

VSL *NEWS*

I S S U E O N E 1 9 9 6

The River Leven Bridge, Scotland.



A new layout for a new approach

The Specialist Contractor concept was launched to ensure that VSL's offer would continue to meet increasingly exacting market requirements and anticipate future clients demands.

A New Approach

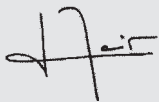
Our organisation has long-standing and rich post-tensioning expertise, unmatched technical capabilities as well as unique network of local affiliates that combine the strength of a world-class specialist with the responsiveness of locally based partners. As a Specialist Contractor, VSL provides all-inclusive packages that include upstream design and construction planning, the supply of high quality post-tensioning systems and the downstream management of on-site operations.

This new approach of post-tensioning focuses on projects and processes. It is our way of ensuring that our clients are provided with the best value-for-money services available on the market.

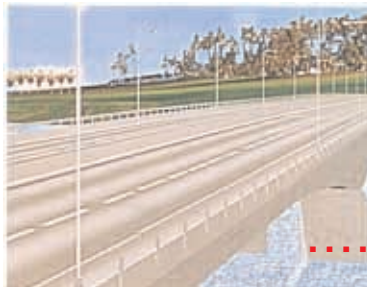
A New Layout

As VSL's main communications tool, VSL News should reflect this state-of-the-art approach. The new layout has been designed to clearly represent VSL's far-reaching Specialist Contractor capabilities. Readers will rapidly see that these go far beyond simply supplying post-tensioning materials. VSL News has been redesigned to show how VSL adds value by having an all-encompassing project approach to client requirements. Finally, our purpose is to highlight the advantages offered by VSL's unique network of companies and the important role played by their proximity to local markets.

We wanted to make it interesting and informative. We hope you enjoy reading it.



Michel Maître
CEO and
Chairman of the Board



HIGHLIGHTS

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VSL involvement in the first modern bridge in Vietnam

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Post-tensioning and launching of the world's longest incrementally launched bridge



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VSL launches the most cost effective state-of-the-art PT slab system in the world



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PIERRE BRON
REGIONAL MANAGER OF VSL'S OPERATING UNIT 5



Mr. Bron could you briefly explain OU5's purpose ?

OU5 stands for Operating Unit number 5. It is the fifth of VSL's five Operating Units. With its responsibility for marketing and management in Western Europe, Africa and South America, it covers the largest of the OU territories.

What is OU5's role within the VSL Group ?

The role of the OU is to offer its client's service packages, clearly defined working methods and scope of works. It also provides a high level of responsiveness and flexibility to adapt to specific local situations. The OU is responsible for supplying needed local resources where they exceed the capacities of a VSL affiliate. Lastly, it is to coordinate strategies of Profit Centres.

What added value does OU 5 offer its clients ?

By providing backup to local VSL affiliates OU 5 adds value in four ways :

Firstly by offering technical support. Thanks to VSL's European Technical Center, we can offer our clients the experience, know how and technical expertise an excellent team of post-tensioning specialists.

The second type of backup takes the form of providing construction methods and managing site operations. Here at OU 5, we believe that a well planned construction, schedule which is then implemented by our specialized Project Managers represents the best way to make considerable savings in the cost of labour and materials whilst retaining optimum quality levels. The third way is by optimizing the allocation of resources. By coordinating strategies and consolidating the resources of a number of local affiliates, OU 5 is able to provide local clients with



the capacities of a world-class contractor whilst retaining the lightweight structure needed to be efficient, flexible and economic. Fourth way is the guarantee to have VSL's quality products and the proven working methods that underline our reputation as an international PT specialist.

What ambitions do you have for OU 5 ?

Our goal is to adapt our organization to work even more efficiently as a specialist contractor, increase our presence in those countries where we have no permanent representative, improve the quality of the services we offer and extend our scope of works to include VSL's complete range of capabilities.

How do you intend going about this ?

For clients in countries where we are permanently represented by our Profit Centers, we will provide services that, apart from providing high quality equipment and materials, will also offer alternative design solutions, a PT consultancy service and on-site operational management.

In territories covered by a license, we shall focus on large or technically complex projects where our know-how can offer a specific added value. We recently set up a "Special Projects" team that includes our best technical

and marketing specialists to provide services that extend beyond the scope of our licensee.

What about those countries where OU5 is not represented ?

We are looking at projects on a case-by-case basis.

Our structures are organized in such a way that we can rapidly mobilize human, material and technical resources to meet all opportunities that present themselves.

What are the results so far ?

A large number of important contracts have been signed and completed : the world's largest floating concrete barge - the n'Kossa barge, strengthening the Oléron bridge in France, reinforcing and lifting the Kingston bridge in Scotland and the construction in joint venture of the New Tagus bridge in Portugal.

As far as increasing our presence is concerned, we have created a subsidiary in Chile to promote business in South America. In Columbia, we have signed a pre-stressing and soil anchor contract for the Pescadero Bridge.

What about OU5's scope of works ?

We are proud to offer all VSL capabilities : Post-tensioning (which is naturally present as a core business), Heavy Lifting, Retained Earth Walls, Stay Cables, Offshore Structures, Storage Structures as well as repair and maintenance of concrete civil structures.

In addition to VSL traditional scope of works, we also offer specific PT applications such as Autofonçage - a state-of-the-art concept that allow the boring of railway underpasses in record time.

Let me conclude this interview on our main asset : Quality. Our aim is to be certified ISO 9001 by year 1997.



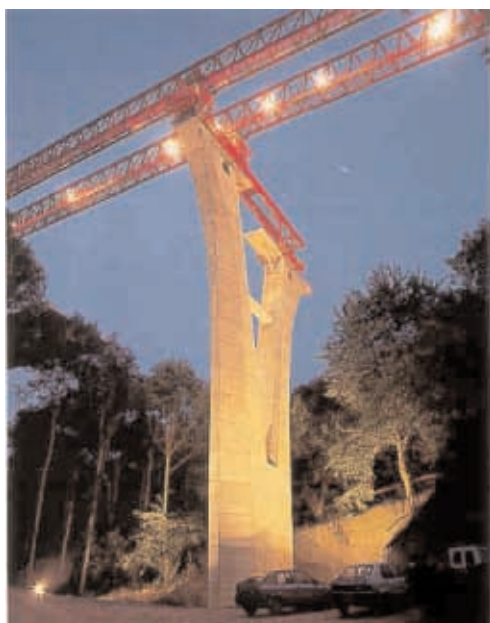
- FRANCE -

ROGERVILLE VIADUCT, NORMANDY

609 TONNES OF PT INSTALLED IN JUST 8 MONTHS

The 680-m long Rogerville Viaduct lies along the route of the A 29 motorway which will link the towns of Le Havre, Amiens, and Saint Quentin.

The viaduct has two parallel decks made of precast segments. The decks have a constant 5 m level difference



between each deck, a 4% slope and a curve following a 3,000 m radius.

The viaduct, built by Bouygues, covers 10 spans (43.4 m, 68.8 m, 6 x 76.0 m, 68.6 m and 43.3 m) and bears on two abutments and nine V-shaped piers that have been vertically pre-stressed using EC 6-19 tendons. The maximum pier height is 42.5 m. The legs of the smallest V-shaped piers are prestressed with EC 6-19 tendons and braced by a cross wall while the highest piers are braced by a cross beam.



The spans are fixed to the piers and articulations placed at mid-span (every three spans) permitting the deck to move thanks to mobile steel beams installed on sliding bearings inside the box girders.

Each precast segment has a constant height of 3.7 m and a maximum weight of 103 tonnes. A pair of symmetrical segments are alternatively placed at each deck using a 140 m long launching girder.

The segments are prestressed with internal PT (EC 6-19 tendons) at placing stage and then with external PT (ED 6-18 and 6-19 tendons) once the spans have been completed

The 609-tonne strands used for the post-tensioning works were installed within eight months, with teams working two to three shifts per day over the last four months.

Jean Claude BARBIER
Operating Unit 5 Western Europe



- VIETNAM -

PHU LUONG BRIDGE, HANOI

THE FIRST MODERN VIETNAMESE BRIDGE TO USE WESTERN TECHNOLOGY



The Phu Luong Bridge is one of the largest river crossings along the route of Highway No. 5. This is currently the busiest road in Vietnam, linking Hanoi to the port of Haiphong. The new bridge, scheduled to be opened in mid-1997, will replace the existing multi-purpose steel bridge which carries a one-way vehicle traffic and the railway line. The twin two-lane bridge is being constructed using the balanced cantilever method with main spans of 65m + 102m + 102m + 65 m, an 11 m wide deck and a depth varying from 6 m to 2.5 m.

The contract is being carried out with two companies forming part of the Ministry of Transport and Communication : Transport Engineering Design Inc. (TEDI) and Construction Co. No. 12 (CC12). It is the first modern bridge in Vietnam to be constructed using Western technology. VSL's scope of works involves designing the superstructure and formtraveller, supplying post-tensioning materials including strand and stressbar systems, as well as bearings and expansion joints. It also includes supplying the form traveller and providing construction engineering and management services as well as training of TEDI and CC12 engineers and transferring technological know-how.

This bridge is the first project in Asia to use CS anchorages. Construction of the superstructure began in July 1995 and is scheduled for completion by the end of 1996. This is made possible using the fast track methods introduced by VSL which provide a 7 day completion period per pair of segments.

The site was visited by the Prime Minister of Vietnam, H.E. Mr. Vo Van Kiet on 23 December 1995. He praised the project as being one of the most successful cooperative ventures between a foreign firm and local companies.

Siah Chee Seng
VSL Vietnam R.O

- INDONESIA -

K.S. TUBUN FLYOVER,
JAKARTA

THE WORLD'S LONGEST INCREMENTALLY
LAUNCHED BRIDGE.



A difficult design brief faced VSL's post-tensioning and launching the K.S. Indonesian engineers when they were Tubun Flyover bridge. Not only will it awarded the contract in 1995 for cross the Jakarta Flood Control Canal and Dass over the city's largest railway junction, but high voltage power lines overhead as well. Once completed, the flyover will connect the districts of Jalan Tubun and Jalan Kebon Sirih in central Jakarta. Traffic will be diverted to the western part of the City, thus bypassing the crowded Tanah Abang market.



P T Wijaya Karya, the general contractor, stated there was to be no disturbance to the railway system, that headroom had to be kept to a minimum 10.45 m metres and that a minimum distance had to be kept over-



head for the power lines. This meant that the bridge could only be 3.6 m high. To comply with all these restric-

tions, the logical solution was to launch the bridge incrementally.

One of the end spans to this five-span bridge is curved to minimise the disturbance to surrounding buildings. Spans are 45, 55, 65, 55 and 45 m long.

VSL TC Europe designed the superstructure and VSL TCAA - based in Singapore - designed the temporary structure.

The bridge consists of two identical box girders, each 8.5 m wide and 3.6 m high. A casting yard was installed on the site of the end span. A total

of 24 cast segments, each 22 m long are required for the two boxes. Because of the short distance between the bridge and the casting yard, a temporary pier is required to overcome the problem of hogging at the casting yard segment.

The final 65 m span represents a world record for an incrementally launched bridge.

Since the terms of the contract specify that railway traffic must not be disrupted, it was not possible to use a temporary pier between the bridge and the casting yard. As a result, the bridge has a 46 m launching nose.

The post-tensioning uses VSL 5-19 tendons and couplers: Additional longitudinal tendons required for the live load were installed after completion of the launching. The construction of the deck began in October 1995 and completion is expected by May 1996.

Johannes Himawan
VSL Indonesia

- THAILAND -

THE PA-MOK BRIDGE

CONSTRUCTION OF THE FIRST SPAN HAS BEEN COMPLETED

Construction of the first span on the Pa-Mok Bridge has been completed and work is underway on the assembly of the launching truss for the installation of the second span.

The bridge is being constructed across the Chao Phraya River, located in Pa-Mok, Aung Thong Province, 100 km to the north of Bangkok. It will be assembled from seven spans of post-tensioned high girders. A total of 91 beams are required, each 50 m in length and weighing 120 tonnes. The Highways Department is both the designer and the client.

Our scope of works covers the post-tensioning and erection of high girders. The first span was erected by a gantry crane designed and operated by VSL. The other spans will be erected using a self-launching truss, also designed and operated by VSL.

VSL's contract will be completed in September 1996. Final project completion is scheduled for November 1996.

Gaysorn Lertmongkonnam
VSL Thailand





- VIETNAM -
SAIGON TOWER

VSL CONTRIBUTES TO FAST TRACK BUILDING CONSTRUCTION IN VIETNAM

The use of post-tensioning and a flying tableform for the Saigon Tower project in Ho Chi Minh City earmarked the birth of fast track construction buildings in Vietnam.

Approached by Transfield Construction of Australia, the design and building contractor, VSL made an alternative post-tensioning proposal in 1994 which showed savings in both materials and time. To provide an added value, VSL, together with Aluma Formwork Systems, proposed a light-weight aluminium formwork system to improve overall constructibility and reduce work time.

With spans of 11 m and 8.3 m, each 1,000 m² level took an average of 6 to 7 days to complete. This represents a record for fast construction in



Vietnam. The 15 storey project has a ground floor area of 15,000 m² for use as office space. VSL's scope of work included the design for the floors and formwork, supply of PT materials as well as and formwork and site supervision.

Being the first alternative PT proposal in Vietnam, this project has launched the idea of cost and time savings for many other projects currently on the drawing board and has once again reaffirmed VSL's position as the market leader in value added engineering and services.

Siah Chee Seng
VSL Vietnam R.O.



- HONG KONG -
LEE GARDEN REDEVELOPMENT

VSL CLIMBFORM SYSTEM IN A HONG KONG SKYSCRAPER

Hong Kong's unrelenting pace of building construction recently led to the replacement of the historic Lee Garden Hotel by yet another skyscraper. Main Contractor for the project - Aoki Corporation - was successful in its tender for the construction of the 50 floor office building with an aggressive bid based on the use of the VSL Climbform System for the substantial core wall.

The building is steel framed and has a large volume of structural steel columns and beams cast into the heavily reinforced core wall. Because the core was on the critical path, the client wanted a guaranteed four day floor-to-floor cycle time.

The shape of the core is a truncated triangle with wing walls which drop

off at varying floor heights. This, and a large reduction in the wall thickness, led the design team to adopt an unusual but ultimately successful adaptation of the standard Climbform System which was dismantled in April this year within the target programme.

Stuart Pearson
VSL Hong Kong





- MALAYSIA -

KOTA MASAI WATER RESERVOIRS, JOHORE BHARU

VSL - A SPECIALIST STORAGE STRUCTURE CONTRACTOR.

More than 24,000 houses are planned in a new multi-billion development for the fast-growing Malaysian state of Johore. VSL has been invited to submit a proposal for the design and construction of two service reservoirs to form part of this development. Total scheduled construction time for the reservoirs is 14 months, with a June 1996 start date. This project will be carried out on a turnkey basis and the scope of VSL's

works includes the design and construction of the 8 and 2 million gallon (36 and 9 million litres) water reservoirs and the pumping station, including commissioning of the pumps and laying of associated pipework.

The construction method uses full height precast prestressed concrete segments for the wall and cast-in-place concrete for the base slab, ring footing and roof.

The 8 million gallon reservoir is made of 46 precast standard wall panels and 4 precast buttress panels. The base slab and the dome roof are in reinforced concrete. The pumping station will be designed and built by a specialist sub-contractor appointed by VSL.

Chong Chee Ken
VSL Malaysia



- SINGAPORE -

KRANJI SEWAGE TREATMENT WORKS - PHASE III

THE FIRST APPLICATION OF PT-PLUS IN SINGAPORE

VSL's involvement in the Kranji Sewage Treatment Works includes the design and construction of three egg-shaped digesters and the construction of two gas holder tanks and one sludge storage tank.

The engineers, Binnie & Partners, approached VSL for the preliminary design and structural sizing of the digesters prior to tendering. Each digester, with a 7,760 m³ tank capacity, is 36.5 m high and has an internal diameter of 21.9 m. Wall thicknesses vary from 459 mm to 707 mm and the foundations include forty 1.2 m dia. bored piles.

This is the first application of the PT-Plus system in Singapore. The vertical digester tendons have twenty EC 5-18 tendons, while the horizontal tendons are made of 25-18 and 25-12 strands. The sludge storage tank and gas holder tanks are also post-tensioned using EC 5-7 type horizontal tendons and 5" monostrand vertical tendons. Site works are on schedule and the General Contractor, Hyundai Engineering & Construction Co Ltd, is keeping up with the construction programme.

Patrick WOO
VSL Singapore



- JAPAN -

TAKAHAMA PUMPING STATION, TOKYO

VSL GROUND ANCHORS USED TO DRIVE DOWN A MASSIVE CAISSON

To improve water supply to the Northeast of Tokyo, two large water

pipelines totalling 45.5 km have been laid to connect two rivers and a lake.

An underground concrete shaft jointing the pipelines and the pumping station was cast. VSL used a drive down caisson method to construct the shaft from which the two pipeline tunnel routes will be bored.

To provide the 3,000-tonne pressure needed to drive down the caisson, ten E6-17 ground anchors were laid out around it and ten sets of VSL 500-tonne lifting gear (stroke 350 mm) were needed. A distinctive feature of this project was that the operation was fully automated. The shaft has a 23 m external dia., a 47.8 m depth and a 1.8 m wall thickness.

Susuke SAKATA
VSL Japan





- AUSTRALIA -

CROWN CASINO PROJECT, MELBOURNE

THE PROJECT IS NEARING COMPLETION.



The Crown Casino is nearing completion with the first stage due to be opened in November 1996.

The casino structure consists of two basement and four podium levels providing 3,000 car park spaces, and 300,000 m² of general floor area incorporating gaming tables, showroom and function facilities, night-clubs, restaurants and family entertainment.

In addition, a five star hotel rises forty floors above street level with an emphasis on suite-style accommodation.

VSL has contributed specialist expertise to three areas of the job, namely, Vertical Lift Core, Transfer Beams, and Hotel Floor Slabs.

- Vertical Core: The Core is stressed

to accommodate eccentric floor loadings on the external cores caused by their interaction with the Transfer

Beams. Stressing is carried out incrementally using 126, 96 and 75 m length VSL 5-19 type tendons.

- Transfer Beams (7) are located four storeys above the main hotel entrance and atrium. They support the hotel structure. Each beam is 1 m wide, with spans ranging from 21 m

to 30 m and depths from 6 m to 9 m.

- Hotel Floor Slabs. Includes 40 levels of band beams and slab bonded post-tensioned tendons.

Warwick Copeland
VSL Australia



- GERMANY -

THE NEW BICYCLE IN BERLIN

AN ALTERNATIVE DESIGN FOR TENSION MEMBERS

This new stadium will be equipped with a 250 m long oval race track and seating capacity for 10,000 spectators.

French architect, Dominique Perrault, won the competition for the design of the stadium. The structural design was by Arup GmbH of Berlin. The steel roof was built and erected by Krupp Stahlbau GmbH. The 142 m diameter roof is constructed of 48 radial girders, an inner ring beam, an outer ring beam and 48 tension members.

The tension members provided for in the initial design used 160 mm dia. solid core mild steel sections with 220 mm diameter end forks and steel bolts. This solution was judged to be questionable by the building authorities and was rejected by Krupp Stahlbau GmbH as the rigid steel members offered no flexibility in the adjustment of construction tolerances. This led to VSL's alternative design for the tension members being adopted.

This design is based on VSL's stay cable system. Each tension member includes twenty-two 0.6" mono-strands, a fixed end anchorage and an

adjustable stressing anchorage with a ring nut. Each individual tension member was accurately tightened using hydraulic jacks.

The stressing of the tension members took place in December 1995 and January 1996. Following the removal of the central support tower in February 1996, the force in certain tension members was remeasured and

satisfactorily matched the theoretical calculated values.

This project represents a good example of the value VSL can add thanks to its technical expertise, innovative ideas and high quality post-tensioning systems.

Johann Kollegger
VSL Germany





- AUSTRALIA -

SYDNEY CASINO PROJECT, NEW SOUTH WALES

VSL 'S CONTRIBUTION TO NSW'S
MOST PRESTIGIOUS CONSTRUCTION PROJECT

The Sydney Casino project, at an estimated value of AU\$575 million (US\$435 million) is currently New South Wales' largest and most prestigious commercial construction project. The Developer of the project is Sydney Harbour Casino Properties Pty Ltd, and the General Contractor is Leighton Contractors Pty Ltd.

For ease of control, Leighton have split the site into a number of separable packages including hotel, apartments and theatres. VSL were successful in negotiating post-tensioning (PT) contracts to cover all areas of the project, one of only three or four contractors to do so.

The project is being constructed on a fast track programme with construction following very closely behind the design by Consulting Engineers Ove Arup and Partners. Consequently, our PT contract was awarded on the basis of a schedule of rates per tonne of strand installed. The project will use a total of 950 tonnes of PT over an area of 150,000m² with a completion date of May 1996.

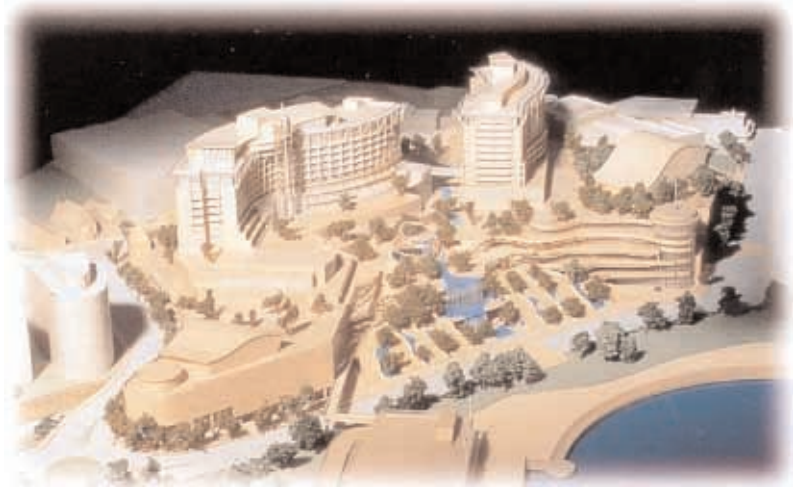
The structure, covering a site area of approximately 35,000 m², includes a five level basement carpark, main casino floor and three levels of family entertainment. Above the Podium



levels are two 12 level tower blocks, one for the hotel, the other for the apartment accommodation. These

tower blocks are not stressed due to their irregular S-shape. Commencing in January 1995, VSL installed 104 permanent ground anchors to the perimeter diaphragm wall. The anchors ranged in size from 6-3 to 6-10 and took approximately four months to complete. An interesting element of the construction is the transfer slab at level 5 which includes approximately 86 tonnes of multistrand tendons with a large percentage using 55 strand tendons.

John Davie - VSL Australia



- USA -

THE RITZ-CARLTON HOTEL AND SAN JUAN CASINO, PUERTO-RICO

VSL OPTIMUM DESIGN SAVES OWNER CONSTRUCTION DOLLARS

The Miami office of the VSL Corporation continues to serve Owners and Engineers by providing a high level of value-added engineering services that result in real construction savings. VSL's early involvement in a project results in a more efficient design - the right slab thickness for the spans and loads, compatibility with available slab forming systems, and establishing the fastest possible construction cycles.

The Engineer of Record for The Ritz-Carlton Hotel worked together with VSL Engineers to fine tune the floor layout, balancing architectural, mechanical, structural and construction requirements.

VSL is able to bring our specific expertise to this and other projects by recognising and simplifying post-tensioning details to prevent them from becoming problems during the



construction phase. This expertise speeds up preparation of the placing drawings and allows us to solve construction related problems quickly, whenever they occur, without causing delays.

VSL (your Project Partner) often has a close relationship with the Engineer (and therefore with the Owner) from the start of a project. It is VSL's experience, technical ability and capacity to perform at a higher level of value which make it stand out from the competition.

Phil Arana
VSL Corp. - Florida, USA

- GERMANY -

KAISERSAAL MONUMENT IN BERLIN

COMPUTER CONTROLLED PRECISION HEAVY LIFTING



Sony is building its European headquarters on the site of the neo-Baroque Kaisersaal building, adjacent to the luxury war-damaged Hotel Esplanade on the Potsdamer-Platz in Berlin.

To preserve these historical monuments, the city council required that Sony integrate them into its building complex. However, because the Kaisersaal was also blocking the construction of an important road, it had to be relocated by 75 m.

Sony entrusted general contractor Ed. Ziblin AG with the relocation works. This consisted in strengthening the



▲ **Control room:**
*the nerve centre
of the lifting operation*

As Ziblin had already successfully worked with VSL's Heavy Lifting specialists, we were invited to define a lifting concept. VSL's lifting scheme consisted of jacking up the 1,300 tonne building using VSL strand lifting units. 13 SLU-330 type units were used to form 11 lifting points, nine outside and two inside the building. The hydraulic pump scheme and the computerised control system using laser technology were both designed by VSL to maintain the level and avoid excessive deformation.

The scope of VSL's works included the design, supply, assembly and operation of the lifting and control equipment. After five days of assembly work, the Kaisersaal was raised off the ground on 29 February and lifted the following morning without major interruptions over a distance of 2.40 m in about two hours.

This very demanding project was an excellent occasion for VSL Heavy Lifting to prove its know-how and reliability.

**Erich Miischler
and Ernst Schneider
VSL Switzerland**

- FRANCE -

NUCLEAR POWER PLANT MAINTENANCE

REPLACING THE CLOSURE HEAD
IN A NUCLEAR REACTOR



Part of the EDF (Electricité de France - the government-owned French utility company) maintenance system for French nuclear sites includes removing and replacing the closure heads in 1,300 MW nuclear power plants.

The scope of VSL's works involves lifting the closure head (100 tonnes) from ground to 27 m using a trolley placed on beams fitted with a SLU 120 handling jack at 36 m, then sliding the trolley and its load over a distance of approximately 7 m to the entrance of the building.



Lifting the closure head
Weight : 100 tonnes

The replacement closure head is then attached to the trolley at 27 m and slid into the plant to replace the removed head.

The reverse operation is scheduled to take place two weeks later to remove the old closure head.

The handling equipment has been sold to EDF and is exclusively used for this replacement operation in the power plant. EDF is in charge of storing the equipment and VSL is responsible for supervising the operations and maintenance.

**Jean-Claude Peslier
VSL France**

▲ **Shop-testing the lifting equipment (partial view)**

fairly fragile two-storey building (14 x 17 m in plan) and underpinning it with a grid of massive post-tensioned beams. Once the building had been lifted, sliding tracks could be extended underneath and the building moved.



- CHILE -

ESCONDIDA COPPER MINE

LIFTING THE ROOF OF ONE OF THE WORLD'S LARGEST MINES

VSL was engaged as the specialist contractor to lift more than 4,200 tonnes of steel roof structure and conveyor for the Escondida Copper Mine in northern Chile. VSL's contract for engineering and execution of the lifting operations was critical to the success of this fast-paced project.

VSL was selected by the owner - Minera Escondida Limitada - and the construction manager - Fluor Daniel - because of its technically superior solution, its ability to respond rapidly to the needs of the project, and the confidence of the construction manager and owner that VSL could perform the work without interruption to ongoing mining operations. Through extensive engineering and close co-ordination with the client, construction manager and general contractor, the project was completed in less than a year, despite the difficult site conditions and several changes in the scope of the project.



The 20,000 m² steel roof structure was lifted in eight separate operations. The heaviest roof section and auxiliary lifting structures weighed over 620 tonnes. The lifting system was designed for zone 4 earthquake loading (UBC) and to withstand the daily blasting at the open pit mine.

Close co-operation between VSL Corporation in the United States and VSL Sistemas Especiales de Construction S.A. in Chile resulted in

a successful project for the client. The engineering of the heavy lifting towers, tower guys and roof support trusses; the choice of the methods; the provision of equipment as well as specialists for operating the equipment were provided by VSL Corporation. On-site labour and local engineering were provided by VSL Sistemas.

Construction manager, Frank Arcese, said "We are very happy with the work of VSL....If we ever have another project like this, we will definitely invite VSL to be involved."

Keith W. Jacobson
VSL Corp. - USA

and

Andrés Avendano
VSL Sistemas - Chile



- MALAYSIA -

PERTRONAS TOWERS, KUALA LUMPUR

LIFTING THE SKYBRIDGE LINKING THE WORLD'S HIGHEST TOWERS

The Skybridge project consists of a steel/concrete two storey glass sided walkway spanning between the world's two tallest buildings which stand at 450 m. It links the twin towers at levels 41 and 42. The V-shaped legs supporting the bridge at its centre represent a distinctive feature of the skybridge project. These legs are mounted upon a spherical bearing at level 29 on each of the towers and rise at 63 degrees towards the bridge centre.

The scope of works of VSL was the lifting of the skybridge using a piece-by-piece method. The operation was carried out by VSL Singapore Heavy Lifting Department, in co-operation with the Asia/Australasia VSL Technical Centre for the temporary works design and with local support from VSL Malaysia.



The small working area and time constraints meant that the four components had to be lifted from eccentric positions. The degree of manipulation required to move these components in plan, orientation and vertically involved an intricate sequence of controlled moves.

In addition, the client - Samsung (M) Sdn Bhd - specified that eight lifting tendons were to be used to lift the Central section. To further complicate the lift, there was a stringent tolerance on allowable deflections to protect the glass cladding.

With the invaluable assistance of VSL Heavy Lifting team from Switzerland and a modification to their new laser levelling system, it was thus possible to monitor and fully control this lifting operation.

The works proceeded successfully despite the persistent efforts of the elements with strong winds, torrential rain and electrical storms (including lightning strikes).

The VSL proposal provided the Main Contractor - Samsung/Kukdong/Jasatera JV - and the owner - Kuala Lumpur City Centre Bhd - with a significant saving in cost, time and risk.

David Trayner
VSL Singapore



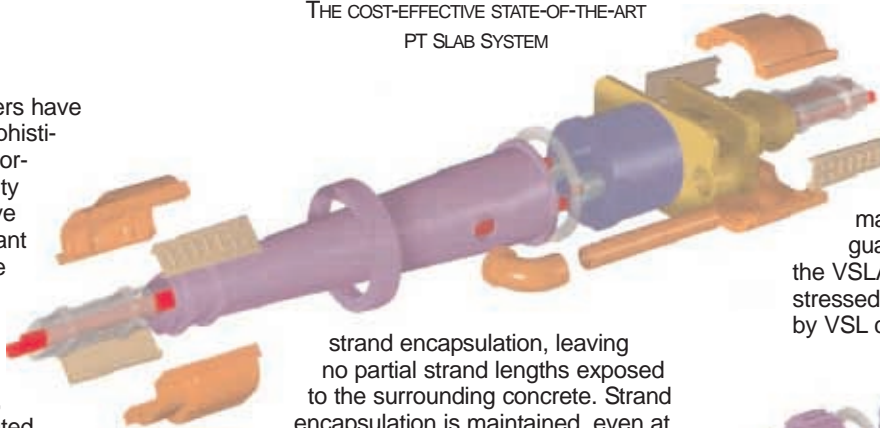


- SLAB SYSTEM - VSL LAB™

THE COST-EFFECTIVE STATE-OF-THE-ART
PT SLAB SYSTEM

As Building Owners have become more sophisticated, demands for construction quality and durability have risen. In its constant search to improve the science of post-tensioning, VSL is pleased to offer its new VSLAB™ System, a two strand grouted tendon.

The VSLAB™ (pronounced V-SLAB) System offers many features previously unavailable in commercial post-tensioning. Lying at the heart of the VSLAB™ System are two grouted slab strands that provide a higher performance level. Each of the two strands is placed within a corrosion-resistant polypropylene duct. Positive duct-to-anchorage connections provide full



strand encapsulation, leaving no partial strand lengths exposed to the surrounding concrete. Strand encapsulation is maintained, even at slab construction joints, by the incorporation of the innovative VSLAB™ System details.

To meet its commitment to provide the highest quality system, VSL offers a complete package. This begins with the production of components. VSL has set up a Quality Assurance Plan to ensure that all production problems are resolved prior to field use. VSL engineering ensures that all compo-

nents are compatible and designed to maintain tolerances during normal field handling. To guarantee in-place quality, the VSLAB™ System is installed, stressed and grouted by VSL crews.



By specifying the VSLAB™ System, the Owner has the most cost-effective state-of-the-art post-tensioned slab system in the world.

Dan Falconer
VSL Corp. - USA

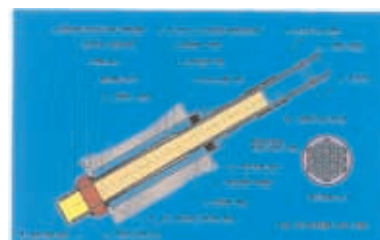


- STAY CABLE - TESTS

2 MILLION LOAD CYCLES AT 160 MPa FOR THREE PERFECT VSL CABLE TESTS

VSL has recently completed testing three full sized stay cable specimens, this being part of the contract requirements for the Foss Waterway cable stayed Bridge in the State of Washington, USA. On this contract, VSL Corporation will supply and install the VSL 200 Monostrand stay cable system (with grouted free length).

The stay cable specimens tested were for 6-24, 6-44, and 6-63 strand cables. Testing, which was carried out in Chicago, was in accordance with the Post-Tensioning Institute's recommendations for Stay Cable Design, Testing and Installation. After successfully undergoing 2 million load cycles at 160 MPa stress range, each

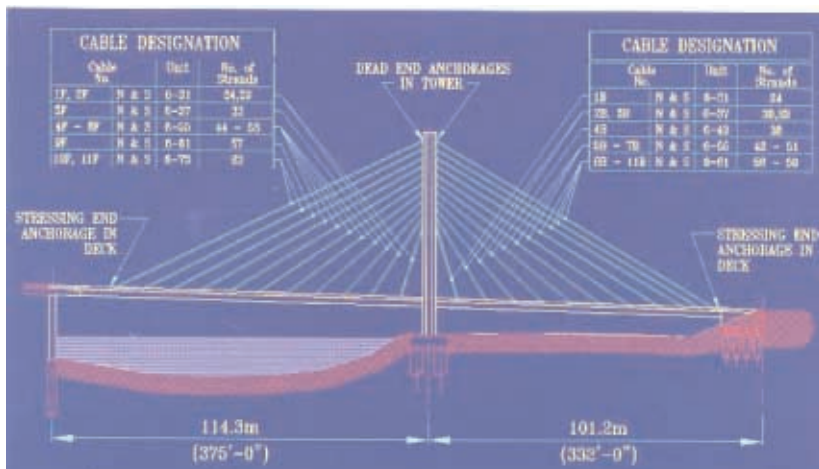


specimen was subject to static ultimate loading. All three specimens easily passed the test requirements.

These three results show that VSL's 200 SSI and 200 Monostrand (Grouted) stay cable systems, both of which use greased and sheathed monostrands, have very high fatigue resistance and excellent anchorage efficiency.

Manufacturing and installation of the Foss Waterway Bridge stay cables will commence in May 1996.

Duncan LAPSLEY
VSL Technical Centre - USA





- STAY CABLE -

RIVER LEVEN BRIDGE, SCOTLAND

AN APPLICATION OF VSL STAY CABLES WITH SINGLE STRAND INSTALLATION (200 SSI)

The River Leven Bridge links the Leslie Roundabout to the Southfield Roundabout in Glenrothes, 30 miles north of Edinburgh in Scotland. The bridge is situated in a park area and crosses 17 m above the water level of the River Leven.



200 SSI Anchor Head

The metal pylon head is supported by two cylindrical concrete legs and rises 60 m over the deck which is a 240 m long, 7.3 m wide single carriageway. The deck is supported by 28 stays. Seven groups of two parallel stays support a 133 m long main span and seven groups of two parallel stays support the smaller 64.5 m long span.

The scope of VSL's works was the design and installation of the 200 SSI System. VSL was selected by the general contractor on the technical performance of the system. Close co-operation between the European Technical Centre and the Western Europe Operating Unit led to the commercial success of the operation.

The multi-layer conception of the 200 SSI system guarantees optimal corrosion protection. The strands, greased and covered with a tightly-extruded PE sheath, are guided from anchor head to anchor head by individual PE tubes. Finally, an outer PE pipe protects the bundle formed by the guide tubes.

The main feature of the 200 SSI concept is its ease of installation. Having positioned the preassembled



empty stay pipe, the strands are individually pushed through the anchor head. This system also allows for non-destructive inspection and even the replacement of strands during the structure's service life.

An international site team was brought together to ensure the success of the 200 SSI. The installation

works and stressing of the stay cables were completed in a record-breaking eight weeks. This feat highlights the advantages of the system: possibility of preassembly, lightness of stay pipes and use of a single strand installation system.

Adrian GNAEGI
Western Europe Operating Unit 5

VSL DEVELOPS ITS PRESENCE IN SOUTH AMERICA

EJE PRAT ROAD WALL, CONCEPCION, CHILE

OUR FIRST RETAINED EARTH WALL IN CHILE



After casting an eye around for projects to develop the Retained Earth Wall system (REW) in Chile, VSL Sistemas Especiales de Construcción S.A. was awarded a contract for the execution of a REW project for 6,200 m² of plain facing panels by the Chilean contractor, Brotec, in August 1994.

The Eje Prat Road project in Concepcion, a town in southern Chile, includes ramp structures and an embankment between two new bridges with eight back-to-back retained earth walls. The longest wall is 210 m long and 10 m high.

Because the project is located in a zone 4 seismic area and for aesthetic reasons, 30% of the panels have a raised finish. The REW between the bridges includes a terrace with a curved lower wall. The distribution of raised finish panels and the curved layout was chosen by the client, the Public Department of Transportation.

The REW system provided significant savings in cost and time as well as being a practical solution given the unfavourable soil characteristics.

Andres Avendano
VSL Sistemas - Chile

▼ General view of wall n°2



CTC BUILDING, SANTIAGO, CHILE

VSL PT ALTERNATIVE WAS THE ONLY SUITABLE SOLUTION FOR THIS HIGH RISE BUILDING



The office building for Chile's Telephone Company (CTC) will be the tallest in the middle of Santiago's downtown section. With 33 storeys, it covers approximately 60,000 m². It should be noted that the building is located in a zone 4 seismic area. The post-tensioning alternative offered by VSL was the only solution that met the building's height criteria, the owner's column-free space require-

ment and the tight budget. The flexibility of the VSL post-tensioning system meant that CTC's demanding specifications could be met. The close working relations between the project's engineers (Lagos & Contreras), the contractor (Inela-Agroman) and the VSL design team resulted in a highly successful project.

Celso Villa
VSL Sistemas - Chile



VSL MOVES INTO NEW ZEALAND

AFTER THE AUCKLAND SKY TOWER,
VSL SIGNS THE QUAY WEST PROJECT

Following the successful introduction of VSL Climbform into New Zealand via the award of the Auckland Sky Tower Project to VSL NSW, VSL is now making inroads into the precast concrete-dominated New Zealand building industry.

Post-tensioning has been used predominantly in Civil Engineering structures in New Zealand (e.g. bridges, wharves etc.). However, the building industry has been heavily geared to precast concrete construction systems.

The Quay West project, being built by Civil & Civic for Mirvac Developments (NZ) Pty Ltd has been awarded to VSL on a design and construct basis. The Consulting Engineers are Murray Jacobs Limited. The project is a prestigious 33 levels apartment building,

28 of which are post-tensioned. Our contract involves some 100 tonnes of strand and approximately 20,000 m² of stressed floor.

Our marketing efforts are obviously paying off as we have also been awarded our second New Zealand Climbform Contract - the Mount Street Student Accommodation project for Fletcher Construction Pty Ltd. Although only 16 floors, and not of the same scale as Sky Tower, it is always pleasing to receive repeat custom.

We look forward to providing more innovative construction solutions in New Zealand.

Michael Brown
VSL Australia

Sky Tower - Auckland ▶



VSL'S UNIQUE REPAIR/RETROFIT EXPERTISE

GEORGETOWN UNIVERSITY LAW CENTRE,
WASHINGTON, D.C.

Increasingly, VSL's services are being sought as a specialist repair/retrofit contractor for routine cable repairs as well as for major restoration works to existing structures. VSL has recently completed a project that highlights our unique capabilities in this area.

Georgetown University in Washington, D.C. is undertaking an expansion of its Law Centre. A new structural steel building is being constructed on top of an existing three-level post-tensioned parking garage. VSL was contracted by Whiting Turner, the construction manager, to carry out the following works related to the repair and selective demolition of the parking garage:

- Provide more than 80 openings in the post-tensioned slabs for steel column penetrations.
- Provide 12 openings in the post-tensioned mat foundation to allow for penetration of new piles and pile caps.
- Provide two new elevator openings in the post-tensioned slabs.

- Re-anchor unbonded tendons at the edge of all new openings.
- Provide a structural surveillance of the parking structure to assist the construction manager in his evaluation of the garage.
- Provide various concrete and PT repairs to beams, slabs and at construction joints.

As the Georgetown University project demonstrates, VSL can provide a broad scope of services on repair/retrofit projects. In addition to the capabilities listed above, VSL has developed expertise in the following specialties:

- Conventional reinforced concrete repairs
- Precast refurbishment
- Fabrication and installation of structural steel elements for repairs
- Shotcreting
- Slab waterproofing/membranes

Because of these unique capabilities, we have developed close relationships with consultants, property managers, and contractors who have an ongoing need for these services. VSL's works closely with the client to provide structural surveys, budget pricing information, and a broad scope of repair services.

Our highly-skilled technical staff, from engineers to field technicians, provide the highest quality and most innovative solutions to our clients needs.

Don Kline - VSL Corp.
Washington DC - USA



THE COMBINATION OF A WORLD-CLASS SPECIALIST CONTRACTOR
WITH THE RESPONSIVENESS OF A LOCALLY BASED PARTNER

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