Dear readers,

For more than 40 years our customers have related to DSI as a competent and reliable partner for post-tensioning, geotechnics and mining systems.

In 2005, the DSI Group was acquired by the financial investor Industri Kapital. This change of shareholder has been very positive for us. In our new owner we found a strong partner fully supporting our worldwide expansion. This is already reflected in acquisitions made by DSI in 2005, such as Stewart Mining in Canada and Artéon in France.

We have been able to expand our activities in the fields of post-tensioning and geotechnics as well as particularly in the mining roof support business. This DSI Info will provide you with an overview on these, including recent developments in the main mining areas all over the world.

Again, during the last year, DSI Business has been growing. This success, we primarily attribute to you, our customers and long-term business partners. In particular, by being close to our customers and offering local services, we continuously strive to improve customer satisfaction. Based on our global experiences, solution-oriented R&D and short decision processes, we endeavor to strengthen your trust in DSI as reliable supplier of high quality products and systems.

We are convinced that satisfied customers are the key to success for our company and aspire to support you with our competence. Therefore, our highly committed employees are at your service worldwide.

Please accompany us in this fourteenth edition of DSI Info on a journey around the world through interesting projects and various fields of applications for numerous innovative DSI Products.

Yours sincerely,

From left to right: Eric van Lammeren M.Sc., CEO, Heinz Heiler M.Sc., CTO, and Dipl.-Kfm. Dieter Mayer, CFO
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Use of DYWIDAG Bar Anchors for the Construction of an additional Overflow Spillway at Soyang Dam

The Soyang River raises in the Sulak mountains and ranks among Korea’s most famous sightseeing attractions. About 250 km north of Seoul the Soyang River dammed up by the Soyang Multipurpose Dam built between 1967 and 1973 is one of the largest reservoirs in the Far East. Because of the area’s beautiful scenery, a tourism and recreation area has developed around the Soyang Lake. Many people like to go there on daily excursions.

Because of its dimensions, the Soyang Multipurpose Dam is a milestone in Korean civil engineering and construction. The dam is 123 m high, 530 m long and has a volume of 9,600,000 m³. The reservoir holds 290 million m³. The electric power station at the base of the dam has a capacity of 200,000 kWh.

To avoid possible floods caused by unusually heavy and long rain falls an additional overflow spillway had to be built. Therefore, the owner of the dam, Korean Water Resources Corporation, decided to build additional discharge or spillway tunnels. The new spillway consists of two side-by-side tubes with a diameter of 14 m each. The tunnels have lengths of 1,276 m and 1,206 m respectively with a gradient of nearly 100 m. This way, an additional 6,700 t water per second can be discharged through a total of four new flood gates.

The discharge of the two new spillway tunnels is located in a very steep slope that had to be stabilized elaborately. DSI Korea supplied a total of 296 DYWIDAG Bar Anchors Ø 32 mm. In addition, DSI Korea provided the equipment for grouting and stressing as well as technical assistance.
Owner: Korea Water Resources Corporation, South Korea
Main Contractor: Samsung Corporation, South Korea
Subcontractor: Heachang Development Ltd., South Korea
Engineering: Korea Consultant, South Korea

DSI Unit: DSI Korea, Seoul, South Korea

DSI Services: Supply of 296 pcs. DYWIDAG Bar Anchors Ø 32 mm in various lengths, with an overall length of about 4,500 m; Rental of equipment; technical assistance
DYWIDAG Post-Tensioning Bars support Breakwater for the Jeju Port Extension Project

Port extension on the island of Jeju

Jeju, Korea’s largest island is located south of the Korean Peninsula. The volcanic island with its subtropical climate and versatile vegetation is considered as a gem by the Korean people. Therefore, tourism has strongly developed since the 1970s and is increasingly becoming the main source of income. But the island is also plays an essential role in providing Korea with agricultural products. To date the majority of the traffic with the mainland has been airborne. Due to the increasing economic importance of the island, however, construction work on the extension of the Jeju port began in December 2001. Following completion of the extension work for the outer port, a new pier will offer sufficient space for 1 cruise ship of 80,000 tons alongside 2 ships of 20,000 tons and 1 ship of 10,000 tons, thus providing the opportunity to establish the harbor as a hub for international cruises.

Due to the strong winds with high waves in that region, it was decided to build a 1,425 m long breakwater in form of a so-called slit caisson as a protection for the extended port. Prestressed concrete segments in the form of quarter arches were installed on the caisson by means of unbonded THREADBAR® tendons on the side facing the waves.

Several construction companies including Daelim Industry Co. Ltd., Gunil Engineering, Samsung Corporation and Segi Construction were involved in the construction of the breakwater (about 23,471 m², average width 16.5 m, length 1.42 km).

The arched segments were cast in place in prefabricated forms onshore. After curing of the concrete four 3-0.6" DYWIDAG Multistrand Type SD Tendons were prestressed and grouted for each segment. After curing of the grout the segments were lifted onto the caisson and fixed thereto at both ends using four unbonded THREADBAR® tendons each. Subsequently, the post-tensioning bars were stressed that had been pregrouted onshore before installation and were therefore perfectly corrosion protected. For this purpose, DSI Korea supplied 3,984 pcs. L50135 36 mm, gr 1080/1230 smooth post-tensioning bars and anchorages.

Having successfully used DYWIDAG Post-Tensioning Systems for this project, DSI Korea plans to extend its Division for post-tensioning systems and special solutions for prestressed concrete. DSI Korea will focus on the development of special solutions for particularly challenging structures.

Owner: Jeju Regional Maritime Affairs & Fisheries Office, South Korea
Main Contractor: Daelim Industrial Co. Ltd., South Korea
Engineering: Gunil Engineering, South Korea
DSI Unit: DSI Korea, Seoul, South Korea
DSI Services: Supply of 49,400 m DYWIDAG Post-Tensioning Bars Ø 36 mm, gr 1080/1230 incl. accessories, 3,984 pcs. 3x0.6" SD Anchorages
Construction of Cone Shaped Water Tanks using DYWIDAG Post-Tensioning Systems

“Newater” Water Tanks at Tampines

About 4.4 million people in the city-state of Singapore live on an area as small as 683 km². With a population density of 6,400 inhabitants/km² the city of Singapore that takes up the majority of the island state has very few natural resources. Due to its geographical constraints Singapore severely lacks sufficient natural drinking water sources.

In the modern water processing techniques Singapore sees a possibility to solve its perennial water shortage problem. The Public Utilities Board favors the term “recycling” for turning waste water into “ultra clean” water. This treated water called “newater” in Singapore will again have drinking water quality after elaborate treatment processes.

As a specialist subcontractor Utraco Structural Systems Pte. Ltd. (USS), DSI’s licensee in Singapore, was significantly involved in the design and construction of two elevated cone shaped water tanks for the “Tampines Newater Service Reservoir” project. Construction of these elevated tanks was necessary to store recycled “newater” from a nearby water treatment plant. In particular, the storage capacities serve to supply nearby electronics chip manufacturing facilities with the ultra pure water they require.

The two elevated water tanks have a storage capacity of 8,448 m³ each and were 31.5 m above ground at their brims. The tanks have a maximum diameter of 43.0 m, a central access reinforced concrete core measuring 5.9 m in diameter and are capped at their top with a steel roof.

The water tank walls were post-tensioned both radially and circumferentially using DYWIDAG Post-Tensioning Tendons. The tank walls measure 650 mm at their base, tapering to a lean 480 mm at their top. The internal wall surfaces were lined with HDPE in order to prevent contamination of the “newater” from its potential reaction with concrete.

The most challenging aspect of the water tank construction was the provision of a safe and fast in situ formwork and working platform system. Due to the planned height and degree of inclination of the tanks Utraco Structural Systems developed a modified jump form system that could handle fast concrete pours of up to 1.45 m in height. This modification allowed for the accommodation of the varying cast diameters after each pour and rendered the “fanning out” effect of the tank walls possible.

Thus the walls were successfully constructed using a total of 15 pours within the scheduled 7 days for each pour.
The Kallang-Paya Lebar Expressway (KPE) is another project of the Land Transport Authority’s effort to improve the road network in Singapore. Since 2002, when a total of 6 packages of this project were tendered, construction has been underway at full speed. After its scheduled completion in late 2006/early 2007, the 12 km long Kallang-Paya Lebar Expressway will provide a direct link between the new downtown area in the South and the housing estates in the North-East of Singapore. The KPE will then also include the longest road tunnel in South-East Asia, since three fourths of that two times three-lane expressway are built underground.

Of the 6 individual contracts, contract 422 is considered by many as one of the most challenging packages as it comprises the construction of a series of underground roadways, slip roads, traffic interchanges and some major surface road widening. One of these traffic interchanges is being built at the intersection of KPE with the Pan Island Expressway (PIE), one of the busiest expressways in Singapore. Three road connections are being built between the new KPE tunnel and the PIE, partly as a bridge across the busy PIE.

Within the scope of contract 422, Utraco Structural Systems Pte. Ltd., DSI’s licensee in Singapore, was awarded a subcontract for the construction of those elevated slip roads with a total length of 2.2 km. That contract also includes the construction of a single span precast bridge over the Pelton canal, the construction of a pedestrian bridge and the supply and installation of pot bearings and expansion joints. Further integral parts of that comprehensive contract are the construction of the pile caps, piers and the superstructure of the elevated slip roads.

The bridges mainly consist of hollow box girders that were cast in place by Utraco Structural Systems Pte. Ltd. A combination of 12- and 19x0.6” DYWIDAG Post-Tensioning Tendons and MA Anchorages were installed into the individual box girders. For the bridge crossing above the PIE, Utraco supplied and installed precast U beams that were reinforced by 6 pcs. 12x0.6” DYWIDAG Tendons.

Using its proprietary USS Formwork and Falsework System, Utraco Structural Systems Pte. Ltd. completed the installation of the in-situ hollow box girders for the bridges during the 3rd quarter of 2005 on schedule.
DYWIDAG Post-Tensioning Tendons for a new Railroad Bridge on the Nambu Line

Yanoguchi Bridge, Yanoguchi, Inagi-shi, Tokyo

In order to save time and minimize cost, it is quite common for extensions of the Japanese railway system to incorporate gated at-grade crossings for road and footpaths.

In the past few years the Japanese railroad company JR East Japan Corporation has worked to eliminate traffic tie ups and increase safety by the increased use of bridges as grade separation structures.

From 2002 to 2005 a total of 15 level interchanges were redesigned over a length of about 4.3 km on the Nambu line between Inadazutsumi and Fuchuhon-machi. The removal of five at grade interchanges was even stipulated in the town planning act.

One bridge built as part of this project is the nearly 60 m long Yanoguchi bridge that was erected at the site where the Nambu line crosses the Tsurukawa expressway. This bridge across the Tsurukawa expressway was designed as a Langer bridge. As the bridge is located in an urban area, prestressed concrete was selected as the construction material to reduce vibration and noise.

To enhance the service life of the Yanoguchi bridge its deck was transversely prestressed using epoxy-coated DYWIDAG Prestressing Strands. The bridge was constructed using fixed scaffolding systems. A special feature of the bridge construction was the continuous maintenance of traffic volumes on the railroad line and on the expressway during the construction work. To maintain sufficient overhead clearance during construction the bridge was constructed approximately 2.2 m above its final position and then jacked down after completion.

The bridge was opened to traffic in summer 2005 and takes trains of the Nambu line safely across the Tsurukawa expressway.

**Owner** JR East Japan Corp., Tokyo, Japan  
**General Constructor** JV consisting of Tekken Corporation and Ohki Corporation, Japan  
**Design** Japan Transportation Consultants, Inc., Tokyo, Japan  
**DSI Unit** SUMITOMO (SEI) STEEL WIRE CORP., Tokyo, Japan  
**DSI Services** Supply of 12x0.6” DYWIDAG Post-Tensioning Tendons type MA with epoxy-coated strands
First prestressed concrete wind generator in Japan

Umiterasu Nadachi Wind Power Plant, Nadachi-cho, Nishikubiki-gun, Niigata

Umiterasu Nadachi, a recreation center for the inhabitants of the city of Niigata, opened in 2000, accommodates a fitness center with swimming-pool, a venue for major sports events, a hotel and a local products center. In particular, the center was designed as a meeting point for the local population.

Power generation from renewable energies such as wind power is of high importance in Japan. This type of power generation is very much in line with the motto of the Umiterasu Nadachi recreation center, since its focus is placed on promoting the health of the population. Therefore, a wind power plant was planned for supplying power to that facility that at the same time is also a landmark for the center that can be seen from afar.

In the past wind power plants in Japan were mainly built out of steel. For the new Umiterasu Nadachi wind power plant, however, the shaft was erected using prestressed concrete for the very first time. The plant’s proximity to the shore was a decisive criteria for choosing prestressed concrete. The use of steel in the salty atmosphere would have been extremely expensive as a result of the cost for corrosion protection and maintenance.

Due to the simpler structural design and higher service life compared to steel, the construction of a wind power plant using prestressed concrete was the best economical solution.

The tower was erected using a special formwork construction method that was developed in Austria. It consists of 12 blocks with a height of 3.90 m each. The outer diameter of the tower measures 4.0 m at its base, tapering to a lean diameter of 2.1 m at its top. For connecting the individual blocks DYWIDAG Post-Tensioning Bars were selected as they are the simplest and most secure joining method.

The 600 kW wind power plant was completed in December 2003.
World Record for Extradosed Bridge with Extradosed Cables in Japan

Sannohe-Boukyo Bridge

The Sannohe-Bokyo bridge is a three-span, extradosed prestressed concrete bridge with a total length of 400 m. It runs from east to west, connecting the Nanbu-cho, Sannohe-cho, and Takko-machi, Aomori Prefecture’s agricultural development areas.

This bridge was designed as an extradosed continuous girder, since this construction method was deemed best in view of the geographical conditions that existed at the site. The Mabuchi River that is to be crossed runs through very uneven territory there. Due to its classification as a category A river, it must be particularly protected. Category A means that the river is important for the national economy and the welfare of the population. To protect the river and at the same time cross the Aoimori line (former JR Tohoku line) and the Sannohe town road, a main span length of 200 m was required.

At the time of its completion in early 2005, this structure held the world record for an extradosed bridge with a main girder constructed solely of prestressed concrete. The Sannohe-Bokyo bridge is the first extradosed bridge in Japan to use shop fabricated multi-epoxy tendons. These tendons were made of prestressing steel strands coated with a fine-grain epoxy resin. This way, the service life was increased and the construction period considerably reduced.

The shop fabricated multi-epoxy tendons were transported to the site where they were installed in the structure. Large bridge sections were first completely assembled on the ground and then lifted into their final position by means of a crane and an electric winch and installed.

Owner Aomori Prefecture, Aomori, Japan, JR East Japan Corp., Tokyo, Japan +++ Main Contractor Right river bank: Joint Venture consisting of Kajima Corp., Hozumi Co. and Tsujimoto Co., Japan; Left river bank: Joint Venture consisting of Kajima Corp. and Tekken Co., Japan +++ Consulting Sanyu Consultants, Tokyo, Japan

DSI Unit SUMITOMO (SEI) STEEL WIRE CORP., Tokyo, Japan

DSI Services Supply of multi-epoxy tendons, anchorages type MC 19-0.6” and 27-0.6” and DYWIDAG Bars Ø 32 mm
In mountainous Nepal the power of water can be seen time and again during the rainy season. The monsoon makes the water volume of the approximately 6,000 rivers in Nepal increase thirtyfold. For centuries the Nepalese have therefore used water power for generating energy. To this day, their traditional mills (ghattas) for grinding grain are operated by hydropower in a country poor in mineral resources. Electric current was produced by a small water-power plant for the first time in 1911.

Due to continuously rising energy demand, sustained power supply based on the lavishly available, regenerative energy source of water is advanced in that
developing country. International funds play an important role in that advancement. The objective of the development aid, which is also financed out of funds provided by the German "Kreditanstalt für Wiederaufbau" (government-backed Development Loan Corporation), is securing the energy supply. This is a significant contribution to investments in the industrial and service sectors, leading to the creation of urgently required jobs. Furthermore, Nepal may use the increased power production for power exports to India for example, thus opening up another profitable source of revenue in addition to tourism.

Construction of the Middle Marsyangdi Hydroelectric Power Plant located about 170 km west of Kathmandu, began in 2001. Following completion, the power plant that takes advantage of the natural height of fall of the Marsyangdi river of about 108 m on a 5.5 km long section will generate 72 MW or 400 GWh. As a result, only a relatively small dam is required that mainly serves as an equalizing basin.

In particular, the difficult geological conditions of the Himalayan Mountains present certain challenges for all parties involved in the project. Within a few meters very hard and stable quartzite seams alternate with instable and swelling phylites. Decisions must be frequently made at short notice how the various slopes and the associated tunnel are to be stabilized. For this stabilization flexible, high-grade geotechnical products are required on short notice. For the slope stabilization of the dam, DSI supplied 41 temporary DYWIDAG Bar Anchors ∅ 26 mm, gr 950/1050, and 528 permanent double corrosion protected DYWIDAG Bar Anchors ∅ 26 mm, gr 950/1050, corresponding to an overall length of about 5,800 m. In addition, DSI supplied 115 DYWIDAG Multistrand Anchors consisting of 2, 4 and 8x0.6" prestressing strands with a total weight of 16.4 tons as well as accessories for additional stabilization measures.
In the past few years massive slope slides and settlements have occurred on the A 13 Brenner expressway at Matreiwald, about 16 km south of Innsbruck. In late 2004 ASFINAG, the operating company of the Brenner expressway, tendered the execution of high-quality stability measures to avoid further damage to the expressway that could possibly be caused by further slides of the slope.

**Special challenges posed by the construction site**

The slope inclination at that site is 33 degrees to partly over 40 degrees, rendering all activities such as anchor fabrication, excavation, shuttering and concreting very difficult. The steepness of the site made it necessary to secure the drilling equipment with winches. For this purpose, the heavy equipment had to be placed on the emergency lane of the expressway for attachment.

The slope was redeveloped and stabilized by the installation of 12,000 m of double corrosion protected GEWI® Soil Nails, consisting of 400 individual units between 25 and 38 m long and 27 reinforced concrete ribs 80x80 cm ranging between 10 and 30 m in length and three shotcrete beams 40x150 cm, each 70 m long.
Open roads in the South of Vienna – GEWI® Bars Anchor the Underwater Concrete Slab of the new Rannersdorf S1 Tunnel

S1 expressway between the Vösendorf interchange and the Schwechat interchange, Vienna, Austria

The rapid growth of jobs and inhabitants in the south of Vienna in the past few years made a new traffic concept for that area imperative. A core project in this connection is the extension of the S1 expressway connection between the interstates A2 south and A4 east. Work on that connection started in October 2001.

With five tunnels this project is one of Austria’s most expensive road construction projects undertaken during the past few years. In particular, the core item of the new S1, the 1,880 m long tunnel in Rannersdorf with a contract volume of about EUR 62 million, posed great technical challenges for all persons involved in its construction. The tunnel that is in some locations up to 12 m below groundwater level is to be completed and opened to traffic within the relatively short period of three years.

The tunnel, built as a watertight structure by JV Strabag AG - Ed. Züblin AG using the open-cut system, is routed through quaternary gravel. Due to its permeability and high groundwater levels, quaternary gravel poses great technical challenges for the tunnel’s design and execution. In addition, two villages and two federal roads must be crossed while constantly maintaining traffic and digging must be executed underneath four bodies of flowing water in compliance with all environmental standards.

Sheet pile construction method using anchored underwater concrete slab

With increasing depth of the tunnel route and increasing external water pressure dewatering in compliance with the relevant requirements was no longer possible.

Following the driving of the sheet piles, excavation was made under water. For sealing of the base in order to create a dry building pit an underwater concrete slab with a thickness of 1.50 m was required. For the temporary tie back anchoring of that underwater concrete slab DSI supplied about 400 t GEWI® Tie Down Piles that were driven from a floating platform in a 3-4 m grid and a length of up to 14 m below the level of the base slab. Their tensile force totals up to 1,000 kN per tie down pile. Before placing the underwater concrete, divers provided the tie down piles with a counter plate and removed remaining mud. Concreting of the underwater concrete slab was made in one cycle; this meant more than 3,000 m³ concrete or more than 30 hours of working time. After 5 days the concrete was cured so that the excavation could be pumped dry. Analogous to the sheet pile troughs, the further activities could be carried out in dry construction.

Completion and opening of the new southern bypass S1 to traffic is scheduled for summer 2006.

Owner: ASFINAG, Austria
Main Contractor: JV Strabag AG - Ed. Züblin AG
Design: Zivilingenieurbüro Stella & Stengel, Vienna, Austria
Geotechnical Consultant: Zivilingenieurbüro Dr. Dietmar Adam, Mödling, Austria
Special Civil Engineering Subcontractor: Spezialtiefbau Insond Wien, Austria
DSI Unit: DSI Austria, Salzburg, Austria
DSI Services: Supply of approximately 400 GEWI® Bars, ø 63.5 mm, including pile heads, Technical assistance.
DYWIDAG Post-Tensioning Systems secure Railroad Bridges as Part of the High Speed Line from Brussels to Cologne

Construction of the eastern high-speed line (HSL) across the plateau of Herve parallel to the E40, Belgium
Due to its geographical position Belgium plays a vital role in the extension of the North European high-speed line (HSL). In Brussels the important European railroad lines of the Eurostar to London have always crossed with the lines from Paris to Amsterdam and from Paris to Cologne. The European guidelines stipulate that new high-speed lines are designed for minimum speeds of 250 km/h (155 mph). As a result of the construction of such new lines European railroad connections are considerably shortened: For example, the travel time from Amsterdam to Paris is reduced by more than 1 hour, the distance from Amsterdam to London can be covered in $3\frac{3}{4}$ hours only and it takes only 7 hours to get to Barcelona by train.

Hence, high-speed trains are a competitive alternative to road and air traffic and therefore are considered environmentally friendly.

In 1990 the Belgian authorities decided to build high-speed lines (HSL) in their country. For this purpose, 3 lines were deemed reasonable: the western line from the French border to Brussels, the northern line from Brussels to the Dutch border and the eastern line from Brussels to the German border. In total, the Belgian railroad project consists of 314 km of high-speed lines of which 200 km are to be new construction designed for maximum speeds of 300 km/h.

The crossing of the plateau of Herve east of Liège with its new TGV station designed by Santiago Calatrava placed high demands on the construction work. Parallel to the E40 expressway, the line passes through many small valleys and crosses a number of important roads in a highly urbanized environment. Therefore, different structures were required, cut and cover tunnels, open tunnels and underpasses, and 4 viaducts with a total length of nearly 2.5 km: near José (422 m), near Herve (459 m), near Battice (1,226 m) and near Ruyff (312 m).

For the construction of these four viaducts DSI and Freyssinet set up a joint venture in late 2002. All viaducts consist of continuous beams and single span beams in turn and were built using precast prestressed concrete elements.

DSI Belgium offered the client special solutions to allow for faster and safer installation of the DYWIDAG Post-Tensioning-Systems

Construction phases:

1. Footings and foundation of (cast-in-place) piers

2. Installation of the precast, post-tensioned piers

3. Installation of the central U-beam (height 2.6 m, weight approx. 200 tons)
First the cast-in-place concrete foundation of the V-shaped bridge piers was cast and anchored in the ground. Subsequently, the precast, post-tensioned V-legs were assembled thereon parallel in a row and continuously post-tensioned into the foundation. Two parallel V-shaped bridge piers were connected with two parallel, 2.6 m high and about 200 t heavy post-tensioned U-girders each. Subsequently, the outer U-girders were lifted upon the V-legs and the continuous girder post-tensioned. These parallel placed continuous girders ultimately form the support for the 3.4 m wide concrete slabs for the railroad tracks. Post-tensioned single span U-girders were installed between the continuous girder spans.

This particular construction method demanded a great deal of discipline from all people involved. Since the components were precast in various factories and assembled on site, proper fitting accuracy had to be ensured. This was made possible through careful design and dimensioning as well as meticulous execution and quality controls. The technical know-how of the experienced staff significantly contributed to the overall success of this project. Hence, this section of the new HSL connection from Brussels to Cologne was successfully completed on time in summer 2005. The commissioning of the entire HSL network in Belgium is scheduled for 2007.
Bridges on the new Motorway from Zagreb to Split employ DSI Know-how

Bridge over the Guduča River, Motorway Zagreb-Split, Croatia

On June 26, 2005, the new Zagreb-Split Motorway was opened to traffic. This 375.7 km long motorway, part of the European Vb corridor, now links Zagreb and Split, the two largest cities in the Republic of Croatia. It is now the fastest route to the South of Croatia cutting travel time from Zagreb to Split to 3.5 hours compared to 7 hours via the old route. Thousands of tourists visiting Dalmatia and south-east Europe benefit from this new motorway as do the towns along the old city streets which are relieved of what had been heavy through traffic.

The area’s rugged terrain required that more than 70 structures including tunnels, viaducts, and bridges were built in order to successfully complete this project.

In DSI Info 13 we included a report about the Krka arch-bridge in the Skradin-Šibenik section of the new Zagreb-Split Motorway which made use of temporary DYWIDAG Suspension Cables.

In 2004/2005 DSI participated in another bridge on this important project, the Guduča Bridge located near Šibenik, a 55 meter tall structure crossing a canyon of the Guduča River. The bridge consists of two separate parallel structures, each for one motorway direction. The length of the bridge is 225 m with spans of 67 m + 96 m + 62 m. The piers have a height of 35 m and 45 m respectively; the width of each deck is 13.9 m.

Each pre-stressed hollow box girder superstructure was constructed using the free cantilever method employing a total four DYWIDAG Form Travellers and Type 12, 15 and 19x0.62” DYWIDAG Post-Tensioning Strand Tendons.

The construction of the foundations and piers started in September 2004 and superstructure construction began in December 2004. The bridge was successfully completed by the end of May 2005.
DYWIDAG Stay Cable and Prestressing Systems incorporated into a traffic and pipeline Bridge in Zagreb

“Domovinski Most” over the River Sava, Zagreb, Croatia
The City of Zagreb lies on both sides of the Sava River. The river is heavily contaminated because the wastewater from this growing city with a population of 900,000 and the growing industrial zone on the left bank near the airport has up to now been discharged directly into the river. In 2001 the City of Zagreb decided to build its first ever wastewater treatment plant on the left bank of the river which was determined to be the most appropriate location, making it possible to treat municipal wastewater according to current EU standards. The project, co-financed by EBRD (European Bank for Reconstruction and Development) and KfW (Kreditanstalt für Wiederaufbau, the German government development bank) and planned on a BOT basis for 28 years, incorporates not only the wastewater treatment plant, it also includes the supporting infrastructure such as access roads, collecting pipelines, and a bridge across the river.

This 840 m long “Domovinski” Bridge will not only ease traffic congestion between the inner city and the industrial and airport area on the other side of the river, it will also carry two water pipelines. One will transport the waste water from the inner city to the new wastewater treatment plant and the other will supply the growing areas of the left bank of the river with drinking water as the drinking water pumping sites are located on the right bank.

The bridge’s superstructure was designed as a continuously prestressed five-cell hollow box girder. The superstructure is prestressed in the webs with 15x0.62” strand tendons, in the diaphragms with 12x0.62” strand tendons and in the deck slab in transverse direction with unbonded 0.6” monostrand tendons.

The superstructure is 34 m wide because the city’s development plan required that the bridge deck provided enough space for a double-track tramway line, two separate double traffic lanes, as well as a footpath and a bicycle lane on each side.

The bridge has spans of 48 m + 6x60 m + 72 m + 120 m + 72 m + 2x60 m + 48 m which also cross the former flood plain. The main span of 120 m across the river is constructed using the free cantilever method. A total of 2x8 pairs of DYWIDAG Stay Cables consisting of 48x15.7 mm strands are used to carry the total load of the bridge deck. All approach spans were constructed span by span on scaffolding. The completion of the entire project is scheduled for the second half of 2006.
Valik Tunnel reinforced with DYWI Drill® Hollow Bar Anchors

Construction of an expressway bypass around the city of Pilsen in connection with the extension of the D5 expressway Prague-Pilsen-Germany

Currently a new 22 km long expressway ring is being built around the city of Pilsen.

At the same time, the bypass is part of a 151 km long expressway leading from Waidhaus in Germany via Pilsen to Prague. With the scheduled opening of this 22 km long section around Pilsen in October 2006 this expressway will then be complete.

During construction special focus was placed on the protection of the environment, since the job site is located in an ecologically sensitive area. The sources that provide the city of Pilsen with drinking water are located in the area of the 435 m high Mount Valik. For this reason, extensive measures had to be taken within the framework of the construction works to avoid possible contamination of the environment with emissions and to maintain ecological equilibrium. For this purpose, any waste water resulting from the construction works was purified in a biological waste water treatment plant.

The tunnel itself consists of twin bores closely located side by side. The individual bores are each about 380 m long, 8.2 m high and 11.5 m wide. Each tunnel bore consists of a two-lane expressway with one emergency sidewalk in each driving direction.

Construction of the Valik Tunnel began in September 2004. The tunnels were driven using the single-layer shotcrete construction method according to the New Austrian Tunneling Method (NATM). Due to the unfavourable geological conditions of Mount Valik, the entire driving work was technically very elaborate. In addition, the covering of the tunnel only measures from several meters at some locations to a maximum of 30 m.

For reinforcement of the advance driving according to NATM DSI licensee SM7 A.S. supplied a total of 180 t DYWI Drill® Hollow Bar Anchors Ø 25 mm with hardware accessories including drill bits, couplers and anchor plates. This corresponds to a total length of 67,000 m DYWI Drill® Hollow Bar Anchors.

The overall costs of the Valik Tunnel amount to about Euro 44 million. Its opening is scheduled for October 2006.

Owner ČR, Road and Expressway Directorate of the Czech Republic
General Contractor Metrostav A.S., Prague, Czech Republic
DSI Unit SM7 A.S., Prague, Czech Republic/DSI Austria, Salzburg, Austria
DSI Services Supply of 67,000 m DYWI Drill® Hollow Bar Anchors Ø 25 mm with hardware accessories such as drill bits, couplers and anchor plates
Bridge crossing the Úhlava River near Pilsen

„Most pres Uhlavu”, Pilsen, Czech Republic

Most pres Uhlavu-bridge translated from the Czech language means “bridge crossing the Úhlava river”. This bridge is an important part of a new 22 km long expressway bypass around the city of Pilsen which in turn is part of a 151 km long connection from Prague via Pilsen to the German border near Waidhaus, now being completed as a continuous expressway.

The bridge has an overall length of 445 m, a width of 27.5 m and is founded on a total of 9 piers. The overall costs for these construction works amount to about EUR 19 million. A precast segmental concrete bridge design was chosen in order to complete the construction project in the shortest amount of time possible. About 400 precast concrete segments were produced in a precast concrete products plant near Prague. The entire transverse post-tensioning including 1,600 SDR anchorages was also installed and post-tensioned in the precast concrete products plant. Subsequently, the precast elements were delivered to the construction site just in time. The individual segments were temporarily post-tensioned with DYWIDAG Threadbars during lifting in place by means of movable scaffolding.

For the internal post-tensioning DSI licensee SM 7 A.S. supplied a total of 310 t DYWIDAG Bonded Multistrand Tendons 0.62" gr 1570/1770 MPa and 1,032 MA anchorages. In addition, SM 7 A.S. supplied 72 t external PE sheathed DYWIDAG Strand Tendons type 19x0.62" gr 1570/1770 MPa and 64 anchorages.

The precast concrete segments were temporarily post-tensioned during installation with about 5 t DYWIDAG Threadbars Ø 32 mm that were also supplied by SM7 A.S.. Completion and opening of the Pilsen bypass is scheduled for October 2006.
From Dresden to Prague for Breakfast

Construction of the new A17 – D8 expressway Dresden – Prague, section Trmice – Kninice

To Prague for Breakfast – this was the advertising slogan of Saxon politicians for the construction of the new A17 expressway or D8 respectively as it is called on the Czech side. This would be possible indeed, since the new expressway will reduce the travel time for the 140 km long section to about 1 hour when completed in 2008. But not only day trippers will profit from this new connection.

Since the Czech Republic joined the European Union, traffic between Dresden and Prague has increased significantly. Currently, more than 2,000 trucks jam the federal highways and country roads in that area every day which has led to a significant increase in road accidents. In addition, the A17/D8 expressway is part of the No. IV trans-European corridor from Berlin to Istanbul via Prague, Budapest and Sofia.

For this reason, the new expressway was included in the EU priority list of traffic projects and is financially supported by the European Investment Bank on the Czech side.

The time factor plays a vital role in this mega project, since the residents of the highly congested country roads hope for a speedy completion of the expressway.

The section is about three fourths completed, however, the geographical conditions in the border area between Germany and the Czech Republic pose some difficulties with regard to the routing. Numerous bridges must be built because the area is mountainous. Also the crossing of extremely large waste dumps that are the by-product of recently terminated surface mining of coal posed a significant challenge to the project’s design engineers. These pits were mostly filled with cohesive material that is not particularly stable.

Various construction methods have been used for the construction of these numerous bridges, depending on which construction method was deemed best in view of the geographical conditions. Many of these single bridges were built using DYWIDAG Strand Post-Tensioning Systems.

Within the scope of the extension of the D8 expressway the construction of a 1,180 m long cantilever bridge near Doksany, a town about 60 km north-west of Prague, was an important milestone. The bridge was opened to traffic in late 1998 and still is the longest bridge in the Czech Republic.

SM7 A.S., DSI’s licensee in the Czech Republic, supplied and installed entire DYWIDAG Strand Post-Tensioning Systems both for the construction of the aforementioned longest bridge in the Czech Republic as well as for 20 additional bridge structures. The utilization of DYWIDAG Strand Post-Tensioning Systems under various conditions and in various methods has demonstrated the flexibility and adaptability of these systems. DSI’s and its licensees’ committed employees can quickly adapt to the most difficult challenges and that way contribute to the completion of projects on schedule.
The partial collapse of an old stone retaining wall required stabilization of approximately 40 m of the RD13 road in the French community of Arras en Lavedan.

An alternative proposal submitted by DSI France convinced the owner to use DYWIDAG Ductile Iron Piles to stabilize the road. The piles allow for easy and fast installation on the job site. Stabilization included the construction of a longitudinal concrete beam founded on the piles.

The DYWIDAG Ductile Iron Piles driven beside the road were anchored in solid rock at a depth of about 6 m. For this purpose, the piles were provided with a tip for driving to reach the bearing layer in the rock.

To enhance the bearing capacity of the soil in the immediate vicinity of the piles, the piles were concurrently injected with grout during driving in accordance with consulting engineer Jean Frugier’s proposal. This was easily and quickly achieved by means of an injection adapter. During installation a gauge ensured that pressure and volume of the cement injection were continuously controlled during driving. In addition to the foundation construction, the use of this system allowed for sustained soil improvement.

Because it was easy to exchange the dredging shovel with a rapid percussion hammer fixed to a mechanical shovel excavator the terracing of the longitudinal beam and the driving of the piles could be carried out quickly and economically. A total of 25 DYWIDAG Ductile Iron Piles spaced at 1.60 m were driven in July 2005. The use of this efficient technique and simple equipment made it possible to complete the project in a very short period of time. This first successful use of DYWIDAG Ductile Iron Piles in France will surely be followed by many more in the future.
Renovation of the Boeing 747 maintenance hangar

Investigation of the tendons of maintenance hangar V, Frankfurt airport, Germany

Coincident to the delivery of the first jumbo jets to Deutsche Lufthansa AG in 1970, maintenance hangar V of the Frankfurt airport, which had been specifically designed for this type of aircraft, was put into use.

Having a width of 320 m and a length of 100 m the hanger can accommodate a total of 6 Boeing 747s. These span widths as well as a hangar height of 23 m to 43 m imposed significant demands on the structural design of the hangar.

The loads of the ceiling shell are transferred into the side-mounted trestles or the central frame by means of bracing wires and suspension straps made of pre-tensioned light weight concrete. Subsequently, these trestles transfer the loads into the soil via a concrete strut frame.

In order to examine the historical development of the corrosion protection of tendons used in the trestles after more than 30 years of service, and carry out possible renovation works in time, Lufthansa Technik AG Hamburg searched for a strong partner in the field of stressing technique for this significant undertaking.

As a provider of stressing systems and tendon renovation services SUSPA-DSI GmbH has been able to gather long-term experience in this field.

The investigation concept required locating and the endoscopic investigation of tendons. Should inadequately grouted tendons be discovered, the corrosion protection was to be restored for the next few years using vacuum grouting. More than 2,750 drill holes were made to carry out the endoscopic investigation, but only in about 200 areas vacuum measuring with subsequent vacuum grouting was required.
DYWIDAG Post-Tensioning Systems secure “Archaeological Reconstruction” of the Church of Our Lady in Dresden

Reconstruction of the Church of Our Lady, Dresden, Germany

Once Dresden’s Church of Our Lady was deemed the most beautiful urban artwork in the world. The Church of Our Lady withstood the bombing of February 13, 1945, but two days later the meanwhile completely burnt out church collapsed as a result of the enormous heat.

In 1992 the Dresden city council gave its consent to the historical reconstruction of the world-famous Dresden Church of Our Lady in order to return to Dresden its most important landmark decades after the end of the Second World War.

From the very beginning of this quite unique building project, SPESA Spezialbau and Sanierung GmbH Nordhausen, Germany, chose SUSPA-DSI as its preferred supplier of critical construction elements.

During the process of removing the “Trümmerberg” formed out of approximately 20,000 m² of war debris in 1993, the remaining remnants of the old structure substance were secured by means of Ø 26.5 mm gr 835/1030 prestressing bars and appropriate flat bearing plates and domed hex nuts. The rebuilding of the church began at the end of 1994. At that time, SUSPA-DSI supplied large quantities of Ø 26.5 mm and 32 mm steel bars for the static and structural reinforcement of the basement vault of the lower church.

In the course of further construction progress of the church, SUSPA-DSI supplied extensive material including numerous multistrand bonded tendons made of Ø 26.5 mm and Ø 32 mm gr 835/1030 DG steel. The services provided by SUSPA-DSI not only included the supply of post-tensioning tendons, but at the same time it also included comprehensive technical consultation to the engineers in charge and the main contractor as well as the undertaking of part of the post-tensioning work required on site.

In addition, galvanized Ø 50 mm GEWI® Bars were used - amongst others - in the connection area between the vault arches and the piers of the church to a large extent. Here, as well, SUSPA-DSI successfully carried out the stressing operations which posed quite a challenge due to the specific characteristics of sandstone, a natural product, and the unique nature of the structure itself.

Another significant challenge was the installation of permanent single-bar anchors to secure the lantern (the tower-like structure with windows above the opalion of the external cupola) that now constitutes the observation platform for the Church of Our Lady in Dresden. Four permanent single-bar anchors with a total length of up to 11 m were installed in each of the four lantern columns. SUSPA-DSI provided the technical equipment required for the relevant stressing operations.

The church was finished in July 2004. Following completion of the finishing of the interior, the Church of Our Lady in Dresden was solemnly consecrated on October 30, 2005.

Owner Stiftung Frauenkirche Dresden (Foundation for the Dresden Church of Our Lady), Germany

Main Contractor JV Frauenkirche Dresden - Walter Bau-AG, Philipp Holzmann AG, Sächsische Sandsteinwerke GmbH, Germany

Subcontractor SPESA Spezialbau und Sanierung GmbH, Nordhausen/Thuringia, Germany

Main Designer IPRO DRESDEN Planungs- und Ingenieuraktiengesellschaft, Germany

DSI Unit SUSPA-DSI GmbH, Germany

DSI Services Supply of various DYWIDAG Post-Tensioning Systems and GEWI® Bars;
Stressing operations; rental of technical equipment and comprehensive technical assistance
DYWIDAG Strand Cables with DYNA Grip® Anchorages

General
Since 1970 DYWIDAG-Systems International (DSI) has been engaged in the development, fabrication, supply and installation of stay cables. In compliance with international stay cable guidelines and in conjunction with our in-house design criteria for the internationally known DYWIDAG Strand and Bar Post-Tensioning Systems, bar cables were developed first and subsequently installed in large projects such as the second Main Bridge in Frankfurt, Germany, and the Dames Point Bridge in Florida, USA. In the 1980s DYWIDAG Strand Cables with DYNA Bond® Anchorages were developed. These bond socket anchorages have excellent dynamic behavior and are still used in many stay cable bridges today. Due to the demand for stay cable anchorages that allow replacement of individual strands, the DYNA Grip® Anchorage was developed in the late 1990s and has since been installed in many stay cable bridges throughout the world from 2000 to the present date.

Free Cable Length
DYWIDAG Strand Cables are made up of a bundle of individual, parallel, corrosion protected stay cable strands protected by a sheathing.

The stay cable strands consist of seven galvanized, cold-drawn, smooth round wires. The wires, which are cabled into a strand, are coated with a corrosion protecting material and the entire strand is PE sheathed. Quality 1770 N/mm² with a nominal diameter of 15.7 mm is currently used in Germany. A thick-walled, weather-proof HDPE duct is usually used as an external sheathing and its color may be selected from a wide range. An external PE helix about 2 mm high prevents rain and wind induced cable vibrations.

Anchorages
The DYNA Grip® Anchorage, which offers the possibility to inspect and replace individual strands of a cable, consists primarily of an anchor block into which the stay cable strands are anchored using 3-piece,
high-capacity (both statically and dynamically) wedges. A short steel tube is welded to the anchor block which accommodates a sealing unit consisting of three rubber seals, an HDPE spacer and a steel pressure plate. The water-tight sealing unit protects the anchorage not only against corrosion, but also ensures a straight alignment of the strands into the anchor block, minimizing bending stress of the strand in the wedge anchorage. A stressing anchorage is illustrated in the graphic below. A ring nut with external trapezoidal threads is threaded on to the round anchor block which is supported by the bearing plate in the structure. For dead end anchorages, the anchor block is directly positioned on the bearing plate.

The strand bundle, which is spread at the support, is located at a certain distance from the anchorage, tightened by means of a steel clamp, and inserted into the HDPE tube. Elastomeric bearings are arranged around the clamp that are supported by the bearing tube via a compression-proof layer accommodating dimensional tolerances. The removable longitudinally split bearing tube is connected to the recess tube attached to the structure by means of a flange connection. This elastic fixed fastening reduces the cable deviation at the support and helps reduce cable vibrations.

The unique features of the DYNA Grip® Anchorage are:

- The PE sheathed strands are shop-injected with anticorrosion material up to the wedge. Therefore the space which must subsequently be filled with an anticorrosive agent is reduced to a minimum.
- It is not necessary to cut the strands exactly to length and to accurately remove the PE sheathing in the anchorage area. During the first stressing operation the PE sheathing of the strands may be removed using a special peeling device. For higher stressing levels the PE sheathing is restrained by a compression tube located on the strand ahead of the wedge. The tube compresses the PE during stressing of the strand.
- Post-tensioning as well as replacement of individual strands and of the entire cable is possible at any time.

Application

The second Strelasund Crossing to the isle of Rügen is currently the largest bridge building project in Germany. For the very first time strand cables are used for a large stay cable bridge in Germany. For this purpose, the DYWIDAG Strand Cable with DYNA Grip® Anchorage was extensively tested in compliance with the new fib guidelines for stay cables. The tests were carried out by the Technical University of Munich and witnessed by an expert committee under the supervision of the Deutsche Institut für Bautechnik (DIBt, German Institute of Building Technology). See also the following article in the current DSI Info.
DYNA Grip® Stay Cables for new Ziegelgraben Bridge
Ziegelgraben Bridge, 2nd Strelasund Crossing, Stralsund - Rügen Island, Germany

At present, the only road connection from the mainland to the island of Rügen is a two-lane road built on top of the Rügen dam, crossing the “Ziegelgraben”. The road includes a bascule bridge that opens several times a day. As a consequence, particularly in the summer months and on weekends, opening of the bridge causes traffic jams sometimes lasting several hours. This situation hinders the development of tourism on Rügen island as well as in the entire economic area.

The second Strelasund Crossing as part of the A20 “Baltic Sea” expressway to the city of Bergen will finally eliminate this bottleneck. This project is characterized by a particular complexity, since in addition to planning and legal conditions, special environmental and peripheral requirements must be taken into account. The entirety of these marginal conditions defined the engineering scope of work, in particular for the key structure, the clear span crossing of the “Ziegelgraben” with a navigation clearance of 42 m and a span length of about 200 m.

The multi-stage preliminary planning for the 4,100 m long section including the feasibility study, the road order and the design was managed by DEGES and the federal state of Mecklenburg-Vorpommern on behalf of the national government. Remarkable from an engineering point of view, this 2,830 m long structure is one of the longest road bridges in Germany. Most of its length is across the Baltic Sea but some crosses densely populated terrain.

Preliminary designs were prepared for alternative construction methods including arched, continuous girder and pylon bridges with span lengths from 150 m and evaluated according to technical, functional and economical criteria. The various bridges designs were examined with regard to their effect on the urban...
environment at the given location using visualizations – an indispensable planning aid in such cases.

Subsequently the chosen bridge configuration was ultimately optimized to include a pylon and the entire structure designed. The stay cable bridge across the “Ziegelgraben” has a main span of 198 m and a total length of 583 m. The 16 m wide steel superstructure is supported from the 128 m high tower by two planes of stay cables arranged in the shape of a harp.

Originally, locked coil cables were planned and tendered. For its tender SUSPA-DSI took advantage of the explicit approval of supplementary tenders featuring strand bundles. The stay cables consist of bundles of 34 high-grade, multiple corrosion protected individual prestressing strands bundled into an ∅ 180 mm HDPE sheathing. For their anchorage DYNA Grip® Anchorages type DG-P 37 were used.

This anchorage procedure allows inspection of each individual strand in the future. In addition, it is possible – if required – to replace individual strands without compromising the entire stay cable. The DYNA Grip® Anchorages successfully meet the suitability and quality tests accurately described in the catalog of requirements in accordance with the new fib guidelines and comply with the most demanding quality assurance requirements.

After a construction period of only 3 years the new Rügen bridge will be opened to traffic in summer 2007.
Double Corrosion Protected DYWIDAG Bar Anchors secure Expressway Link to the Harbor in Trieste

*Grande Viabilitá Triestina - 3° Lotto – 2° Stralcio – Tratto Padriciano-Cattinara - Trieste, Italy*

As a result of the “free port license” granted by Emperor Charles VI of Austria, the Adriatic port of Trieste developed into a major import and export harbor. The opening of the Suez Canal provided an additional boost to the port’s role, since transport via Trieste and the canal cut the distance to the Far East by about 2,000 sea miles compared to transport via the North Sea harbors. In the course of the EU’s eastward expansion, Trieste gained further importance as a vital port of transshipment to the Southeast European neighboring states.

As a result, Trieste has successively expanded the size of its port in the past few years. In addition the city’s transportation infrastructure has been improved such that trucks heading to or leaving the port no longer block the city’s narrow streets.

In connection with the extension project of the “Grande Viabilitá” of the Province of Trieste only the 5.5 km long interstate section “3° Lotto - 2° Stralcio” was missing. This section is an important link between the road already completed from the harbor to the Cattinara district and the expressway from Venice to Slovenia.

As part of the “Grande Viabilitá” construction project a significant slope required some elaborate stabilization. The retaining walls were tied back with double corrosion protected DYWIDAG Bar Anchors of various lengths with diameters of 26.5, 32, 36 and 40 mm. A total of 42,700 m DYWIDAG Bar Anchors were supplied by our Italian affiliated company DYWIT S.P.A. In addition, DYWIT supplied the technical equipment required for installing the DYWIDAG Bar Anchors and consulted the parties involved with regard to the technical execution. In the meantime this last important section of the “Grande Viabilitá” could be successfully completed.
Double Corrosion Protected DYWIDAG Bar Anchors secure Local Ring Road

SS48 State Route in Moena, Dolomites, Italy

The village of Moena is blessed with idyllic scenery as a result of its location at the entrance to the valleys of Fiemme and Fassa in the Dolomites. In summer more than 4,500 bikers meet there for the “Rampilonga”, Italy’s largest mountain bike marathon event. In winter the village turns into a skiing area called “Tre Valli” with fantastic ski slopes and excellent ski lifts.

The economy of that region very much depends on tourism. The SS48 state route - also called “Road of the Dolomites” (“Strada delle Dolomiti”) runs through the village of Moena. To maintain the center of the village’s appeal to tourists, the government of the province of Trento began construction of an outer by-pass ring road in 2004. In particular, this ring road was designed to relieve the village center of heavy vehicles.

The village of Moena is located in an alluvial soil area, and the planned SS48 by-pass is located directly at the confluence of two small rivers, the San Pellegrino and the Avisio. The difficult terrain requires the ring road to be secured over a length of 1,800 m by means of elaborate slope stabilization measures. The retaining walls in some locations are more than 12 m high and must be secured by anchors that are permanently protected against corrosion as well as against the moisture prevailing there.

DYWIT S.P.A. supplies a total of 54,000 double corrosion protected DYWIDAG Bar Anchors Ø 32 and 36 mm, for design working loads of 450 or 580 kN. Test anchors have already been successfully tested in accordance with AICAP (Associazione Italiana Calcestruzzo Armato e Precompresso) regulations. Construction of the outer ring road is scheduled for completion in 2009.

Owner Autonomous Province of Trento, Italy
Supervision Coopsette Scarf– Geom. Donelli, Ing. Santarelli
Coordinator Oberosler Cav. Pietro S.p.A., Ing. Boller, Italy

DSI Unit DYWIT S.P.A., Milan, Italy
DSI Services Supply of 54,000 double corrosion protected and pre-grouted DYWIDAG Bar Anchors; Technical assistance
Currently the Portuguese interstate network is being extended north of Lisbon. A principal element in this new A10 interstate is the bridge near Arruda dos Vinhos, about 20 km north of Lisbon. In that area the new interstate passes through the plain of the rivers Ribeira da Laje and Rio Grande da Pipa. In this connection, special focus is placed on the protection of the sensitive ecological equilibrium along the courses of the rivers. Since the area with the embedded rivers Ribeira da Laje and Rio Grande da Pipa is highly uneven, construction of a bridge is the most economical solution.

The interstate employs two lanes in each direction. The 1,319 m long structure consisting of two parallel single bridges rests on 14 piers with a height of up to 48 m. As a result of the length of the viaduct there will be considerable span widths of up to 90 m between the piers, requiring intensive, reliable prestressing. For the prestressing operations about 1,460 t DYWIDAG Strand Tendons will be used that are delivered by DSI Portugal just in time to the construction site. The main contractor, CONDURIL, has been successfully cooperating with DSI Portugal for more than 10 years and is highly experienced in installing DYWIDAG Stressing Systems. Therefore, the entire post-tensioning work will be carried out by CONDURIL itself.

The entire bridge is built using the free cantilever construction method. Up to 6 form travellers will be used at the same time. A total of 69,174 m³ of concrete and 7,600 t of structural steel will be needed for the construction of this viaduct. The bridge is to open for traffic in summer 2006.
In Portugal as in many other countries, companies with large space requirements, continue to move out of cities. As a result, various industrial areas have been developed around Lisbon in the past few years. This process has significantly reduced the number of heavy vehicles travelling into the city of Lisbon, however, the traffic infrastructure in the suburbs can no longer cope with the increasing industrial growth.

A new industrial zone has recently developed at the edge of the village of Vialonga, about 10 km outside of Lisbon. Until now the IC2 expressway has passed the village's MARL hypermarket without any direct road connection thereto.

Therefore, it was decided to build a new exit off IC2 to direct delivery vehicles directly to the hypermarket. Since the new road connection passes through hilly territory, extensive earth movement measures had to be undertaken to prepare the site for the future road. To stabilize the slope, a retaining wall with a maximum height of 15 m had to be built. To tie back the retaining wall permanent DYWIDAG Strand Anchors were used.

For this project DSI Portugal supplied about 10,000 m of permanent DYWIDAG Strand Anchors and technical equipment for installing and prestressing of the anchors.
Record Pace Installation of DYNA Grip® Stay Cables for Bridge in Madeira

Riverside promenade, Machico, Madeira

Madeira’s discoverer is said to have landed in Machico Bay in 1419. What now is the second largest city of Madeira had kept its tranquil character as a fishing village in the shadow of the capital of Funchal since 1497. Only recently have more and more tourists “conquered” the city, causing a strong construction boom. The new congress center in the city center with an old town and tourism infrastructure and the harbor that was extended in summer 2004 are separated by the Machico river.

A new bridge over the Machico river was built to improve the linkage between the old town and the harbor. DSI Portugal supplied a total of eight DYNA Grip® Stay Cables and Stay Cable Anchorages for the visually very appealing stay cable bridge. Two specialists of DSI’s licensee SM7 from the Czech Republic and Tecnasol from Portugal each assisted DSI Portugal with the installation work.

The close cooperation of all parties involved enabled the successful installation of the eight DYNA Grip® Stay Cables in the new bridge in a record time of only 11 days.
DYWIDAG Post-Tensioning and Reinforcement Systems secure Liquid Natural Gas Tanks in Sagunto

Construction of two LNG tanks (LNG=Liquid Natural Gas) in Sagunto, Valencia, Spain

DYWIDAG Sistemas Constructivos (DSC) installed the post-tensioning material for two new 150,000 m³ LNG tanks. The tanks in the harbor of Sagunto were constructed by JV Regasagunto (ACS, Sener, DYWIDAG International GmbH, TKK and Osaka) under the leadership of SAGGAS (Unión FENOSA, Iberdrola and Endesa).

The two LNG tanks were built in the midst of the region with the second largest natural gas consumption. Due to their geographical position they are well suited for the accommodation of liquid gas supplies from North Africa and the Persian Gulf.

The tanks reach a height of 52 m with an inner diameter of 74.0 m and a wall thickness varying between 0.6 and 1.20 m. DSC Services included the supply of DYWIDAG Multistrand Tendons and their complete installation with placing, stressing and grouting. Furthermore, DSC supplied also GEWI® Threadbars with accessories for splices in construction joints and in subsequently concreted access openings.

The client turned particular attention to the cryogenic suitability of the PT-system and the strand. DSC with support of DSI Technical Service in Munich furnished the proof, that the applied DYWIDAG PT-system with strands meets all criteria of the most demanding standards for construction of LNG tanks.

In each LNG tank 12 horizontal DYWIDAG Multistrand Tendons were installed in the bottom slab, 178 in the outside wall and 18 in the ring beam. The horizontal multistrand tendons consist of 19 strands Ø 0.62” and MA-Anchorages at both ends. The bottom slab was circumferentially post-tensioned with tendons
anchored in sections in 6 buttresses shifted by 60 degrees. The Multistrand Tendons were anchored in 4 buttresses placed at 90° centers in the outside wall and in the ring beam of the LNG tanks.

The vertical post-tensioning was accomplished by 80 U-shaped DYWIDAG Multistrand Tendons 9x0.62" per tank. This PT-system is also known as loop tendon and consists of two vertical tendons, which are connected at their bottom ends by an 180° arc and anchored at their top ends by MA-Anchorages in the ring beam.

For this project DSC supplied a total of 320 anchorages for DYWIDAG Multistrand Tendons consisting of 9 strands, 832 anchorages for 19 strands, 14,250 m galvanized sheathings with an inner diameter of 80 mm, 51,166 m galvanized sheathings with an inner diameter of 100 mm, 320 pocket formers for Multistrand Tendons consisting of 9 strands and 152 pocket formers for tendons with 19 strands. In addition, 9,312 m GEWI® Threadbars ø 28 mm as well as 5,300 couplers and nuts for standard and cryogen applications were supplied.

Post-tensioning began with the placing, stressing and grouting of all vertical DYWIDAG Multistrand Tendons. Subsequently the horizontal tendons in the wall – with the exception of the tendons in the area of the access openings of the tanks – as well as 50% of the tendons in the ring beam were post-tensioned. Then the remaining tendons were stressed in the walls, in the bottom slab and in the ring beam to complete the work.

A total of 1,300 t 0.62" DYWIDAG Multistrand Tendons were placed, stressed and grouted from October through December 2004. To complete the required work on schedule DSC employed up to 8 work teams with appropriate equipment.
More than 1,000 t Post-Tensioning Systems installed in the Reppisch Valley Ventilation Center

SpannStahl AG as partner of the JV Spannarbeiten, Uetliberg Tunnel, Zurich West By-pass, Switzerland

The 4.4 km long Uetliberg tunnel is a key structure for the new 10.6 km long Zurich West By-pass. In addition, the Zurich West By-pass closes a significant gap in the Swiss national road network between the A1 (Zurich-Bern) and the A3 (Zurich-Chur) expressways.

The entire Uetliberg tunnel consists of two parallel tunnel bores each underneath the Uetliberg and Ettenberg hills, one for each driving direction. In the valley between the two hills passes the Reppisch creek. This near-surface site of the Uetliberg tunnel in the Reppisch valley was used to build a ventilation center in an open cutting transverse to the valley. Following completion of the structure, the original natural scenery will be restored by completely covering the ventilation center. The recultivated bed of the Reppisch creek will then be positioned exactly above the center. The only thing that will indicate the existence of the ventilation center underneath is an open access road.

With a length of about 200 m, a width of about 55 m and a total volume of 180,000 m³ (according to SIA) the ventilation center will be significantly larger than “normal” ventilation centers. These dimensions are necessary for the planned extended functions of the structure over a total of four levels.
The bottom level below the driving lane level will accommodate supply lines and cable trays for the power supply of the Uetliberg tunnel as well as sewer pipes for the tunnel drainage and fire hydrant supply pipes.

The subterranean space provides for a possible interchange of traffic between the two tunnel bores at the second level, the driving lane level. It is this level that is principally responsible for the size of the ventilation center. In addition to the two driving lanes and one emergency lane in the tunnels, the width of the ventilation center will be extended by an additional emergency lane.

The level above the driving lanes will accommodate the actual ventilation facilities. In case of fire, smoke and fumes can be removed from the driving space by suction and purged from the vent stack situated on the Ettenberg hill via a ventilation gallery. The only access to the ventilation center from outside will also be located on this level.

The fourth top level will accommodate the electromechanical facilities of the Uetliberg tunnel such as control systems and emergency power supply. The ventilation and air conditioning equipment installed there will also ventilate internal spaces.

Due to its extended function and considerable repair work required in case of fire, extremely high demands were made on fire protection. The fire protective panels are 10 cm thick, prefabricated and have a quality similar to concrete. Fire tests at temperatures of up to 1,350°C that lasted several hours showed excellent resistance and insulation characteristics. As a result, the temperatures at the level of the lower reinforcement and post-tensioning are effectively limited to less than 150°C.

The Reppisch valley ventilation center was designed as a monolithic structure. It was post-tensioned in the transverse and longitudinal directions and partly in the vertical direction. Joints are located at the transitions to the tunnels. The ventilation center is designed to resist uplift (as it is 14 to 18 m below ground water level) and after backfilling will bear superimposed loads of 2 to 15 m, including the Reppisch creek bed. SpannStahl AG supplied GEWI® Reinforcement Systems to connect the walls and slabs.

The ventilation center was continuously designed as a “bath tub”. In addition, the two upper stories accommodating electromechanical facilities will be protected against surface water by means of polymer bitumen waterproofing sheets (PBWS).

All of the post-tensioning operations for this challenging construction project were carried out by the Joint Venture Vorspannung LZ Reppischtal consisting of SpannStahl AG, Stahlton AG and Geniteam SA. A total of approximately 70 km of post-tensioning systems were supplied and installed in this structure. In addition, special concrete with delayed setting was used for the 1.5 m thick foundation slab. The post-tensioning of the foundation slab with installed longitudinal and transverse tendons had to be carried out within a very short period of time, since the concrete had cured after three days.

Unfortunately, the construction site did not escape the flood that affected large areas of Central Europe in August 2005. Consequently, there were some delays in the construction schedule. For example, the production of the fire protective panels had to be temporarily stopped as a result of flooding of the precast concrete factory. Nevertheless, the original date of completion scheduled for summer 2006 shall be kept.
Rehabilitation Works during Construction of the Chienberg Tunnel, Sissach

The 2.3 km long Chienberg Tunnel is the principal element of the 3.5 km long Sissach ring road scheduled for completion in 2006

Construction of the Chienberg Tunnel began in 1998. In January 2000, during the process of mining the tunnel, a number of technical problems were encountered.

Between the fall of 2002 and January 2004, uplifts of the tunnel floor measuring nearly 10 cm were discovered at tunnel meter 880 during the process of conducting routine measurements posed yet another problem. Based on model calculations, uplifts of this magnitude had only been expected in 50 to 100 years.

The tunnel floor was lifted by a swelling process caused by geological conditions that primarily occurs with changing moisture conditions in the ground.

To secure the invert level of the tunnel, the GEWI® Pile System, traditionally used in pile foundations, was selected for the job. The GEWI® Pile System, also known as a micro pile system, is particularly well suited for use where space is limited, e.g. restricted head room.

In cooperation with SUSPA-DSI GmbH, Königsbrunn, Germany, SpannStahl AG, Switzerland, supplied approximately 600 t of double corrosion protected GEWI® Anchors for the tunnel to resist uplift forces. The 21,000 m GEWI® Anchors were installed during the ongoing construction and extension work and their installation was subject to very tight schedules. The pile lengths were typically 21 m. To deal with space and access limitations, the factory fabricated double corrosion protected bars were supplied in 6-7 m long sections that were coupled as they were installed in the drilled hole. Once the entire GEWI® Anchor was installed, the sheathing was injected and grouted. Installation of the GEWI® Anchors will be completed in summer 2006.

Owner Kantonales Tiefbauamt BL (Foundation Engineering Office), Switzerland +++ Contractor JV Chienbergtunnel Sissach, Batigroup AG Tunnelbau, Basel, Switzerland +++ Engineering Joint Venture Aegerter und Bosshardt/Gruner, Switzerland

DSI Units SpannStahl AG, Hinwil, Switzerland / SUSPA-DSI GmbH, Königsbrunn, Germany
SpannStahl Services Supply of 21,000 m double corrosion protected GEWI® Anchors including accessories, technical assistance for installation, testing and post-tensioning
DYWIDAG Post-Tensioning Systems strengthen Çumra Sugar Silo in the Konya Province

Supply and installation of DYWIDAG Strand Post-Tensioning Systems for the Çumra sugar silo in Konya, Turkey

In 1992, Konya Seker Fabrikasi A.Ş. evolved from what was formerly the national Turkey Sugar Factories Inc. to become what is now Turkey’s largest private sugar producer.

The plant’s cornerstone was laid on September 27, 2003 and after a construction period of only 12 months Turkey’s most modern sugar production plant was officially opened on September 25, 2004. The plant is located in Çumra in Central Anatolia, about 300 km south of Ankara and about 30 km south-east of Konya (a city with a population of 40,000).

While the plant was under construction, plans for its expansion by adding an additional sugar silo were being prepared. The new sugar silo is built on a foundation ring that has an internal diameter of 44.12 m and a height of 2.55 m. The silo has an internal diameter of 38 m and a height of 40.4 m.

At the beginning of 2005 a total of 120 t DYWIDAG Multistrand Tendons St1860 and 264 MA Anchorages were supplied to the job site and installed there. DIVIGER completely installed the ducts and also placed, stressed and grouted the DYWIDAG Multistrand Tendons for the new silo between May and August 2005.

The work was performed on schedule with the full appreciation of the main contractor. The new silo was handed over to the owner in the second half of 2005 and is now an integral component of the Çumra sugar factory.
First projects with DYWIDAG Ductile Iron Piles in Ireland

The DYWIDAG Ductile Iron Pile is a driven pile system, utilising high strength ductile cast iron. Pile sections are connected together by a unique spigot and socket joint, which offers speed of connection together with a high degree of stiffness. The piles are installed in a quick succession using an Excavator with a Hydraulic Hammer, to both pitch and drive each pile section.

Manufactured as Ductile Cast Iron, also known as Spheroidal Graphite Cast Iron, the system is immensely strong and offers superior durability over conventional tubular steel piles.

Additional compressive strength is provided by the concreting or grouting of the bore, to form a composite pile.

Installed as an End-Bearing Pile (dry driven to a set, followed by concreting of the bore) or a Skin Friction Pile (simultaneous drive and grout, with an oversize shoe), the Ductile Iron Pile can accommodate a range of different ground conditions.

After being used mainly in Central Europe for a couple of years, the DYWIDAG Ductile Iron Pile has recently found applications on a variety of jobsites in Ireland, where the demand is currently high for piled foundations. Increasingly developers are looking to build on poor ground which they would previously have avoided due to the cost of a piling, also the demand for housing apartments on waterfronts has led to an increased requirement for piled foundations.

The DYWIDAG Ductile Iron Pile has been used for a range of piled foundations, from houses and apartment blocks to hotels and factory units. It also provides an effective pile in civil engineering applications including: pipeline support, bridge piers and wind turbines. The key benefit of the system is the rate of installation coupled with its flexibility for a range of ground conditions.

Recent projects in Ireland have included:
- Luxury Apartments at Monaghan: 76 No. 118/7.5 piles (up to 18m)
- Hotel and Banqueting Suite at Limerick: 220 No. 118/9.0 piles (up to 22m)
- Hotel and Conference Centre at Tralee: 50 No. 170/9.0 pile (up to 16m)

DSI Services:
- Supply of piles and accessories
- Assistance during installation through DSI-UK and DSI-HQ, Munich

Excavated grouted piles

Non-grouted piles for Luxury Apartments at Monaghan

Non-grouted piles
Driven Piles with Subsequent Placement of Concrete (typically end bearing piles)

Installation of the Driven Ductile Iron Pile is one of the quickest and simplest piling methods available. The pile is driven to a “set” in dense gravel or on to bedrock. Concrete is then placed into the bore of the pile to give additional strength. An end plug or rock point is fitted to the lead section, which is then driven to its full length, with additional sections added as required. The set is defined as the reduced rate of pile penetration, in relation to a sustained driving energy (of the hammer), over a given time. Achievement of the set, demonstrates the pile’s ability to sustain its design load on a long term basis. The value for the set (i.e. penetration rate in relation to sustained driving energy) is determined from empirical data, correlated with static load test results, in a range of different ground conditions over many years.

Driven Piles with Grouted Annulus (typically skin friction piles)

Grouted driven piles combine the installation benefit of a driven pile with the flexibility of a grouted system. An oversize grout shoe is fitted to the base of the lead pile section. As the pile is driven into the ground, the oversize shoe creates an annulus between the pile shaft and the ground, which is constantly filled with a pile-concrete, to mobilise skin friction. Installed by the simultaneous drive and grout technique, grouted piles can be also used in ground conditions where other systems are not suitable (i.e. high ground water or contaminated sites).
DYWIDAG Technology is incorporated into Jordan’s largest Wastewater Treatment Plant

As-Samra Wastewater Treatment Plant, Greater Amman Area, Jordan

The new As-Samra Wastewater Treatment Plant, expected to be operational by December 2006, will replace the existing overloaded and inadequate facility. The plant will play a central role in Jordan’s overall water management strategy. Jordan is located in one of the semiarid areas of the World. During the last few years, the country has experienced an improved standard of living, significant population growth as well as growth in agriculture and industry. As a result, the country’s natural water resources are almost completely consumed. Hence it is absolutely necessary that wastewater be reused to avoid future shortfalls in available water supply.

Once complete, the new wastewater treatment facilities at the plant will be capable of treating up to 330,000 cubic meters of wastewater per day to serve 2 million residents of the Amman and Zarqa areas, the first and third most populated cities of Jordan. The plant is designed to meet Jordanian and international environmental standards for discharge into streams and river valleys. Thus the treated water can be used for irrigation and for industrial purposes, thereby freeing up urgently needed drinking water.

The concrete outside walls of 8 aeration tanks, 8 secondary settlement tanks and 4 anaerobic digesters tanks are prestressed with circumferential DYWIDAG Strand Tendons 5x0.6” and 9x0.6”.

The project is constructed by The Morganti Group, Inc. as a part of a consortium with Infilco Degremont, Inc. under “Jordan’s first ever” BOT agreement with the Jordanian Ministry of Water and Irrigation.

Owner Ministry of Water and Irrigation, The Hashemite Kingdom of Jordan

General Contractor and Consultant Consortium of The Morganti Group, Inc., USA and Infilco Degremont, Inc., USA

DSI Unit DSI Group HQ Operations, Munich, Germany

DSI Services Supply of 560 t DYWIDAG Post-Tensioning Systems, Type MA 5 and 9x0.6”, Rental of Prestressing Equipment and Technical Assistance for Installation
Construction of the Doosti Dam near Khorasan

_Tie back anchoring of the radial gates and the intake tower with DYWIDAG Bar Anchors_

Between 2001 and 2005 a new dam was constructed in the north-east of Mashad near the Turkmenian-Iranian border. With a capacity of 1,250 million m³ the Doosti dam is to provide 50,000 hectare of Turkmenian and Iranian agricultural fields with water for irrigation from the Harrirood River. In addition, the Doosti dam provides drinking water to the Iranian province of Mashad. The dam has a length of 655 m and an average height of 80 m. The impoundment basin has an average width of 1.5 km.

DSI supplied a total of 90 pre-grouted Ø 36 mm DYWIDAG Bar Anchors to secure the radial gate trunnion beams to the dam piers. The radial gates are located in the center of the dam about 50 m below the crest, and serve to regulate the water level of the dam in case of emergency such as in floods. In addition, DSI supplied, installed and stressed 36 pre-grouted Ø 26.5 mm DYWIDAG Bar Anchors for the intake tower.

The construction costs of the dam totaled US$ 168 million. On April 12, 2005 the Presidents of the Iranian and Turkmenian Republics officially inaugurated the Doosti dam.
DYWIDAG Anchors secure new Subway Tunnel

Extensions to the Algiers metro from Hamma to Hai-El-Badr, Algiers, Algeria
In 1981 the Algerian government made the basic decision to building a subway in Algiers. Increased revenues from crude oil and natural gas discoveries were earmarked to improve the local infrastructure. Lost revenues as a result of the collapse in oil prices in the mid 1980s led to a stop of the construction works on the subway before they had effectively begun. Following increasing economic growth of the Algerian economy in the 1990s again many people returned to Algiers where a majority of the booming industry is located. Consequently, the plan for constructing a subway was reactivated and works on the first section of line 1 from Emir Abdelkader to Hamma began.

To further improve the quality of air and life as well as traffic conditions, the government provided additional funds for extending subway line 1 by 3.9 km from Hamma to Hai-El-Badr and for the construction of four new stations at the beginning of the new millennium. Studies had shown that approximately 250,000 car trips per day could be saved this way.

The aforementioned section is located in an urban and hilly area. This plus the tight schedule placed exceptional demands on all parties involved in the construction project. The new tunnel is being built using the New Austrian Tunneling Method (NATM), with driving taking place at 5 different locations at the same time. The main idea of NATM is to use the geological stress of the surrounding rock mass to stabilize the tunnel itself, using shotcrete and support elements. These support elements are mainly anchors. In particular, high-grade DYWIDAG Anchors are well suited for this purpose. Their certified quality allows for fast, safe and therefore cost-effective installation. For securing the cuts of the 3.9 km long tunnel DSI supplied 68 tons of DYWI Drill® R32N Hollow Bar Anchors and 15 t of DYWIDAG Form Ties 15 mm for the subway stations.

The new tunnel will be completed in the second half of 2006. The commissioning of the entire line 1 is scheduled for 2008. Plans for extending the Algiers subway network by two further lines already exist.

Owner: Entreprise du Métro d’Alger, Algiers, Algeria
Main Contractor: G.A.A.M.A. (Groupement Algéro Allemand du Métro d’Alger), consisting of DYWIDAG International, Munich, Germany and Cosider TP, Algiers, Algeria and Infrafer EPE, Algiers, Algeria
Engineer: Systra-SGTE, Paris, France
DSI Unit: DSI Group HQ Operations, Munich, Germany
DSI Services: Supply of 68 tons DYWI Drill® Hollow Bar Anchors R32N and 15 t DYWIDAG Form Ties 15 mm
Bridges not only serve to cross valleys, rivers or other obstacles, they also provide important connections between people. As a result, the city of Winnipeg planned the construction of a new bridge across the Red River. This new bridge was conceived not only to replace the 85 year old Provencher bridge, but to constitute a meeting place for the inhabitants of the two significant neighbourhoods of The Forks and St. Boniface situated on opposite sides of the river. As a result, the cultural and economic connection between these historically English and French quarters is to be promoted. For this reason a public project committee was established that reflected the diversity of the inhabitants directly affected by the bridge. This committee played an important role in the early design selection for the bridge.

This led to the construction of two bridges—the Provencher Paired Bridges: A four-lane bridge for cars and trucks and a smaller, more elegant bridge to be exclusively used by pedestrians, cyclists and recreational users. Some of the unique features of the pedestrian bridge, the Esplanade Riel, include an architectural composite tower that is prestressed with a cantilevered and stayed semi-circular plaza area at the base of the tower, which provides space for commercial activities and also accommodates a restaurant. This “annex” to a bridge is absolutely new for bridges in North America.

From an engineer’s point of view, this highly challenging stay-cable pedestrian bridge reflects the lightness of its use as a pedestrian bridge by incorporating a slightly inclined, elegant tapered pylon. The 7 m wide bridge deck has spans of 110 m and 87 m. The top of the pylon is 57 m above the bridge deck, which, in turn, is about 11 m above the water level.

The single reinforced concrete tower which is inclined from the stay plane is founded on a pile cap footing and eleven 1.83 m bored piles. It was erected using 10 m long precast reinforced concrete elements. These precast elements were subsequently post-tensioned with DYWIDAG Post-Tensioning Systems.

The plaza area and the shorter west span were built on a falsework. The longer east span was built using the free cantilever construction method and a form traveller supplied, erected and operated by DSI. Based on a proposal submitted by the engineers from DSI and Buckland & Taylor, the DYNA Grip® Stay Cables were used for the temporary support of the DYWIDAG Form Traveller. Precast reinforced concrete elements were used for anchoring the stay cables in the bridge deck;
The lengths of the stay cables that also anchor the plaza vary from 37.5 m to 107.1 m. They are connected to the pylon at the upper anchorage. Installation of the DYNA Grip® Stay Cables took place between temperatures of -35°C and +30°C.

DSI is proud to have contributed to the successful construction of the new Esplanade Riel in a record-breaking construction time through innovative alternative proposals and through the supply of high-quality products. The Vancouver Regional Construction Association in Canada honoured DSI with the Award of Excellence 2004 in the category Trade Contractor for its achievements in this project. The bridge was opened in summer 2004.

thus eliminating the need to adjust the formwork and the form traveller to the varying angles of the cables. These alternatives were decisive for the awarding of the contract and saved the city of Winnipeg CAN$ 2.0 million over the originally planned bridge option designed to be built using precast elements.

The stay cables were spaced 10 m apart. This spacing makes it possible to replace individual cables without the need to install falsework. For additional reinforcement the super structure of the entire bridge was also internally post-tensioned in the longitudinal direction using DYWIDAG Tendons supplied and installed by DSI.

The 44 type DG-P12 and DG-P14 DYNA Grip® Stay Cables consist of galvanized and waxed strands, encased in a 1.5 mm thick extruded HDPE sheathing. The outer diameter of the stay cables is 125 mm or 140 mm with 8.0 mm wall thickness of HDPE sheathing.
The Red Hill Creek lies in a 68 km² watershed located on the southern shore of Lake Ontario. On the west side of the creek within the city of Hamilton is the former Rennie Street landfill site. The landfill was closed in 1962 after it had been in operation for nearly 20 years.

The Red Hill Valley Project, an integrated infrastructure project, is highly controversial. The included expressway required a retaining wall to be built through the south corner of the former landfill. The retaining wall served to separate the remaining landfill to the west and the waste to be excavated to the east. Once the wall construction was completed, the city of Hamilton proceeded with the removal of about 70,000 m³ of waste from the closed landfill. To permanently secure the retaining wall, DYWIDAG Post-Tensioned Rock Anchors with triple corrosion protection were chosen. Technical performance, cost and local availability were among the criteria that made DYWIDAG Anchors the winning choice for installation in the extremely challenging underground created by decomposed toxic waste material that include industrial grade dumping.

The 22.1 to 31.7 m long DYWIDAG Rock Anchors consisted of galvanized DYWIDAG Threadbars Ø 46 mm (835/1030 N/mm²). A polyethylene sheathing (yellow jacket) was extruded on the free length portion of the bar. This assembly was encased over its entire length in a corrugated plastic sheathing, with the annular space between the sheathing and the bar grouted in DSI Canada’s shop.

A smooth PVC pipe covered the corrugated sheathing in the free length to create a bond break between the anchor and the outside grout during stressing.

The entire fabrication was subject to strict quality requirements and controls.

All anchors were successfully tested to the project requirements.

DSI’s dedicated customer support and high quality products met another challenge and confirmed once more the leading role of DSI Canada in the geotechnical field.
High-rise Building Construction in Las Vegas using DYWIDAG Monostrand Systems

With 6,000 new inhabitants every month Las Vegas is the fastest growing American city. Particularly retirees are increasingly coming to Las Vegas to retire to or spend some time in and around the city that never sleeps.

This demographic change results in condominiums beginning to sprout up on drawing tables and on zoning maps in addition to hotels and parking structures. Currently a new mega resort is being planned that involves 66 acres of land and will include hotels, theatres, shops, restaurants and also condominiums.

Furthermore, both business travel and leisure travel have returned to and even exceeded their pre-2001 levels. Hotels are expanding, parking is at a premium and there is a new vitality in town.

The “time is money” motto is very critical for the owner of hotels and casinos in Las Vegas to make revenues flow as quickly as possible. Therefore, there is a premium for speedy construction methods. It is important to deliver systems to the job sites which are flexible, which meet the highest quality standards and which can be easily and quickly installed. The DYWIDAG Unbonded Monostrand System meets all these requirements.

DSI was the first supplier of monostrand systems in Las Vegas in 1991. Since the DYWIDAG Monostrand Systems convinced customers, these systems can meanwhile be found in a large number of objects in the city, e.g. in the famous hotels Luxor, Bellagio, Sands, Sands Venetian or Paris.
AMERICA – USA

- Caesars Palace
- Mandalay Bay
- Marriott Grand Chateau
- South Coast Parking
- Paris Las Vegas Hotel
- Mandalay Bay
Also the list of recently completed projects using DYWIDAG Monostrand Systems is very impressive and continuously growing:

- MGM Residence Towers A, B, C
- Tahiti Village Towers 1 and 2
- Marriott Grand Chateau
- Le Reve Hotel
- Red Rock Casino
- SOHO Lofts
- Marriott Renaissance Tower P/S
- Metropolis
- Caesars Palace Towers
- Hardrock P/S
- Mandalay Bay

DYWIDAG Unbonded Monostrand Tendons are made up of cold-drawn, low-relaxation, seven wire strands of 0.5" (12.7 mm) or 0.6" (15.2 mm) diameter, conforming to ASTM (American Society for Testing and Materials) A 416. DYWIDAG’s small tendon diameters and small anchor plate dimensions meet the edge dimension requirements of slabs as thin as 114 mm.

Although DSI offers both strand sizes, the predominant strand size used in Las Vegas is 0.5". No special corrosion requirements are specified due to the dry desert environment of the area. Tendons are fabricated at the DSI Long Beach, California facility and shipped daily by truck to the various ongoing projects in and around Las Vegas.

In addition, DYWIDAG Monostrand Tendons are successfully used as barrier cable solutions and systems in particular for the construction of parking structures.
Commercial Buildings

- MGM Grand Hotel
- Metropolis Lofts
- Monte Carlo Resort
- Red Rock Casino
- New York – New York
- MGM Grand Hotel
DSI prides itself in supplying a complete high-quality solution to architects who are concerned about openness, safety and aesthetics. Proper stressing and back stressing is the key to a professional and secure installation. DSI’s service scope comprises both the supply and complete assembly of the tendons.

In 2004 and 2005 DSI America supplied DYWIDAG Monostrand Systems worth more than $ 5.5 million to Las Vegas for the following major projects:

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<th>Subcontractor</th>
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<td>MGM Residence</td>
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<td>Le Réve</td>
<td>Wynn Las Vegas, LLC</td>
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Seismic Upgrade of a Football and Soccer Stadium

Rose Bowl Stadium, Pasadena, California, USA

The Rose Bowl Stadium is nestled in the foothills of the San Gabriel Mountains north of Los Angeles. The Rose Bowl was originally designed in 1922 as a horseshoe stadium with the north, east and west sides built into an earthen berm. The first addition to the stadium was completed shortly thereafter in 1933 where the south end was closed, completing the elliptical stadium with poured in place concrete columns and bracing to support the concrete seating deck above. In 1948 an independent cantilevered structure was added, offering an additional eleven rows of seating to the top of the stadium, supported by a series of 1.00 m columns, with a 15 cm wide expansion joint between the two concrete structures.

California is located at the boundary between two huge tectonic plates, the so-called San Andreas fault. As the two plates slide past each other, earthquakes occur. For this reason, seismically retrofitting of the Rose Bowl Stadium was indispensable.

As earthquake codes were developed and modified over the years, the Rose Bowl had already undergone a series of seismic strengthening programs in the past. In 1982 the south end was strengthened with concrete shear walls. During the summer of 2005, the cantilevered structure built in 1948 was reinforced. Engineers at Brandow and Johnston Associates proposed a post-tensioned cabling system using DYWIDAG Multistrand Tendons to hold the 1948 addition to the 1933 concrete structure on the south side. DSI USA performed this latest strengthening.

DSI was contracted to:

1) Design special anchorages for DYWIDAG Multistrand Tendons and prepare the installation shop drawings.
2) Prepare and evaluate alternative reinforcement measures.
3) Supply and install DYWIDAG Multistrand Tendons with galvanized 0.5" strands.

DSI executed and completed the project in 3 months, a full month ahead of schedule, to the complete satisfaction of the client. Immediately after completion of the reinforcement work, sporting and other events took place in the Rose Bowl Stadium according to schedule.
DYWIDAG Ring Tendons increase Capacity of Digester Tanks

*External Strengthening of Digester Tanks, New Stanton, Pennsylvania, USA*

The capacity of the two concrete digester tanks of the city of New Stanton, Pennsylvania, USA, was no longer sufficient to meet the increased requirements. Since the construction of a new digester tank was to be avoided for cost reasons, an investigation was made to determine whether or not the capacity of the existing digester tanks could be increased through expansion.

The tanks have an inside diameter of 19.8 m and wall heights of 27.4 m. The thickness of the tank walls varies and measures 45.7 cm at its base, tapering to 35.5 cm at its top. The outer walls of the existing two digester tanks were originally designed as cantilever walls with their main reinforcement oriented vertically. However, in their existing form the tanks were not capable of accommodating the additional pressure caused by an increased volume. For the strengthening of the walls the engineers considered the subsequent installation of external horizontal prestressing strands more efficient than strengthening through an additional horizontal reinforcement.

DYWIDAG-Systems International USA, INC. was contracted by Fox Rothschild on behalf of Lexington Insurance Company in December, 2004 to strengthen the two concrete digester tanks. To this end, the clay bricks on the outside surface of the tanks were first removed. Some soil excavation was performed in order to access the portion of the tanks below ground level.

For the actual reinforcement of the walls DSI USA installed a total of 56 sheathed and greased DYWIDAG Ring Tendons 0.6" around each tank and anchored them in movable ME type couplers. The strand ends were overlyingly spliced in pairs and tensioned by means of special bent adapters. Subsequently, the DYWIDAG Ring Tendons and Couplers that had been installed on the outer walls were painted to match the color of the concrete wall. To finish the works the clay bricks were replaced on the outside surface of the tanks restoring them to their original appearance. DSI executed this project in 5 months to the complete satisfaction of the client.

Cylindrical structures (water tanks, digester tanks, large pipes or dome shells) that require circumferential post-tensioning are the principal applications for the non-fixed coupler M/ME. The tendon anchorage consists of an anchorage block with wedge holes on both sides to accept bare or greased and sheathed strands. The strands actually overlap in the block and use the belt-buckle principle. The ring-tendon is very compact and requires a very small pocket only.
DYWIDAG Multistrand Tendons secure new Interstate Bridge across the Potomac River near Washington, D.C.

Replacement structure for overloaded Woodrow Wilson Bridge on the Interstate I-495/I-95, Washington, D.C., USA

The I-495/I-95 Capital Beltway, one of the busiest east coast interstate highways, is a 103 km stretch of interstate that circles Washington, D.C. At its southernmost point the highway spans the Potomac River via the 44 year old Woodrow Wilson Bridge.

The current traffic of almost 200,000 vehicles per day threatened the capacity of the existing bridge which had been designed for a capacity of 75,000 vehicles per day. In addition to congested lanes, the drawbridge had to be raised about 265 times per year due to its limited clearing height for ship traffic. Therefore the decision was made to replace the old Woodrow Wilson Bridge with two parallel 1,850 m long bridges in each driving direction.

Each of the new bridges will have room to accommodate 6 lanes of traffic plus shoulders and will be 6 m higher than the old bridge. This new total clearance of 21 m will only require the bridge to be raised about 80 times per year based on today’s ship traffic which will allow for 70 percent fewer bridge openings and subsequent traffic interruptions.

This 2.5 billion US Dollar project, which was begun in 2003, also includes the construction of four interchanges in order to provide better traffic flow onto the bridge. The project area is a 12 km corridor beginning in Maryland and connecting to Virginia by the new Potomac River Bridge.

After the initial bid for the bridge came in approximately 75% above the engineer’s estimate, the project was split into three contracts and re-bid.
Contract 3A includes four side by side double leaf bascule spans on each side and 12 cast in place V-shaped legs connected by tie girders. To achieve the required stability all structural elements had to be heavily post-tensioned.

Contract 3B relates to the mostly overland segment from the Virginia shore to the bascule. Contract 3C, the approach from Maryland, is mostly over water. Both contracts together require the construction and post-tensioning of a total of 60 V-shaped bridge piers. The bridges are built using precast segmental construction. The precast elements for the bridge deck and the piers are produced in two precast yards set up on site.

The requirements for the post-tensioning material were extremely strict and incorporated many of the requirements of the Florida Department of Transportation specification such as plastic ducts and field air pressure testing of the tendon systems.

DYWIDAG-Systems International USA supplied the post-tensioning material and related equipment in compliance with the strict quality requirements for all 3 contracts. In addition, DSI provided some unique solutions to construction issues such as radius bent bars. The pre-bent bars allow for easy installation of the bar system through the curved section of the arches and eliminate the sharp bend the bar would experience if straight bars were used.

Another DSI proposal concerned the use of friction-welded transition couplers for the temporary post-tensioning facilitating the connection between the cold-rolled threaded bars installed in the arch base and the DYWIDAG Bars used for the arches. DSI also supplied prefabricated bar and strand tendons for the permanent post-tensioning of the arches.

In spring of 2006 a major milestone was reached with the opening of the outer bridge. The complete crossing is scheduled to open in mid 2008, followed by the demolition of the old Woodrow Wilson Bridge.
DYWI Drill® System secures Trough Structure for Railroad, Reno

The Reno ReTRAC Project in Reno, Nevada, USA

Reno ranks among the US cities with the highest quality of life and the best environment for families. In the past few years the city’s booming economy has also led to a strong increase in rail traffic, in particular in downtown Reno. With the Reno ReTRAC Project (Reno Transportation Rail Access Corridor) the city of Reno wanted to eliminate traffic jams, accidents and emissions at at-grade rail crossings. For this reason, rail traffic was relocated below ground into a 3.3 km long and 10 m deep trough structure along the existing railroad line.

Traffic studies had shown that vehicle delays were expected to more than double from 188 hours to 473 hours per day. In addition, the emissions of vehicles caught up in traffic jams would result in a significant reduction of the local air quality. Furthermore, the exposure of people living along the railroad line to noise would increase by 2.7 db to nearly unacceptable values due to slowly moving trains.

The new trough structure, which is part of a primary East-West Union Pacific rail line, now provides smooth flowing passage directly through the center of downtown Reno on two mainline tracks at speeds of up to 100 km per hour.

The temporary retention of the retaining walls until the permanent walls were in place posed a special technical challenge for this project. Due to the unstable soils which were present throughout the entire project area, casing of the bore holes would have been required in order to install typical soil nails. The use of DYWI Drill® Hollow Bar Anchors was ideally suited for such soil conditions. The DYWI Drill® System used, which simultaneously drills the hollow bar anchors into the earth and fills the created cavity with cement grout, eliminated the need for casing, and helped the shoring contractor to construct a high quality, cost-effective solution that played a large role in maintaining the project schedule.

DSI-LANG supplied more than 390 tons (about 184,000 m) R38 DYWI Drill® Hollow Bar Anchors just in time for this technically complex construction project. The execution was completed within the stipulated schedule to the satisfaction of the owner. The city of Reno has been profiting from this new trough structure since early 2006.
Owner: City of Reno, Nevada, USA
Main Contractor: Granite Construction, USA
Design Team Leader: Parsons, USA
Project Management: Jacobs Engineering Group, USA
Subcontractor for Shoring Contractor: Schnabel Foundation Co., USA

DSI Unit: DSI USA, Business Unit Geotechnical Systems, DSI-LANG, Toughkenamon, PA, USA
DSI Services: Supply of 184,000 m R38 DYWI Drill® Hollow Bolt Anchors
Currently, about 15,000 windmills are operating in Germany producing regenerative energy as an alternative to energy produced from nuclear power. Every third wind wheel in the world rotates in Germany.

The windmill industry employs 45,000 people, has an annual double-digit growth and has an annual turnover of 4 billion Euros. The German steel industry supplies more steel to windmill contractors than to shipbuilders.

Also in the USA windmills for generating electric power are being built at an ever increasing rate. In addition to mechanical engineering problems, the structural engineering problem of anchoring the towers in the soil must be solved. One system uses double concentric rings of vertical bars (about 240 pcs. with lengths varying from 5.5 to 8.0 m) which serve as ground anchors and anchor bolts for the steel towers. The bars vary from \( \varnothing 25 \text{ mm} \) thru \( \varnothing 35 \text{ mm} \) reinforcing steel grade 75 and \( \varnothing 26 \text{ mm} \) thru \( \varnothing 36 \text{ mm} \) prestressing steel grade 150 (St 1030 N/mm²). The bars are cast in a vertical torus formed by concentric corrugated steel pipes 3.05 m to 3.65 m in diameter. This patented system is inexpensive and fast. However, some of these foundations failed and were subsequently repaired using GEWI® Piles. The foundation failed because the wobbling of the windmill towers induced passive compression resistance to the top level soils which were incapable of the loads applied.

Therefore, 12 micropiles using 3 GEWI® Bars \( \varnothing 63.5 \text{ gr} 80 \) (St 700 N/mm²) with a length of 13.7 m each were installed around each windmill. The tops of the bars terminated in a cluster plate which was
embedded in a 1.2 x 1.2 m concrete circular perimeter beam. This beam was dowelled into the corrugated steel pipe. Some of the towers required plumbing (moving to vertical) prior to the micropile repairs. For this purpose, two pile-anchored abutment blocks were concreted near the tower foundation. An HDPE sheathed strand bundle was wrapped around the foundation corrugated steel pipe and each end was inserted into an abutment block. The strand bundles were tensioned by means of two jacks and the tower vertically plumbed.

DSI-LANG provided the bars for the repairs of about 20 windmills and more will be repaired in the course of 2006.
true to its motto “Local Presence – Global Competence” DSi is continuously striving to better serve its customers by shortening its channel to the market. Customers in South and Central Florida will benefit from faster delivery and lower transportation costs and DSi can now provide better and faster services locally.

In early 2004, DSi opened a sales office and warehouse in Sunrise, Florida, North of Miami. As a result of a continuously growing demand for DYWIDAG Monostrand Systems in the area, the sales office and warehouse very quickly reached their capacity limits.

To offer its customers an even more central location DSi decided to start fabricating DYWIDAG Monostrand tendons locally and to strengthen its position in the area by establishing a facility of its own with enlarged offices and increased warehousing and fabrication capacities.

The new plant is located in the city of Davie at the intersection of Interstate Highway 595 and the Florida Turnpike providing easy access to all of south Florida. The region around Miami/Fort Lauderdale is currently experiencing a real construction boom because of the area’s continuously growing population. Currently many new condominiums and parking garages are under construction that are being erected quickly and cost efficiently using cast in place post-tensioned concrete because of its low cost and very short construction time.

The central location of the new monostrand facility opened in November 2005 has enhanced flexibility and optimized DSi Services to the benefit of the construction companies operating in Florida.
New DSI-LANG Bar Facility in Pennsylvania

DSI-LANG GEOTECH announced the opening of a brand new Bar Service Center effective from May 2, 2005

The new facility is located near Philadelphia, PA, next to DSI-LANG’s existing strand anchor manufacturing facility. The new Bar Service Center was built for the specific purpose of quick, efficient and orderly handling of all Geotech bar products. These include bare, SCP, DCP, epoxy coated and galvanized bars, as well as the new DYWI Drill® Bars.

The 16,000 sq.ft. building stocks the Grade 75 and Grade 150 bar sizes in mill lengths along with accompanying hardware and stressing equipment required for a broad range of geotechnical applications. DSI-LANG GEOTECH also stocks DYWIDAG THREADBAR® for anchors, soil nails, micropiles, tie-rods and other special uses.

As part of an ongoing improvement program, DSI’s bar fabricating facility in Fairfield, New Jersey was relocated to the new PA plant.

Visitors and employees at the opening.
The new Penobscot stay cable bridge in Bucksport, Maine, USA, on US Route 1, will replace the old Waldo-Hancock Bridge, a steel suspension bridge, designed by David B. Steinman and opened in 1931. The new stay cable bridge has a main span of 354 m and a total length of 646 m. Installation of the first DYNA Grip® Stay Cables began in September 2005.

To provide for a permanent protection of this first stay cable bridge in the US state of Maine several protection systems were developed and combined in cooperation with DSI USA. In addition, DSI USA supplied a total of four DYWIDAG Form Travellers for the construction of the bridge.

80 stay cables were designed in accordance with the new “cradle system” developed by Figg Bridge Engineers, Inc., Tallahassee, Florida. In the new system the cables are not individually anchored in the pylon, but run through cradles with a defined curvature that are installed into the pylon.

The continuous stay cables run from the bridge deck, through the cradle at the top of the pylon, and back down to the bridge deck in the subsequent span. In addition to significant reductions in material costs and
construction period, the “cradle system” allows the pylon to be very slender and aesthetically appealing.

The stay cables for the new Penobscot bridge consist of 61 to 73-0.6" epoxy-coated strands encased in a common sheathing. Each strand will pass through its own individual stainless steel tube in the cradle assembly, eliminating strand-to-strand interaction in the curved portion of the stay cable caused by shear forces.

The architectural design of the bridge provided for two pylons with centrically arranged stay cables. The stay cables are paired in elevation in the tower, however, they land in different segments on the bridge deck.

The DYNA Grip® Stay Cables have a shorter back span than in the main span. Another feature of the bridge is an asymmetrical curve in one back span.

Due to the asymmetric geometry of the cradles the installation of the 40 cradles into the pylons on site would have been very elaborate. DSI developed a pedestal support system for the complex design that significantly facilitated the installation of the cradles into the pylons. This system integrated all angles and elevations into the fabrication prior to installation into the pylons.

In addition, DSI developed a protection system making it possible to permanently monitor the stay cables. For this purpose, DYNA Grip® Stay Cables are first inserted into hermetically sealed HDPE ducts. During installation warm dry air is first pumped into the stay cable system. Then the HDPE sheathing will be filled with pure nitrogen. The gas will eliminate the presence of all potentially corrosive elements such as oxygen, chlorides and humidity.

Each stay cable contains a small nitrogen gas reservoir that will feed additional pressurized gas at an overpressure of 0.14 bar in the event of a small leak. In addition, gauges will be connected to each stay cable recording fluctuations in pressure and providing a continuous monitoring system.

A sealing cap that forms part of the stay cable anchorage fully encapsulates the entire anchorage system. For the sealing cap of the anchorage a transparent material was used as the end plate which allows direct visual inspection of the anchorage area.

The main challenge was to cost-effectively provide a gas-tight sealed system which on one hand can accommodate the movements and oscillations of a stay cable and on the other hand can withstand the extreme temperature fluctuations occurring in the US state of Maine.

Another monitoring tool used for the Penobscot bridge is the DYNA Force System. It consists of a series of measuring coils fixed to each stay cable. The system can measure readings with an accuracy of +/- 1%. The system is very robust, requires no maintenance and is designed to have a similar service life as the bridge. This will allow the owner to regularly and cost-efficiently monitor the forces in the stay cables as part of the inspection procedures and without considerable expenditure.

Protection of the Penobscot bridge and therefore of the DYNA Grip® Stay Cable System consists of a combination of four safety measures:
- Epoxy resin coated DYNA Grip® Stay Cable Strands,
- HDPE ducts,
- nitrogen gas protection system,
- DYNA Force Monitoring System.

Completion of the new Penobscot bridge is scheduled for late 2006.
Use of DYWIDAG Multistrand Tendons for the Construction of a LNG tank in the Caribbean

*LNG Tank, Point Fortin, Trinidad*

Trinidad-Tobago is a two-island Caribbean state just northeast off the coast of Venezuela. The production and processing of natural gas found in extensive fields deep under the sea level southeast off the island of Tobago takes place on Trinidad. The island state has considerably increased the production of natural gas in the past few years. In 2004 for example, about 83.2 million m³ per day were produced which is twice as much as in 2000. This increase made the construction of a fourth tank for the storage of the cleaned, liquefied gas necessary in Point Fortin where the gas is directed into a natural gas liquefaction plant via pipelines. From Point Fortin the liquid natural gas (LNG) is exported, in particular to the USA and Spain. Also the supply of other Caribbean states with natural gas from Point Fortin has already been initiated.

DYWIDAG International GmbH constructed this fourth LNG tank built in form of a double containment system consisting of an inner steel tank and an outer post-tensioned concrete tank with a domed steel roof. The hollow space between the two tanks serves as an insulator. With a diameter of 90 m, the tank has a capacity of 160,000 m³. DSI USA supplied horizontal 19x0.6" DYWIDAG Multistrand Tendons for the post-tensioning of the bottom ring, the tank wall and the top ring of the outer concrete casing.

LNG tanks must be built of materials that are designed to resist extremely low liquefied natural gas temperatures of at least -161°C. Previous tests, done by DSI Munich, had already proven the cryogenic suitability of the 19x0.6" DYWIDAG Multiplane Anchorages. Continuous qualification tests on site also certified the adequate cryogenic behavior of the installed strand. DYWIDAG International GmbH did its own tendon installation and stressing with equipment supplied by DSI USA.

DSI USA also supplied cryogenic and regular 28 mm GEWI® Bars and couplers to close temporary openings in the outer tank wall used as access for the construction of the inner steel tank. The fourth LNG tank in Point Fortin was completed on schedule in spring 2006.
Construction of the First Stay Cable Bridge in Puerto Rico

Bridge over the La Plata River, Naranjito, Toa Alta, Puerto Rico

Naranjito (Spanish for “small orange”), a city in the middle of the island of Puerto Rico that got its name from the many orange trees in the town center, is pleased with the new bridge over the La Plata river. The bridge is 320 m long, with spans of 80 m + 160 m + 80 m and a deck width of 30.2 m, making it one of the largest bridge construction projects in Puerto Rico.

The construction of this bridge was associated with many challenges. Extreme climatic conditions and heavy rains during the rainy season affected the construction schedule. For the construction of this stay cable bridge a new construction method, new to Puerto Rico, was used for both the towers and the superstructure.

The main bridge consists of two diamond-shaped towers and a bridge deck with two edge girders and transverse floor beams. The bridge deck was built using the free cantilever construction method. For this purpose, two sets of DYWIDAG Form Travellers and DYWIDAG Multistrand Tendons were employed. In addition, DSI USA was responsible for providing the assembly, disassembly and the shifting of the DYWIDAG Form Travellers between the pylons.

The 96 DYNA Bond® stay cables were preassembled on the bridge deck. They consist of 19x0.6" and 37x0.6" individually waxed and sheathed strands grouted inside a common PE pipe. For installation into the DYNA Bond® Anchorages the strands were cut to the required length and the PE sheathing was removed from their ends. The stay cables were lifted by a crane, fixed at the pylon, temporarily attached to the form traveller and tensioned. After curing of the concrete of the bridge deck, the stay cable force was transferred to the DYNA Bond® Anchorage already installed in the deck. After adjustment of the transfer forces, the anchorage was grouted.

DSI’s extensive services for this project included the rental of DYWIDAG Form Travellers, the supply of DYWIDAG Multistrand Tendons and of the complete DYNA Bond® Stay Cable System.

Owner: Highway and Transportation Authority, Puerto Rico
Main Contractor: Las Piedras Construction Corp., Las Piedras, Puerto Rico
Architect: CSA Architects and Engineers, San Juan, Puerto Rico
Consulting Engineers: HNTB, New York, NY, USA

DSI Unit: DSI USA, Business Unit Post-Tensioning, USA
DSI Services: Supply of: 162 t of waxed and sheathed strand for 96 stay cables, ranging from 19 t 37x0.6", 153 t of 0.6" strand for the pier and tower struts (43 tendons 19-0.6"), floor beams (110 tendons 19x0.6"), edge girders (42 tendons 9x0.6") and longitudinal deck tendons (116 tendons 4x0.6"). 22 tons of 36mm DYWIDAG Threadbars St 835/1030 for 776 bar tendons in the towers.
Innovative solution using pre-grouted THREADBAR® in Australia

Once again DSI has introduced technology and know-how to improve the design life of bridges in Australia.

Throughout the eastern seaboard states of Australia typical regional bridge construction consisted of reinforced concrete decks with in-situ concrete and asphalt overlays, however a recent revision to the bridge design code has resulted in a re-evaluation of all bridges throughout the country.

Current designs utilize pre-stressed concrete planks with transverse post-tensioning bars, however the construction methodology diminish the lifetime of the transverse bars and limit the amount of pre-stress applied. Simply the transverse bars substitute the need for a reinforced concrete deck, however with no deck in place (asphalt only) the joints between the planks act as a passage for moisture/water to work its way through the grouted joints and ultimately affect the performance of the bar.

To overcome this DSI Australia has been working closely with the RTA and contractors to develop an economical solution.

The solution was to integrate DSI’s geotechnical know-how into a structural application and as a result the Company developed a double corrosion protected THREADBAR® for transverse post-tensioning. The system is a design using pre-grouted bars in a PVC corrugated sheath with a PVC smooth sheath over the entire length of the bar. End anchorage connections consist of an anchor nut and bearing plate with a guide pipe welded to provide a tight seal to the sheath ends.
Caps are also provided for additional corrosion protection.

The benefits of the system enabled the contractors to fully grout the precast plank joints including all voids in and around the pre-grouted transverse bars, stress the bars without any secondary grouting operation thereby providing a simplified construction method and long term corrosion protection.

DSI Australia has now successfully integrated the system into 4 bridges for the RTA in NSW and was recently recognized by Queensland Main Roads (QMR) for their bridge replacement program.

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**Owner** Roads and Traffic Authority (RTA), NSW, Australia

**Contractors** Nelmac Pty Ltd., Yackandandah, Victoria, Australia; Fernandes Constructions Pty Ltd., Denman, NSW, Australia

**Consulting Engineers** Sinclair Knight Merz Pty Ltd., Sydney, NSW, Australia

**DSI Unit** DYWIDAG-Systems International Pty Ltd., NSW, Australia

**DSI Services** Supply of pre-grouted 36mm THREADBAR® System; Expertise and equipment
DSI provides Wambo Mine with Roof Support Products, NSW, Australia

The Wambo coal mine located about 190 km north of Sydney in the heart of the Hunter Valley was operated as an open cut mine for a very long time. It is currently Excel’s (an Australian company) largest operating mine. The open cut mining operations at Wambo are contracted to Roche Mining, a subsidiary of Downer EDI Limited. Excel refines the coal into a diverse range of products and sells them to major customers at home and abroad.

In particular coal from the Wambo mine has gained wide market acceptance due to its quality and consistency. For more than 20 years Wambo’s long term customers include major Japanese power utilities.

In the course of the Wambo mine extension started in February 2004 shafts are driven into the subsoil to gain access to lower, unmined coal seams that are to be mined in longwall mining operations.

To provide the Wambo mine with any and all mining products required the operator entered into a life-time mining services contract with DSI Australia. The contract provides for the supply of high-quality DSI Mining Products for the coal mine such as rock bolts, anchors, resin cartridges for as long as coal is being mined in the Wambo coal mine. In addition, the operator of the coal mine profits from the close vicinity to DSI Australia and its extensive customer consulting and services. The DSI Mining Products primarily serves to secure the driving work and the mining areas at economic costs.

Owner Excel Coal Ltd., Sydney, NSW, Australia
DSI Unit DYWIDAG-Systems International Pty Ltd., NSW, Australia
DSI Services Contract for supplying the entire product line of mining products such as rock bolts including accessories to the Wambo coal mine
New Delivery Contract for the Ashton Coal Mine in New South Wales, Australia

Ashton Coal Operations Limited with its headquarters in Camberwell, New South Wales, Australia, began with the development of the new Ashton coal mine in September 2003. Due to its extensive experience with similar projects, White Mining Limited (WML) based in Sydney, Australia, was awarded the contract for the development of the complete Ashton Coal Mine Project.

Following the commencement of the development and construction works in September 2003, the open cut mining operations began in early 2004. In a further step, mining operations commenced in the new underground Ashton coal mine in 2005.

The new coal mine is located about 14 km northwest of Singleton and includes:
- an open cut coal mine,
- an underground coal mine,
- a coal handling and preparation plant, and
- a rail siding for removing the mined coal.

DSI Australia will supply any products such as rock bolts, anchors, resin cartridges including accessories required for securing the driving work at the underground coal mine. For this purpose, Ashton Coal Operations Limited entered into a life-time mining services contract with DSI Australia. The contract provides for the supply of high-quality and innovative DSI Mining Products for the coal mine for as long as coal is being mined in the Ashton coal mine. In addition, DSI with its headquarters in Bennetts Green, NSW, will also supply new products designed for monitoring the mining operations.
Derek Hird, the National Sales and Marketing Manager of DSI Australia was awarded the NSW Young Exporter of the Year

Winning the NSW Regional Exporter of the Year makes DSI Australia now eligible for the Australian Export Awards which will be conducted in December 2005.

Derek Hird, the National Sales and Marketing Manager was awarded the NSW Young Exporter of the Year for outstanding export achievement by an individual aged 35 years or under, in any industry sector, for the export of goods or services. To win this award the individual must have made an exceptional contribution to the development and management of export sales.
DSI Australia records significant Increase in Export Activities for Mining Products

DSI Australia exported mining products worth more than 20 million Australian dollars in 2005!

YWIDAG-Systems International (DSI) is Australia’s market leader in the production and distribution of mining products and systems. The range of products essentially includes friction bolts, rock bolts, multistrand anchors, resin rock bolts, reinforcement mats, anchor rods and drill bits. These high-quality DSI Products are primarily used for securing the driving work at underground mines.

In 2005 DSI Australia exported mining products and systems worth more than 20 million Australian dollars. This success is mainly based on two pillars: On one hand, DSI Products are distributed via a network of worldwide operating DSI Companies in countries such as the USA, Canada, United Kingdom and Germany. On the other hand, DSI Australia exports a substantial number of products and systems directly to mines in countries such as Indonesia, New Zealand, Papua-New Guinea, Turkey and Norway.

In the past five years what had already been a high export volume was increased by more than 400%. DSI Australia’s favorable overall development is based on a strong market position in its home country on one hand and on long-term customer relationships with the predominately internationally oriented mining industry on the other hand.

Some of DSI Australia’s long-term customer relationships and supply contracts with mining companies date back to its roots in the year 1970. More than 35 years of profound experience in the mining industry and the related Know-how gained during this period are the foundation blocks on which DSI Australia will continue to build and enhance its growth rate in the future.

In this connection, three important entrepreneurial principles are significant:

- DSI endeavors to have frank and open long-term partnerships with its customers. Based on such customer relationships existing DSI Products are often individually modified to meet specific requirements in mining operations.
- A second important factor in its successful market operations is DSI’s continuous close cooperation with its suppliers. Consistent with the motto “the whole is more than the sum of its parts” DSI Australia actively integrates its suppliers into a continuous quality assurance and improvement process.
- Last but not least, intensive research and development work carried out at in-house R&D departments is equally important for the continuing development of existing products and for developing new and innovative mining products to serve the changing needs of its customers.
Development of a new “Single Pass” Rock Bolt

New product developments of the R&D department, DSI Mining, Australia

An important task of DSI Australia as the worldwide competence center for mining products is the development of new products. One of the newest developments made by the DSI Research and Development Department in Australia is a new single pass, tubular bolt known as the ‘SP Bolt’.

“Single pass” means that this newly developed bolt is completely installed in only one step. First successful tests with the SP Bolt were carried out at Mount Magnet Gold Mine in Western Australia. Further tests were also successfully performed in various mines.

The SP Bolt has an ultimate tensile strength of 18 tonnes. It can be quickly and easily installed in high tunnel roofs, eliminating the need for operators to work at heights. A resin cartridge is placed inside the bolt prior to installation, protecting the cartridge from damage, even in holes drilled through fibre reinforced shotcrete.

The SP Bolt is easily handled: The bolt is first connected onto a dolly mounted on a drill rig drifter. The drifter is then raised partially inserting the bolt into a pre-drilled hole and then water pressure is applied to the inside of the bolt via the dolly. During water pressure application the resin cartridge inside the bolt is pushed out of the tube and into the drilled hole. After ejection of the resin out of the bolt, the water pressure builds up inside the bolt, until the dolly relief valve starts relieving the water as a very obvious misty spray. The misty spray acts as an indicator to the operator to turn the water off. The operator then spins and pushes the bolt into the hole, thereby mixing the resin cartridge. The resin is then allowed to set, and the bolt is firmly anchored.

With this SP bolt DSI Mining Division has developed another product that has significant potential. In particular operators of hard rock mines are moving from mechanical to resin anchored bolts to improve the ground support efficiency.
Solution to Stress Corrosion Cracking of Roof bolts

Representatives from the mining industry and Queensland University meet at DSI Newcastle, Australia

Underground coal mines in Australia rely extensively on effective ground control through the use of resin-grouted roof bolts. This technology was developed over many years and proved to be very successful. However, in recent years it has been recognized that bolts in some areas fail due to stress corrosion cracking (SCC).

SCC is a progressive fracture mechanism, which can occur in different metals. It is not a new phenomenon and has been found in Bronze Age swords and in brass ammunition used in India in the last century. However, the effect of SCC on roof bolt failure has only been recognised in recent years.

Despite the fact that a relatively small number of bolts fail this way affecting only some mines in specific areas, DSI decided to investigate the problem in order to come up with a solution.

In order to learn more about the problem, a collaborative project was established between the University of Queensland (Australia) recognized corrosion and metallurgical experts and DSI.

This three-year project was started in the year 2000. It successfully developed a laboratory testing procedure, under which SCC failure was artificially induced so the required conditions for SCC could be identified. As a result, it is now possible to test the susceptibility of various steels used to manufacture roof bolts.

At the same time, the specific conditions of areas where bolt failures occurred were investigated by a mining industry funded project (ACARP). This study identified that the presence of mildly corrosive ground water may encourage the development of SCC.

A further feature of the site data base development was a small-scale investigation into bacterial corrosion. This investigation did confirm that iron and sulphur eating bacteria were present at least in the one mine investigated.

So far, it has been found that the most economical measure to combat the problem of SCC is finding a suitable grade of steel rather than applying any protective coating to the bolts. Therefore a second project was established with the University of Queensland, under which susceptibility of various steel grades will be investigated in order to come up with a metallurgical solution to this problem.

This project is now industry supported by DSI, Australian steel suppliers as well as other roof bolt manufacturers.
Black Empowerment business activities in South Africa

Gwendolyn Mahuma - managing director of DSI-Mandirk met Thabo Mbeki - President of South Africa

Black Empowerment business activities are becoming more and more important in South Africa. Anglo Zimele – the Small - Medium Enterprise business development initiative of Anglo American – supports Black Empowerment business activities in South Africa. To showcase their activities for Black Empowerment business Anglo Zimele organized an exhibition that was held on the 22nd of July in Sandton, Johannesburg.

DSI-Mandirk was one of the Black Empowerment companies that participated in this exhibition.

The exhibition was very successful and Thabo Mbeki, the president of South Africa, accompanied by the Minister of Minerals and Energy, the Minister of Communications and his legal adviser visited the exhibition on July 22nd, 2005. To emphasize the importance of this event Anglo American was represented by most of their senior executives.

In the course of the exhibition Gwendolyn Mahuma, managing director of DSI-Mandirk, presented a special edition brochure signed by the entrepreneurs to Thabo Mbeki, the President of South Africa as an expression of their gratitude to the president for being part of this momentous occasion.

* "Black Empowerment", a program initiated by the Republic of South Africa to rectify the economic injustices created by apartheid, describes the aggressive promotion of black entrepreneurship.
DSI-Thiessen trains Personnel at the HBM&S Chisel North Mine, Canada

DSI-Thiessen was awarded the exclusive contract for the supply of all ground support products to Hudson Bay Mining & Smelting in Flin Flon and Snow Lake for a five-year term.

An important criterion for the contract negotiations was the excellent customer service provided by DSI-Thiessen to local mines. As part of this excellent customer service, Grant Powell and Floyd Wudrick – both from DSI-Thiessen – recently were on site training HBM&S mine personnel on recommended installation procedures for resin/rebar systems for expanding mines.

In addition, underground pull tests on already installed anchors and reinforcement systems were performed on the occasion of said training. Within the framework of the continuous customer service DSI-Thiessen is planning further activities.

DSI attaches great importance to dedicated commitment in the field of customer service. Customer service is the basis for a continuous exchange of experience. This exchange often results in important impulses for the further development of existing products or for the new development of products respectively.

At the same time this service is an important investment for DSI to establish a long-term partnership between DSI and mining companies. Satisfied customers are the best reference!
The City of Atlanta has been extensively upgrading its sewer and water supply systems for the past few years.

Within the framework of these construction projects DSI Ground Support, Salt Lake City, is involved in supplying three of these projects: Nancy Creek, Atlanta CSO and Custer Avenue CSO.

The combined sewer overflow project at Custer Avenue began construction in August 2005 and was carried out by Gunther Nash (a subsidiary of the Alberici Group) under a design build contract. Its completion is expected for early 2007.

The following underground excavation components are part of the work:

- Access shaft – a 40 m deep shaft with an inside diameter of about 5 m to be used for tunnel construction and access to the storage facility during its lifetime,
- Storage facility – a 183 m long arched chamber with a nominal span of 18 m and a height of 17 m,
- Connecting tunnels – short 4.5 m span horseshoe shaped tunnels,
- Ventilation shaft – required for providing fresh air to the storage facility.

First application of DCP-Bolts in America

Custer Avenue Combined Sewer Outflow – Construction of a Storage & Dechlorination Facility in Atlanta, Georgia, USA
SEM (sequential excavation method) is being used to drive the tunnels. Normal drill, blast and muck operations is followed by rock reinforcement with support elements such as welded wire mesh, steel lattice girders, rock dowels, spiles and shotcrete.

Within the scope of this construction project DSI Ground Support supplies products for stabilizing the tunnel such as welded wire mesh, friction bolts, 32 mm hollow bars, THREADBAR®, double corrosion protection bolts (DCP Bolts) and hardware accessories such as plates, nuts, couplers, resin.

The highlight of this project is the use of DYWIDAG DCP Bolts for the first time in the Americas. For this job site a total of 3,000 DCP Bolts in varying lengths from 1.5 m to 6 m were required. All products were delivered by DSI Ground Support, Salt Lake City, just in time.

In addition to these supplies DSI Ground Support provided technical support including bolt installation and grouting, pull test training and miner certification.
DSI opens new Facility for Mining Products in Pennsylvania’s Appalachian Mountains

*Extension of the production capacities for mining products in Blairsville, PA, USA*

The coal basin in the Appalachian Mountains has always been one of the most important American and worldwide regions for coal production. Concurrent with the European hard coal deposits, the carbonaceous layers were deposited there 300 million years ago. Based on the regional geological structures and their stratigraphy, the region is historically divided in three areas: the northern region includes Western Pennsylvania, Eastern Ohio, Western Maryland and North-Western Virginia. The central region comprises the largest part of West Virginia, Eastern Kentucky, Northern Tennessee and South-Western Virginia. The southern region reaches from Southern Tennessee via Northern Alabama to North-Western Georgia. Currently about 60 of approximately 100 known coal seams in the Appalachian Mountains are mined. The northern region has always had the largest portion of the coal production, with the Pittsburgh seam being one of the most important deposits. Approximately 420 million tons were produced in the northern region in 1998. The coal produced in the Appalachian Mountains is primarily used to generate electricity. However, it is also partly used for metallurgic purposes such as the production of coke.

In the 1970s the demand for coal rapidly decreased worldwide. As a consequence, many mines in the Appalachian Mountains closed and workers moved away.

Due to the highly increased oil and gas prices at the beginning of the 21st century, the relatively cost-effective coal became interesting again as a source of relatively inexpensive energy. Hence, the coal producing regions in the Appalachian Mountains are currently experiencing a genuine comeback. The demand for coal in the USA has reached new record heights, since more than half of the American current energy demand is covered by coal. To satisfy the further increasing electric power consumption in the USA—an increase by 40% is expected by 2025—the construction of 120 coal powered electric power stations all over America has already been proposed. Another major purchaser of coal products is the worldwide booming steel industry.

The growing demand for coal also leads to an increasing demand for mining products since additional coal seams and mines must be developed. Furthermore, existing mines must be modernized and
shafts newly buttressed and reinforced. Since the price of coal nearly doubled in the past two years, the mine operators are in a position to make investments again and also create new jobs. Hence, one of the oldest industries in the world is playing an important role once again in the energy supply sector.

Although the main production sites for coal are situated in the Rocky Mountains and in states such as Wyoming, Montana and Colorado and the Appalachian coal generally has a higher sulphur content, mining in the Appalachian Mountains is also accelerated due to the shorter and therefore more cost-efficient transport routes to the densely populated urban centers in the Eastern US. In addition to the noteworthy coal deposits in the Appalachian Mountains, limestone and salt are mined in that region.

DSI has been represented in Johnstown, Pennsylvania with a warehouse and sales office for mining products since the summer of 2004. Johnstown is located within the region of the Pittsburgh coal seams. The DSI motto is to be as close to its customers as possible to supply its mining products to the mines just in time and at low transport cost.

Therefore, DSI opened a new facility for the production of mining products in Blairsville near Johnstown in early 2006. The existing warehouse and sales office was also transferred from Johnstown to Blairsville. The new production facility is located in close proximity to the large coal mines in Pennsylvania, Maryland and in North-West Virginia. The limestone mines in Pennsylvania and in North-West Virginia can be reached in less than 3 hours drive, and the salt mines in Ohio and New York are only 400 km away. Thus a large number of mines that use DSI Mining Products are located in close vicinity to the new facility. Also a major and continuous purchaser of DSI Mining Products in Kentucky can now be supplied with high-quality DSI Products faster and more cost-efficiently.

The complete product range including rock bolts, cable bolt anchors and anchor plates is produced in Blairsville and directly supplied to the mines together with geotextiles and resin injection cartridges. In particular the newly developed and produced DSI “100 kip Bar Truss System” shows excellent success when used in underground coal mining. The simple design of the “Bar Truss System” eliminates many small parts common with other similar truss systems.

The DSI Truss offers the advantage that the assembly of the few individual parts of the “Bar Truss System” under unsupported roof and rib conditions is very simple, significantly increasing the operator’s safety.

Another advantage of the “Bar Truss System” that immensely enhances safety during the mining work is the possibility to visually inspect the system at any time.

In more than 220 years, the coal seams around Pittsburgh have yielded more coal than any other mining region in the USA. DSI is proud to provide mines in that important coal production region in the USA with DSI Mining Products by the shortest possible route.
With its Missouri based mines Doe Run Corporation is one of the largest producers of lead in the world. One of these mines, the Brushy Creek Mine, was awarded the prestigious “National Safety Award” in August 2005 for its outstanding safety performance during 2004.

The recovery of pillars may result in extensive rock falls in mines. These rock falls increase ore dilution, loss of ore and compromise safety for miners and mucking equipment.

Doe Run Corporation opted for the use of cable bolts and turned to DSI to help them design a system of cable bolts that can allow them to safely and more profitably mine the pillars. DSI through its technical services in North America helped specify and design the system that is being put in place today.

Following numerous tests the system has been fully operational since September 2005 and is also being tested at Doe Run’s Buick mine. If the system meets the high requirements in both mines, there will be widespread usage of it in other mines as well.
Application of Tekflex in the EKATI Diamond Mine at BHP Billiton Diamonds Inc., Canada

The EKATI Diamond Mine is Canada's first surface and underground diamond mine. BHP Billiton Diamonds Inc. is the mine operator. The EKATI Diamond Mine is located in a remote Arctic tundra region near Lac de Gras lake in the Northwest Territories, approximately 200 km South of the Arctic Circle, approximately 300 km Northeast of Yellowknife, capital of the Northwest Territories, and 100 km North of the tree line, in an area of continuous permafrost.

Access to the EKATI Diamond Mine is by air only, except during a three-month period in winter, when a 400 km long ice road allows for the trucking of bulk supplies to the site.

DSI-Thiessen’s Floyd Wudrick was underground at EKATI mine and saw BHP’s newly excavated Wash Bay, Service Bay and Lube Bay. BHP engineers were just looking for a cost effective solution to provide area support for all three sites with an overall area of approximately 2,000 m². The engineers had considered shotcreting the entire area, however, the bagged shotcrete would have to be flown to site and transported underground with considerable expenditure. It also would have taken many weeks to apply the shotcrete. In addition, ground conditions did not necessarily warrant the application of shotcrete. Floyd Wudrick presented the idea of using Tekflex and BHP’s engineers agreed to try the product.

Floyd Wudrick and Grant Powell flew to site to assist the contractor, Procon Mining & Tunnelling, with the application of that material. Everyone involved was impressed with the speed of application carried out by the two DSI-Thiessen employees. In fact, BHP’s engineers immediately saw the potential for the product and have recently completed supporting four transfer stations in their Panda Conveyor Ramp as well as miscellaneous substations and refuge stations.

Description
Tekflex White is a premium strata support membrane spray material that was specifically developed in response to customer demand. It has flexibility, high tensile strength and excellent adhesive qualities. The product enhances the structural integrity of rock and forms an impervious barrier, which eliminates the degrading effects of weathering. Material coverage at a thickness of 42 mm varies from 0.11 to 0.25 m² per liter, depending on the roughness of the rock surface. Tekflex White achieves the strength of metal screen in approximately 8 hours.
ITA-AITES World Tunnel Congress, Istanbul, Turkey

May 7-12, 2005

International technical congresses and conferences provide the optimum platform for DSI to present its products and systems to an expert audience on one hand and to maintain continuous contact to its international customers on the other hand.

For this reason, DSI once again participated in the World Tunnel Congress 2005. A total of 853 exhibitors from 43 countries participated in that international congress.

Within the framework of the international conference, an exhibition took place concurrent with the congress where 39 international exhibitors presented themselves to the participants of the congress. DSI presented products from the fields of geotechnical systems and tunneling and provided updated product documentation and information to the interested expert audience. The participation in the exhibition on the occasion of the World Tunnel Congress 2005 was a huge success. Therefore, DSI will also be present at the World Tunnel Congress 2006 that will take place in Seoul, Korea.

4th IUT Hagerbach in Sargans, Switzerland

September 14-15, 2005

The IUT (“Innovation in Underground Construction and Tunneling”) is a live underground fair that takes place inside the full scale demonstration tunnel in Hagerbach every three years. Nearly 100 companies presented their underground construction products within that extraordinary framework. Parallel to the trade show a congress was organized in which recognized European mining experts met.

DSI presented products from the fields of geotechnical systems and tunneling in an 18 m² large booth. In addition to the DSI Products DYWi Drill® Hollow Bar Anchors, Omega® Bolts, Single Bar and Strand Anchors, Rock Bolts and Soil Nails, exhibits of SpannStahl AG were presented.
“World Mining Congress”, Tehran, Iran
November 7-11, 2005

The beginnings of the “World Mining Congress” (WMC) date back to the year 1958 when Prof. Boleslaw Krupiński – a famous Polish scientist and mining engineer – organized the first congress in Warsaw, Poland. Today the WMC is the largest international mining congress in the world.

A total of 319 international exhibitors from 19 countries participated in the concurrent exhibition. DYWIDAG-Systems International participated in the WMC with a booth of its own for the very first time in 2005. More than 30,000 interested visitors learned about high-quality mining products and systems at the DSI Booth. The visitors showed great interest in the new and innovative DSI Products that are produced and distributed in DSI Facilities around the world.

The next “World Mining Congress” takes place in Poland in 2008 on the occasion of the Congress’s 50th anniversary.

BIG5 2005, Dubai, United Arab Emirates
November 16-20, 2005

In 2005 DSI’s Form Tie System Business Unit participated in the BIG5 trade show for the very first time. The quality of the trade show contacts was extremely good and the technical audience was particularly interested in high quality form ties and extensive system accessories. Due to the positive business contacts established, DSI is planning to participate in the BIG5 trade show in 2006 again that will also take place in Dubai from October 28 to November 1, 2006.
Participants from Hong Kong, India, Indonesia, Japan, Singapore and Taiwan discussed their regional markets, while DSI Munich participants made presentations concerning the centralized Technical Service department Quality Management, Purchasing and Logistics.

The present situation in the individual regional markets was jointly discussed and objectives defined to continue the generation of sustained growth for the DSI Group.

The dialogue between the participants significantly enhanced the team spirit among the Asian DSI Companies, Licensees and the Central Headquarters.

Once more it became clear that the joint appearance as a “DSI Family” worldwide is of considerable importance. For “the whole is more than the sum of its parts”.

From June 14th to June 16th, 2005 representatives of the DSI Companies and Licensees from the Asia-Pacific Region met in Munich.

On May 21, 2005 the Super 12 Rugby Semi Final was held in Sydney at the „Aussie Stadium“.

The New South Wales Waratahs beat the Bulls (South Australia) 23-13 and advanced to the final against the Crusaders in Christchurch (Crusaders were winners).

A very special guest joined this special sporting event: The new DSI Mascot – “The Marmot“.

Through this appearance the DSI Mascot, exclusively designed for DSI, was able to show its local and worldwide presence.

DSI-Marmots are everywhere...

DSI Baseball hats featured in rowing at the Regatta in Munich

From May 7-8, 2005 the first International DRV Junior Regatta of the 2005 season took place on the Munich Olympic course in Oberschleissheim. As in every year, numerous rowing clubs met at this regatta to pit their strength and skills against each other in all boat classes.

This year one of the 5 German junior men’s coxed fours (JM4+) was equipped with DSI Baseball hats. The heat was convincingly won by the “DSI Boat” with Sebastian Kasielke (RCM at SC Magdeburg e.V.), Christoph Zimmermann (Hallesche Rvg Bollberg von 1884 e.V.), Enrico Stapel (Berliner RC Ägir e.V.), Tim Laube (Vegesacker RV e.V.) and cox Ben-Jack Dreese (Potsdamer RG e.V.).

A few hours after the successful heat the DSI boat was at the start again to take part in the final on the 2,000 m long regatta course. The air was charged with excitement when the much anticipated start signal was given. During the first 500 m the boat was slightly laying behind the leading British boat. But at the 1,000 m mark the DSI team had already caught up with the British team and went slightly into the lead. The boat finished first with a lead of more than one boat length. Two additional German boats finished second and third.

Christoph Zimmermann, Enrico Stapel and Tim Laube together with 6 further sports friends also won the men’s coxed eights rowing final with a convincing performance.

We congratulate the DSI Baseball hat team on these excellent results and we are looking forward to the forthcoming competition season.
Local Presence – Global Competence –
the challenge posed by foreign countries

Lecture given by Dr. Christian Scheld at the Technical University of Braunschweig, Germany

On November 27, 2004 the annual Graduation Day for civil engineers and civil engineers in economics took place at the Technical University of Braunschweig, one of the most renowned civil engineering universities in German-speaking countries. Within the framework of that event Dr. Christian Scheld from DSI Group Headquarter Operations gave a lecture before 700 invited guests.

Currently civil engineering graduates face difficult economic conditions in Germany. Therefore, the objective of the lecture was to encourage the graduates and demonstrate to them how a company can successfully grow even in such difficult times. Using DSI as an example, Dr. Scheld explained how disproportionate growth can be consistently achieved by means of a clearly defined corporate strategy and the marketing of innovative products and services.

In particular, the presentation of DSI as an international company showed the graduates that foreign countries pose both great challenges and great opportunities.

With his lecture Dr. Scheld pointed out to the Graduation Day audience that the DSI slogan “Local Presence – Global Competence” when systematically put into practice becomes a significant success factor in these difficult times for the German construction industry.

Dr. Scheld’s lecture was very positively received by the guests.

Acquisition of Artéon in France

On 15 September 2005 DSI acquired 100% of the shares in Artéon SA from the private equity firm, Halifax Industrial

Artéon, founded in 1964, has established an extensive nationwide sales network in France. Based on intensive sales activities in connection with local presence Artéon has established itself as the market leader in form tie systems. In addition, Artéon has a very good reputation for post-tensioning systems and geotechnical products. Another important business segment is the supply of lifting systems for transporting precast concrete elements.

The acquisition of Artéon is a further step in strengthening DSI’s market position in France and establishing the Company’s market leadership for geotechnical and form tie systems in Europe. Furthermore, the joint economic power of DSI and Artéon offers possibilities to utilize synergy effects with regard to purchasing, logistics and marketing.

Based on the strong support of all Artéon and DSI employees and the Know-how available in both companies, the Company’s future business development is quite positive. The joint market operations have been handled by DSI-Artéon SA beginning on January 1, 2006.

DSI Fairs & Exhibitions 2006 – 2007

ExpoMin
► Santiago, Chile, May 23-27, 2006

XIII. Danube-European Conference on Geotechnical Engineering
► Ljubljana, Slovenia, May 29-31, 2006

fib-Congress
► Naples, Italy, June 05-08, 2006

5th International Congress on Environmental Geotechnics
► Cardiff (Wales), Great Britain, June 26-30, 2006

Hydro Vision 2006
► Portland (Oregon), USA, July 31 - August 04, 2006

Electra Mining Africa 2006
► Johannesburg, South Africa, September 11-15, 2006

29. Baugrundtagung
► Bremen, Germany, September 27-30, 2006

The BIG5 Show 2006
► Dubai, United Arab Emirates, October 28 - November 01, 2006

Bauma
► Munich, Germany, April 23-29, 2007

AIMEX
► Sydney, Australia, September 04-07, 2007
László Palotás Medal to Dr. Andor Windisch

On 12 December 2005 Dr. Andor Windisch, long-term employee of DSI GmbH, was awarded the László Palotás Medal during a ceremonial act at the Technical and Economic University of Budapest.

Dr. Windisch was awarded the László Palotás Medal of the national Hungarian fib (fédération internationale du béton) group for his extraordinary commitment for and merits in the research in, teaching and further development of concrete construction.

This medal, which was already awarded for the 6th time this year, is presented to two persons - one from Hungary and one from abroad - of outstanding merit in the field of concrete construction.

László Palotás (1905-1993), member of the Hungarian Scientific Academy and professor for concrete construction and building material science at the Technical University of Budapest until 1968, significantly advanced the reconstruction of bridges in Budapest and Hungary and the construction of the underground system in Budapest. He also was a founding member of CEB (Comité Euro-International du Béton). In 1998 fib (fédération internationale du béton) was created by the merger of CEB and FIP (Fédération Internationale de la Précontrainte).

We extend our warmest congratulations to Dr. Windisch on this award.

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DSI acquires 100 percent of DSI-LANG GEOTECH, LLC, PA

Early in 2004 DYWIDAG-Systems International (DSI) merged its own geotechnical activities in North - and Central America with Lang Tendons Inc.

On April 1st, 2004, the new entity, DSI-LANG GEOTECH, LLC., was launched to market the pooled geotechnical products and services to their customers. DSI-LANG, headquartered in Toughkenamon, PA, and was jointly managed by Co CEO’s Christopher Lang and Kerry Allen.

The specialty of DSI-LANG is the fabrication and supply of a comprehensive range of geotechnical products to foundation and geotechnical contractors. The Company’s most important objective is to always provide quality engineered construction products and the highest level of service to its customers in the Geotech and Foundation industries.

Thanks to the unwavering commitment and dedication of Christopher and Kerry DSI-LANG is now the leading provider of geotechnical systems and products in the USA.

On February 1st, 2006, Christopher Lang sold all of his remaining shares to DSI and has retired in order to pursue other interests.

DSI thanks Christopher for his undivided commitment and his strong and very successful efforts to establish DSI-LANG GEOTECH, LLC, successfully in the market. We wish him all the best for his future.

Customers will not be affected by this change as DSI-LANG will continue to provide the same quality products and high-level service as in the past.
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