where Freyssinet strengthened the treatment tanks with shotcrete before applying a fibreglass reinforced acid-proof epoxy coating, and treated 1,500m<sup>2</sup> of supply pipes by wet coating.

### Replacement of structural fittings

The financial year was marked in this field by the Saint-Cloud viaduct project, near Paris, which saw the fitting of 76m of expansion joints on the abutments and on the central cantilevered section. In the Midi-Pyrénées region Freyssinet replaced the 12 bearings on a bridge over the Lot.

In the north of France, the company replaced rails on the 317 and 318 overpasses on the RN30 road, which crosses the A2 motorway near the locality of La Sentinelle. In eastern Scotland in August, Freyssinet Ltd started work on the replacement of the bearings on a 2.25km bridge between Newport-on-Tay and Dundee.  Application of watertightness at the Saint-Thibaultles-Vignes water treatment plant, France
Rehabilitation of the Muratte dam, France
Pipeline strengthening in Arizona, United States

### Threefold mission in the UK

In Milford Haven, Wales (United Kingdom), Freyssinet Ltd, Freyssinet France and CCSL pooled their expertise to restore South Hook Jetty, where a liquefied natural gas (LNG) terminal is to be built. The 30-year-old, 2,000m jetty was partly corroded and required considerable repair. Supervised by Freyssinet Ltd, the work, which began in August 2005 and lasted for 18 months, consisted of Freyssinet France repairing and strengthening the damaged structures with shotcrete, and CCSL treating the reinforcements with cathodic protection.

# Soils

## 36% of turnover

I During the 2005 financial year, Reinforced Earth business was steady and particularly marked by the revival of retaining wall work in Germany, the completion of a record-breaking project in Swaziland and the development by SoilTech of the Omega synthetic connection system for connecting facing and reinforcement strips. In terms of soil improvement, Ménard Soltraitement signed significant contracts on all five continents, particularly in South Korea, Vietnam and Australia.





## Reinforced Earth

#### **Retaining walls**

In Eisenhüttenstadt, the German subsidiary of Reinforced Earth, Bewehrte Erde, designed several TerraTrel welded mesh bridge abutments, some permanent and some temporary, for the construction or reconstruction of civil engineering structures. In total, 1,320m<sup>2</sup> of walls, the highest of which measure 8.5m, were erected in just 20 days. In France, the outstanding event remains the completion of the A51 motorway (Grenoble-Sisteron) in May 2005, and the construction of 30,000m<sup>2</sup> of TerraClass retaining walls on the mountainside, for which Terre Armée designed and supplied the materials. As part of the same project, the company was involved in the construction of the Le Savoy roundabout, for which it supplied its Omega system, which comprises an innovative synthetic connection that makes Reinforced Earth structures invulnerable to corrosion.

On Tenerife in the Canary Islands, Spanish subsidiary Tierra Armada SA designed two 5,580m<sup>2</sup> and 1,312m<sup>2</sup> architectural tiered retaining walls for the Tf-142 coast road between El Guincho and Icod. In northern Portugal, the construction of a 300m Iong, 27m high (6,000m<sup>2</sup>) tiered retaining wall as part of the IP3 motorway project is of note. In Rome, the *«grande raccordo anulare»*, (ring road), was enhanced in 2005 with a number of TerraTrel retaining walls up to 350m in length and 14 m high. Further south in Caserta, near Naples, Terra Armata was involved in the construction of 11,000m<sup>2</sup> of retaining walls using TerraClass facing and green walls to strengthen a railway embankment.

In North Africa, Terre Armée SNC won its first

contract in Morocco and designed two slip road retaining walls made up of Freyssisol facing (3,000m<sup>2</sup>) between the town and port of Tangiers. In the heart of Swaziland in southern Africa, subsidiary Reinforced Earth designed and is supplying the materials for 36,000m<sup>2</sup> of Reinforced Earth structures in Mbabane. In the emirate of Abu Dhabi, Reinforced Earth has completed its collaboration on the building of a tiered wall 6,400m long and 12m tall at its highest point (32,000m<sup>2</sup>) as part of the construction of the Sheikh Zayed bridge.

Moving to Asia, in Japan, several remarkable structures have been completed by licensees, such as the 4,600m<sup>2</sup>-wall supporting the Ehime prefectural road (Shikoku Island), with almost seven terraces approximately 9m high.

Also in Japan, the construction of a 3,900m<sup>2</sup> retaining wall on the railway line between Tokai and Hokuriku in Gihu province is worthy of note. In Malaysia, group subsidiary Reinforced Earth Management Services Sdn Bhd designed and supplied all of the materials for the construction of 60 retaining walls and bridge abutments, a total of 45,000m<sup>2</sup>, as part of the Gerbang Selatan Bersepadu project in Johor. In the United States, Reinforced Earth took part in the construction of a 2,300m long slip road

## -36.000m<sup>2</sup>

ot retaining walls

In Swaziland, Africa, Reinforced Earth is currently building 36,000m<sup>2</sup> of retaining walls on the Mbabane by-pass. The project constitutes a record for the South African subsidiary and will be completed in 2007.

1 Reinforced Earth slip roads on the Sheikh Zayed bridge, Abu Dhabi 2 Dynamic replacement near Warsaw, Poland 3 Construction of TerraTrel abutments in Eisenhüttenstadt. Germany 4 Mbabane by-pass project, Swaziland 5 Le Savoy retaining wall, with Omega synthetic connections, France

# Soils



 Slip road wall on the Seminole bridge in Florida,
United States
Structure combining TechSpan arches and spandrel walls on the Princes Highway at North Kiama,
Australia
Reinforced Earth retaining wall on the A51 motorway,
France



retaining wall culminating at a height of 7.3m (7,434m<sup>2</sup>) made up of facing decorated with patterns illustrating aquatic life in Corpus Christi, Texas. In Denver, Colorado, the company continued with its collaboration on T-Rex (the Transportation Expansion Project), for which it has designed and supplied 105,311m<sup>2</sup> of TerraPlus facings for a number of road and rail structures. In Castle Rock, a slip road retaining wall designed by Reinforced Earth has been built. To blend the structure into the surrounding rocky landscape, the company reproduced the pattern chosen for the facing panels in six different variations, arranged randomly. Finally, the completion of the slip road wall for a pedestrian bridge in Seminole county, Florida, must be noted.

In Chile, Reinforced Earth technology was chosen for two major structures. The first, built for the El Teniente mine in Caletones, is a 1,935m<sup>2</sup> dump wall 6m in height. It is made up of special 20cm thick panels that can withstand temperatures of 900°C. The second project relates to the construction of a 6,035m<sup>2</sup>, 9m high Reinforced Earth wall for the Nueva Aldea cellulose plant in Chillán.

#### **Precast arches**

At the end of the financial year, French entity Terre Armée SNC, in conjunction with its Spanish sister company Tierra Armada SA, won its first contract for the construction in 2006 of two TechSpan arches on the A89 motorway near Brive. This project marks the revival of this activity in mainland France.

150km outside Doha in Qatar, on the Umm Bab-Salwa road, Reinforced Earth carried out its third TechSpan precast arch project, using elements 34m long with a 13m opening.



Finally, in Australia the middle of the year saw the completion of a 64m curved TechSpan precast arch and a slip road retaining wall (2,400m<sup>2</sup>) with TerraClass facing on the Princes Highway at North Kiama (New South Wales).

#### Foundations and grouting

In France, the teams at Ménard Soltraitement installed 680 Jet Grouting columns and used some one hundred nails to strengthen a wall running along the Isole river in the old town of Quimperlé. An identical technique was used to strengthen the foundations of Saumur castle, where the backfill had partly collapsed. Finally, in Biarritz Ménard Soltraitement built a composite retaining wall 90m long and 8m deep, combining Jet Grouting and piles to strengthen the foundations of buildings dating from the 1850s.

In Australia, Austress Menard was awarded a contract for the strengthening of a retaining wall running alongside a runway at Sydney airport reclaimed from the sea with the installation of 2,815 Jet Grouting columns. In Eildon, Victoria, Austress Menard called in three drilling machines to install 257 vertical anchors to strengthen a dam. In Papua New Guinea, it installed the anchors for the Hegigio suspended bridge.

### Soil treatment

## Soil improvement without additional material

2005 was marked by the resumption of dynamic compaction in France, with three simultaneous projects. The first was in Arbresle (Rhône) to consolidate a piece of land destined to hold a supermarket, the second in Garchizy (Nièvre) for a logistics unit, and the third in Champagné (Sarthe), for a storage warehouse. In Constanta, Romania, the company spent four months treating a 65,000m<sup>2</sup> platform of compressible loess on which a shopping centre will be built. In Spain, the technique was implemented twice by the Madrid-based subsidiary, in the Madrid suburbs for the consolidation of 25,000m<sup>2</sup> as part of the new light rail system project, and in Pau Arroyo del Fresno, to treat the base for the roads for a residential project.  TechSpan arches on the Umm
Bab-Salwa road, Qatar
Wall strengthening by Jet Grouting in Quimperlé
France
Installation of the anchors on the Hegigio Bridge, Papua New Guinea



# Soils





Business in Asia was particularly good in the field of soil improvement in 2005. In Lindong, China, South Korean subsidiary Sangjee-Menard supervised the dynamic compaction consolidation work on an area destined to take eight large tanks for a new flavourings factory. The company also carried out soil improvement in South Korea, at the port of Kwang Yang (see box below).

Ménard Soltraitement used the same process Menard Vacuum in Ca Mau in the south of Vietnam, to consolidate the first section of a 90,000 m<sup>2</sup> marshy area on which a combinedcycle electric power station is to be built. Finally, near Kuala Lumpur in Malaysia, a soil improvement project using dynamic compaction and ballasted columns was carried out in Desa Park for a vast building complex.

In the Americas, worthy of note is the Minatitlán site near Veracruz (Mexico), where Ménard Soltraitement used dynamic compaction for the anti-liquefaction treatment of a 23,000m<sup>2</sup> platform within the Lazaro Cardenas refinery. Further south in Trinidad and Tobago, the company carried out the anti-liquefaction treatment of a 25,000m<sup>2</sup> plot of land to take buildings as part of the Port of Spain, International Waterfront project.

## Soil improvement with additional material

In Europe, Ménard Soltraitement's business continued to grow. Two controlled modulus column (CMC) projects were completed in Spain, with 12,000m in Barcelona to consolidate part of the high speed train line, and 25,000m in Cartagena to strengthen the foundations of a liquefied natural gas storage tank.

In Germany, the financial year first saw the completion of two large projects in Bremen for

a logistic platform. Then, over 10,000 CMCs were installed to strengthen compressible soil underneath the biggest logistics platform (40,000m<sup>2</sup>) in Hamburg.

In Calarasi, Romania, in order to improve the soil stability under the new Saint-Gobain flat glass plant Ménard Soltraitement installed a network of 3,900 CMCs combined with a 60cm thick sand-gravel mixture distribution cushion. In France, 1,700 CMCs (10,000m) were installed to strengthen the soil at the new water treatment plant for the urban community of Brive.

 Soil consolidation by installation of controlled modulus columns in Calarasi, Romania
Soil improvement using the Menard Vacuum process, Ca Mau, Vietnam



## • 350.000m<sup>2</sup> of consolidated land

Land has been reclaimed from the sea at the port of Kwang Yang, South Korea. In 2005 Ménard Soltraitement handed over a 295,000m<sup>2</sup> platform consolidated using the Menard Vacuum process (atmospheric consolidation) before starting work on a new 55,000m<sup>2</sup> section.

## Soils



 Installation of CMCs on the Mondragon site, France
Installation of CMCs in Pennsylvania, United States

In Mondragon, in the Vaucluse region, Ménard Soltraitement used its new, more powerful and more efficient stone column machine to consolidate a 5,700m<sup>2</sup> platform for an industrial compost production site at a record rate. The new crane was then used alongside two conventional machines in Beaune, allowing for the installation of 3,000 stone columns in just



## 15.000m<sup>2</sup>

Near Warsaw, Poland, Ménard Soltraitement, in conjunction with Freyssinet Polska, carried out soil inprovement using 15,000m<sup>2</sup> of dynamic replacement on marshy land on which the backfill for a future motorway is to be placed.

five weeks for the construction of a 55,000m<sup>2</sup> logistics platform.

Near Warsaw in Poland, Ménard Soltraitement worked with Freyssinet Polska to install 15,000m<sup>2</sup> of dynamic replacement along the Vistule river to consolidate the base for a road to be built over 5.5m of backfill (see box below).

At the beginning of the year in Ras Laffan, Qatar, VINCI Construction Grands Projets handed over the consolidation of the foundations of a 76m diameter liquefied natural gas storage tank to Ménard Soltraitement. Following this project, for which a solution combining dynamic replacement and rammed earth was implemented, the company was entrusted with the soil consolidation using dynamic replacement for 40 storage tanks at four purification plants as part of the Qatar Gas II project.

In North America, the year saw a wealth of achievements for Ménard Soltraitement subsidiary DGI-Menard. In June, the subsidiary installed 135 controlled modulus columns in six days to strengthen the soil at a new service station in Monongahela, Pennsylvania (USA). In August it installed 350 CMCs to improve the soil for a building complex on Kenilworth Avenue in Washington DC. Finally, DGI-Menard consolidated the soil for a future tool warehouse in Quebec, installing 1,600 CMCs in just three weeks - a fantastic performance on its first Canadian project.





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