VSL NEWS

NUMBER ONE 1991

The VSL Licensee network: Providing local service on a global scale

The topics of the last two editorials reflected some major changes within and around the VSL Group. In today's Editorial we would like to present significant changes and developments in our license network which again demonstrate VSL's expanding rote as a transnational organization and as a leader in the field of post-tensioning and other specialized construction activities.

We are pleased to announce that Killick Nixon Ltd. have joined the VSL post-tensioning family as the exclusive licensee in India. Based in Bombay and represented with nine branches throughout India, this company has some 25 years of experience with post-tensioning. As one of the market leaders, Killick Nixon Ltd., under the leadership of Mr. J.N. Jambusaria, will soon be in a position to offer full subcontract services with modern technologies and act as a competent partner for engineers and contractors.

In Spain, VSL is now represented by its subsidiary VSL Iberica S.A. Under the leadership of Mr. Luis Perez de Medina, the Madrid based company will play an increasingly important rote in the very promising Spanish construction market. By establishing this subsidiary, Western Europe is now completely serviced by local VSL representatives.

In Portugal, Prequipe, our previous licensee is now a VSL subsidiary. With Joaquim Rodrigues as manager, the company has become a leader in the field of post-tensioning, lt is now in an even stronger position and will continue to be a valuable partner in the construction industry.

Last but not least, the license situation has also changea in Greece where VSL Systems SA has been established as a VSL subsidiary. The company, lead by Mr. George Armoutis is not only active in post-tensioning and rock anchoring but is also marketing VSLS Retained Earth System.

These and future developments will strengthen VSLS position as a locally rooted, globally present transnational organization, capable of creating and executing innovative solutions as your project partner anywhere in the world.

Franck Fischli, Vice-President
PR & Licensing Division
Berne, Switzerland

Contents

Cover: VSL Corporation's latest automated transit system at the Primadonna Resort and Casino, near Las Vegas, Nevada. The system is the first privately owned people-mover to cross a U.S. Interstate Highway. Story on page 8. (Photo by Philip Thompson, Los Angeles).

Passing the test of time: VSL Organizations celebrate anniversaries in Australia, United States and Far East

Since the first commercial application of the VSL Post- Tensioning System in 1956, the VSL Organization has grown from a small, Swiss-based post-tensioning subcontractor to an acknowledged world leader in special construction methods. Today, the VSL Group is a transnational organization, locally represented in 32 countries throughout the world.
As time goes on, the VSL Group continues to grow and excel. The following historical briefs are in honour of the four VSL organizations who are celebrating significant anniversaries in 1991. Congratulations!

25 years in the United States

VSL Corporation was founded in 1966 for the purpose of developing the US market for post-tensioned concrete structures. Through the innovation and hard work of its people, VSL became the largest and most experienced post-tensioning firm in America. Today the company serves its clientele from 12 facilities strategically located throughout the country. The history of VSL Corporation is highlighted by many achievements which both advanced the technology standards of the industry and added value for the Company's clients. During the course of its 25 year history, VSL has diversified by bringing several other innovative and specialized systems to the construction market. Notable among these are VSL Retained Earth, VSL Transit Systems, VSL Heavy Lifting, and VSL Structural Modification and Life Extension. Focusing on responsive local service combined with value-added solutions, VSL Corporation stands ready to meet the challenges of the next 25 years.

Guida Schwage VSL Western
Richard Watts, VSL Eastern

25 years in Australia

VSL Prestressing (Aust.) Pty Ltd. was incorporated in Sydney in 1966 with the vision of applying post-tensioning with professional engineering design, direction and central.
In the early 1960's prestressed concrete was beginning to find acceptance as an economical and attractive solution for civil and building structures. At that time, the engineering profession lacked specialist construction organizations with sufficient design, construction and mechanical skiffs to develop and skilfully apply this new technique. VSL Prestressing (Aust.) Pty Ltd. satisfied this need. The VSL System found immediate success in Australia and has been used on many prestigious bridge, dam and building projects. The motivated team at VSL has earned an enviable reputation in Australia as a specialist contractor of superior performance with a high degree of design and construction expertise.

Graeme F ·Pash,
VSL Prestressing (Aust.) Pty Ltd.

20 Years of VSL in Singapore

The award for the post-tensioning of the slabs of Ming Court hotel's carpark in 1970 prompted VSL Prestressing (Aust,) Pty Ltd, to open a branch office in Singapore which became a subsidiary under the name of VSL Singapore Pte. Ltd. In the 20 years since the first VSL application prestigious projects have followed including the post-tensioning of 21 km of elevated structure for the M RT project.

With the end of the recession in 1988, VSL has surged forward. Today VSL has a dynamic management and a young and motivated staff with skiffs in designing complicated structures and in carrying out projects either as a specialist subcontractor, construction manager, or even as a turnkey contractor.

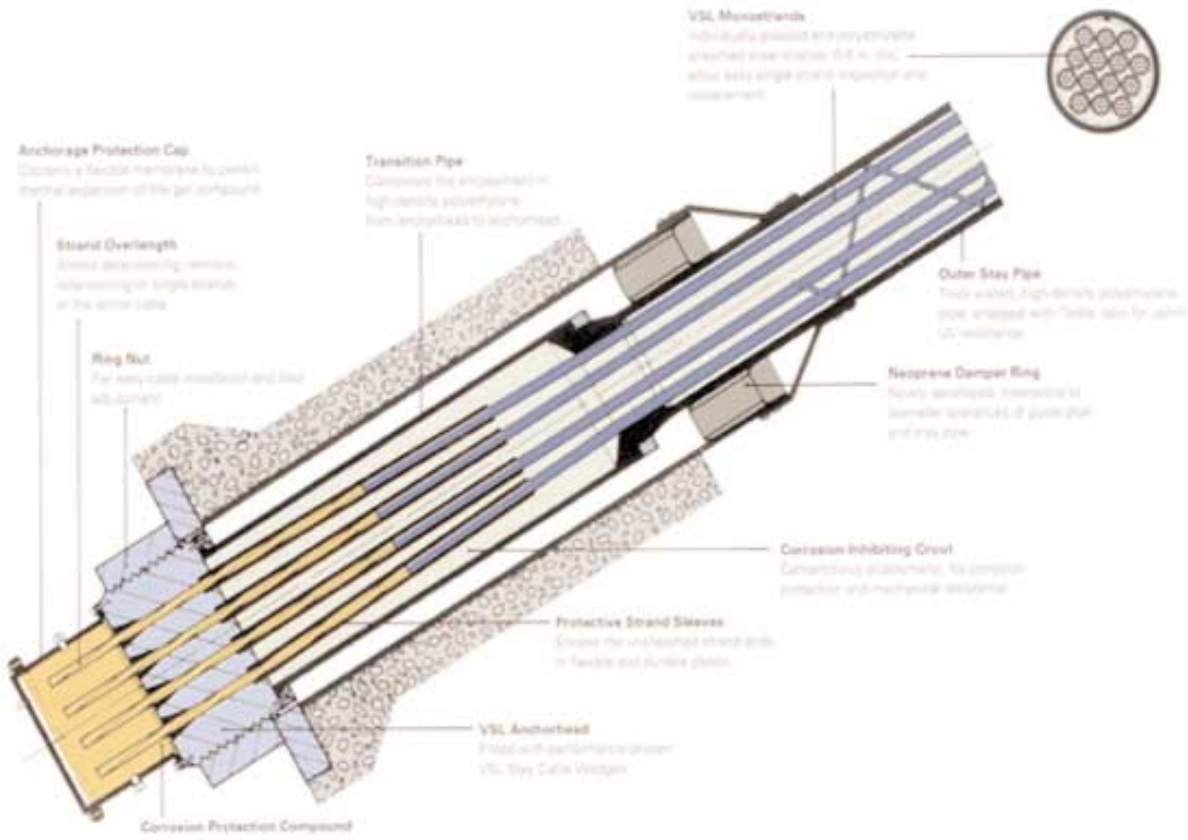
Giovanni Crivelli,
VSL Far East Pty. Ltd.

15 Years of VSL in Indonesia

PT VSL Indonesia was established in 1976 when post-tensioning in Indonesia coula only be found in text books.

Today VSL is a respected and reputable company that is played a major rote in enhancing the development of local construction technology PT VSL Indonesia has extensive experience in post-tensioning of bridges, buildings and silos while also worked in other specialist fields like heavy lifting, slip-forming and ground anchoring. Projects range from simple span post-tensioned bridges in rural areas to highrise buildings in the cities, PT VSL Indonesia provides a national service.

Johannes Himawan,
PT VSL Indonesia



The VSL Monostrand Stay Cable System – typical strand and anchorage details.

New VSL Stay Cable System offers major advancements in corrosion protection, durability and inspectability

VSL has developed a new bridge stay cable system which possesses the most thorough level of corrosion protection available today. The system incorporates several active corrosion barriers that encapsulate the steel along the entire length of the tendon, including the anchorage zone. To assure reliability, the new system allows individual strands to be easily inspected and adjusted, and, if necessary, extracted and replaced.

The VSL Monostrand Stay Cable System arose from today's heightened requirements for bridge stay cables. Chief among these concerns is corrosion protection and durability. Additional requirements addressed by the system include inspectability, the ability for monitoring and adjustment, replaceability of individual strands, easy installation procedures, and fatigue and static tensile efficiency.

A combination of new approaches

In recent years, two basic approaches for addressing the corrosion problem have evolved :

a) The use of multiple robust protection barriers, whereby one or more materials provide backup protection for a barrier which has failed. This approach improves reliability and life expectancy, but has typically made direct inspection of the steel difficult.

b) Concentration on inspectability. In this case, a bundle of single strands without external tubing or grouting is used. This allows easier detection of corrosion, however at the expense of actual corrosion protection, reliability, and life expectancy.

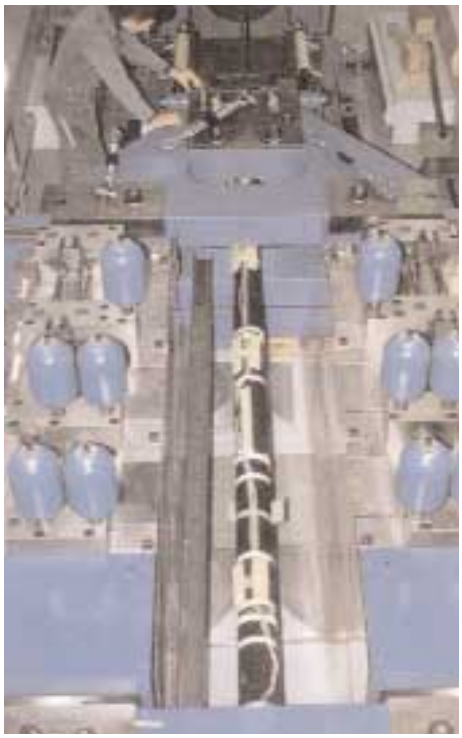
VSL's new system combines the advantages of both approaches, providing four layers of robust corrosion protection as well as easy inspection and replacement of individual strands.

Uniform protection from anchorhead to anchorhead

As shown in the drawing to the lleft, the tensile elements of the new VSL Stay Cable consist of a bundle of parallel monostrands. The number of monostrands which make up the stay cable can range from 4 to 91 strands. Each 0.6 inch diameter monostrand is individually greased and sheathed in high density polyethylene IHDPE). Specially-designed strand sleeves cover the unsheathed strand ends at the anchorheads.

The cable is completely encased from anchorhead to anchorhead in a thick-walled HDPE pipe. After installation and stressing, the pipe is filled with à corrosion-inhibiting cementitious grout. This approach provides four active layers of corrosion protection (i.e. grease, sheath, grout, and outer pipe). In addition to their corrosion protection properties, the cement grout and thick-walled outer tubing furnish excellent mechanical protection from impact, fire, vandalism, and abrasion.

The stay cable design also provides a high degree of corrosion protection in the anchorage. After the cables are installed, stressed and grouted, a specially compounded, thixo-tropic gel is injected into the anchorage zone to completely encapsulate the strand. This compound has been extensively tested for its protective properties under low and elevated temperatures (-50 to +70° C) and for its void filling properties.



The injection procedure utilizes a vacuum technique which assures that virtually all internai spaces in the anchorage and the strand sleeves are filled. Air bubbles and gaps do not occur. Tests have shown that even the smallest cavities in the gripping wedges are thoroughly filled by the corrosion preventive compound.

Easy strand inspection and replacement

The composition of monostrand tendons makes inspection and/or replacement of individual strands a relatively simple procedure. Although the monostrand bundles are grouted within the outer tube, they remain unbonded within their plastic sheathing This allows individual strands or the entire stay cable to be detensioned, removed, and replaced. Trials and tests have proven these procedures to be simple, fast and re-fiable. The technique makes it possible for bridge authorities to establish a regular surveillance program to monitor the condition of the stay cables.

Newly-designed plastic sleeves protects monostrands at the anchorhead.

Adequacy of strength and performance has been confirmed by static and dy-namic testing.

Recent testing

The monostrand stay cable system is designed to withstand a fatigue loading of 200 MPa at an upper load of 45% of the guaranteed ultimate tensile strength (GUTSI of the strand under 2 million load cycles. Full-scale testing has recently been conducted in Munich, Germany, with a 55-strand stay cable. After successfully undergoing two million cycles at a 200 MPa stress range, the cable was subjected to static ultimate loading. It was shown that the cable meets the high requirements of the PTI's *Recommendations for Stay Cable Design, Testing and Installation.*

Previous tests have also confirmed the adequacy of the system. Component testing has been successfully performed with stress ranges significantly higher than the targeted 200 MPa.

VSL'S new Monostrand Stay Cable System offers an excellent combination of new ideas and proven materials and methods. It meets today's high requirements for corrosion protection, inspectability and performance. It also imposes no limitations on the use of galvanized strands, polyurethane grout, or other materials sometimes specified by bridge engineers.'

Peter Buergi
VSL International Ltd.
Berne, Switzerland

Work has begun to strengthen Burrinjuck Dam.

VSL Rock Anchors secure Burrinjuck Dam

Burrinjuck Dam is located 360 km south-west of Sydney on the headwaters of the Murrumbidgee River. Vihen construction of the dam commenced in 1907 it was rated as the fourth largest concrete gravity dam in the world. Due to revised peak maximum flood levels it was decided to raise the height of the main wall by a massive 13.2 metres, which will result in a greatly increased spillway capacity.

The New South Wales Department of Water Resources has designed the dam raising to be secured by the use of permanent, restressable rock anchors. VSL pioneered the worldwide use of permanent, restressable rock anchors in the mid 1960's. The major research and development programme was carried out in the early 1970's between VSL and The Sydney Water Board on the Manly Dam strengthening project near Sydney. As a direct result of this work the VSL permanent restressable rock anchor is now the preferred medium for streng-thening and securing dams by most dam authorities in Australia.

The VSL permanent restressable rock anchor is designed to outlast the life of the structure that it is securing. In the case of monumental structures such as dams this life span could exceed 500 years. In order to check on the performance of the anchor thioughout its life the anchor design allows full load monitoring and load adjustment if required.

Thiess Contractors Pty. Limited were awarded a contract to carry out the flood security works on Burrinjuck Dam in February, 1990. Subsequently, a subcontract was awarded to VSL to carry out the permanent rock anchoring and other ancillary post-tensioning works on the project.

The major rock anchoring works consist of 159 no. VSL permanent restressable rock anchors, each consisting of 63 no, 15.2 mm diameter strands (U.T.S. 261 kN/strandl. The average anchoring force based on a wall crest length of 144.0 metres and a design working load equal to 65 % of the rock anchor breaking load is 11,780 kN/m. The VSL rock anchors are arranged in two parallel rows along the crest in order to provide an acceptable spacing.

In all, approximately 1400 tonnes of high tensile 15.2 mm diameter prestressing strand will be used. On completion, this project will represent one of the largest concentrations of anchoring force ever carried out in the world.

Duncan MacDonald
VSL Prestressing (Aust.) Pty Ltd.
Thornleigh, New South Wales .

VSL provides speed and economy for new grandstand in Melbourne

The Melbourne Crickel et Ground is known the world over as the venue of the 1956 Olympic Games. A major redevelopment of the southern grandstand is currently underway. The new grandstand will have a seating capacity in excess of 47,000 people.

A contract was awarded to John Holland Constructions Pty. Limited in March, 1990, for the design and construction of this facility. VSL have worked closely with the design team to ensure that an optimised structural system is specified, that will provide major benefits in speed of construction and maximum cost reductions.

A precast post-tensioned floor system has been adopted for the

Post-tensioning combines with precast and structural steel elements to speed erection

amenities areas, with post-tensioned connections at the interface of structural steel beams supporting the seating decks to the main concrete support structure. The post-tensioned structural steel elements provide construction flexibility coupled with erection speed and reduced costs. The speed of construction is important to ensure minimum interruption to the facility as it is in high demand for various sporting functions throughout the year.

VSL has detailed the post-tensioning so that minimum backpropping is required. This allows early access for finishing trades and services, which adds to the overall speed of construction.

Peter J. Tilley
VSL Prestressing (Aust.) Pty Ltd.
Melbourne, Victoria

A Royal job for VSL

The Rivage Royale, a $ 175 million luxury apartment complex, is located on Queensland's Gold Coast, Australia's foremost holiday destination.

Construction commenced in February, 1990, and is due for completion fate 1991. VSL have been awarded the post-tensioning of the floors in this project.

The post-tensioned floor design provides a 10.0 metre clear span to the living areas by utilising a curved spine beam containing 3 no. 5-7 tendons on a 25.0 m radius. The shallow depth post-tensioned beam provides the most economic solution to the large clear span requirement of the structure.

The podium roof slab with an area iin excess of 3,000 m2 will be landscaped with soil depths in excess of 1.0 metre. The roof slab is post-tensioned with the VSL 5-4 slab system to provide a watertight structure without the need for a membrane.

VSL plays its part in Gold Coast development.

Eric Schwarz
VSL Prestressing (Aust.) Pty Ltd.
Brisbane, Oueensland

New VSL Transit System now in service near Las Vegas

VSL Corporation's latest automated transit system in Stateline, Nevada, is now complete, operating 22 hours ver day, seven days ver week.

The custom designed, 60 passenger vehicle connects the new Primadonna Hotel and Casino with Vihiskey Pete's Castle in the Desert, a long-time Nevada landmark located 1,800 feet to the west of Primadonna, on the opposite side of U.S. Interstate Highway 15. The vehicle rides on an elevated concrete guideway for the point-to-point trip between the two resorts and spans the interstate with a clearance of 19.5 feet. Passenger boarding stations are integrated into the architecture. all functions are fully automated, including door and gate operation, vehicle, acceleration, cruising speed, deceleration and stopping.

VSL was the single-source turnkey contractor for the project, responsible for all aspects of system design, construction, start-up and operator training. The system was put into operation in fate 1990 and has been operating at full capacity since that time.

VSL transit system combines modern styling, passenger, comfort and workhorse efficiency. The system can transport 32,000 passengers per day between points.

Rainer Kuehborn
VSL Western Campbell, California

Precast water siphons repaired by VSL Post-Tensioning

Corroded prestressing wire was replaced by corrosion-protected VSL monostrands. The monostrands are epoxy coated, grease coated and encased in high-density polyethylene sheaths.

Originally constructed in the mid 1970's, the 21-foot-diameter siphons of the Central Arizona Project carry Colorado River water into the arid regions of central Arizona. The siphons are built of precast concrete, externally prestressed with spiral-wrapped wire and covered with shotcrete.

In early 1990, workers discovered substantial corrosion of the original bare prestressing wire in two siphons, accompanied by cracking of the con-crete. A repair contract was subse-quently awarded by the United States Bureau of Reclamation.

The repair design consisted of removing the earth cover, shotcrete and corroded wires and replacing the damaged wires with 0.6 inch diameter VSL monostrands. The monostrands are individually epoxy coated, greased, and extruded in 100 mil thick polyethylene sheaths. In addition to supplying the post-tensioning strand for this unique application, VSL Viestern also developed special anchorages and wedges for the circumferential post-tensioning.

Manly Jackson
VSL Western Campbell, California

The Caguanas River Bridge, built by the VSL Incremental Launching Method.

VSL complete segmental bridge superstructure

In February, 1991, the Engineering Structures Group of VSL Western completed final launching operations on the 385 m Caguanas River Bridge in Central Puerto Rico.
This single-cell box girder bridge is only the second incrementally launched concrete bridge built in the United States. (The Wabash River bridge, the first, was also a VSL project.) The superstructure geometry is a helix, combining a horizontal radius of 360 meters with a 7 % cross slope and a 4 % longitudinal grade.
The remoteness of the site, roughness of the terrain, and height of the structure made incremental launching particularly attractive. While the original old documents were based on a precast balanced cantilever solution, the design anticipated the possible use of incremental launching by selecting a structure of constant geometry.

17 Andrew Micklus
VSL Western Campbell, California

Water treatment tanks given second life by VSL

Tank life extended with VSL monostrand system.

Two aging 6.8 million litre11.8 million gallon) concrete water treatment basins at the Ullrich Viater Treatment Plant Expansion in Austin, Texas, were rehabilitated by VSLS Dallas office. External post-tensioning, with some 9 km (29,000 ft) of extruded mono-strand, was used to close existing cracks in the tank walls, and provide a residual hoop compression stress of 1.7 MPa (250 pst). A custom tendon support system, designed by VSL, allowed the tendons to be routed around large existing openings in the basin walls. The walls were sand-blasted prior to post-tensioning. Afterwards, a shotcrete cover was used to provide mechanical protection, and additional corrosion protection, as well as to enhance the appearance of the tanks.

Michael G. Powell
VSL Eastern
Grand Prairie, Texas

Six months of winter and five million gallons later…

VSL Denver recently completed the fabrication, installation, stressing of all post-tensioning materials, labour and rebar labour on a 19 million litre (5 million gallon) buried water storage tank for the City of Arvada, Colorado. To provide for maximum corrosion protection, the fully encapsulated VSL CP+ system was used for the unbonded tendons in the floor and roof slabs while fully bonded multistrand tendons were used in the 0.3 m (12 inch) thick walls. The structural work was executed in the six month period from October 1990 to March 1991 . What makes the construction speed even more impressive is that it was achieved during the Colorado winter months.

Robert Allen
VSL Eastern
Lakewood, Colorado

Colorado tank has post-tensioned floor, wall and roof.

VSL post-tensioned solution beats structural steel and reinforced concrete

First Union Capitol Center is a 31 storey office building in downtown Raleigh, North Carolina. The project was originally designed for structural steel, and later for ordinary reinforced concrete.

VSL'S value engineering proposal with post-tensioned two-way flat plate floor was accepted as it provided additional savings compared with the other schemes. The combination of post-tensioning with punching shear 20 reinforcement at the columns permitted the use of thinner than normal slabs without sacrificing safety, economy or performance.

In spite of changing to the VSL alternative, construction delays were avoided and the building "topped out" one week ahead of schedule.

Miroslav Vejvoda,
VSL Eastern Norcross,
Georgia

First Union Capitol Center, a faster and more economical project as a result of VSL Post-tensioning.

Post-tensioned residential foundations on expansive soils

Typical Texas single family rsidential housing (Courtesy of David Weekley Homes).

The VSL Monostrand Post-Tensioning System has proven to be an excellent solution to the problems associated with the design of soil supported foundations on expansive soils. In 1990, over 25,000 single family residential homes were constructed in Texas utilizing post-tensioned foundations. These homes range in size from 1,500 sq.ft. (140 m2) to over 6,000 sq.ft. (560 m2) with a median price of 115,000 US dollars.

21 Locally, the expansive clays are vulnerable to significant volumetric changes induced by moisture variation. The clay particles have the ability, due to electrical charges, to attract and hold water to their surfaces. The attraction of available water during the wet seasons and loss of moisture during the dry seasons results in cycles of shrink-age and swelling.

A typical post-tensioned project consists of a monolithic "waffle type" foundation with a 4 in. (101.6 mml slab, a perimeter beam and interior beams spaced in both directions at 15.0 ft. (4.6 ml maximum centers. Post-tensioning is accomplished using 0.5 in. (12.7 mm) monostrand tendons distributed in both directions to provide a residual compressive stress of approximately 75 psi (517 kPa). These compressive stresses counteract the anticipated tension stresses induced by the soil movements.

VSL annually provides monostrand post-tensioning material for over 6,000 foundations in the Texas Residential Market.

Jack W Graves, Jr
VSL Eastern
Grand Prairie, Texas

Aircraft hangar trusses lifted and laterally braced

Construction of a maintenance hangar at the new Munich Airport required lifting of the two main trusses which span over the hangar doors. The 150 m, 500 tonne trusses were lifted 22 m.

During lifting, lateral stability of each truss was assured by a combination of temporary steel frames (white on the photo) and post-tensioning cables. After lifting, lateral stability was provided by guy cables. This allowed the white frames and cables to be reused for the second lift.

VSL was responsible for the lifting as well as materials and services for temporary stabilization and guy cables.

Erich Môschler
VSL International Ltd.
Lyssach, Switzerland

Lifting of 150m long hangar doorway truss

Composite bridge leaned and launched by VSL International

Heavy Lifting techniques feature in bridge construction.

Construction of the bridge across the spectacular la Dala Gorge in Switzerland was accomplished with an innovative application of VSL Heavy Lifting technology. The 210 m bridge consists of steel indined piers at each end, two longitudinal steel girders and a composite concrete deck.

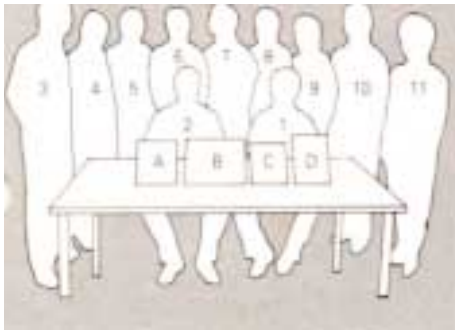
The inclined piers were constructed vertically then lowered or leaned into position with temporary strand tie backs. The girders were launched from each end and spliced at midspan.

Leaning of the piers and launching of the associated girders was done simultaneously by VSL. This was an operation requiring the ability to push and pull at various stages of movement and the ability to control the movement of the piers and girders independently. This method of erection reduced the project cost considerably.'

Erich Môschler
VSL International Ltd.
Lyssach, Switzerland

VSL Korea Co., Ltd. proud of their success

Hard work, dedication and client satisfaction are essential ingredients for good business. For the people of VSL Korea Co. Ltd. these attributes have been well recognized by their clients who have seen fit to formally acknowledge their contracting skill, as is apparent by their impressive collection of awards.



1 Mr. H.W. Shin (Manager Director)
2 Mr. C.B. Choi (Deputy Manager Directro)
3 Mr. M.S. Lee (Chief Engineer)
4 Mr. C.S. Choi (Shop Manager)
5 Mr. B.H. Yoon (Field Engineer)
6 Mr. Y.S. Ryoo (Design Engineer)
7 Mr. S.B. Kwak (Field Engineer)
8 Mr. K.D. Sung (Accountant)
9 Mr. J.H. Lim (Purchaser)
10 Mr. S.A. Lee (Admin. Manager)
11 Miss M.K. Moon (Secretary)

A Award for excellent sub-contractro from You-One Const. Co. (1988). Project: Olypimc Grand Bridge

B Award for excellent sub-contractor from Daelim Const. Co. (1989). Project: Kang-Dong Grand Bridge

C Award for excellent sub-contractor from Jinhung Const. Co. (1989). Project: Noryang Grand Bridge

D A plaque of appreciation from the Institute of Korean Machinery (1987). Project: Load test laboratory

Kang-Dong Viaduct

As part of a highway project near Seoul City, the Kang-Dong Viaduct crosses the Han River providing a 790m continuous joint free riding surface.

The parallel box girders were cast-in-situ by free cantilevering. Maximum spans were 125m, with a total length including approach spans of 1126m. While originally designed to be post-tensioned longitudinally and vertically, with bars an alternative using the VSL strand system was subtituted for the longitudinal post-tensioning.

VSL's onvolvement in the project included: redesign of superstructure, post-tensioning, placing of reinforcement and concrete, form traveller operation, and camber control.

Project participants included: Korea Highway Corporation, Owner; Korean Eng. Consultants Corp., consultant; Dae-Lim Industrial Co., Ltd., Contractor; Sam-Woo Engineering, Co., Ltd., Contractor's Consultant.

M.S. Lee
VSL Korea Co., Ltd.
Seoul, Korea

Kang-Dong Viaduct: a multi-faceted project for VSL Korea

Design and Build- The Way Ahead

Meeting the needs of today's challenging construction market in South-East Asia calls for some new approaches. VSL Singapore has already achieved some success with two design and build contracts which offer the owners sole source responsibility, as well as faster and more economically executed projects.

Batam, Indonesia

VSL was contracted to design and build the superstructure of 5 three storey high industrial factory units each of which measures over 10,000 m^2. Each unit was completed in under 2 months by using precast columns of full building height, table form construction and prestressed drop panel slabs which allowed early stripping. Batam-Indo, the industrial Park developers, are well pleased with the speed produced by the combined construction efforts of VSL Singapore and VSL Indonesia.

27 Ciba-Geigy, Singapore

Extensive upgrading of its production facilities and creation of a regional warehouse has led Ciba-Geigy to carry out major alterations and additions to its existing premises in Singapore.

VSL is managing the complete design and build process for Ciba-Geigy. The project consists of 4400 m^2 of warehouse and 3600 m^2 of office/ production area. The building structures are a mixture of reinforced concrete and structural steel. One of the main features of the project is a combined underground sprinkler water and containment tank providing Ciba-Geigy with the means to prevent environmental damage in the event of a fire. VSL has employed consultants locally to carry out the design and the work is being carried out under VSL supervision.

Colin B. Thoms, Mark Wong
VSL Singapore Pte. Ltd.
Singapore

VSL Design and Build combines precast columsn, modular formwork system and prestressing to complete industrial complex on time.

COMPAQ goes VSL

The Compaq Computer Corporation Asian administration and production facility was recently completed in Singapore and comprises a two level production building and a three level office structure.

An alternative post-tensioned flat slab floor system with drop panels was proposed and adopted for this prestigious office and production complex.

The proposai had the advantage of providing a simple uncluttered floor and was built within an extremely tight schedule. The use of prestress tendon couplers, large rolling table forms and judicious planning enabled 14,000 m^2 of floor to be built in a month. The solution proved to be the most economical due to reuse of forms made possible by early stressing, optimum utilization of labour and equipment resources and minimum use of materials.

28 Cris Dedigama
VSL Singapore Pte. Ltd.
Singapore

Post-tensioned flat slabs the key to open floor space and quick constuction.

VSL Post-Tensioning for Jabotabek Elevated Railway Line, Jakarta

The Jabotabek Central Line is an elevated railway [(ne running from Manggarai station in the south to Kota station in the northern part of Jakarta. The total length of the project is 9 km, of which one third is post-tensioned segmental box girder construction with spans varying from 21 m to 38 m.

PT VSL Indonesia and VSL Far East Pte. Ltd. were awarded three contracts for the post-tensioning while erection was by the consortium made up of Tekken (Japan), PT Wijaya Jarya and PT Udinda Aneka Sarana of Indonesia. The project started in 1989 and is due for completion in 1992.

The 10 m wide 55 tonne precast concrete segments are erected with the aid of a launching girder. Joints between segments are glued with epoxy and stressed temporarily before permanent 6-12 tendons are installed.

VSL post-Tensioned Railway Viaduct will improve the Jakarta railway system.

Johannes Himawan
PT VSL Indonesia
Jakarta, Indonesia

VSL Climbform makes headway in Far East

The introduction of VSL Climbform into the Hong Kong market was heralded with the award of two prestigious contracts in the heart of Hong Kong's financial centre.

The first project, called Central Plaza, will tower 278 metres above the ground and will be the world's tallest reinforced concrete building. By August 1992, the whole building will provide 186,000 m2 of office space.

The climbform was adopted to take the core construction off the critical path. Each climbform attaining a comfortable cycle of four days. The building is designed in the form of a sleek triangular pillar, thus three climbform platforms in a triangular orientation are being used to construct the service cores of the tower.

The second project, Citibank Plaza, will be the flagship of Citicorp's Hong Kong operations and consists of a 47 storey tower, and a second 37 storey tower. Again, climbform is being used to accelerate the construction sequence as this development is scheduled for completion in February 1992, only 26 months after inception. For the largest tower the climbform features single storey height forms covering 654 square metres of core wall surface and incorporates 117 tonnes of reinforcement steel with a concrete pour of 306 cubic metres.

Central Plaza Hong Kong. Climbform takes the panic out of core construction.

Stuart Pearson
30 VSL Engineers (HK) Ltd.
Hong Kong

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