



NEWS

THE VSL NEWS MAGAZINE • ISSUE TWO 2006

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for business**

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**European Technical Approval (ETA)
for VSL post-tensioning systems**

This provides VSL with the most comprehensive range (from 1 to 55 strands) of ETA approved of the market.

TECH SHOW

Playing mega scale in Macao

Venetian Macao Phase I is a large scale development to build another giant casino. For VSL, it is a large scale precast beam installation project

Cover photo: the Venetian Macao Resort Hotel Phase I

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EDITORIAL

Sustainable development: our responsibility

For over 50 years, VSL has made valuable contributions towards innovative and highly-efficient construction solutions focusing on raw material consumption (concrete, steel, etc.). Our local facilities spanning more than 40 countries and our training policy are both aimed at long-term sustainability, by promoting integration and economic development across many nations.

The term sustainable development is in vogue today, but the prime focus needs to be placed on personal and collective responsibility.

We must adapt our mode of operations and make the most of our team spirit inside the company to expand the approach and convert our broad-based drive for environmental protection into decisive actions.

Sustainable development is more than a concept, it embodies a daily practice derived from a visionary objective and from the will to work for a future to preserve a high-quality planet for our children's sake.



Jean-Philippe Trin

SUSTAINABLE DEVELOPMENT

CONSTRUCTION AND SUSTAINABLE DEVELOPMENT

Global issues at

VSL is constantly reassessing its way of working and looking to best practice, quite simply to 'be the best'. Sustainable development is already firmly on the agenda. During 2006 objectives have been developed.

Around the world, from governments and industry to the public, there is a growing realisation that current methods of development are unsustainable. In 1987 the UN successfully promoted the most widely used definition of sustainable development "*Development which meets the needs of the present without compromising the ability of future generations to meet their own needs*". Current levels of resource usage and wastage are placing to high a burden on the planet. Globally we are not meeting the needs of the present let alone considering the future.

A part to play

We are using up our natural resources quicker than we are replenishing them. We face a future that will be less secure.

We all need to reduce our environmental impact, not just because it is the right thing to do, but also because it is in our own long-term best interests.

The standard approaches in the past to the environmental problems generated by business have been legal driven "end-of-the-pipe" clean-up efforts. This approach has had limited success in

developed areas of the world, and is not enough to control the problem, especially in developing areas. As development continues and grows in intensity, new and larger problems will emerge. For example there simply is not enough fuel in the world for countries like China and India use cars like North America does. The effects on the world of Asia's recent demands for natural resources can clearly be seen (e.g. steel shortages). It has recently been reported that China's greenhouse gas emissions will exceed the USA's 20 years earlier than predicted.

New ways of doing business

Higher energy costs, a growing demand from consumers and governments are putting greater pressure on businesses to change.

However, these challenges are also opportunities to improve performance through reduced input costs, better external relations and greater innovation.

In tomorrow's world, sustainability will more visibly impact on business performance. Increasingly, social and environmental issues are an area of risk for businesses alongside traditional economic



risks. For example consumer boycotts due to poor performance risk corporate reputation. Companies that anticipate changes in resource availability and acceptability of working practice are in a stronger position. Leaders in business, government, academia, and communities are providing innovative new solutions to sustainability issues. Large corporations, as well as small businesses are going beyond legal compliance to conserve resources. Perhaps the single most influential factor that has emerged is the realization that waste reduction, energy efficiency, and pollution prevention make economic sense. Companies are starting to understand that sustainability involves more than ethical considerations - it improves the bottom line and is good business.

How to survive?

Sustainable Development is not a new thing to VSL though it has not been called this before. Few

local level

businesses survive for 50 years, as VSL has done, that have not already embraced aspects of sustainability. For example VSL invests heavily in R&D and is continually introducing new techniques (e.g. Pipeline Rehabilitation).

An important aspect of sustainability for VSL is being part of the local community. This has been done by adopting a decentralized business model, which better meet the needs of local markets and allows greater flexibility in decision making. VSL also produces high quality work, more safely and with less waste than its competitors, and of course VSL's core activities reduce the resources used by clients and increase efficiency (e.g. prestressing, precasting). Additionally VSL also looks after its employees better than the norm especially in 'terms and conditions' (30 year service awards are not uncommon in VSL). They are also active in supporting charities (e.g. the Lighthouse Club Construction Charity in Hong Kong) and industry development initiatives.

Global issues at a local level

Until now there has been no clear strategy in relation to some of the wider aspects of sustainability such as environmental impacts. The full power of the group network has not been used at the local level to address all sustainability issues. Also while VSL may be good,

improving is even better. As such during 2006 objectives have been developed to ensure that VSL is covering 'the fundamentals', and targeting its efforts. These include reducing impacts on the environment, employees and the wider community. In particular the following areas will be focused on in 2007:

- Improving the capability of staff to assist in designing and implementing sustainable development initiatives;
- Auditing of suppliers on quality and social issues;
- Initiating research projects focused on sustainable development;
- Encouraging reduction, reuse, recycling;



- Assessing customer satisfaction systematically and in relation to a wider range of business concerns;

- Aiming to be a leader in health & safety standards in all areas;
- Improving the ratio of women in technical and operational roles;

- Providing educational support to employees and their families.

VSL operates in over 40 countries, employing 80 different nationalities usually as a small or medium sized company. VSL is therefore in a position to understand global issues at a local level, and also local issues. This is not something new, and is not a marketing slogan, it has been a cornerstone of VSL's success to date. The new measures are simply expanding the scope of what is meant by 'sustainable development'. ■





Ground engineering First project in the UAE

→ VSL is carrying out its first ground engineering project in the UAE, with Intrafor's installation of diaphragm walls for Burjuman station and a cut and cover tunnel as part of the new Dubai Metro. Japan Turkey Metro JV has been building the metro since late 2005. Excavations vary from 20m to 60m deep and require a range of tools as there are four different wall widths, ranging from 600mm

to 1,200mm. A BC40 cutter and five cranes were mobilised from Hong Kong and Perth. They will shortly be joined by a second cutter, an MBC30. The project team has a challenging task in installing 73,000m² of diaphragm wall by mid-2007. Work takes place around the clock and temperatures approach 50°C in summer.

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Formtravelers Record in sight for Climbform

→ Gammon Construction is using VSL's Climbform system for the rapid construction of the core wall of Hong Kong's 70-storey One Island East tower. A key factor in choosing Climbform was its ability to incorporate the projecting lintel beams. Installation started at the



basement and the system will be built up to the 308m-high roof. The client plans to accelerate work to a three-day cycle which would be a new Climbform record, considering the restricted working hours.

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Geotechnics

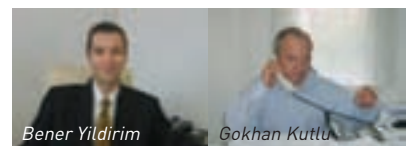
Long cores

→ Intrafor's steerable long hole coring method is attracting considerable interest among tunnel designers in Hong Kong. It will be used to gather information about the complex geology of fault zones at the ends of a 5.5km-long drainage tunnel to be built from Tsuen Wan to Ting Kau. The advanced technology of horizontal directional coring will enable coreholes of 935m and 660m to be drilled from the portals across the fault zones.

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Network

New Turkish licensee



→ VSL has welcomed Mega Yapi as its newly-appointed licensee in Turkey to cover this growth market.

Ankara-based Mega Yapi works throughout the country. The range of services will include post-tensioning, supply and installation of bearings and joints and as well as bridge deck erection. Mega Yapi and VSL are already working together: a recent success has been the award of a project for the seismic retrofit of major bridges in Istanbul where VSL will be responsible for the post-tensioning. Other projects include a 90m-span footbridge in Konya where Mega Yapi and VSL are supplying the stays and carrying out the erection. This is only the second bridge in Turkey with stays made of parallel strands inside an HDPE pipe using the VSL SSI 2000 system. ■ Contact: ealonso@vslsp.com

Tanks

Cryogenic success



→ VSL's involvement in the rapid expansion of LNG tank development in China continues with a contract to supply all the post-tensioning material for a major new facility in Fujian. The contract also includes design and supervision work and there was a special requirement for VSL to complete cryogenic tests at temperatures of -170°C . China National Offshore Oil Company has invested in the project. Engineering, procurement, and construction of the facility's two LNG tanks and receiving terminal are being carried out by Chicago Bridge & Iron Company, in collaboration with designer Chengda Engineering Corporation. The tanks are each designed with a storage capacity of $160,000\text{m}^3$. They have VSL's GC6-27 horizontal prestressing while the vertical prestressing is made up of U-looped tendons of size GC6-12.

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Bridges

PT in Riga

→ Post-tensioning supplied by VSL is being installed on the concrete approaches of a new bridge over the Daugava River in the Latvian capital, Riga. Major construction company BMGS is contractor for the bridge and VSL is providing supervision and equipment as well as the post-tensioning system. Work is due for completion in 2008.

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Offices

Year of the slab

→ This is proving to be the "year of the slab" in Chile, with the completion of more than $400,000\text{m}^2$ of post-tensioned slabs, especially offices, together with projects such as Territoria ($91,000\text{m}^2$), Parque Araucano ($56,000\text{m}^2$) and Plaza Oeste ($39,000\text{m}^2$). Almost all have been won by proposing bonded post-tensioning using the Bondtech monostrand system with polypropylene ducting. Clients have recognised its economic advantages in rebar reduction. For instance, VSL provided the most competitive solution for Plaza Oeste, where more parking was needed in time for Christmas.

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VSoL®

Wall firsts

→ VSoL® is enjoying significant market growth in Australia, the Middle East and Spain. Recent highlights include: 1st Keystone wall project in Hong Kong (full installation of a 13m-high Keystone® segmental block wall for main contractor China State Construction); 1st VSoL® Polymeric wall project in Thailand ($16,000\text{m}^2$); 1st Geogrid reinforced steep slope project in Hong Kong; ($24,000\text{m}^2$ of noise barrier panels supplied with VSoL® walls on Albury Wodonga by-pass in Australia); 1st VSoL® Projects in Egypt and Morocco. News contracts also include: $125,000\text{m}^2$ of VSoL® Polymeric walls in Oman ($92,000\text{m}^2$ on the Southern Expressway project); $47,000\text{m}^2$ of VSoL® Polymeric wall on NH28 at Lucknow, India; $88,000\text{m}^2$ of VSoL® Steel system walls on 17 N°. projects in Spain.

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NOTE PAD

Double win. VSL has recently received two awards from the Post-Tensioning Institute, USA. The first was for efficient use of light-weight concrete and post-tensioning the Union Station parking garage expansion in Washington, DC which called for wide areas uninterrupted by columns. The other was for LeJeune Road Flyover in Miami for repair, rehabilitation and strengthening with post-tensioning as an economical way.

General industry. Coca-Cola's largest Latin American bottling plant has been inaugurated in Mexico by Grupo Tampico. The plant was built using cutting-edge technology, including $25,000\text{m}^2$ of slab on grade by VSL Mexico.

VSL officer as fib president.



The General Assembly of fib has elected Hans Rudolf Ganz, currently Chief Technical Officer at VSL International Ltd, as fib President for 2007 – 2008. H.R. Ganz was appointed Chairman of the FIP Editorial Board in 1997, and served as member of the fib presidium since 2002. Further affiliations include membership in ACI, ASCE, IABSE and other national organisations in France, Switzerland and USA. Since 1996 he has served as Chairman of FIP then fib Commission 9 "Reinforcing and Prestressing Materials and Systems".

VSL & PARTNERHIPS

Attractive network for

In line with VSL's successful corporate strategy to integrate new business venture synergies, several JV partnerships have recently been launched. Here are some of VSL's new trump cards for relevant services.

Whether as a springboard from existing activities or by offering the VSL network as a ready-made tool for distribution of products and services, VSL strongly believes in developing through business partnerships. Bars in the booming Middle-East, pipeline rehabilitation in Hong Kong and Australia, a new slab lifting system in New Zealand and Australia, FRP in post-tensioning systems, vibration control of cable structures are some of the new paths. Whatever field, the quality of the partners selected is a must, as is the resulting benefit to clients.

Threaded bars to address Gulf boom

Commencing from the beginning of this year, VSL Middle East launched a partnership with Stahlwerk Annahütte (SAH) of Germany –the oldest existing steelworks in Europe with a history of more than 460 years. This partnership combines SAH's technical expertise & quality of their products (threadbars in reinforcing and prestressing quality for large construction projects) combined with VSL Middle East's active presence in the region & their market leadership in the field of post-tensioning and specialized construction systems. More than \$1 trillion worth of construction projects are planned or underway in the Gulf region. JV operations are planning to supply SAS Threaded Bars to activities such as tunneling, reinforcement, marine, form ties, post-tensioning, soil nails, ground anchors & micro piles. SAS Thread bars are produced in various



business



◆ SUMITOMO RUBBER INDUSTRIES, LTD.



Admiralty pipeline rehabilitation project in Hong Kong.

grades such as SAS 500 (grade 75), SAS 670 (grade 97), SAS 950/1050 (grade 150), SAS 900/1100 (grade 160) and Cold rolled SAS 850 (grade 120). These threaded bars are available in diameters 12mm to 75mm. These threaded bars and all the accessories are complying to the relevant standards as well as with the project requirements. In addition, any specific request / requirement to the construction industry are being developed and tested by SAH's Research and Development Department.

For VSL Middle East who is in the forefront with its activities as a "Solutions Provider" in the region, this partnership will definitely contribute and provide value added services to their ever expanding list of satisfied customers. The JV operations have recently received an order for the supply of rock bolts for the Portal works for Daftah-Shis Road & Tunnel Project

in Fujairah, UAE. Moreover, orders for form ties, stress bars & accessories, have been received.

Trench-less pipeline rehabilitation

In August 2006, Insituform Technologies®, Inc. and VSL formally agreed to start Insituform Asia Ltd. as a 50:50 joint venture. Established in the United Kingdom in 1971, Insituform® has grown to become an international pipeline rehabilitation company with annual revenues of €500m. While its core business focuses on sewer pipe rehabilitation, Insituform® also restores steel, iron, concrete, PVC and asbestos cement (AC) pipes conveying a variety of fluids. Because Insituform®'s techniques avoid digging up existing pipelines, disruption to the public is minimized. Disposal problems with AC pipes are also eliminated since the pipes remain safely in the ground following rehabilitation.

For VSL this strategic merger will increase its already determined involvement in the repair and strengthening sector. For Insituform® VSL provides a platform in the Asia Pacific region. This platform will allow them to quickly establish new business ventures backed by the support and establishment of a contractor with considerable expertise delivering specialist services to the civil engineering sector.

The initial business targets are Hong Kong, Macao, Australia and Taiwan. The Hong Kong and Macao locations have been in operation since October 2005 and have completed work for the Water Supplies Department and the Hong Kong Mass Transit Corporation. A steady stream of rehabilitation contracts is also being tendered by Hong Kong's Water Supplies Department. Opportunities are being explored in Australia, particularly in the heavily populated areas of South and East Australia

In addition to operating as a contractor, IAL has exclusive rights for sale of the MTube® brand Cured-in-Place Pipe (CIPP) tubing for Hong Kong, Macao, Australia



and Taiwan. IAL has non-exclusive rights for a wide range of Asia Pacific countries (with the exceptions of Japan, Singapore and Malaysia) and sales have already begun in both Korea and Hong Kong. The IAL Taiwan operation is in the initial stages of development and should be fully incorporated early in 2007.

CFRP laminate post-tensioning system

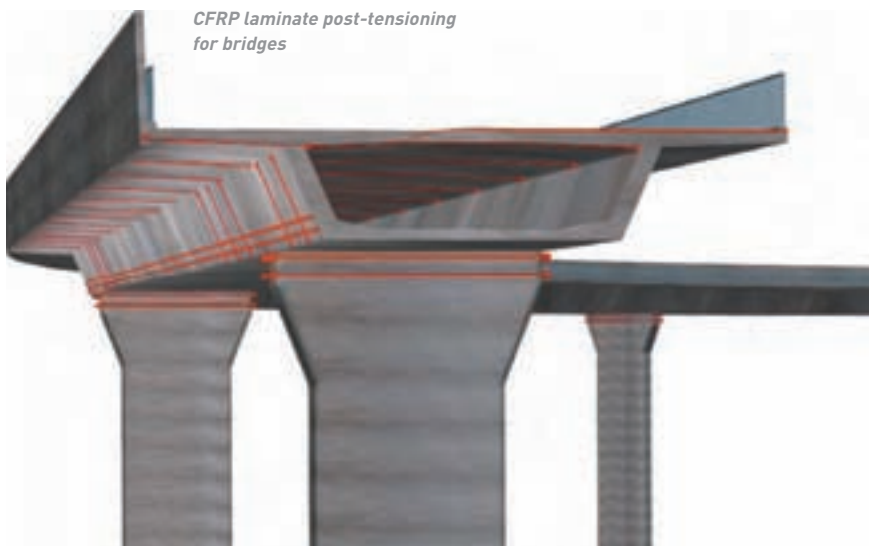
Since the development of CFRP (Carbon Fibre Reinforced Polymer) in the late sixties these materials have been used increasingly for structural strengthening. During the last ten years, they have also been used as post-tensioned strengthening tendons for applications on bridges and other structures. Sika and VSL are co-operating in the worldwide market with their newly developed composite CFRP laminate post-tensioning system. By combining their respective know-how, expertise, products and networks in this field, the parties have decided to create this year and market a "quality controlled pre-stressed CFRP system" under the trademark CarboStress®, with local expertise and site support from the global network of both companies.

The synergy of quality materials from Sika and innovative engineering from VSL provide significant advantages and benefits for clients. For the designer, advantages are: high flexibility in anchorage design to suit specific structural situations; standard solutions for bridges, roofs, floors and walls; thin CFRP plates make tendon cross overs possible. For the contractor, advantages are: very light weight (a 10m-tendon weighs only 3,5kg; can be rolled easily; good solution

for difficult access sites or structures; easy and fast installation without special equipment; strengthening at low temperatures (down to -10°C non-bonded) without additional curing equipment; minimal breakout on site. Easy and economic to bond to the structure; can also be used non-bonded; short load transfer of external PT force into sound concrete; increased ductility for non-prestressed structures. Last but not least, for the owner, advantages are longer life



CFRP laminate post-tensioning for buildings



CFRP laminate post-tensioning for bridges

expectancy and low maintenance due to non-corrosive CFRP tendons, good fatigue characteristics, pre-assembly in quality controlled factory conditions, active PT force (reduction of passive steel stress, crack widths and stress amplitude), and cost effective and safe strengthening solutions for external prestressing.

Multi-point synchronised slab lifting system

VSL and Jacking Systems Ltd NZ have come together to combine modern computerized jacking techniques and slab post-tensioning to deliver an innovative flooring construction system: VSL Climbfloor.

VSL Climbfloor is used for the construction of cast in-situ post-tensioned slabs without the use of conventional formwork. In a typical Climbfloor application, each slab is cast on top of the previous slab then lifted into place by a computer-controlled multi-point synchronised jacking system. The system can combine void formers, edge formwork, self-climbing perimeter access platforms with edge protection and safety screens. VSL Climbfloor provides a comprehensive self-climbing and self-contained slab forming system allowing infinite combinations of flat slab and band beam configurations.

This system provides a safe and a very cost competitive alternative to labour intensive conventional formwork and crane intensive pre-cast concrete operations.

The key advantages are:

- Substantial cost savings over timber formwork and pre-cast concrete systems.
- Larger spans and thinner slabs inherent in PT slabs, whilst retaining the benefits of pre-cast systems.
- Significant reduction in craneage. All formwork, screens and edge platforms are self-climbing.
- Allows the continuation of the next floor cycle as soon as the concrete starts setting on the previous slab. There is no need to wait for the erection of the next levels formwork to commence the installation of the reinforcement & PT for the next level.
- Superior surface finishes, especially in flat plate slabs.
- Slabs can be lifted to 5.2 metres eliminating costly high propping.
- Improved safety with safety screens, edge boards and edge

protection being automatically carried up.

- Environmentally friendly through reduced formwork materials and waste.

The 121 Strand in Auckland New Zealand is a 4 level car park with 3 floors being lifted with a total area of 3,300m²: 36 synchronised screw jacks elevated each of the slabs within a relative accuracy of 0.1mm. The entire slab could be lifted the 2.1m in only 20 minutes. In the case of the three-storey Middlemore Hospital car park, 40 jacks were set-up to lift the slab in two parts; each slab measured 1,300m² and weighed 700t, creating one half of a 2,600m² level.

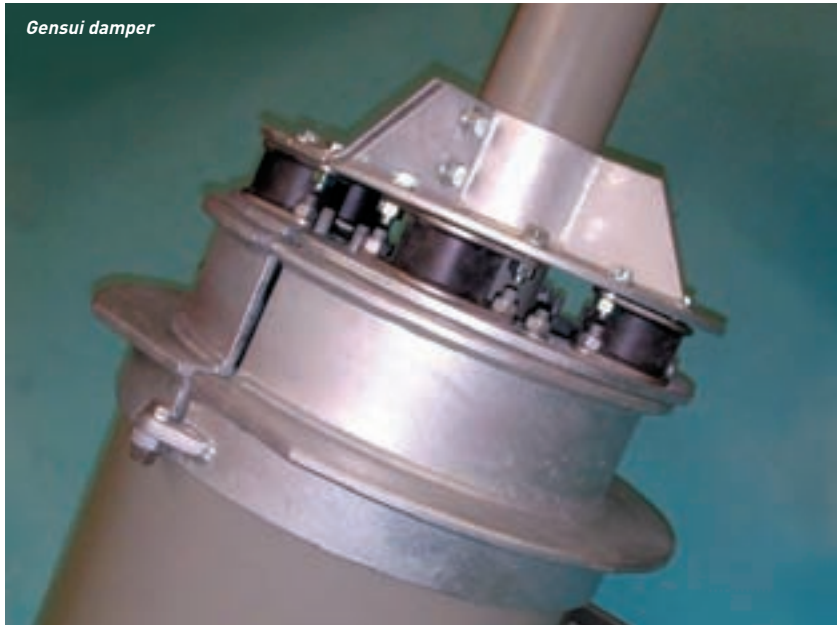
Vibration control of cable structures

VSL has signed an exclusive purchase and distributorship agreement with SRI Hybrid for special damping devices. This proprietary rubber mix named Gensui gives the material unique properties both for monotonic and for cyclic loading. Presently, two types of Gensui rubber are available, standard and high damping types with loss-factors of ≥ 0.50 and ≥ 0.63 , respectively. The Gensui rubber has other quite exceptional properties which result in a loss-factor which is very little dependent on actual shear displacement/strain, temperature, frequency of cyclic displacements, and age of the rubber. These properties make Gensui rubber an excellent material of choice for damping devices to control vibrations of stay cables and other components or entire structures.

The Gensui rubber damper has been installed first in 1994 on the Odawara Blueway cable-stayed bridge in Japan. Since then more than 36 cable-stayed and extradosed bridges have been equipped with Gensui dampers in Japan. Span lengths of these bridges ranged from less than 80m to more than 400m. Typically, the Gensui dampers



**Middlemore Carpark,
Auckland, New Zealand**
40 jacks lifted the slab
in two parts; each slab
measured 1,300m² and
weighed 700t.

Gensui damper

were installed at a distance equivalent to about 2.5-6.0% of the cable length from the deck cable anchorage and typically contained between two and six pads.

Significant number of projects in Japan have shown that the actual damping is equal or typically

10-20% larger than the theoretically determined damping. In mid 2006, VSL tests with the Korean Highway Corporation confirmed again the excellent behaviour of the Gensui damper. VSL is right now supplying Gensui dampers for the Richmond-Vancouver Airport North Fraser River Crossing cable-stayed project in Vancouver/ Canada, the first application outside of Japan.

However, the one additional very appealing characteristics of the Gensui damper is maintenance: apart from the steel components, the rubber pad in fact needs no maintenance at all. VSL is now in the very comfortable position of

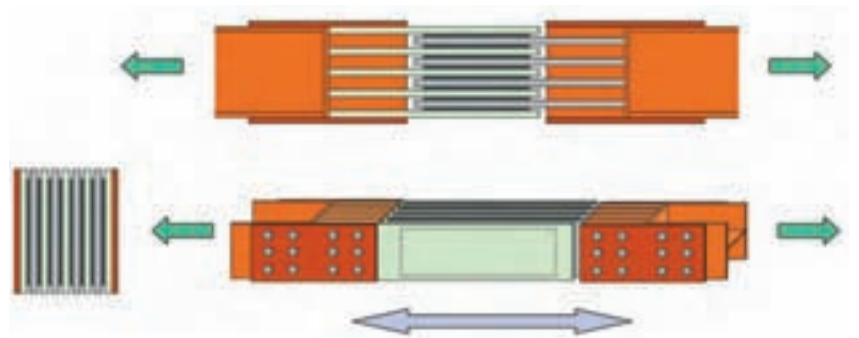
being able to offer two excellent damping systems for stay cables to clients: the VSL Friction damper and the Gensui damper. The Gensui damper will be the preferred choice for cables where the required installation position for the specified damping ratio is within the practical limitations of the guide pipe length and/or for cases where damping at small amplitudes is desired. The VSL Friction damper and/or a combination with the Gensui damper will be preferred for cases where high damping ratios have to be provided with dampers installed close to the deck as it is often the case for long stay cables anchored above the bridge deck.

VSL has secured the contract for the first bridge in Canada to use the Gensui damper system. The precast segmental extra-dosed cable-stayed bridge is part of Vancouver's Canada Line light rail system. Installation of the 24 Gensui high damping rubber dampers is expected to take place in the first quarter of 2007. VSL has also been awarded the contract to supply 400 Gensui high-damping rubber dampers for the John James Audubon Bridge, Louisiana, USA, set to become North America's longest cable-stayed bridge. VSL and SRI started with the bridge damper but such a partnership could expand to another area in near future. ■



Gensui dampers on record bridge in the US
The John James Audubon Bridge to be built in south central Louisiana, USA is set to become North America's longest cable-stayed bridge with a main span of 482.5m over the Mississippi River and back spans of 195.5m. The bridge will be supported by 900t of stays up to 256m long. VSL has recently been awarded the contract to supply 400 Gensui high-damping rubber dampers. The project is being constructed by Audubon Bridge Constructors and is due for completion in 2010.

The damper is made of supporting elements attached to cable and guide/structure between which a number of Gensui rubber pads are installed which provide damping when the cable moves relative to the structure



Gensui flagship

Interview with Mr Toji, general manager of Sumitomo Rubber Industries, and director of SRI Hybrid, Mr. Shimizu, marketing manager and Dr. Matsumoto, technical manager.

What is Gensui?

Mr. Toji: The Gensui damper is a rubber damping system developed for, but not limited to, stay cable bridges. It is used to mitigate stay cable vibrations that could be induced for example by rain and wind. This system stems from our core technology, rubber, which made Sumitomo Rubber Industries the number one in the world. As a rubber manufacturer we concentrate on Gensui's development. In Japan, in the last twelve years, we installed Gensui damper on 38 bridges and we have been keeping the top share (about 90%) for the last few years.

How do you explain such a successful development?

Mr. Toji: First of all, technical reasons.

Dr. Matsumoto: Indeed, our damper is easy to install due to its small size. Besides, it is basically maintenance free. It is designed to last around 60 years on bridges applications. In comparison with other damping systems, it offers less temperature dependency and less frequency dependency, and also our damper has the same damping performance whatever the frequency, from very low mode to very high mode.

Mr Shimizu: And, its cost is very competitive.

Dr. Matsumoto: Aesthetics is very important too. Our damper is small and compact and matches well with the structure it is installed on.

Mr. Toji: Our product also meets the bridge industry needs in Japan, where as you know, we have many bridges. Key people in

the industry and in the university –as for example the research centre of Kyoto University– recognize the quality of the Gensui damper.

Why did you choose VSL as a partner?

Mr. Toji: We have been quite successful in Japan, so I believe that the world market should be bigger than Japan. We were looking for an international partner able to open up the world market for our product.

Mr Shimizu: Particularly for stay cable bridges, we thought we should tie to a stay cable supplier. In Japan, general contractors have cables supplied from cable suppliers and have dampers supplied from a damper manufacturer such as us. But in Europe it is often the cable suppliers who decide what kind of dampers should be installed on the bridge. We learned a damper supplier should have the cable supplier as a partner.

Dr. Matsumoto: We recognized VSL is a reliable partner through discussion particularly with Dr. Ganz and Mr. Bournand. In addition, we think VSL could be the best damper supplier by having two options: VSL original friction damper and Gensui damper which could be applied up to 250m or 300m cable length.

Mr. Toji: Moreover, while the other two cable suppliers only concentrate on the bridges

market; we think that VSL and its various activities can offer other applications to Gensui dampers.

Since our agreement in 2005, how about the first steps?

Mr Shimizu: We hope VSL will install Gensui damper at least over 1600 pieces annually. Judging from Japanese market, we thought it was a reasonable estimate.

Dr. Matsumoto: Among this quantity, we also expect VSL to install Gensui damper to the existing small medium size bridges having vibration problem and not only newly built large bridges because the Gensui damper is quite easy to install and we think the cost is interesting considering other dampers.

Mr. Toji : We always believed that VSL will meet our expectation. We realized that exporting our Gensui solution could take time, but now with a project coming in Vancouver, an extradosed stay cable bridge, and another potential project in the USA in Saint-Francisville, longest span stay cabled bridge in the US, we feel very confident.

What does "Gensui" mean?

Mr. Toji: The direct meaning is high damping. But as we use Chinese characters, depending on the pronunciation it can be understood as "admiral", a top ranking officer. My wish is that our Gensui system will be the flagship of VSL range of dampers! ■



Dr Matsumoto, Mr Toji, Mr Shimizu.

SITE INSIGHTS



Australia

New tests for Ductal®

→ **Successful tests were conducted this year for resistance of Ductal®** against rifle and fragment projectiles, the effects of close-charge threats and large-scale blast effects. A prototype modular Ductal® Protective Solution building constructed from 100mm thick panels connected with steel plates, was subjected to the effects of 500kg of industrial grade Ammonium Nitrate Fuel Oil (ANFO) at a distance of only 12m. In a separate test, 2m long and 1m high Ductal® Protective Panels were subjected to the effects of a 5,000kg packed TNT charge at distances of 20 and 30m. The tests demonstrated the superior protective performance of Ductal® in direct comparison to ordinary reinforced concrete panels. Similar panels are currently in use as roof protection against mortar threats for a government building in a high-threat zone.

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Australia

Gateway to alliance



→ **VSL Australia, in alliance with Abigroup Contractors and Leighton Contractors,** has been awarded the contract for the construction of the Gateway Upgrade Project in Queensland, Australia. This project worth 1.35 billion USD comprises 10km of new freeway, 10km of existing freeway to be upgraded and one major bridge to be duplicated. The duplicate bridge is a post tensioned concrete structure comprising 260m-long main spans and 70 to 80m long approach ramps. The main deck will be constructed using formtravellers utilising cast in-situ balanced

cantilever techniques. VSL's scope as main bridge alliance partner includes assisting in the construction engineering, provision of key personnel and specialist plant & services for the entire bridge structure from its foundations (piles caps, piers, abutments) up to and including the superstructure. The main bridge alliance is 15% of the total project budget, the construction of which will be shared collectively between the three partners and represents approximately 4 years of activity for VSL Australia.

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Australia

High-speed cycle at Windsor

→ **Achievement of fast deck erection times** means that the superstructure for a new bridge near Sydney is now on track to finish two months early. VSL-Abigroup Alliance is building the bridge as part of the Windsor flood evacuation route. Twenty two of the bridge's 800t spans have been erected since the work started in June, with cycle times as little as 24 working hours. The 1,500m-long bridge is being constructed using the segmental match-cast method with an under-slung erection system. It is made up of 34 simply-supported spans, each 44.3m long and consisting of 15 segments with 18t of external prestressing.

■ **Contact:** dmarchand@vsl-australia.com.au



Russia

Ring road return

→ **VSL's July completion of its work on a bridge** over the Okhta River marked its second major structure for the St Petersburg Ring Road. The bridge follows on from a first cable-stayed bridge over the Neva River and VSL's involvement continues with a second Neva bridge (see *note pad*). Site constraints had led to the design of a steel arch with composite deck. The arch reaches a maximum height of 28m, with a span of 160m. VSL was awarded the supply and installation contract for cables from its SSI 2000 stay cable system, based on the quality, performance and experience of earlier Russian schemes. Fifteen pairs of SSI 2000 suspension hangers were used, ranging from 16 to 19 strands. ■ **Contact:** jcampbell_russia@hotmail.com

Taiwan

Concrete savings for HannStar

→ **An alternative design by VSL is achieving a substantial cost saving** in construction of the three-storey HannStar TFT-LCD CUB factory in Taiwan's Tainan Science Park. The building was originally designed to use structural steel but the dramatic rise in steel prices led VSL to suggest the use of post-tensioned reinforced concrete. More than 44,000m of post-tensioning is needed for the project, using tendons up to 71m long. Floor-to-floor height is 9m as the factory will house the equipment to manufacture very large LCD monitors and TV screens.

■ **Contact:** fchang@vsl-tw.com

NOTE PAD

Neva again. Stay installation for the second Neva River cable-stayed bridge on the St Petersburg Ring Road is due to start in December 2006. The contract for the 382m-span bridge follows VSL's successful completion in 2004 of work on the first crossing, using VSL SSI 2000 stay cable system in extreme temperatures of below -30°C.

Centenary upgrade. VSL in Australia has won a contract for the supply and installation of soil nails as part of the Centenary Link Alliance project for the upgrade of an intersection in Queensland. The work involves more than 680 fully-encapsulated soil nails up to 12m long as well as almost 2.5km of slotted PVC drains.

Dual success. Two VSoL® contracts have been won by VSL in Queensland. Work at the Westfield North Lakes shopping centre builds on VSL's relationship developed on the Westfield Chermside project. The second project involves panels for abutments and wing walls for the RG Tanna Dozer Overbridge, which is part of a coal terminal upgrade.

Flying success. A joint venture of Kajima, Taisei, Obayashi and Maeda has awarded VSL Vietnam a sub-contract to supply and install 280t of post-tensioning on the new terminal at Tan Son Nhat International Airport. VSL anchorages and couplers are being used on slabs beams and an access viaduct.

Reinforced tee-off. VSL Hong Kong is undertaking a geogrid-reinforced steep slope project for Hong Kong Jockey Club's third golf course on Kau Sai Chau Island. Soil reinforcing geogrids and erosion protection matting will be installed on 10 steep slopes up to 8m high.

Hong Kong

Alliance overcomes project challenges

→ **The final segment of the Lai Chi Kok Viaduct** has been erected and the closure pour completed. VSL Hong Kong formed an alliance with Acciona (formerly known as NECSO) for the project which is on Route 8, connecting Tsing Yi Island to Shatin. The scope of the alliance includes the erection of 1,766 precast segments and the installation of post-tensioning, bearings and movement joints. The project is situated in a highly-populated area of Kowloon. The deck is supported on piers up to 45m high, with the majority being about 25m. The 172m-long launching gantry, weighing about 1,000t, had the capability to move sideways across a 45m range and could be used to erect four parallel box girders simultaneously. VSL's strand lifting system allowed segments to be lifted from the

ground on either side of the parallel bridge decks. A lifting frame was used at piers with single box girders where access at the pier was possible but where the ground below the cantilever was inaccessible. A sliding support system was used to take precast segments to inaccessible locations. The segments were lifted by crane onto one end of the sliding system and then moved up to 80m. This method faced several challenges, such as the fact that the bridge was curved, had a longitudinal gradient of up to 4% and that the piers were obstructing the slide. A tie-down system was also designed to counter movement and hold the box girders in the correct position during construction.

■ **Contact:** patrick.arnold@hk.vsl-intrafor.com

Singapore


Diverse approach to bridge upgrades

→ **Singapore's Land Transport Authority has embarked on a series of projects** to repair and strengthen vehicular bridges to take increased loadings. VSL has been involved as a specialist main sub-contractor for the upgrade of 11 bridges. The scope of work included concrete repair, protective coatings, bearing rehabilitation, expansion joint replacement, external post-tensioning and the application of carbon fibre reinforced polymers (CFRP).

Bridge soffit protection took the form of a three-coat anti-carbonation system comprising a layer of siloxane-silane and two acrylic-based coats. Deck parapet walls were given a two-coat protective system made up of an epoxy undercoat and a polyurethane resin sealer. External post-tensioning was used to strengthen five of the bridges. The new concrete anchorage blocks incorporated lateral CTA 40 stress bars and main external post-tensioning systems. Calculations had shown that the strengthening work would increase the structural capacity by at least 20% and up to 60%.

■ **Contact:** adesilva@vsl-sg.com





Hong Kong

Shatin T3 bridge nears completion

→ **Segment erection on the T3 road project in Shatin, Hong Kong** is due to be completed in February 2007. The scope of VSL's work is to erect 1,807 segments, which vary from 30t to 90t, and to install 1,240t of internal and external PT. The segments are erected by the balanced cantilever method, using a 450t, 108m-long overhead gantry and various sizes of hydraulic cranes. This is the third segment

erection project for this gantry, which had worked previously in Korea and Singapore. The T3 team is made up of people from 15 countries. Their greatest challenge to date has been the erection of a 65m-span cantilever where the supporting lower cross beams were launched onto the cantilever while it was being erected. ■
Contact: colin.calder@hk.vsl-intrafor.com

NOTE PAD

Team building. Leading contractor Dragados picked VSL's post-tensioned slabs for its new headquarters building in Madrid. VSL's contract involved 27,500m² of PT slabs, using the VSL Bondtech. Three PT slab designs were developed. All buildings have an 8m cantilever transferred by just two beams at first floor level, hidden in the façade.

Police drill. Intrafor is installing 64 horizontal ties by the Horizontal Directional Drilling method at a project to turn the former Marine Police Headquarters in Tsimshatsui into a hotel. The building stands on top of a small hill and needs retaining works. Precise drilling is needed and the Eclipse walkover surveying system is being used.

Sound performance. VSL Australia's successful installation of 4,000m² of VSoL[®] on the first section of the Albury Wodonga Bypass Project has led to a further order for 6,000m² and the subsequent supply of 24,000m² of architectural sound barrier panels. At peak production, VSL Australia was casting 24 panels every day.



Mexican silo. VSL in Mexico was the main contractor earlier this year for the rapid construction of 39.6m-high cement storage silo for Holcim-Asasco. Some 14t of vertical 36mm-diameter PT bars were used to join the foundation to the superstructure, while the superstructure contains 22t of vertical and horizontal ring tendons.



Singapore

Bridge to luxury

→ **VSL is playing a major role in a bridge** to link Singapore and the luxury apartment developments of Keppel Bay Island. Seven stay cables support the 90m-long main span, with four more supporting the back span. The cables are from the VSL SSI 2000 Stay Cable System and range in size from 22 to 85 strands. The inclined concrete pylon reaches almost 50m above deck level. VSL is in charge of superstructure construction above the piers, with

a wide-ranging scope of work including casting the 77 segments and erection using a 400t barge crane and a custom-made erection frame. VSL Singapore led a key design change that was needed because of height restrictions on the use of floating cranes imposed by a nearby cable car. The design for the anchorage at the top of the pylon was therefore changed from the original steel box to reinforced concrete. ■
Contact: cschai@vsl-sg.com

Dubai

Complex cells for new LRT

→ **The first mould has been delivered from China** for the cantilever sections of the Dubai Metro Light Rapid Transit system and site installation and commissioning is under way. Five cells, made from approximately 450t of steel, will be delivered by January 2007, including all the mechanical, electrical and hydraulic systems. VSL Switzerland was appointed by the VSL-Freyssinet-Rizzani Joint Venture to design and fabricate the cell formwork. Cell design was complex because of the shape and variable geometry of the segments. Design has been closely managed by the VSL Technical Centre in Switzerland, with the manufacture in China supervised by VSL.

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18

Dubai

Record pace for world's biggest mall



→ **The world's largest shopping mall** -a million square metres- is under construction in Dubai and VSL is working around the clock to maintain the exceptionally fast pace of construction. In several occasions, more than 200t of strand have been installed within a single month. It would normally take nine months to install this quantity in a typical building with post-tensioned slabs in Dubai. The structure has been designed with post-tensioned beams and slabs. VSL's scope of work covers approximately 30% of the total floor area -some 300,000m². The mall stands next to the world's tallest building, the Burj Dubai tower. VSL has also recently won the post-tensioning for an adjacent project, involving some 3km of bridge deck on one of the major vehicular accesses to the new district.

■ **Contact:** YSLi@vslme.ae



Kuwait

Hot season at Stadium

→ **VSL has been working as the specialist contractor** for lifting and tensioning the cable net structure supporting the roof membrane of a stunning new stadium under construction in Kuwait. The project follows on from the company's involvement in many sports stadiums worldwide. Local timber-built merchant ships have inspired the architecture of the Jaber Al-Ahmad International Stadium. The circular structure has a diameter of 250m and rises at opposite ends to 65m. The elegant wave-shaped roof is carried on a structural

skeleton made up of 52 wall piers with inclined cantilever beams. The cable net is made up of 52 radial cables and a central tension ring. VSL supported the contractor with an innovative scheme to optimise the installation and tensioning. The construction schedule required the work to be carried out in the hottest season, when temperatures in the stadium reached 60°C. Crews worked seven-day weeks and the stadium is on track for completion in 2007.

■ **Contact:** wschroeppel@vsl-schweiz.ch

USA

Supporting Utah's Capitol



→ **VSL has been working with Jacobsen Hunt Joint Venture** to supply and install a bonded post-tensioning system as part of the

seismic isolation of the dome of Utah's Capitol building. VSL's responsibility includes supply and installation of a bonded post-tensioning system as part of the seismic isolation of the dome. Post-tensioning was chosen because it allowed for the transfer of dome loads from existing footings to new seismic isolators and deep foundations. Large post-tensioned tendons have had to be placed under difficult access conditions.

■ **Contact:** jcrigler@structural.net

NOTE PAD

Dual role. VSL Thailand has erected more than 109 spans of the elevated Suvarnabhumi Airport Rail Link. VSL Thailand was awarded a subcontract for superstructure erection and 5,600t of post-tensioning works. The work involves the erection of 612 of the project's 900 spans and PT works for the remainder.

VSoL® record for ME. VSL Middle East, in JV with VSL Hong Kong, has secured its largest ever VSoL® win with the award by Galfar Engineering & Contracting of a sub-contract for the Oman Southern Expressway: design, supply and supervision of more than 92,000m² of the VSoL® polymeric wall system. Panels will be installed at a peak rate exceeding 120m² a day.

Imported gantries. VSL India is set to start gantry erection for a scheme to build an 8km viaduct to carry four lanes of traffic above an existing six-lane highway near Bangalore. A total of 2,860 segments are to be erected. The three launching gantries have been fabricated in China and shipped in 90 containers. This was two months quicker than making them locally.

Noiseless. VSL Hong Kong has recently completed a full scope supply and installation package for VSoL® retaining walls on Hong Kong's T3 project. Working on a congested site, the VSL site team installed 1,725m² of VSoL® wall together with associated parapet barriers and noise barrier support walls.

Spanish showcase. CTT Stronghold has completed the installation of stay cables for the new exhibition centre in La Coruña in northern Spain. The VSL SSI 2000 Stay Cable System was used for the 18 stays that support the 160m by 50m roof from three steel pylons.



Czech Republic

Team success at Rybny Potok

→ **Excellent coordination between all participants** has led to successful completion of work on a bridge over Rybny Potok on the D8 highway. VSL installed secondary external cables on the bridge, following the launch of the 20,000t superstructure. The cables, which are up to 360m long, consist of 31-strand replaceable CS 2000 tendons. VSL also carried out all the lifting works needed to replace

temporary bearings with permanent ones. The maximum lift on a single pier was 3,500t, provided by eight 500t jacks. A consortium of Strabag and Skanska was the general contractor for this section of highway, with Metrostav as bridge contractor. Bridge design was carried out by SHP with assistance from VSL.

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UK

Flower for savings

→ **VSL UK's method of post-tensioning two LNG tanks** in Wales has saved time on the critical path for the main contractor, Whessoe-Volker Stevin Joint Venture. Owner Dragon LNG commissioned the tanks at Milford Haven. One of the key aspects of VSL's proposal was to use the new AF flower anchorage system for the vertical tendons instead of the original design with stressing at both ends, or the U-shaped system that is commonly used for this kind of structure. The vertical tendons are anchored in the bottom with the type AF dead anchorages. The proposal saved time by avoiding excavation and subsequent back filling below the tank slab. More than 52km and 6,500 couplers of the PT-PLUS® system have been installed. The 700mm-thick wall is reinforced with 144 vertical and 158 horizontal tendons. High-performance Ductal® G2 grout has been used.

■ **Contact:** cpetrel@vsl-schweiz.ch



UK

Towers reaching for the skies

→ **VSL is carrying out post-tensioning on the tallest tower in Liverpool.** A construction boom is under way in this World Heritage City and future European Capital of Culture, with new sports, cultural and shopping facilities as well as an impressive skyline of towers. Tallest is the 120m-high Beetham West Tower, for which VSL designed the post-tensioned slabs and is carrying out the installation using the SO 6-4 system.

■ **Contact:** fpersch@vsl-schweiz.ch



NOTE PAD

Out or rain. VSL Argentina has been appointed to build two PT water tanks to prevent flooding inside the Repsol-YPF Refinery in La Plata. Each water tank is approximately 70m by 70m with 3.5m-high walls. VSL is using the Bondtech system with 0.5" strands.

Carbon plate. VSL France has installed a 15m-wide, 100m-long suspended floor underneath the deck of a motorway viaduct over the River Yonne as part of a project to repair the structure. CFK 150/2000 carbon plates are being bonded to the beams as strengthening.

Tunisia

Works start



→ **VSL Switzerland has recently started building** the deck of the main bridge of the Rades-La Goulette project in Tunis for Taisei Corporation. The extradosed bridge is 260m long, with a main span of 120m and end spans of 70m. VSL is supplying two pier table formwork units, two pairs of form-travellers, PT components and all the necessary construction supervision. Components and supervision are also being supplied for another part of the project, which involves four post-tensioned ramps constructed on scaffolding. Completion is due in November 2007.

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Switzerland

Flexible build

→ **Post-tensioning has recently been completed by VSL** on floor slabs for the extension of a car park in Lausanne. The lower three levels were made up of 350mm-thick prestressed slabs with VSL SO-H 6-4 post-tensioning cables. Cycle times were reduced to less than a week, thanks to VSL's post-tensioning method and the use of thin prefabricated slabs, which

doubled as lost formwork. The fourth level, the roof slab, has to support heavier loads and so is 600mm thick and post-tensioned with VSL EC-H 6-12 cables. The flexibility and adaptability of the VSL system also facilitated an easy transition between the new extension and the existing car park.

■ **Contact:** fvouilloz@bluewin.ch



Iran

Tough tanks

→ The fast-growing list of liquefied natural gas storage tanks built with VSL post-tensioning now includes the South Pars Gas Field project in Assaluyeh, Iran. VSL is providing the post-tensioning for two propane and two butane storage tanks for the ninth and tenth phases of the huge project. PT-PLUS® duct is being used for all

the semi-circumferential horizontal tendons and U-shaped vertical loops. The system's superior friction coefficients allowed a significant reduction from the strand quantities initially estimated. Further benefits came from the robustness and ease of installation. VSL's CS 2000 anchorage is used throughout.

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Russia

High and dry

→ VSL has been playing a key role in major scheme under way in St Petersburg. A new protective dam will guard against the danger of flooding and an elevated highway is also being built. The elevated structure is largely made of precast beams but also includes a 122m-long, 1,500t section of steel deck, which was assembled at ground level and raised 22m to its final level. VSL's computer-controlled laser levelling system proved ideal for this as the structure was very flexible transversely. The lift was successfully carried out in a single, smooth operation.

■ Contact: dgratteau@vsl-schweiz.ch



Ecuador

Achievements in deep forest

→ Installation of 128 stays for a 183m-span bridge over the Pastaza River in the Amazonian forest has been completed three months ahead of schedule, despite difficult site conditions. The stays for the new bridge on the Baños-Puyo road were installed in just five months. The composite deck

of the steel bridge with its concrete slab is being supported by SSI 2000 stays, sized between 6-12 and 6-31. A total of 81t of replaceable stays were used. Galvanised and waxed monostrands were placed in an external polyethylene pipe.

■ Contact: epalos@vslsp.com



Chile

Superflat and smooth

→ A “superflat” slab surface has been achieved at a major Chilean distribution centre, far exceeding the project’s already demanding requirements. Expansion of Falabella, one of Chile’s top three retail companies, prompted the construction of a new 30,000m² distribution centre in Santiago. The slab needed to be very flat for efficient performance of the

centre’s specialised fork-lift trucks. VSL’s ability to produce a joint-free finish provided additional benefits. The high specification was achieved through the use of special formwork and narrow 4m-wide pouring strips. VSL’s scope of work also included engineering advice, supervision and liaison.

■ **Contact:** rcarrillo@vslchile.cl



France

Seaside repairs

→ Major renovation has now been completed of the Grau Saint-Ange coastal bridge alongside the Mediterranean. VSL France was awarded the project which was financed by the local council of Pyrénées-Orientales. The 15-month project restored damaged areas and brought safety features up to standard. Proximity to the sea had led to chloride contamination in the double-deck structure’s concrete. Hydrodemolition removed some 800m² of contaminated concrete, which was replaced using shotcrete.

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France

Landmark win for VSoL[®]

→ An exceptional VSoL[®] project has recently been undertaken along the French banks of Lake

Geneva as part of the Thonon-les-Bains bypass. The scheme used almost 9,000m² of VSoL[®], made up

of more than 3,000 concrete facing panels measuring 1.68m wide by up to 2.80m in height. All panels feature complex architectural finishes with patterns measuring up to 200mm. VSL’s role ranged from design through to construction and included securing the architect’s approval. The project specification also called for nearly 22,000m² of VSoL[®] Steel with a mineral facing. The VSoL[®] Steel Mesh system was applied over straight and curved wall segments, for structural bridge abutments and for reinforced fill approach ramps. The first VSoL[®] Steel panels were installed during June 2006 and the team began setting up the concrete panels in mid-September.

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European Organisation for Technical Approvals (EOTA)

ETA for VSL post-tensioning systems

On 31st July 2006, French Approval Body SETRA has issued the European Technical Approval (ETA) for VSL post-tensioning systems for a period of five years. This provides VSL with the most comprehensive range (from 1 to 55 strands) of ETA approved of the market. VSL's ETA is valid in all EU and EFTA countries.

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The introduction of Construction Products Directive (CPD) (see box) represents a giant step in the aim of harmonisation and setting of higher standards in post-tensioning systems. Structures will be safer and also more reliable thanks to the ETA process. To have certified systems that can be used in all EU/EFTA countries without need of further country by country approvals certainly is the main objective of the CPD.

Upon mandate from EU/EFTA and in order to guarantee that all regulated characteristics were taken into consideration, VSL assisted EOTA in the drafting of the ETAG 013 which is the one referring to post-tensioning systems. VSL's ETA has been issued on 31-07-2006 by the prestigious French Approval Body SETRA and is valid for a period of five years. VSL had to submit an application including full details of our systems and their intended use as well as test reports and a comprehensive description of our VSL manufacturing centres. Tests were carried out at the prestigious Swiss laboratory EMPA and comprise mainly static load,

tensile, fatigue and load transfer tests, as well as many other tests required to check the performance of our post-tensioning system.

Full range approval

The ETA has been granted for VSL full range of systems:

- The VSL Multistrand System (anchorage from 1 to 55 strands), intended more for massive civil engineering structures with either metallic ducts or VSL PT-PLUS®.
- The VSL Slab System (from 1 to 4 strands), intended for thinner construction elements such as building slabs or bridge decks, is used along with either bare strands inside metallic ducts or VSL PT-PLUS® as well as individually greased and sheathed strands.

The VSL Post-Tensioning System may be used for new structural works or repair and strengthening works for existing structures. It may also be employed in structures made of other materials than concrete as masonry, steel, wood or combinations of several materials.

The tendons assembled as part of the VSL Post-Tensioning System may have the following basic use categories:

- internal bonded tendon for concrete and composite structures,
- internal unbonded tendon for concrete and composite structure,
- external tendon for concrete structures with a tendon path situated outside the cross section of the structure or member but inside its envelope.

The following optional use categories are added:

- restressable tendon (internal or external),
- exchangeable tendon (internal or external),
- internal bonded tendon with plastic duct,
- encapsulated tendon,
- electrically isolated tendon,
- tendon for use in composite construction as external tendon,
- tendon for use in structural masonry construction as internal and/or external tendon,
- tendon for use in structural timber as internal and/or external tendon.

EU/EFTA countries



Belgium



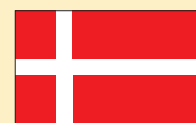
Cyprus



Czech Republic



Austria



Denmark



Estonia



Finland



France



Germany



Greece



Hungary



Iceland



Ireland



Italy



Latvia



Liechtenstein



Lithuania



Luxembourg



Malta



Netherland



Norway



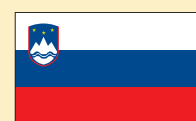
Poland



Portugal



Slovak Republic



Slovenia



Spain



Sweden



Switzerland



United Kingdom

VSL differentiation

Other post-tensioning systems with ETA approvals had only up to now anchorages ranging from 1 to 27 or 31 strands, whereas VSL goes up to 55 strands, allowing customers and consultants a much wider variety of choices. VSL's ETA is valid in all EU/EFTA countries (today, 29 countries, in the future, maybe more than 40). This could also affect many countries in the world that have national codes and practices inspired from British Standard, German or French codes. Conferences will be carried by VSL during the next months in all subsidiaries affected by the implementation of ETA in order to fully disclose the importance for the post-tensioning industry of these matters.

VSL will also continue to include new anchorage as well as developments of the existing systems in future ETA so that customers and consultants could have access to an even greater choice of anchorages and applications.



Extralong CS 2000 trumpets
on midway bridge deck

After contributing to ETAG 13, VSL is pursuing its efforts to guarantee that customers and consultants benefit from state of the art post-tensioning systems as well as safe and reliable methods and installation personnel. The aim is that after a certain period, the expertise gained with issuing ETAs could be used for making a European Standard for installation of post-tensioning. VSL is presently working in order to have

EOTA, how it works



EOTA (European Organisation for Technical Approvals) was born out of the Construction Products Directive (CPD) 89/106/EC of the European Union. The goal of the CPD is the removal of technical barriers in the construction products sector through:

- compliance of works with the six Essential Requirements (6ERs)
- transformation of the 6ERs to product requirements by means of Interpretative Documents
- determination of performance oriented regulations for products used in the works by technical specifications
- attestation of conformity of the product
- CE marking of the product

EOTA comprises the Approval Bodies (AB) nominated to issue European Technical Approvals (ETA) by EU Member States and EFTA States who have contracted to the European Economic Area Agreement.

An ETA for a construction product is a favourable technical assessment of its fitness for an intended use, based on the contribution made by this product to the fulfilment of the six Essential Requirements, as stated in the CPD for the construction works in which the product is installed. An ETA can be granted when any of the following conditions apply:

- no relevant Harmonised Standards for the product exist
- no mandate for such a Standard has been given by the European Commission
- the European Commission considers that a Standard cannot be developed (yet)
- a product deviates significantly from the relevant Harmonised Standards

The Attestation of Conformity (AC) procedure with a technical specification like the ETA, is intended to ensure that the product specification set out in an ETA is maintained by the manufacturer. The AC system is decided by the EU for each individual product or product family and given in the mandate for an ETAG.

Although in certain circumstances it may be possible for an ETA to be issued on the basis of a common assessment procedure agreed among EOTA members, in most cases an ETA for a product will be granted to a manufacturer based on the assessment principles set out in an ETA Guideline (ETAG) for the relevant product sector.

An ETAG describes how to assess, in an harmonised way, products of a particular product family, so that the result products, if the AC provisions are satisfied, can carry CE marking and can be placed on the market in any of the EU/EFTA countries without further regulatory requirements. ETAGs are binding for all Approval Bodies, grouped in EOTA.

a European Standard on installation and qualification of post-tensioning personnel adopted in EU/EFTA countries A first step has already been done with the preparation of the CEN Workshop

Agreement, CWA 14646 which is already specified in many European countries and could eventually lead towards an prENV and thus become a European Standard in the future. ■

Venetian Macao phase I

Precast for mega casino

The Venetian Macao Resort Hotel Phase I is the major development of another giant casino by Las Vegas Sands Group in Macao. For VSL, the project involves large scale precast beam installation.





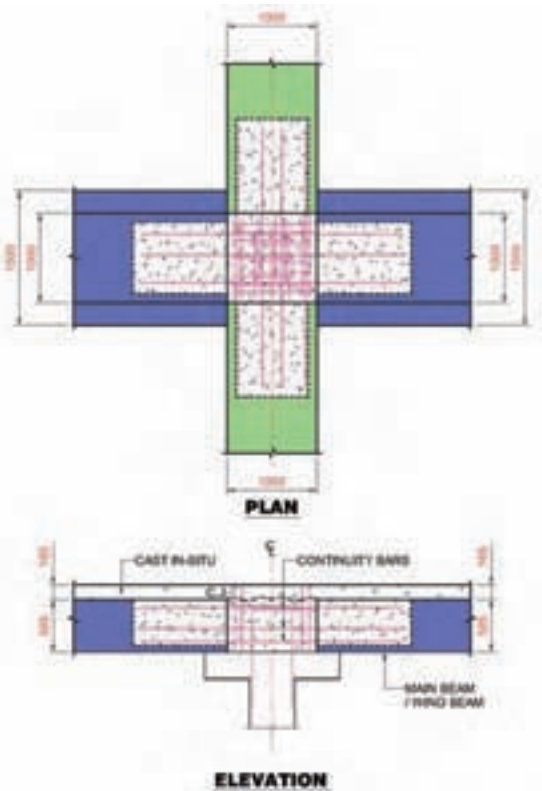
1

Giant footprint .

The East Podium is on a footprint of 250 x 310m. The main structure consists of level 1 at +7m above ground level, on a column grid of 10 x 10m, followed by level 3 at +18m and level 6 at + 33.0m above ground level, both on a column grid of 20 x 20m and 20 x 30m. Level 3 is carrying 2 canal structures and a retail level above and is partially supporting a hanging floor below, both composite structures. Level 3 and 6 are highly loaded, designed as wind and earth quake resisting frames supporting up to 20kPa live load.



From left to right: K.F. Au, Erection Foreman; C.W. Chan, Erection Supervisor and Gary Hackett, Senior Superintendent



2 Precast wind - and main beams at level 1.

Level 1 is the Casino level on a 10 x 10m grid. The main- and wind (framing) beams are full span precast beams supported on column heads and made continuous over the columns with cast in-situ stitches. The mainbeams with continuous nips on either side are carrying the precast double T beams.

3 Precast double T beams at Level 1.

The precast double T beams have proven to be the most efficient in terms of design as well as for erection: 3 numbers of double T beams are placed in a 10 x 10m bay, before a topping of 75mm thickness is cast in place. Scaffolding System's (MSS).

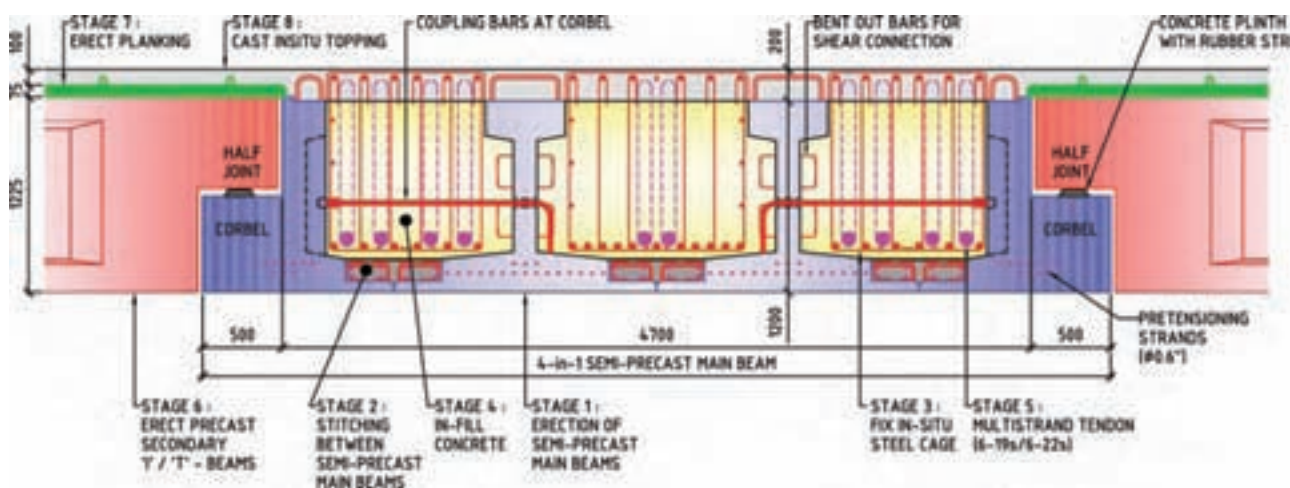


4 Semi-precast pre-tensioned mainbeams and precast pre-tensioned phi shaped beams at level 3 & 6.

Level 3 and Level 6 have typical bay layouts of 20m x 20m and 20 x 30m. The structure consists of continuous post-tensioned framing beams, made up of semi-precast pre-tensioned mainbeams and precast pre-tensioned phi shaped beams supported on column heads. Simply supported precast and pre-tensioned T or I shaped secondary beams are supported on the continuous corbels on either side of the main beams. Precast planks are placed in between the secondary beams to receive a cast in-situ topping. The precast beams and planks are cast in China, transported by road to the construction site and installed by custom made high capacity traveling cranes, which allow placing 25 ton beams at a 50m radius.



31



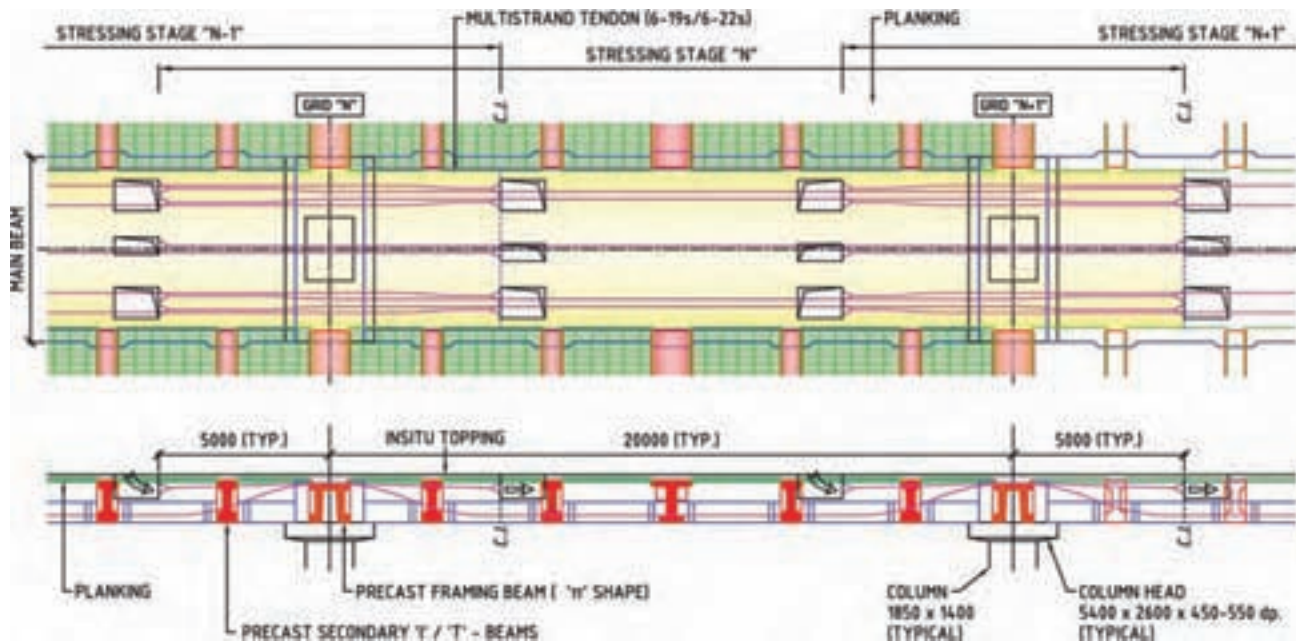
5 4-in-1 semi-precast main beams in the sequence of works.

The details of the 4-in-1 semi-precast main beams play a vital role to the success of VSL's alternative design. The sequence of works is as follows:

- Installation of 4 nos. of semi-precast main beams by heavy duty tower crane on column heads.
- Stitching of flanges of precast beams to ensure the structural integrity.
- Fixing of steel reinforcement cages and PT ducts in between precast beams.
- In-situ concrete in-fill of main beam.
- Span by span stressing of continuity tendons across columns.
- Installation of precast secondary beams supported by corbels on main beams.
- Erection of precast planking supported by secondary beams.
- Fix top reinforcement and cast topping.

Typical weights of precast beams are 20 to 28 tons





6 Overlapping post-tensioning tendons.

The post-tensioning tendons of a respective span typically overlap by 1/4 with the previous and next span. The detailing is done such as the tendons can be stressed at either end from stressing pockets, bringing the stressing operation out of the critical path.

7 High capacity tower cranes.

The large footprint of about 250 x 310m and the heavy precast beams of up to 28 ton required 4 custom made high capacity tower cranes made in Denmark, 2 of them rail mounted, capable of traveling under full load. The rail tracks consist of steel or concrete beams spanning 20m from pile cap to pile cap above the lower ground floor. The beam installation started near to the hotel and moved progressively away. The access corridor for the tower crane was in-filled as the crane retreated. Upon completion, the tower cranes are dismantled by crawler cranes placed on top of level 6, which also fill in the last openings.



8 Erection of precast secondary beams and precast planking.

The precast secondary beams are installed on top of the corbels of precast main beams after stressing the continuity tendons. The beams are T- or I-shaped to minimize the weight to 28t for erection. Half joints at either end of the beams are detailed by using strut-and-tie models to ensure the load transfer at the critical zones. In between the typically 4m spaced secondary beams, 75mm thick precast planks with cast in lattice girders are installed. Top slab reinforcement is fixed directly on top of the lattice girder to receive the in-situ cast topping.

VSL's services included as well the coordination with the architect and building services engineer for detailing of the planking layout.

Venetian Macao project at a glance



Designed as a luxurious resort and convention destination with Venice's landmarks, this project includes a podium with casino and retail space, with an integrated canal structure to sail gondolas, a 40 storey hotel, a theatre and an exhibition centre. All are built on the newly reclaimed land in the Cotai Strip of Macao SAR, China. VSL, in a JV with Dragages and China Civil, were awarded the construction of the 5 level podium structure.

VSL Hong Kong successfully converted the cast-in situ structure into a partially precast scheme, which allowed fast track construction and minimized the need of large falsework and formwork. This enabled a quick handover of the completed bays to the next trade contractor. The precast unit weights were limited to maximum 28 ton and 19m length and required custom made high capacity travelling tower cranes for installation. VSL's erection team under Henry Chan successfully demonstrated the effectiveness of the scheme and installed over 9,300 precast units in less than 13 months.



The pre-tensioned beams and planks of level 3 and 5 have been cast by China Railway in Zuhai (Guangdong Province), about 30km away from the site, under close supervision of VSL.

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50 YEARS OF PARTNERSHIP

VSL operates through 35 subsidiaries as a world-wide network. The company has adapted post-tensioning principles to civil structures such as LNG tanks, plants, tunnels, off-shore platforms, dams -and stay cables. In addition, the group's scope of works covers rock and soil anchors, stabilized walls, precasting, formwork systems, launching gantries, heavy lifting, bearings, repair works, monitoring, deep foundation and soil engineering activities. VSL offers skilled and trained specialists; an experienced technical center able to benchmark new methods, new equipment and new materials; specialist equipment designed as modular as possible; innovative contracting approach to focus with the Main Contractor on what is "best for project". www.vsl.com

