VSL NEWS

ISSUE ONE 1998

Batam-Tonton cable-stayed bridge

EDITORIAL

Post-tensioning should be an integrated process

A post-tensioning system is often the most critical aspect of a concrete structure. But more than the quality of its individual components, the quality of post-tensioning depends on the control exercised over the entire chain leading up to installation of a system in a project.

The involvement at the inception stage of engineers familiar with the detail design of a post-tensioning layout; the quality of the overall system and the consistency of all its components; the implementation of rigorous installation procedures: all these key phases contribute to the overall quality of a post-tensioning structure.

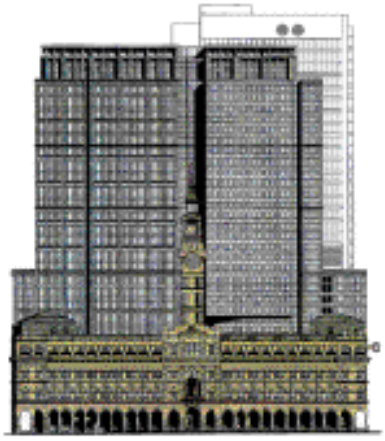
At VSL we are convinced that only vertically-integrated companies can ensure the optimum quality of an installed post-tensioning system. By this we mean companies that perform the whole gamut of services, i.e. design their system, conduct research on its components and materials, manufacture their key components in-house following strict quality programs, work together with consultants on the detailed design of a PT layout, carry out installation on-site, and, finally, perform inspection and maintenance themselves.

These companies are genuine specialist contractors that work hand-in-hand with the main contractor as an authentic construction partner specialized in post-tensioning and related engineering.

VSL is one of these companies.

Alain Le Pivert
CEO and Chairman of the Board

HIGHLIGHTS



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The PT-PLUS flat duct

- SWITZERLAND -

PT-PLUS, THE OPTIMUM SOLUTION

The Business Market is 3-storey high and located next to VSL's headquarters in Lyssach.
The first storey is a transfer slab with 20 t of post-tensioning cables. The other storeys were designed as flat slabs with typical spans of 7.20 m x 7.20 m.

Based on past experience, the engineer's design used PT-PLUS flat ducts (72 / 21 mm) with four 0.6" strands combined with SO 6-4 anchorages - a system which proved to be technically advantageous and economic.
All tendons were prefabricated at the VSL workshop. The 50 t of strands required for the 3,650 m² total slab area were built in a challenging 9 weeks, thus meeting the tight schedule set by the client.

Franz Fischli
VSL (Switzerland) Ltd.

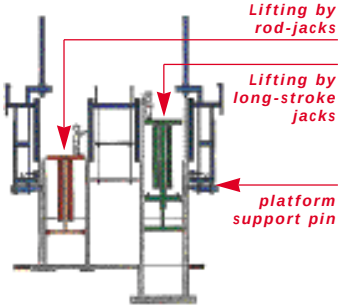
- INDONESIA -

FIRST VSL CLIMBFORM IN INDONESIA
BDNI CENTRE

The BDNI Centre consists of two towers: Tower A comprises 62 storeys and Tower B 43 storeys. After a successful experience with VSL in Hong Kong, the main contractor, Kumagai Gumi, chose the VSL Climbform system for the core wall of both towers. A total of three Climbforms were used, two on Tower A, reaching heights of 228 m and 123 m, and one on Tower B reaching a height of 145 m. VSL's scope of work was the design, supply of materials, and supervision of the system formwork.

The flexibility of the VSL Climbform system was especially suited for this project: as the height of the building progresses, the dimension of the core wall structure changes in both shape and size.

Inggriani Setiawan
VSL Indonesia



The VSL Climbform system

- USA -
EMBASSY SUITES HOTEL

Given its proximity to Puerto Rico International Airport, the 30,700-m² Embassy Suites Hotel has a strict height limitation which dictated the use of thin post-tensioned flat slabs without beams (except for creation of conference and ballroom spaces on the ground floor).

VSL Miami was the post-tensioning consultant to the Structural Engineers (H.M. Zapata and Assoc.) from the outset of the project which required tackling space and height problems to achieve the project requirements. This relationship saved a significant amount of time, as design, shop drawings, and materials lists were prepared in advance.

Besides its role of specialty consultant, VSL provided final design and detailing of post-tensioning and reinforcing steel in the slabs, monostrand materials, and technical field services to F&R Construction, a long-term client.

This efficient design required 115 t of prestressing steel, and met all requirements.

The hotel was built to an ambitious construction schedule and opened on time. l

Phil Arana
VSL Corporation
USA

- THAILAND -
U CHU LIANG COMPLEX

U Chu Liang is a large complex, consisting of a 39-storey office tower, a 12-storey parking structure and a 12-storey commercial building housing the headquarters of the Hong Kong Bank. All these facilities are linked together by an 8-storey retail complex.

The main contractor—Thai Leighton Ltd—awarded VSL the design, supply and installation of 111,300 m² of post-tensioned slab comprising 698 t of strand.

The structural system for the tower and retail link is flat slab with drop panels. A band beam and one-way slab system is being used for the banking and parking structures.

The post-tensioning work commenced on site in April 1997 and completion is scheduled for end of April 1998. l

Gaysorn Lertmongkonnam
VSL Thailand

- AUSTRALIA -

THE GROCON-VSL SYNERGY CONTINUES

Grocon is currently involved in a number of high-profile projects in Sydney. Thanks to a close working relationship with Grocon, VSL is playing a specialist contractor role on each of them.

400 GEORGE STREET is a 33-storey office tower in the centre of Sydney. It consists of 2 basement levels, 4 levels of podium for retail stores and 29 levels of office accommodations each measuring 1,660 m² in area.
The floor system is a 140-mm thick reinforced concrete slab spanning 3.9 m between post-tensioned beams. A total of 280 t of PT has been used, and a typical floor construction cycle averages less than 1 week per floor.
The total construction period for the structure is 15 months.

ELAROSA is a 45-storey prestige residential building situated 2 km east of Sydney. This development is characterised by an unusual design created by Harry Siedlier – an eminent Australian architect.
The floor system is a 180-mm thick post-tensioned flat slab of 630 m² with four 12.7 mm slab tendons representing a total of 172 t of strands.
Construction of the structure will take 13 months.

Elarosa project - Darlinghurst

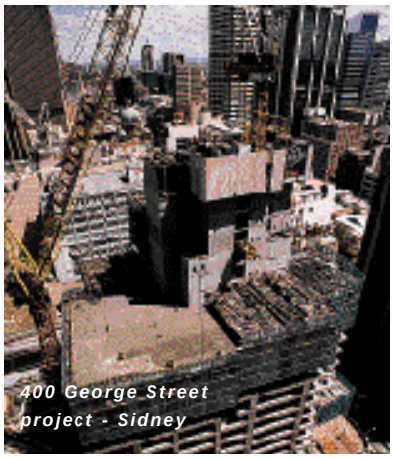
NO. 1 MARTIN PLACE REDEVELOPMENT

After the completion of Melbourne's Crown Casino, several key Grocon personnel, including Project Manager Frank Bortolletto, were transferred to manage the restoration of the GPO building in Sydney's Martin Place and the construction of a 24-level office tower and of a 31-level 5-star hotel on a site covering 7,200 m² .

The 2,680-m² GPO office tower has a 120-mm thick reinforced slab spanning 4.7 m between 600-mm deep stressed beams. The beams span 13.5 m between the building core and the edge beam.
The hotel represents an area of 1,245 m² and uses 220-mm stressed flat slabs typically spanning 8.5 m. The slab is formed on a Condeck, a permanent metal deck formwork.
Our scope of work includes the post-tensioning of all the suspended horizontal elements totalling 90,000 m² and including 465 t of post-tensioning.

The project is expected to be completed by mid-1999 with our works due to be finalised early in 1999.

Neil Audsley and Ross Ioakim
VSL Australia



400 George Street project - Sidney

VS
SPECIALIST C
IN STAY

The leader in post-tensioning, VSL is also a major cable-stayed bridge specialist. With references such as Wadi Leban in Saudi Arabia, Sunshine Skyway, Neches, Baytown and C&D canal in the USA, River Leven in Scotland, Koshiki in Japan, Evripos in Greece or Kemijoki in Finland, VSL has acquired unrivalled expertise in stay cable design, system engineering, and installation.

Among the most recent VSL references in cable-stayed bridges is the Batam-Tonton bridge (page 8). It is an illustration of the expertise VSL can provide to a contractor when building such highly technical civil structures.

• **Construction engineering assistance:** the design of a cable-stayed bridge requires experience, skill and a heavy engineering background. VSL possesses all three capabilities and intervenes at the tender stage, helping the contractor propose the optimum solution to the owner.

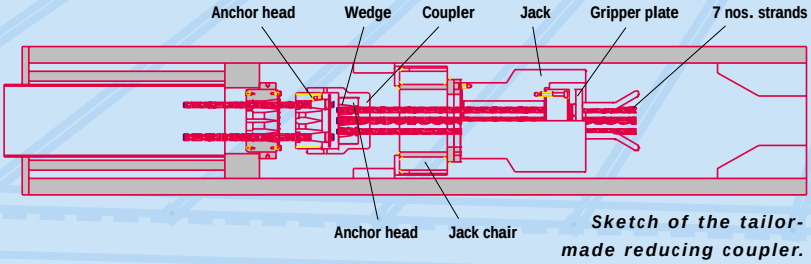
• **Supply of an integrated system:** At VSL, we design, manufacture and install the system we build. Our systems are tailored to suit the needs of the owner: economy, durability, aesthetics, performance. For example, our Single Strand Installation System 200 is renowned for its high degree of corrosion resistance (multiple layers of corrosion protection) and its ease of installation (strand-by-strand). But paramount is its characteristic of having each strand stressable, inspectable and replaceable individually.

• **Installation and on-site supervision:** the installation of the stays is often on the critical path of the construction sequence. This service enables our client to benefit from our hands-on experience and allows us to design the materials, equipment and methods that will guarantee the optimum productivity.

- FRANCE -

VAL DE RENNES

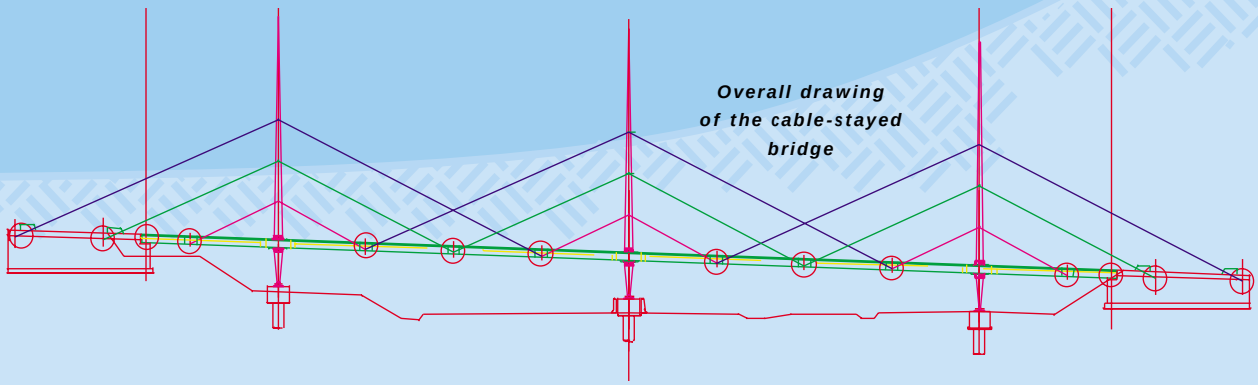
As part of the extension of its public transportation system, the city of Rennes is constructing a new people mover railway line.
To span the heavily congested Rennes ring road, a 450-m long double deck viaduct and a cable-stayed bridge (the VAL) are under completion. VSL was chosen by the main contractor—a joint venture between Quille (leader) and GTB—to supply and install the stay-cable system and the transversal post-tensioning (120 t of the VSL E 6-12 system) of both bridges. A specific requirement of the contractor S.S.E. (a joint venture between SYSTRA-SOFRETU-SOFRERAIL, SEEE and EEG) was to build the bridge without interrupting the traffic beneath. The strands of the stays are galvanised, waxed, sheathed and further protected by a thick HDPE pipe.
Due to the particular site condition, the stay cables will be pre-assembled prior to install.



Sketch of the tailor-made reducing coupler.

Furthermore, to accommodate the limited space for stressing the cables in the zones of the anchorage, a special reducing coupler was developed to enable the use of smaller jacks.
Construction is scheduled for completion in October 98. ▮

L. Marchand and A. Gnaegi
VSL France



Overall drawing of the cable-stayed bridge

SL ONTRACTOR CABLE

- CHILE -

HUERFANOS FOOTBRIDGE

The cable-stayed footbridge at the crossing of Huérfanos Street and the Pan-American Highway constitutes an important innovation in long-span bridge construction in Chile. It also represents a first step in the conversion into a pedestrian area of Santiago's old downtown.

The presence of the route Highway No. 5 and Metro line No. 2 called for a main span of almost 60 m without intermediate supports. A cable-stayed bridge proved to be the best alternative to avoid interference with road and metro traffic.

The footbridge consists of two 20-m high pylons with 40 stays supporting a 5.4-m wide deck. The bridge is 109-m long, with a main span of 57 m and two back spans of 26 m.

The deck consists of a 20-cm thick concrete slab with two 60-cm high edge beams.
The stays are made of 4 greased and sheathed 0.6" dia. strands positioned inside an HDPE pipe that is grouted after stressing.
For aesthetic reasons, the stays were subsequently coated with a white tape.

VSL was involved at an early stage of the project, assisting the Ministry of Public Works' Bridge Department and Santiago's City Hall Architects in the design.

VSL persuaded the contractor, ByM, to use individually stressable, inspectable, and replaceable stays. The stays have a triple protection consisting of 2 layers of HDPE and one of cement grout.

Anchorages were manufactured in CTT's factory in Spain and delivered to site after being fully assembled at the VSL workshop in Santiago.

Eric Palos Jovani
VSL Sistemas Especiales
de Construcción SA

- INDONESIA -

BATAM-TONTON BRIDGE

In order to accommodate the expansion of Batam Island as a free-trade industrial area, a master plan was put in place to connect Batam Island to five neighbouring islands. The Barelang projects consist of six bridges, the largest being a cable-stayed structure which links Batam with Tonton Island.

It is a three-span, symmetrical cable-stayed bridge with a total length of 642 m and a main span of 350 m built of cast-in-place concrete. It has two A-shaped pylons extending 118 m above the pile caps, which are supported on bored piles. The navigation clearance is 39 m.

The 22 m wide deck consists of an in situ concrete slab supported on two edge girders and cross beams, while the stay cables are arranged in a fan shape in two planes between the pylon head and the edge girder. The deck covers a total area of 13,800 m^2, consisting of a 280 mm slab sitting on transverse beams spaced at 4 m intervals. The deck is rigidly supported at the abutments but floating — with transverse restraints only — at the pylon. During construction the deck was temporarily restrained longitudinally at the pylon.

The deck is prestressed longitudinally in the edge girders, and transversally in the cross beams.

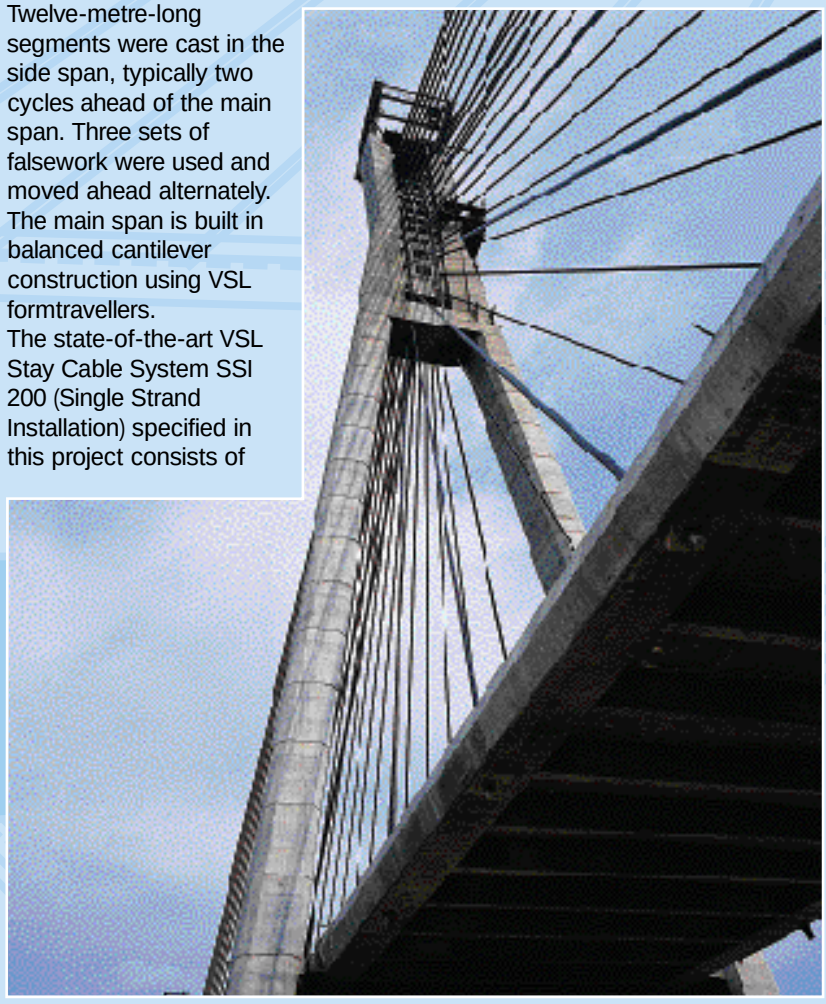
The pylons are supported on caisson-type pile caps sitting on 30 bored piles, each 1.5 m dia., and some up to 40 m long. The two pylon legs are linked together transversally with a concrete beam at pile cap level. The pylon legs were built with climbform system in typical lifts of 4 m.

A particular aspect of the bridge is that the back stays are externally anchored in the abutments which were filled with sand to withstand the back-stay forces.

Twelve-metre-long segments were cast in the side span, typically two cycles ahead of the main span. Three sets of falsework were used and moved ahead alternately. The main span is built in balanced cantilever construction using VSL formtravellers.
The state-of-the-art VSL Stay Cable System SSI 200 (Single Strand Installation) specified in this project consists of greased and sheathed monostrands individually placed inside HDPE guide tubes. The entire bundle of monostrands and guide tubes is encapsulated by an HDPE pipe. A total of 986 t of stay cables was used with cable sizes ranging from 31 to 91 x 0.6” strands. The cables measure between 61 m and 190 m, and are spaced at 12-m intervals in the deck edge girders.

Stay cable anchorages including guide tubes and grouting were prefabricated on site. Stressing of the stays is performed from the pylons with custom-designed compact multistrand jacks.

Joannes Himawan
VSL Indonesia



- USA -

Foss Waterway Bridge

The Foss Waterway Bridge is one of the final links connecting the City of Tacoma's Waterfront Industrial Park to downtown Tacoma.
The Washington State Department of Transportation, owner and engineer, designed the bridge in two units.
The western part is a two-span cast-in-place post-tensioned concrete box-girder bridge.
The main part is a two-span cable-stayed bridge of cast-in-place post-tensioned concrete.
The bridge was awarded to the Max J. Kuney Co.
The cable stayed portion of the bridge has a 107 m main span with a 101 m backspan. It is supported by two planes of cables attached to two identical pylons. The two vertical planes of cables are aligned with longitudinal girders on each edge, and with crossbeams at 4.6 m on center supporting the roadway. A total of 44 cables (containing from 24 to 63 15.2-mm monostrands) are typically spaced at 9.1 m centers.
The system uses VSL 200 Monostrand cables made of greased and extruded PE sheathed strand subsequently injected with cement grout.
The stay cables were installed and stressed with 1,700 t rams by VSL after completion of the superstructure and pylons.

Charles Hanskat
VSL Corporation - USA

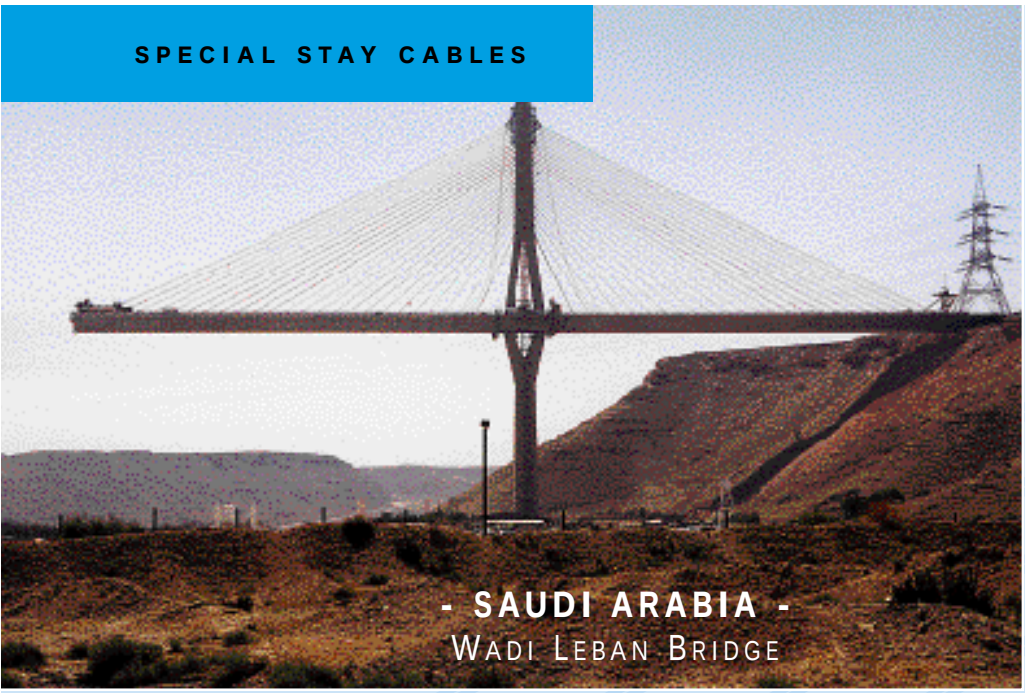
▲ *installation of the stays*

- SWEDEN -

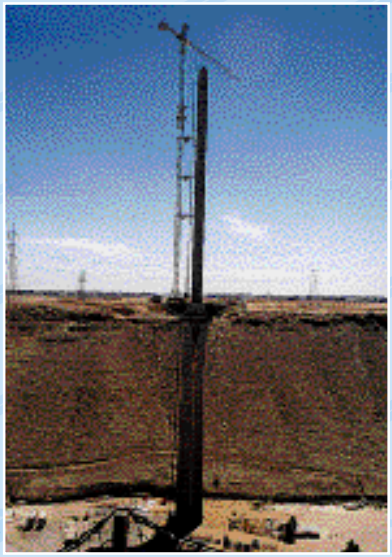
Uddevalla Cable-Stayed Bridge

In a joint venture with ISAB, VSL intervenes as a specialist contractor for the cable-stayed portion of the Uddevalla bridge spanning the Sunnigesund river.
On this 414-m main-span bridge, 1,100 t of galvanised, greased and sheathed strand will be installed. The stay cables range from 22 to 77 strands, with the longest one being 220 m.
The strands will be installed one-by-one. To offer savings for the Client, no tower crane will be used for stay erection. A special damping system is being studied in conjunction with VSL to avoid stay vibration due to rain and wind.
First stay erection is planned for mid October 1998.

Jean-François Cubille
Special Projects



- SAUDI ARABIA -
WADI LEBAN BRIDGE



This bridge involves the assembly of glued prefabricated segments, incorporating stay cables every second segment. The precast segments are 35 m wide, 5 m deep and weigh between 185 and 240 t. With a main span of 405 m and 179-m side spans, this 763-m long structure will cross the Wadi Leban valley, providing the longest link of the Riyadh ring road.
The scope of VSL works is the design and supply of post-tensioning and stays, construction engineering, supervision during installation, stressing and grouting of the stays. The construction of the stays is scheduled for 18 months. The VSL System 200 is used on the project. Cables vary in size from 6-19 to 6-52 and in length from 87 m to 420 m. With anchorages located at deck level, the stay cables are winched over the saddle areas, which are pre-grouted.

To maintain the parallel pattern of the strands established during fabrication, VSL, in co-operation with the contractor (a joint venture between Tanmia and Saudi Archirodon, with design consultants Dar Al Handasah) has designed a tailor-made winch system to allow the cables to be pulled from the fabrication table up 75 m onto the bridge deck. Once the stays are in place and finally stressed, they will be injected with cement grout and the anchorage caps filled with a special grease.
The works are progressing well and 50% of stay installation had been achieved at the end of March 98.

Bruno Pouquet
Special Projects

- USA -
MAYSVILLE & OWENSBORO CABLE-STAYED BRIDGE

Two stay-cable bridges of similar profile, with the same Owner (State of Kentucky), Client (Traylor Brothers, Inc.), stay cable system (VSL Monostrand System 200), and scopes (supply of the system, method statement for strand-by-strand installation and technical assistance) are currently under construction in Kentucky. For both projects, VSL will supply pre-assembled, pre-grouted anchorages, which simplifies the installation and increases the quality of the anchorage assembly. The pre-assembled anchorages will be configured to allow the contractor to install the stay-cable strands one at a time. The stays will be encased in colored co-extruded HDPE pipe.

Owensboro bridge

Maysville bridge

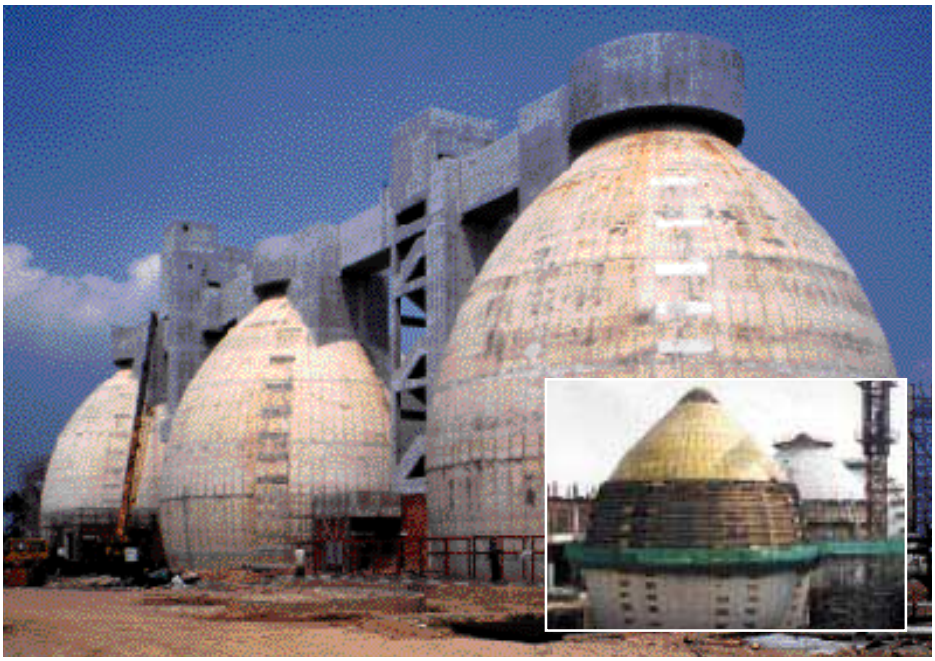
The Maysville Bridge consists of three spans [135 m-320 m-135 m] with two parallel planes of stays anchored in goal-post shaped pylons. The superstructure will be erected using the balanced cantilever method of construction and consists of steel edge girders and transverse floor beams. It will be decked with precast concrete panels overlayed with a latex-modified concrete. The 80 stays range in size from 6-31 to 6-55 and vary in length from 56 m to 166 m. The installation of the stay cables will be finalized end of 1999.

The Owensboro Bridge is a traditional two-tower stay-cable bridge with two planes of inclined stays anchored in diamond-shaped pylons with span lengths of 152 m-366 m-152 m. The bridge deck consists of steel edge girders and transverse floor beams, decked with precast concrete panels overlayed with a latex-modified concrete and will also be erected using the balanced cantilever method of construction.
The 96 stays range in size from 6-19 to 6-61 and vary in length from 56 m to 190 m. The installation of the stays is scheduled to be completed by March of 2000.

Robert Sward
VSL Corporation - USA

- SINGAPORE -

Seletar Sewage Treatment Works



After the award of the Kranji Sewage Treatment Works PT digesters, VSL has been chosen for the design and installation of post-tensioning of 6 egg-shaped digesters for Seletar Sewage Treatment Works.
Each digester is 35 m high, measures 22.1 m dia. and has a storage capacity of 6,495 m^3. Wall thickness varies from 320 mm to 600 mm and the top of the foundation ring is 4.7 m above the lowest invert level of the digester. Horizontal tendons in the walls are made up of S 6-4 tendons while the vertical tendons are of EC 6-4, 6-7 and 6-12 types inserted into galvanised steel ducts. A total of 40 t of strand is installed in each digester. The main contractor is Hyundai Engineering & Construction and Kinhill Tan Pte Ltd is the structural engineer.

Gary Soon
VSL Singapore

- FRANCE -

Rhone River Railway Viaducts

As a part of the extension of the French High Speed Train network (TGV), SNCF (the national railway company) is building two viaducts (approximately 1,500 m long each).
These precast segmental viaducts with 100 m spans are the first of this type for the SNCF and are currently the biggest civil structure under construction in France.
The main contractor—a joint venture between Bouygues and GTM—chose VSL and GTM's PT division for the technical assistance and PT-related works including cantilever, continuity, mid-span locking, and longitudinal internal and external post-tensioning.

Jean-Luc Mohr
VSL France

- UNITED ARAB EMIRATES -

LIFTING OF THE EXOSKELETON FOR THE WORLD'S TALLEST HOTEL

VSL Singapore has completed the lifting and placing works for the installation of the main elements comprising the exoskeleton for the Tower Hotel at Chicago Beach in Dubai. This structure is soon to be the world's most luxurious and tallest hotel, reaching 320 m with a typical floor-to-floor height of 7.0 m.

VSL's previous success with high lifts such as the KLCC skybridge led to the award of the contract by Eversendai Engineering—the steel works erection sub-contractor to the Murray and Roberts, Al Habtoor, Fletcher joint venture.

The operation involved the lifting and placement from ground level of 6 horizontal trusses and 6 diagonal trusses, an operation outside existing tower crane capabilities. The use of the VSL heavy-lifting system maximised the potential size of the prefabricated elements, hence minimising the amount of work required aloft.

The maximum truss length was 86 m, the maximum weight lifted was 225 t and the maximum lifted height was 196 m. Lifting was carried out from jacking carriages mounted on 2 relocatable cantilever frames which could accommodate lifting off-sets from the building of up to 24 m to account for the geometry of the building and the delivery position of the trusses.

David Trayner
VSL Singapore

VSL Strand Lifting Unit

- HONG KONG -

Tsing Yi Walls

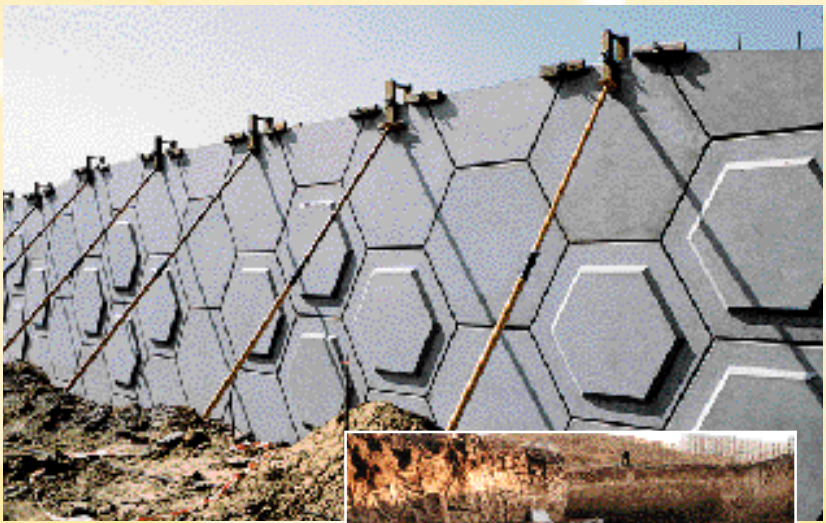
As a result of the residential development of Tsing Yi Island an additional bridge was needed to cope with the increased traffic going to and from the island. The eastern approach to the bridge required a retaining structure which was originally designed as a large-diameter bored-pile wall with a concrete facing to support the road and service trough of the approach route.
VSL Hong Kong successfully proposed an alternative design consisting of a temporary cut slope stabilised by rock and soil anchors and a Retained Earth Wall as the permanent structure. The 4,100-m² wall is up to 24 m in height with a series of benches 4.5 to 6.5 m high by 1.5 m wide giving an overall inclination of approximately 70%.
VSL's scope of work was a complete package comprising the alternative design (temporary and permanent works), the temporary slope stabilisation works, and erection of the VSL Retained Earth Wall including placement and earthworks.

Stuart Pearson
VSL Hong Kong

- PORTUGAL -

EN10 Walls

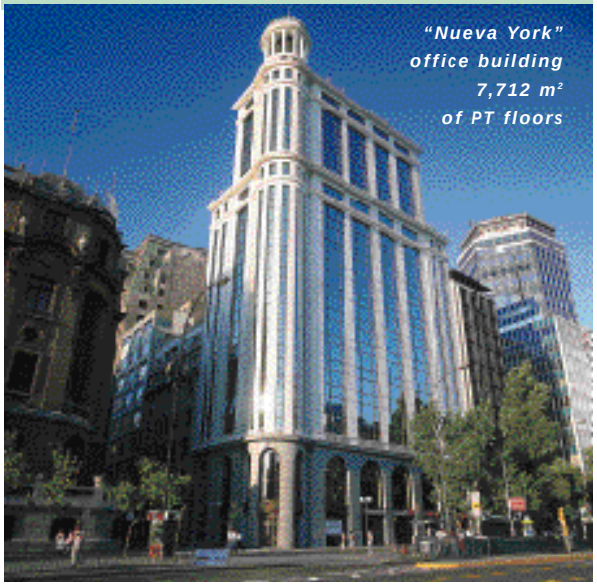
The E.N. 10 is the connecting road to the new Tagus Bridge in Lisbon for which VSL carried out post-tensioning and segment precasting for the access viaducts.
VSL was chosen by the main contractor—ACE Novaponte—to build a series of Retained Earth Walls because its system was economical to construct when compared with conventional stabilisation methods. In addition to economy, the smooth and raised hexagonal panelled finish provides pleasing aesthetic features that blend harmoniously into the landscape.
VSL's scope of works included panel design, and the supply and installation of the mechanically stabilised system. The system was specified for a service life of 120 years and a seismic acceleration of 1.6 m/s².



Average wall height is 7 m and the largest wall is 100 m long.

Zenobia Quadros-Martins
VSL Sistemas Portugal

YOUR LOCAL CONSTRUCTION PARTNER

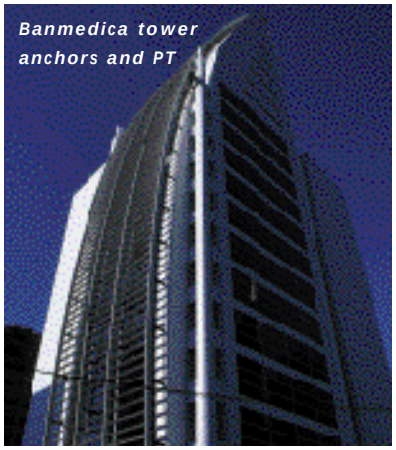


"Nueva York" office building 7,712 m² of PT floors

- VSL IN CHILE -

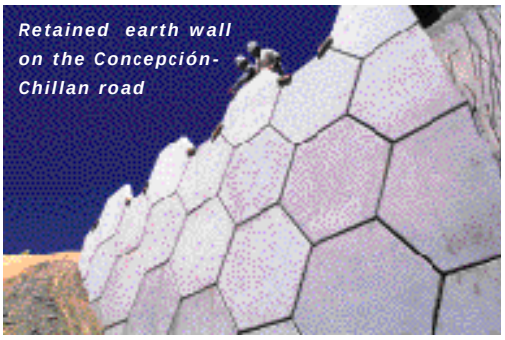
SU MÁS VALIOSO Y CREATIVO SOCIO CONSTRUCTOR

VSL has been present in Chile since 1988. It first started with a licensee, Sistemas Especiales de Construcción SA, owned by the well-known local entrepreneur Fernando Echeverría and his partners. In October 1995 a genuine subsidiary—VSL Sistemas Especiales de Construcción SA—was established to expand the rock anchors, PT slabs, post-



Banmedica tower anchors and PT

tensioning, Retained Earth Walls and Heavy Lifting businesses in this country. Today, the company is bringing new ideas and construction methods to local contractors and civil structure owners. As a construction partner, VSL has been involved in dams, cement plants, the mining industry-related structures, geotechnics and bridges, and has designed and executed more than 1,000,000 m² of post-tensioned slabs in hotels, commercial centers, parking garages, offices and residential buildings.

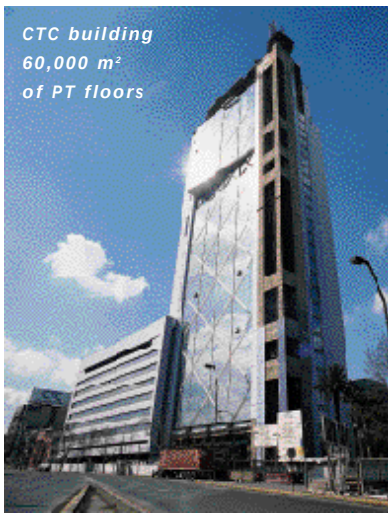


Retained earth wall on the Concepción-Chillan road

Mercado de Abasto

Main references are the El Teniente copper mine (rock anchors), CTC building (60,000 m² of PT floors), airport access viaduct (PT), Eje Prat road (retained earth walls), the Escondida copper mine (lifting of a 20,000 m² roof), the Sheraton and Marriott hotels (anchors and PT), Banmedica office building, Parque Arauco and Plaza Vespucio shopping centers, Huerfanos cable-stayed footbridge (stay installation), Chuquicamata copper mine wall and Acceso Norte a Concepción retained earth walls, and the lifting of 2 stockpiles at María Elena mine among many others.

At the end of 1996, VSL Sistemas Especiales de Construcción SA created a branch in Argentina to develop this promising market. With the technical and commercial back-up of the Santiago office, this new branch has secured important contracts such as the impressive Mercado de Abasto in only one year of operation.



CTC building 60,000 m² of PT floors

Eric Palos Jovani
VSL Sistemas Especiales
de Construcción SA

Plaza Vespucio shopping center anchors and PT floors

Isidora tower Santiago

- VSL IN THE PHILIPPINES -

With references such as Alson's cement silos (PT and slipforming design, supply and supervision) or the Vargas flyover (PT of I-beams), VSL has contributed to the improvement of the construction infrastructures in the area.

Two projects illustrate particularly well the value added services VSL can bring a main contractor in the Philippines:

PHILAMLIFE TOWER is a Grade A office building located in the heart of the Manila financial district, Makati. The Main Contractor, EEI Corporation/EE Black Joint Venture, awarded to VSL a package of Climbform system (35 m-long x 13-m wide) and post-tensioning works (51 post-tensioned levels and an area of 100,000 m^2). The project began in August 1996 and will be completed by early 1999.

METRO MANILA SKYWAY - STAGE 1 is a 35-km-long 6-lane fully elevated expressway.
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VSL has been contracted to undertake the post-tensioning works for the pierheads and the precast I-girders. The project is now reaching peak construction with up to 10 I-girders produced in the casting yard every day and simultaneous work on pierheads along the full 9.3 km length. Because of the tight schedule, work proceeds 24 hours per day. The first section of Stage 1 will be opened to traffic by mid 1998.

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