The Charles De Gaulle Bridge - Paris, France
VSL Your Specialist Contractor

Prestressed concrete structures are making significant contributions to improving the overall effectiveness and quality to a growing and sensitive European infrastructure. VSL in cooperation with other partners has established “Convention Européenne de la Précontrainte” (C.E.P.) - an international non-profit organization with a view to:

• Promoting solutions using post-tensioning techniques and related structures in Europe.
• Improving construction effectiveness and the quality of concrete structures by providing complete post-tensioning services as a specialist contractor.
• Promoting post-tensioning in European codes and Approvals as a construction technique including research, development, production, installation, monitoring services and overall technical support - rather than product trading.
• Co-operating with National and European bodies together with other local and international associations having similar objectives particularly in relation to prestressed structures and technology.

VSL Clients and Partners will be able to assess our approach to post-tensioning capabilities by:

• measuring VSL’s achievements in satisfying their needs
• meeting VSL staff and sharing innovative solutions for projects
• teaming with VSL’s regional and technical specialists
• reviewing VSL’s continuing development
• relying on VSL’s research
• sharing VSL’s confidence in the future of post-tensioned concrete and prestressed structure construction.

Michel Maître
CEO and Chairman of the Board
The roof structure for the terminal building consists of large barrel vaults, each spanning 36 m. For site erection the vaults have been divided into 36 m x 36 m modules of 80 t to 120 t. The layout of the terminal precludes the use of cranes to place the modules into the interior of the building.

The launching system consists of two 80-m long self launching beams (SLBs) supported on electrically driven lower roller supports and temporary columns. Each SLB carries two motorized carriages which support, transport and lower the roof module into place. A cycle times of five days for transporting the modules over a distance of 360 m are now being achieved.

The design of the launching system was carried out by VSL Technical Centre Europe and site supervision is by VSL Hong Kong. Completion date is October 1996.

- HONG KONG -
Kap Shui Mun Bridge and Mawan Viaduct

This project includes a cable stayed bridge with a 430-m main span and a 503-m long elevated viaduct. Both structures have two deck levels. The upper deck carries a dual three-lane carriageway and the lower deck carries the airport railway with two emergency lanes for vehicle transport.

The Main Contractor, Kumagai-Maeda-Yokogawa-Hitachi Joint Venture, awarded to VSL Hong Kong the supply and installation of 2,200 t of PT tendons and 20 t of VSL Stress Bar. VSL successfully proposed the VSL Type L anchorage as an alternative to the original vertical tendons for the 7-m high bridge web of the side spans. VSL also helped to optimise the tendon sizes for both the bridge deck and the viaduct.
Festival Walk includes 90,000 m² of landscaped - thumbed mega mall covered by 23,000 m² of business complex. The exterior resembles a crystal embedded rock and incorporates extensive sky lighting with cavernous food courts and a 180-m deep shopping canyon.

PT has been utilised in four key areas:

- The general floor comprises PT primary beams with a precompressed ratio of 2.5 MPa.
- The suspended floors at the canyon extremities are supported on PT beams spanning up to 30 m.
- The adjacent floors and void perimeter of the secondary canyon are supported on PT beams with a continuous span of over 70 m.
- The flooring system of the office tower utilises PT ribs at 1 m centres spanning 12 m.

MTR Contract 509 includes six viaducts to be constructed using a standard stage-by-stage cast in-situ method. The difficult detailing for the stressing anchorage coupling zone led the Main Contractor to use VSL expertise for this project.

To comply with the electrical insulation requirements specified by MTR’s Engineer, VSL proposed to use EC and K type multistrand stressing anchorages with the following features:

- 400 microns epoxy resin coating to all the exposed metallic anchorage components.
- 3 mm thick Cevolit isolating plates to be installed between the coupler block and the casting.
- 3.5 mm thick PT-PLUS high density polyethylene ducts to be used for tendon sheathing.
- Heat shrink sleeves to join the PT-PLUS duct and trumpet connection points.

Electrical insulation tests had been satisfactorily carried out on complete assembled PT anchorages in the VSL workshop. Full scale tests will be jointly conducted by the Engineer and VSL when vacuum assisted grouting of the tendons is carried out which should occur in November 1996.

C. T. Fung - VSL Hong Kong
In 1995, VSL Hong Kong decided to develop a quality assurance system to meet the growing demand from contractors and to maintain a leading position in its field. By the end of the year, structural bearings and movement joints were certified to ISO 9002 and post-tensioning works to ISO 9001.

The results observed so far in 1996 have been highly positive, leading to a more systematic approach to works-in-hand and a greater awareness of the need for quality.

We intend to expand the quality assurance system to cover other activities, such as System Formwork, Retained Earth and Ground Anchors.

Y. S. Li
VSL Hong Kong
The 140-m long three span box girder bridge forms a vital link for the Gateway Arterial Road in Deagon. The bridge, built by J. F. Hull, was constructed in three stages with each stage joined by a 2-m closure segment. Each closure segment allowed for the installation and stage stressing of multistrand coupling anchorages.

The triple box girder construction accommodated ten 31 x 15.2 mm multistrand anchorages in the four 2.2-m high vertical webs supporting an 11-m wide deck.

VSL carried out the material supply, installation of ducting and strands as well as all stressing and grouting works.

Barry Story
VSL Prestressing (Aust.)

VSL's scope of works includes the design of all structural elements except foundations and pilecaps and complete erection of the structural framework from 1st storey to 9th storey and roof. The total suspended floor area is 86,500 m². Sembawang Construction Pte Ltd has been a VSL client for a long time. The structural engineer is Chong & Lee Consultants.

Due to the excellent layout and loading conditions of the building, a post-tensioned cast in-situ flat slab system was adopted. Large rolling table forms were used to improve the construction. Parapets and stairflights were also precast. The formwork for the core wall construction was modified so that the entire form assembly could be raised to the next pour level by VSL hydraulic jacks. When completed, this will be the largest project in Singapore fully designed and constructed by VSL.

Gary Soon
VSL Singapore
The M2 is a 23-km stretch of new road being built by the Abigroup Obayashi Joint Venture for the NSW State Government linking the North Western suburbs with Sydney City. The project is a Build Own Operate Transfer toll scheme and is due to open mid 1997. VSL has been awarded the contract to supply and install 332 permanent rock anchors to retain the bored pier and shotcrete wall which stretches for over 0.5 km. Anchors range in size from 3 to 9 strands x 15.2 dia., and have a specified 100 year design life.

anchoring works be completed within nine weeks, with only one week for preparation. Anchors were prefabricated in a controlled yard environment and transported to site on extendable semi-trailers. To further streamline the installation, VSL designed a special 'wrap around' bracket for the 30° angled bearing pads, thus avoiding the labour intensive and costly jack hammer preparation works to the concrete bored piers.

Mick Holland
VSL Prestressing (Aust.)

As its name suggests, the Elephant Tower resembles an elephant. It is part of the new Ratchyothin business district in the north of Bangkok.

The 32-storey complex includes two office towers and a luxurious residential condominium as well as a 1,200-car parking facility.

VSL was responsible for lifting four twin steel trusses approximately 100 m above ground level from a temporary fabrication platform on the 3rd floor level up to the 25th floor transfer level. The trusses were lifted by four SLU 30 hydraulic jacks. Each pair of trusses span 32.7 m and has an approximate weight of 106 t.

Gaysorn Lertmongkonnam
VSL Thailand

- THAILAND -
THE ELEPHANT TOWER, RATCHYOTHIN

- AUSTRALIA -
M2 TOLLWAY, SYDNEY
The Koror-Babeldaub Bridge is located in the Palau archipelago, approximately 1,000 km southwest of Guam. The single cell box girder bridge with shear hinges at mid-span was built in 1978 using the free cantilever construction method, providing a then record span of 240.8 m. Appreciable elastic and plastic deformation has taken place since the original construction, leading to a mid-span vertical deflection exceeding 0.9 m and considerable loss of riding comfort.

An alternative repair method proposed by VSL was accepted by the contractor, Black Micro Corp., and approved by the Engineer Berger/ABAM. This uses continuous external PT inside the girder cell over 310 m, with eight 12.7 mm tendons x 31 strands. All strands were uncoated, each tendon encapsulated in HDPE sheathing, and cement grouted. Large diameter flat jacks were used in a vertical arrangement at the mid-span hinge to assist the upward deflection and counteract.

The Vasco da Gama bridge is the second crossing over the River Tagus. With a length of 18 km, it is the longest bridge in Europe.

The scope of work of the JV ACE TEJO PRE-ESFORCO includes the supply and installation of 13,000 t of prestressing for the South (3.8 km), Central (6.5 km),
the Exposition (420 m) and the North (560 m) viaducts. For the four viaducts, four different construction methods are used cast in-situ with form traveler, installing of 78-m long elements made of precast segments, symmetric installation of precast segments and cast in-situ on scaffolding.

The bridge should open to traffic in April 1998 and so far 250,000 m³ out of 650,000 of concrete have been cast.

Joaquim Rodrigues
VSL Prequipe

- FRANCE -

THE CHARLES DE GAULLE BRIDGE, PARIS

This bridge, constructed by a Bouygues-led consortium, opened to traffic in August 1996. VSL France was responsible for installing a variety of transverse post-tensioning. T 13 and T 15 combined with EC 5-3 anchors and SO 6-4 anchors were used on the project. The SO anchors were connected to a flat PT-PLUS duct, a system which is ideally suited to thin decks with stringent corrosion and cable fatigue resistance requirements.

A. Guillou
VSL France
SITE OPERATIONS

- JAPAN -

NATORIGAWA BRIDGE, SENDAI

The works for JR Eastern Japan involve replacing a steel railway bridge on a busy line linking Sendai and Tokyo.

The new bridge will sit alongside the existing structure and, on completion, the rails will be switched over.

This new post-tensioned concrete panel stayed bridge will be 512.2 m long. The main girders and stay panels are constructed from Prestressed Reinforced Concrete (PRC) utilising the VSL system.

The bridge design is economical and uses feweranchorages.

Prestressed steel anchorages in the stay panels were placed on the girder side only. A "through-type" system was used on the pylon side - a first for cable stayed bridges in Japan.

Shusuke SAKATA
VSL Japan

- USA -

MIAMI INTERNATIONAL AIRPORT PARKING GARAGE # 7

These two parking garages, each covering 55,800 m², use standard cast in-situ reinforced concrete slabs and post-tensioned beams. There are 450 post-tensioned beams with 19.8 m (mostly single) spans. Early in the design stage and acting as the specialty consultant, VSL Miami presented the CS System with its reduced anchor sizes to Beachamps & Associates, Engineer of Record, as the solution to resolve reinforcing congestion at the beam-column joint and prevent the corrosion problems experienced on previous garages. This resulted in the column and beam bar patterns being arranged around the CS system.

The system was endorsed by the Engineer for its technical superiority and labour saving characteristics. This led the contractor, Odebrecht Contractors of Florida, to award the contract to VSL.

The first of the two garages was topped out in May 1996 and the second should begin in mid-1997.

Several comprehensive value engineering alternatives were presented by VSL on behalf of the Contractor which, although not finally used, demonstrated VSL’s ability to work alongside the Contractor as a partner.

Rafael Puerta/Raymond Bontz
VSL Corporation - Miami, Florida

In the "New Central Gymnasium - Osaka" article (VSL News II 1995) the following information was omitted:
Client: Osaka City, Board of Education
Design, Supervision: Osaka City, Municipal Improvement Agency, Building and Repairs Dept.
Entrusted Design, Supervision: Nikken Sekkei Ltd.
We apologise for the omission.
- GERMANY -
SLIDING OF THE SPREE VALLEY BRIDGE

Since the old steel bridge with a total weight of 400 t and a length of 120 m could not be dismantled and lifted by cranes, Hochtief AG - the General contractor - gave VSL Germany the responsibility of sliding out the old structure and putting in place the new concrete arch bridge.

This job also included the engineering of the sliding procedure and the replacement of the existing bearings with sliding bearings. One week after the job award, VSL was on site and completed the job within the scheduled period of two weeks.

Chong Chee Ken

- MALAYSIA -
MALAYSIA/SINGAPORE SECOND CROSSING BRIDGE

The twin deck construction of this major crossing supports a dual three lane carriageway, each deck being 15 m wide. The overall length of the bridge is 1,919 m. The approach viaducts are being constructed using precast box girders, the first time this method has been used in Malaysia. The main navigational span consists of a variable depth cast in-situ box girder.

VSL’s scope of works includes:
• Design, construction and commissioning of the erection gantry for the precast segments of the approach spans.
• All temporary props, temporary stressing, epoxy joints and permanent prestressing of the 840 segments for the approach spans.
• Erection of all precast segments for the approach spans.
• Construction of the superstructure for the main navigation spans including the design, fabrication and commissioning of eight sets of overhead formwork travellers.

There are approximately 2,650 t of VSL internal and external tendons.

Johann Kollegger
VSL Germany
THE AUTOFONÇAGE® SLIDING
Louvres Underpass, France

Because of the unique feature of the AUTOFONÇAGE® sliding system which minimises traffic disruption, VSL France and JMB-Méthodes were awarded the construction of an underpass for the French Railway Authorities. The general contractor was LANG TP. The precast concrete elements are built alongside the railway line and then pulled into final position.

The underpass was created from four precast elements of 2,000 t which were prefabricated on a concrete slab. On completion of the embankment excavation the precast elements were slide into the final position.

The pulling system uses four cables with 37 x 0.6" strands that pass through bored holes in the embankment. These cables are anchored to the precast elements on opposite sides of the embankment. The elements are then pulled at an average speed of 4 m per hour using four VSL SLU 580 jacks, each with a 1,000 t capacity.

Less than three days were required for earthwork and the sliding of each element.

Alain STamm - VSL France

INNOVATIVE APPROACH TO BRIDGE STRENGTHENING
The Z33 Bridge, Switzerland

The bridge owner, the Canton of Solothurn, asked VSL Switzerland to produce a design able to strengthen the unsound bridge’s load-carrying box.

VSL’s solution was to introduce 0.6” single strand tendons, arranged in pairs, in individual steel tubes. These are looped around the webs and simultaneously stressed from the deck level. The strengthening of the box is completed by placing two horizontal single strand tendons, one below and one above the lower box slab, between the two web tendons. The two pairs of tendons are joined together in a combined anchorage and deviation support element at the outer corners of the box.

The client found this solution to be technically and aesthetically satisfactory and awarded VSL the work.

Mario BEVILACQUA
VSL Switzerland
As a part of EUROCRETE—a research programme on the use of Fibre Reinforced Plastics (FRP) in concrete structures—a pedestrian and light vehicle bridge exclusively using FRP has been built at the Oppegaard golf course.

This 9.5-m span bridge consists of two prefabricated concrete archformed edge girders carrying a wooden deck. Each girder is post-tensioned with a VSL/Linear Composites Ltd (LCL) Parafil™ tendon (nominal ultimate load 900 kN) equipped with aluminium terminations.

To ensure that all details were well specified and documented for the research programme, close co-operation was established between the engineer - Dr. Tech. Olav Olsen a.s., VSL Internordisk Spännarmering AB and LCL.

Kalle NILSSON
VSL Internordisk
Spännarmering AB

This bridge consists of a single 33.4 m cable stayed span utilising VSL CT Stress Bars for the stays and transverse deck stressing. The deck is constructed of stress-laminated treated timber.

The Roads and Traffic Authority of NSW has included many new developments in the structure and is using this project to assess these new features.

VSL has incorporated a VSL Parafil™ non-metallic tendon in the works as a transverse deck tendon. This tendon has been fitted with an electronic load cell which is regularly monitored.

Mark Sinclair
VSL
Prestressing (Aust.)
**NEW MARKETS**

---

**THE FIRST B.O.T. PROJECT IN THE PHILIPPINES**

**MANILA SKYWAY**

This 35 km six lane elevated expressway is the first Build Operate Transfer (B.O.T) road project in the Philippines. Stage 1 is 9 km long and includes 2,900 precast post-tensioned I-beams spanning an average of 36.5 m with 10 beams per span.

Standard single column pierheads are 27.5 m wide and weigh 350 t. They are cast parallel to the road to minimise the space required for pierhead construction and then rotated 90 degree after post-tensioning using a special non-friction hydraulic device. U-tendons between the column and pierhead are stressed for the final connection of these two elements. VSL is supplying PT materials and carrying out the installation, stressing and grouting works for the columns, pierheads and precast I-beams.

The project client is the Citra Metro Manila Tollways Corp. and the Main Contractor is Hutama - RSEA Joint Operation.

---

**THE FIRST BONDED FLAT PLATE BUILDING IN THE PHILIPPINES**

**FILSYSTEMS TOWER 1, MANILA**

Manila being in an active seismic zone made earthquake loadings a prime design consideration for this 33-floor building. Indeed, under seismic loads the flat plate acts as a diaphragm connecting the earthquake load resisting elements i.e. the external frame and internal shear core.

VSL was able to show the client the advantages of the bonded system over the more commonly used unbonded solution.

A 200-mm flat plate spans from the perimeter framing beams to a central core, with a maximum span of 10 m.

The main contractor, Filsystems, chose VSL to design the post-tensioned slab, supply the materials and carry out the stressing and grouting works. The floors are currently being built on a 6-day cycle and the project will be completed by the end of 1996.

---

Michael Phillips

VSL Philippines
NEW MARKETS

VSL LEADS THE RETAINED EARTH MARKET IN SOUTH EASTERN UNITED STATES

The introduction of our 1.5 m square panel in Florida has met with considerable success because of ease of fabrication, increased flexibility of the facing - an important factor in Florida where most foundation soils are quite compressible - and speed of erection in the field.

These advantages were highlighted on the recently completed Midpoint Bridge project in Lee County, Florida. The project included some 5,000 m² of Retained Earth walls (REW) to limit right-of-way requirements for the approach embankments; the walls also wrap around the pile-supported bridge abutments. The finish on the 1.5 m square panels is “fractured fin” with 20 mm relief.

The approach embankments and bridge were completed approximately three months ahead of schedule due, in large part, to the speed of construction of the REWs. The success of this project was instrumental in our securing a further three Midpoint Corridor contracts totaling 8,000 m².

William Neely
VSL Corporation - Raleigh, USA

VSL MAKES A SUCCESSFUL ENTRY INTO THE POLISH MARKET
VISTULA RIVER BRIDGE, POLAND

The Vistula River Bridge near Torun in Poland is 955.4-m long and includes three 130-m long main spans.

VSL provided the technology for the four form travelers, design assistance and the post-tensioning for the balanced cantilever main spans and the incrementally launched approaches. VSL’s specialist on site is supervising the post-tensioning works and servicing VSL’s equipment. The project includes 470 t of strand post-tensioning and stress bar. The contractual terms and conditions as well as the good relations between the General Contractor (ZBM Warsaw) and VSL have contributed to the project’s fast progress this year remaining on schedule despite some initial delays and a tough winter.

Miroslav Vejvoda