VSL NEWS

NUMBER ONE 1993

Editorial

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.

Pierre Bron

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 bot in Czechoslovakia and has been with VSL for many years, with his last assignment as Branch Manager of VSL Atlanta, USA.

Miroslav Vejvoda

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, aesthetical and economical structure. Armand Fürst's solution is in fine with VSL's aim†: To encourage a creative corporate culture which brings optimized construction solutions to you, our dear reader and construction partnert!

Armand Fürst

Reto Jenatsch
Group Chief Executive Officer

Highlights of this Issue:

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

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 ad[illegible]ed on Monday because the

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.

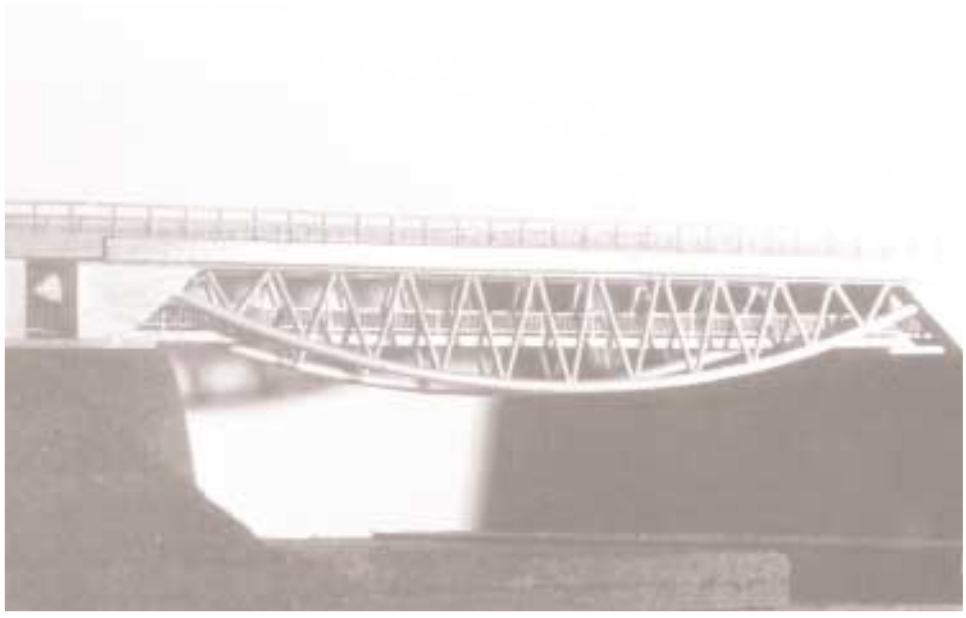
The new VSL COMPOSITE SYSTEM gives the answer.

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 SYSTFM allows for significant improvement in the quality of new construction as well as for monitoring of the tendons during their full design life lime.

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 bas 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 coula 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 PARAFILI tendons (a product made by the British company "Linear Composites Ltd") in order to carry eut some preliminary testing. PARAFIL cables consist of a tightly packed core of parallel aramid yarns le-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 losse-soccurring 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. Bath tendon ends were connected to hydraulic jacks through special couplers. With this arrangement the tendon coula first be stressed to 40 % of its nominal capacity, and then pulled under load

1 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. Trie tendon was pulled back and fortin 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 ares 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 l'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, Porgera PNG

Clough 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

The 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 Mezzainine 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-tensionig 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 un 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 sortit 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 utilising 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

VSL Fngineers (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) shah 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

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

Central Plaza dominates the Wanchai waterfront

Central Plaza illuminated.

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 clone by our Hong Kong office. Design and sirop drawings were clone 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 Prepakt (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 bas 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 fane traffic in Glenwood Canyon was recently opened at a total cost of approximately $ 484 million US.

The distinguishing characteristic of the Glenwood Canyon project bas 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 surfaces to match the existing, bas 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

VSL a part of Interstate Highway's Quality.

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 fane, 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

When completed, the bridge and tunnel connections being built across Denmark's Storebaelt to connect the islands of Fyn and Sjaelland 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 clone by VSL engineers and the post-tensioning is being performed by VSL Storebaelt J.V., a joint venture between VSL (Switzerland) Ltd. and Internordisk Sp‡nnarmering 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 km2 prefabrication yard and gave the participants an unforgettable, first hand view of the impressive bridge structure.

Toni Sieber
VSL (Switzerland) Ltd.
Lyssach, Switzerland

Denmark's link is half way.

Retained Earth gets a Start in Europe

With 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^2.

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^3.

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. Alter 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, Trinidas – An Application of VSL Heavy Lifting

Apart 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, contracter 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 Word's largest Rock Anchor Job nears Completion

The Atat¸rk Dam and Hydroelectric Power Plant, located on the Euphrates river in the south eastern part of Turkey, is arguaby one of the largest rockfill dams in the world. The spillway has a maximum water discharge capacity of 17'000 m^3/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 corrosion 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.

Spillway and stilling basin.

Ground anchors with a VSL packer being homed.

Robert Baumann
VSL (Switzerland) Ltd.
Lyssach, Switzerland

Atatürk Dam has an embakment 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

ADRESSES 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

U S A
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 nám$e$sti
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

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

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

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

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

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

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

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

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

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