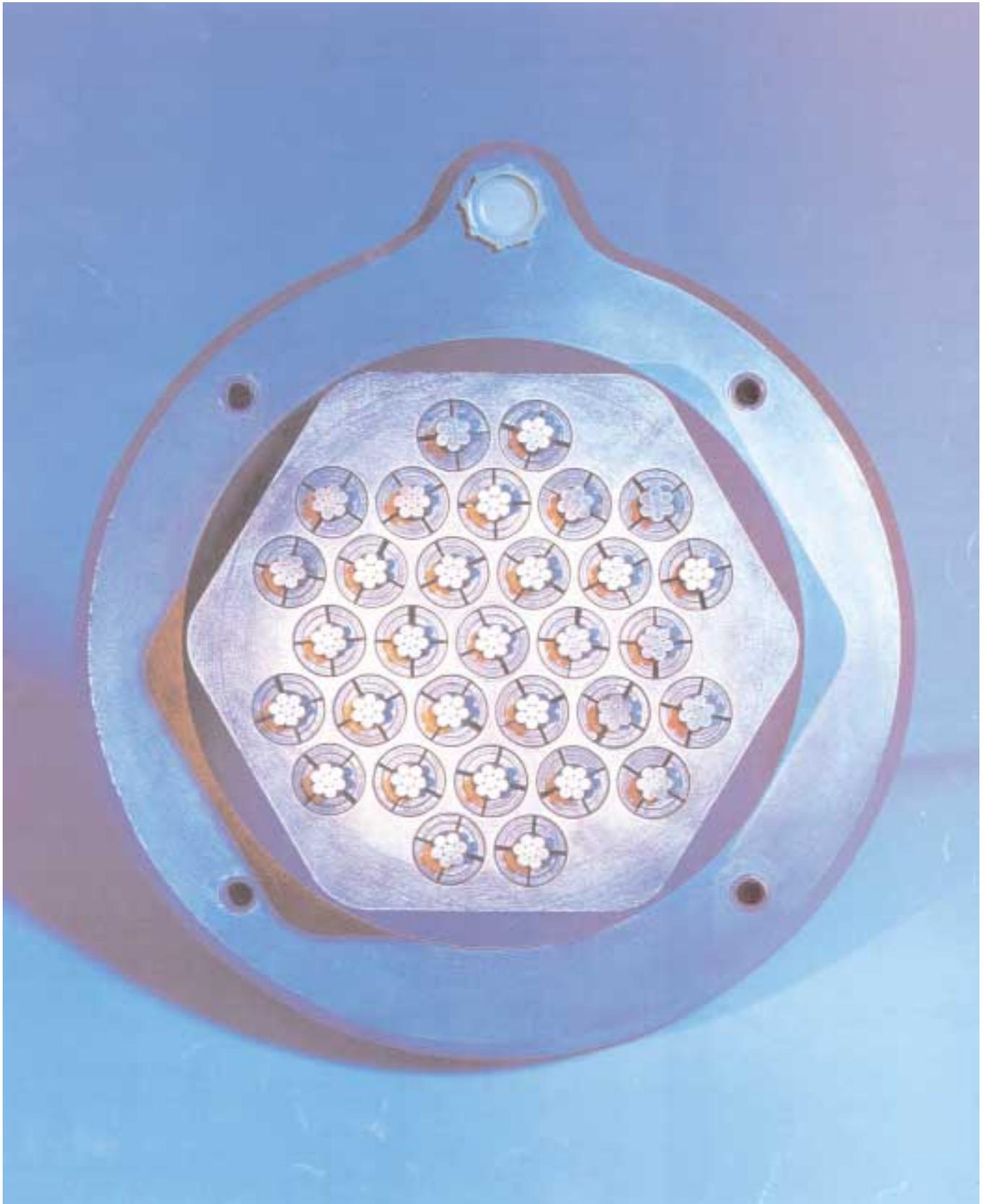


# VSL NEWS

N U M B E R   O N E   1 9 9 3



## VSL and its Environment on the Move

**1993** will be an important year for Europe. The European Community opens its markets and permits cross border activity without major restrictions. The home country of our Group Headquarters recently in a vote said no to Europe. Fortunately, VSL has for a long time confirmed its capability for cross border activity and will not be affected by that vote. VSL has also proven its flexibility to adapt to a changing environment as well as to accept new challenges. As per January 1st, 1993, VSL Europe has been divided into two operating units. The new operating unit **VSL Western Europe** covers France, Benelux, Spain, Portugal, Italy and the United Kingdom. The new unit is headed by **Pierre Bron**, a long-standing VSL leader, with the Regional Headquarters at Arpajon near Paris.

The remaining part of Europe belongs to the operating unit **VSL Eastern Europe**, headed by **Frédéric Regard**, with its Regional Headquarters unchanged at Lyssach in Switzerland. That operating unit includes the newly opened **VSL Office in Prague** under the direction of **Miroslav Vejvoda**. Miroslav was born in Czechoslovakia and has been with VSL for many years, with his last assignment as Branch Manager of VSL Atlanta, USA.

**The VSL Prize** is a recently issued competition for graduates from Swiss Federal Institute of Technology Zurich (ETHZ). The topic for the thesis in 1992, defined and guided by Prof. Dr. Peter Marti, was the construction of a bridge including all aspects of design, statics and construction. The winner of the 1992 prize, **Armand Fürst**, has given an innovative solution in a promising direction. It is the use of different materials combined with post-tensioning in order to obtain an optimum technical, aesthetic and economical structure. Armand Fürst's solution is in line with VSL's aim: To encourage a creative corporate culture which brings optimized construction solutions to you, our dear reader and construction partner! 



*Reto Jenatsch*  
Group Chief Executive Officer



Pierre Bron



Miroslav Vejvoda



Armand Fürst

### Cover

It is not modern art – it is the face of VSL's new post-tensioning COMPOSITE SYSTEM

### Highlights of this Issue:

- 4 VSL joins forces with LCL PARAFIL for non-metallic tendons
- 7 A post-tensioned raft slab for the Hilton Hotel in Guam
- 8 VSL Hong Kong's involvement in Asia's tallest building
- 11 A 20th Century Master Piece in Colorado
- 15 6550 VSL permanent fully corrosion protected rock anchors at Atatürk Dam

## Durability of Post-Tensioned Concrete Questioned

● The Department of Transport has outlawed construction of new post-tensioned prestressed bridges with grouted ducts until it has reviewed design and construction standards. Chlorides in de-icing salts are being blamed for corrosion of the steel prestressing strands in the bridges.

● The prosecution of Birkenhead company Demolition UK for the death of a worker in London was said to end on Monday because the

The new VSL COMPOSITE SYSTEM gives the answer.

In its **CS-PLUS** configuration a unique plastic duct and plastic trumpet system integrated with the anchorages provides complete encapsulation of the post-tensioning steel. In its **CS-SUPER** configuration even electrically isolated tendons are made available.

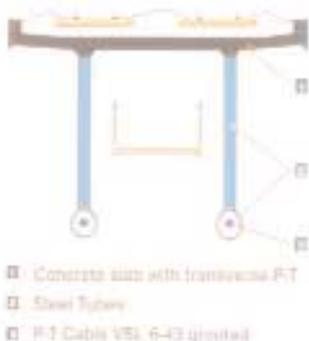
Combined with the **VSL Vacuum Grouting** method and the **VSL Electrical Resistance Measurement** method, the VSL COMPOSITE SYSTEM allows for significant improvement in the quality of new construction as well as for monitoring of the tendons during their full design life time. 



With the press release of September 25, 1992, the British Department of Transport is banning grouted post-tensioning for new construction. The main area of concern is corrosion of the prestressing steel resulting from improperly grouted tendon ducts.

## The VSL Prize goes to a Composite Construction

The VSL Prize 1992 (see Editorial) was awarded to a bridge project which combines concrete, steel and post-tensioning in a very original way.



## Non-Metallic Tendons

For a leading specialist contractor like VSL it is imperative to keep up with the rapid development of new materials and technologies. Among the developments VSL has taken a serious interest in are non-metallic tendons. While still rarely specified today, the potential of non-

metallic tendons in the future should not be under-estimated. Thanks to their low specific weight and high tensile strength non-metallic tendons could be used for long stay cables or suspension cables, where steel cables would be at their limit due to their self weight. The excellent

corrosion and chemical resistance of non-metallic tendons makes them ideally suited for structures in aggressive environments. Savings on elaborate corrosion protection systems can be expected when non-metallic tendons are used. Other potential applications are structures where high magnetic fields would interact with conventional steel reinforcement, such as magnetic monorail train viaducts, or where the presence of steel reinforcement would adversely affect the use of the structure, such as floors supporting highly sophisticated computer equipment.

In 1991 VSL obtained samples of PARAFIL tendons (a product made by the British company "Linear Composites Ltd") in order to carry out some preliminary testing. PARAFIL cables consist of a tightly packed core of parallel aramid yarns (e.g. Kevlar 49) encased in an extruded sheath which provides shape, toughness and mechanical protection. The tendons are anchored by means of special mechanical terminations based on the spike and cane principle. The primary objective of the test was to gather first-hand experience with PARAFIL tendons, in particular the practical handling and stressing of the tendons and their anchorages. A further objective of the test was to determine the friction losses occurring when stressing a PARAFIL tendon that is deviated over a saddle, and the behaviour of the sheath material in the saddle region. Finally, the test was to demonstrate the long-term behaviour of a stressed PARAFIL tendon.

A 7.6 m long sample with a nominal breaking load of 600 kN was tested in the VSL testing facility in Lyssach (near Berne). The tendon was deviated by 17.8° over a steel saddle with a 2.5m radius. Both tendon ends were connected to hydraulic jacks through special couplers. With this arrangement the tendon could first be stressed to 40 % of its nominal capacity, and then pulled under load



<sup>1</sup> PARAFIL is a registered Trade Mark of Linear Composites Ltd.

through a total of 640 mm in one direction, thus simulating the elongation of a long external prestressing tendon being stressed. The tendon was pulled back and forth 3 times in this way, giving a total relative movement with respect to the deviation saddle of 1.92 m. Finally,



a long-term load test was carried out by keeping the load constant at 40 % of the nominal breaking load over a period of 11 days, in order to determine the creep behaviour of the material.

The test showed that handling, stressing and anchoring of PARAFIL cables are suitable for practical applications as unbonded prestressing tendons, and that the sheathing material does not suffer any damage from extensive movement over a deviation saddle under load.

*Dr. Franz Zahn  
VSL International Ltd.  
Berne, Switzerland*



The encouraging conclusions of a test on a PARAFIL cable prompted VSL to sign a cooperation agreement with Linear Composites Ltd (LCL) to jointly market VSL-LCL PARAFIL tendons world wide. Targeted applications will be unbonded prestressing tendons for concrete structures, such as bridges, buildings, masts and towers, storage tanks, etc. The tendons could be either inside or external to the concrete section. Initially tendons with nominal breaking loads of 1'000 kN, 2'000 kN and 3'000 kN will be available.

VSL-LCL PARAFIL tendons have outstanding qualities†:

- excellent corrosion resistance
- high resistance against abrasion
- excellent chemical resistance
- high resistance against ultra-violet degradation
- excellent fatigue characteristics
- safety over a wide temperature range

The high durability of VSL-LCL PARAFIL tendons ensures a long and essentially maintenance free life. The tendons are fully pre-fabricated and delivered to site on coils.

Extensive testing both by the manufacturer and by independent testing laboratories has been carried out, including tests of concrete beams with PARAFIL as external prestressing tendons. The VSL-LCL PARAFIL Tendons are now ready for practical applications! 

## Tawisakale Workshop & Warehouse, Porergera PNG

**C**lough Engineering, in joint venture with Brice Engineers and with assistance from VSL Australia won a major workshop and warehouse at the Forgera gold mine in the highlands of Papua New Guinea. The workshop and warehouse serves as a maintenance facility for mining trucks up to 250 tonnes gross weight. Project consulting engineers, Bonacci Winward, also chose permanent VSL Stressbar anchors for the Vierendeel core frame warehouse support to provide resistance against transverse earthquake forces.



The building used a 300 mm thick slab on grade construction measuring 110 m x 44 m. It was post-tensioned in borin directions with bonded tendons at 1200 mm centres and constructed in 5 pours. //

---

*Barry Story  
VSL Prestressing (Aust.) Pty. Ltd.  
Geebung, QLD, Australia*

**Post-tensioning slab on grade provides strength and durability.**



## Metway Centre

**T**he Metway Centre project is currently being constructed by F.A. Pidgeon & Son Pty. Ltd. and on completion will become the head office of the Metway Bank Group in Brisbane, Queensland. VSL was awarded the post-tensioning of the floors and transfer beams as well as the temporary and permanent rock anchor works associated with the foundation excavation.

The structure is a 22 storey office tower with the typical floors constructed using 400 mm deep post-tensioned beams which span 11.5 m between edge beam and core walls and columns. Transfer beams at the Mezzanine level and level 17 use up to five 27x12.7 mm strand tendons to accommodate changes in the building plan area. //

---

*Barry Story  
VSL Prestressing (Aust. ) Pty. Ltd.*



**A contract package of post-tensioning and ground anchors for VSL.**

*Geebung, QLD, Australia*



VSL's foundation alternative improved constructability

## Hilton Hotel Guam 1992

**Foundation Raft†:** A twelve storey extension to the existing Hilton Hotel on Guam had the foundation designed as a reinforced concrete mat with beam depths of nine feet and an average slab thickness of three feet. This posed a major problem as the expected water table depth below the top of the slab during construction was estimated at six feet.

Responding to the Contractor's request, VSL designed an alternative post-tensioned raft slab which kept the sort of the beams above the high water mark, significantly reduced material content and allowed for a normal construction procedure to be followed without the need for the dewatering of excavations. The ground beams were typically reinforced with 5 No. 27 x 12.7 mm strand cables in each with the slab stressed with 12 x 12.7mm strand cables at five feet centres.

The slab was constructed in three pours and was stressed in one operation. Stage stressing was not required as transfer condition was satisfied by utilizing concrete depths and strategic profiling of the cables.

### Transfer Beams – Level Four†:

The Level 4 slab was the junction between the non typical levels (restaurants, ballroom etc) and the typical hotel suite levels. The slab was designed utilising three main post-tensioned beams linked with reinforced beams spanning 35 feet to carry the load of the typical walls above to the main beams.

The two outer main beams have a maximum span of 52 feet and each was post-tensioned with 5 No. 25 x12.7 mm strand cables. The central main beams have a maximum span of

65 feet and were post-tensioned with 5 No. 27 x 12.7 mm strand cables.

VSL offered a flat slab alternative deleting the "linking" beams thus greatly simplifying the formwork and reducing the total material content. The post-tensioned 12 inch slab spanning the 35 feet between main beams was reinforced with 5 x 12.7 mm strand slab cables at 40 inch centres. The slab was constructed in three pours and stressed in two stages. The first stage allowed the full stressing of the flat slab and the complete removal of all formwork and backpropping. This allowed early access for finishing trades and the on site storage of materials. ▀

---

*Ian Craigie  
VSL Prestressing (Guam) Inc.  
Guam*

## Central Plaza reaches New Heights

**V**SL Engineers (HK) Ltd. successfully completed the erection of a 125 tonne steel mast making the 78 storey Central Plaza, Asia's tallest building (378.4 m).

VSL was responsible for the engineering method, fabrication, on site assembly and erection of the 69 metre long mast.

Prefabricated segments (up to 10 tonnes each) were delivered to site and lifted one by one to the top of the building. The mast sections were then assembled and welded together inside a tilt (elevator) shaft at the 69th floor. The fully assembled mast was lifted vertically 47 meters to its final position using VSL Heavy Lifting jacks.

The erection of this mast within 10 mm of its theoretical position is a testament to VSL'S commitment to quality engineered solutions. **///**

---

*Michael Phillips, Mobashir Zia  
VSL Engineers (HK) Ltd.  
Hong Kong*

**Central Plaza illuminated.**



**The VSL (HK) team at the top guide prior to jacking.**

**Central Plaza dominates the Wanchai waterfront**



## VSL Redland – Off and running at the Royal Hong Kong Jockey Club

Issue Number One, 1992, of VSL News announced the birth of VSL Redland. With this issue, we can announce VSL Redland's "baptism under fire".

This company's first contract was to supply prestressed beams and prestressed bleachers for the Royal Hong Kong Jockey Club Stadium Redevelopment. Some 300 beams and 1350 bleacher units were manufactured and delivered between May and December 1992.

VSL Redland was responsible for both design and manufacturing. Some 130 different beam types, approximately 900 different bleacher types, a fast track schedule and an international cast of players made this a challenging project.

Job coordination, production and delivery planning were done by our Hong Kong office. Design and shop drawings were done by Holmes Consulting Group in New Zealand.

VSL Redland shapes up new stadium.



Elements were manufactured at our facilities near Macau and were barged and then trucked to the project site in Hong Kong.

The architects for the project are Hellmuth, Obata and Kassabaum of Kansas City, Missouri, the engineers are Ove Arup & Partners of Hong Kong and the Contractors are Dragages et Travaux Publics Limited of Hong Kong plus their foundation subsidiary Intrusion Prepak (Hong Kong) Ltd. //

---

*Russell Poole  
VSL Redland Concrete Products Ltd.  
Hong Kong*





## Giant Safety Wall for Cryogenic Tank

VSL Japan is nearing completion of a safety wall for a new 43,000 tonne capacity LPG tank. The project is at the GFNFRAL OIL COMPANY'S Kawasaki tank farm facilities. The safety wall provides protection for the steel tank. It will also contain a spill in the event of a steel tank leak or failure.

The 550 mm thick safety wall is post-tensioned horizontally and vertically. The clearance between the post-tensioned safety wall and the 59.6 m diameter x 30.7 m high steel tank is a mere 1.3 m. //

---

*Shusuke Sakata  
VSL Japan Corporation  
Tokyo, Japan*

Safety wall takes shape with tendons.

## VSL Japan Post-Tensions Parking Tower

CHIBA SHINMACHI'S 19 storey multi-use facility contains car parking areas for 1800 cars on the 5th to 17th floors.

A detached external spiral ramp provides access to the 5th floor, along with an internal spiral ramp at the center of the parking tower.

The cylindrical tower walls are slipformed cast-in-situ concrete. Ramps consist of precast fan-shaped ribbed segments. Radial tendons in the ribs stress the precast concrete ramps to the cast-in-situ walls. For continuity, segments were stressed with circumferential tendons located along the edge of the ramp way. //

---

*Shusuke Sakata  
VSL Japan Corporation  
Tokyo, Japan*

VSL tendons integrate into multi discipline construction.



## New Elevated Freeway Access Ramps utilize VSL External Tendons

Construction is currently under way on the widening and modernization of the highly congested Noah Central Expressway in Dallas, Texas. This ambitious, 10-year project along a 10-mile

(16 km) stretch of the highway will include new highway interchanges, additional roadway, improved highway access and below grade transit tunnels. VSL was awarded the contract for the

design and supply of the post-tensioning system used in two ramp bridges within the first phase of the project.

Each bridge utilizes a single-cell box girder configuration with both longitudinal and transverse post-tensioning. The bridges are cast-in-place on falsework and are comprised of 17 individual spans with a total length of 1,980 ft. (604m). The longitudinal tendons consist of both embedded and external grouted multistrand tendons while the transverse road-deck tendons utilize individually grouted monostrands. 



*Michael G. Powell*  
VSL Corporation  
Grand Prairie, Texas

Transverse road-deck grouted monostrands utilize custom fabricated anchorages.

## A 20 th Century Master Piece is Completed in Colorado

The final segment of Interstate Highway 70 has been completed in a remote area of Colorado near Glenwood Springs, 160 miles (260 km) west of Denver. Culminating over twelve years of continuous construction, the final 12 mile (19.5 km) section of four lane traffic in Glenwood Canyon was recently opened at a total cost of approximately \$ 484 million US.

The distinguishing characteristic of the Glenwood Canyon project has been its extremely limited access in an environmentally sensitive area. The Colorado River Gorge is over 2000 ft. (600 m) deep with vertical walls of weathered granite on both sides†; during initial planning it was considered by critics to be far too narrow to accommodate an interstate route. Environmental restoration, including extensive revegetation and terracing and staining of fractured rock sur-  
VSL a part of Interstate Highway's Quality.

faces to match the existing, has given the project the reputation of being one of the great pieces of public architecture of the 20th century.

VSL'S involvement included the supply and installation of post-tensioning

materials for numerous box girder bridges, rock anchors, and miles of cantilevered roadway slabs. 

*Daniel Harger*  
VSL Corporation  
Denver, Colorado



## Post-Tensioning helps Minnesota Bridge carry more Lanes

When the State of Minnesota decided to strengthen and extend the pier caps on the Blatnik Bridge in Duluth, Minnesota, to accommodate an additional north and south traffic lane, post-tensioned concrete was selected as the preferred method of strengthening the extended pier caps.

The bridge spans more than 8,000 ft. (2,440 m) between abutments. - Thirty-nine of the existing 43 pier caps will be strengthened longitudinally and transversally with post-tensioning tendons. Construction began in the summer of 1992, with completion anticipated in spring 1993.

VSL'S value-added approach reduced the quantity of transverse tendons by 33 % and represented significant time and construction savings. In addition to proposing and implementing the reduction in transverse tendons VSL'S services include furnishing the stressing and grouting equipment, and providing technical assistance. ▀



*Marty Mikula  
VSL Corporation  
Burnsville, Minnesota*

VSL adds value to this bridge augmentation.



## Storebaelt West Bridge progressing well

**W**hen completed, the bridge and tunnel connections being built across Denmark's Storebaelt to connect the islands of Fyn and Sjælland will have a major influence on the country's traffic, permitting approximately 13'000 cars and 200 trains to cross the Belt daily.

One of the main elements of this project is the Storebaelt West Bridge, a 6.6 km long road and rail bridge built from post-tensioned concrete by the European Storebaelt Group (ESG). The bridge will have a navigation clearance of 18 m and consists of 51 spans of approximately 110m and 12 spans of 81 m. The tender design of the road and rail superstructures was done by VSL engineers and the post-tensioning is being performed by VSL Storebaelt J.V., a joint venture between VSL (Switzerland) Ltd. and Internordisk Spännarmring NB, the Scandinavian licensee of VSL. VSL is supplying a total of over 12'000 tonnes of post-tensioning material.

In August 1992, half-completion of the structure coincided with the visit of a large group of VSL staff from

Switzerland. Many of the more than 100 Swiss visitors were or are working on this project. The site visit included a tour of the 3 km<sup>2</sup> prefabrication yard and gave the participants an unforgettable,

**Denmark's link is half way.**

first hand view of the impressive bridge structure. 

*Toni Sieber  
VSL (Switzerland) Ltd.  
Lyssach, Switzerland*



## Retained Earth gets a Start in Europe

**W**ith the award of earth retaining walls on the A5-Auto Estrada da Costa do Estoril in Portugal VSL Prequipe had been successful in introducing the first application of Retained Earth in Europe. Wall construction began in June 1992 and is now well underway. VSL Prequipe has thus far secured additional contracts for a combined total area in excess of 14'000 m<sup>2</sup>.

VSL (Switzerland) Ltd. is actively marketing the Retained Earth System in several European countries, Africa and the Middle East. 

*Isam S. Sahawneh  
VSL (Switzerland) Ltd.  
Lyssach, Switzerland*



Retained Earth panels support embankment of a widened highway in Portugal.

## VSL Lifts Water Tower

The Maikkula Water Tower in Oulu, Finland, was planned and built by the Town Council to increase the capacity of the towns water supply by 4'000 m<sup>3</sup>.

The tower construction required VSL'S Heavy Lifting Capability. The water tank has an overall diameter of approx. 40 m and a depth of approx. 11 m. The total weight of the tank (ind. the supporting columns) is in excess of 3000 tonnes and the overall height of the tower is 55 m.

VSL strand lifting units were used to tilt the tank in two stages. In a first stage it was lifted approx. 13 m to install the concrete encased steel columns supporting the water tank. In a second stage the tank was lifted another 23 m. After pouring the lower ring beam to support the columns the load of the tank was transferred from the VSL lifting units to the concrete structure.

The aesthetically pleasing results speak for themselves. //

*P. Leuenberger  
VSL (Switzerland) Ltd.  
Lyssach, Switzerland*



VSL heavy lifting serves the needs of this water tower construction.

## CMC Methanol Plant Point Lisas, Trinidad – An Application of VSL Heavy Lifting

A part of Trinidad's natural gas reserves are converted into Methanol. TO increase the production capacity of the Point Lisas complex, a second plant is presently being built. VSL Heavy Lifting participated in this project.

The equipment of the plant comprises 2 major vessels. One is a free-standing refining column of 340 tonnes weight and 63 m height†; the other, rather stocky convertor vessel of 250 tonnes sits on an 8 m high concrete pedestal. While smaller vessels were placed by means of the 150 tonne crawler crane available on site, contractor Proman of D\_sseldorf had to contact a heavy lifting specialist for the 2 heavier vessels. VSL submitted a proposai for a tower lifting system without guy wires, which found the approval of the contractor.

VSL designed temporary steel gantries which are based on a modular tower system. These were constructed of standard and custom made beams and components. For the lifting of the vessels, VSL used its proven and reliable hydraulic strand lifting system. Erection of the temporary structures was supervised by VSL and carried out by Proman, with local workforce. //

*Erich M'schler  
VSL (Switzerland) Ltd.  
Lyssach, Switzerland*



VSL Lifting Towers without guy wires solve Trinidad Lifting problem.

# The World's largest Rock Anchor Job nears Completion

The Atatürk Dam and Hydroelectric Power Plant, located on the Euphrates river in the south eastern part of Turkey, is arguably one of the largest rockfill dams in the world. The spillway has a maximum water discharge capacity of 17'000 m<sup>3</sup>/sec.

The base slab of the stilling basin, side and end walls are secured by more than 6550 VSL permanent fully corrosion protected rock anchors, varying from 6 to 17 strands with an average length of 20 meters.

---

Atatürk Rock Anchor Testing Programme  
 37 pull-out tests  
 24 suitability tests  
 54 comprehensive production anchors  
 183 monitored (short term) production anchors  
 All production anchors proof loaded to 80 %

---

Harsh climatic conditions and extreme dusty site conditions, further exacerbated by dust generated from the down ñ the hole - hammer drilling rigs, combined to make working conditions most demanding. Additionally, the extreme artesian water conditions encountered would have put to question the corro-



Spillway and stilling basin. sion protection of the free length of a considerable number of anchors. A packer that permitted pressure grouting of the anchors was specially developed to overcome this problem. █



Ground anchors with a VSL packer being homed.

---

*Robert Baumann  
 VSL (Switzerland) Ltd.  
 Lyssach, Switzerland*



Atatürk Dam has an embankment volume in excess of 84 million cubic meters.



**PUBLISHED BY** VSL International Ltd., P.O. Box 7124, CH – 3001 Berne / Switzerland, Tel 41 - 31 - 66 42 22, Fax 41 - 31 66 42 50  
Editor: Therese Wenger

#### ADDRESSES OF VSL COMPANIES AND LICENSEES

#### SOUTH EAST ASIA / AUSTRALIA

##### AUSTRALIA

VSL Prestressing (Aust.) Pty. Ltd.  
6 Pioneer Avenue  
Thornleigh, NSW 2120  
Tel 61 - 2 - 484 59 44  
Fax 61 - 2 - 481 01 60

##### AUSTRALIA

VSL Prestressing (Aust.) Pty. Ltd.  
VIRGINIA, QLD  
Tel 61 - 7 - 265 64 00  
Fax 61 - 7 - 265 75 34

VSL Prestressing (Aust.) Pty. Ltd.  
NOBLE PARK, VIC  
Tel 61 - 3 - 795 03 66  
Fax 61 - 3 - 795 05 47

##### BRUNEI DARUSSALAM

VSL Systems (B) Sdn. Bhd.  
BANDAR SERI BEGAWAN  
Tel 673 - 2 - 22 91 53, - 22 18 27  
Fax 673 - 2 - 22 19 54

##### GUAM

VSL Prestressing (Guam), TUMON  
Tel 67 - 1 - 646 80 61  
Fax 67 - 1 - 649 08 50

##### INDONESIA

PT VSL Indonesia, JAKARTA  
Tel 62 - 21 - 570 07 86  
Fax 62 - 21 - 581 217

##### MALAYSIA

VSL Engineers (M) Sdn. Bhd.  
KUALA LUMPUR  
Tel 60 - 3 - 242 47 11  
Fax 60 - 3 - 242 93 97

##### NEW ZEALAND

Precision Precasting (Wgtn.) Ltd.  
OTAKI  
Tel 64 - 694 81 26  
Fax 64 - 694 83 44

##### SINGAPORE

VSL Singapore Pte. Ltd., SINGAPORE  
Tel 65 - 235 70 77/9  
Fax 65 - 733 86 42

##### THAILAND

VSL (Thailand) Co., Ltd., BANGKOK  
Tel 66-2-237 32 88/89/90  
Fax 66-2-238 24 48

#### NORTH EAST ASIA

##### HONG KONG

VSL North East Asia  
Regional Office  
Bank of America Tower, Suite 1407  
12 Harcourt Road  
Central, Hong Kong  
Tel 852 - 537 93 90  
Fax 852 - 537 95 93

##### HONG KONG

VSL Engineers (HK) Ltd.  
WANCHAI / HONG KONG  
Tel 852 - 520 16 00  
Fax 852 - 865 62 90

VSL Redland Concr. Prod. Ltd.  
WANCHAI, HONG KONG  
Tel 852 - 598 72 28  
Fax 852 - 598 50 87

##### JAPAN

VSL Japan Corporation, TOKYO  
Tel 81 - 33 - 346 89 13  
Fax 81 - 33 - 345 91 53

##### KOREA

VSL Korea Co., Ltd., SEOUL  
Tel 82 - 2 - 574 - 82 00  
Fax 82 - 2 - 577 00 98

##### TAIWAN

VSL Systems (Taiwan) Ltd., TAIPEI  
Tel 886 - 2 - 707 72 53  
Fax 886 - 2 - 704 04 63

#### NORTH AMERICA

##### USA

Corporate Office  
VSL Corporation  
1671 Dell Avenue  
Campbell, CA 95008  
Tel 1 - 408 - 866 67 77  
Fax 1 - 408 - 374 41 13

##### USA

VSL Corporation NORCROSS, GA  
Tel 1 - 404 - 446 - 30 00  
Fax 1 - 404 - 242 74 93

VSL Corporation GRAND PRAIRIE, TX  
Tel 1 - 214 - 647 - 02 00  
Fax 1 - 214 - 641 11 92

VSL Corporation LAKEWOOD, CO  
Tel 1 - 303 - 239 66 55  
Fax 1 - 303 - 239 66 23  
VSL Corporation EWA BEACH, HI  
Tel 1 - 808 - 682 28 11  
Fax 1 - 808 - 682 28 14

VSL Corporation  
HUNTINGTON BEACH, CA  
Tel 1 - 714 - 894 58 85  
Fax 1 - 714 - 894 88 96

VSL Corporation MIAMI, FL  
Tel 1 - 305 - 592 50 75  
Fax 1 - 305 - 592 56 29

VSL Corporation EAGAN, MN  
Tel 1 - 612 - 456 09 86  
Fax 1 - 612 - 456 92 81

VSL Corporation LANGHORNE, PA  
Tel 1 - 215 - 750 66 09  
Fax 1 - 215 - 757 03 81

VSL Corporation CAMPBELL, CA  
Tel 1 - 1 - 408 - 866 50 00  
Fax 1 - 408 - 379 62 05

VSL Corporation LYNNWOOD, WA  
Tel 1 - 206 - 771 30 88  
Fax 1 - 206 - 672 30 20  
VSL Corporation SPRINGFIELD, VA  
Tel 1 - 703 - 451 43 00  
Fax 1 - 703 - 451 08 62

##### CANADA

Canadian BBR (1980) Inc.  
AGINCOURT, ONT  
Tel 1 - 416 - 291 - 16 18  
Fax 1 - 416 - 291 99 60

#### EASTERN EUROPE

##### SWITZERLAND

VSL (Switzerland) Ltd.  
Bernstrasse 9  
3421 Lyssach  
Tel 41 - 34 - 47 99 11  
Fax 41 - 34 - 45 43 22

##### GREECE

VSL Systems S.A., ATHENS  
Tel 30 - 1 - 363 84 53  
Fax 30 - 1 - 360 95 43

##### NORWAY

VSL Norge A/S, STAVANGER  
Tel 47 - 4 - 56 37 01  
Fax 47 - 4 - 56 27 21

VSL OFFICE PRAGUE  
Václavské náměstí  
110 00 PRAHA 1  
Tel 42 - 2 - 2 - 236 69 92  
Fax 42 - 2 - 236 73 59

#### WESTERN EUROPE

##### FRANCE

VSL France S.à r.l.  
110 Avenue Verdun  
91526 EGLY  
Tel 33 - 1 - 69 26 14 00  
Fax 33 - 1 - 60 83 89 95

##### SPAIN

VSL Iberica S.A., MADRID  
Tel 34 - 1 - 556 18 18  
Fax 34 - 1 - 597 27 01

##### PORTUGAL

VSL Prequipe SA, LISBOA  
Tel 351 - 1 - 793 85 30  
Fax 351 - 1 - 793 09 01

##### ITALY

PRECO S.r.l., MILANO  
Tel 39 - 2 - 481 80 31  
Fax 39 - 2 - 481 64 15

#### LICENSEES

##### AUSTRIA

Sonderbau GesmbH, WIEN  
Tel 43 - 222 - 892 02 80  
Fax 43 - 222 - 892 02 80 33

##### BRAZIL

Rudloff-VSL Industrial Ltda.  
SAO PAULO  
Tel 55 - 11 - 826 04 55  
Fax 55 - 11 - 826 62 66

##### GREAT BRITAIN

Balvac Whitley Moran Ltd.  
LIVERPOOL  
Tel 44 - 51 - 549 21 21  
Fax 44 - 51 - 549 14 36

##### PERU

Pretensado VSL del Peru SA, LIMA  
Tel 51 - 14 - 76 - 04 23, -76 04 26  
Fax 51 - 14 - 76 04 77

##### BOLIVIA

Prestress VSL of  
Bolivia Jauregui Ltd., LA PAZ  
Tel. 591 - 2 - 321 874  
Fax 591 - 2 - 371 493

##### CHILE

Sistemas Especiales de  
Construccion SA, SANTIAGO  
Tel 56 - 2 - 233 10 57  
Fax 56 - 2 - 231 12 05

##### INDIA

Killick Prestressing Ltd., BOMBAY  
Tel 91 - 22 - 578 44 81  
Fax 91 - 22 - 578 - 47 19

##### SOUTH AFRICA

Steeledale Systems (Pty.) Ltd.  
JOHANNESBURG  
Tel 27 - 11 - 613 77 41/9  
Fax 27 - 11 - 613 74 04

##### NETHERLANDS

Civielco B.V., AT LEIDEN  
Tel 31 - 71 - 76 89 00  
Fax 31 - 71 - 72 08 86

##### SWEDEN

Internordisk Spännarmring AB  
DANDERYD  
Tel 46 - 8 - 753 02 50  
Fax 46 - 8 - 753 49 73