

# VSL NEWS

NUMBER ONE 1992



## The VSL Mission

**VSL is the leading world-wide specialist contractor in the field of post-tensioning and related engineering.**

**Our mission is to:**

**First, provide optimized design and construction solutions with outstanding support service to construction industry customers in order to maximize their financial benefits.**

**Second, encourage a motivated and creative corporate culture with group synergy aimed at generating rewards for staff and shareholders.**

**Third, operate as a transnational group of companies, locally rooted, implementing coordinated strategies.**

## The only Constant in Business is Change

**F**or VSL change means continuous improvement. A company which does not change, is a company which does not improve, and is a company which will wither. In a healthy growing organization change is not just desirable, change is essential. Naturally, it is human nature to resist change, as change makes us anxious and feel uncomfortable. But we must look beyond this initial discomfort and look at the advantages which change brings with it.

A change took place within VSL on April 1st, 1992, and is illustrated on the opposite page. Instead of five, four Operating Units cover the world market. The former two units in the USA are consolidated in one unit. The former Far East Unit has been split into two units with Australia going into the Southern Asian unit.

What do these changes mean for our customers and business partners? The basic principle of VSL – being near to the markets and, therefore, understanding the customers' and partners' needs – is unchanged. With the organizational changes, we will be able to better service you because of more efficiency and strength within VSL. And our staff, feeling they are part of a company which gives them opportunity for personal growth and development, will solve your problems and support your needs with still more enthusiasm and dedication.

What has not changed is VSL'S commitment to be the best. Today, we are world leaders in post-tensioning and related engineering. The recent changes within our organization will help us to become even more. The vision of the future is a vision of VSL – **The World's Most Creative and Valued Construction Partner!** 



*Reto Jenatsch*  
Group Chief Executive Officer

## Highlights of this Issue

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- 14** Incremental Launching Down Hill with Horizontal and Vertical Curves (Loewenberg)

## Cover:

The 665 m Loewenberg Viaduct currently under construction in Switzerland uses the VSL Incremental Launching System. See story on page 14.



If it appears to you that we have turned the world and VSL upside down, don't worry. It is still the same world and we are still the same solid and reliable VSL which you have come to know and trust.

Far East South/  
Australia



Graeme Pash

Far East North



Cris Dedigama

Europe/  
Middle East



Frederic Regard

North America



Andrew Payne



**Headquarters Group**

- 1 Franz Fischli *Vice President PR+Licensing*
- 2 Thomas Fröhlicher *Chief Financial Officer*
- 3 Reto Jenatsch *Group Chief Executive Officer*
- 4 Hans Rudolf Ganz *Chief Technical Officer*
- 5 Maria Bühler *Chief Human Development Officer*
- 6 Hans Hitz *Quality Manager (not pictured)*



## New VSL Method Improves Constructability of Concrete Pressure Tunnels



Prestressed pressure tunnels offer proven safety and durability.

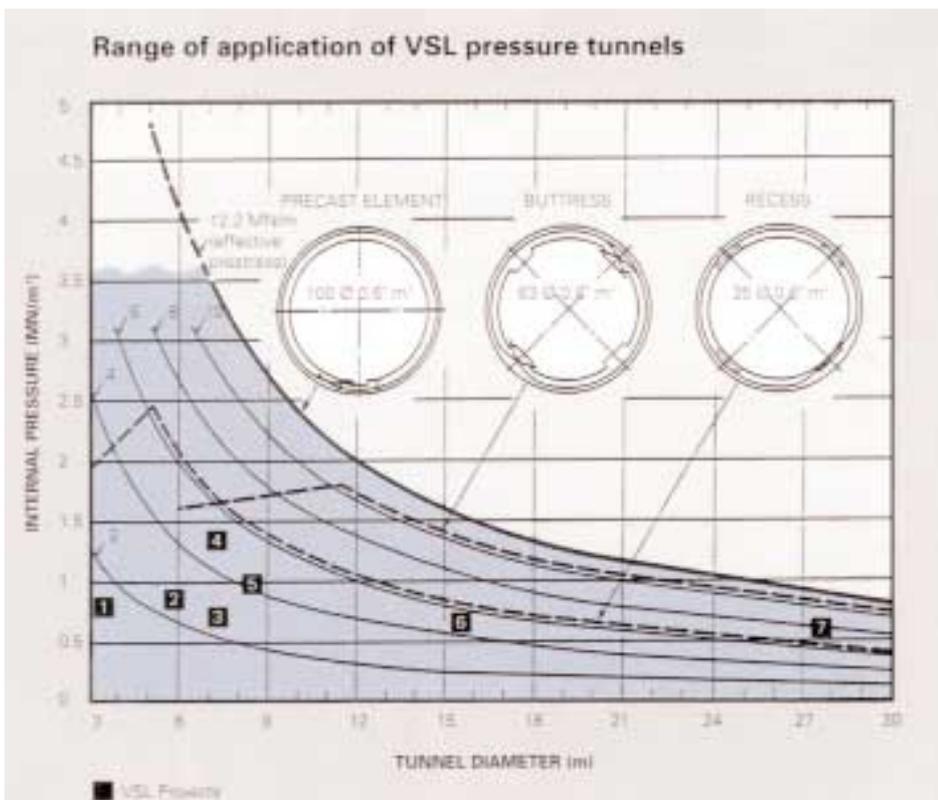
**P**restressed pressure tunnels are not new to civil engineering and are a logical application of the post-tensioning method. Existing VSL methods and components have satisfied the needs of many projects and will continue to do so in the future. However, VSL has developed a new approach that extends the range of application to higher internal pressures while significantly simplifying the site work.

Pressure tunnels are a fundamental part of flood mitigation, hydroelectric power and pumped storage schemes, trunk mains for sewerage outfalls and water supply. The lining of such tunnels must provide the strength to contain the internal pressure particularly when the surrounding ground is weak or lacks sufficient overburden. This fundamental strength requirement translates to controlling leakage that would be a loss of resource or a source of pollution. The lining also needs to be durable, low maintenance and cost effective.

### Post-Tensioned Concrete Tunnel Linings Offer Major Advantages

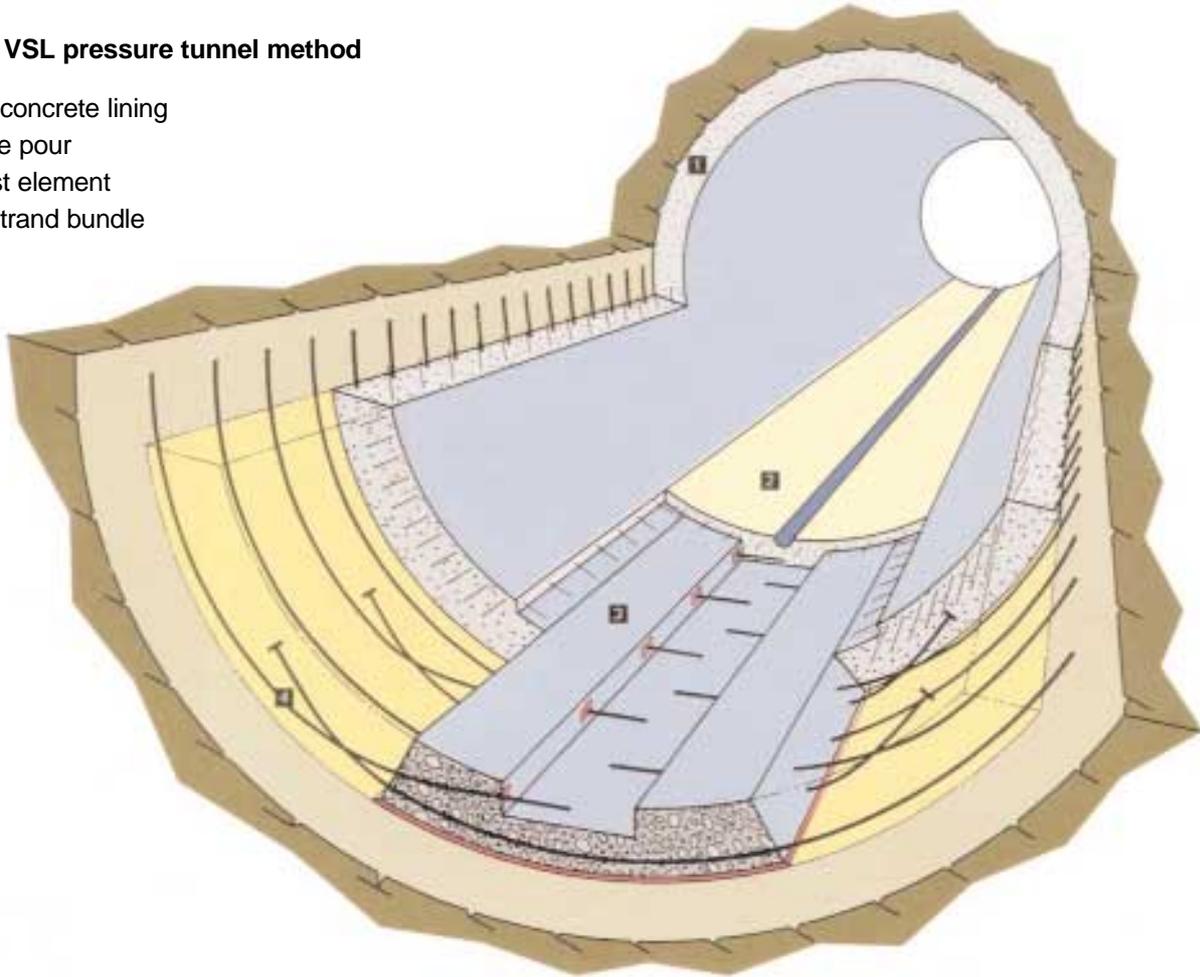
Many factors must be considered when selecting the tunnel lining. The primary choice is between thick steel plates and post-tensioned concrete. Some of the more important advantages of post-tensioned concrete are:

- **Steel Consumption:** Due to the higher strength grade of prestressing steel the amount of steel required for a post-tensioned lining is much less than for a steel lining. This can be particularly important in countries which do not have their own steel making industry or for remote construction sites.
- **Strength and Durability:** Post-tensioned concrete is well known for its inherent stiffness and strength. Therefore, such linings do not need special strengthening against sudden dewatering to prevent buckling. Post-tensioned concrete also is extremely resistant to abrasion and corrosion. Therefore, maintenance costs are minimized.



## The new VSL pressure tunnel method

- 1 In-situ concrete lining
- 2 Closure pour
- 3 Precast element
- 4 Monostrand bundle



– *Versatility:* Post-tensioned concrete allows easy in-situ construction and use of local materials. It offers flexibility to adjust the composition of the post-tensioned tendons to match actual rock conditions. This is an important advantage over steel linings which must be ordered well in advance of actual excavation. This advance commitment precludes changes during construction.

– *Local Labour:* The welding and testing of thick structural steel plates is a demanding and skillful process. In contrast, post-tensioning is an easy repetitive process which can be performed by local labour with appropriate skilled supervision.

### Practical Details Simplify Construction

The new VSL method includes greased and sheathed monostrand bundles cast into in-situ concrete linings. The bundles are anchored in a common anchor head within a precast element.

The precast element is produced from high strength concrete and includes all special reinforcement for load transfer of the prestressing force. It also includes a common stressing recess, starter bars for joining to the in-situ wall, and an invert closure pour. This greatly reduces the labour content of tunnel construction. The elements can be placed by a tunnel boring machine (TBM) and be fitted with a track system to carry the TBM, formwork and materials.

The use of pre-cut monostrand bundles avoids duct placing and grouting. It coordinates well with the placing and fixing of a layer of reinforcement. The monostrand bundles are secured into position by special tendon support bars. These bars also support the reinforcement.

Stressing operations are only needed along the invert of the tunnel. Therefore, no scaffold is needed and the work progresses quickly. A simple closure pour finally seals the anchorage zone and completes the lining.

### VSL Method Extends Range of Application

The diagram on the opposite page gives an overview of the range of application of prestressed concrete pressure tunnels. The new VSL method considerably increases the range of application for pressure tunnels up to 12 meters in diameter. While traditional methods were limited to pressures around 2.5 MN/m<sup>2</sup> the new VSL Method can handle pressures exceeding 3.5 MN/m<sup>2</sup>. In addition to the extended range of application the method offers major improvements in constructability and economy. //

*Brad Rathbone  
VSL International Ltd.  
Berne, Switzerland*

## Slab on Grade for Franklins, Richlands (Queensland)



**Post-Tensioning eliminates problems for slab on grade floors.**

**W**hen the Franklins food chain decided to duplicate their existing warehouse distribution center at Richlands, an outer suburb of Brisbane, post-tensioned concrete was selected by the contractor as the preferred method of slab on ground construction. Not only did post-tensioning offer initial economies over reinforced concrete construction, it also provided the owner with greatly reduced maintenance costs for the projected life of the warehouse floor.

The extension to the distribution center contains over 22,500 sq.m. of slab on ground. It was constructed in 8 pours. VSL installed the post-tensioning and anchorage reinforcement for the project with the total floor area being constructed in slightly under 9 weeks.

The slab was 160 mm thick with bonded slab tendons at 1600 mm centers in both directions. There was no reinforcement in the slab itself other than at joints, edges and set downs. //

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

## Retained Earth in Australia

**V**SL Australia has been awarded three major Retained Earth projects within 12 months of their introduction of the system to the Australian market.

The latest project is the Heathcote Road Interchange located at the western end of the new F5 Tollway which links the south west suburbs of Sydney to the innercity. The project consists of nine Retained Earth walls which form the approaches and abutments to a pre-stressed concrete overpass.

The longest wall is 250 meters and

rises to a height of 9.0 meters at the abutment. The total wall area of the project was 3700 m<sup>2</sup> and was constructed in a period of 10 weeks.

The foundation material, an alluvial silt, was found to be unstable for the construction of the embankments. The VSL Retained Earth System was used to provide an economic solution.

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



**The VSL Retained Earth System - an attractive and economical solution for difficult embankment and retaining wall problems.**



Nepean Dam safety improved by the world's largest and longest permanent ground anchor.

## Nepean Dam

VSL Australia has recently completed the contract for fabrication, installation, grouting, stressing and monitoring of high capacity permanent VSL rock anchors at Nepean Dam. Each anchor is fully encapsulated, monitorable and can be restressed.

The 57 year old Nepean Dam is located approximately 100 km south-west of Sydney and is owned and operated by the Water Board of Sydney. Recent hydrological assessments determined that the spillway was inadequate and the dam wall did not meet current safety standards. The spillway is being enlarged while the main wall of the dam is being anchored utilizing VSL Permanent Ground Anchors.

Additional strengthening of the anchorage zone at the top of the wall is being provided by VSL Stressbars which are placed horizontally through the wall. A variety of anchor sizes and lengths were required. The largest anchor had a capacity of approximately 16,000 kN. The longest anchor, at 122.06 m, is the longest anchor ever installed in Australia and is also believed to be the longest in the world to date. This record will be surpassed by anchors yet to be installed at Burrinjuck Dam (Australia) during 1992. ▀

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

## VSL Slab Floors built in Record Time

Two recent projects incorporating VSL designed post-tensioned floors have created a great deal of interest in Hong Kong for their speed and efficiency of construction

The City Plaza project incorporating two twenty two (22) storey office buildings, CP3 and CP4, was built by Dragages et Travaux Publics (HK) Ltd. and is in the final stages of completion.

The City Center project currently built by Gammon Construction Ltd. is a thirty three (33) storey office building. Both projects are owned and have been developed by Swire Properties Hong Kong Ltd.

The City Plaza project incorporates a total of 70,000 m<sup>2</sup> of post-tensioned floor.



City Plaza, "CP4" after completion

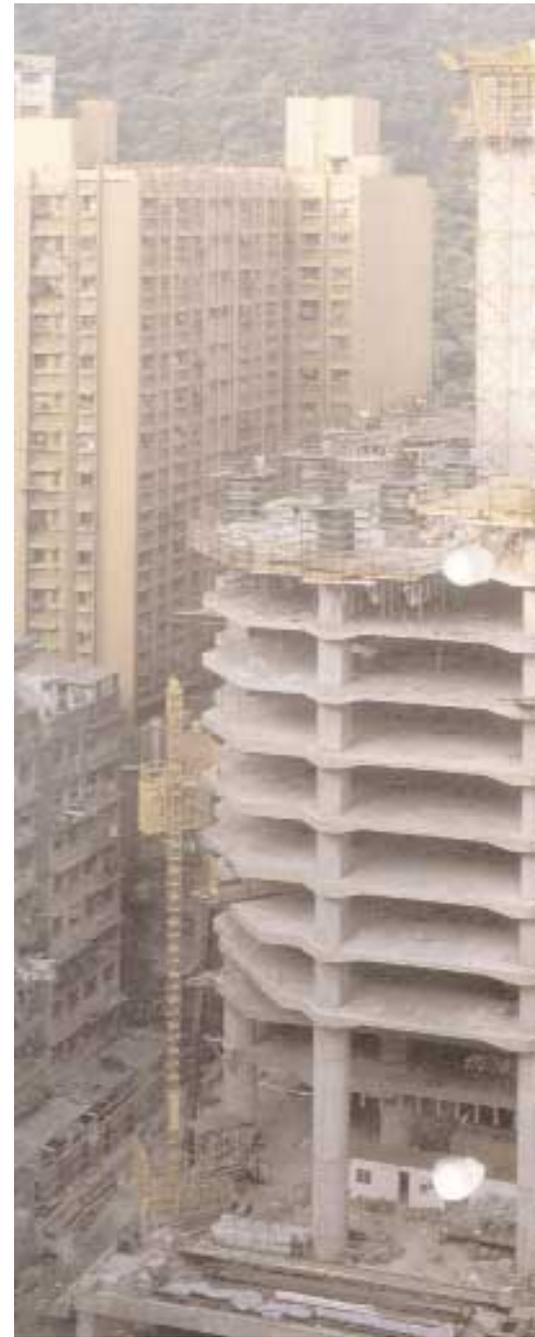
The floor structure consists of a shallow reinforced concrete beam around the perimeter supporting a 300 mm thick post-tensioned slab which spans 11.5 m between the edge beam and the core walls. The City Center project which when complete will have 56,000 m<sup>2</sup> of post-tensioned floor uses a 235 mm flat slab with spans up to 12.0 m between the columns. On this building, post-tensioning of 6.0 m long cantilever beams (1630 mm depth) which support a curtain wall, will ensure minimum deflection of the sensitive facade elements.

On both projects a VSL alternative design was chosen as it offered a more economical and more construction friendly design.

High quality, speed and economy have been of prime concern on these developments. The use of VSL prestressed floors has been fundamental in contributing to all of these factors. It has ensured a minimization of materials and has allowed the structures to be constructed with extremely quick floor to floor cycles using only a single set of system formwork (City Plaza - 4 day cycle, City Center - 5 day cycle).

In addition on the City Plaza the choice of a prestressed flat slab instead of a reinforced concrete beam system, permitted an additional floor of office to be built in what is a restricted building height zone. //

*Duncan Lapsley  
VSL Engineers (HK) Ltd.  
Hong Kong*



City Center during construction

## Birth Announcement

Reto Jenatsch, CEO of The VSL Groupe is pleased to announce the birth of VSL-Redland Concrete Products Ltd. the newest member of the VSL family. Born on the island of Macau on July 25, 1991, VSL-Redland will design and produce specialized precast concrete products for the Hong Kong and Chinese markets.

VSL-Redland is an offspring (joint venture) of VSL Engineers (HK) Ltd. and Redland Concrete Ltd. delivery of this newest member of the VSL family was assisted by Andrew Payne and Howard Chan. We are pleased to report that VSL-Redland is doing well and growing rapidly. //

## Climbform – A big Hit in Singapore



Even complex building cores can be easily and rapidly constructed with the VSL Climbform system.

Contractors, Owners and Consultants have shown great interest in the VSL Climbform for construction of medium and high rise projects.

After completion of Alexandra Point and Phoenix Tower, VSL Singapore has now secured six more Climbform projects in Singapore.

The popularity of the Climbform is due to:

- The unique heavy duty working platform which enables productivity enhancing features to be integrated at the top working level.

- The saving in craneage due to handling of materials in bulk (sorting out on platform).

- The possibility of fast track construction without additional resources. Three to six day cycles are easily achievable.

- The reduction of labour required for core construction and unique quality of finish. //

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*Mark Wong  
VSL Singapore Pte. Ltd.  
Singapore*

## VSL Singapore celebrate 3,000,000 m<sup>2</sup> of Post-Tensioned Slabs



Strong interest in post-tensioning attracts the leading construction professionals to VSL's seminar.

More than 200 professionals in the construction industry attended a seminar at The Regent Hotel in Singapore to commemorate the completion of 3 million sq. meters of post-tensioned slab. VSL's commitment to excel in this area with innovative buildable designs for fast track construction of both low rise industrial and high rise commercial buildings has proven that post-tensioning can be used effectively to

compete with steel and precast floor systems from an economical, construction speed and quality point of view. The large number of ongoing post-tensioning building projects is testimony to its popularity and acceptance in Singapore. //

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*S.C. Kuah  
VSL Singapore Pte. Ltd.  
Singapore*



Giant buried post-tensioned waffle slab spans 90 feet and supports multistorey buildings.

## Huge Underground Complex achieves Record-Breaking Spans

**S**an Francisco's George R. Moscone Center is undergoing an ambitious construction program that will significantly expand the convention center. The new underground expansion covers 487,000 sq.ft. (45,000 m<sup>2</sup>). The roof top of this underground structure will support multistorey structures!

The underground spaces required large spans, while the roof top facilities produced a superimposed load of up to 600 psf (28.7 kPa).

A waffle slab with 90 ft. (27.4 m) bays, 10 ft. (3.0 m) rib spacing, and a 6 ft. (1.8 m) depth was chosen. As a result, the roof has a structural scale about three times greater than regular waffle slab construction.

Post-tensioning tendons were used in the waffle ribs in both directions. Up to two 5-31 tendons per rib were used.

The structure was originally designed to be constructed in 15 stress segments with tendons coupled at each segment.

VSL proposed a construction sequence with only 3 stress segments. This significantly improved the speed of construction. //

*David T Swanson, PE.  
VSL Western,  
Campbell, California*

## Expansion of Retained Earth Markets

**V**SL Western aggressively expanded its Retained Earth Wall market by signing two international licenses for the system in 1991 and by opening a Retained Earth office in Canada in February 1992.

VSL Western's licensee in Japan is the well-known construction company,

Sanshin of Tokyo, Japan. In Mexico, VSL Western has licensed with Grupo Mexicano de Desarrollo, the second largest heavy construction company in the country.

With these new additions to the Retained Earth family, VSL Western expects to continue increasing VSL's

market share and enhance worldwide acceptance and recognition of these products. //

*Scott Thompson  
VSL Western  
Campbell, California*

## Largest Us Seismic Retrofit Project to Utilize VSL Isolator Bearings

A newly-developed base isolation bearing system has been selected for the seismic retrofit of San Francisco's U.S. Court of Appeals building. After evaluation of several systems and tenders, the General Services Administration accepted the \$ 3,126,000 proposal for engineering and isolator supply of the Joint Venture of VSL Corporation, Campbell, and Earthquake Protection Systems, Inc., San Francisco. The contract will be part of an approximately \$ 70 million retrofit project precipitated by the 1989 Loma Prieta earthquake.

The five storey, 350,000 sq.ft. Beaux Arts structure will be the largest seismically isolated building in the U.S. A total of approximately 300 isolator bearings will be installed between the foundation and the load bearing columns. The retrofit is designed to reduce the structural response of the building by a factor of 4 to 5 during a major earthquake. Nearly

all of the anticipated displacements will be absorbed by the isolator bearings, with the building remaining essentially straight during an earthquake.

The VSL/EPS system is based upon the friction pendulum principle of seismic isolation. When the earthquake forces are below the designed friction force level, the structure responds with small amplitude pendulum motions, with the earthquake's energy absorbed by the friction dampening of the isolator bearings. The system has been extensively tested on earthquake simulators of the University of California, Berkeley and The National Center for Earthquake Engineering Research at Buffalo, NY.

The friction pendulum system offers several advantages over conventional isolation bearings of high-dampening rubber or lead core rubber. The system's design versatility allows the engineer to independently choose the

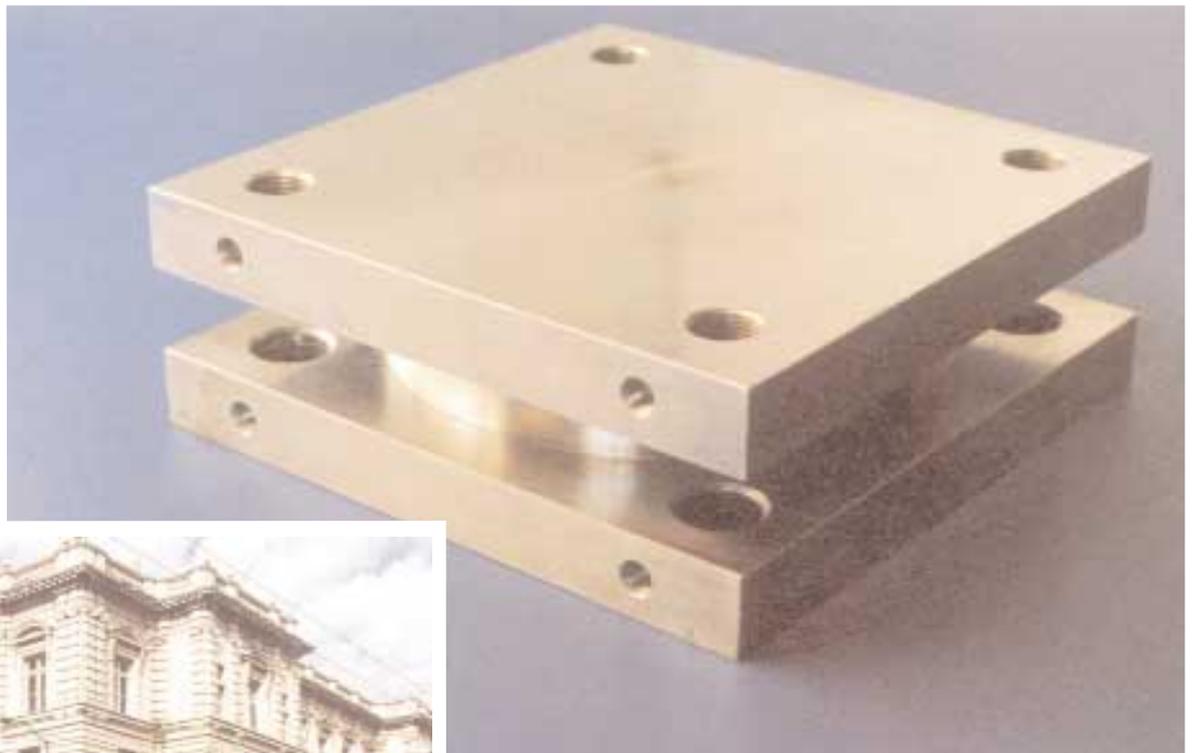
natural period, displacement capacity, load carrying capacity, and effective dampening to suit the structure. The chosen bearings are also smaller than the rubber systems, and are considerably more economical to manufacture and install.

VSL will be responsible for all aspects of manufacturing, quality control and contract administration. EPS will provide engineering and technical services.

Shipment of the isolators to the site will begin in December 1992, with installation scheduled for completion in the latter part of 1993. //

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*Shane Korfike  
VSL Western  
Campbell, California*



**San Francisco's US court of Appeals building, the largest US seismic retrofit project to date.**

**VSL/EPS Isolator Bearings will be installed between the foundation and the load bearing columns.**

## Post-Tensioned Multi-Cell Rectangular Tanks are a Reality



With suitable design, even multicell rectangular tanks can reap the advantages of post-tensioning.

VSL recently served as the engineer of record and post-tensioning material supplier of a rectangular four cell waste water treatment facility for Dauphine County near Harrisburg, PA. Terre Hill Concrete Products provided the balance of the concrete package to complete the tanks in place.

The outside dimensions are 91 ft.x 65 ft.x 8 ft. tall (28mx20mx5.5m). The walls are post-tensioned both horizontally and vertically, and the foundation slab has two directional post-tensioning. All elements employ the VSL CP+ monostrand system which provides fully encapsulated tendons.

The tank is partially buried. Therefore, the exterior walls are subject to a reversal in loading during a tank empty con-

dition. Each cell can be empty or full, independent of the other cells, requiring that the interior walls also be designed for loading reversals. A three dimensional finite element analysis was performed to predict the design forces in all elements for all loading conditions.

Non-circular concrete liquid storage structures in the United States have historically been constructed with ordinary reinforcement only. This project demonstrates that the addition of post-tensioning can enhance the economy and durability of non-circular tanks.

*Hank Cronin  
VSL Eastern  
Springfield, Virginia*

## Retained Earth Walls used in Virginia Highway Expansion

When the Virginia Department of Transportation awarded its largest highway project ever, VSL Retained Earth was chosen as the retaining wall system to support the new access ramps. The project involves construction of several new bridges and widening Interstate 95 south of Washington, D.C. To ease traffic congestion the new lanes are restricted to vehicles carrying three or more passengers. Two back to back Retained Earth walls support the access ramps from a new bridge onto the high occupancy vehicle lanes.

Since over 65,000 sq.ft. (6000 sq.m.) of retaining wall face was required with minimal disruption of traffic flow, speed of erection was of major importance. Ease of installation, outstanding project coordination capability, and timely deliveries were major considerations in the award of the retaining walls. VSL completed the design and delivery of the Retained Earth system on schedule and has recently been awarded the contract on the next section being widened which includes 100,000 sq.ft. (9000 sq.m.) of walls. 



Retained Earth fractured fin panels support access ramps from Springfield Parkway on Interstate 95.

*Roger Bloomfield  
VSL Eastern  
Springfield, Virginia*



Cooperation from the engineer of record help VSL's redesign provide benefits for Lauderdale's New River Center project.

## A Successful Redesign of Post-Tensioning

**T**he New River Center office complex located in the prime business area of downtown Fort Lauderdale, Florida, is a 22 storey structure with 590,000 sq.ft. (55,000 sq.m) of elevated floor space.

When bids were received by the General Contractor, the structural frame was over budget. With the engineer's blessing, VSL proposed a redesign of the intricate system of post-tensioned beams, most of which did not run on a rectangular grid. VSL's specialized post-tensioning design expertise helped

to optimize the design of the beams. Design efficiency was further improved by realignment of some of the members. This reduced the amount of concrete, simplified formwork, and significantly reduced the post-tensioning and ordinary reinforcing. The savings were shared by the owners, contractor, and VSL Corporation. /

*Rafael Puerta  
VSL Eastern  
Miami, Florida*

## VSL Incremental Launching of the Loewenberg Viaduct, Switzerland

The Loewenberg Viaduct, currently constructed by a joint venture including Losinger Fribourg, will close a

gap in the NI highway.

The superstructure consists of two 12.5 m wide concrete boxes. The total

length of 665 m is divided into 15 main spans of 40.2 m and 2 end spans of 31.0 m each. The bridge follows a horizontal and vertical radius and staffs with a 2.4% downhill slope at the fabrication yard, ending with a 0.6% slope. The bridge was designed to accommodate construction by launching in increments of 20.1 m.

The VSL Heavy Lifting Division installed its Lift-and-Push launching equipment together with two Hold-Back strand units. The combination of both systems was necessary because the superstructure may have to be pushed or held back, depending upon the relative friction on piers and in the fabrication yard. VSL also installed a safety system which included emergency push buttons at each pier and pier deflection limit switches.

The first superstructure will be finished this summer, the second in the summer 1993. //



The incremental launching method offers improved quality because of shop like fabrication conditions, as well as economy.

*Ferdi Trenkler  
VSL International Ltd.  
Lyssach, Switzerland*

## Viaduct Rehabilitation with External Post-Tensioning

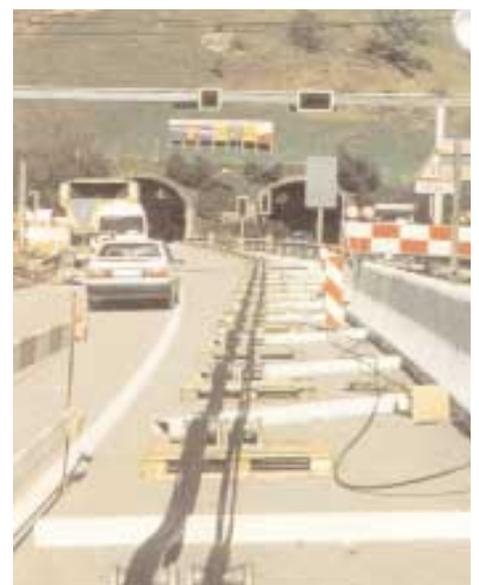
Since the opening of the N2 Gotthard Motorway in 1971, it has been subjected to continuously increasing traffic, a severe climate, de-icing salts, and air pollution. New standards, and the need for an enlarged traffic deck lead to rehabilitation and general refurbishment of the Hoell viaduct.

Post-tensioning played a key role in the rehabilitation of the 406 m long viaduct. Support zones at the abutments and piers were strengthened with a concrete envelope which was post-tensioned vertically and horizontally. The new deck was post-tensioned with transverse tendons. The key to the rehabilitation consisted of longitudinal external post-tensioning of the viaduct.

External post-tensioning permitted the elimination of two joints thus creating a jointless viaduct which is continuous over 10 spans. A vacuum technique allowed complete grouting of even the 406 m long tendons from one inlet only.

The project illustrates the usefulness of external post-tensioning and the exceptional tendon lengths which can be achieved. //

*Mario Bevilacqua  
VSL International Ltd.  
Lyssach, Switzerland*



VSL's monostrand concept for external tendons provides the strands with corrosion protection during fabrication and permits extremely long tendons.

## Nice Airport Roof Slide – An Exceptional Challenge

The assembly of the new roof for Nice Terminal 1 constitutes a technical premiere. Built more than 30 years ago, Airport Terminal 1 Nice Riviera has been completely replanned to meet traffic growth. In conjunction with other improvements, a new roof structure was required.

The steel frame roof structure consists of nine arch-shaped girders 120 m long that are joined together with beams. The arches were assembled on a form at the end of the building then slid laterally by means of VSL jacks and tendons. The arches rested on sliding pads during erection.



**This unprecedented incremental roof launching project provided a simple solution to a difficult problem.**

The whole roof was moved after each arch was added. The new roof with a final weight of 26,000 kN progressively covered the old terminal that continued to operate. Once the new roof was in place, the old roof could be dismantled. Erection of the new roof structure without interruption of the airport terminal operation constitutes an exceptional advancement in construction technology. //

*Pierre Bron  
VSL France Sarl  
Boulogne, France*

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Editor: Therese Wenger

Könizstrasse 74  
P.O. Box 7124  
CH-3001 Berne/Switzerland

Tel 41-31-66 42 22  
Fax 41-31-66 42 50  
Layout by comDesign Berne/Switzerland

## FAR EAST SOUTH/ AUSTRALIA

### Australia

VSL Prestressing (Aust.)  
Pty. Ltd.  
81 Granite St.  
Geebung, QLD 4034  
Tel 61-7-265 6400  
Fax 61-7-265 7534

VSL Prestressing (Aust.)  
Pty. Ltd.  
2, Summit Road  
Noble Park, VIC 3174  
Tel 61-3-795 0366  
Fax 61-3-795 0547

VSL Prestressing (Aust.)  
Pty. Ltd.  
2, Summit Road  
Noble Park, VIC 3174  
Tel 61-3-795 0366  
Fax 61-3-795 0547

## FAR EAST NORTH

### Hong Kong

VSL Engineers (HK) Ltd.  
20/F, East Town Building  
41 Lockhart Road  
Wanchai, Hong Kong  
Tel 852-520 1600  
Fax 852-865 6290

### Japan

VSL Japan Corporation  
Tachibana Shinjuku Bldg. 4F  
2-26, 3-chome Nishi-Shinjuku  
Shinjuku-ku, Tokyo 160  
Tel 81-33-346 8913  
Fax 81-33-345 9153

2do, Pasaje No 715-B, La  
Paz  
Tel 591-2-321 874  
Fax 591-2-371 493

### Brunei

VSL Systems (B) Sdn. Bhd.  
P.O. Box 33  
Bandar Seri Begawan 2600  
Tel 673-2-229 153  
Fax 673-2-221 954

### Indonesia

PT VSL Indonesia  
Jalan Bendurgan Hilir Raya  
Kav. 36A Blok B No. 3  
Tromol Pos 3609/JKT  
Jakarta 10210  
Tel 62-21-571 1882  
Fax 62-21-581 217

### Korea

VSL Korea Co., Ltd.  
5/F., Yang Jae Building  
261, Yangjae-Dong,  
Seocho-Gu  
Seoul  
Tel 82-2-574 8200  
Fax 82-2-577 0098

Rudloff-VSL Industrial Ltda.  
Rua Dr. E. Th. Santana, 158  
Barra Funda  
Sao Paulo/CEP 01140  
Tel 55-11-826 0455  
Fax 55-11-826 6266

### Malaysia

VSL Engineers (M) Sdn.  
Bhd., 39 B Jalan Alor  
50200 Kuala Lumpur  
Tel 60-3-242 4711  
Fax 60-3-242 9397

### New Zealand

Precision Precasting  
(Wgtn.) Ltd.  
Main Road South  
Private Bag, Otaki  
Tel 64-694 8126  
Fax 64-694 8344

### Macau

VSL Redland Concrete  
Products Ltd.  
18 B Fragrant Court  
Ocean Gardens  
Taipa  
Tel 853-81 00 77  
Fax 853-81 00 76

## NORTH AMERICA

### Corporate Office

VSL Corporation  
1671 Dell Avenue  
Campbell, CA 95008  
Tel 1-408-866 6777  
Fax 1-408-374 4113

### USA East

VSL Eastern  
8006 Haute Court  
Springfield, VA 22150  
Tel 1-703-451 4300  
Fax 1-703-451 0862

VSL Corporation  
5555 Oakbrook Parkway, #530  
Norcross, GA 30093  
Tel 1-04-446 3000  
Fax 1-404-242 7493

VSL Corporation  
7223 N.W. 46 th Street  
Miami, FL 33166-6490  
Tel 1-303-592 5075  
Fax 1-303-592 5629

VSL Corporation  
P.O. Box 1228  
11925 12th Avenue South  
Burnsville, MN 55337  
Tel 1-612-894 6350  
Fax 1-612-894 5708

VSL Corporation  
1414 Post&Paddock  
Grande Prairie, TX 75050  
Tel 1-214-647 0200  
Fax 1-214-641 1192

VSL Corporation  
608 Garrison Street #V  
Lakewood, CO 80215  
Tel 1-303-239 6655  
Fax 1-303-239 6623

VSL Corporation  
370 Middletown Blvd. #500  
Langhorne, PA 19047  
Tel 1 -215-750 6609  
Fax 1 -215-757 0381

### USA West

VSL Western  
1077 Dell Avenue  
Campbell, CA 95008  
Tel 1-408-866 5000  
Fax 1-408-379 6205

VSL Corporation  
10810 Talbert  
Fountain Valley, CA 92708  
Tel 1-714-964 6330  
Fax 1-714-965 3265

### Chile

Sistemas Especiales de  
Construccion SA  
Josue Smith Solar 434  
Santiago 9  
Tel 56-2-233 1057  
Fax 56-2-233 1205

### Singapore

VSL Singapore Pte. Ltd.  
151 Chin Swee Road  
#11-01/10 Manhattan House  
Singapore 0316  
Tel 65-235-7077/9  
Fax 65-733 8642

### Thailand

VSL (Thailand) Co., Ltd.  
7th Fl., Sarasin Building  
14 Surasak Road  
Silom, Bangrak Bangkok 10500  
Tel 66-2-237 3288  
Fax 66-2-238 2448

### Taiwan

VSL Systems (Taiwan) Ltd.  
1 Fl. No. 20-1, Lane 107  
Hoping East Road, Sec. 2  
Taipei, R.O.C.  
Tel 886-2-707 7253  
Fax 886-2-704 0463

VSL Corporation  
4208 198th Strset, SW  
Lynnwood, WA 98036  
Tel 1-206-771 3088  
Fax 1-206-672 3020

VSL Corporation  
91 -313 Kauhi Street  
Ewa Beach, HI 96707  
Tel 1-808-682 2811

### Canada

Canadian BBR (1980) Inc.  
P.O. Box 37  
Agincourt, ONT M1S 3B4  
Tel 1 -416-291 1618  
Fax 1-416-291 9960

## EUROPE - MIDDLE EAST - AFRICA

### Switzerland

VSL Switzerland Ltd.  
Bernstrasse 9  
3421 Lyssach  
Tel 41-34-47 99 11  
Fax 41-34-45 43 22

### Austria

Sonderbau GesmbH  
Sechshauser Str. 83  
1150 Wien  
Tel 43-222-892 02 80  
Fax 43-222-892 02 80 33

### France

VSL France S à r.l.  
154, rue du Vieux-Pont-du-  
Sèvres  
92100 Boulogne-Billancourt  
Tel 33-1-462 149 42  
Fax 33-1-476 105 58

### Germany

SUSPA Spannbeton GmbH  
Max-Planck-Ring 1  
4018 Langenfeld/Rhld.  
Tel 49-2173 79020  
Fax 49-2173 790 220

### Greece

VSL Systems S.A.  
18, Valaoritou Str.  
Athens 10671  
Tel 30-1-36 38 453  
Fax 30-1-36 09 543

### Italy

Preco S.r.l.  
Via Olona 12  
20123 Milano  
Tel 39-2-48 18 031  
Fax 39-2-28 10 2111

### Netherlands

Civielco B.V.  
Rijnhofweg 9  
2300 At Leiden  
Tel 31-71-768 900  
Fax 31-71-720 886

### Norway

VSL Norge A/S  
P.O. Box 173  
4001 Stavanger  
Tel 47-4-56 37 01  
Fax 47-4-56 27 21

### Portugal

VSL Prequipe SA  
Av. da República, 47-2.º Esq.  
1000 Lisboa  
Tel 351-1-793 85 30  
Fax 351-1-793 09 01

### South Africa

Steeledale Systems (Pty.) Ltd.  
8 Nansen Place  
Tulisa Park 2197  
Jobannesburg 2000  
Tel 27-11-613 7741  
Fax 27-11 -613 7404

### Spain

VSL Iberica S.A.  
Paseo de la Castellana, 117 2º D  
28046 Madrid  
Tel 34-1-556 18 18  
Fax 34-1-597 27 01

### Sweden

Internordisk Spännarmering  
AB (ISAB)  
Vendevägen 89  
18225 Danderyd  
Tel 46-8-753 0250  
Fax 46-8-753 4973

### United Kingdom

Balvac Whitley Moran Ltd.  
Ashcroft Road, P.O. Box 4  
Kirkby, Liverpool L33 7ZS  
Tel 44-51-549 2121  
Fax 44-51 -549 1436

## INDIA

Killick Prestressing Ltd.  
Killick House/Killick Estate  
Baji Pasalkar Marg, Chandivli  
Bombay 400072  
Tel 91-22-578 44 81  
Fax 91-22-578 47 19

## SOUTH AMERICA

### Bolivia

Prestress VSL of Bolivia  
Jauregui Ltd.  
Calle Fernando Guachala

### Brazil