VSL NEWS

NUMBER ONE 1995

Editorial

The VSL Group has been operating successfully in the South East Asian/Australasian region for more than 25 years. We have established a skilful and creative network of key marketing and technical staff, business partnerships and construction affiliations.

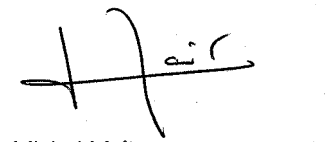
In all of our operating areas within OUI we have developed an enviable reputation for marketing, technical design achievement and construction performance. A team of outstanding local marketing and design engineers and construction achievers have performed all of their tasks with initiative, enthusiasm and overall effectiveness. Our clients have been able to benefit from innovative design and construction solutions which concentrate on optimizing overall project costs.

OUI has continued to thrive as a result of its long lasting local partnerships and client affiliations which have been nurtured with sound cultural awareness and understanding. Our valued clients are able to communicate face to face with skilled engineering personnel of similar culture, in their own language. The local personnel of VSL are able to take decisions in a decentralized manner close to the scene of the action. International technical and financial skills are readily available through well defined support structures located close within the operating unit.

OUI has been continually successful by focusing on its core specialized post-tensioning business. The scope of our subcontract work is strategically enhanced to embrace alternative design and construction methods and related complementary specialist work.

In the French language «OUI» means «Yes». Within VSL's OUI the same positive and optimistic approach is applied to solving the design and construction problems of our valued clients and to look forward to future progress.

In South East Asia / Australasia VSL is represented in each country by local companies. They are leading the different markets, thanks to their efficient presence and their quality of organization. 1 am convinced that OUI is The Shining Example of the *VSL Group.*



Michel Maitre
Chairman of the Broad

Front Cover:
Second Stage Expressway Bangkok, Thailand.
External post-tensioning and erection by VSL of 9000 match cast segments for 12 km of dual elevated expressway.

Highlights of this Issue:

Operating Unit 1 -

Within OUI, VSL continues to seek and identify specialist opportunities which give increased scope of work for VSL and significant benefit and value to our clients. Design and construction method innovation are supported by professional project management to ensure that the challenging construction assignments are completed in an economical and timely manner. The organizations within OUI have been able to tailor their degree of specialization to reflect the construction needs of their country. The blend between bridges, buildings, climbform, heavy lifting, specialist engineering, ground anchoring and Retained Earth have been skilfully refined. Exemplary team spirit within the operating unit has contributed to the successful transfer of technical skills between the profit centres for special projects.

In Singapore, VSL have just completed major post-tensioning and climbform work for the first tower on the *Pontiac Marina* (see photo) project and have subsequently been awarded the sub-contract for the second 52 storey tower. On the civil side, VSL are installing the cable stays and post-tensioning for the unique Safti Bridge.

The Shining Example of the VSL-Group

In **Australia** the incrementally launched Maribyrnong Bridge represents a major civil achievement. The *Governor Philip Tower* (see photo) in Sydney and the Tuggerah Shopping Centre, NSW, are two massive examples of VSL's Post-tensioning involvement in high rise towers and expansive low rise projects.

In **Indonesia** the bridge structures are dramatic and challenging. The *Sudirman Flyover* (see photo) constructed in downtown Jakarta is the first example of the use of the incrementally launched method in Indonesia adopted in this case to avoid any disruption to the major traffic flow. The Barelang project sees VSL constructing four major bridge structures linking islands within the vicinity of Batam Island, near Singapore. The projects include cable stayed, balanced cantilever and precast segmental construction methods for the major crossings.

In **Malaysia**, VSL is carrying out specialist post-tensioning work for the *LRT* (light rail) project (see photo) in Kuala Lumpur. We have also been awarded the complete superstructure contract for the Second Crossing Bridge linking Malaysia to Singapore. Foundation work is well advanced and we expect to be commencing on site in September 1995.

In **Thailand,** VSL has carried out the post-tensioning and erection of the NS4 and NS7 sections of the Bangkok Second Stage Expressway. These elevated viaducts total 12 kilometres in length. The success of this project carried out to an extremely tight construction schedule has resulted in the award of additional major elevated expressway projects in Thailand. The *Fashion Island Shopping Centre* in Bangkok (see photo) represents one of the large number of major commercial building projects carried out utilizing VSL design, post-tensioning and in many cases VSL Climbform.

CS-PLUS in Hong Kong

There is no better example of the process , «converting research into reality». than that which resulted in the first installation of CS-PLUS in Hong Kong. Conventional prestressing enjoys widespread acceptance and has been extensively used on civil projects, throughout Hong Kong for over 20 years. The CS-PLUS system is new to Hong Kong and its physical introduction was the result of a combination of factors coming together at the same time.

The Environment

The industry in Hong Kong has close links with the United Kingdom and was well aware of the question mark that had been raised over corrosion protection of post-

First Segment

tensioning cables within the UK. This concern led ultimately to the temporary ban of new post-tensioned prestressed bridges by the UK Department of Transport in September 1992.

The local industry was similarly aware of the introduction in UK of the Concrete Society Specification for Grouting published in CONCRETE July/August 1993.

Concerned owners in Hong Kong, aware of the situation in UK, were actively investigating ways to improve the durability of Post-tensioned structures through the use of new generation materials.

CS-PLUS

The CS-PLUS configuration, used for applications requiring enhanced corrosion protection or improved fatigue resistance, combines the VSL Composite System (CS) stressing anchorage with the VSL PT-PLUS plastic duct system. The compact CS stressing anchorage is lighter, easier to install, requires smaller and shallower block-outs, and permits closer anchorage spacing in certain applications. The PT-PLUS offers a fully encapsulated system with superb corrosion protection, and eliminates fretting fatigue between the strand and duct.

Recognizing Opportunity

An initial contact with VSL by a potential client resulted in immediate dispatch of technical literature on CS-PLUS. Subsequent contact revealed that the potential client was committed to specifying a system with enhanced corrosion protection, furthermore they were interested in improved fatigue resistance, more reliable and reduced friction and particularly the potential for electrical isolation (up-grade to CS-SUPER). Having made the initial contact the opportunity for CS-PLUS was quickly recognized and followed up. Following establishment of a working relationship the client was invited to view the manufacturing facility, and to discuss the system with VSL Technical Centre staff in Switzerland.

Precast Yard

Endorsement

As part of the invitation a site visit to a project utilizing CS-PLUS, in the construction stage, was arranged. The project was being constructed for the Swiss Federal Railways who were kind enough to not only facilitate the site visit but also to endorse the system and to offer to share their experience of the VSL product with the potential client. Continuing with the follow up service, budget pricing was provided, along with further presentations and discussion, to demonstrate the , «Value for Money»inherent in the system.

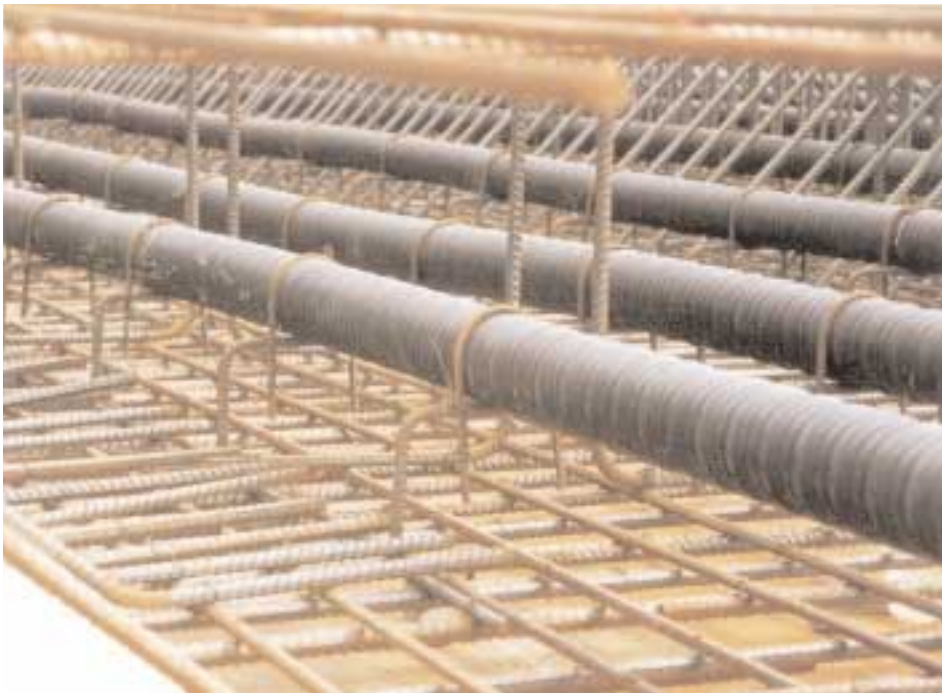
Conversion to Reality

Although the clients initial interest was for future projects, they chose to amend 2 clauses of the specification for an existing Project.The amendments, following the UK grouting code, called for sheaths to be of a «corrosion resistant durable material» and for the post-tensioning system to be «fully compatible».

To comply with these revisions VSL proposed the CS-PLUS which was accepted as variation in place of the conventional anchorages and corrugated steel ducting. The final structure, a 1260 m long concrete immersed tube consisting of 10 Nos. 126 m precast, prestressed units will incorporate 520 CS 5-31 anchorages and 34,000 m of PT-PLUS ducting. The ducting will be joined by mirror welding with PT-PLUS couplers at construction joints only. When complete the tunnel will carry a dual railway under Victoria Harbor.

The process, «Converting Research into Reality» was facilitated; by the environment, as a result of industry concerns over durability; by availability of new technology and recognizing the opportunity to use it; by follow up service, providing the client with information allowing them to reach their decision; by endorsement from a reputable existing client and finally by demonstrating value for money.

Andrew Rose
VSL Hong Kong Ltd.
Hong Kong



PT-PLUS 100

Construction Joint Base Slab

ACACIA Ridge Intermodal Terminal, Queensland

Post-Tensioning was the chosen solution for 1200 m of container pavement

The Acacia Ridge Intermodal Terminal located in Brisbane, Queensland, has now twice been a successful project for VSL. In 1980, VSL installed 8680 sq.m of post-tensioned slab on grade construction and again lately with the installation of 29,000 sq.m of slab.

Working in conjunction with Coffey Partners International, VSL was able to prepare a post-tensioned alternative that not only re-designed the concrete slab, but also reduced the depth of subgrade preparation. The total design alternative assisted Concrete Constructions (Queensland) to win the project.

The total slab area consisted of 1.2 km of pavement placed in eleven pours with the typical pour length being 110 m long. Jointing of the slab was greatly reduced when compared to the conforming reinforced concrete design. At the joint between pours a 1200 mm wide «sleeper beam» was installed with compression seals placed between the sleeper beam and post-tensioned slab.

Post-tensioning also reduced the construction time for the placement of the pavement to a 12 week period including delays due to weather. VSL carried out the material supply, installation, stressing and grouting works for the 240 mm thick slab. Post-tensioning to the slab consisted of 5 x 15.2 mm tendons both transversely and longitudinally. The pavement was designed for solid tyred forklifts with a 90 tonne axleloading.

Barry Story
VSL Prestressing (Aust.) Pty. Ltd.
Brisbane, Queensland

Army Distribution warehouse-Bandiana, Victoria

Yet Another 22,000 sq.m of Post-Tensioned on grade

In addition to the 60,000 sq.m of slab on grade undertaken in 1994, VSL Southern Division was awarded the post-tensioning design and construct contract for this 22,000 sq.m of slab area.

The pavements were designed for racking storage, forklift loads (250 KN axle loads) and post loads.

The ability to dramatically reduce the number of construction joints and produce a crack free surface whilst maintaining a thinner slab (150 mm and 175 mm thick slabs) combined with increased speed of construction were the major selling features for our client. The 112 tonne of 15.2 mm diameter strand with no passive reinforcement other than at joints and slab edges was installed in 9 weeks.

J. Karabatsos
VSL Prestressing (Aust.) Pty. Ltd.
Noble Park, VIC

Melbourne Exhibition Centre

A new Melbourne Exhibition Centre is currently under construction in the capital of Victoria. The structure includes a 30,000 sq.m clear area exhibition hall situated above a single basement carpark.

The floor slab will be 360 m x 84 m supported on an 8.0 x 8.3 m structural grid, and is required to support up to 20 KPa live load to provide significant user flexibility.

VSL was awarded the design and post-tensioning contract on a 2 way P.T. flat plate alternative slab design, 320 mm thick. All tendons are 5S5 (15.2 mm) slab system.

A feature of VSL's design is the integration of cast-in floor service conduits and boxes, necessary for the hall's operations. These boxes are required on a 3 m by 3 m grid and are interconnected by cast-in conduits 110 mm diameter and 60 mm diameter.

Delicate design, coordination and detailing was required to balance the structural requirements of the heavy design live load, physical constraints from the boxes and conduits and practical considerations to simplify tendon profiles without the need for weaving of the tendons.

The resulting design achieved a high capacity floor, simple in form, accommodating significant in-floor services in a safe and unobtrusive manner, which is proving economical to build!

F G. Filippone
VSL Prestressing (Aust.) Pty. Ltd.
Noble Park, VIC

Colo River Bridge, NSW

The Colo River Bridge located 25 km north of Windsor, NSW is a 7 span (5 x 28 m internal, 2 x 22 m end span) incrementally launched double tee beam bridge.

The client/designer, the Roads and Traffic Authority of NSW, decided on an incrementally launched solution primarily to minimize the environmental impact during construction. The project was also identified as an ideal model for project partnering - a project management procedure intended to promote superior co-operation and communication between the client, the main contractor (Barclay Mowlem) and subcontractors. VSL participated fully in the partnership as our involvement was deemed to be integral with the success of the project.

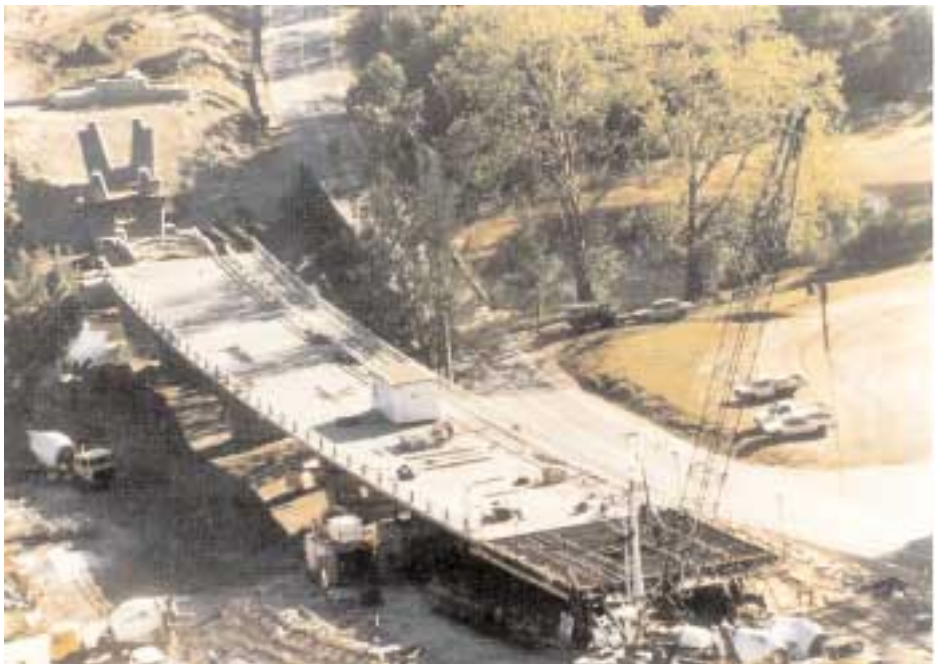
VSL's scope of work was the incremental launching and installation of Post Tensioning in the tee beams. VSL developed a launching system using their coarse thread CTA bars fixed to a bracket clamped to the bottom flange of the bridge. Bar jacks equipped with a continuous nut winding mechanism were used to launch. This method has the advantage over the traditional lift and push method, of being able to be used for all segments, except for the first and last seg

ments. The post-tensioning in the tee beams comprised 24 Nos. 12 strand 12.7 mm strand tendons distributed throughout the cross section, typically coupled at every 2nd segment.

The project was completed in December 1994 with launching completed 5 weeks ahead of program.

The project partnering was considered by all parties a success and will be used on future projects.

Brad Hannan
VSL Prestressing (Aust.) Pty. Ltd.
Thomleigh, NSW



Casting bed and existing timber bridge in background

Kuala Lumpur Light Rail Transit System 1 - Phase 1

The Kuala Lumpur LIRT System, the most talked about and prestigious project in Kuala Lumpur is currently being constructed. This project plays a very significant role in helping to ease over congested traffic problems in Kuala Lumpur.

VSL's role in this project is to assist the main contractor, Taylor Woodrow Project (M) in the design and supply of 6 numbers of match cast moulds for concrete segments as well as the supply and installation of post-tensioning and epoxy jointing during erection. LRT-System 1 - Phase 1 consists of 2.5 km elevated viaduct. There are a total of 969 segments to be erected over 75 piers. Each segment is 8.4 m wide by 2.7 m long and weighing from 30 to 51 tonnes. Segments are erected by balanced cantilever construction using overhead launching gantry weighing approximately 180 tonnes. Both the precast moulds and the launching gantry are designed to handle the horizontal curve of a maximum of 22 degrees. During erection, each segment is temporarily supported by 2 to 4 numbers of 32 mm diameter VSL CT stress bars before they are permanently stressed by 5-12 tendons. The viaduct is currently being erected on 24-hours basis as the project was behind schedule due to foundation problems encountered by the main contractor. VSL's best record so far was erecting 12 segments in a 12-hour shift. The project is expected to be completed by August 1995.

Raymond Seah
VSL Engineers (M) Sdn, Bhd.
Kuala Lumpur, Malaysia

Pusan Harbor Elevated Expressway

VSL Korea takes the lead through teamwork

This 2.34 km long 4-1ane expressway is part of a container transport bypass road of Korea's largest harbor. A typical 50m span comprises 15 precast box segments each 3.4 m long, and two 1.68 m long diaphragm segments. They form twin 3 m deep single-cell box girders with a 9.5m wide deck and 3.5 m wide soffit.

Construction began in February 1994 for completion in September 1996. VSL was awarded a large part of the project in November 1993, including

- Segment fabrication, transportation and span-by-span erection
- Post-Tensioning, rebar and concrete placement for the 130 m free cantilever in-situ main span
- Supply and stressing of 1177 tonnes of post-tensioning
- Contractor consultancy.

Span-by-span erection using one overhead truss covering two box lines simultaneously

JA Lee
VSL Korea Co., Ltd.
Seoul, Korea

Rambler Channel Bridge, Hong Kong

The 1.2 km long Rambler Channel bridge will link Tsing Yi Island's Chung Ching Tunnel with the Kwai Chung Viaduct on the Kowloon mainland. Dual 3-lane expressways are constructed by an overhead launching gantry, placing precast segments using the balanced cantilever technique. Construction began in 1993 and is due for completion by 1996.

VSL's scope of works involves supply, stressing and grouting of external and internal prestressing. External tendons will be installed, allowing full replaceability throughout the bridge service life.

K H. Lai
VSL Hong Kong Ltd.
Hong Kong

MARTA CIF 310 - Atlanta, Georgia

The latest extension to the North Line of the Metropolitan Atlanta Rapid Transit Authority (MARTA) is due to be completed and in service in time for the 1996 Summer Olympic Games. A portion of this extension consists of 1600 m of dual and parallel single track aerial structures. The tendered design for the aerial structures consists of 35 one and two span precast segmental frames constructed by the span by span method utilizing external post-tensioning tendons. A nearly identical Cast-in-Place (CIP) on falsework option was also included in the bid documents. The span lengths for the aerial structures vary from 27.4 m to 42.7 m averaging 40 m.

VSL offered an alternative design to the general contractors which was based on typically three-span continuous cas-tin place frames utilizing internal P.T. tendon in PT-PLUSTm duct. This alternative improved the construction speed for this cast-in-place method while reducing the forming costs.

The project was bid in November 1993 with the low bidder, Archer-Western Contractors, Ltd. selecting VSL's alternative. VSL's scope of work for this project includes the engineering for the alternative and the post-tensioning, (approximately 375 tonnes). Once completed this project will be an integral part of the transportation system for the City of Atlanta when it hosts the Olympics in 1996.

Robert W. Sward
VSL Corporation
Miami, Florida

San Joaquin Corridor

The San Joaquin Hills project is located in Orange County just South of Los Angeles, California. It is a design/build toll road with a length of approximately 24 Kilometers and includes 72 box girder bridges, many complex interchanges, and on/off ramps to the existing road system. It is the first privately funded highway project in California with recovery of finance through a toll system. The general contractor is ‚California Corridor Constructors., which is a joint venture between Kiewit Pacific and Granite Construction ‚with Kiewit Beinq the lead partner.

VSL's scope of work is to supply and install post-tensioning (including working drawings) for the 72 box girder bridges. Typical tendon sizes on the post-tensioning are 5-19 and 5-31 and on many of the structures the tendons are over 200 meters long. We are installing the strand using our hydraulically driven wheel pushers designed and built in house by VSL. The longest structure on the project is 353 meters in length.

In addition to the post-tensioning VSL has a separate contract for the engineering

and supply of Retained Earth TM walls. The original quantities for this contract were approximately 38,000 Sq.m. Through value engineering VSL has converted many of the Cast-in-place walls to our Retained EarthTM system such that the total area now exceeds 58,000 sq.m. The contractor has been pleased with the Alec Bloem quality, speed of our design, and exe- VSL Corporation cution. Work on this project commenced San Jose, California in May 1994 and is scheduled for completion in June 1996.

Alec Bloem
VSL Corporation
San Jose, California

MGM Grand/Bally's Monorail

The MGM Grand Hotel and Bally's Hotel in Las Vegas, Nevada, are soon to be linked by a 11/2 kilometer long monorail which is being provided by VSL Corporation.

The project was initiated in December 1993 when the two hotels decided to purchase two, six car monorails from Disney World in Orlando, Florida. VSL was then contracted to design and build the infrastructure which consists of twin guideways, two stations and a maintenance facility. VSL is also refurbishing the monorails, including brand new interiors and exterior finishes.

The guideway structure is entirely precast and has some extremely challenging shapes for the beams with some combining in plan curvature with super elevation. The beams are post-tensioned together into continuous frames which typically include four spans. The unique beam column connection combines structural steel, and prestressed concrete to take care of the large transfer forces. The infrastructure has been designed to accommodate the latest monorail system of Bombardier, Inc., the M6, in anticipation of the system being ultimately expanded to serve other casinos and to link with the airport.

The on-site construction, including all the precasting, has been accomplished in five months and the grand opening is set for one month ahead of schedule in June 1995.

Andrew Payne
VSL Corporation
Raleigh, North Carolina

Contractor Capitalizes on VSL's Package Deal

Increased cement consumption necessitated the expansion of the Rabigh Cement Production Line 5 by the Arabia Cement Company Ltd. The project, situated in the Western Province of Saudi Arabia, was awarded to KHD Humbold Wedag AG towards the middle of 1994.

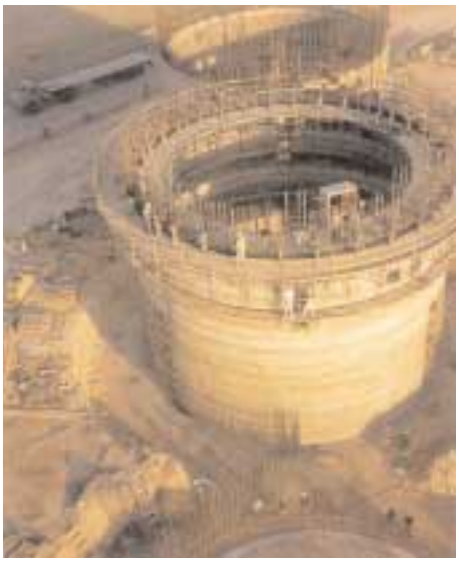
A package proposal combining post-tensioning and slipforming for the seven silos (2 Nos. clinker, 2 Nos. raw meal and 3 Nos. cement silos) was awarded to VSL by the civil works subcontractor Arabian Hanil Development Co.

The post-tensioning utilizes the VSL monostrand system using S-6 anchorages. The total post-tensioning tonnage is in excess of 140 tonnes and the total slipformed area is 41,000 sc.m.

The scope of the slipforming subcontract was subsequently enlarged to include slipforming for staircases, lift shafts and columns for an additional area of 8,000 sq.m.

VSL's work on site started in September of 1994 and is due for completion in May 1995.

A. Floreani, R. Mathys VSL (Switzerland) Ltd. Lyssach, Switzerland



Slipforming in progress on Cement Silo

Reeled monostrands being installed during slipforming

Slipforming in progress on Clinker Silo

Bridge Repair Kresice, Czech Republic

VSL innovative heavy lifting engineering was successful in connection with repair works needed for a 5 span freeway bridge near Prague. In order to treat the bearings, the seats and the faces of the 5 x 9 = 45 nos. 30 m long girders it was required to lift the individual spans, always two at a time, so that one whole support was accessible for repairs..

The original method was to build temporary foundations, consisting of 2 support towers at each bridge support, one on each side. The lifting was planned to be accomplished with individual small jacks under all girders from underneath of the bridge. The manpower needed and the coordination of the lifting was extensive.

The VSL Heaving Lifting method simplified all procedures in lifting the spans from above. A small steel support structure was built to rest on top of the bridge support and it received two VSL lifting units SLU 330, one for each adjacent span. Two support structures wore needed per support. There were totally four structures, with eight VSL lifting units, making it possible to lift one span entirely and two adjacent ones from one side. It required 4 lifting points to lift a span totally.

The benefits to the contractor were obvious. He had two support caps free to work on at one time, instead of one. The positions of the spans were changed

within a very short time to make the access to the front of the girders easy. Several changes of locations were made. This option did not exist with the original method. Also, the preparation time, the lifting and lowering times were very short, and the precision of setting the bridge into the mortar bed at the bearings was much higher. This method is essential where no access from underneath exists and is much more economical in any span manipulation during bridqe repair.

Miroslav Vejvoda
VSL Systerny (CZ)
Prague, Czech Republic

VSL Heavy Liftings' First in Poland

In May of last year, VSL had the opportunity to cooperate with main contractor Avanti for the erection of a ship yard portal crane in the city of szczecin in Western Poland.

Initially, the high, auxiliary A-frame at the left was erected partly by crane, and subsequently by pulling it up to vertical position with VSL strand lifting equipment. This structure served for the up-ending and lifting of the shear leg. Thereafter, the pier leg (right) was erected, firstly by crane and then by pulling with the strand equipment fixed to the top of the A-frame.

Once the legs were stabilized, the 108 m long main box girder with the 2 crane crabs, totaling 750 tonnes, was lifted to its permanent level, by means of 4 strand lifting units. For the main girder lift through 70 m, a relatively calm day was chosen.

Ench Mödschler
VSL (Switzerland) Ltd. Lyssach, Switzerland

Lifting of the 750 tonne crane girder.

Alpine Express or Progress with VSL in Saas-Fee

The world-renowned, traffic-free holiday resort Saas-Fee (1800 m) located at the foot of Switzerland's highest mountain (Dom 4,545 m) continues to build on VSL, at present with their ultra-modern cable-car «Alpine Express»

In order to offer covered parking facilities to the rush of vehicles at the entrance of the «Pearl of the Alps» Saas-Fee a 9 floor car park with 950 parking lots was constructed in 1980 with VSL post-tensioning.

Between 1990 and 1992 a concrete arch bridge with VSL P-T technology was built connecting the car park with the lower station of the Alpine Express. At the same time the first section of this cable car was constructed using 10 monitorable, adjustable and fully isolated rock anchors for the anchoring of the tensile forces of the suspension cable, as well as another 87 monitorable rock anchors required for the pylons of the cable car and the avalanche diversion dam.

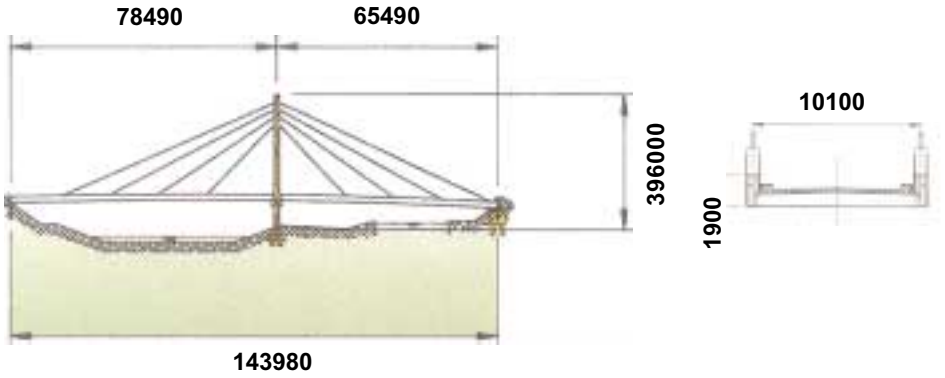
The construction of the second section (1992-1994) of the Alpine Express took advantage of VSL's newly developed Electrically Isolated Tendon (EIT) rock and soil anchors: for the middle station (at 2500 m) and the top station (at 3000 m), EIT technology for all anchors and tendons was exclusively used, whereby the prestressing tendons are external and also replaceable.

Each EIT anchor and EIT prestressing tendon is equipped with an electrical load cell, indicating at any moment the isolation condition and anchor force. All in all some 30 of these high-tech rock anchors were installed.

To complete the current development programme of the tourist resort Saas-Fee the construction of a 2nd parking of 11 floors started some weeks ago, again with VSL.

Max Corpataux
VSL (Switzeland) Ltd.
Penthaz, Switzeland

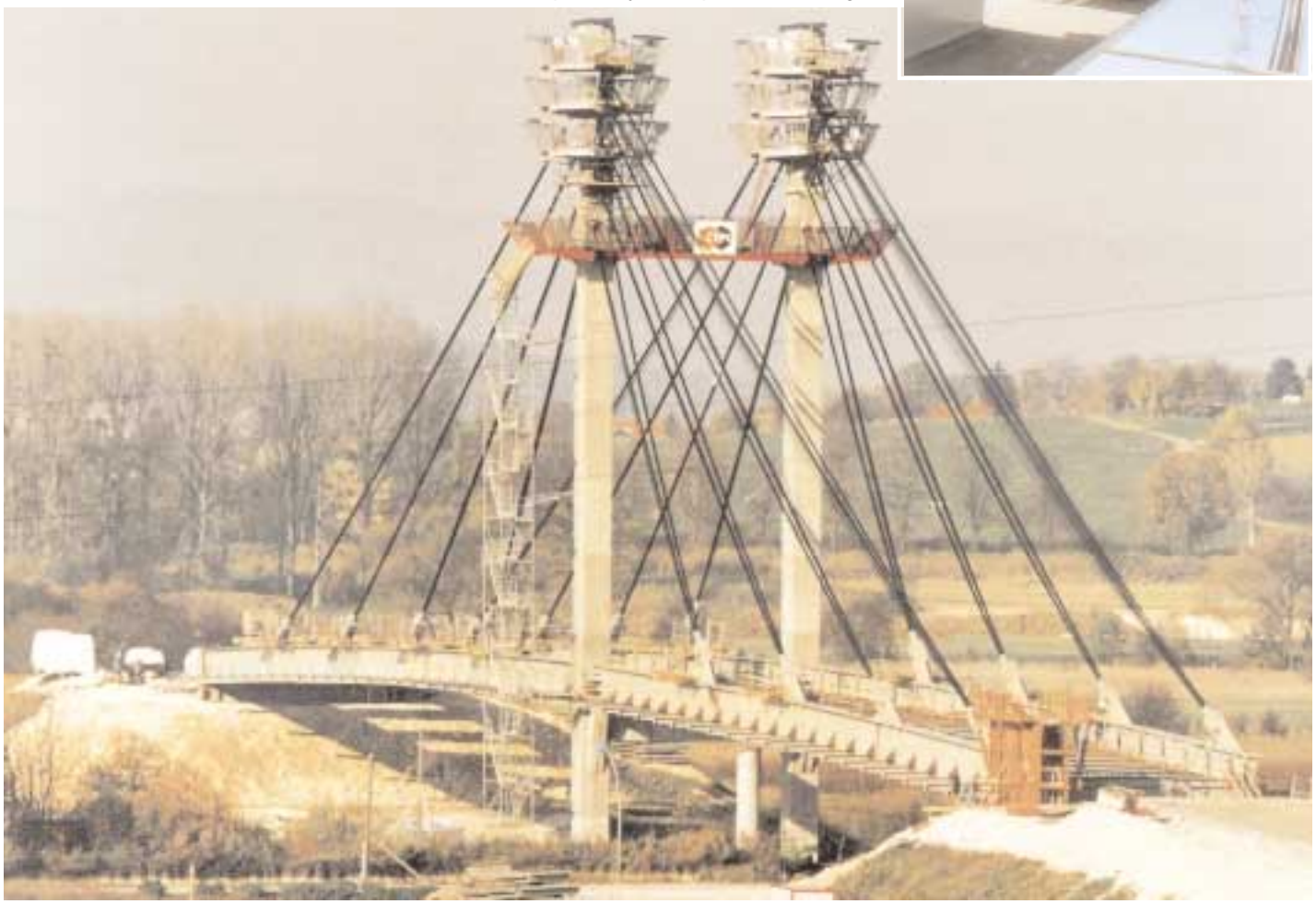
VSL Stay Cables used for the Bridging of the Allan River and the Rhone-Rhine Canal



Emmanuel Le Thyerry
VSL France S.A
Egly, France

VSL France was entrusted with the supply and installation of the stay cables for the Allan Bridge in the county of Doubs in the eastern part of France. The 200 SSI System (SSI = Single Strand Installation) with individually PE-sheathed, waxed and galvanized O.W strands was adapted to allow some of the stays to be bifurcated at the pylon end. Stay cables are between 29 m and 68 m long and consist of between 18 and 36 strands. The solution with bifurcated stays allows the pylon to remain elegantly slender and aesthetical.

The steel superstructure of the two spans (78.5 m and 65.5 m) of the deck are preassembled on each side, then pushed over the Allan River and the Rhone-Rhine Canal, respectively. After partial stressing of the stays the deck is concreted, followed by final stressing.



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