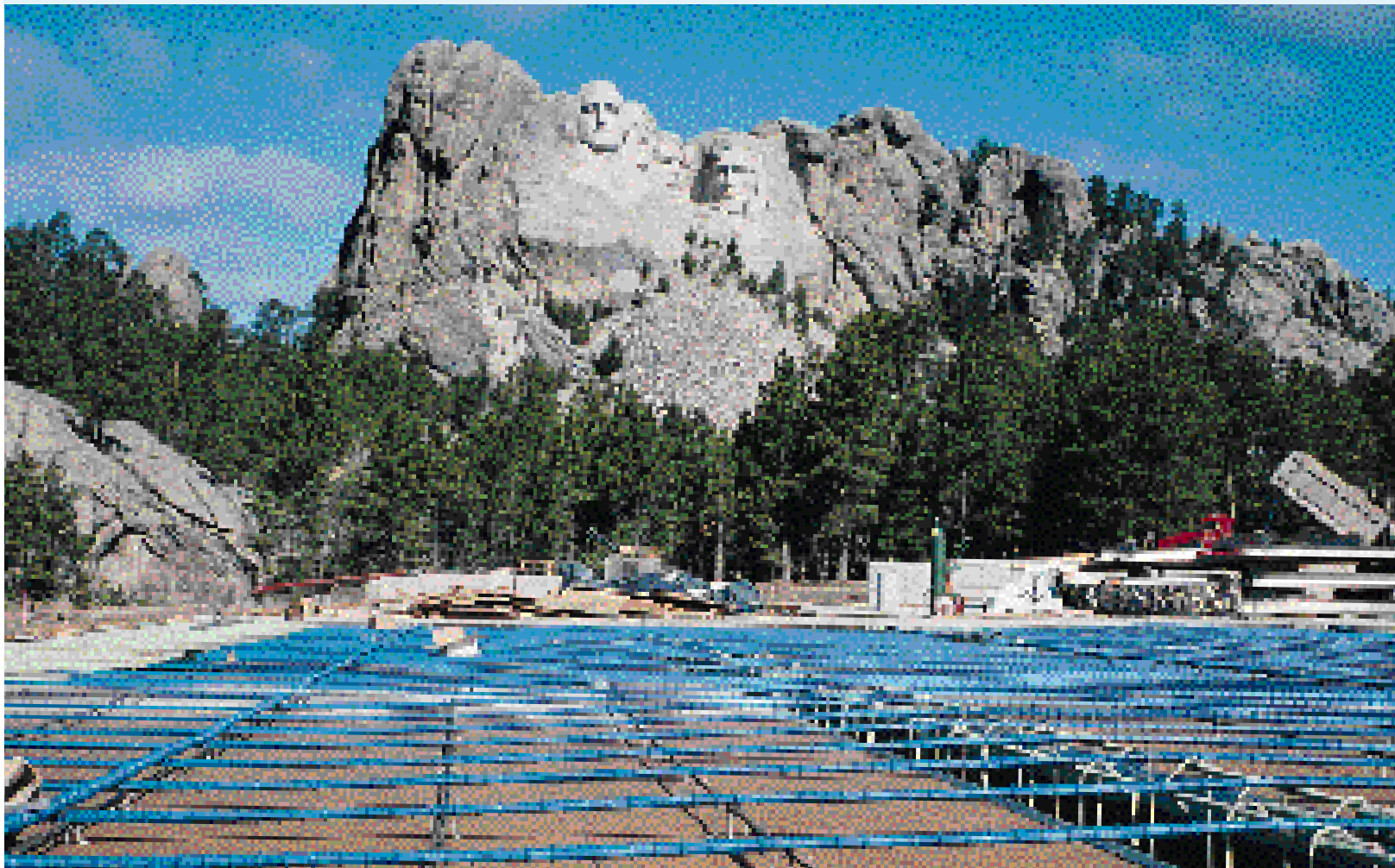


Mount Rushmore Parking Garage - USA



VSL brings Post-Tensioning to Buildings construction

The ever-more complex and sophisticated demands made in the engineering sector have led to post-tensioning being increasingly specified in bridge construction works. The reason is simple: whether for in-situ cast constructions or structures assembled from precast elements, post-tensioning provides a wide range of advantages. These cover both the structure (longer spans, lighter superstructures, aesthetics) and its construction (economy, speed, standardisation of tasks).

These same advantages can also be provided when post-tensioning engineering is incorporated into building construction. Post-tensioned buildings are now being erected throughout the world, with the system's specific characteristics adapted to local building codes, standards and practices. Although now widely used in the construction of high-rise offices, commercial centres and parking garages in Asia, Australia and America, the system unfortunately continues to remain comparatively under-developed in certain European countries, such as France and Germany.

However, thanks to our international network of partners and subsidiaries, we are constantly confronted with a wide range of different construction environments. Our unmatched track record and list of references demonstrate that post-tensioning is always able to provide a large number of advantages over traditional reinforced concrete buildings.

VSL's successes in the use of post-tensioning for building construction are detailed in this magazine which features the company's most recent PT projects (high-rise buildings, office complexes, multipurpose tower blocks, shopping centres, car parks, etc).

Our role is to intervene as a post-tensioning specialist to the Main Contractor, providing packages that include design and technical assistance, the supply of high quality materials and site supervision.

Alain Le Pivert
CEO and Chairman of the Board

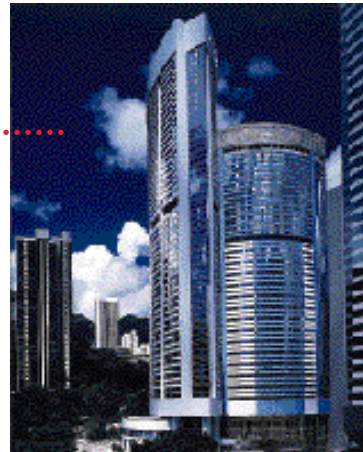


6-7

VSL post-tensioning in a footbridge with no reinforcing steel

8-9

VSL PT in the construction of buildings provides speed and economy



13

VSL contribution to the tallest building of its type in south-east of the USA

10

PT-PLUS duct adopted as standard for building in Switzerland



Lifting of two 20,000 t caissons

15

P U B L I S H E D B Y

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- HONG KONG -

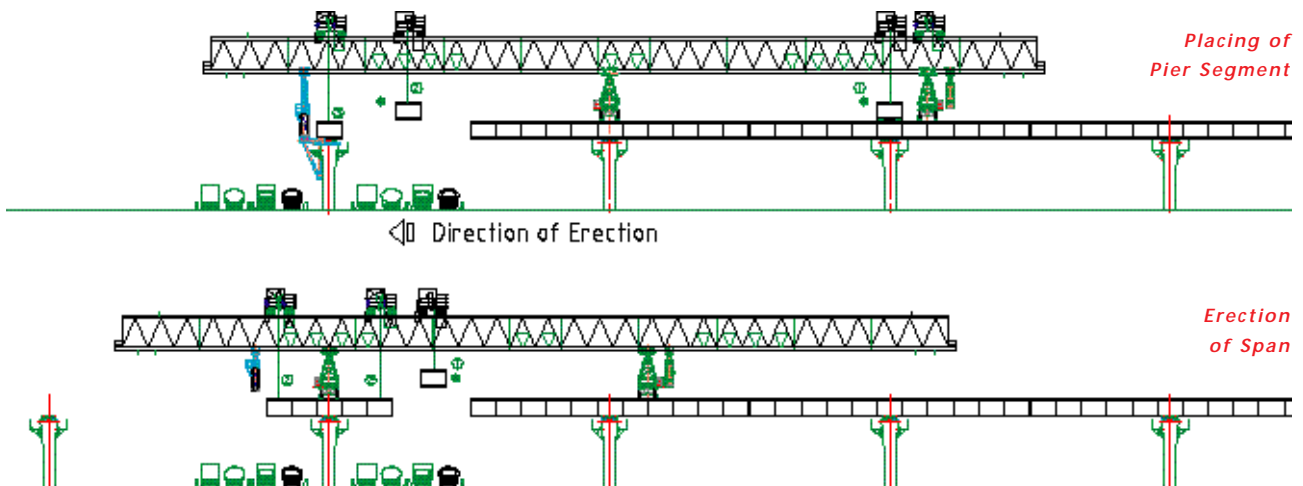
HUNG HOM BYPASS AND PRINCESS MARGARET ROAD LINK



This interchange, located at the new Hung Hom reclamation area on Kowloon side, includes a 950-m long 4-lane elevated road, a 1,300-m elevated road, and 6 footbridges.

The Main Contractor, Maeda / Chun-Wo J.V., awarded VSL the :

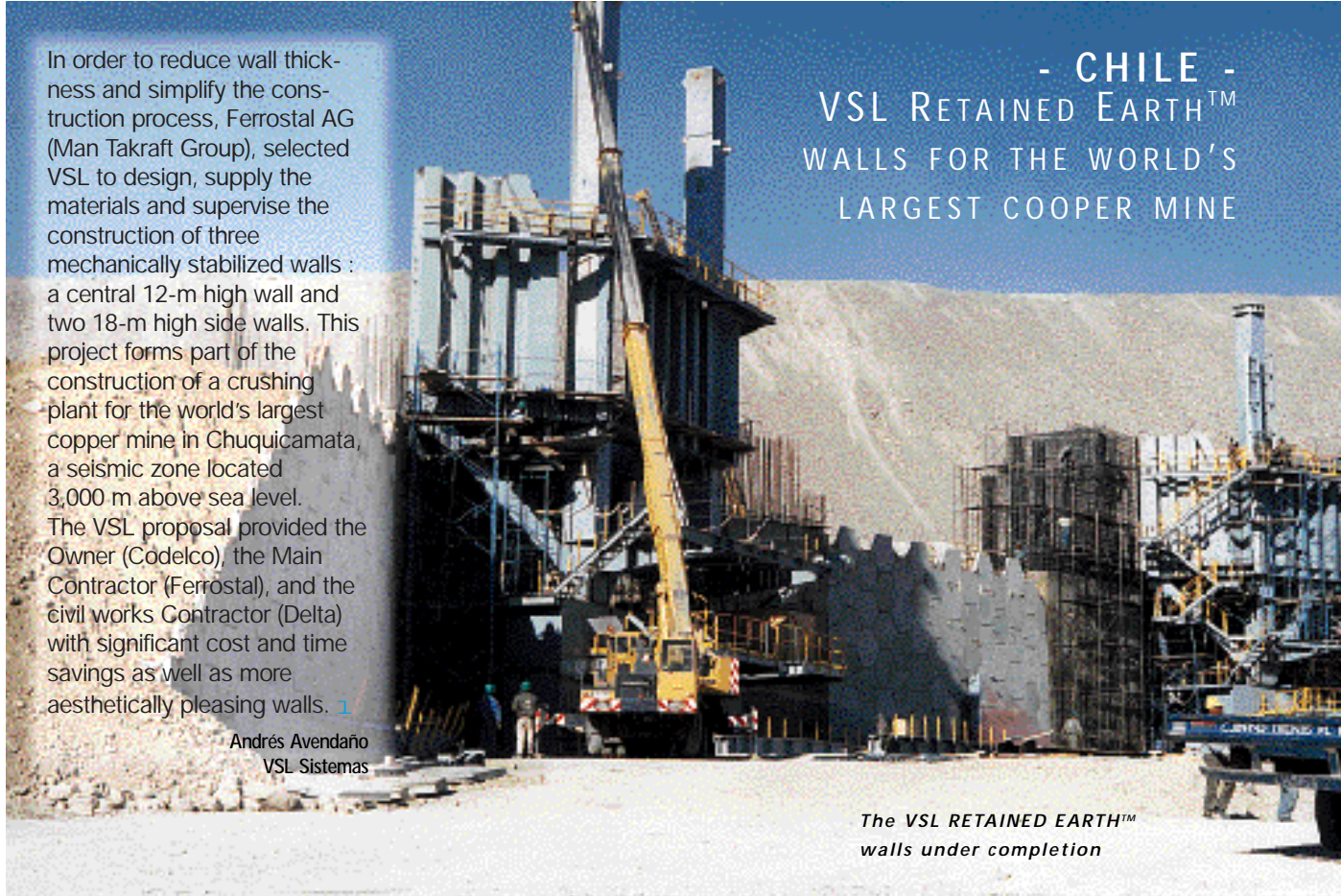
- Design of cell formworks and supply of the hydraulic equipment
- Geometry control of the casting curves at segment precasting stage
- Technical assistance at the precasting yard during the first 6 months
- Transport and erection of 1,645 segments
- Supply and installation of the permanent post-tensioning (1,200 t)
- Supply and installation of 480 bearings & 49 movement joints



The main difficulty of the project lies in placing the segments by launching girder in a heavily congested environment in the northern part of the project. Part of the interchange will cross over the KCRC (a railway line to the New Territories and China) and the exit of the Cross

Harbour Tunnel draining heavy vehicle traffic from and to Hong Kong Island. To minimize disturbance, most of the works in this sensitive area will be carried out exclusively at night from 1 am to 5 am. [1](#)

Guillaume Moutier
VSL Hong Kong



In order to reduce wall thickness and simplify the construction process, Ferrostal AG (Man Takraft Group), selected VSL to design, supply the materials and supervise the construction of three mechanically stabilized walls : a central 12-m high wall and two 18-m high side walls. This project forms part of the construction of a crushing plant for the world's largest copper mine in Chuquicamata, a seismic zone located 3,000 m above sea level. The VSL proposal provided the Owner (Codelco), the Main Contractor (Ferrostal), and the civil works Contractor (Delta) with significant cost and time savings as well as more aesthetically pleasing walls. 1

Andrés Avendaño
VSL Sistemas

- CHILE - VSL RETAINED EARTH™ WALLS FOR THE WORLD'S LARGEST COOPER MINE

*The VSL RETAINED EARTH™
walls under completion*



The piers are monolithic and include three V-shaped inclined supports and the pier head segment



Main balanced cantilever span

- MALAYSIA - IBAI RIVER BRIDGE

Located about 12 km from the town of Kuala Terengganu, on the east coast of west Malaysia, the Ibai River Bridge is being built to replace the existing bridge.

The two side approaches - respectively 40 m and 45 m spans - are constructed span-by-span using a conventional falsework system. The center spans (65-100-65 m) are constructed using the cast in-situ balanced cantilever method.

The innovative feature of this project is that the main balanced cantilever span includes a transitional horizontal curve with a minimum 220-m radius. The top deck and the bottom flange of the box girder have a cross-fall up to 5.5% to achieve the required road alignment.

The support system used for both abutments and approach piers is on mechanical bearings.

VSL's scope of works is to :

- design and detail of the superstructure,
- design of the falsework for the pier head unit construction,
- design, manufacture and supply two sets of formwork travellers.

Each formwork traveller is designed to move forwards, upwards, downwards and curve horizontally, as well as adjust to match the bridge's changing cross-fall,

- prestressing works using E5-19 tendons,
- calculation of the deflection for balanced cantilever construction.

Expected completion date is December 1997. 1

C K Chong
VSL Malaysia



- FRANCE -

LIFTING OF THE WATTRELOS TOWER CUPOLA

To improve the water supply in the town of WATTRELOS, "Les Eaux du Nord" - a local utility company - decided to construct a new 3,000-m³ water reservoir. Norpac/Dumez, the Main Contractors, chose VSL to raise the 2,000-t cupola reservoir from ground level to the top of the 37.5-m structure.

The structure was completed in two stages : the core tower was constructed and the reservoir was built on the ground using a formwork system. The Ø 38.90-m cupola was then raised into

position from the top of the tower. To carry out this operation, twelve SLU 330M 500-t jacks were bundled in three groups having the same load distribution. The lifting was performed from ground using two monitoring devices : oil pressure gauges to control the

hydraulic pumps and maintain a balanced load distribution, and a video system to check the horizontal positioning of the cupola. The head supervisor was in constant communication with the top of the tower where the jacks were placed. The lifting operation was performed in less than 13 hours.

The cupola was then held stable in its final position for one week so that it could be connected to the core tower. 1

Pascal Helfer
VSL France



- SINGAPORE -

PT LPG TANKS

Close co-operation with Sato Kogyo's Singapore office led VSL to be awarded the post-tensioning related works for two concrete Liquid Petroleum Gas (LPG) tanks in Bintulu, on the island of Borneo.

The propane tank is 27 m high and Ø 28 m, whilst the butane tank is 32 m high and Ø 41 m. Tendons around the tanks consist of 5-14 and 5-19 tendons, while the

vertical looped tendons with U-shaped steel pipes are of 5-9 and 5-10 tendons.

The tanks were cast in lifts of 2.85 m and both directions of tendons were only stressed once the full height of the wall had been cast. 1

Gary Soon
VSL Singapore



The propane tank
under construction

Monostrand
used in
conventional
concrete

The custom
designed
miniaturized
VSL
monostrand
anchorage
without
bearing plate



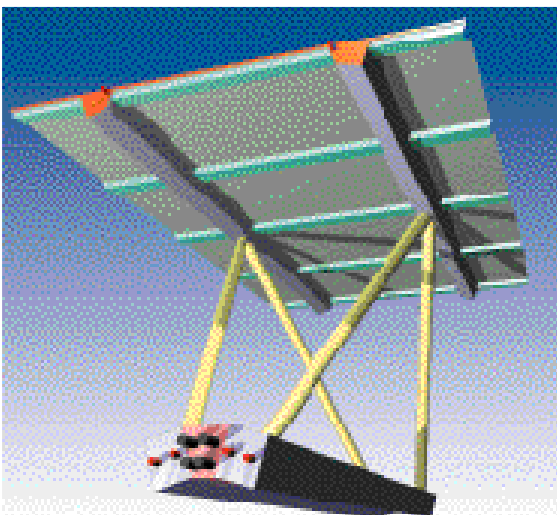
The Sherbrooke footbridge is the world's first post-tensioned structure to use RPC - a revolutionary concrete developed by Bouygues Research Department.

Besides remarkable ductility properties, RPC provides outstanding compression strengths ranging from 200 to 800 MPa.

RPC is made from a special mix of small particles (less than 0.5 mm) providing a dense mixture, minimising void spaces in the concrete and greatly enhancing durability. Its properties are further enhanced by heat treatment at high temperature (90°).

The characteristics of the RPC used in the Sherbrooke footbridge are:

- 200 MPa compression strength i.e. two to four times greater than High Performance Concrete (HPC),
- 7 MPa direct tensile resistance,
- 40 MPa flexural tensile strength (up to eight times that of HPC),

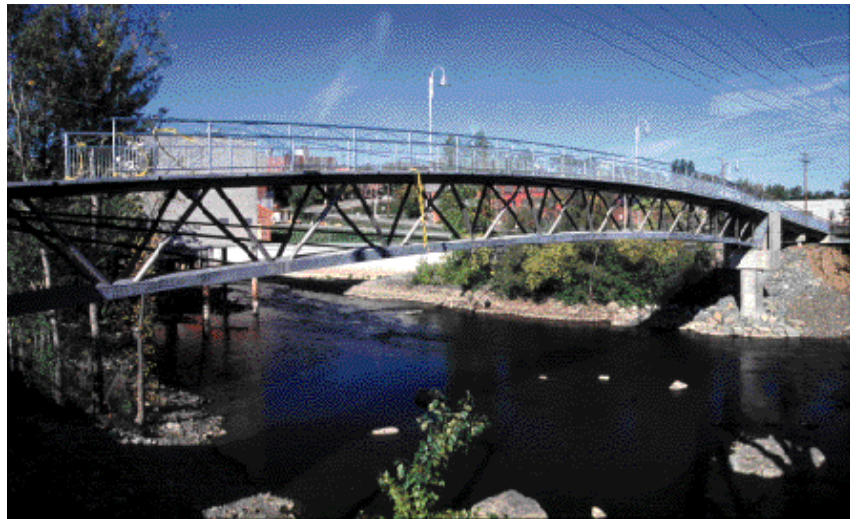


Construction partners:
Béton Bolduc
Béton Canada
Bouygues
City of Sherbrooke
HDR
Pomerleau
Sika
Teknika
University of Sherbrooke
VSL

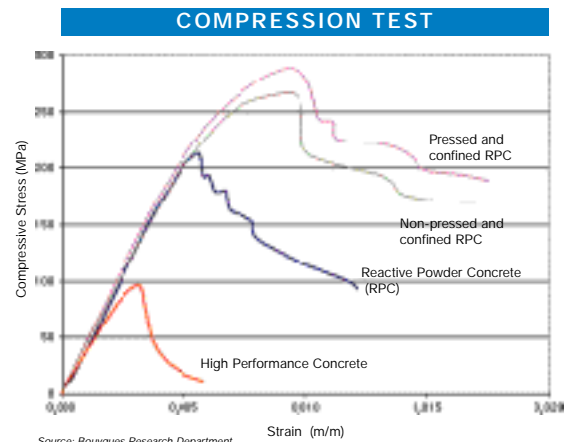
A FOOTBRIDGE WITH NO CONVENTIONAL THE FIRST APPLICATION OF REACTIVE POWDER CONCRETE IN A PT CONCRETE

- 50 GPa modules of elasticity. Fracture energy is 250 times greater than that of HPC.

For the Sherbrooke footbridge, a three-dimensional space truss has been utilised for the superstructure. The deck, which acts as the top chord of the truss is 3.3 m wide and 30 mm thick. The inclined members / diagonals



are made from a thin-walled stainless steel tube filled with RPC. The bottom chord is a 320 mm by 380 mm RPC section.



CONVENTIONAL REINFORCING STEEL : ACTIVE POWDER CONCRETE (RPC) CONCRETE STRUCTURE

The truss-type superstructure spans 60 m and is 3.5 m deep.

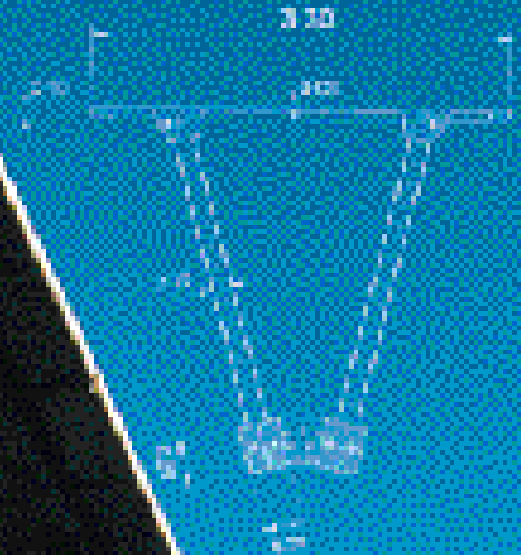
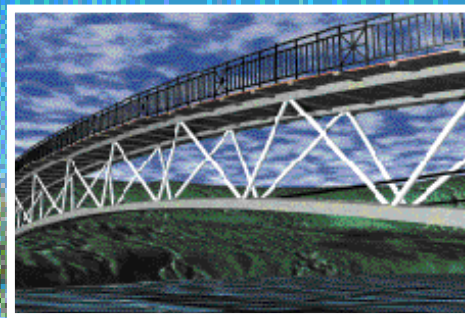
The primary prestressing uses VSL External Tendons between the truss members. The deck slab is prestressed transversally. The diagonals are connected with prestressing tendons to the top and bottom chord. Both these tendon types use greased and sheathed monostrand, anchored in custom designed miniaturised VSL monostrand anchorages.

These tendons are fully encapsulated for optimum corrosion protection. A few tendons have been equipped with load cells and strain gauges to monitor tendon forces over time.

This first application of a post-tensioned RPC bridge was completed in September 1997, after only two months for precasting the segments and two weeks for their erection.

This footbridge located in the city of Sherbrooke, Quebec, is a testimony of the significant opportunities for new designs of light and durable structures provided by the VSL post-tensioned RPC system.

Hans Rudolf Ganz
VSL International Ltd.

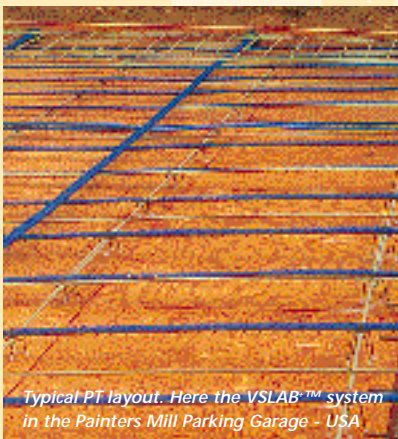




VSL's scope of works includes the design of the slab, supply and installation of the post-tensioning as well as supervising the operations on site.

There are many advantages to the VSL post-tensioned systems :

- **Overall speed of construction:** by providing a high level of task repetition and a faster equipment turnaround, the VSL PT system is ideally suited when time is of prime concern.
- **Savings in materials and equipment :** By reducing the amount of steel required (a PT slab is two thirds lighter than a reinforced one) and simplifying the slab design, the VSL PT system provides dramatic savings in the construction of non-structural elements, which represent 70% of the cost of a building.



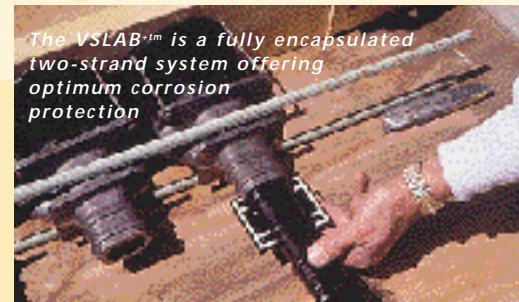
Typical PT layout. Here the VSLAB™ system in the Painters Mill Parking Garage - USA

- **Early Stripping of formwork:** Because the pre-stress forces allow the floor to carry its own dead load, the formwork system can be removed early - generally 72 hours after pour - drastically reducing backpropping and the number of forms required.

By successfully transferring its expertise in the post-tensioning of civil structures, VSL has become the worldwide specialist contractor in the field of PT applied to buildings. In 1996 alone, VSL has post-tensioned nearly 3.5 million m² of floors around the world.

- **Higher productivity**
The systems can be placed in relatively small sections as the formwork is erected, resulting in the concrete being poured before the entire floor area is completed. This minimizes idle labour time while ensuring full continuity of work for all subcontractors.
- **Larger column-free areas**
The VSL PT system offers the developer, architect and user larger column-free areas with greater spans, thus increasing the overall useable surface and enabling a more flexible utilization of the space.
- **Reduced floor-to-floor height with thinner and lighter slabs**
As the structural depth of the floor system is kept to a minimum, floor-to-floor height can be reduced and for the same total height, additional floors can be added (about one every twenty stories) . In addition, the lightness of a post-tensioned structure also results in savings in foundations and earthquake loadings.

POST-TENSIONING SPEED ECONOMY



The VSLAB™ is a fully encapsulated two-strand system offering optimum corrosion protection

- **Deflection-free**
The VSL post-tensioned floor system is virtually deflection-free under permanent loading, and has the ability to recover should the floor be overloaded at any given time.



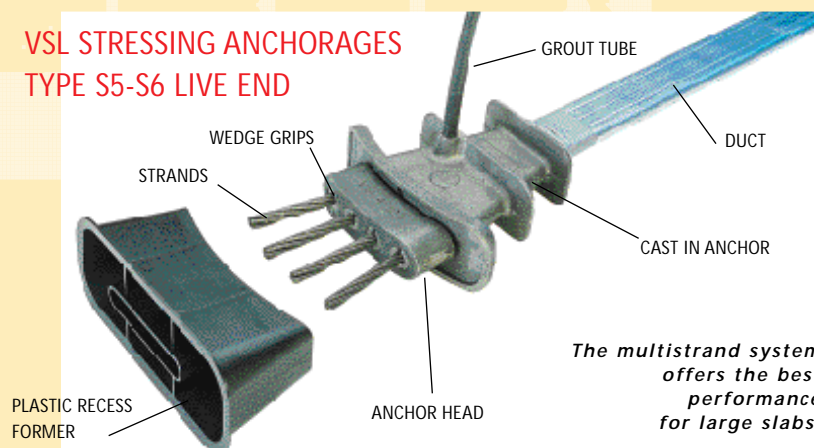
Tullamarine Car Park in Australia. VSL PT was selected on cost and speed of construction grounds.



VSL system is suitable for slab-on-ground applications. In the Pilkington glass plant in Australia, VSL installed 22,000 m² of crack free, durable PT ground slab.

IONED SLAB AND NOMY

VSL STRESSING ANCHORAGES TYPE S5-S6 LIVE END



• Crack-free and waterproof slabs

A nominal pre-stress of 2 MPa is sufficient to ensure a waterproof structure under normal loading, without the need for expensive waterproofing membranes being applied.

The VSL PT system can be used in nearly all kinds of buildings : high-rise towers (such as the Pornpat center on page 11 and Santa Maria condominium on page 13), industrial warehouses (see OCG factory p.12), parking garages (such as Mount Rushmore project p.12 and Rex p.13), in large area or residential buildings (see SUVA clinic and Cairns retail development on p. 10 and Tan Tock Seng Hospital p.11). [1](#)

Mikhaïl Botbol
Technical Center Europe



▲ On the Gateway II complex, VSL offered a package including the detailed design of three towers with three podium levels, the supply and installation of the post-tensioning for the floors and the design, supply and operation of the system formwork. A five-day cycle was achieved for blocks 1 & 2. The aim is to reach four days for block 3.



The VSL systems can also be used in high rise buildings such as the Devon House in Hong Kong.



VSL systems are most suitable for commercial shopping centres where large column-free areas are needed. Above is the Fashion Island shopping center in Bangkok where VSL installed 220,000 m² of post-tensioned slab

Typical four-day construction programme

Activities	Day 1	Day 2	Day 3	Day 4	Day 5
Stressing					Repeat
Flying Forms					Day 1
Reinforcement					
Tendons					
Concreting					
Curing					
Columns					



- AUSTRALIA -

CAIRNS CENTRAL PROJECT

The Cairns Central project forms the largest retail and carpark development in Cairns, located 1,200 km north of Brisbane. Retail areas are located on the ground and level one, with car parking provided on ground, mezzanine and level one.

The project was awarded to Multiplex Constructions in May 1996 with VSL commencing on site in June 1996 and activity on site lasting 12 months.

Typically the structure comprises a band beam and slab configuration with a post-tensioned solution being chosen by the structural engineers, MPN Group.

The total suspended slab area of 90,000 m² was divided into 80 major pours, containing over 600 t of post-tensioning. [1](#)

Barry Story
VSL Prestressing (Aus.) Pty

- SWITZERLAND -

SUVA REHABILITATION CENTER PT-PLUS DUCTS ADOPTED AS STANDARD FOR MANY BUILDINGS IN SWITZERLAND



The PT-PLUS is a corrugated plastic duct that provides the tendons with optimum protection and fatigue resistance. It is especially suited for structures where severe corrosion and high fatigue resistance may be encountered.



In November 1996, VSL was awarded the post-tensioning works of a rehabilitation clinic for the Swiss National Insurance against Accidents (SUVA) in Sion. It consists of several buildings with a total slab area of 27,400 m².

The post-tensioning cables were prefabricated on-site and uses the flat duct VSL 6-4 PT-PLUS 72/21 system, a solution increasingly specified in Switzerland because of its optimum corrosion protection.

200 t of strands, 3,270 stressing, intermediate and dead-end anchorages, and 420 couplers were used in this project.

Though works were interrupted for two months due to an intense winter, VSL maintained the initial programme and will met the completion deadline scheduled for November 1997. [1](#)

F. Vouilloz
VSL (Suisse) SA

- SINGAPORE -

TAN TOCK SENG HOSPITAL



The Tan Tock Seng Hospital ▲

As it was anticipated that many openings in the slabs would be required during the service life of the Tan Tock Seng Hospital tower block, the Consulting Engineer (Indeco Consultants P.L.) first opted for a conventional 8 m by 8 m reinforced concrete design using of a two-way ribbed beam system.

VSL, with the consent of the consultants, presented an alternative post-tensioned solution to the Main Contractor Ssangyong Engineering and Construction Co, Ltd. The alternative scheme consisted of a one-way beam and slab system with tendons grouped together to form a "hidden" secondary beam within the slab. VSL was subsequently awarded the installation of this PT slab system. Apart from satisfying owner's strict requirements, this proposal also provided more headroom, thinner slab and a faster construction method for the Main Contractor. 1

Gary Soon, VSL Singapore

- THAILAND -

PORNPAT CENTER

The Pornpat Center Project is one of many building projects under construction in Bangkok for which VSL Thailand is involved as a specialist sub-contractor.

The project consists of a 41-storey tower and three basement levels. A podium structure, part of which is for car parking, occupies the first 12 storeys, while the upper floors are devoted exclusively to offices.

VSL was awarded the design, supply and installation of the post-tensioned floor slabs representing more than 56,000 m².

The particularity of the structure is that the floor plan changes in size as the height of the building increases. This is achieved by set



back columns supported on post-tensioned transfer beams at levels 33, 36 and 39.

The typical floor slab consists of 450 mm deep PT band beams spanning 13 m with 160 mm and 200 mm thick PT one-way slabs. In order to save on the number of formworks, the Main Contractor - Thai Gammon Ltd. - specified that typical floor slabs should be split into two pouring zones. This requirement led VSL to design a number of band beams so that the first pouring zone could be supported independently from the second one. 1

Gayson Lertmongkonam,
VSL Thailand

▲ *The Pornpat tower
near completion*

- USA - MOUNT RUSHMORE VSLAB⁺™ PARKING



The Mount Rushmore project consists of two separate parking structures to help accommodate the 2.5 million annual visitors to this well-known Memorial in South Dakota. Each parking structure is composed of two suspended levels with a total area of 23,000 m² made of post-tensioned cast-in-place beams and slabs.

The conforming design, which specified unbonded post-tensioning, was successfully changed by VSL to a VSLAB⁺™ / CS-PLUS bonded/grouted post-tensioning system. Thanks to a special high-density, non-bleed grout containing microsilica and heavy polyethylene PT-PLUS continuous duct; this fully-encapsulated system offers superior corrosion protection, longer durability of the slab, a substantial decrease in maintenance cost and a reduction of mild reinforcement. The first parking structure was completed in time for the '97 summer tourist season and scheduled completion of the second one is programmed for the spring of 1998. 1

Daniel M. Harger
VSL Corporation - Dallas, TX



- FRANCE - VSL INTRODUCES PT GROUND SLABS IN FRANCE

Widely used in Asia and America by commercial, industrial and car park owners, the VSL post-tensioned ground slab system has recently been introduced in France. This system offers thin, crack-free slabs with no joints - in certain application, 10,000 m² slabs have been constructed without movement joints. In addition, it reduces construction lead time, extends the life of the slab and effectively minimises maintenance and repair costs. As part of a new chocolate factory located in the city of Rouen, the



contractor Bouygues DCI needed a 600 m² ground surface which could support 37 t cacao storage tanks. Because the tanks could not easily be moved, minimising repairs and maintenance operations was a prime concern for the client - OGC a well-known chocolate producer.

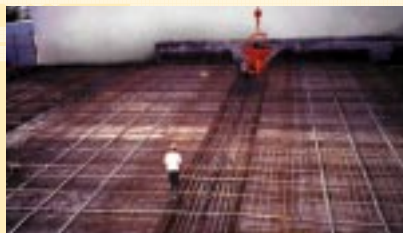
Slab support-load capacity and its long-term durability were critical factors in convincing the client to choose a PT solution over a standard reinforced slab system.

In this project, VSL's scope of works was to design the 600-m² ground slab, supply the PT and reinforcement shop drawings, as well as carry out the post-tensioning of the slab. 1

Mikhail Botbol
Technical Center Europe

- LA REUNION -

VSL INTRODUCES POST-TENSIONED SLAB ENGINEERING



Following an alternative proposal to the original reinforced concrete design for the «Rex le Chaudron» building, GTOI awarded VSL the detailed design, supply and

installation of post-tensioning for the 1,800 m² slabs.

GTOI, a subsidiary of COLAS - one of the world's largest road works groups, was keen to use a method providing overall savings on materials and allowing the early stripping of scaffolding in critical areas of the building.

The PT system used for the lower (parking garage) and upper slabs

included SO6-4 stressing anchorages, flat ducts and type H dead-end anchorages. The upper level beams were post-tensioned with 6-12 cables.

This was the first time post-tensioning was used in La Réunion. [1](#)

Jean-François Cubillé
Special Projects OU4.5

- USA - SANTA MARIA CONDOMINIUM

This 52-storey 100,000-m² luxury condominium located in the prestigious Brickell Avenue area is one of the tallest building of its type in the south-east of the USA. VSL's scope of works included re-designing and detailing the post-tensioned slabs for the tower, parking and recreational decks, as well as the supply of the post-tensioning system.

As time was a key concern, and to reduce the design stage which was on the critical path, VSL intervened in the early conceptual phases working as a project partner with the owner/developer (CMC Group) and the structural consultant (Raul Puig Group). By the time the Main Contractor (Bovis of Florida) was selected, the drawings were so advanced that the construction schedule was not affected. To reduce construction schedule even further, VSL developed a specific stressing procedures allowing Bovis to achieve a cycle of one floor every five days.

The VSL portion of the project was completed in July 1997. [1](#)

Phil Arana
VSL Corporation - Miami, FL



*The Santa Maria
condominium under
construction*

- USA -

WINFIELD LOCKS & DAM GUIDE WALL & GUARD WALL - WEST VIRGINIA

VSL has completed 7 of 14 lifts on the Winfield Lock & Dam in West Virginia, USA. The lifting solution was developed by VSL in conjunction with the selected contractor (Al Johnson - Massman) as part of a value engineered alternative solution for the guide wall and guard wall. The original design for the new lock required placement of twenty-nine, Ø 10 m by 12 m deep, tremie seal concrete "cells." The value engineered solution reduced the number of required cells to 12, but included very large concrete beams (3 m x 3 m x 34 m) weighing approximately 500 tons each. This solution decreased the

VSL
Strand
Lifting
Unit

performed the on-site work for the complete lifting operation.

The concrete beams were segmentally match cast and subsequently post-tensioned together using VSL tendons. The beams were then loaded into barges (two beams per barge) for transport to the project site. The unloading of the concrete beams, which were eccentric in the barge, caused the barge and beam to roll from side to side as the load was transferred from the barge to the lifting tendons. A pinned connection was used to accommodate this movement. After lifting free of the barge, the lifting jack assemblies were slid along the top of the lifting frame by use of a "strand-climbing" system before lowering the beams into final position.

The contractor is very satisfied with the VSL operations which include lifting (7 m), sliding (6 m) and lowering (6 m). A complete cycle of lifting, sliding and lowering has been accomplished in as little as two hours. ¹

overall project cost and improved the project schedule, mainly due to the reduction in the number of cells - a reduction of 16,000 m³.

VSL performed the design of the entire lifting system, including the lifting frame, lifting beams, frame tie-downs, attachment to the concrete beams and lifting method. VSL also

Keith Jacobson
VSL Corporation - Raleigh, NC



- THAILAND -

U-TAPAO 3,400-T HANGAR ROOF LIFTING

Sino Thai is constructing a new maintenance center for Thai Airways at U-Tapao Airport. The largest building is a 225-m by 99-m maintenance hangar covered by a 3,400-t roof. VSL's task was to raise the roof, assembled on the ground, to its final position 25-m above ground level. The structure was erected in 3 sections - a central element and two symmetrical side parts.



Lifting of the central element weighing 1,200 t and measuring 45 m x 99 m

In July, VSL lifted the central element. To carry out this operation, VSL installed four temporary steel columns, subsequently used as permanent supports in the side walls of the hangar. Once the roof was erected, four permanent columns were installed adjacent to the lifting towers. The structure was then lowered into its final position. Afterwards, 20 jacks installed on the central element and on top of the side-wall columns, were operated to raise the side parts to their final position. [1](#)

Walter Althaus
VSL Switzerland Ltd.

- SWEDEN -

LIFTING AND LOWERING TWO 20,000-T CAISSONS FOR THE ØRESUND BRIDGE



Caissons hanging on lifting strands between two barges being towed out from the fabrication dry dock

In April 1997, VSL successfully positioned two 20,000-t concrete caissons. This operation sets a world record for the weight handled using a hydraulic strand lifting system.

Each caisson measures 35 m by 37 m and is 22.5-m high. Prefabricated in a dry dock in Malmö, the caissons were then towed by boat to their final position. VSL used 40 SMU-330 lifting/ lowering units to safely handle the loads. Thanks to sophisticated control devices, only one person was required to operate the hydraulic system and

supervise movements.

During the tow-out, fenders were used to prevent the caissons, hanging free on lifting cables, from undergoing any horizontal swing. Wind and wave conditions could have entailed up to 200,000 load cycles with load fluctuations of up to $\pm 18\%$ on the strand cables. Consequently, extensive fatigue calculations were carried out to ensure the satisfactory performance of the suspension system. [1](#)

Erich Möschler
VSL Switzerland Ltd.



The lifting/lowering operation required twenty VSL SMU-330 units on each barge.



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

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MALAYSIA

VSL Engineers (M) Sdn. Bhd.
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Precision Precasting (Wgtn.) Ltd.,
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HONG KONG

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JAPAN

VSL Japan Corporation
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KOREA

VSL Korea Co. Ltd.
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PHILIPPINES

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VSL Corporation
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VSL Corporation
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Fax: 1 - 703 - 451 - 0862

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VSL Corporation
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Fax: 1 - 305 - 592 - 5629

MIDWEST

VSL Corporation
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Fax: 56 - 2 - 233 67 39

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VSL Systemy (CZ) s. r. o.
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Balvac Whitley Moran Ltd.
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Fax: 31 - 71 - 572 08 86

Stronghold Benelux B.V.
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Fax: 31 - 70 - 517 66 24

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VSL Norge A/S
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PERU

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