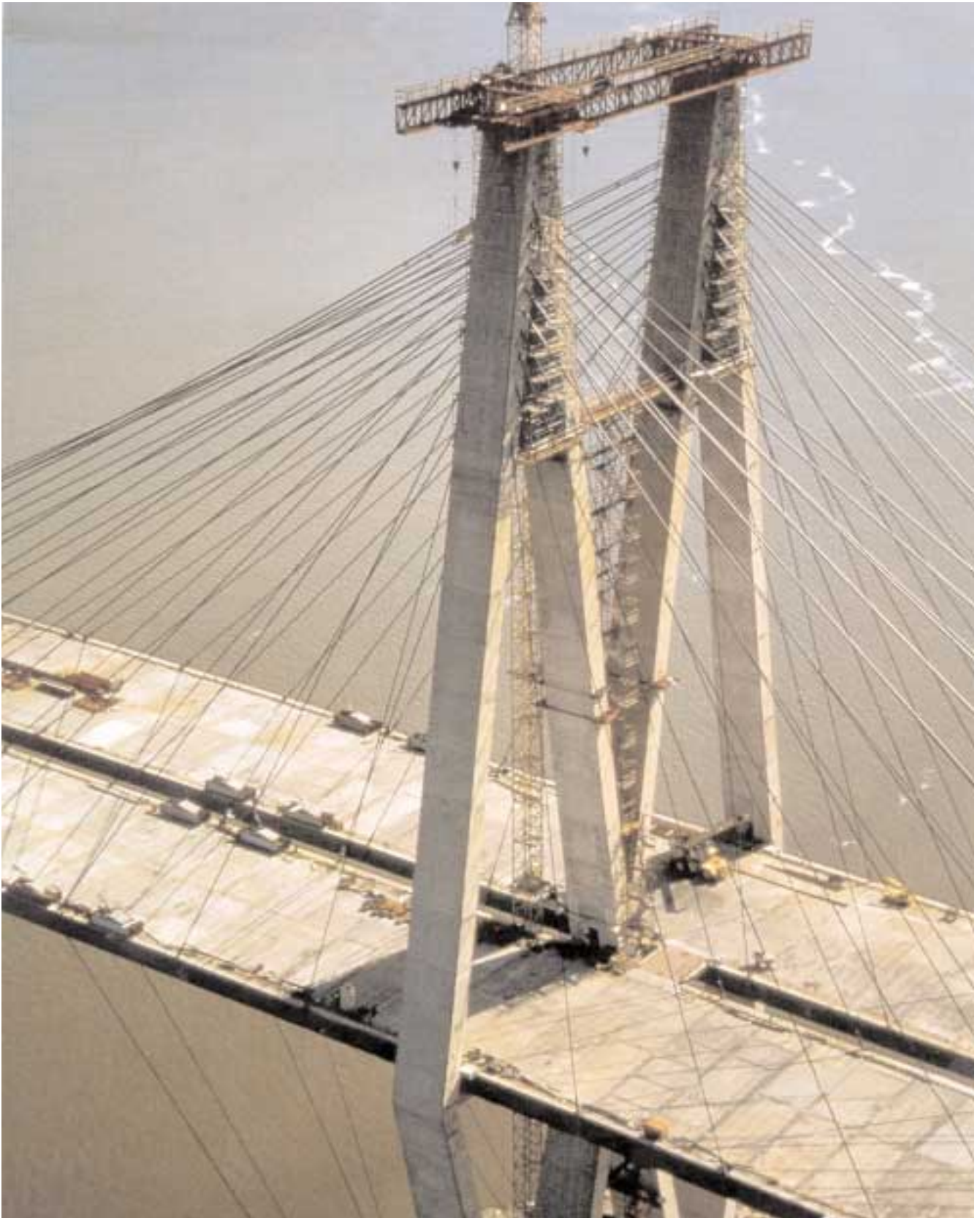


# VSL NEWS

I S S U E   T W O   1 9 9 4



# Let Those who know best, do it

Post-tensioning or stay cables are essential parts of a structure. When you look at the front cover everyone will easily understand that this key activity must rely on people with know-how.

Prestressed structural solutions come to reality through the coordination of several clearly defined spheres of activity that require two basic types of contribution.

Firstly:

- to specify and design the structure needs competent Post-Tensioning Engineering
- to design and supply the means for it calls for a reliable Post-Tensioning System
- to install and supervise the works requires Post-Tensioning Skill
- to guarantee durability you need established Post-Tensioning Quality.

These requirements can only be brought by specialists, thus Post-Tensioning is the business of a **Specialist**.

Secondly:

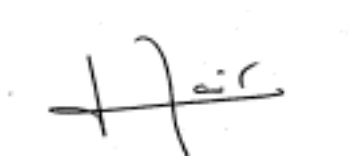
- Post-Tensioning is a critical part of a structure
- Post-Tensioning must be specifically detailed for each project
- Post-Tensioning sitework must be done at least in part by duly trained staff.

These features define the concept of subcontracting, thus Post-Tensioning is the business of a **Subcontractor**.

The VSL Group is structured as a service organization with personnel trained and experienced in engineering and site construction, qualified to perform as specialized Subcontractor, taking on the task and responsibility to supply and install our post-tensioning system. We strongly believe that this approach is very much to the benefit of you as our partner.

Our personnel are engaged exclusively with Post-Tensioning. They are totally familiar with the components and site work. Through regular training and know-how exchange our people continuously gain specific skills and so assure the required quality or identify and prevent problems prior to construction.

Today, VSL is already approaching our projects as a specialist. Today, VSL is already working as a subcontractor. VSL is striving to be even more your **Specialized Subcontracting Partner**.



Michel Maître  
Chairman of the Board

**Front Cover:**

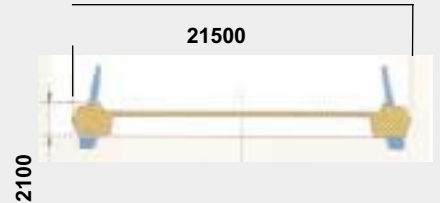
Houston Ship Channel Crossing, Baytown, Texas, USA. 192 VSL Stay Cables up to 61 strands support the 381 metre main span.

Photo: Greiner, Inc. / Leonhardt, Andrä and partners

**Highlights of this Issue:**

- 3 Recent VSL Stay Cable projects
- 4 VSL's new SSI system
- 6 Retained Earth out back
- 9 VSL in Vietnam
- 10 Turnkey project opens the floor
- 12 VSL in service of the offshore industry
- 15 External tendons for Paris freeway

Batam-Tonton Bridge, Indonesia  
Lapi-institute of Technology, Bandung



Stay cable bridges are always something special. Whether small or large they normally represent a landmark wherever they are built.

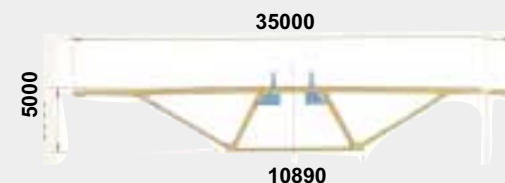
VSL's involvement in this type of construction can range from supply of stay cable material to a full subcontract. VSL's construction packages can include services like construction stage analysis including camber calculation, design of travellers, computation of temporary prestressing in case of a precast segmental construction method, detailing of the saddle at the top of a pylon, etc.

Lately VSL was awarded some extensive specialist work in connection with notable stay cable projects on which we will report in more detail when they are at an interesting construction phases.

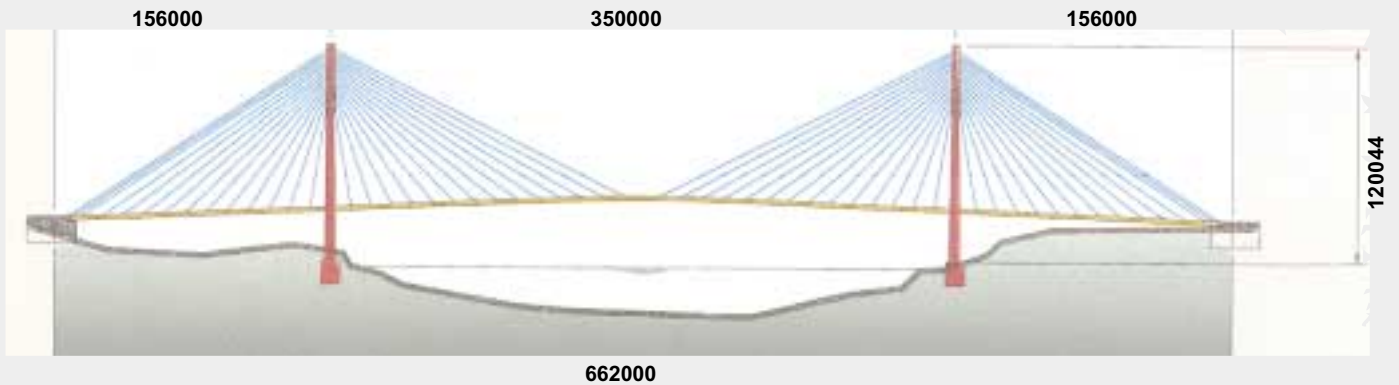
Franz Fischli VSL International Ltd. St-Quentin Yvelines, France

Wadi Leban Bridge, Saudi Arabia

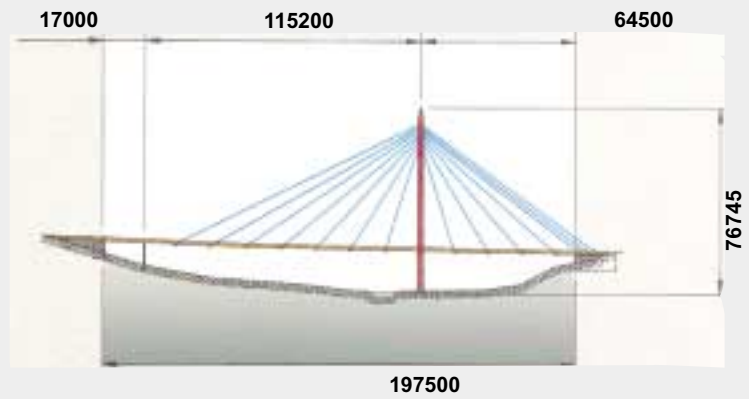
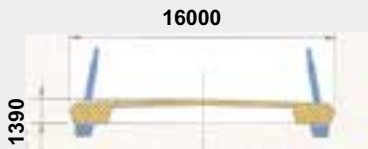
Dar Al-Handasah Consultants (Shair & Partners) (UK) Ltd.



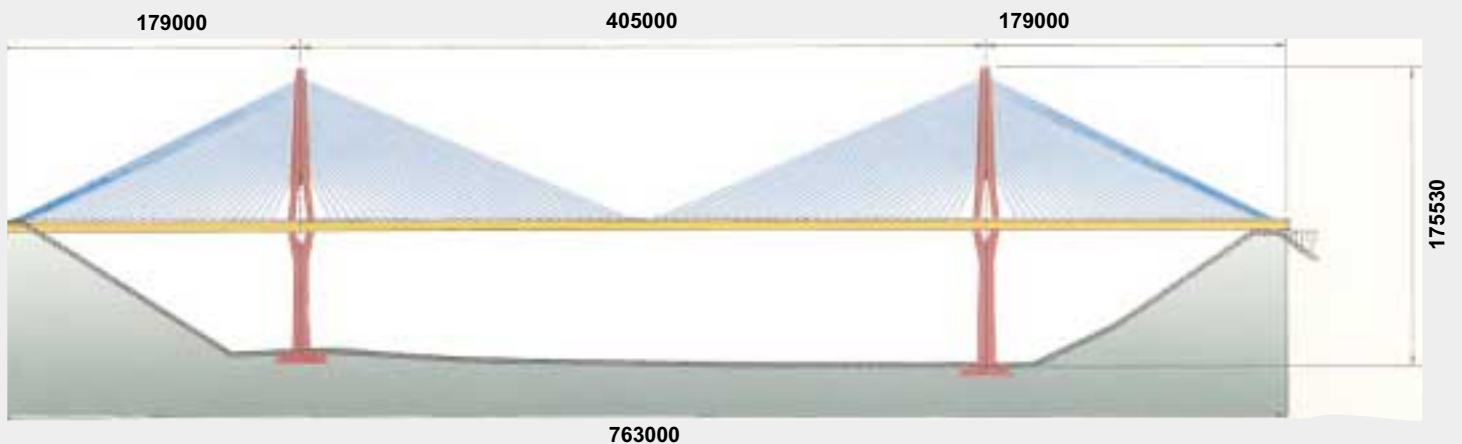
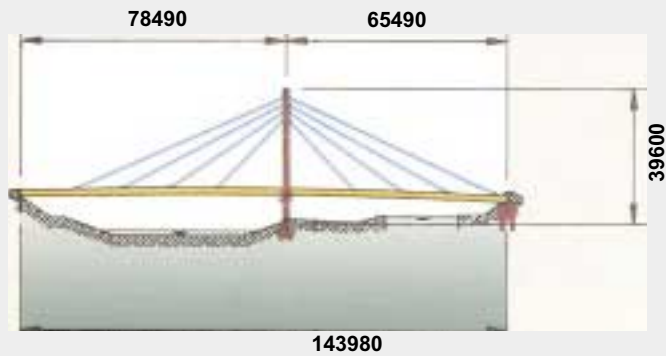
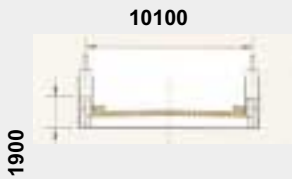
## Success for VSL Technology and Partnership Approach



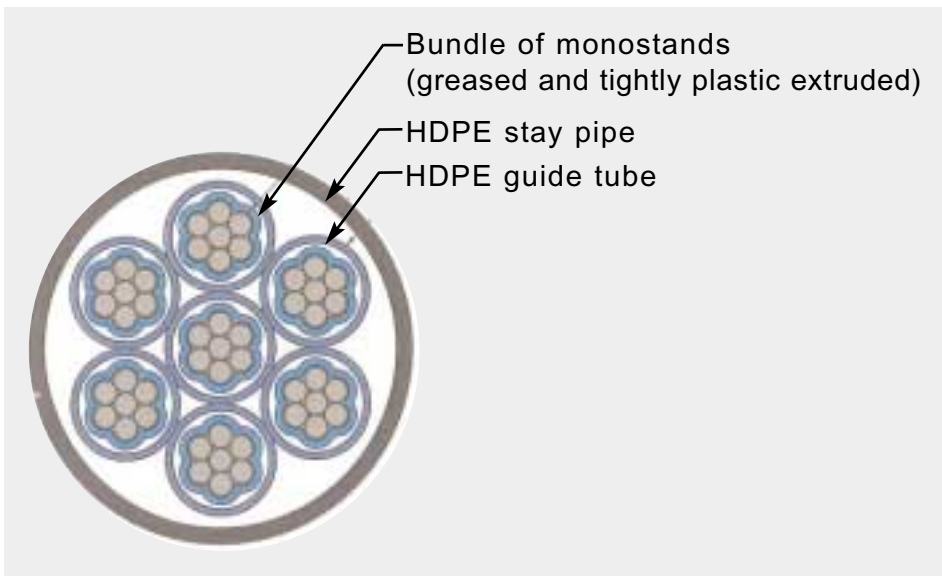
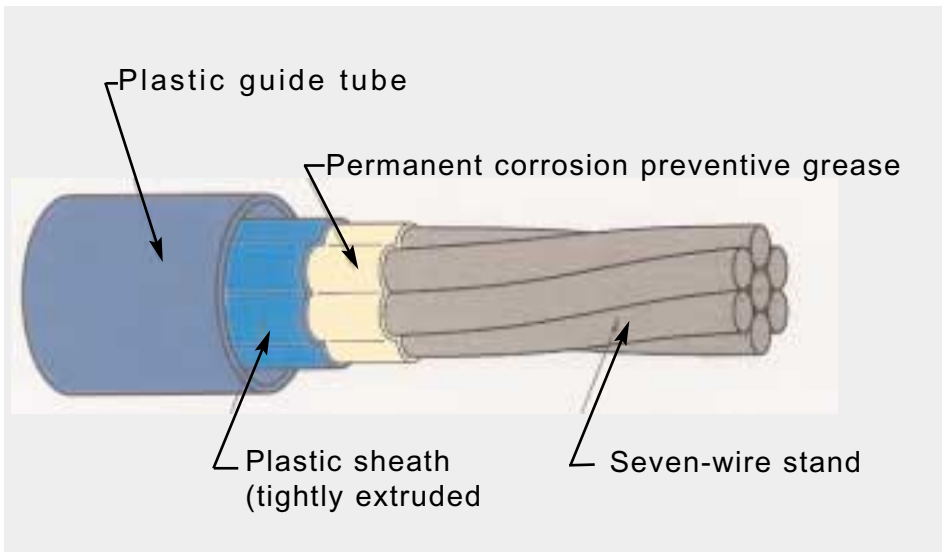
River Level bridge,  
Scotland  
Babtie Shaw & Morton



Allan Bridge, France  
J.Tonello



## VSL Stay Cable System 200 SSI



Converting research into reality is synonymous with providing what the industry and the end user needs. VSL is dedicated to providing new solutions. Below we present the latest release of the VSL Stay Cable System referred to as SSI. Previous VSL Stay Cable systems have been well developed and quite simple in configuration. However, the method of stay construction had the potential for improvement. It was the main contractor and his construction programme that became the focus of the development team to evolve a stay that was more tuned to practical and

quick construction. The result of that work is the SSI Stay Cable.

SSI is an acronym for **Single Strand Installation**. The main features of the SSI stay are an excellent anchorage efficiency, a very high fatigue strength, much easier construction, very durable with several layers of corrosion protection, desirable life time features permitting total inspectability and replaceability. SSI stays also allow the client's most desirable strand type and preferred stressing method to be used.

So now to the specifics.

**Anchorage:** the SSI stay cable uses the well proven and very simple wedge and strand anchoring in the well known compact VSL hole pattern that allows small compact components.

**Free length:** extending from anchorage to anchorage the free length is made up of an outer stay pipe, a compact assembly of guide tubes, strand, and spacers to maintain the relative position of the outer pipe to the guide tubes, but no grout.

**Grouting:** The SSI method eliminates almost all grouting, it only employs a small amount of grout in the stay's anchorage zone. This grouting is carried out prior to stay installation so it does not interfere or become a part of critical construction activities. This small amount of grout is used to maintain the position of each individual strand profile with separation and so avoid any concentrated angular changes as the strands deviate from the compact free length bundle to the anchor head hole pattern. The separation of the strands and the individual support provided by the grout totally avoids any lateral strand on strand forces.

**Stay erection:** The real asset of this stay system is the meaning behind the name: Single Strand Installation. The parallel guide tube bundle is inserted into the outer stay pipe but without strand. The end anchorage zones are profiled and grouted. With only a few strands inserted the essentially unstranded stay is ready to be erected. Without the weight of the steel strand this erection becomes a quick and easy process that does not require heavy construction equipment.

**Single Strand Installation:** Once the stay assembly is erected strand by strand installation can proceed by reeling one strand at a time. The strand may be a monostrand or a galvanized monostrand. Both these strands provide excellent site corrosion protection for the period prior to installation and during erection of the stay.



**Model of the Safti Stay Cable Bridge, Singapore.**  
**Design Engineer:**  
**T.Y. Lin Souht-East Asia Pte. Ltd.**

As each strand is installed it is stressed individually to a predetermined load.

**Corrosion Protection:** The SSI stay provides a multi-layer approach to corrosion protection: firstly, the monostrand grease layer and its cover of PE or the galvanizing of a galvanized strand, then the guide tube which runs totally unbroken from anchor head to anchor head. Finally the outer HDPE stay pipe provides full encapsulation with a thick walled robust pipe from anchor head to anchor head.

**Outer Stay Pipe:** The outer stay pipe has been maintained for the SSI stay system. Without it individually exposed strands are known to vibrate and impact against each other even in moderate wind. This may in time lead to splitting of the strand's PE sheathing. Full encapsulation with a robust pipe is an essential element for durability.

**Inspection:** By providing each strand with its own designated guide tube with pur

pose made profiling in the anchorage zone, inspection of every single stand is easier than ever before. Linked with inspectability is replaceability. Replacement of individual strands is possible without any significant loss of tensile capacity of the stay in the process. The bridge can remain open to full service during any such quality control or maintenance.

**Stressing:** Multistrand stressing or if feasible strand by strand stressing can be used.

Other sections of this VSL NEWS highlight recently awarded projects some of which will be built using the SSI method. The award of these current projects is a fair reward for the effort to develop, test and bring to the world market user friendly and reliable systems. VSL's "Single Strand



Installation" stay cable with its features of high fatigue strength, excellent anchorage efficiency, and easy construction with durability, are best linked with well trained and experienced site personnel; a service that VSL is ready to provide. █

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*Brad Rathbone  
 VSL International Ltd.  
 Lyssach, Switzerland*

## Two New Versions of VSL RETAINED EARTH



Steel sheet facing



Welded mesh wall facing

The Yarrie Iron Ore Mine is located approximately 2500 km north of Perth, Western Australia, on the edge of the Great Sandy Desert, in an almost uninhabited area of Australia.

It was for this open cut mine that Boulderstone Hornibrook Pty. Ltd. approached VSL to design and construct two Retained Earth walls, each significant in its own right and each a new application of VSL Retained Earth technology.

The first wall was 45 metres long and a maximum of 9 metres high with surcharge loads of 24 kPa applied due to heavy steel column loads. The wall facing used is a welded steel mesh which interlocks with the traditional VSL Retained Earth steel reinforcing mesh to form the complete wall.

The second wall, to service the iron ore crusher, and a more significant structure having a maximum height of 22 metres and 90 metres long, is designed to operate with vehicles of up to 230 tonnes each, working only 2 metres from the face of the wall.

This VSL Retained Earth structure uses a wall facing panel fabricated from processed 2.5 mm steel sheets and was remarkably easy to erect on site even in this remote and harsh area. █

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*Mark Sinclair/Peter Tilley  
VSL Prestressing (Aust.) Pty. Ltd.  
Noble Park, Victoria*

## MACKAY Sugar Silo, Australia

### PT-PLUST Duct Saves Times and Money

The construction of Mackay Refined Sugar's new 45,000 tonne storage silo located in Mackay, Queensland, was awarded to Concrete Constructions (Queensland). VSL Prestressing (Aust.)

Pty. Ltd. was able to assist the contractor reduce labour in the silo slipform operation by redesigning the silo wall to make full use of VSL PT-PLUS ducting for all the horizontal hoop tendons. By designing

with PT-PLUS duct, the total number of tendons was reduced by over fifteen percent.

The construction of the 45 m high 350 mm thick silo wall utilized over 6000 m of type 76 PT-PLUS duct with a maximum tendon



length of 65.8 m. Construction of the silo wall was completed in eight days.

VSL's scope of works included the material supply, placement of strand, stressing and grouting of the 19 x 12.7 mm tendons. Also included in VSL's work was the supply of mast climbing platforms which assisted with the construction period being maintained to six weeks.

*Barry Story*

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

First use of PT-PLUS for a silo

## VSL Climiform – Silom Precious Tower

Following the introduction of VSL Climiform into the Thailand construction market, VSL Thailand was awarded its second

project; Silom Precious Tower. The first Climiform project, Baiyoke Tower II, is the tallest building in Bangkok.

Silom Precious Tower is a 67 storey highrise building with a height of 249 metres above ground level and a total floor area exceeding 325,000 square metres.

The core wall area is approximately 73,000 square metres. Two VSL Climiforms were used in order to take the core's construction off the critical path.

An unusual feature of this project was the erection of the VSL Climiforms after approximately 15 floors of the building were constructed. This was due to the unique programme requirements of the project. The VSL Climiforms caught and passed floor construction well ahead of programme, to the delight of the main contractor, Samsung Development (Thailand) Co. Ltd.

This project commenced in 1993 and should be completed in 1996, with the anticipated value of the overall project being US\$ 167 million. ▀

*Narenn Jinruang  
VSL (Thailand) Co., Ltd.  
Bangkok, Thailand*

Thailand's second climiform



## Bridge Connection to Isolated Island



The Ministry of Construction in Korea intends to build several bridges to connect isolated islands in the southern part of the West Sea to improve the transportation system there.

The first such bridge connection named Bee-Do Bridge will employ in-situ Free Cantilever Method of construction. There are 5 main spans of 128 metres with 86 metre approach spans with a 8.2 metre wide deck.

Due to the difficult site conditions like heavy fog, typhoons, a high tidal range, and tremendous difficulties with site access, only 220 actual working days out of 365 days have been programmed for. This results in a cycle time for one segment of 15 calendar days to meet the target date of project completion which is the middle of 1995.

VSL Korea's scope of works includes the redesign of the superstructure, geometry control, post-tensioning works (approximately 430 tonnes of prestressing steel) and reinforcement fabrication and concrete casting. ▀

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





## VSL's PT at the Sukubo Bridge Enhances Agricultural Industry

Though being located close to a famous hot spring resort in Toyama prefecture, this bridge construction project is a major part of a programme to improve agricultural efficiency for a number of villages scattered over this mountainous area. The programme, planned by the prefectural government office, intends to improve the road system, to improve local industrial productivity, and to stabilize the regional community.

The bridge crosses a valley with two main spans of 140 metres. The height of the tallest pier is about 31 metres. The single cell box girders of prestressed concrete with an effective deck width of 7.8 metres were constructed by Free Cantilever Construction Method consuming a total of 244 tonnes of longitudinal VSL posttensioning cables.

Following the completion of the foundations, Kawada Construction Co. Ltd., one of the sublicensees of VSL Japan Corporation, started superstructure construction in September 1991, and will complete its work in March 1995.

When this bridge is opened to the public a total area of 6,000 hectares and 6 villages will be able to appreciate the benefit of this construction towards the future prosperity of the local region. ▀

*Shusuke Sakata*  
VSL Japan Corporation  
Tokyo, Japan



## VSL in Vietnam



An office opening ceremony presided over by Cris Dedigama, Regional CEO of VSL North East Asia, took place in Hanoi on July 18, 1994. The occasion marked the opening of two VSL Representative Offices in Vietnam: a main office in Hanoi and a branch office in Ho Chi Minh City. Delegates from VSL international and from all VSL North East Asia regional offices (Hong Kong, Korea, Japan) participated in this unique opening.

The two offices will promote post-tensioning for large infrastructure works and private property developments, throughout the Vietnamese construction market and will become a trusted partner to local construction companies. ▀

*Bob Nguyen*  
VSL Vietnam  
Hanoi, Vietnam

## Tallest Residential Building South of New York City



**B**ristol Towers Condominium is located on the residential portion of prestigious Brickell Avenue in Downtown Miami, and with 40 stories it is the tallest condominium in the southern United States with an approximate area of 700,000 sq.ft. (65,000 sq.m). The General Contractor was McDevitt Street Bovis.

The structural frame for most of the floors has an irregular, round pattern of columns and consists of an 8 inch (200 mm) two-way post-tensioned flat plate, which used 500,000 lbs (230,000 kg) of post-tensioning material. Once again VSL's design expertise optimized the design resulting in a significant reduction in the post-tensioning and simplified an otherwise complicated layout of the cables to facilitate the construction of this unusually shaped structure for the benefit of all the parties involved in the project.

VSL's engineering and technical know how enabled the contractor to build this fast-track project in record time. Pouring one typical floor per week, which was 18,000 sq.ft. (1,700 sq.m.) helped cut two months off the scheduled completion date. █

*Rafael E. Puerta*  
VSL Corporation  
Miami, Florida

## VSL Turnkeys Large Openings in Buttonhead Wire Reinforced Slabs



**W**hen Borders Books and Music moved to their new location at 1801 K Street N.W., Washington, D.C., their build out design team was faced with a unique problem. They wanted to install a new escalator between two levels and a new elevator between three levels in the store. This required three new openings to be created in the 7 1/2 inch two-way post-tensioned flat slab floor system. Normally a relatively routine demolition

job, this particular slab system presented a more difficult problem. The building was originally constructed in the late 1960's using a buttonhead wire post-tensioning system. Modifying such a slab system requires speciality equipment and expertise which VSL is uniquely qualified to supply.

VSL was awarded a subcontract to create the new slab openings on a turnkey basic.

VSL's work included developing the demolition procedure, detensioning and retensioning the PT tendons, and removal of concrete from the openings. The largest of the openings was 13'x70' (3.96 m x 21.3 m) in which there were a total of 50 tendons ranging in size from 4 each (1/4 inch wires) to 10 (1/4 inch wires). In the three openings more than 70 tendons were reanchored and 25 cubic yards of concrete were removed. █

*Don Kline*  
 VSL Corporation  
 Washington, D.C.



## Bridging the Canal



**T**he new Chesapeake & Delaware (C&D) Canal Bridge is scheduled to open in the fall of 1995. The 229 metre main span crosses the C&D Canal approximately 42 metres above the water. The canal allows ships to bypass ocean travel in favour of an easier and shorter route to some of the busiest ports on the East Coast of the United States. Recchi America, Inc. selected VSL Corporation to provide the stay cables, stay cable anchorages and permanent post-tensioning for this «gateway» between the canals.

The bridge consists of two single cell box girders with transverse and longi-

Delta Frame

tudinal post-tensioning. Each box girder has an 18 metre wide top deck, a bottom slab width of 5.5 metres and a total depth of 3.7 metres. Thirty-two central stays, ranging in size from 6-79 to 6-84, are used to support the main span. Each stay consists of two end anchorages, a central saddle, steel stay pipes, bare strand and grout.

The precast segmental main spans are erected using mobile cranes at the leading edge of the structure. «Delta Frames» placed in the 3 metre gap

between the single cell boxes provide the anchorage for the stays. The approach spans are erected span-by-span using an overhead gantry. VSL external post-tensioning is used to provide continuity. █

*Keith Jacobson*  
 VSL Corporation  
 Raleigh, North Carolina

## World's First Catenary Moored Floating Platform

The Troll Oil Production Platform is a concrete hull based on the semi submerged concept. This Floating Production Unit is to be moored to the sea bed, at a depth in excess of 300 m in the Norwegian Trench, by chain/wire catenary lines. The semi-submerged concrete hull consists of four cylindrical columns, 29 m in diameter, standing 65 m high on rectangular pontoons with base measurements of 102x102m.

In March 1993, VSL (Switzerland) Ltd. was awarded the subcontract for the supply and installation of 3,100 tonnes of prestressing steel by the AF Troll Joint Venture. Construction of the structure started at the dry dock facilities of the main contractor, Kvaerner Concrete Construction a.s., at Hanoytangen in June 1993 with completion of the prestressing work scheduled for early September, 1994

An extremely tight construction schedule necessitated elaborate programming and scheduling of the prestressing works. For example at one point in the construction one hundred prefabricated vertical tendons in each of the four columns were



Slipforming of the columns almost complete

installed in a record time of twenty-four hours. ▀

*Hans Hitz  
VSL (Switzerland) Ltd.  
Hauglandshella, Norway*

Installing vertical tendons in a column



Duct placing in bottom slab





The first module support beam during launching

## Launching of Two Module Support Beams in Norway

**A**t Stavanger, Norway, the Heidrun tension leg platform (TLP) is presently in its final construction phase. Heidrun is the world's first TLP with a concrete hull. Norwegian Contractors (N C) the main contractor, simultaneously built the 2 components of the hull namely the bottom section

with 4 platform legs and 2 module support beams (MSB).

In May 1994, the four huge platform legs, out at the deep water site in the Gandsfjord, were ready for mating with the 2 MSBs, having been stressed by VSL.

Norge, at their onshore construction site. The MSBs are 145 m long light weight concrete boxes with dimensions of 7.0 x 7.5 m, each weighing 9,000 tonnes. The mating operation of each MSB started with the load-out of the MSB onto 3 barges.

VSL was entrusted to play an important role in the load-out operation, being responsible for the launching of the MSBs onto the barges. VSL's contract with NC comprised consulting services with respect to skid tracks, skid shoes, lateral guiding as well as the provision and operation of the launching equipment.

An intensive planning phase preceded the operation, as it was the first time one rigid structure had to be launched onto 3 barges. It was very important to match the launching speed with the pumping capacity of the de-ballasting pumps.

The load of 9,000 tonnes was spread over 94 skid shoes, 47 per side, equipped with a teflon plate and sliding on polished stainless steel skid tracks. The 2 MSB load-out operations were carried out at the beginning of June 1994.

It proved to be a demanding and satisfying teamwork effort, for all parties involved: Norwegian Contractors, the barge ballasting crew, the surveying crew, the marine crew and the VSL launching crew. █

*Ferdi Trenkler  
VSL (Switzerland) Ltd.  
Lyssach, Switzerland*



The Composite System Anchorage was the center piece of attraction

## VSL Participates in World of Concrete Middle East 94

**T**he Composite System Anchorage was the center piece of attraction. The Composite System Anchorage was the center piece of attraction. VSL Participates in world of Concrete Middle East 94. The concrete construction industry's leading exhibition took place between 23rd-26th January, 1994. The venue was Dubai, United Arab Emirates. VSL was among more than one hundred participating companies from over fifteen different countries. Almost three thousand professionals from the

concrete construction industry: clients, contractors, engineers, designers visited the exhibition. VSL's highly specialized services attracted tremendous interest from the visitors who came from various countries from the entire region. VSL's presence reiterated our keen intention to actively participate in construction activities in the Middle East. █

*Isam Saad Sahawneh  
VSL (Switzerland) Ltd.  
Lyssach, Switzerland*

## Sliding Bridge Construction Method is User Friendly

A new freeway extension near Yvetot, Normandy, France, was required to cross under the existing railway line between Paris and Le Havre. The French National Railways, SNCF, decided to adopt the construction method AUTORIPAGE which is a registered construction method of JBM-Methods and so avoid a lengthy out of service period.

This construction method calls for the full construction of the complete bridge along side the railway embankment. With a limited period of track closure, the embankment is removed and the new underpass structure is pulled into position. The general contractor Spie-Citra/Quille entrusted VSL France with the operation of shifting the precast

concrete bridge structure, complete with wingwalls and track, 36 metres from its casting point to the final alignment. The precast bridge weighed approximately 4,000 tonnes and had been constructed on a guiding



## First Construction Phase of Paris Freeway Using VSL External Post-Tensioning Completed

concrete slab. Four stranded cables were used to pull the bridge into position. The pulling cables were passed through bored holes made through the embankment prior to excavation. The four 36 strand cables were anchored in piers on the far side of the embankment and connected to four 580 tonnes SLU jacks behind the structure. Shifting proceeded



at an average speed of 5 metres per hour. Precise control of the whole shifting process ensured that there were no delays and the precast bridge was in position 2 hours ahead of schedule. ▀

*Bernd Speck  
VSL France S.A.,  
Egly, France*

The viaduct Carrières sur Seine will permit the crossing of the two branches of the Seine River between Carrières sur Seine, the Chatou Island and Nanterre for the future freeway A14 which will connect Orgeval and Nanterre.

The viaduct consists of two parallel structures and has a length of 820 m and a width of 12.5 m each. Its three main spans of 122 m are constructed by the Free Cantilever Method.

VSL France was entrusted to carry out all the post-tensioning work

- temporary stabilization of the cantilever structure during construction
- all cantilever cables (EC 6-19)
- all continuity cables (EC 6-19)
- exchangeable external cables within the box (up to 250 m long), in HDP ducts, 6-19 ▀

*Francis Crozat  
VSL France S.A.,  
Egly, France*



**PUBLISHED BY**

VSL International Ltd., Bernstrasse 9, 3421 LYSSACH, Switzerland • Editor: Therese Wenger

Representative Office, VSL International Ltd., 41 Avenue du Centre, 78067 ST-QUENTIN YVELINES, France  
TEL 33 - 1 30 12 09 30, FAX 33 - 1 - 30 48 94 94

**REGIONAL HEADQUARTERS**

**SOUTH EAST ASIA/  
AUSTRALIA**

VSL Prestressing (Aust.)  
Pty. Ltd.  
6 Pioneer Avenue  
THORNLEIGH, NSW 2120  
Australia  
Tel 61 - 2 - 484 59 44  
Fax 61 - 2 - 875 38 94

**NORTH EAST ASIA**

VSL North East Asia  
Regional Office  
1508 Devon House  
979 King's Road  
QUARRY BAY  
Hong Kong  
Tel 852 - 590 22 22  
Fax 852 - 590 95 93

**USA - AMERICA**

VSL Corporation  
Crosspointe II Plaza  
2840 Plaza Place  
Suite 200  
RALEIGH, NC 27612  
USA  
Tel 1 - 919 - 781 6272  
Fax 1 - 919 - 781 6892

**EASTERN EUROPE  
MIDDLE EAST**

AFRICA\*  
\* (English speaking part)  
VSL (Switzerland) Ltd.  
Bernstrasse 9  
3421 LYSSACH  
Switzerland  
Tel 41 - 34 - 47 99 11  
Fax 41 - 34 - 45 43 22

**WESTERN EUROPE  
SOUTH AMERICA**

AFRICA\*  
\*(French speaking part)  
VSL France S.A.  
110, Avenue Verdun  
91520 EGLY  
France  
Tel 33 - 1 - 69 26 14 00  
Fax 33 - 1 - 60 83 89 95

**VSL COMPANIES AND LICENSEES**

**AUSTRALIA**

VSL Prestressing (Aust.)  
Pty. Ltd.  
THORNLEIGH, NSW 2120  
Tel 61 - 2 - 484 59 44  
Fax 61 - 2 - 875 38 94

VSL Prestressing (Aust.)  
Pty. Ltd.  
VIRGINIA, QLD  
Tel 61 - 7 - 265 64 00  
Fax 61 - 7 - 265 75 34

VSL Prestressing (Aust.)  
Pty. Ltd. NOBLE PARK, VIC  
Tel 61 - 3 - 3 - 795 03 66  
Fax 61 - 3 - 795 05 47

**AUSTRIA**

Sonderbau GesmbH, WIEN  
Tel 43 - 1 - 892 02 80  
Fax 43 - 1 - 892 02 80 33

**BOLIVIA**

Prestress VSL of  
Bolivia Jauregui Ltd., LA PAZ  
Tel 591 - 2 - 321 874  
Fax 591 - 2 - 371 493

**BRAZIL**

Rudloff-VSL Industrial Ltda.  
SAO PAULO  
Tel 55 - 11 - 826 04 55  
Fax 55 - 11 - 826 62 66

**BRUNEI DARUSSALAM**

VSL Systems (B) Sdn. Bhd.  
BANDAR SERI BEGAWAN  
Tel 673 - 2 - 22 91 53,  
- 22 18 27  
Fax 673 - 2 - 22 - 19 54

**CHILE**

Sistemas Especiales de  
Construccion SA, SANTIA-  
GO  
Tel 56 - 2 - 233 10 81  
Fax 56 - 2 - 233 67 39

**CZECH REPUBLIC**

VSL Systemy (CZ) s. r. o.,  
PRAHA  
Tel 42 - 2 - 242 252 96  
Fax 42 - 2 - 242 254 31

**FRANCE**

VSL France S.A.  
EGLY  
Tel 33 - 1 - 69 26 14 00  
Fax 33 - 1 - 60 83 89 95

**GERMANY**

VSL Vorspanntechnik (D)  
GmbH  
ELSTAL  
Tel 49 - 33 234 - 8340  
Fax 49 - 33 234 - 83416

**GREAT BRITAIN**

Balvac Whitley Moran Ltd.  
DERBYSHIRE DE55 4PY  
Tel 44 - 773 54 26 00  
Fax 44 - 773 54 27 00

**GREECE**

VSL Systems S.A., ATHENS  
Tel 30 - 1 - 363 84 53  
Fax 30 - 1 - 360 95 43

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Fax 67 - 1 - 649 08 50

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Quarry Bay, HONG KONG  
Tel 852 - 590 22 88  
Fax 852 - 590 02 90

VSL Redland Concr. Prod.  
Ltd.

Quarry Bay, HONG KONG  
Tel 852 - 590 03 28  
Fax 852 - 562 94 28

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Fax 91 - 22 - 578 47 19

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Fax 62 - 21 - 573 12 72 17

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Fax 39 - 59 - 98 14 12

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Fax 81 - 33 - 345 91 53

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Fax 82 - 2 - 577 00 98

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Tel 60 - 3 - 242 47 11  
Fax 60 - 3 - 242 93 97

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Fax 31 - 71 - 72 08 86

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Fax 64 - 6 - 364 83 44

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Fax 47 - 51 - 56 27 21

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LIMA  
Tel 51 - 14 - 76 04 23,  
Tel 51 - 14 - 76 04 26  
Fax 51 - 14 - 76 04 77

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Tel 351 - 1 - 793 85 30  
Fax 351 - 1 - 793 09 01  
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SINGAPORE  
Tel 65 - 235 70 77/9  
Fax 65 - 733 86 42

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Fax 27 - 11 - 613 74 04  
SPAIN  
VSL, BARCELONA  
Tel 34 - 3 - 200 87 11  
Fax 34 - 3 - 209 85 90

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AB, DANDERYD  
Tel 46 - 8 - 753 02 50  
Fax 46 - 8 - 753 49 73

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LYSSACH  
Tel 41 - 34 - 47 99 11  
Fax 41 - 34 - 45 43 22

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BANGKOK  
Tel 66 - 2 - 237 32 88/89/90  
Fax 66 - 2 - 238 24 48

VSL Corporation DALLAS, TX  
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Fax 1 - 214 - 641 - 1192

VSL Corporation  
LAS VEGAS, NV  
Tel 1 - 702 - 791 - 0844  
Fax 1 - 702 - 791 - 0960

VSL Corporation MIAMI, FL  
Tel 1 - 305 - 592 - 5075  
Fax 1 - 305 - 592 - 5629

VSL Corporation  
PHILADELPHIA, PA  
Tel 1 - 215 - 750 - 6609  
Fax 1 - 215 - 757 - 0381

VSL Corporation  
SAN JOSE, CA  
Tel 1 - 408 - 866 - 6777  
Fax 1 - 408 - 374 - 4113

VSL Corporation  
WASHINGTON, DC  
Tel 1 - 703 - 451 - 4300  
Fax 1 - 703 - 451 - 0862

**VIETNAM**  
VSL HANOI  
Representative Office  
HANOI  
Tel 84 - 4 - 245 488  
Fax 84 - 4 - 245 717

VSL HO CHI MINH CITY  
Representative Office  
HO CHI MINH CITY  
Tel 84 - 8 - 293 678  
Fax 84 - 8 - 293 684