

DYWIDAG-SYSTEMS INTERNATIONAL



Geotechnics



Global Services



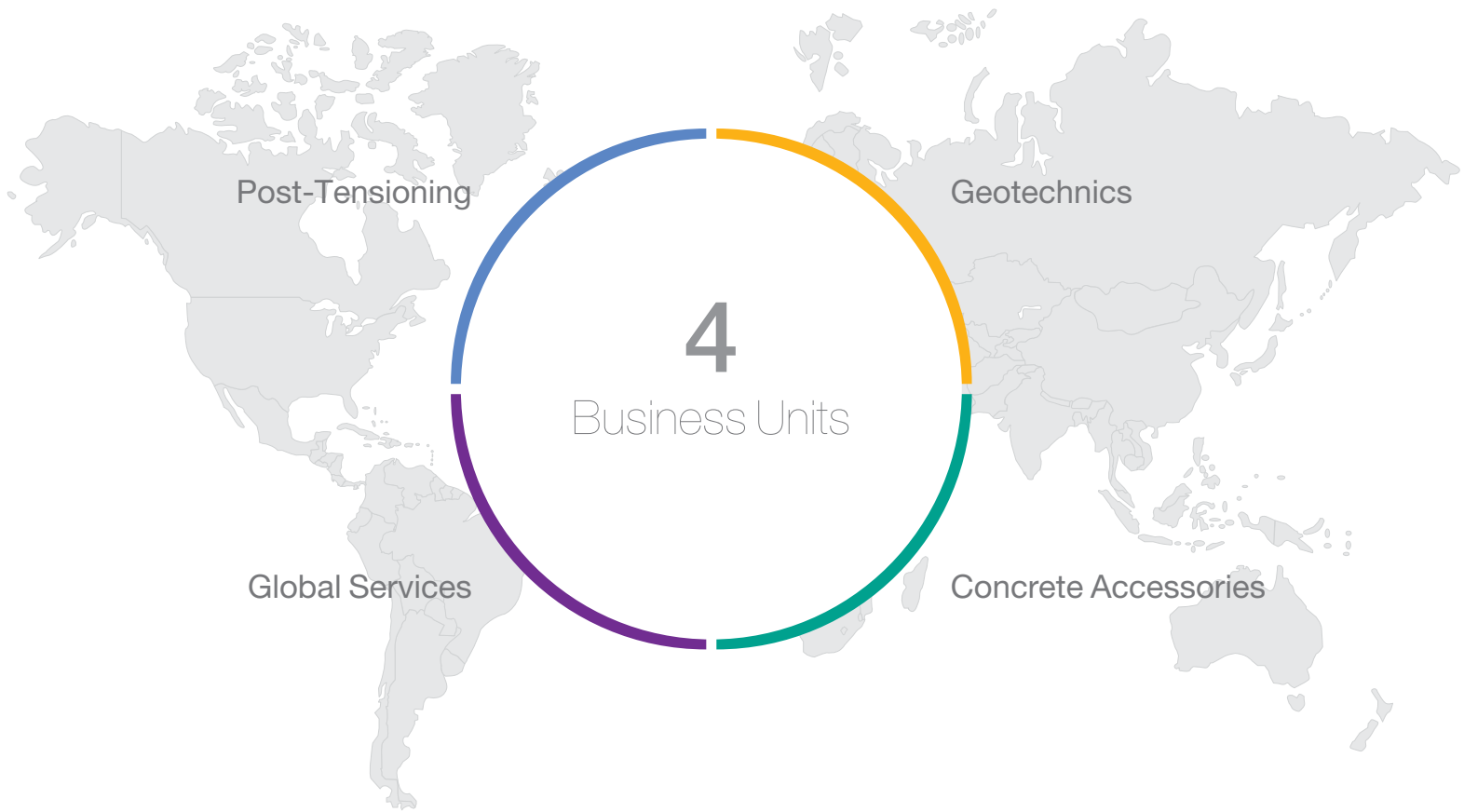
Post-Tensioning



Concrete Accessories

DYWIDAG-Systems International Today

A world leader in specialized construction systems, techniques and services.



50 branches

400 mio. revenue

1,350 employees

25 licensees

Dear clients and partners,

2017 was a year of changes for DYWIDAG-Systems International. The word that describes the changes best is **focus**.

It all started by separating DYWIDAG-Systems International from the mining focused business that is now called DSI Underground and ended by the introduction of four dedicated business units. DYWIDAG-Systems International is now focusing on the construction industry only and is organized into four business units,

- Post-Tensioning,
- Geotechnics,
- Global Services and
- Concrete Accessories Europe,

each of them focusing on their own unique applications and requirements. The customers are benefitting from this increased focus by getting better and more dedicated service, faster product innovation, and more competitive products. DYWIDAG-Systems International is now lean, agile, and more dedicated to help our customers around the globe.

Perhaps the most interesting change from your perspective was the creation of the Global Services business unit and the introduction of robotic enabled inspection and maintenance services. Thanks to the organization change and the acquisition of Alpin Technik, DYWIDAG-Systems International can now offer high value added inspection and maintenance services of unmatched quality. You can find more information on pages 6-9.

Our story is based on a long tradition of reliability, product safety and professional services and our success directly depends on our clients' achievements. We trust that our technical leadership, professional know-how and quality services contribute to our clients' successes and to building sustainable, long-lasting infrastructure that can be relied on by future generations.

Enjoy reading DYWIDAG Info.

Sincerely,



Matti Kuivalainen



Matti Kuivalainen

CEO DYWIDAG-Systems International

3		Editorial
4		Content
6-7	Global	More Customer Focus and Transfer of Technologies
8-9	Global	Ensuring future Growth: The new Global Business Group Mega Project and Wind Energy

Region	Business Segment	Project
--------	------------------	---------

APAC (ASIA/PACIFIC)

10	Australia	<i>Excavations</i>	DYWIDAG Bar Anchors secure Australia's largest Infrastructure Project: WestConnex, M4 East Motorway
12	Australia	<i>Commercial Buildings</i>	Exceptional Architecture with <i>GEWI® Plus</i> High Strength Threaded Reinforcement Bars: The High Rise Building Australia 108
14	Australia	<i>Commercial Buildings</i>	DYWIDAG Post-Tensioning Tendons strengthen Connecting Bridge Abutment of the Narellan Town Centre
15	Indonesia	<i>Bridges</i>	The MRT Jakarta: DYWIDAG Systems contribute to Indonesia's first Light Rail Project
16	Indonesia	<i>Bridges</i>	Corridor 13 in Jakarta: DYWIDAG Products for a new Viaduct in the Seskoal Section
17	Indonesia	<i>Bridges</i>	DYWIDAG Systems ensure fast Construction Progress: The Taman Puring Section of the Jakarta Elevated Busway
18	Japan	<i>Bridges</i>	New Combination of Extradosed and Butterfly Web: The Shin-Meishin Mukogawa Bridge
20	Japan	<i>Bridges</i>	Long Service Life with DYWIDAG Systems and installed Monitoring System: The Osabe Viaduct
21	Japan	<i>Bridges</i>	DYWIDAG Tendons using High-Strength Prestressing allow economic Concrete Cross Sections: The Aigawa Bridge
22	South Korea	<i>Foundations</i>	<i>GEWI®</i> Anchors protect modern Waste Disposal Facility in South Korea from Uplift: The Pyeongtaek Eco Center
23	Sri Lanka	<i>Bridges</i>	The Lunugamvehera Bridge Project in Sri Lanka: DYWIDAG Post-Tensioning Systems for enhanced Infrastructure
24	Tajikistan	<i>Hydro & Marine Structures</i>	The Rogun Dam: DSI supplies DYWIDAG Rock Bolts for the World's highest Dam

EMEA (EUROPE, MIDDLE EAST, AFRICA)

26	Austria	<i>Bridges</i>	Installation in shallow Box Girders: Strand Tendons for Incrementally Launched Bridge at the Inzersdorf Traffic Intersection
28	Belgium	<i>Hydro & Marine Structures</i>	The Moervaart Canal: <i>GEWI® Plus</i> Anchors with specially developed Couplers ensure efficient Installation
29	Belgium	<i>Hydro & Marine Structures</i>	1,500kg DYWIDAG Bar Anchors: A Challenge in the Port of Antwerp
30	Czech Republic	<i>Bridges</i>	Faster from Prague to Linz: New D3 Highway in the Czech Republic
31	Czech Republic	<i>Bridges</i>	Fast Traffic Connection with DYWIDAG Strand Tendons: Expansion of the I/11 in the Czech Republic
32	France	<i>Commercial Buildings</i>	The Muse Shopping Center in Metz: Technique Béton supplies the largest private Jobsite in France
33	France	<i>Commercial Buildings</i>	Technique Béton supplies watertight Systems for new Aquatic Center in Saint Nazaire
34	France	<i>Commercial Buildings</i>	Technique Béton and DSI Artéon supply Specialized Products for new Ocean Road on La Réunion
36	Germany	<i>Wind Energy Structures</i>	The Walting Wind Park: Wire EX Tendons for Renewable Energy
37	Germany	<i>Commercial Buildings</i>	Construction of the TAZ Publishing Building in Berlin: International DSI Cooperation for fast Construction Progress
38	Germany	<i>Bridges</i>	First German Project featuring Clevis Anchorages: The Markkleeberg Stay Cable Bridge
39	Germany	<i>Foundations</i>	DSI supplies <i>GEWI®</i> Anchors for Ackermann Bridge Project in Augsburg
40	Germany	<i>Excavations</i>	Stabilization of an Excavation using DYWI® Drill Hollow Bar Anchors: New Residential Building at the Dietl Brewery Site in Straubing
41	Germany	<i>Excavations</i>	DYWIDAG Strand Anchors stabilize Supporting System against Water Pressure: Construction of the B 15neu Federal Road
42	Germany	<i>Excavations</i>	DYWIDAG Systems for the Conversion of Augsburg Main Station
43	Germany	<i>Excavations</i>	Stuttgart 21, Feuerbach Tunnel: Conversion of Feuerbach Station using DYWIDAG Systems
44	Germany	<i>Structural Repair Solutions</i>	The Aldingen/Remseck Lock: Rehabilitation using permanent DYWIDAG Strand Anchors
45	Germany	<i>Excavations</i>	Trouble free Removal of DYWIDAG QuickEx® Strand Anchors: trivago, Duesseldorf
46	Germany	<i>Excavations</i>	The Trimberg Tunnel: <i>GEWI®</i> Soil Nails stabilize Precuts for Motorway Section near Kassel
47	Germany	<i>Foundations</i>	The Niederhafen: <i>GEWI®</i> Anchors stabilize Flood Control Structure at Hamburg's most famous Harbor Promenade
48	Great Britain	<i>Slope Stabilizations</i>	The A465 Heads of the Valleys Road: DYWIDAG Systems permit efficient Reinforcement of steep Earthworks Cuttings
49	Great Britain	<i>Foundations</i>	Battersea Power Station: SUPERLATCH® ensures a safe Connection of Reinforcement Cages
50	Great Britain	<i>Foundations</i>	Systematic Uplift Protection: The Raith Interchange near Glasgow
52	Great Britain	<i>Excavations</i>	DYNA Force® Sensors monitor Deep Excavations at the new Hinkley Point Nuclear Power Station
54	Italy	<i>Bridges</i>	The Syracuse-Gela Motorway on Sicily: DYWIDAG Strand Post-Tensioning Tendons for an important Part of the Road Network
56	Luxembourg	<i>Excavations</i>	The Kirchberg-Pfaffenthal Station: DYWIDAG Systems ensure fast Connection to Luxembourg's City Center
57	Netherlands	<i>Hydro & Marine Structures</i>	<i>GEWI®</i> Piles against Uplift: New Aqueduct on the "Centrale As" Motorway
58	Poland	<i>Tanks</i>	The Opole Power Plant: DSI supplies Post-Tensioning Systems for Poland's largest Coal-Fired Power Station
60	Spain	<i>Slope Stabilizations</i>	DYWIDAG Bar Anchors and DYWI® Drill Hollow Bars stabilize a steep Cliff on Tenerife
61	Spain	<i>Bridges</i>	The Ingeniero Fernández Casado Stay Cable Bridge: Efficient Repair with DYNA Protect® Corrosion Protection Tape
62	Qatar	<i>Bridges</i>	The Al Wakrah Bypass: DSI Middle East supplies DYWIDAG Strand Post-Tensioning Systems for an important Connecting Road
63	Qatar	<i>Commercial Buildings</i>	The B Square Mall in Doha: Rapid Construction Progress using Flat Slab Post-Tensioning
64	Qatar	<i>Commercial Buildings</i>	The Al Thuraya Tower: DYWIDAG Flat Anchors for Doha's new Landmark
65	Qatar	<i>Commercial Buildings</i>	Bonded DYWIDAG Tendons for the Al Tilal 1 Project in Lusail, Qatar
66	Qatar	<i>Commercial Buildings</i>	Flat Slab Post-Tensioning using Bonded DYWIDAG Tendons: The Marina COM-05 Tower in Lusail
67	Uganda	<i>Bridges</i>	DYWIDAG Strand Tendons for Bridge over the Nile River in Uganda

Region	Business Segment	Project
NORTH AMERICA		
68	Canada	<i>Special</i> DSI Canada Civil receives PTI Award of Merit for Slab on Grade Project
69	Canada	<i>Foundations</i> The Yonge-Sheppard Centre in Toronto: GEWI® Micropiles stabilize Pillars for remodeled Parking Garage
70	Canada	<i>Structural Repair Solutions</i> Freezing Temperatures and Limited Space: Rehabilitation of the Hudson's Hope Bridge using DYWIDAG Tendons
72	USA	<i>Foundations</i> DYWIDAG THREADBAR® saves Time and Money: The One Bennett Park Tower in Chicago
74	USA	<i>Bridges</i> Cantilever Construction for unhindered Traffic: DYWIDAG Tendons for the new Brattleboro Bridge in Vermont
75	USA	<i>Bridges</i> Track Capacity Expansion using DYWIDAG Strand Tendons: The I-10 Neches River Bridge in Beaumont
76	USA	<i>Bridges</i> The IH 35E near Dallas: DYWIDAG Strand Tendons contribute to the Widening of an important Transport Link
77	USA	<i>Excavations</i> The Park District Project in Dallas: Top-Down Method minimizes Construction Time
78	USA	<i>Commercial Buildings</i> The Maritime Building in Seattle: DYWIDAG Micropiles ensure Stability and Seismic Safety
79	USA	<i>Slope Stabilizations</i> Long term Stability: GEWI® Soil Nails stabilize Slopes at the Highpark Project near Los Angeles
80	USA	<i>Slope Stabilizations</i> Widening of the I 10: DYWIDAG Systems stabilize Retaining Walls along one of the longest Freeways in the USA
81	USA	<i>Excavations</i> DYWIDAG Anchors pass strict Tests: The Loma Linda University Hospital in California
82	USA	<i>Bridges</i> The Gerald Desmond Bridge: DYWIDAG Strand Tendons for the USA's second highest Stay Cable Bridge
84	Costa Rica	<i>Foundations</i> The Reventazón Hydroelectric Power Plant: Foundation of Transmission Lines using DYWI® Drill Micropiles
85	Mexico	<i>Commercial Buildings</i> DYWIDAG Post-Tensioning Tendons for a new Project in the Center of Veracruz: The Villa del Mar
85	Mexico	<i>Excavations</i> DYWIDAG Bar Anchors stabilize 24m deep Excavation: The Centro Médico ABC in Santa Fé
SOUTH AMERICA		
86	Brazil	<i>Slope Stabilizations</i> Grand Reserva Paulista: DYWIDAG Bar Anchors for one of São Paulos' largest Residential Projects
87	Brazil	<i>Hydro & Marine Structures</i> Energy for 1.6 Million People: DSI Prepron and Protendidos DYWIDAG supply DYWIDAG Systems for the Sinop Hydroelectric Power Plant
88	Brazil	<i>Bridges</i> The Line 13 Jade: DSI Prepron supplies DYWIDAG Post-Tensioning Systems for connecting São Paulo with the International Airport
89	Brazil	<i>Bridges</i> New Tamoios Highway: DSI Prepron supplies DYWIDAG Strand Tendons for several Bridge Structures
90	Brazil	<i>Bridges</i> Precision Work with DYWIDAG Systems: Lifting a new Span for the Ayrosa Galvão Bridge
91	Brazil	<i>Tanks</i> Tanks using Post-Tensioning with DYWIDAG Strand Tendons: Expansion of Isabela's Plant in Brazil
92	Brazil	<i>Tanks</i> DYWIDAG Micropiles stabilize Tanks against Tensile Forces: The Ageo Terminal at the Port of Santos
93	Colombia	<i>Foundations</i> GEWI® Piles for Electrical Transmission Tower Foundations: The Nueva Esperanza Project in Colombia
94	Peru	<i>Slope Stabilizations</i> DYWI® Drill Hollow Bar Soil Nails for efficient Slope Stabilization: The Chilina Bridge
95	Peru	<i>Slope Stabilizations</i> DYWI® Drill Hollow Bar Anchors ensure better Connections: The IIRSA Sur in Peru
96	Peru	<i>Slope Stabilizations</i> Toquepala: DYWIDAG Strand Anchors stabilize Anchor Wall in the World's fifth largest Copper Mine
97	Peru	<i>Bridges</i> Reducing Traffic Congestion: DSI supplies DYWIDAG Strand Tendons for the new Villena Rey Bridge in Miraflores
98		Imprint

More Customer Focus and Transfer of Technologies: The new Organization Structure of DYWIDAG-Systems International now includes 4 Business Units

In December 2017, we successfully restructured DYWIDAG-Systems International into 3 global Business Units and one Business Unit focusing exclusively on Europe:

- **Post-Tensioning (global)**
- **Geotechnics (global)**
- **Global Services (global)**
- **Concrete Accessories (Europe)**

These important organizational changes will enable us to achieve profitable growth in the years to come. With this new structure, we can address the long-term potential of high growth segments and open new markets. Furthermore, the new organization structure enables us to increase our customer focus to your advantage.

Thanks to the global and more efficient technology transfer and the global use of best practices, we will be able to support you and your projects with even more advanced products and systems.

The new matrix structure replaces the previous geographical organization model. Every Business Unit is managed by an experienced President.

Global Business Unit – Post-Tensioning

As President, Christian Roemschied leads the Post-Tensioning Global Business Unit. Mr. Roemschied has worked in our company for many years and previously successfully managed the Geotechnics Business Unit EMEA as General Manager for many years.

In Post-Tensioning, we can now focus even more on you as our customers in order to not only react flexibly to your needs, but to proactively offer you innovative solutions and special proposals that are profitable and customized to suit your project specific requirements.

Global Business Unit – Geotechnics

Mike Kelley is President of the Geotechnics Global Business Unit. Mr. Kelly was responsible for the Geotechnics business unit in the USA, Mexico, the Caribbean and Central America for many years and is a Deep Foundation Institute (DFI) Board member. As a special distinction, Mike Kelley was also included in the circle of DFI Trustees at the end of 2017.

In Geotechnics, you as our customers will also remain the center of our actions. Fulfilling your requirements and keeping you satisfied is our priority. Furthermore, we are going to expand and stabilize our position as a world market leader – because DYWIDAG-Systems International has been and continues to be a pioneer in the development of rock and soil anchor systems and technology.

We have an outstanding reputation thanks to the excellent quality of our products and systems as well as of our reliable customer service. As leaders in innovation, we have been offering you a comprehensive product range of technically sophisticated solutions for decades. We actively promote technical development and research projects. Global patent applications demonstrate our leadership position and form the foundation stone of our successful work – to your advantage. We are your independent system supplier and your competent partner for special civil engineering.



Christian
Römschied



Mike Kelley

Global Business Unit – Global Services

Sanjay Razdan was appointed President of the new Global Services Business Unit. Previously, Mr. Razdan worked for the technology company QinetiQ and has been with DYWIDAG-Systems International since December 1st 2017.

The newly established Business Unit includes all global activities in the following three areas:

1. Repair and Strengthening (R&S)
2. Robotic Inspection & Maintenance (RI&M)
3. Infrastructure Health Monitoring (IHM)

Currently, we are sustainably expanding our range of services especially in infrastructure monitoring and robotic inspection.

With our Global Services solutions, we can detect defects before they turn into critical problems and before complex repairs or long downtimes ensue. This way, we help you to make your project safer in the long run and to make informed decisions about upcoming repair measures. By staying in touch with you continuously and proactively on site, we are able to offer you solutions that are ideal for you at all times. We attach importance to short response times because we understand that civil engineering projects often have to be realized and repaired and strengthened under time pressure.

Regional Business Unit – Concrete Accessories

As President, Ian Jarvis leads the Concrete Accessories Europe Business Unit. Mr. Jarvis has been with DYWIDAG-Systems International Ltd. UK since 1988 and successfully worked as Commercial Director for many years.

The new pan European Business Unit bundles all Concrete Accessories activities in Europe and the Middle East. Through product innovation and the use of our Europe wide network, we will continue expanding our market share in this area in the future. This way, we can now offer you our complete product portfolio and new developments all over Europe and the Middle East.

We are known for our high quality products and supply chain efficiency as we deliver our products directly to the jobsite – on short notice and on time. As a producer of “Concrete Accessories”, we bear responsibility up to the smallest detail. We specialize in the production and supply of technically sophisticated products including lifting and fixing tools as well as chemicals for concrete structures.



Sanjay Razdan



Ian Jarvis

Ensuring future Growth: The new Global Business Group Mega Project and Wind Energy

Early in 2018, DYWIDAG-Systems International bundled all its activities in the areas of wind energy and mega projects into a specialized unit, the Mega Project and Wind Energy Business Group.



Dr. Christian Glaeser leads the Mega Project and Wind Energy Global Business Group as president. Dr. Glaeser looks back on many years of experience in civil engineering, is a globally recognized expert and authority in many committees and has worked as an advisor for many international projects.

After working as a technical operations manager in the civil engineering laboratory at Munich's Technical University, he joined DYWIDAG-Systems International on October 1st 2009, where he was responsible for Post-Tensioning until the end of 2017 as CEO EMEA. During his tenure in that position, he significantly enhanced the organization's competences in the area of wind energy.

mega projects and wind energy projects in which a cross-functional coordination between Post-Tensioning, Geotechnics and Services is necessary or in which construction methods are required as part of the scope of DYWIDAG-Systems International.

Wind Energy

Key Account Managers continue to be responsible for our Wind Energy Business. So doing ensures that you as our customer will always have the same competent contact person: independently of where in the world wind projects are planned and realized and of which changing requirements DYWIDAG-Systems International is facing.

It is our ultimate ambition to support you as our customer even more comprehensively in your projects around the world in the future.

The newly founded Global Business Group offers our clients customized and project specific integral solutions on a global scale that include both technology and services.

The new Mega Project and Wind Energy Business Group centrally coordinates all stay cable projects and mega projects of DYWIDAG-Systems International and is also sought after as a central contact and coordinator for complex projects due to its technical expertise. Furthermore, the Global Business Group is responsible for



Dr. Christian
Glaeser



We offer you efficient and safe solutions in the following application areas:

- Offshore steel towers: stay cables for salt water applications
- Onshore steel towers: stay cables including the corresponding foot point anchorage e. g. ground anchors
- Onshore concrete and hybrid wind towers: Wire EX Tendons

Both DYNA Grip® Stay Cables and Wire EX Tendons are characterized by their fast and high quality installation methods, their ability to be individually restressed and replaced while offering maximum flexibility for your project.

You can count on the quality of our systems: They correspond and often exceed the norm requirements of international organizations such as EOTA, pti, fib or CIB/Setra.

Mega Projects

In Mega Projects, we support our local sales teams with the bundled know-how and experience of the Mega Project Team. We offer comprehensive service packages, post-tensioning systems, stay cable systems, geotechnical products and systems, construction methods as well as professional installation and services comprising much more than all of these areas. Furthermore, we support you in risk and project management in order to make your project successful.

The Ganges Bridge near Kacchi Dargah in India is one example for a current mega project in which we are involved. By closely cooperating with an interdisciplinary, international team, we will be able to successfully realize the world's longest, 9.7km long cable stayed bridge together with our partner DSI-BRIDGECON.

We are also actively involved in the large stay cable bridge crossing the St. Lawrence River in Montreal, Canada. 1,250t of post-tensioning tendons in different anchorage sizes are used in this project. Furthermore, we are supporting the project with innovative solutions for frost control and explosion and fire protection.

DYWIDAG Bar Anchors secure Australia's largest Infrastructure Project: WestConnex, M4 East Motorway

Once completed, the new, 33km long WestConnex Motorway in Australia will connect Sydney's West and Southwest with the city center, the airport and Botany Harbor. The project is being carried out in 3 sections and is currently Australia's largest infrastructure project.



In the first section, the new M4 East Motorway is being built and the existing M4 is being widened. The approx. 7km long M4 East includes a 5.5km long double tube tunnel with three lanes in each direction from Homebush to Haberfield.

At Wattle Street in Haberfield, the project was initially started as an open-cut excavation and

is now a tunnel after pre-cast planks have been put in place to cover the excavation. Since the street is located in the middle of a residential area, noise and air pollution had to be kept to a minimum.

DYWIDAG-Systems International Australia supplied permanent, double corrosion protected (DCP) DYWIDAG THREADBAR®

Anchors for stabilizing the excavation walls of the open-cut tunnel. 167, 40 WR, 9m long DYWIDAG THREADBAR® Anchors and 55, 40 WR, 7m long DYWIDAG THREADBAR® Anchors were used for this purpose.

In addition, 16, 32 WR, 7m long DYWIDAG THREADBAR® Anchors and 252, 6.2m long stainless steel CT-Bolts were installed.



Furthermore, DYWIDAG-Systems International had an RMS approved anchor supervisor on site for the duration of all drilling, anchor installation, grouting and stressing work.

Owner

Sydney Motorway Corporation Pty Ltd, Australia

General Contractor

Joint Venture, consisting of CPB Contractors Pty Ltd, Australia, Samsung C&T Corporation, South Korea and John Holland Group Pty Ltd, Australia

Subcontractor

The Rix Group Pty Ltd, Australia

Consulting Engineers

Joint Venture, consisting of Arcadis N.V., Netherlands and AECOM, Australia

Unit

DYWIDAG-Systems International Pty. Ltd., Australia

Scope

Supply, technical support, supervision, rental of equipment

Products

167 DCP, 40 WR, 9m long DYWIDAG THREADBAR® Anchors,
55, 40 WR, 7m long DYWIDAG THREADBAR® Anchors,
16 DCP, 32 WR, 7m long DYWIDAG THREADBAR® Anchors,
252, 6.2m long CT-Bolts

Exceptional Architecture with *GEWI® Plus* High Strength Threaded Reinforcement Bars: The High Rise Building Australia 108 in Melbourne

At a height of 319m, the Australia 108 project is the country's second tallest skyscraper with regards to its total height. The high rise building is located in Melbourne's Southbank District and will include 1,105 apartments on 100 floors.



The upper part of the building features a starburst that symbolizes the Commonwealth Star on the Australian flag. It cantilevers 6m out from the building façade at a height of 210m and includes a sky garden and two swimming pools.

At levels 40-47 and 65-68, extremely high loads and forces acted on the supporting structure that would have resulted in reinforcement congestion.

DYWIDAG-Systems International has an extensive record of examples, approvals and applications across the globe where

GEWI® Plus 670-800 Threaded Reinforcement Steel Bars have been used to optimize structures, increase building speed and save time and money.

DYWIDAG-Systems International Pty. Ltd., Australia presented the *GEWI® Plus* System to the Consulting Engineers and was asked to support them with this problem. As an optimum solution, DYWIDAG-Systems International Pty. Ltd. suggested reinforcement consisting of high tensile *GEWI® Plus* Threaded Reinforcement Steel Bars in larger diameters to reduce congestion.

For the Australia 108, the *GEWI® Plus* System including couplers was used in order to optimize the cross sections of the columns and wing walls at levels 40-47 and 65-68. The tendons were specially cut to length for this project.

In total, DYWIDAG-Systems International Pty. Ltd., Australia supplied 260t of high strength reinforcement, grade 670/800 N/mm², 50, 57, 63,5 and 75mm Ø *GEWI® Plus* Bars. The tendons are both in accordance with local ACRS Approval T1002 and the Australian reinforcement norm AS/NZ 4671.



Furthermore, 63.5mm Ø *GEWI® Plus* Threaded Reinforcement Bars with a double 11 degree bend and specially designed cranked couplers were installed. In addition, 20t of high tensile 75mm Ø, grade 835-1030N/mm² post-tensioning bars according to ACRS approval T1003 and AS/NZ 4672, the norm for post-tensioning bar and strand, were used in this project.

The designer was very satisfied with the help from DYWIDAG-Systems International in adapting the design methods to fit within Eurocode and check against Australian

standards. The feedback of the builder and its subcontractors was very positive, as the threadbar system proved to be easy to use on the building site, including the coupling of the bars. It prevented a redesign of concrete cross-sections, and the bar systems made the construction of the building possible and reduced building delays that would otherwise have occurred.

Owner

World Class Land

General Contractor

Multiplex, a Brookfield company, Australia

Contractor

Form700 Pty. Ltd., Australia

Architect

Fender Katsalidis, Australia

Consulting Engineers

Robert Bird Group Pty. Ltd., Australia

Unit

DYWIDAG-Systems International Pty. Ltd., Australia

Scope

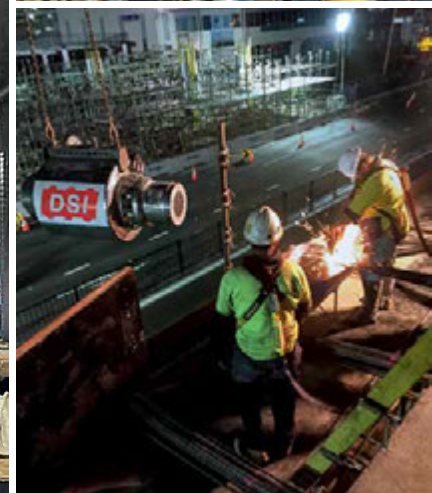
Production, supply, engineering services, technical support, supervision, rental of equipment

Products

260t of high strength, 50, 57, 63,5 and 75mm Ø *GEWI® Plus* Threaded Reinforcement Bars, 63.5mm Ø *GEWI® Plus* Threaded Reinforcement Bars with a double 11 degree bend, 20t of high tensile 75mm Ø Post-Tensioning Bars

Undisturbed Shopping: DYWIDAG Post-Tensioning Tendons strengthen Connecting Bridge Abutment of the Narellan Town Centre

Recently, the Narellan Town Centre shopping mall in Narellan, a suburb of Sydney located 60km south-west of Sydney's central business district, was extensively expanded. The shopping mall area was enlarged from approx. 35.000m² to approx. 70.000m². The new part of the center includes more than 100 new shops and 1,500 additional parking spaces.



The old and the new sections of the building were connected via a bridge that also accommodates shops and that leads over the Camden Valley Way.

The two bridge abutments were post-tensioned using DYWIDAG Strand Post-Tensioning Systems. 34 Type 27-0.6", grade St 1660/1860 DYWIDAG Tendons with fixed and stressing anchorages were used at the northern abutment.

8 Type 27-0.6" and 36 Type 12-0.6" DYWIDAG Strand Tendons including fixed and stressing anchorages were installed at the southern abutment. Experienced DSI employees supported the subcontractor during post-tensioning.

The 30m long bridge was lowered into its final position.

Owner
Dart West Developments Pty Limited, Australia
General Contractor
Mainbrace Constructions Pty Ltd, Australia
Contractor (Bridge)
Waeger Constructions PTY Ltd., Australia
Subcontractor Post-Tensioning
APS Australian Prestressing Services Pty Ltd, DYWIDAG-Systems International Pty. Ltd., BU Civils, both Australia
Architect
The Buchan Group, Australia
Architect (Bridge)
Jim Alexander, Australia

Unit
DYWIDAG-Systems International Pty. Ltd., BU Civils, Australia
Scope
Production, supply, post-tensioning
Products
42 Type 27-0.6" DYWIDAG Strand Tendons, 36 Type 12-0.6" DYWIDAG Strand Tendons

The MRT Jakarta: DYWIDAG Systems contribute to Indonesia's first Light Rail Project

The large scale Mass Rapid Transit (MRT) project in Jakarta is the first light rail project in Indonesia and is expected to significantly reduce traffic congestion. In 2013, the first, approx. 16km long section of the North-South Corridor from southern Lebak Bulus to the Hotel Indonesia in the city center was opened.



The second phase is 8.1km long and leads to Kampung Bandan in North Jakarta. The section includes 6 subterranean stations and 7 elevated stations.

In section CP 102, an elevated bridge that crosses the heavily trafficked Jakarta Outer Ring Road is being built using the balanced cantilever method. The bridge is 173m long and has a tight radius of 182m.

PT Delta Systech Indonesia was awarded the post-tensioning work as well as the rental and operation of the form travelers

and supported the jobsite with engineering services. DYWIDAG Taiwan supplied 4 sets of DYWIDAG Form Travelers for the construction project. The limited space posed a challenge for the assembly and the use of the form travelers.

A total of 68t of Type 19-0.6" DYWIDAG Strand Post-tensioning Tendons with Type 6819 MA Anchorages were installed in the balanced cantilever bridge. DYWIDAG Post-Tensioning Bars were used for form traveler operation.

Owner
PT MRT Jakarta, Indonesia
General Contractor
Joint Operation Tokyu-WIKA, Indonesia
Design
AECOM Singapore Pte. Ltd., Singapore
Consulting (Construction Management)
JMCMC - Jakarta MRT Construction Management Consultants, Indonesia

Licensees
PT Delta Systech Indonesia, Indonesia and DYWIDAG Co. Ltd., Taiwan

Scope
Supply, installation, engineering services, technical support, supervision, rental of equipment

Products
68t Type 19-0.6" DYWIDAG Strand Tendons with Type 6819 MA Anchorages, DYWIDAG Post-Tensioning Bars, 4 DYWIDAG Form Travelers

Corridor 13 in Jakarta: DYWIDAG Products for a new Viaduct in the Seskoal Section

Corridor 13 is a new, 9.3km long, elevated roadway for buses in Jakarta, Indonesia, that leads from Ciledug to Jalan Tendean. A 1,400m long viaduct is being erected in the Seskoal section, one of 8 sections of the new busway. The viaduct had to be built in a highly frequented area while traffic was running in limited space both day and night.



In order to comply with the limited schedule and to reduce traffic obstruction to a minimum, the decision was made to build the segmental box girder bridge using the span by span method with an overhead launching gantry.

The individual segments were glued together with epoxy resin and then connected using short, temporary bar tendons. The permanent prestressing forces were applied to the structure via external post-tensioning tendons. Despite the fact that work was only possible at night, the team of DSI licensees achieved a cycle time of 4-6 days per span.

With the support of the DSI network, PT Delta Systech Indonesia actively accompanied the project from the design to the construction stages and suggested an

innovative and efficient solution. Furthermore, PT Delta Systech Indonesia supplied and installed internal and external DYWIDAG Post-Tensioning Tendons. A Joint Venture consisting of PT Delta Systech Indonesia and DYWITECH Co. Ltd., Taiwan was responsible for operating the overhead launching gantry and provided engineering services.

Approx. 600 precast box girder segments were installed in total. The box girder and the pier heads were strengthened by internal and external DYWIDAG Strand Tendons with Type MA6812, MA6815 and MA6819 Anchorages using 360t of Type 0.6" post-tensioning strand. Short 36mm Ø DYWIDAG Bar Tendons were also used for temporary stressing.

Owner
Dinas Bina Marga Pemprov DKI Jakarta, Indonesia
General Contractor
PT WIJAYA KARYA (Persero) Tbk., Indonesia
Design
PT Cipta Graha Abadi, Indonesia
Consulting (Construction Management)
PT Yodya Karya (Persero) – Aksa Internusa Putra KSO, Indonesia
Consulting (Supervision)
PT Lapi Ganeshatama Consulting, Indonesia

Licensees
PT Delta Systech Indonesia, Indonesia and DYWITECH Co. Ltd., Taiwan
Scope
Supply, installation, engineering services, technical support, supervision
Products
DYWIDAG Strand Tendons with Type MA6812, MA6815 and MA6819 Anchorages, 36mm Ø DYWIDAG Bar Tendons

DYWIDAG Systems ensure fast Construction Progress: The Taman Puring Section of the Jakarta Elevated Busway

The Jakarta Elevated Busway, which is also known as Corridor 13, is a new, 9.3km long, elevated busway in Jakarta, Indonesia, that will transport up to 30,000 passengers per day.



One of the 8 sections of the new route is the 1,144m long Taman Puring section. The viaduct consists of internally post-tensioned segmental box girders that were constructed using the balanced cantilever method. The main part of the viaduct consists of single box spans. In the area of the bus station, the viaduct changes to a double box span. The bridge deck reaches a height of 12 to 22m.

The DSI licensee PT Delta Systech Indonesia supported the contractor and the engineers during design and construction. PT Delta Systech Indonesia supplied Type 15-0.6" and 19-0.6" DYWIDAG Strand Tendons with MA 6815 and MA 6819 Anchorages and a total of 332t

of post-tensioning strand. The segments were temporarily fixed and stressed using 36mm Ø DYWIDAG Bar Tendons.

PT Delta Systech Indonesia cooperated with Utracon Overseas Pte Ltd, Singapore, to erect the precast segmental box girders. 4 sets of fully automatic lifter frames were used to erect the 423 segments or 35 spans of the box girders for the viaduct. The Taman Puring section was the fastest accomplished part of the route. The owner was very satisfied with the exact alignment and placement of the segmental box girders.

Owner
Dinas Bina Marga Pemprov DKI Jakarta, Indonesia
General Contractor
PT HUTAMA KARYA (Persero), Indonesia
Design
PT Maratama Cipta Mandiri, Indonesia
Consulting (Construction Management)
PT Eskapindo Matra-PT Artefak Arkindo KSO, Indonesia
Consulting (Supervision)
PT Dwikarsa Envacotama, Indonesia

Licensees
PT Delta Systech Indonesia, Indonesia and Utracon Overseas Pte Ltd., Singapore
Scope
Supply, installation, engineering services, technical support, supervision
Products
Type 15-0.6" and 19-0.6" DYWIDAG Strand Tendons, 36mm Ø DYWIDAG Bar Tendons

New Combination of Extradosed and Butterfly Web: The Shin-Meishin Mukogawa Bridge

The Shin-Meishin Mukogawa Bridge is located north of Kobe between the Takatsuki and Kobe junctions on the Shin-Meishin Expressway. The 442m long extradosed bridge with a continuous rigid frame and butterfly webs includes three 100m long spans.



It is the world's first bridge to have been designed as an extradosed bridge combined with butterfly shaped webs for the main girder. This design concept greatly reduced the structure's weight and enhanced its earthquake resistance.

The weight of the superstructure was reduced by butterfly shaped precast concrete panels that are installed at defined distances. Thanks to the reduced weight, the cross section of the piers was reduced to create a slender pier configuration.

The height of the girder was limited because transportation restrictions between the precast factory and the jobsite dictated the maximum size of butterfly panel that could be accommodated.

In order to achieve a span length of 100m and to bring the girder to the desired height, the bridge was designed as an extradosed bridge.

The use of the SPER Method (Sumitomo Precast form for resisting Earthquakes and for Rapid construction) in the pier structure

ensured a rapid construction progress through labor saving. In this method, stay-in-place precast concrete panels are used both as segments and as formwork for cast-in-place concrete. In order to save labor and shoring for the pier heads, a section of the crossbeams was precast.

The main tower is located in the median strip between the lanes so that the available space in the hollow box girder was not as large as in the case of stay cable bridges.



Consequently, Sumitomo developed a new, isolated anchor system consisting of a single steel plate and two independent pillars that can also be installed in narrow spaces.

Type 12S 15.7 MC and 19S 15.7 MC DYWIDAG Strand Tendons with high-strength (2,230MPa), epoxy coated and filled strands were used as external tendons. In order to protect the external tendons from the ultra-violet rays coming in through the web panels' openings, the strands are covered with HDPE sheaths.

The high-strength Type 19S 15.7 MC DYWIDAG Strand Tendons were also used as extradosed tendons outside the box girder.

The main girders were constructed with Type 12S 12.7 MA, 12S 15.2 MA and high-strength Type 12S 15.7 MA DYWIDAG Strand Tendons using the cantilever method. Both Type 1S 21.8 and 1S 28.6 pre-grouted DYWIDAG Tendons were used for transverse post-tensioning.

Owner

West Nippon Expressway Co., Ltd, Japan

General Contractor

Sumitomo Mitsui Construction Co., Ltd, Japan

Architect

Sumitomo Mitsui Construction Co., Ltd, Japan

Licensee

Sumitomo (SEI) Steel Wire Corp., Japan

Scope

Production, supply, technical support

Products

Type 12S 15.7 MC, 19S 15.7 MC, 12S 15.7 MA, 12S 15.2 MA, 12S 12.7 MA, 1S 21.8 and 1S 28.6 DYWIDAG Strand Tendons

Long Service Life with DYWIDAG Systems and installed Monitoring System: The Osabe Viaduct

The Osabe Viaduct was built as a part of the reconstruction project of the Sanriku Coast Road (National Highway 45) near the town of Rikuzentakata in the Iwate Prefecture in Japan. Due to the serious damage that was caused by the Great East Japan Earthquake in 2011, the new Sanriku Coast Road is constructed at a higher elevation than the existing road in order to minimize damage that may be caused by future tsunamis.

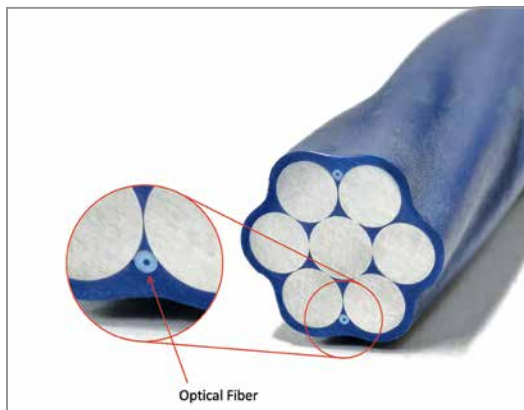
The Osabe Viaduct is a 6-span, prestressed concrete continuous rigid frame box girder bridge. Since the bridge is located in the cold north of Japan, it is exposed to detrimental influences such as freezing and de-icing salts. Consequently, a number of new construction methods were implemented to enhance the bridge's durability.

SmART Cell Sensors were used to measure and confirm the prestressing force acting in the bridge girder. In this system, permanent magnets measure the tension force of a strand by measuring the changes in the magnetic properties that occur during the tensioning of the strand.

Furthermore, epoxy coated and filled strands with optical fibers were used. The strand provides strain data for itself when it is stressed. This data can be converted to the tensile force of a cable using the E-modulus. The special strands were used for the inner post-tensioning tendons, and the data measured during stressing was used for stressing management. Using this technique, the forces acting on the structure can also be measured at any time in the future.

A highly water-repellent sheet was used as a new technique for concrete curing. This sheet is attached to the inside face of the forms and kept in place during concrete pouring. The sheet is kept in contact with the concrete surface even after the removal of forms in order to extend the time of curing for as long as possible. This method perfectly controls the loss of moisture in the concrete by leaving the sheet in contact with the concrete surface and preventing it from direct exposure to ambient air. This method not only reduces surface voids, but also improves salt insulation properties and the neutralization resistance of the concrete. Furthermore, it suppresses the concrete drying shrinkage strain.

To improve the durability of the tendons and anchorages, multiple corrosion protection methods were selected. Type 19S15.2 MC DYWIDAG epoxy coated strand tendons with HDPE sheathed strands were used as external post-tensioning tendons with double layered corrosion protection.



Cement grouted Type 12S15.2 MA DYWIDAG epoxy coated strand tendons with HDPE sheathed strands were installed as internal post-tensioning tendons with triple corrosion protection. Type 1S28.6 pre-grouted DYWIDAG Strand Tendons with double corrosion protection were used for transverse post-tensioning. In addition, the steel members of each anchorage were coated with a thick layer of electrostatic epoxy resin powder coating to improve corrosion resistance.

Owner

Ministry of Land, Infrastructure and Transport/ Development Bureau of Tohoku, Japan
General Contractor
Kajima Corporation, Japan

Licensee

Sumitomo (SEI) Steel Wire Corp., Japan

Scope

Production, supply, technical support

Products

Type 19S15.2 MC, 12S15.2 MA and 1S28.6 DYWIDAG Strand Tendons, SmART Cell Sensors

DYWIDAG Tendons using High-Strength Prestressing allow economic Concrete Cross Sections: The Aigawa Bridge

The Aigawa Bridge is a continuous multi-span rigid frame bridge on the Shin-Meishin Expressway in the northern part of Ibaraki City, Osaka Prefecture. Its longest spans, which cross both the Aigawa River and a prefectural road, are 179m in the eastbound direction and 170m in the westbound.



In order to produce a lightweight superstructure, corrugated steel plate webs were used. Approximately 200 bridges have previously been built in Japan using corrugated steel webs, but the Aigawa Bridge is the world's longest girder span in which these webs have been used.

The main girder was constructed using the cantilever erection method. Since long span lengths require many prestressing tendons for cantilever erection, Type 12S15.7 DYWIDAG Tendons consisting of high-strength prestressing steel were used. Regular strength prestressing steel would have required the use of 52 tendons, which it would not have been possible to distribute over the cross-section. By using high-strength prestressing steel strands, the required number of tendons was reduced to 46. Moreover, 50MPa high strength concrete was used for the main girders to allow early tensioning of the tendons for cantilever erection and to further reduce the weight of the main girders.

To shorten construction time of the cantilever section at the westbound pier P2, which was critical for construction progress,

a new cantilever construction method was used. The corrugated steel webs were first installed and then used as erection members. The form traveler was placed on the installed, corrugated steel webs, and, during concrete placement, the weight of the upper and lower slabs was directly suspended from the traveler.

This way, the form traveler was simplified and its capacity increased, thereby allowing for longer construction segment lengths. The 6.4m long segment lengths reduced the number of segments from 16 to 12 (for standard segment lengths of 4.8m), which shortened the overall construction period.

The longitudinal post-tensioning is provided by a combination of both internal and external tendons. Type 12S15.2 MA DYWIDAG Strand Tendons and high strength Type 12S15.7 MA DYWIDAG Strand Tendons were installed as internal tendons. The external tendons were Type 19S15.2 MC DYWIDAG Strand Tendons with epoxy coated and filled strands. Pre-grouted Type 1S21.8 and 1S28.6 DYWIDAG Monostrand Tendons were used as transversal tendons in the bridge deck.

Owner

West Nippon Expressway Co., Ltd, Japan

General Contractor

Sumitomo Mitsui Construction Co., Ltd, Japan

Architect

Sumitomo Mitsui Construction Co., Ltd, Japan

Licensee

Sumitomo (SEI) Steel Wire Corp., Japan

Scope

Production, supply, technical support

Products

Type 12S15.2 MA, 12S15.7 MA and 19S15.2 MC DYWIDAG Strand Tendons, Type 1S21.8 and 1S28.6 DYWIDAG Monostrand Tendons

GEWI® Anchors protect modern Waste Disposal Facility in South Korea from Uplift: The Pyeongtaek Eco Center

In the seaport city of Pyeongtaek in northwestern South Korea, the Eco Center is being built. It is a modern facility with a combustible waste fuel facility for domestic waste, a recycling center, a bio gas facility for organic waste, a sewage plant and a boiler for producing electricity and hot water.



The facility is being built on an area of 58,066m² and will be the largest environmentally friendly facility in South Korea once completed. In order not to affect the adjacent residential areas, the complete facility is constructed underground. On the surface, different recreational facilities such as a swimming pool, a baseball park and a gym are being built.

248 double corrosion protected (DCP), 63.5mm Ø, 10-11m long permanent GEWI® Anchors were used to protect the facility from uplift. They were especially suitable for this project due to their excellent durability in aggressive environments and due to their fast installation time.

Owner

Pyeongtaek City, Korea

General Contractor

Hansol EME Co., Ltd., Korea

Subcontractor

Shinwoo Construction Co., Ltd., Korea

Engineering

DOHWA Engineering Co., Ltd., Korea

Unit

DYWIDAG-Systems Korea Co. Ltd., Korea

Scope

Supply, technical support

Products

248 double corrosion protected (DCP), 63.5mm Ø, 10-11m long permanent GEWI® Anchors

The Lunugamvehera Bridge Project in Sri Lanka: DYWIDAG Post-Tensioning Systems for enhanced Infrastructure

The Road Development Authority in Sri Lanka has improved its road network by widening roads, thereby reducing travel time to the southern borders of the country.



The Katharagama – Lunugamvehera project, a 13.8km stretch of road that includes two bridges, forms part of this infrastructure project. The first bridge is a five span bridge crossing the Lunugamvehera reservoir spillway, and the second bridge is a single span bridge across a water stream. Both bridges consist of a four lane roadway and span 30m between supports.

The two bridges were constructed using 1.8m high and 30m long precast I-girders. Each girder is post-tensioned using Type 7-0.6" DYWIDAG Strand Tendons. In total, 792 strand tendons were used in the girders.

Utracon's scope included the supply and installation of the DYWIDAG Post-Tensioning System, the supply of the steel forms for girder

fabrication, the delivery of precast girders to the launching fronts using rail cars and the launching of the precast girders using a double truss self-launching erection girder. Due to the unfavorable conditions for cranes on site, the decision was made to use the special double truss self-launching erection girder instead of tandem lifting using two cranes.

The high standard and excellent quality of the DYWIDAG Post-Tensioning System as well as the well-founded technical support by Utracon once again convinced the General Contractor in this project. Furthermore, Utracon was able to provide a wide range of unique solutions to cater for all needs of the client.

Owner
Road Development Authority,
Sri Lanka
General Contractor
R & J Engineering (Pvt) Ltd, Sri Lanka
Contractor
R & J Engineering (Pvt) Ltd, Sri Lanka
Consulting Engineers
Engineering Design and Project
Management Consultants (Pvt) Ltd,
Sri Lanka

Licensee
Utracon Overseas Pte Ltd., Sri Lanka
Scope
Supply, installation, technical support,
rental of equipment
Products
792 Type 7-0.6" DYWIDAG Strand Tendons

The Rogun Dam: DSI supplies DYWIDAG Rock Bolts for the World's highest Dam

The Rogun Dam is a dam under construction on the Vakhsh River in central Tajikistan. The dam is one of 10 hydroelectric projects that are planned or in operation along the river. Originally, construction work began in 1980, but was time and again delayed and stopped completely due to political, economical and ecological issues. The Rogun Dam has a planned height of 335m, which would make it the world's highest dam.



Once completed, the dam will have a total power generating capacity of 3,600MW with 6 turbines, thus doubling Tajikistan's present energy production.

Within the last few years, stabilization measures have been carried out at the power house and the transformer hall in the caverns. This included the systematic consolidation grouting of the cavern sidewalls, the installation of passive rock anchors and the installation of active, pre-tensioned rock anchors.

At the present construction stage, DSI was selected to provide expertise regarding geotechnical systems because passive rock bolts were not only installed in the power

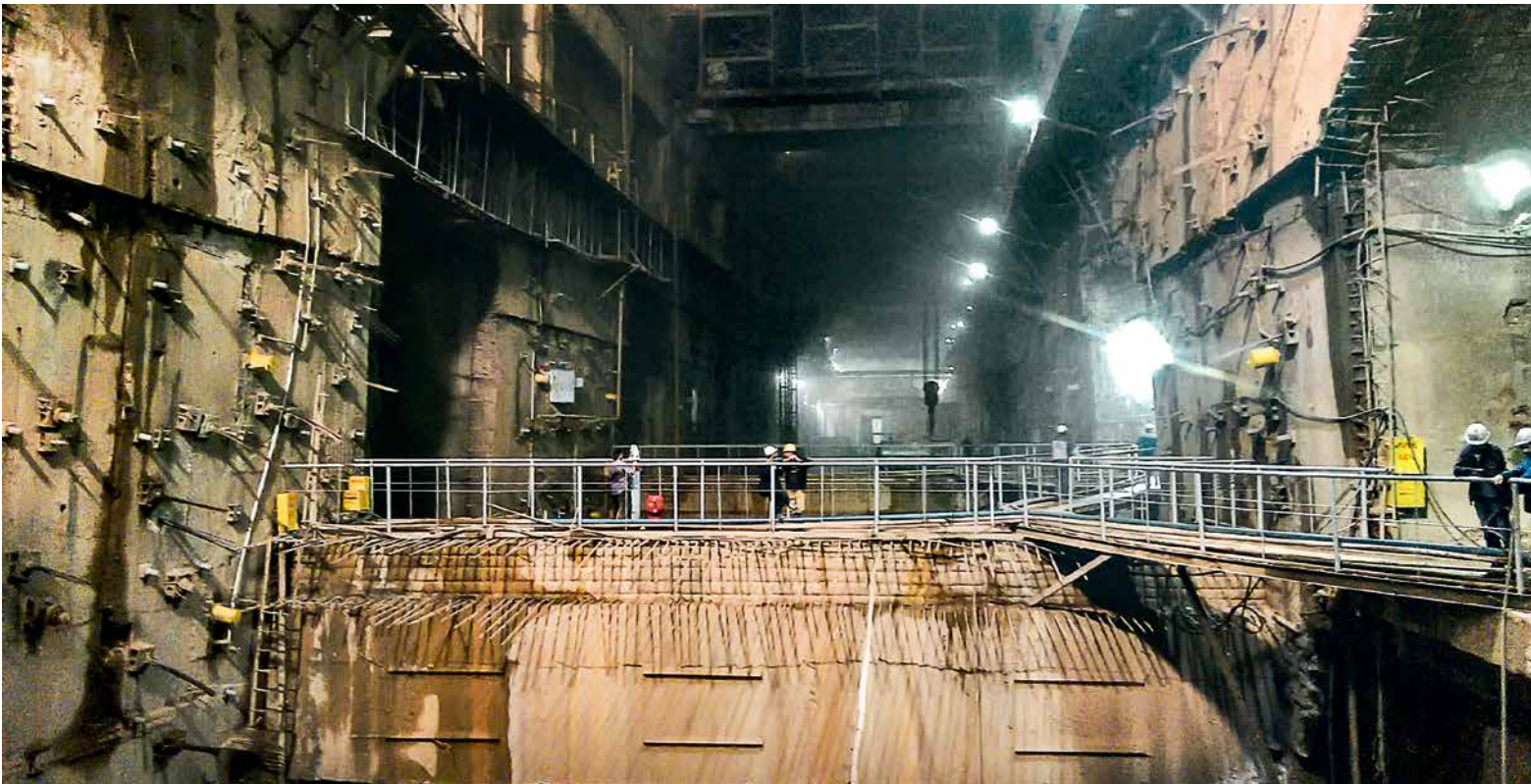
house and the transformer hall, but also in several sections of the water derivation tunnels.

The technical requirements included the design and production of a particularly robust and high quality rock bolt for inclined and declined installation consisting of St 950/1050, 36 and 47mm Ø DYWIDAG THREADBAR®. The extremely tight production and installation schedule represented an additional challenge.

Within a mere 11 months, DSI produced 4,595 DYWIDAG Rock Bolts with a total weight of 1,360t in its plants in Koenigsbrunn and Nauen, Germany.

This included 2,162 36 WR double corrosion protected DYWIDAG Rock Bolts, 825 temporary 36 WR DYWIDAG Rock Bolts and 1,608 double corrosion protected, 47 WR DYWIDAG Rock Bolts with a total length of 71,357m.

The rock anchors were loaded on 68 trucks and transported to the Rogun Dam; a trip that took three weeks. On site, specialized technicians of the DSI-PSK Joint Venture successfully installed the up to 27m long DYWIDAG Rock Bolts in the up to 65m high, 24m wide and 200m long caverns.



Owner
OJSC Rogun Hydropower Plant (HPP),
Tajikistan
General Contractor
Salini Impregilo S.p.A., Italy
Subcontractor
DSI-PSK OOO Joint Venture, Russia
Engineering
Tractebel Engineering, Belgium, ELC
Electroconsult S.p.A., Italy

Units
DYWIDAG-Systems International GmbH,
GBU and DYWIDAG-Systems International
GmbH, BU Geotechnics, both Germany,
DSI-PSK OOO Joint Venture, Russia
Scope
Production, supply, technical support,
supervision
Products
2,162 DCP 36 WR DYWIDAG Rock Bolts,
825 temporary 36 WR DYWIDAG Rock Bolts,
1,608 DCP 47 WR DYWIDAG Rock Bolts

Installation in shallow Box Girders: Strand Tendons for Incrementally Launched Bridge at the Inzersdorf Traffic Intersection

The 1.7km long Inzersdorf traffic intersection on the South East Ring Road in Vienna includes the highly frequented connecting roads of the A 2 South motorway and the A 23 motorway with the Altmannsdorfer and Triester roads. The intersection was built in the 1970's and required rehabilitation due to the high traffic load. The project also includes the partial new construction of a hollow box girder bridge with 2 separate post-tensioned concrete superstructures.



The bridge is being built using the incremental launching method, which reduces environmental impact to a minimum. No false work is needed, so that additional road closures were not necessary.

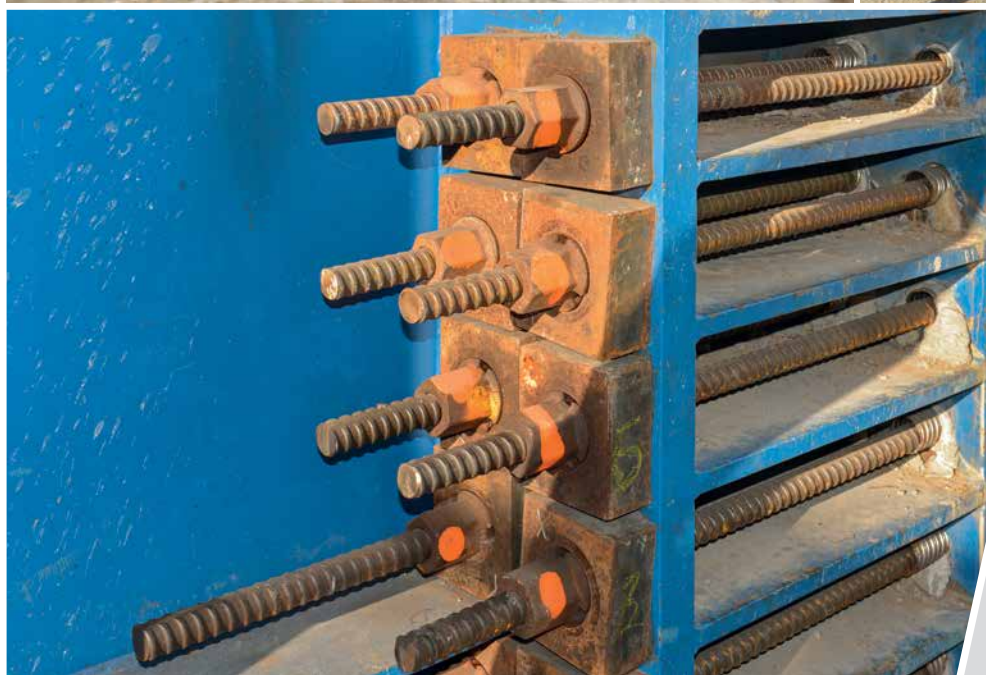
The southern superstructure was built in 25 increments with an additional falsework section while the northern superstructure was built in 24 increments. The section length varied between 10.50m and 22.69m. There were no tendons in the webs of the box girder.

In order to be able to accommodate the external loads once the bridge was completed,

additional tendons were aligned in the spans of the floor slab and in the supporting area of the roadway slab that were anchored in pilaster strips. During incremental launching, the 10m wide and up to 300t segments were pushed step by step over the pillars using a lift thrust device to make room for the next section in the launching area. With the last bridge segment, a total launching load of nearly 8,000t was reached.

The standard cross section of the hollow box girder was required to be very shallow representing a special challenge for post-tensioning the additional tendons that had to be installed after the bridge was in its final position.

For tensioning the bridge, DSI supplied and installed Type SUSPA Bonded Strand Tendons with approximately 450 Type MA 6-12 Anchorages and approx. 445 Type MK 6-12 Couplers. Furthermore, DSI supplied 184 high-strength, short bar tendons, Types 32 WR and 36 WR that were used to connect the launching nose tightly to the first segment.



Owner
Country of Austria
Operator
ASFINAG Autobahnen- und Schnellstrassen-
Finanzierungs-Aktiengesellschaft, Austria
General Contractor
Massivbau Ges. m.b.H., Austria
Engineering
Horn & Partner Ziviltechniker GmbH, Austria

Unit
DYWIDAG-Systems International GmbH,
BU Post-Tensioning, Germany

Scope
Production, supply, installation

Products
Type SUSPA Systems Strand Tendons with posterior
bond with approximately 450 Type MA 6-12 Anchorages
and approx. 445 Type MK 6-12 Couplers, 2 x 20 Type
32 WR DYWIDAG Bar Tendons and 2 x 72 Type 36 WR
DYWIDAG Bar Tendons

The Moervaart Canal: *GEWI® Plus* Anchors with specially developed Couplers ensure efficient Installation

The Moervaart Canal in Ghent, Belgium, is 22km long and connects the Durme River with the Ghent-Terneuzen Canal that leads into the North Sea near Terneuzen, Netherlands. In order to ensure a safe and efficient loading and unloading of ships in the Moervaart Canal in Ghent Harbor, the Ghent Port Company has decided to build a new quay wall in this area.



The new quay wall is built 2m in front of the existing, 30 year old, highly corroded wall. The new, 1km long quay wall is much deeper, allowing larger ships to pass on its widened fairway.

With the support of DSI's technical department, a coupler with a smaller diameter (85mm Ø instead of 102mm Ø) was designed for this project, which helped the contractor to reduce the diameter of the necessary sleeve pipe system and thus also of the drilling pipes.

DYWIDAG-Systems International Belgium was awarded the contract to produce and supply single corrosion protected, 57.5mm and 63.5mm Ø *GEWI® Plus* Anchors.

The active anchors were installed in a sleeve pipe system to create a permanent anchor system and installed according to plan by the subcontractor De Brandt NV, Belgium.

Owner
Ghent Port Company Ltd.,
Belgium
General Contractor
Hye NV, Belgium
Subcontractor
De Brandt NV, Belgium
Consulting Engineers
SBE NV, Belgium

Units
DYWIDAG-Systems International N.V.,
Belgium,
DYWIDAG-Systems International B.V.,
Netherlands

Scope
Production, supply, technical support

Products
474 active 57.5mm Ø *GEWI® Plus* Anchors,
40 active 63.5mm Ø *GEWI® Plus* Anchors

1,500kg DYWIDAG Bar Anchors: A Challenge in the Port of Antwerp

The Noord Natie Terminals company operates a large facility for the storage and handling of liquids in the Port of Antwerp, Belgium. The facility offers its customers different stainless steel storage tanks with capacities ranging from 30 to 8,300m³. The storage terminal is located on the right bank of the Schelde River in the port of Antwerp.



To allow Noord Natie to expand its terminal, the Port of Antwerp decided to make the northern quay of the 4th harbor dock accessible for ships with a draft of up to 14m.

To accomplish this objective, the existing quay walls had to be renovated and expanded over a length of approx. 380m. The existing quay wall foundation was deepened by dredging and stabilized using ground anchors. Work also included the construction of a new quay wall and the repair of the damaged platform as well as the vibration-free demolition of the quay wall toe of the existing quay wall.

To tie back the deepened quay wall, DYWIDAG-Systems International Belgium supplied 154 75mm Ø double corrosion

protected (DCP), permanent DYWIDAG Bar Anchors in lengths ranging from 29.5 to 33.5m.

The DYWIDAG Bar Anchors were produced at the DSI Koenigsbrunn site in only two segments that were connected on site using a coupler splice in the unbonded anchor length. In total, 240t of material were used for the ground anchors including accessories.

The individual anchor parts were up to 16.75m long, with their weight of 750kg representing a special challenge for production. The production of the permanent anchors had to keep up with the rapid installation rate.

Owner
Antwerp Port Authority, Belgium
Contractor
DEME NV, Belgium
Subcontractor
Smet-F&C NV, Belgium
Consulting Engineers
SBEN NV, Belgium

Units
DYWIDAG-Systems International N.V., Belgium,
DYWIDAG-Systems International GmbH, BU Geotechnics, Germany
Scope
Production, supply, technical support
Products
154 permanent, 75mm Ø, DCP,
29.5 to 33.5m long DYWIDAG Bar Anchors

Faster from Prague to Linz: New D3 Highway in the Czech Republic

The new D3 Highway in the Czech Republic is part of the European E55 Motorway from Scandinavia to Greece. Once completed, the D3 will lead from Prague to the Czech-Austrian border and connect with the Muehlviertel Expressway to Linz.



The Borek-Usilne section in southern Czech Republic minimizes congestion on the existing I/3 Road through the town of Borek. The SO 202 Bridge, for which DYWIDAG-Systems International Czech Republic supplied the post-tensioning systems, also forms part of this section.

The bridge consists of two separate structures crossing a river. Each structure was divided into four sections. Since the owner wanted to install the post-tensioning tendons separately

in each section without the use of any continuous tendons, some tendons ended in the webs of the box girder. This resulted in little space for inserting the individual strands.

Furthermore, the tendons had to be tensioned through a special beam. In this project, DSI supplied and installed a total of 120.62t of 19-0.62" Bonded Strand Tendons, 112 OVM.M15-19 Anchorages and 32 OVM.L15-19 Couplers.

Owner

Roads and Highways Directory,
Czech Republic

General Contractor

Joint Venture Eurovia – Strabag,
D3 Borek – Usilne, Czech Republic

Subcontractor

METROSTAV a.s., Czech Republic
Consulting Engineers
PUDIS a.s., Czech Republic
Engineering
INFRAM CZ, a.s., Czech Republic

Unit

DYWIDAG-Systems International,
Czech Republic

Scope

Production, supply, installation, technical
support, supervision

Products

120.62 t Type 19-0.62" Strand Tendons,
112 OVM.M15-19 Anchorages,
32 OVM.L15-19 Couplers

Fast Traffic Connection with DYWIDAG Strand Tendons: Expansion of the I/11 in the Czech Republic

In eastern Czech Republic near its border with Slovakia, a 4,860m long section of the I/11 road is being expanded from Nebory to Oldrichovice. The project is an important infrastructure project that will connect the R48 expressway with Slovakia. The current route of the I/11 is being redirected in order to circumnavigate densely populated and highly frequented areas and to improve the traffic situation currently characterized by frequent traffic jams.



In this section, DYWIDAG-Systems International Czech Republic was asked to supply post-tensioning systems and to post-tension a total of 15 bridge structures as the subcontractor. The largest of these structures are the SO 203 and SO 207 bridges.

The SO 203 bridge across the Neboruvka River consists of two separate superstructures that were each divided into five sections. Since the girders were cast in stages, the continuously coupled post-tensioning tendons had to be filled with strands, and the couplers had to be completed before each casting. Due to the presence of extensive reinforcement, prefabricated tendons could not be used. Therefore, the strands had to be pushed in using a special process, and the couplers had to be completed in a very small space inside the girders.

In total, 128.8t of Type 19-0.62" and 12-0.62" Strand Tendons with 56 active OVM.M15A-19 Anchorages and eight OVM.M15A-13 Anchorages were used for the SO 203 bridge. Eight HL 6-19 Anchorages and 8 HL 6-12 Anchorages, Type SUSPA Systems, were used as passive anchorages. Furthermore, DSI supplied 60 OVM.L15A-19 couplers.

The SO 207 bridge also consists of two separate superstructures that are each 134.7m long. The contractor decided to cast the complete structure at one time. 104t of Type 19-0.62" Strand Tendons were installed in the SO 207 bridge.

60 OVM.M15A-19 Anchorages were used as active anchorages, 12 HL 6-19 Anchorages, Type SUSPA Systems, were used as passive anchorages.

Owner

Roads and Highways Directory,
Czech Republic

General Contractor

Joint Venture I/11 IMOS – D.I.S.,
Czech Republic

Subcontractor

SMP CZ a.s., Czech Republic

Consulting Engineers

Dopravoprojekt Ostrava a.s.,
Czech Republic

Engineering

Pragoprojekt, a.s. – INFRAM CZ, a.s.,
Czech Republic

Unit

DYWIDAG-Systems International,
Czech Republic

Scope

Production, supply, installation, technical
support, supervision

Products SO 203

128.8t of Type 19-0.62" and 12-0.62" Strand
Tendons

Products SO 207

104t of Type 19-0.62" Strand Tendons

The Muse Shopping Center in Metz: Technique Béton supplies the largest private Jobsite in France

The Muse Shopping Center in Metz near the French border with Luxemburg and Germany is the largest private jobsite in France. The total area of the building complex is 160,000m², and 60,000m³ of concrete and 4,000t of steel were used for the construction of the shopping center. The project not only targets French visitors, but also visitors from Luxemburg and Germany.



Up to now, Technique Béton has delivered 11,000l of the vegetable based mould release agent Biodem[®] that meets the project requirements regarding high quality surface finishes as well as the environmental requirements on this jobsite.

Furthermore, Technique Béton supplied 26t of Fibralthoc[®], the single-component fiber-reinforced repair mortar for the structural finishing of the building shells.

In particular, Fibralthoc[®] R, the fast-setting repair mortar was used. Furthermore, Laroche[®] 16-30cm concrete cones and plugs were used together with 63t of the finishing coat mortar Finimur[®] for the aesthetic finish.

Technique Béton is proud to contribute to this major jobsite by supplying its high quality products.

Owner
Apsys, France
Contractor
VINCI S.A., France
Subcontractor
GTM-HALLE, France
Architect
Jean-Paul Viguier et Associés,
France

Unit
Technique Béton, France

Scope
Production, supply

Products
11,000l of the vegetable based mould release agent Biodem[®], 258 boxes of 16-30cm concrete cones and plugs by Laroche[®], 26t of the single-component fiber-reinforced repair mortar Fibralthoc[®], 63t of the finishing coat mortar Finimur[®]

Technique Béton supplies watertight Systems for new Aquatic Center in Saint Nazaire

In Saint Nazaire near Nantes in western France, the “Centre aquatique de l’Estuaire Aquaparc”, an aquatic center that includes a wellness center, is being built. The new aquatic center is integrated into the sports park “La Plaine des Sports” and is close to many schools.



To ensure the impermeability of the pools, a combination of 15-30cm Laroche® Concrete Cones in B60 quality and 2.4t of Ravalchoc® Flexible Etanche Mortar was used. This solution was technically approved and recommended by the French reference laboratory CEBTP. The concrete cones were manufactured at the Laroche® plant near Bordeaux from high-performance C60 concrete.

For the construction joints in the basins, Technique Béton supplied the active contec® sealing system. This included 180m of ACF Plus Metal Water Stops and 1,017m of contaflexactiv ACR 125 Plus Metal Sealings, both with active bentonite coating to create connections.

Furthermore, 9t of the two-component repair mortar Ravalchoc® with polymer resin were used to preserve the waterproofing in the pools during structural finishing. In addition, the steel beams were installed using 6.2t of Calstar® anchoring mortar known for its high performance and its resistance against seawater and high sulphate water.

Furthermore, experienced Technique Béton employees provided technical support, especially in the use of watertight systems.

Owner
CARENE Saint-Nazaire
agglomération, France
Contractor
ANDRÉ BTP, France
Architect
Agence Coste Architectures, France

Unit
Technique Béton, France
Scope
Production, supply, technical support
Products
194 boxes of 15-30cm Laroche® Concrete Cones, B60 quality; 2.4t of Ravalchoc® Flexible Etanche Mortar; 9t of the two-component repair mortar Ravalchoc®; 6.2t of the anchor mortar Calstar®; 180m of contaflexactiv ACF Plus Metal Water Stops; 1,017m of contaflexactiv ACR 125 Plus Metal Sealings

Technique Béton and DSI Artéon supply Specialized Products for new Ocean Road on La Réunion

On Réunion Island in the Western Indian Ocean, the strategically important ocean road RN1 linking the commercial port to the administrative capital and the international airport has been repeatedly affected by ocean submersion and landslides. Since the road is of decisive economic importance, the decision to build a new road was made in 2010.



The new, 12.5km long and 28.9m wide section includes the 5.4km long Littoral Viaduct that is located 20-30m above sea level. The 240m long La Grande Chaloupe Viaduct and the new La Possession Interchange also form part of this section.

For the main part of the route, the Littoral Viaduct, 48 piles were erected and 1,386 precast segments will be produced in a precast plant located in the port. With 300,000m³ of concrete and 38,000t of steel used, the viaduct is France's largest viaduct located in the ocean. The La Grande Chaloupe Viaduct was built directly on the sea construction site. It required 23,000t of steel and 15,000m³ of concrete.

To ensure a 100 year performance of the structures, the porosity, diffusion of chloride ions, gas permeability and compression strength of the Laroche® concrete spacers used were tested in connection with the technical support of Technique Béton. Consequently they were approved for use on this project.

These concrete spacers are perfectly suitable for use with heavy reinforcing steel bars because of their stability and strength. Furthermore, the spacers can resist seawater and water containing a high degree of sulphate.

La Grande Chaloupe Viaduct

Owner

Regional Council of La Réunion, France

Contractor

Eiffage Travaux publics, Razel-Bec, Saipem S.A., NGE Contracting and Guintoli, all of them France

Architect

Lavigne & Chéron Architectes, France

Littoral Viaduct

Owner

Regional Council of La Réunion, France

Contractor

VINCI S.A., Bouygues Travaux publics, Dodin Campenon Bernard and Demathieu Bard, all of them France

La Possession Interchange

Owner

Regional Council of La Réunion, France

Contractor

Les Grands Travaux de l'Océan Indien (GTOI) S.A., Société Bourbonnaise de Travaux Publics et de Construction (SBTPC) and VINCI S.A., all of them France



Up to now, 19,520 boxes of Laroche® concrete spacers have been installed in the structures of the new ocean road. This included 4,150 boxes of SUFA and 15,370 boxes of SUSFA PP Spacers. The supply will continue for the next 3 years. Furthermore, mould release agents and curing compound by Technique Béton were used at the La Grande Chaloupe Viaduct.

DSI Artéon is supporting this major project throughout the complete construction phase with technical expertise and is supplying its anchoring system and formwork accessories. Up to now, 10,000m of form ties, 10,000 nuts and the fixing system with 1,500 shear cones and 10,000 anchor feet have been supplied.

Technique Béton and DSI Artéon are proud to contribute to this important infrastructure project by supplying their high quality products.

Unit
Technique Béton, France

Technique Béton Scope
Production, supply

Products
4,150 boxes of SUFA and
15,370 boxes of SUSFA PP Spacers,
mould release agents, curing
compound

Unit
DSI-Artéon SAS, France

Scope
Production, supply

Products
10,000m of form ties, 10,000 nuts,
fixing system with 1,500 shear cones and
10,000 anchor feet

The Walting Wind Park: Wire EX Tendons for Renewable Energy

Recently, the new Walting Wind Park was built in Eichstaett near Ingolstadt, Germany. The residents in this area can take shares in this special Citizen Wind Project.



The project consists of 3 wind towers with hub heights of 139m and total heights of 199m. The towers are equipped with General Electric Type G 04 wind turbines and have rotor diameters of 120m. The nominal capacity of the 3 towers is 2.78MW per tower per year.

The wind towers are hybrid towers consisting of concrete and steel. The lower portions of the towers are concrete half shells to a height of approx. 80m. After erecting the concrete elements, the segments were post-tensioned using external Wire EX Tendons that ensure the stability of the towers when subject to dynamic loads.

60 Type EX-69 Wire EX Tendons in lengths of 76m and with a total weight of approx. 96t were installed inside the 3 towers. The installation of the tendons was carried out by tailor-made DSI uncoiling devices from the top down using a crane.

The new wind park will generate approximately 16 million kilowatt hours of electricity per year, which roughly equals savings of 1.6 million liters of fuel oil.

Owner
NEW Bürgerwind Walting GmbH & Co. KG, Germany
General Contractor
GE Wind Energy GmbH, Germany
Contractor
Max Bögl Wind AG, Germany
Engineering
Max Bögl Wind AG, Germany

Unit
DYWIDAG-Systems International GmbH, BU Wind Tower Technologies, Germany
Scope
Production, supply, installation
Products
60 Type EX-69, 76m long Wire EX Tendons

Construction of the TAZ Publishing Building in Berlin: International DSI Cooperation for fast Construction Progress

TAZ Berlin, the daily newspaper, is constructing a new publishing building on Friedrichstrasse in the center of Berlin. This building is a 7-level administration building with special structural features. The exterior frame of each slab (from the slab above the ground floor up to the slab above level 7) is formed by monolithic post-tensioning girders.



Photo reprinted courtesy of contempo Zeitraffer Filmproduktion, Germany

These girders were post-tensioned using 141 Type 6-04, SUSPA Systems Post-Tensioning Tendons in oval ducts in accordance with ETA – 13/0839 approval. For static design reasons and for fire protection, common monostrand tendons could not be used in this case. Precast elements were placed in these frames, forming the slab.

The precast elements – ribbed slabs – were produced in a Polish precast concrete plant and were longitudinally post-tensioned using 162 Type 6-03, SUSPA Systems Tendons (length 11m each) and 56 approx. 9m long Type 6-02, SUSPA Systems Tendons. Post-Tensioning was carried out by DYWIDAG-Systems International Sp. z o.o., Poland.

The technical challenge consisted in having to place, tension and grout the tendons in very limited space conditions. This resulted from the special design of the concrete supports that are X shaped and are joined in steel joint connections. The tendons had to be placed through these joint connections. The crew only had two to three weeks per level to install, tension and grout the tendons.

Thanks to the efficient co-operation of the DSI units Germany and Poland, the 12t of tendons were successfully installed within the given time frame.

Owner

TAZ, die Tageszeitung
Verlagsgenossenschaft eG, Germany

General Contractor

SMV Bauprojektsteuerung
Ingenieurgesellschaft mbH, Germany

Contractor

HOCHTIEF Infrastructure GmbH, Germany

Subcontractor Post-Tensioning

DYWIDAG-Systems International Sp. z o.o., Poland

Architect

Schnetzer Puskas Ingenieure AG, Switzerland

Consulting Engineers

GuD Planungsgesellschaft für Ingenieurbau mbH,
Germany

Engineering

PICHLER Ingenieure GmbH, Germany

Units

DYWIDAG-Systems International GmbH, BU Post-Tensioning, Germany,
DYWIDAG-Systems International Sp. z o.o., Poland

Scope

Production, supply, installation

Products

56 Type 6-02 Tendons, 162 Type 6-03 Tendons and
141 Type 6-04 Tendons

First German Project featuring Clevis Anchorages: The Markkleeberg Stay Cable Bridge

Recently, a new stay cable bridge crossing the B2 Federal Road was built for pedestrians, cyclists, emergency vehicles and utility vehicles in the town of Markkleeberg south of Leipzig. The bridge re-establishes the connection between Gaschwitz and Markkleeberg, which had been destroyed for a former open pit mine.



The new structure was designed as a fanned out, asymmetric, 63.81m long stay cable bridge with a superstructure consisting of a steel framework grid and a composite concrete slab. The two cable planes are accommodated in a fan by an approx. 33m high, H-shaped pylon that is slightly inclined towards the east and are anchored via the suspension cables at the eastern abutment.

The symmetric design of the roadway support results in equal stay cable forces in both cable planes as well as identical longitudinal main girders. The three DYNA Grip® Stay Cable pairs with 19 strands each in lengths of 47m, 36.5m and 27.5m were actively stressed using the Con-Ten method.

The two 27.5m long DYNA Grip® Stay Cables with 55 strands each that were installed as tiebacks did not have to be individually stressed. They were stressed by applying the tension forces in the three DYNA Grip® Stay Cable pairs. The DYNA Grip® Stay Cables with 55 strands are tied back in the abutment via 16 post-tensioned, 47mm Ø, 6.5m long DYWIDAG Bar Tendons.

All tendons were produced on the jobsite in advance. During one weekend, the B2 Federal Road was closed, and the bridge girders were installed and welded. Afterwards, the DYNA Grip® Stay Cables were installed using two cranes and a hoisting platform.

The stay cables are attached to the pylon via Clevis Anchorages. This special, space saving anchorage was used for the first time in Germany and for the first time for a smaller structure. Furthermore, external viscous dampeners were installed at the bridge deck to prevent excessive cable oscillation.

The Markkleeberg Stay Cable Bridge is the first project for which the general type approval could be used that was issued by the German Institute for Construction Technology, DIBt for the DYNA Grip® Multistrand Stay Cables. Consequently, in contrast to previous German stay cable projects, no project specific individual approval was required for the stay cable system, and the approval was provided quickly and easily.

Owner

Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft, Germany

Contractor

Artl Bauunternehmen GmbH, Germany

Subcontractor

ZSB Zwickauer Sonderstahlbau GmbH, Germany

Architect

Landesamt für Straßenbau und Verkehr, NL Leipzig, Germany

Engineering

König und Heunisch Planungsgesellschaft mbH and Ingenieurbüro K. Langenbach Dresden GmbH, both Germany

Unit

DYWIDAG-Systems International GmbH, BU Post-Tensioning North-East, Germany

Scope

Design, production, supply, engineering services, technical support

Products

3 DYNA Grip® Stay Cable pairs with 19 strands each, 2 DYNA Grip® Stay Cables with 55 strands, 16 47mm Ø DYWIDAG Bar Tendons

DSI supplies GEWI® Anchors for Ackermann Bridge Project in Augsburg

At 40,000 vehicles per day, the 50 year old Ackermann Bridge that crosses the Wertach River in Augsburg, Germany is one of the most heavily travelled bridges in the city. The structure was badly deteriorated and is therefore being replaced by a new bridge.



Photos reprinted courtesy of D&K Spezial Tiefbau GmbH & Co. KG, Germany

During construction, traffic is being diverted across a temporary bridge south of Ackermann Street.

The substructures of the temporary bridge were built using the sheet piling method. Approx. 5,000m² of sheet piles were installed in 2 abutments and 3 pile structures for this purpose. The piles are up to 15m long. The sheet pile structures are tied back using 80t of walers consisting of double U steel and 35t of 50mm Ø GEWI® Tie Rods.



Owner
City of Augsburg, Civil Construction Authority, Germany
General Contractor
Joint Venture, consisting of Kommanditgesellschaft Bauunternehmung Hermann Assner GmbH & Co. KG and R+D GmbH & Co. KG, both Germany
Subcontractor
D&K Spezial Tiefbau GmbH & Co. KG, Germany
Engineering
SSF Ingenieure AG, Germany

Unit
DYWIDAG-Systems International GmbH, BU Geotechnics, Germany
Scope
Production, supply
Products
35t of 50mm Ø GEWI® Tie Rods

Stabilization of an Excavation using DYWI® Drill Hollow Bar Anchors: New Residential Building at the Dietl Brewery Site in Straubing

In Straubing, a new residential and office building is being built on the site of the former Dietl Brewery. The new building is located at a 5 minutes' walk from Straubing's central square and includes one commercial unit as well as 35 apartments.



Photos reprinted courtesy of Hans Eberhardt GmbH, Germany

The approx. 9m deep and 100m long excavation was temporarily stabilized for the project. Some areas of the excavation were stabilized using self-drilling DYWI® Drill Hollow Bar Anchors and shotcrete.

DYWIDAG-Systems International Germany supplied 1,700m of R32 DYWI® Drill Hollow Bar Anchors as well as 300m of R38 DYWI® Drill Hollow Bar Anchors for this purpose.

To stabilize an existing building, 22 75mm Ø bored piles had to be installed at center distances from 1.75 to 2.5m in some parts of the excavation. These were stabilized in 3 layers using 775m of 2-5 strand temporary DYWIDAG Strand Anchors. DSI supported the stressing work on site.

Owner
Alte Brauerei GmbH, Germany
Contractor
Hans Eberhardt GmbH, Germany
Builder
Gerl & Vilsmeier Bauträger- und Immobilien GmbH, Germany

Unit
DYWIDAG-Systems International GmbH, BU Geotechnics, Germany
Scope
Production, supply, technical support
Products
1,700m of R32 DYWI® Drill Hollow Bar Anchors, 300m of R38 DYWI® Drill Hollow Bar Anchors, 775m of temporary DYWIDAG Strand Anchors with 2-5 strands

DYWIDAG Strand Anchors stabilize Supporting System against Water Pressure: Construction of the B 15neu Federal Road

Since 2006, the B 15neu Federal Road has been under construction in Germany. Once fully completed, the 130km project will lead from Regensburg to Landshut and on to Rosenheim.



Photos reprinted courtesy of G & R Spezialtiefbau GmbH, Germany

Currently, the section between Ergolsbach and Essenbach is being built. This section has a length of 9km and includes 13 structures. Each of the two lanes will have a width of 10m.

The largest engineering structure in this section is the 1,000m long basement waterproofing near the town of Ohu.

The high groundwater table poses a challenge during the construction of this structure. Furthermore, traffic on the A 92 may not be obstructed during construction work.

For the basement waterproofing, sheet pile walls had to be erected that were tied back using temporary DYWIDAG Strand Anchors to resist the water pressure in the jobsite area. During the drilling work, water was encountered 2m above the first anchor layer. To stabilize the supporting system against water pressure, DSI Germany supplied 20,000m or 1,370 pieces of 4-7 strand temporary DYWIDAG Strand Anchors.

Owner

Free State of Bavaria, Southern Motorway Authority, Germany

General Contractor

HOCHTIEF Infrastructure GmbH, Germany

Contractor

G & R Spezialtiefbau GmbH, Germany

Subcontractor

HIRNBÖCK STABAU GmbH, Germany

Unit

DYWIDAG-Systems International GmbH, BU Geotechnics, Germany

Scope

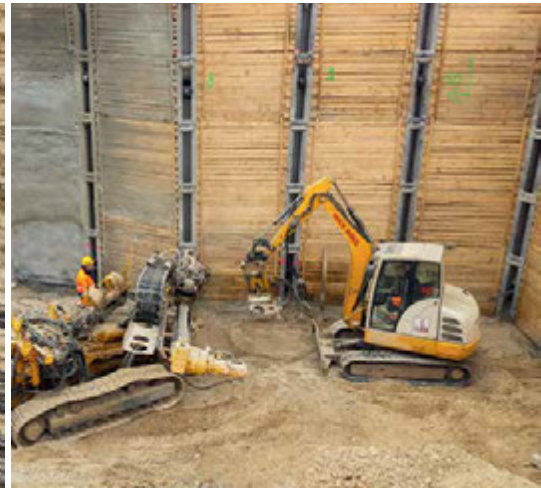
Production, supply, technical support

Products

1,370 temporary DYWIDAG Strand Anchors with 4-7 strands

DYWIDAG Systems for the Conversion of Augsburg Main Station

The public transportation system of the city of Augsburg is being modernized within the scope of what is known as the Augsburg City Project. The Augsburg Mobility Hub (MDA) is an integral part of this project that will ensure a better connection between the city's various means of public transportation.



Photos reprinted courtesy of Max Bögl Stiftung & Co.KG, Germany

The work at the main station in the form of a multi-level tunnel structure and the construction of a new tram tunnel are an important part of the MDA. Furthermore, the junction structure VE 2212 is being built for which an excavation volume of 10,000m² was required.

In this area, a 1,500m² pile wall with 120mm Ø piles and a 1,600m² girder support system with shotcrete infill was constructed.

DYWIDAG-Systems International Germany supplied 170 temporary Type 4-8-0.6" DYWIDAG Strand Anchors to stabilize these structures.

Five DYWIDAG Strand Anchors were equipped with 3 DYNA Force[®] Sensors per anchor and monitored for half a year. In addition, DSI produced and supplied 200m of single corrosion protected 20mm Ø DYWIDAG Soil Nails.

Owner
Stadtwerke Augsburg Verkehrs-GmbH, Germany
Contractor
Max Bögl Stiftung & Co.KG, Germany

Unit
DYWIDAG-Systems International GmbH, BU Geotechnics, Germany
Scope
Production, supply, technical support
Products
170 temporary DYWIDAG Strand Anchors, 200m of 20mm Ø DYWIDAG Soil Nails, 15 DYNA Force[®] Sensors, 1 Readout Unit

Stuttgart 21, Feuerbach Tunnel: Conversion of Feuerbach Station using DYWIDAG Systems

The new Feuerbach Tunnel starts at Feuerbach Station and leads to Stuttgart's main station. It is primarily advanced using mining methods, and the construction of the tunnel also includes a conversion of Feuerbach Station.



Photos reprinted courtesy of Kurt Motz Baubetriebsgesellschaft Hoch-, Tief-, Straßen- und Spezialtiefbau GmbH & Co. KG, Germany

In section PFA 1.5, lot 2, a loop line and a trough structure with a total of 28 blocks are being built. In this area, the installation of the DYWIDAG Strand Anchors produced and supplied by DSI Germany posed a challenge due to the fact that the train tracks had to remain in operation and space was limited.

To stabilize the excavation for a new emergency access, 1,475m of 3-4 strand DYWIDAG Strand Anchors were installed in 3 layers. 954m of these anchors were designed for semi-permanent use.

Another excavation was required for a new pedestrian underpass from Siemens Street to the Feuerbach-Wiener Platz Station. 1,216m of 14.5 to 33m long 3-4 strand

DYWIDAG Strand Anchors were installed in 3 layers above each other at this site. 114m of DYWIDAG Strand Anchors and 19 GEWI® Piles were installed to stabilize a 3.5m long pedestrian ramp.

Within the scope of the stabilization of track No. 102 and during the construction of the trough structure, 328m of 9-20m long 3-4 strand DYWIDAG Strand Anchors were installed, 266m of which were designed for semi-permanent use.

Owner

DB Netz AG, Bauherrenvertretung, Großprojekt Süd, LNPG (S), Germany

General Contractor

Tunnel Feuerbach Joint Venture, consisting of Baresel GmbH, Germany, Alfred Kunz Untertagebau, Germany and Walo Bertschinger Central AG, Switzerland

Contractor

Kurt Motz Baubetriebsgesellschaft Hoch-, Tief-, Straßen- und Spezialtiefbau GmbH & Co. KG, Germany

Engineering

SSF Ingenieure AG, Germany

Unit

DYWIDAG-Systems International GmbH, BU Geotechnics, Germany

Scope

Production, supply, technical support

Products

3,133m of DYWIDAG Strand Anchors with 3-4 strands including accessories, 19 GEWI® Piles

The Aldingen/Remseck Lock: Rehabilitation using permanent DYWIDAG Strand Anchors

The Aldingen/Remseck Lock north of Stuttgart, Germany, located on the right bank of the Neckar River, consists of two chambers that are equipped with mitre gates. The lock complex, built between 1937 and 1956, is being extensively rehabilitated because it is too small for many modern ships and in need of repair.



Photos reprinted courtesy of PST Spezialtiefbau Süd GmbH, Germany

Within the scope of the repair work, the right-hand shore side chamber of the lock is being strengthened using grouted anchors, and the embankment in front of the basin is being modified. The concrete shell of the left-hand chamber is being milled off and new concrete added. In addition the lock is being lengthened by a few meters in order to be navigable by 110m ships.

The chamber on the lock side – the head and the aft – had to be anchored in the rock for stability.

For this purpose, DYWIDAG-Systems International Germany supplied 100 permanent, 15m long 4 strand DYWIDAG Strand Anchors.

The drilling work by PST Spezialtiefbau was carried out on the lock wall in limited space conditions using a double head anchoring machine. The anchor drilling equipment had to be lifted onto the lock wall using a truck crane.

Owner

Amt für Neckar Ausbau Heidelberg, Germany

General Contractor

Bauunternehmung Hofschröder GmbH & Co. KG, Germany

Contractor

PST Spezialtiefbau Süd GmbH, Germany

Engineering

KREBS+KIEFER Ingenieure GmbH, Germany

Unit

DYWIDAG-Systems International GmbH, BU Geotechnics, Germany

Scope

Production, supply

Products

100 permanent, 15m long 4 strand DYWIDAG Strand Anchors

Trouble free Removal of DYWIDAG QuickEx® Strand Anchors: trivago, Duesseldorf

Currently, a new headquarter is being built in Duesseldorf's Medienhafen for trivago, the internet comparison portal for hotel prices. The six floor, rounded new building will accommodate approx. 2,000 employees on an area of 26,000m².



Photos reprinted courtesy of GUP Geotechnische Untersuchungen und Projekte GmbH, Germany

To stabilize the support girders consisting of U profiles as well as the bored pile wall for the excavation perimeter, removable DYWIDAG QuickEx® Strand Anchors were used as temporary tiebacks. The anchor strands could be detensioned by hand following the completion of construction work and then simply pulled out.

The anchors were installed at inclinations of 30 to 40° and had service loads of 442 to 576kN as well as proof loads of 734 to 810kN. To attain a sufficient load-bearing capacity of the anchor systems, grouting pressures of 5 to 15bar were applied.

In total, 203 removable Type 4-0.6" and 4-0.62", 17 to 27m long DYWIDAG QuickEx® Strand Anchors were installed in one anchor layer. Installation was carried out in soil characterized by backfill, high flood loam, sand, gravel and crushed rock. The temporary DYWIDAG QuickEx® Strand Anchors were perfectly suitable for this project due to their ease of removal.



Owner
IMMOFINANZ
General Contractor
ED. Züblin AG, Germany
Subcontractor Drilling Work
GUP Geotechnische Untersuchungen und Projekte GmbH, Germany
Architect
slapa oberholz pszczulny | sop GmbH, Germany

Unit
DYWIDAG-Systems International GmbH, BU Geotechnics, Germany
Scope
Production, supply
Products
203 removable Type 4-0.6" and 4-0.62", 17 to 27m long DYWIDAG QuickEx® Strand Anchors

The Trimberg Tunnel: GEWI® Soil Nails stabilize Precuts for Motorway Section near Kassel

With the new, 4-lane motorway section A 44 between Kassel and Herleshausen, the gap between the A 44 Dortmund-Eisenach and the A 4 near Eisenach will be closed and an important East-West connection created in Germany. The project also includes the construction of the Trimberg Tunnel, a tunnel structure with 2 parallel, 600m long tubes that are connected via 2 crosscuts. The 440m tunnel tubes are being built using underground excavation.



The precuts (East and West) that were realized on both sides of the Trimberg Tunnel were stabilized using GEWI® Soil Nails. Afterwards, 4,000m³ of double reinforced shotcrete were installed over the precuts.

The soil in the precut area consists of slope loam and silt in the first two thirds above the groundwater table with consequent mixed-grained soil and rock pockets. From the groundwater table onwards, the soil is increasingly solid with prevailing sandstone. In the water sensitive slope loam, flushing was at first not permitted during drilling when installing the GEWI® Soil Nails. After comprehensive drilling trials, the required wet drilling method was established in co-operation with the Owner following strict requirements.

The technical challenge consisted in sealing and grouting the up to 30m long soil nails that ascended up to 2°. The soil nails that were inclined at 20° had to be grouted up to a length of 26m using pressure injection.

All of the products supplied by DYWIDAG-Systems International Germany were especially tailored for use on this jobsite in order to ensure an optimum handling and assembly of the GEWI® Soil Nails with a minimum effort to the required lengths of 8 to 30m.

Approx. 40,000m of temporary 32mm Ø GEWI® Soil Nails and approx. 50,000m of permanent 32mm Ø GEWI® Soil Nails were installed to stabilize the precuts.

Owner
DEGES – Deutsche Einheit Fernstraßenplanungs- und -bau GmbH, Germany
General Contractor
Tunnel Trimberg Joint Venture, consisting of HOCHTIEF Infrastructure GmbH and Ed. Züblin AG, both Germany
Contractor
FELDHAUS Bergbau GmbH und Co. KG, Germany

Unit
DYWIDAG-Systems International GmbH, BU Geotechnics, Germany
Scope
Production, supply, technical support
Products
40,000m of temporary and 50,000m of permanent 32mm Ø GEWI® Soil Nails

The Niederhafen: GEWI® Anchors stabilize Flood Control Structure at Hamburg's most famous Harbor Promenade

The Niederhafen in Hamburg, Germany features the city's most famous harbor promenade that connects the St. Pauli Landing Bridges with the historical old warehouse district.



At this location, the existing flood control structure built between 1964 and 1968 was renewed in two sections over a length of approx. 625m. The new structure is 1.40 to 1.70m higher than the existing flood control structure.

First, the existing promenade was demolished and examined for Second World War warfare material. Afterwards, vibrated stone columns covered by geotextiles and steel piles were installed.

Subsequently, Neidhardt Grundbau installed a total of 270 double corrosion protected, 63.5mm Ø GEWI® Anchors from floating pontoons to tie back the steel piling. The up to 35m long anchors were supplied in segments of up to 18m that were later joined together on the job site.



Owner

Freie und Hansestadt Hamburg, Landesbetrieb Straßen, Bruecken und Gewaesser, Germany

General Contractor

Joint Venture, consisting of Bilfinger Construction GmbH and Hochtief Solutions AG, both Germany

Subcontractor

Neidhardt Grundbau GmbH, Germany

Architect

Zaha Hadid LTD Architects, Great Britain

Consulting Engineers

Grundbauingenieure Steinfeld und Partner GbR, Germany

Engineering

Ingenieurbüro GRASSL GmbH, Germany

Unit

DYWIDAG-Systems International GmbH, BU Geotechnics, Germany

Scope

Production, supply, technical support, rental of equipment

Products

270 double corrosion protected, 63.5mm Ø GEWI® Anchors

The A465 Heads of the Valleys Road: DYWIDAG Systems permit efficient Reinforcement of steep Earthworks Cuttings

The A465 Heads of the Valleys Road is an important trunk road connecting Southwest Wales and the British Midlands. In order to promote growth in rural areas of Wales such as Ebbw Vale, investment has been provided by the Welsh Government to upgrade the route. The overall project has been split into several phases with Section 2 currently under construction. The project primarily consists of upgrading 8km of road to allow two lanes of traffic in each direction between Gilwern and Brynmawr.



The topography varies over the 8km site, and in some areas, large amounts of loose overburden overlie rock. DYWIDAG-Systems International UK supplied 240t of R32-360 DYWI® Drill Hollow Bars to stabilize the slopes in this area. The variable geology of the site has made installing the DYWI® Drill Soil Nails challenging for the three specialist geotechnical contractors, BAM Ritchies, CAN Geotechnical and Quantum.

Due to the topography and fragmented nature of the underlying rock head, the soil nail design was reviewed by the principal designer on a regular basis. In order to make the DYWI® Drill Soil Nail spacing as efficient as possible, after nailing, the reinforced cutting slopes were faced with DSI supplied hi-tensile Deltax Rock Netting.

In total, approximately 100,000m² Deltax Rock Netting was used in addition to 5,000m² of DYWI® Mat Erosion Control Matting.

Deltax offers resistance against shallow failure of the slope surface and provides a mechanism of transferring load from the slope to the soil nails. The ability to transfer load efficiently comes down in part to the low strain characteristics of the hi-tensile wire used to make the mesh. In some scenarios, the use of hi-tensile meshes such as Deltax can allow for the DYWI® Drill Soil Nails to be spaced further apart, making the solution more economical for the Client.

Owner
Welsh Government
General Contractor
Costain Ltd, Great Britain
Specialist Geotechnical Contractor
CAN Geotechnical Ltd, BAM Ritchies Ltd and Quantum – Geotech, all of them Great Britain
Consulting Engineers
Atkins/CH2M Design Joint Venture, RPS Group Plc, all of them Great Britain

Unit
DYWIDAG-Systems International Ltd., Great Britain
Scope
Production, supply, technical support
Products
240t of galvanized R32-360 DYWI® Drill Hollow Bars, 100,000m² Deltax Rock Netting, 5,000m² of DYWI® Mat Erosion Control

Battersea Power Station: SUPERLATCH® ensures a safe Connection of Reinforcement Cages

Battersea Power Station is a former coal-fired power station in London and one of Europe's largest brick structures. The plant was operational from 1933 to 1983. In the 1950's, the power plant was the third largest power plant in Great Britain. The approx. 17ha site around the power plant is currently being redeveloped to provide thousands of new homes as well as offices, shops, restaurants and amenity space including a six acre public park and a new river bus service.



On site, open bore piles with reinforcement cages were used. The connection of spliced reinforcement cages poses a safety and efficiency challenge.

The traditional practice generally requires two cages to be connected whilst suspended above an open bore. The first cage is lowered into and supported at the mouth of the pile, and the upper cage is craned over until the cages overlap and then connected to the lower cage. Traditional methods such as U-bolt shackles are hazardous and require operatives to place their hands and arms within the cage overlap. Any unexpected movement can result in serious injury.

The newly developed SUPERLATCH® System offers an efficient solution to this problem. The special latch is already installed during manufacture of the reinforcement cage. The system works in conjunction with metallic plates when used on a diaphragm wall or a continuous metal band on traditional circular piles.

The receiving plate/band is fitted to the top of the first reinforcement cage. SUPERLATCH® is fillet welded to the bottom of the subsequent reinforcement cage. If an inverted splice is to be used, the position of the latch and the receiving band are reversed. As one cage is lowered over the other, the receiving plate/band is pushed past the latch; as it passes through, the integral spring closes the latch automatically, thus forming a safe connection. In total, 4,500 Pieces SUPERLATCH® were used on the Battersea Power Station jobsite.

In a short time, SUPERLATCH® has proven to be very successful. In addition to the Battersea Power Station, it has been used effectively on several sites, including the prestigious One Nine Elms high rise building in London.

Owner

Battersea Power Station
Development Company,
Great Britain

General Contractor

Sir Robert McAlpine, Great Britain

Contractor

Balfour Beatty Ground Engineering,
Great Britain

Unit

DYWIDAG-Systems International Ltd.,
Great Britain

Scope

Development, production, supply,
technical support, supervision

Products

4,500 Pieces SUPERLATCH®

Systematic Uplift Protection: The Raith Interchange near Glasgow

Currently, Transport Scotland is widening the country's motorway network. As part of this initiative, the Raith Interchange, an intersection on the M74 Motorway that is used by 75,000 vehicles per day, has been expanded and opened to traffic in February this year. In this area, a new, 560m long and 35m wide underpass has been built underneath the existing M74.



At the Raith Interchange underpass, several bored pile retaining walls had to be built on both sides and tied back using DYWIDAG Strand Anchors. Furthermore, the base slab was secured against uplift by tension piles.

Albion Drilling, the specialist Geotechnical Contractor, installed 480 permanent, double corrosion protected 4 strand DYWIDAG Strand Anchors as well as 130 temporary, 5 strand DYWIDAG Strand Anchors in lengths of 20-25m each. The anchors were used to

support the contiguous bored pile retaining walls forming the underpass and have load-bearing capacities ranging from 1,200 to 1,800kN. The temporary anchors stabilized the excavation during the construction of the base slab.

DYWIDAG Strand anchors are used when either the anchor load exceeds the capacity offered by solid bar anchors or if access to the drilling area prevents the efficient use of long lengths of bar anchors.

Strand anchors are supplied to the jobsite prefabricated and coiled and can then be unwound and installed in the borehole using an uncoiler. DYWIDAG-Systems International UK supplied the equipment needed for this purpose.

Due to the prevailing geology and the depth of the excavation, double corrosion protected *GEWI®* and *GEWI® Plus* Tension Piles were used to resist uplift of the base slab in addition to the strand anchors.



Albion Drilling installed 300 *GEWI*[®] and *GEWI*[®] *Plus* Tension Piles using the equipment supplied by DSI. Unlike the DYWIDAG Strand Anchors, these tension piles were not pre-stressed, but will begin to resist uplift of the slab from artesian pressures if such loads are encountered. The *GEWI*[®] and *GEWI*[®] *Plus* Tension Piles can accommodate the dynamic loads caused by traffic on the roadway slab. Although double corrosion protection is not required in order to achieve a permanent

tension pile, consideration was given to the expense that replacing the piles would cause, and therefore, the maximum corrosion protection option was chosen.

On other areas of the major project south of Glasgow, DSI UK supplied R32 DYWI[®] Drill Hollow Bar Soil Nails including couplers and plates for slope stabilization work on both sides of the roadway.

Owner

Transport Scotland, Great Britain

General Contractor

Joint Venture, consisting of Ferrovial Agroman UK and Ireland and Lagan Construction Group, both Great Britain

Contractor

Albion Drilling Group, Great Britain

Consulting Engineers

RPS Group Plc, Great Britain

Unit

DYWIDAG-Systems International Ltd., Great Britain

Scope

Production, supply, technical support, rental of equipment

Products

480 permanent, double corrosion protected DYWIDAG Strand Anchors with 4 strands, 130 temporary 5-strand DYWIDAG Strand Anchors, 300 *GEWI*[®] and *GEWI*[®] *Plus* Tension Piles, R32 DYWI[®] Drill Hollow Bar Soil Nails including couplers and plates

DYNA Force® Sensors monitor Deep Excavations at the new Hinkley Point Nuclear Power Station

Hinkley Point C is the first of a number of new nuclear power stations that were commissioned in the UK. The existing power plant is being expanded by the addition of two new reactors, C1 and C2 that have a total combined output of approx. 3,200MW.



DYNA Force® sensors are being used to monitor loads at the face of some of the deepest excavations for the new reactors. They are the key early warning instrument for localized areas of high stress. The sensors are able to accurately measure any load change, without being affected by temperature changes.

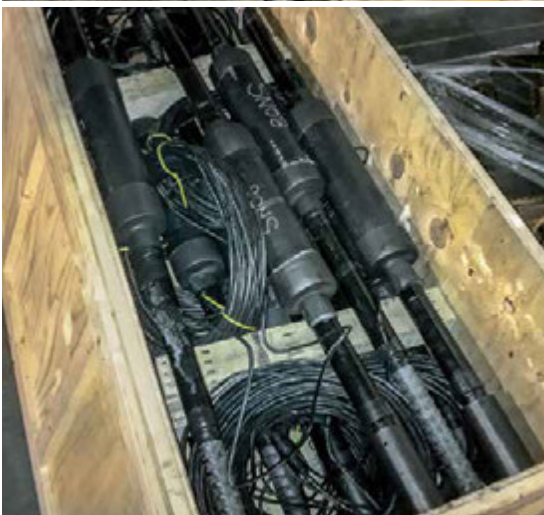
The DYNA Force® sensors are being used for load monitoring in conjunction with some of the approx. 14,000 25-40mm Ø GEWI® Soil Nails that are installed to depths of up to 13.5m. The GEWI® Monitoring Soil Nails feature a bonded section of 3m

at the distal end of the nail, to point anchor in the stable zone, with the remaining length debonded to allow the nail to be used as a monitor for any load change resulting from movement either side of the slip circle.

With the debonded section passing through the active wedge, it is not possible to mobilize any restraining bond in this area; therefore, a heavy bearing plate is required at the face to ensure sufficient restraint. The borehole is first drilled using rotary percussion. This is followed by step drilling the top 1.5m of borehole, in order that one DYNA Force® Sensor can be placed over each GEWI® Soil Nail.

The elasto-magnetic DYNA Force® Sensors induce a magnetic field around the GEWI® Bar, which then passes through the bar, with the changes to the magnetic field picked up by a secondary coil and sent back to the read out unit. Since the magnetic permeability increases in proportion to an increase in load, the system can accurately measure load in kN.

Any movement of the active wedge or face translates into a load increase in the soil nail, which is identified by the DYNA Force® Sensor. The long debonded section, up to 10.5m, ensures that any deep-seated fault movement can be picked up by the sensor.



Some of the excavations are known to cross existing fault zones. As the excavations have deepened, stresses recorded by the DYNA Force®-Sensors in some of the GEWI® Soil Nails have increased significantly. The DYNA Force® measurements have provided the engineers with a high level of information on the impending movement at the face, enabling the areas of high stress to be remediated with additional bolts or anchors prior to the excavation continuing. In addition, in areas where heavy cranes are working at the top of the excavations, DYNA Force® Sensors provided additional safety by an accurate monitoring of load changes.

All sensors are connected to multiplexers and separate read out units. Readings for the sensors are taken remotely and ensure continuous around the clock monitoring of the excavation slopes. DSI UK also supplied double corrosion protected, 40mm Ø DYWIDAG Bar Anchors for the large decoupling walls at the north end of the jobsite.

Owner

Nuclear New Build Generation Company Ltd., Great Britain

General Contractor

ByLor Joint Venture, consisting of BOUYGUES Travaux Publics, France and Laing O'Rourke, Great Britain

Earthworks Contractor

Kier BAM Joint Venture, consisting of Kier Group plc. and BAM Nuttall Ltd, both Great Britain

Engineering

AECOM, Great Britain

Unit

DYWIDAG-Systems International Ltd., Great Britain

Scope

Production, supply, technical support, test installation

Products

86 DYNA Force® Sensors & accessories, 14.000 25-40mm Ø GEWI® Soil Nails, double corrosion protected 40mm Ø DYWIDAG Bar Anchors

The Syracuse-Gela Motorway on Sicily: DYWIDAG Strand Post-Tensioning Tendons for an important Part of the Road Network

The 133km long Syracuse-Gela Motorway on Sicily is an important part of the Italian road network that promotes the economic development of eastern Sicily. The new motorway will have 15 viaducts with a total length of 6,600m, 44 overpasses and 17 tunnels.



Photos reprinted courtesy of CO.SI.GE. SCARL, Italy

Lot 7 in the second section of the motorway includes the construction of the 629m long Scardina Bridge and the 1,474m long Salvia Bridge. Both viaducts consist of 54m long single spans.

In cooperation with Cosedil, the Owner Società Italiana per Condotte d'Acqua proposed the following technical improvements to the viaduct deck:

- increase of concrete strength from 45 MPa to 60 MPa
- change of precast segments length from 3.25m to 4.0m

- use of “short line match cast” technology for segment prefabrication
- launch of precast segments using the “span by span” method
- injection of the tendons using vacuum technology

For the viaducts, DYWIDAG supplied Type 22-0.62" DYWIDAG Strand Tendons with 1.280 MA Anchorages, Type 19-0.62" DYWIDAG Strand Tendons with 280 MA Anchorages and Type 12-0.62" DYWIDAG Strand Anchors with 330 MA Anchorages including accessories.

Furthermore, DYWIDAG provided all equipment needed for installation, stressing and grouting. In addition to the post-tensioning systems, DYWIDAG also supplied 20t of 28mm Ø GEWI® Rock Bolts for slope stabilization at the jobsite.



Owner
Consorzio per le Autostrade Siciliane,
Italy
General Contractor
CO.SI.GE. SCARL, Italy
Subcontractor
SPIC Srl, Italy
Consulting Engineers
Condotte Spa, Italy
Engineering
Pro.Ge. 77 Srl, Italy

Unit
DYWID S.P.A., Italy
Scope
Production, supply, rental of equipment
Products
Types 22-0.62, 19-0.62" and 12-0.62"
DYWIDAG Strand Tendons with MA Anchorages
including accessories; 20t of 28mm Ø GEWI®
Rock Bolts

The Kirchberg-Pfaffenthal Station: DYWIDAG Systems ensure fast Connection to Luxembourg's City Center

The new Kirchberg-Pfaffenthal Station (Pont Rouge) will connect the Kirchberg Plateau in northeastern Luxembourg to the existing train route in the district of Pfaffenthal.



Photos reprinted courtesy of CFL, Luxembourg and aventas.grundbau GmbH & Co. KG, Germany

The connection with the Kirchberg Plateau is realized by two independent funicular railways operating as shuttles that are being built at the bottom of a bridge known as Pont Rouge. Furthermore, the project includes the two new stations Pfaffenthal and Kirchberg.

The civil engineering work includes a retaining wall with shotcrete infill for each of the stations. In Pfaffenthal, the retaining wall is 9.5m high and anchored by 2 layers of anchors that are embedded in highly fragmented sandstone. 3 test anchors with ducts and 3 test anchors without ducts were produced. All performance tests were successful, and all of the 41 temporary Type WR, 26.5 and 32mm Ø, 10-12m long DYWIDAG Bar Anchors featured ducts.

The tracks of the funicular railway were anchored in the sandstone using 478, 3-7m long, 32mm Ø, double corrosion protected GEWI® Soil Nails. The 8.5t excavator with drill attachment had to work from a drilling level with an 11° inclination. Furthermore, the GEWI® Soil Nails were inclined into two directions.

Work was carried out economically using optimized equipment.

Owner
CFL, Luxembourg
General Contractor
Association Momentanée TRALUX-
LuxTP, Luxembourg
Contractor
aventas.grundbau GmbH & Co. KG,
Germany
Engineering
Schroeder & Associés SA, Luxembourg

Unit
DYWIDAG-Systems International GmbH,
BU Geotechnics, Germany
Scope
Production, supply
Products
478, 3-7m long, 32mm Ø, double corrosion
protected GEWI® Soil Nails,
41 temporary Type WR, 26.5 and 32mm Ø,
10 - 12m long DYWIDAG Bar Anchors

GEWI® Piles against Uplift: New Aqueduct on the “Centrale As” Motorway

A new motorway was built between the towns of Dokkum and Nijega in the province of Friesland in the north of the Netherlands: The “Centrale As”. Together with two ring roads, the motorway will have a length of approx. 35km. With two lanes in each direction, the new motorway will establish a better connection between the north-east of Friesland and the other regions of the country.



Photos reprinted courtesy of TBI Infra B.V., Netherlands

The Centrale As also includes an aqueduct along the Prinses Margriet Canal. After the construction of the aqueduct, this canal was relocated towards the south. This way, the enclosed aqueduct structure could be built on the land along the current canal.

To extend the aqueduct, the company Voorbij Funderingstechniek installed temporary and permanent steel sheet piling. Voorbij Funderingstechniek also installed 63.5T GEWI® Piles in the concrete floor of the aqueduct to prevent it from uplifting.

The Timmermans Infratechniek company installed all of the DYWIDAG Strand Anchors that were needed to stabilize the sheet pile construction. Both the temporary and the permanent DYWIDAG Strand Anchors were equipped with watertight anchor heads.

In total, DSI Netherlands supplied 1,220 GEWI® Piles and 280 temporary and permanent DYWIDAG Strand Anchors for this project.

Owner
Province of Friesland, Netherlands
General Contractor
Joint Venture “Nije Daam”,
consisting of Mobilis, Frisco Civiel b.v.
and Van Gelder, all of them
Netherlands

Contractor
TBI Infra B.V. and its subsidiaries
Voorbij Funderingstechniek and
Timmermans Infratechniek B.V.,
all of them Netherlands

Subcontractor
DYWIDAG-Systems International B.V.,
Netherlands

Consulting Engineers
TBI Infra B.V., Netherlands

Scope
Production, supply, technical support
Products
1,220 63.5T GEWI® Piles and 280 temporary
and permanent DYWIDAG Strand Anchors

The Opole Power Plant: DSI supplies Post-Tensioning Systems for Poland's largest Coal-Fired Power Station

In the city of Opole in southwestern Poland, the Opole coal-fired power station has been generating electricity since the 1990s. In 2014, the modernization and enlargement of the power plant started with the addition of two new 900MW blocks. Once completed, the facility will be Poland's largest coal-fired power station.



Within the scope of the expansion, three identical fly ash silos were built. To post-tension each tank, DSI Poland supplied 274 Type SUSPA-Systems Strand Tendons with 548 Type 6-7 anchorages. Approximately 106t of prestressing steel and 13,000m of corrugated ducts were needed for these tendons per tank.

DSI's on site installation of the post-tensioning faced some challenges. This included pushing the prestressing steel strands into the ducts over the complete height of the silo with the highest ones reaching up to 65m above ground level. This operation had to be performed in compliance with all of the extremely strict safety rules that were in place

on the jobsite while, at the same time, not interrupting the work of other onsite teams. The vertical transportation of the stressing equipment was another challenge, often involving struggle with high winds and rain while working on unshielded platforms high above the ground.

Thanks to the optimized number of system parts and their robust design, the post-tensioning tendons were installed, stressed and grouted efficiently, quickly and trouble free on site.

Owner

PGE Górnictwo i Energetyka Konwencjonalna S.A., Poland

General Contractor

Joint Venture, consisting of RAFAKO S.A., Mostostal Warszawa S.A. and Polimex Mostostal S.A., all of them Poland

Contractor

Mostostal Power Development Sp. z o.o., Poland

Subcontractor

INSTAL WARSZAWA S.A., Poland

Unit

DYWIDAG-Systems International Sp. z o.o., Poland

Scope

Production, supply, installation, engineering services, technical support, supervision, rental of equipment

Products

822 Type SUSPA-Systems Strand Tendons with 1,644 Type 6-7 anchorages



DYWIDAG Bar Anchors and DYWI® Drill Hollow Bars stabilize a steep Cliff on Tenerife

The Canarian island of Tenerife is of volcanic origin and therefore features many unstable basaltic cliffs consisting of volcanic scoria and rock. In the district of Punta Brava in Puerto de la Cruz, residential buildings were erected directly on such a steep cliff.



Photos reprinted courtesy of v-traverca, Spain

In the course of time, the waves washed out the base of the cliffs, causing a rock fall that endangered the houses that were built at the top. The municipal council of Puerto de la Cruz therefore asked WARA consultants to provide a stabilization design. The concept included a retaining wall directly in front of the washed out area, a micropile wall and a row of horizontally installed anchors above the retaining wall.

The 708m of horizontally installed DYWIDAG Bar Anchors were 5-7m long, double corrosion protected, 32mm Ø, Grade WR 950/1050 bar anchors in accordance with ETA 05/123.

The load tests carried out on 3 of the DYWIDAG Anchors were successful.

The 59 self-drilling R51/660, 4-7m long DYWI® Drill Hollow Bars for the continuous micropile wall were installed at horizontal distances of 50 cm from each other and grouted with cement mortar.

Afterwards, the slope was sealed with a 10 cm thick layer of shotcrete with integrated polypropylene fibers.

Owner
Municipal council of Puerto de la Cruz, Spain
General Contractor
GRUPO SATOCAN, SA., Spain
Subcontractor
v-traverca, Spain
Consulting Engineers
WARA Consultoria y Desarrollo SL, Spain

Unit
DYWIDAG Sistemas Constructivos, S.A., Spain
Scope
Production, supply, technical support
Products
708m of double corrosion protected, 32mm Ø, 5-7m long DYWIDAG Bar Anchors, 59 R51/660, 4-7m long DYWI® Drill Hollow Bars

The Ingeniero Fernández Casado Stay Cable Bridge: Efficient Repair with DYNA Protect® Corrosion Protection Tape

The Ingeniero Fernández Casado Stay Cable Bridge near León in northern Spain was opened in 1983. At the time, it was the stay cable bridge with the world's largest span. A total of 220 stay cables are attached at the two 102.3 and 117.3m high, H-shaped pylons. The structure has lateral spans of 65m and crosses the Barrios de Luna water reservoir with a 440m long middle span.



Recently, the pipes of some stay cables were comprehensively rehabilitated. Cracks that had opened in the pipes were sealed, and some stay cables were wrapped using the approved DYNA Protect® Corrosion Protection Tape System.

The stay cables of the bridge have diameters between 140 and 225mm and consist of 24 to 80 Type 0.60" steel strands that are protected from corrosion by the enveloping cement mortar and PE ducts. During the course of the years, mechanical and climatic influences caused damage to the stay cables that was discovered by both a detailed visual stay cable inspection and an inspection using a drone.

Afterwards, the cracks in some of the cable pipes were repaired. In cases of larger damage, the respective pipe sections were replaced and the new sections welded on.

The areas in which the stay cables had rusted were cleaned and additionally protected from corrosion. Following the repair work, the stay cables were wrapped with DYNA Protect® Corrosion Protection Tape.

The system is based on two multilayer tapes consisting each of a stabilized polyethylene carrier film with a coextruded butyl rubber layer. The tape is applied using a specific amount of pressure and an overlap of 50% in two layers, thus also permitting a radial mechanical strengthening of the duct.

The higher pylon areas were only accessible via ropes and platforms. On the lower 30m, repair work was carried out from baskets. Furthermore, a robot was used for wrapping the stay cables with the DYNA Protect® System.

Owner
AUTOPISTA CONCESIONARIA
ASTUR-LEONESA, S.A.
(AUCALSA), Spain

Unit
DYWIDAG Sistemas Constructivos,
S.A., Spain

Scope
Supply, technical support

Products
DYNA Protect® Corrosion Protection
Tape System

The Al Wakrah Bypass: DSI Middle East supplies DYWIDAG Strand Post-Tensioning Systems for an important Connecting Road

Currently, the Wakrah Bypass Project is being built west of the harbor city of Al Wakrah south of Doha, Qatar. A new, 11km long expressway with five lanes per direction is being built for the new bypass.



The project includes five large intersections as well as access roads to important connecting roads. The new road will enhance the link between Doha and Mesaieed and ensure an efficient connection with the New Hamad International Airport and the Hamad Port, which was opened in December 2016.

The five intersections also include 20 bridges with average lengths of 120-150m. The longest bridge is the 220m long bridge No. 04 at the 11B Interchange. The bridge structures were tensioned using DYWIDAG Post-Tensioning Systems.

For this project, DSI Middle East supplied DYWIDAG Strand Post-Tensioning Systems with 1,100 Type MA 6837 and MA 6831 Multiplane Anchorages. Furthermore, the company supplied high quality corrugated DYWIDAG GDP Ducts made of HD-PP that provide excellent corrosion protection for the total of 2,770t of strand that were used in the project.

Owner
Ashghal - Public Works Authority,
Qatar
General Contractor
Larsen & Toubro Ltd., Qatar
Consulting Engineers
WSP, Qatar
Consulting
CH2M HILL, Inc., Qatar

Unit
DSI Middle East, Qatar

Scope
Supply, installation, technical support,
supervision

Products
DYWIDAG Strand Post-Tensioning
Systems with 1,100 Type MA 6837
and MA 6831 Multiplane Anchorages,
72,000m of Type GDP corrugated plastic
duct, total tonnage = 2,770t

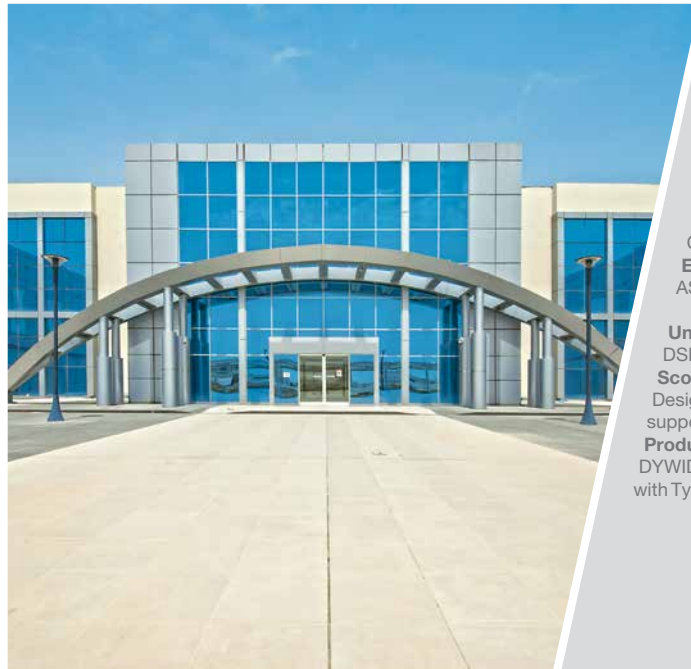
The B Square Mall in Doha: Rapid Construction Progress using Flat Slab Post-Tensioning

The district of Al Thumama south of Doha, Qatar, is a popular residential area that has recently experienced a rise in population. This development is taken into account by the new shopping center B Square Mall that was recently opened there.



The two-storey building that also has a basement features a built-up area of 29,695.5m². The ground floor accommodates a large supermarket, a department store, retail facilities and several kiosks. On the upper floor, there are several kiosks, retail facilities as well as a cinema and a food court.

The flat slabs of the new shopping center were post-tensioned using the DYWIDAG Flat Anchor System in order to ensure rapid completion of the construction work. In total, more than 110t of strand in ducts with Type 3-0.5" and 5-0.5" DYWIDAG Flat Anchorages were installed.



Owner

Al Bandary Real Estate, Qatar

General Contractor

Al Bandary Engineering, Qatar

Consulting Engineers

Gulf Consulting Group, Qatar

Consulting

Development Consulting Engineering Company, Qatar

Engineering

ASAS Engineering, Qatar

Unit

DSI Middle East, Qatar

Scope

Design, supply, installation, technical support, supervision

Products

DYWIDAG Bonded Post-Tensioning Systems with Type 3-0.5" and 5-0.5" Flat Anchorages

The Al Thuraya Tower: DYWIDAG Flat Anchors for Doha's new Landmark

The new Al Thuraya Tower in Doha, Qatar is a building project in West Bay, the city's commercial center located at the sea. With a total area of 45,000m², the building has 3 basement levels and 42 floors above the surface, offering room for 292 hotel apartments and 375 parking spaces.



Thanks to its special architecture and aesthetics, the Al Thuraya Tower is a new landmark in Doha's skyline.

The post-tensioning of all flat slabs using the DYWIDAG Flat Anchor System resulted in considerable weight savings and rapid construction progress. The easy assembly on site is not only economical, but also makes

possible extraordinary structures with a high security standard.

A total of 203t of 0.5" strand was required for the DYWIDAG Bonded Strand Tendons with Type 3-0.5" and 5-0.5" Flat Anchorages that were installed in the flat slabs of the Al Thuraya Tower.

Owner
Al Thuraya Real Estate
Investment, Qatar
General Contractor
Al Bandary Engineering, Qatar
Consulting Engineers
MZ & Partners, Qatar
Consulting
Diwan El Emara, Qatar

Unit
DSI Middle East, Qatar

Scope
Design, supply, installation, technical
support, supervision

Products
DYWIDAG Bonded Strand Tendons with
Type 3-0.5" and 5-0.5" Flat Anchorages

Bonded DYWIDAG Tendons for the Al Tilal 1 Project in Lusail, Qatar

The planned city of Lusail north of Doha, Qatar, is being built on an area of approx. 35km² in a desert. Once completed, the new city will have 200,000 inhabitants, and 170,000 people are expected to work there in the future.



This is where the Al Tilal 1 project is being constructed: A major project with a total of 17 buildings that will accommodate comfortable 1-3 bedroom apartments.

DYWIDAG Strand Tendons were used in 9 of the 4 storey buildings that include basements and have a total area of 54,000m². The post-tensioned flat slabs can accommodate high loads, and the DYWIDAG Bonded Flat Anchor System furthermore ensures a rapid construction progress.

In total, 245t of strands were necessary for the DYWIDAG Strand Tendons with Type 3-0.5" and 5-0.5" Flat Anchorages that were installed in this project.

Owner
Qatari Diar / Lusail Real Estate Development Company, Qatar
General Contractor
Al Bandary Engineering, Qatar
Consulting Engineers
Erga Qatar LLC, Qatar

Unit
DSI Middle East, Qatar
Scope
Design, supply, installation, technical support, supervision
Products
DYWIDAG Tendons with Type 3-0.5" and 5-0.5" Flat Anchorages

Flat Slab Post-Tensioning using Bonded DYWIDAG Tendons: The Marina COM-05 Tower in Lusail

In Lusail, a newly designed city that is being constructed north of Doha, Qatar, a modern marina is under construction. Once completed, the marina will offer 142 berths for 8-40m long yachts.



The Marina COM-05 office tower is also being built here. The tower with a total area of 19,460m² has 3 basement floors that will be used for parking. The ground floor and the two podiums will contain shops. The 25 floors above will accommodate offices.

The simple and flexible system of flat slab post-tensioning using DYWIDAG Strand Tendons

was successfully used for this construction project. In total, 90t of DYWIDAG Tendons were installed in the floor slabs of the Marina COM-05 Tower. All tendons were anchored with Type 3-0.5" or 5-0.5" Flat Anchorages.

Owner
Mashour Real Estate
Development, Qatar
General Contractor
Al Bandary Engineering, Qatar
Consulting Engineers
HILL International
Consulting
EHAF Consulting Engineers, Qatar

Unit
DSI Middle East, Qatar

Scope
Design, supply, installation, technical
support, supervision

Products
DYWIDAG Tendons with Type 3-0.5" and
5-0.5" Flat Anchorages

DYWIDAG Strand Tendons for Bridge over the Nile River in Uganda

In Jinja, the second largest city in Uganda and the second most important economic center in the country, a new stay cable bridge is being constructed across the Nile River. The bridge is a critical part of the Northern Corridor linking Kenya with the Democratic Republic of Congo and promoting trade in Eastern Africa.



The bridge, which is also known as the “Second Nile Bridge”, is the region’s first stay cable bridge and will first supplement and then replace the existing Nalubaale Bridge built in 1954 that is located 750m further downstream.

The new 4 lane hollow box girder structure is 525 m long and has a 135m long eastern span, a 290m long main span and a 100m long western span. The stay cables are arranged in a single plane and anchored in an approx. 80m high pylon in the shape of an inverted Y.

The bridge includes a total of 81 cross beams (2.5m deep, ranging from 400 to 700mm in width) that span transversely across the 22.9m wide box girder bridge deck. 72 cross beams accommodate the stay cable anchorages and are post-tensioned with a total of 72 Type 12-0.6" DYWIDAG Strand Tendons, 16 Type 19-0.6" DYWIDAG Strand Tendons, 236 Type 22-0.6" DYWIDAG Strand Tendons and 144 Type 27-0.6" DYWIDAG Strand Tendons.

Owner

Uganda National Road Authority,
Uganda

General Contractor

Joint Venture, consisting of the Zenitaka Corporation, Japan and Hyundai Engineering & Construction Co., Ltd, South Korea

Subcontractor

Utracon Overseas Pte Ltd., Singapore

Consulting Engineers

Oriental Consultants Global Co., Ltd., Japan

Licensee

Utracon Overseas Pte Ltd., Singapore

Scope

Supply, installation, engineering services, technical support, supervision, rental of equipment

Products

72 Type 12-0.6" DYWIDAG Strand Tendons,
16 Type 19-0.6" DYWIDAG Strand Tendons,
236 Type 22-0.6" DYWIDAG Strand Tendons,
144 Type 27-0.6" DYWIDAG Strand Tendons

DSI Canada Civil receives PTI Award of Merit for Slab on Grade Project

DSI Canada Civil is the recipient of a 2017 PTI Award of Merit for a slab on grade project: The Teck Truck Maintenance Facility. RCEO Kerry Allen received the award on behalf of the DSI subsidiary located in Surrey, BC, Canada at the annual PTI conference in Atlanta, Georgia, USA.

Teck is one of the world's leading diversified natural resource companies active in mining and mineral development. The Truck Maintenance Building, located in British Columbia, was a particularly challenging project.

The reason this project was selected was that the Post-Tensioning created a very stable, high load capacity base slab to separate all the structural components from the utility components and heating elements. This is critical in such a high load slab because the slab must accommodate the loads of the heavy haul trucks used in mining.

The Slab-on-Grade was constructed using bonded Type 9-0.6" DYWIDAG Multistrand Tendons to carry the large loads of the huge coal haul trucks while the trucks are being serviced, washed or tires replaced.

The DSI contract included supply and installation of the Post-Tensioning materials. Work was complicated because construction work also had to be carried out in the alpine mine site in the winter. The slab itself consists of an approx. 50cm (20in) thick base slab which has no other reinforcement component but the uniform, equally spaced, two-way post-tensioned grouted DYWIDAG Strand Tendons. The tendons are centered in the slab with little or no deviations to produce the maximum post-tensioning force possible.

The truck wash bay incorporates a fully integrated, approx. 6m x 30.5m (20ft x 100ft) tank to both store the water from the wash operation and also to contain some of the residue which is dislodged from the truck carriages.

This tank made use of three forms of post-tensioning. The base of the tank consisted of DYWIDAG Post-Tensioning Strand Tendons in the longitudinal direction because of their ability to follow the base contour, and 36mm Ø DYWIDAG Post-Tensioning Bars were used transversely across the base and for the vertical walls of the tank. They were particularly suitable for this purpose due to their ability to be both self-standing and to be accurately tensioned over short lengths.



Photos reprinted courtesy of Post-Tensioning Institute, USA

Horizontally, the walls were post-tensioned using 15mm Ø fully encapsulated strands placed in pairs, one each side of the vertical 36mm Ø DYWIDAG Bar Tendons.

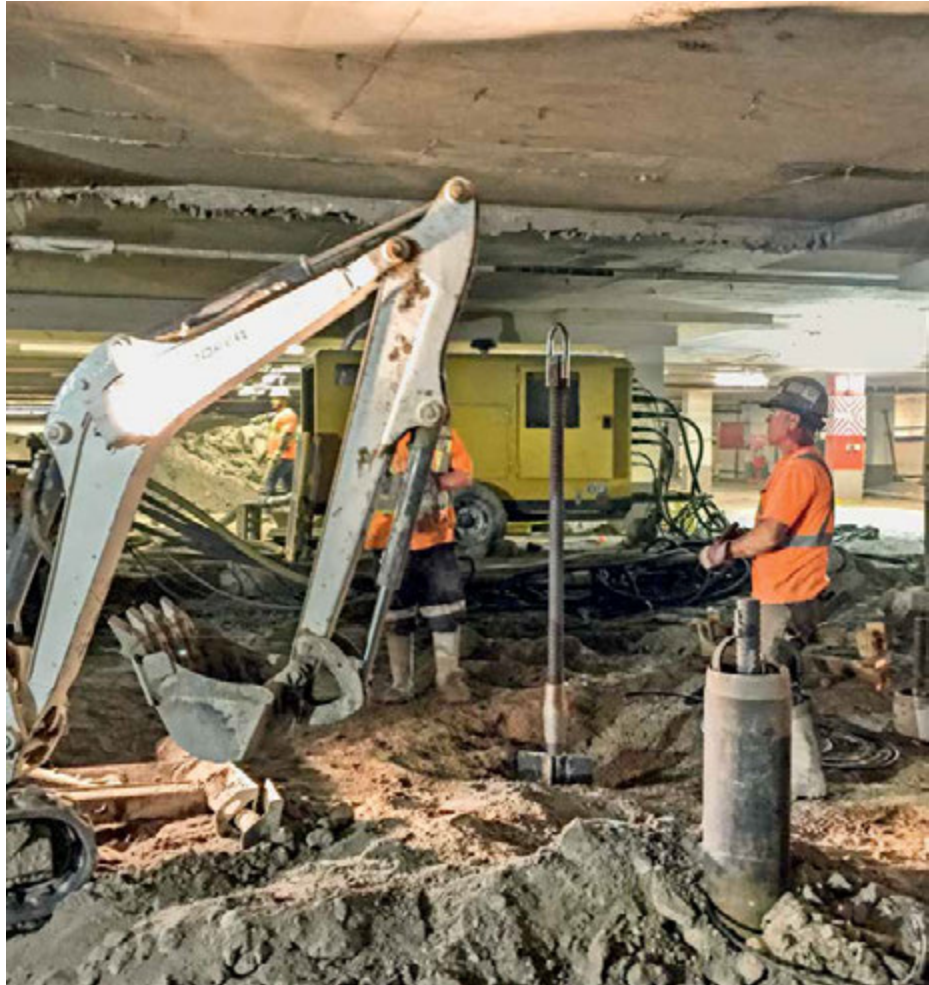
All post-tensioned elements were grouted following the tensioning operation except for the self-encapsulated strands. All walls and the tank base are a nominal 600mm in thickness for water retention requirements. The average post-tensioned stress is equal in all three axes of the tank. The entire tank is fully integrated with the raft slab.

Owner
Teck Resources Limited, Canada
Design/Consulting
JR Spronken and Associates,
Canada

Unit
DSI Canada Civil Ltd., Canada
Scope
Production, supply, installation
Products
Type 9-0.6" DYWIDAG Strand Tendons,
36mm Ø DYWIDAG Bar Tendons,
15mm Ø fully encapsulated strands

The Yonge-Sheppard Centre in Toronto: GEWI® Micropiles stabilize Pillars for remodeled Parking Garage

The Yonge-Sheppard Centre in northern Toronto, Canada, a 1976 shopping center named after two of the city's busiest streets – Yonge & Sheppard, where it is located, is being comprehensively rebuilt and modernized. The commercial area is being widened from 34,188m² (368,000ft²) to 44,036m² (474,000ft²).



Within the scope of the expansion, the basement parking garage was also remodeled. At the lowest level of the parking garage, the foundations of the load-bearing pillars were strengthened using GEWI® Micropiles.

For this purpose, one GEWI® Micropile was installed into the load-bearing soil on each corner of all pillars. In total, DSI Canada Civil supplied 250 63mm Ø, Gr. 550 Mpa GEWI® Micropiles in an average length of 7.62m (25ft) for reinforcing the foundations. Due to limited head room access, the GEWI® Micropiles were brought to the required lengths using 1,230 couplers.

The job used a total length of 1,910m (6,265ft) GEWI® Micropiles.

Due to weak soil conditions at the jobsite, the GEWI® Micropiles were post-grouted, a technique that increases the load transfer capacity when used in cohesive soils by fracturing the primary grout at locations of high pressure grout valves. All preproduction test piles complied with the required design parameters. As part of the testing requirements, one of the preproduction piles was successfully tested to 200% of service load.

Owner

Kingsett Capital Inc. and RioCan Real Estate Investment Trust, both Canada

Consulting Engineer

Entuitive Corporation, Canada

General Contractor

PCL Constructors Inc., Canada

Micropiles Subcontractor

Earthline Foundations & Shoring Ltd., Canada

Micropiles Engineer

Tarra Engineering & Structural Consultants Inc., Canada

Unit

DSI Canada Civil Ltd., Eastern Division, Canada

Scope

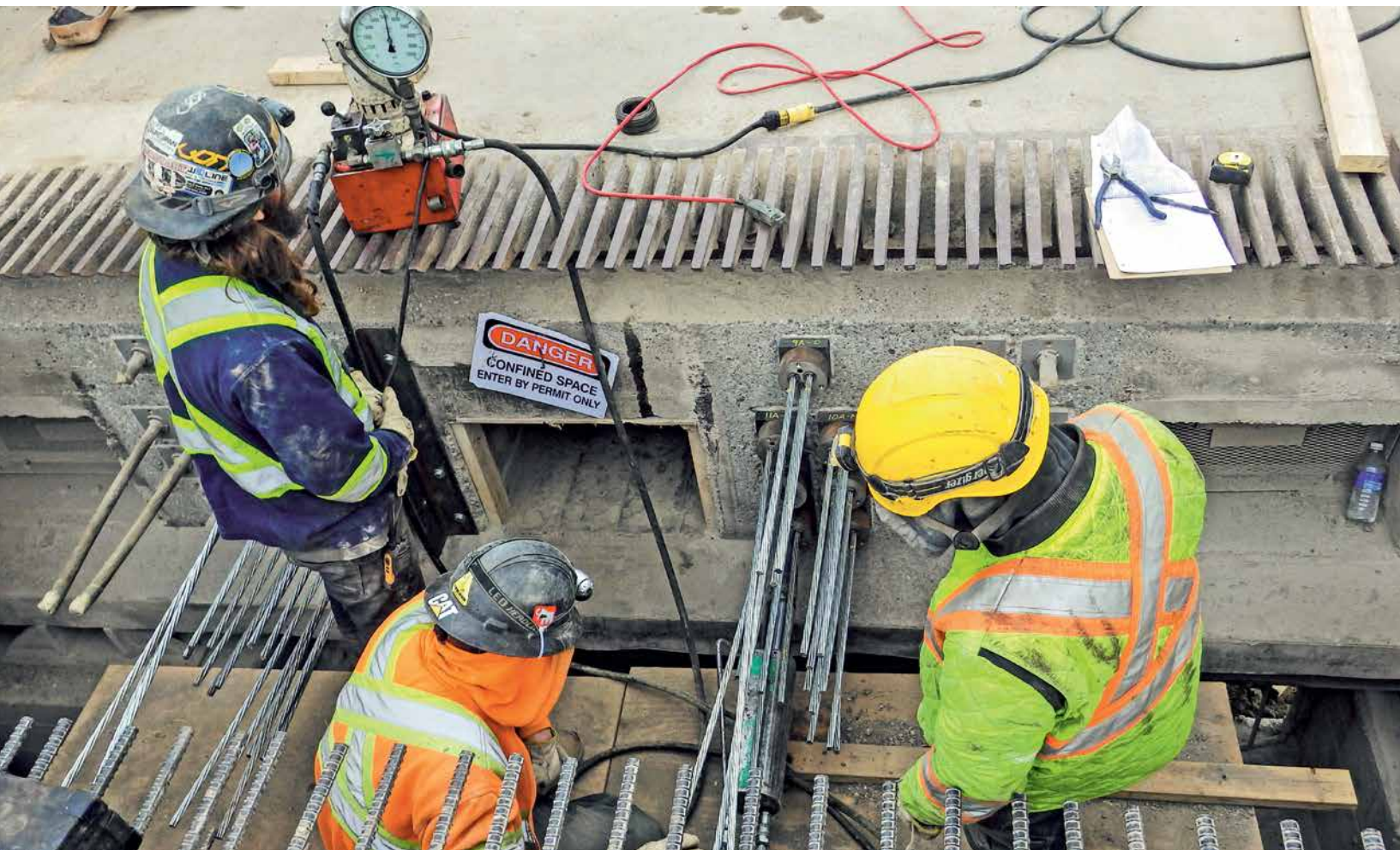
Supply, installation, technical support, rental of equipment

Products

250 63mm Ø, 7.62m long GEWI® Micropiles

Freezing Temperatures and Limited Space: Rehabilitation of the Hudson's Hope Bridge using DYWIDAG Tendons

Approximately 7km south of the remote community of Hudson's Hope in British Columbia in western Canada, there is a historic 207m span suspension bridge originally completed in 1965. 33 pairs of vertical cable hangers are attached to the two main suspension cables and support the 34 precast concrete deck units. The deck units are post-tensioned using 70 post-tensioning tendons.



After some regular inspections, the Ministry of Transportation & Infrastructure of British Columbia, MoT, decided to completely replace the existing post-tensioning tendons to further the life of this magnificent bridge. DSI Canada Civil was awarded the contract to supply the necessary post-tensioning system and special equipment.

The existing tendons were externally placed in the box sections of the precast units and anchored into a 12.19cm thick diaphragm wall at the ends. Access to the precast sections was only possible through the end diaphragm wall with an opening that was only 100cm wide and 75cm high.

The anchorages of the old post-tensioning system essentially consist of a plate with a conical hole, and a large wedge that is used to grip the cable. Behind the anchor plate is a 38mm Ø duct to allow for installation of the cables after erection of the precast deck units.

This section was ungrouted in the original construction, and the anchorage and wedge were not protected from corrosion. Since the anchorages are located directly below the finger joint expansion joints, over time, water and road salts penetrated the anchorages, causing extreme corrosion and the failure of some of the tendons.

Initially, the approach slabs were removed to allow access to the tendons. Afterwards, the tendons were destressed in a controlled manner, cut up and removed through the small access hatch.

Next, the new strands were winched into place, the end anchorages were installed and the wedges set for stressing. It was decided to winch the bundle of strands together directly from the strand packs as there was no area for the laydown of prefabricated tendons. Since there was no sheathing over the tendon length, they could not be pushed into place.



The existing, 2.86cm Ø tendons were each replaced with 3 galvanized 0.6" prestressing strands. The wedge plate anchorage had to be specially designed to fit with the existing anchorage wedge cavity. Due to the space constraints, the tendons were stressed using a monostrand jack. After the tendons had been stressed, a protective hood was installed along the face of the precast unit over the anchorages and then a concrete patch was poured in place to protect the anchorages. The duct behind the anchorage was also grouted in place to protect the new tendons from moisture.

In total, 70 new, Type 3-0.6", 235m long DYWIDAG Strand Tendons were used. This required a total of 55t of galvanized strand.

This project was very challenging due to its remote location and tight construction schedule as well as the inclement winter weather with freezing temperatures. Furthermore, the bridge had to remain in service during the complete course of work. Despite all difficulties, the General Contractor, Surespan, completed the work approximately 1 month ahead of schedule.

Owner
Ministry of Transportation & Infrastructure BC (MoT), Canada
General Contractor
Surespan Construction Ltd., Canada
Consulting Engineers
COWI, Canada

Unit
DSI Canada Civil Ltd., Western Division, Canada
Scope
Production, supply, technical support, rental of equipment
Products
70 Type 3-0.6", 235m long DYWIDAG Strand Tendons

DYWIDAG THREADBAR® saves Time and Money: The One Bennett Park Tower in Chicago

Chicago is currently experiencing a boom in high-rise construction with 43 projects currently underway and more in the works. The tallest of this group is One Bennett Park near Navy Pier.



Photos reprinted courtesy of Case Foundation Company, USA

The new 69 story high rise building will include both rental apartments and condominiums. Standing approx. 254.8m (836ft) tall, One Bennett Park is the highest building in the Streeterville neighborhood. The project also includes a large park that is actually the roof of a new subterranean parking structure.

The new tower is supported by belled caissons. The shafts of 18 of these caissons were reinforced by large steel cages made with 43mm Ø, Grade 80 DYWIDAG THREADBAR®. In total, approx. 16,518m of DYWIDAG THREADBAR® including accessories was used for the reinforcement cages.

The original design consisted of cages with 36mm Ø, Grade 75 reinforcing bars. This would have meant that 28, 85 and 105 reinforcing bars would have had to be installed into the cages. Due to the larger diameter of 43mm bar, the number of bars was reduced to 19, 56 and 62.



Going to the higher grade of steel and a larger bar diameter, 11% of weight was removed and the total number of bars in the cages was reduced by 34%, lowering the overall cost of material and labor and shortening the time to build each cage.

Another driving force in bringing down the cost of material was DSI's ability to produce bars with customized lengths shipped direct from the mill to the jobsite so no material was wasted.

Owner
The Related Companies, L.P., USA
General Contractor
Lendlease Corporation, USA
Contractor
Case Foundation Company, USA
Architect (Design)
Robert A.M. Stern Architects LLP, USA
Architect (Execution)
GREC Architects, USA
Consulting Engineers
Thornton Tomasetti, USA

Unit
DYWIDAG-Systems International USA Inc.,
BU Geotechnics, USA
Scope
Production, supply
Products
16,518m of 43mm Ø, Grade 80 DYWIDAG
THREADEBAR® including accessories

Cantilever Construction for unhindered Traffic: DYWIDAG Tendons for the new Brattleboro Bridge in Vermont

Within the scope of a construction project in Brattleboro, Vermont, in northeastern USA, four old bridge structures are being replaced by two new bridges. The larger of the two, bridge 9, will accommodate the Interstate 91 motorway on 4 lanes, thus eliminating the current road traffic bottleneck in this area.



Photos reprinted courtesy of PCL Civil Constructors Inc., USA

A total of 535m³ (700yrd³) of concrete had to be poured for the bridge foundation – more than any other project in Vermont. The new structure is approx. 316m (1,036ft) long and has a 157m (515ft) long main span as well as two approx. 80m (263ft) and 79m (258ft) long side spans. The segmental bridge is being constructed using the free cantilever method to minimize construction time and to avoid any negative impact on the local natural environment.

The 31.7m (104ft) wide main span is located approx. 30.5m (100ft) above the water surface and includes viewing platforms at each of the curved bridge piers permitting a view of the beautiful countryside.

Types 4-0.6", 12-0.6", 19-0.6" and 27-0.6" DYWIDAG Strand Tendons were predominantly used as post-tensioning systems in the bridge. Approx. 539t (594 US ton) of Grade 270 strand were needed for the tendons.

814 flat anchors were provided for the transverse tendons in the top slab of the box girder. The anchors were reinforced with stainless steel in the anchor zone due to a contract requirement.

The cantilever and continuity tendons consisted of 8 Type 12-0.6" DYWIDAG Tendons, 57 Type 19-0.6" DYWIDAG Tendons and 90 Type 27-0.6" DYWIDAG Tendons in corrugated polypropylene duct. Furthermore, 44 Type 27-0.6" DYWIDAG Tendons were used as traditional external tendons.

DSI USA also supplied 22.7t (25 US ton) of permanent 36mm Ø, Grade 150 DYWIDAG Bar Tendons that were installed longitudinally in the superstructure and at the tops of the piers. In addition, DSI provided detailed assembly drawings and engineering support and rented the equipment needed for stressing.



Owner
Vermont Agency of
Transportation (VTrans), USA
General Contractor
PCL Civil Constructors Inc., USA
Consulting Engineers
FIGG Bridge Engineers, Inc., USA

Unit
DYWIDAG-Systems International USA
Inc., BU Post-Tensioning, East, USA
Scope
Supply, engineering services,
rental of equipment

Products
Type 4-0.6", 12-0.6", 19-0.6" and 27-0.6"
DYWIDAG Strand Tendons, permanent
36mm Ø DYWIDAG Bar Tendons

Track Capacity Expansion using DYWIDAG Strand Tendons: The I-10 Neches River Bridge in Beaumont

The main East-West railway corridor in Beaumont, Texas, crosses the I-10 Neches River Bridge, a vertical lift span bridge that allows ships to pass under the structure. The single track bridge is usually open for ship traffic between 15 and 30 minutes, and 40 to 50 trains cross the bridge each day.



In order to add track capacity to the railway connection over the Neches River, a new structure is being built parallel to the existing bridge. In this project, DSI USA was the contact point between the General Contractor Williams Brothers and Mexpresa, the company supplying the form travelers.

A total of 634 Type 4-0.6" DYWIDAG Strand Tendons were used as transverse tendons in the bridge segments.

Longitudinal post-tensioning was carried out using 372 Type 12-0.6" DYWIDAG Strand Tendons and 4 Type 7-0.6" DYWIDAG Strand Tendons. DSI also supplied the equipment needed for stressing and grouting and supported the jobsite during stressing.

Owner

Texas Department of Transportation (TXDOT), USA

General Contractor

Williams Brothers Construction Co., Inc., USA

Consulting Engineers

Summit Engineering Group, Inc., USA

Engineering

Summit Engineering Group, Inc., USA

Unit

DYWIDAG-Systems International USA Inc., BU Post-Tensioning, West, USA

Scope

Production, supply, engineering services, technical support

Products

634 Type 4-0.6" DYWIDAG Strand Tendons,
372 Type 12-0.6" DYWIDAG Strand Tendons,
4 Type 7-0.6" DYWIDAG Strand Tendons

The IH 35E near Dallas: DYWIDAG Strand Tendons contribute to the Widening of an important Transport Link

The Interstate 35E is the eastern part of IH 35 and leads through Dallas and Denton counties in Texas. During the widening of the 45km long eastern section, one new general purpose lane per direction as well as two reversible managed lanes are being built.



The main challenge in this project was to accommodate the designed tendon sizes in the anchor caps, which was achieved in close cooperation between DSI and the designers.

Since this is a design/build project, DSI was able to propose a change to some of the original post-tensioning design, modifying the quantity and size of the tendons to reduce the use of different equipment sizes and to optimize installation.

DSI USA supplied DYWIDAG Strand Tendons for a section of this project to post-tension the road overpass structure. In total, 121 Type 37-0.6" DYWIDAG Strand Tendons, 40 Type 27-0.6" DYWIDAG Strand Tendons and 8 Type 19-0.6" DYWIDAG Strand Tendons were installed in the structure.

Owner

Texas Department of Transportation (TXDOT), USA

General Contractor

Joint Venture AGL Constructors, consisting of Archer Western Contractors, LLC, Granite Construction Co. and Lane Construction Co., all of them USA

Consulting Engineers

Parsons Transportation Group, Inc. and HDR Engineering, Inc., both USA

Engineering

Parsons Transportation Group, Inc. and HDR Engineering, Inc., both USA

Unit

DYWIDAG-Systems International USA Inc., BU Post-Tensioning, West, USA

Scope

Production, supply, installation, engineering services, technical support

Products

121 Type 37-0.6" DYWIDAG Strand Tendons, 40 Type 27-0.6" DYWIDAG Strand Tendons and 8 Type 19-0.6" DYWIDAG Strand Tendons

The Park District Project in Dallas: Top-Down Method minimizes Construction Time

The Park District Project in the center of Dallas includes the construction of a 20 story office building and a 33 story apartment building that will include offices, restaurants and apartments on more than 83,600m².



Photos reprinted courtesy of Oscar Orduno, Inc., USA

To minimize construction time, the developer, Trammell Crow Company and their business partner Met Life decided to use the top-down method. This method allowed vertical construction to begin while excavation and development of the needed earth retention system continued below.

The office building includes four levels of below-grade parking. Crews needed to dig nearly 18.3m (60ft) down, hitting a layer of limestone at roughly 6m (20ft) below grade. A precision aligned anchored soldier pile and soil nail temporary retention system with reinforced shotcrete fascia was designed by Orduno Designs Services, LLC to facilitate the construction of this challenging project.

Oscar Orduno, Inc first drilled the anchored soldier piles along the tower's roughly 91 x 91m (300ft x 300ft) perimeter and

installed the retention system down to the second basement level. For this purpose, DYWIDAG Soil Nails and DYWIDAG Anchors were drilled in roughly 1.5m (5ft) increments.

Once the above-ground third floor was cast and stressed and the reshoring removed, crews began to excavate the levels below, extending the retention system to basement level 3 and ultimately to basement level 4.

To complete this retention system, DSI supplied approximately 1,000 DYWIDAG Soil Nails consisting of 19mm Ø, Gr 75 THREADBAR® and 200 temporary 46mm Ø, Gr 150, 9-15m (30-50ft) long DYWIDAG Anchors including accessories such as anchor plates.

Owner

Trammell Crow Company, USA

General Contractor

Balfour Beatty, USA

Subcontractor

Oscar Orduno, Inc., USA

Architect

HKS, Inc., USA

Unit

DYWIDAG-Systems International

USA Inc., BU Geotechnics, USA

Scope

Production, supply

Products

1,000 temporary 19mm Ø DYWIDAG

Soil Nails, 200 temporary 46mm Ø,

9-15m long DYWIDAG Anchors

The Maritime Building in Seattle: DYWIDAG Micropiles ensure Stability and Seismic Safety

The 1910 Maritime Building in the harbor area of downtown Seattle, Washington in northwestern USA was originally used as a warehouse. Now, it is being comprehensively renovated and expanded by the addition of three new floors.



The existing 16,072m² (173,000ft²) 5-story structure is a timber post and beam building with a reinforced concrete exterior. The building will be transformed into a modern mixed-use building with approx. 2,323m² (25,000ft²) of additional office space and another area roughly the same size for retail facilities.

Within the remodeling and expansion scope, the building had to meet current safety regulations, which is why it is being seismically retrofitted. A critical part of enhancing earthquake stability was the reinforcement of the building's foundation by a posterior

installation of 151 DYWIDAG Micropiles at the lowest floor. Kulchin Foundation Drilling Company decided to use micropiles consisting of 57mm Ø, Grade 80 DYWIDAG Threadbar. In this system, the high quality thread ensures an easy coupling of the 8 short pile segments and a safe installation in the borehole.

In total, 151 DYWIDAG Micropiles in lengths of 22.9m (75ft) each were successfully installed in very tight conditions with less than 2.4m (8ft) of overhead clearance.

Owner
Beacon Capital Partners, LLC,
USA
General Contractor
Turner Construction Company,
USA
Subcontractor
Kulchin Foundation Drilling Co., USA
Architect
NBBJ, USA
Consulting Engineers
Terracon Consultants, Inc., USA
Engineering
Nabih Youssef Associates Structural
Engineers, USA

Unit
DYWIDAG-Systems International USA Inc.,
BU Geotechnics, USA
Scope
Production, supply
Products
151 57mm Ø, 22.9m long DYWIDAG
Micropiles

Long term Stability: GEWI® Soil Nails stabilize Slopes at the Highpark Project near Los Angeles

The construction project formerly known as Ponte Vista and now renamed Highpark near the Port of Long Beach/Los Angeles in the community of San Pedro is being built on an area of approx. 24.9ha that once was a residential area for the Navy. The project is currently planned to include 676 family homes, town houses and condominiums.



In the first step of construction, the site was leveled and the infrastructure consisting of streets and underground supply lines was built. Within the scope of this work, several slopes and steep embankments had to be tied back. For this purpose, DSI USA produced and supplied 229 test soil nails and 2,529 permanent GEWI® Soil Nails with fusion bonded epoxy coating and factory grouted double corrosion protection.

Once the soil nails were installed and grouted, mesh reinforcement was placed and covered with an initial layer of shotcrete. After installation of wall reinforcement and the hardware for the nails (studded plates, bevel washers and nuts) a second layer of shotcrete was applied, sculpted and stained to look like natural rock.

General Contractor
SFI Bridgeview, LLC and
iStar Financial, both USA
Subcontractor
Drill Tech Drilling & Shoring, Inc., USA
Engineering
Fuscoe Engineering, Inc., USA

Unit
DYWIDAG-Systems International USA
Inc., BU Geotechnics, USA
Scope
Production, supply
Products
229 test soil nails, 2,529 epoxy coated plus
double corrosion protected GEWI® Soil Nails

Widening of the I 10: DYWIDAG Systems stabilize Retaining Walls along one of the longest Freeways in the USA

From the East coast to the West coast, Interstate 10 is one of the longest freeways in the USA. In order to reduce frequent traffic congestion, the California Department of Transportation is widening an approx. 9.7km (6mi) long section in the Californian city of Pomona in Los Angeles County by adding more lanes.



The construction of several retaining walls was required for this project, 8 of which were soil nail walls and 2 were tieback walls.

For the soil nail walls, DSI USA supplied 11,025 DYWIDAG Soil Nails. 7,372 were double corrosion protected Grade 75 THREADBAR® in diameters of 25 to 36mm.

The remaining 3,653 were epoxy coated per ASTM A934 with a 0.90m (3ft) DCP section. In addition, 104 DYWIDAG Strand Anchors were installed in the 2 tieback walls.

Owner

California Department of Transportation, USA

General Contractor

Atkinson Construction, LLC, USA

Subcontractor

Drill Tech Drilling and Shoring, Inc., USA

Engineering

California Department of Transportation, USA

Unit

DYWIDAG-Systems International USA Inc., BU Geotechnics, USA

Scope

Production, supply

Products

11,025 DYWIDAG Soil Nails, 104 DYWIDAG Strand Anchors

DYWIDAG Anchors pass strict Tests: The Loma Linda University Hospital in California

The Loma Linda University Adult Hospital in the city of Loma Linda near Los Angeles was built in 1967; it is outdated, overcrowded and no longer meets current seismic safety standards. Consequently, in 2016, construction work began on a new Adult Hospital and an additional tower for the adjacent Childrens Hospital.



The new hospital complex will not only be the tallest building in San Bernardino County, but it will also be considered one of the safest in California.

The project implements a first of its kind vertical earthquake isolation system which separates the building from the ground using more than 200 vertical shock absorbers – a large scale version of a modern car suspension system. Working together with a lateral earthquake isolation system of sliding bearings and dampers, the system will keep the hospital operational following a potentially catastrophic magnitude 7.9 earthquake.

Over 12m (40ft) of the new building will be below grade. The excavation is supported on all 4 sides by a soldier beam lagging wall, which is tied back by 4 rows of double corrosion protected (DCP) DYWIDAG Anchors.

In total, 675 36mm Ø DYWIDAG THREADBAR® Anchors and 44 46mm Ø Grade 150 DYWIDAG THREADBAR® Anchors in lengths of 9-18m (30-60ft) were installed.

Each anchor was post grouted within 24 hours after initial grouting to enhance its bond capacity. All anchors passed the required tension tests and were accepted under the very strict Office of Statewide Health Planning and Development (OSPHD) requirements. DSI USA also provided stressing equipment for anchor testing.

Among the 719 anchors supplied, 13 were equipped with the DYNA Force® system for load monitoring during and after the wall construction. The sensors were located in the unbonded length of the anchor, approx. 1m (4ft) below the bearing plate, with only the wire protruding through the bearing plate. The anchor force can be read in kips without unit conversion from the portable readout box whenever required.

The new hospital is scheduled to open in 2020.

Owner
Drill Tech Drilling & Shoring Inc., USA
General Contractor
McCarthy Building Companies, Inc., USA
Subcontractor
Drill Tech Drilling & Shoring Inc., USA
Architect
NBBJ, USA
Consulting Engineers
KPF Consulting Engineers, USA

Unit
DYWIDAG-Systems International USA Inc., BU Geotechnics, USA
Scope
Production, supply
Products
675 36mm Ø DYWIDAG THREADBAR® Anchors,
44 46mm Ø DYWIDAG THREADBAR® Anchors,
13 DYNA Force® Sensors

The Gerald Desmond Bridge: DYWIDAG Strand Tendons for the USA's second highest Stay Cable Bridge

Currently, the 1968 Gerald Desmond Bridge that crosses the Back Channel in the Port of Long Beach, California, is being replaced by a new stay cable bridge. The bridge is an important connection to the city center. Thanks to a 62.5m (205ft) clearance, the bridge is also suitable for large cargo ships. The two pylons are approx. 157m (515ft) high, and, once completed, the new Gerald Desmond Bridge will be the USA's second highest stay cable bridge. The bridge deck has a 610m (2,000ft) long main span and is supported by 40 stay cables at each of the two pylons.



DSI USA is producing and supplying the complete longitudinal and transverse post-tensioning for the entire bridge deck and the approach structures.

In total, over 3,000t of bonded DYWIDAG Strand Tendons of different Types ranging from 4-0.6" to 37-0.6" with MA Anchorages will be installed in the bridge. The scope also includes the installation of all anchorages, duct and strand as well as stressing and grouting.

For the high-level approach structures that are being built using the incremental

launching method with Movable Scaffolding Systems (MSS), DSI is also installing the strand tendons and performing the stressing and grouting operations as well as the complete installation of the transverse deck post-tensioning.

When using the incremental launching method, stressing operations follow concrete placement by just 48 hours. Therefore, the equipment must be provided just-in-time in order to ensure the completion of the stressing and grouting work within the tight launch schedule.

The typical spans are constructed using 4 to 5 Type 27-0.6" DYWIDAG Strand Tendons, running full-length in each girder web.

Additional, part-length, typically Type 27-0.6" or 37-0.6" DYWIDAG Strand Tendons pass longitudinally through the top deck. The top decks are transversely post-tensioned using Type 4-0.6" DYWIDAG Strand Tendons in flat ducts with Type FA Flat Anchorages. Several structures feature part-length DYWIDAG Strand Tendons that necessitated stressing from the interior of the box girder. This requires close collaboration with the contractor.



Cast-on-falsework construction is common in the western USA, and DSI is one of the most experienced subcontractors in this market. The extensive experience of DSI's field crews ensures a safe and efficient installation within the tight schedule.

Thanks to the fact that DSI's Long Beach facility is located at a distance of only 16km (10mi) from the jobsite, DSI is able to rapidly respond to the contractor's changing needs at all times in this major project. Furthermore, due to the wide array of available equipment,

DSI is able to supply the matching equipment to the jobsite at all times without any delays. The continuous coordination between multiple work locations on the project site as well as the Long Beach plant ensures a seamless flow of materials, equipment and manpower.

Owner

Port of Long Beach and California Department of Transportation (Caltrans), both USA

Design/Build Contractor

SFI Joint Venture, consisting of Shimmick Construction Inc., USA, FCC Construction, Spain and Impregilo S.p.A., Italy

Architect

HNTB, USA

Consulting Engineers

Arup Pty. Ltd. and Biggs Cardosa Associates, Inc., both USA

Subcontractor

DYWIDAG-Systems International USA Inc., BU Post-Tensioning, West, USA

Scope

Production, supply, installation

Products

over 3,000t of Type 4-0.6" to 37-0.6" DYWIDAG Strand Tendons with MA Anchorages

The Reventazón Hydroelectric Power Plant: Foundation of Transmission Lines using DYWI® Drill Micropiles

The new Reventazón Hydroelectric power plant in Costa Rica is the largest hydro station in Central America and the second largest construction project in the region after the Panama Canal. The power station is located in the Siquirres Canton and will supply energy to approximately 525,000 households with a generating capacity of 305.5MW. To ensure the electricity supply to the region, ICE built and modernized a total of 164km of transmission lines.



In the remote areas of the Sarapiquí Mountains, it would have been difficult to build the foundations for the transmission towers using reinforcing steel mesh and large concrete blocks.

For this reason, the foundation was built using micropiles. For economic reasons and due to the faster installation time,

DSI proposed the use of self-drilling T40N, 40mm Ø DYWI® Drill Micropiles as an alternative to the originally planned, conventional micropiles.

In total, 753 DYWI® Drill Micropiles with 592 couplers, 592 spacers, 532 nuts and 266 90mm Ø cross bits were installed in the foundations of the new transmission lines.

Owner

Instituto Costarricense de Electricidad (ICE), Costa Rica

General Contractor

Instituto Costarricense de Electricidad (ICE), Costa Rica

Contractor

Pilotes Preexcavados de Costa Rica, Costa Rica

Subcontractor

Superba S.A., Costa Rica

Consulting Engineers

Coesa, Costa Rica

Unit

DYWIDAG-Systems International USA Inc., BU Geotechnics, USA

Scope

Production, supply

Products

753 T40N, 40mm Ø DYWI® Drill Micropiles

DYWIDAG Post-Tensioning Tendons for a new Project in the Center of Veracruz: The Villa del Mar

In the center of Veracruz on the east coast of Mexico, the Villa del Mar project is under construction. The block of buildings includes a 180 room hotel, a 12 level, 11,400m² office building and a 3 level, 23,000m² shopping center. In addition, the Villa del Mar has 4 subterranean parking decks.

For the project, the floor slab was longitudinally and laterally post-tensioned using Monostrand Tendons, 0.5", G-270 K.

DYWIDAG Bar Tendons were installed in recesses in the floor slab formwork. Following concreting, the precast supports were placed on these tendons and connected by force-fit.

The supports, stiffening girders, load-bearing girders and double T beams were produced using precast concrete elements and placed on site. For this project, DYWIDAG Systems International Mexico supplied 17,800m of 26mm Ø, G-150 K DYWIDAG Bar Tendons as well as Type 20-0.5" DYWIDAG Strand Post-Tensioning Systems and accessories.



Owner
Artha Capital, Mexico
General Contractor
Beck Internacional de México, S. de R.L. de C.V., Mexico
Contractor
Tecnología en Concreto, Mexico
Architect
kmd Architects, Mexico
Subcontractor
DYWIDAG Systems International Mexico, S.A. de C.V., Mexico

Scope
Production, supply
Products
17,800m of 26mm Ø DYWIDAG Bar Tendons, DYWIDAG Strand Tendons

Photos reprinted courtesy of DYWIDAG Systems International Mexico, S.A. de C.V., Mexico (both articles)

DYWIDAG Bar Anchors stabilize 24m deep Excavation: The Centro Médico ABC in Santa Fé

The Centro Médico ABC in Santa Fe, a district southwest of Mexico City, is one of the city's four main hospitals.

Recently, a new, 7 story parking structure

was added to the hospital requiring a 24m deep excavation on the 3,182m² large area.

To stabilize the excavation, 270 double corrosion protected, 36mm Ø, G-150 K

DYWIDAG Bar Anchors in lengths of 10, 12, 13 and 14m were installed in 5 levels.



Owner
Centro Médico ABC, Mexico
General Contractor
Viguetas y Bovedillas, S.A. DE C.V., Mexico
Subcontractor
DYWIDAG Systems International Mexico, S.A. de C.V., Mexico

Scope
Production, supply
Products
270 double corrosion protected 36mm Ø, G-150 K DYWIDAG Bar Anchors

Grand Reserva Paulista: DYWIDAG Bar Anchors for one of São Paulo's largest Residential Projects

With a total area of 180,000m² and with over 6,900 residential units, the Grand Reserva Paulista Project is the largest residential development in the district of Pirituba in the north of São Paulo, Brazil. The two 36 floor “Spazio Pôr do Sol” residential towers are being built as part of this project.



In order to build the tower foundations, a new 55m wide and 9m high retaining wall had to be constructed and anchored in front of an old tieback structure of the adjacent building. In this wall, 66 permanent, epoxy coated 32mm Ø DYWIDAG Bar Anchors with working loads of 343kN and average lengths of 14m were used. The anchors had a total length of 1,000m and were supplied to the jobsite including accessories.

Due to the existing structure, the formwork had to be directly locked against the old wall using long DYWIDAG Anchors. Furthermore, the formwork could not be anchored against the soil because it was not adequately compacted and did not offer enough resistance.

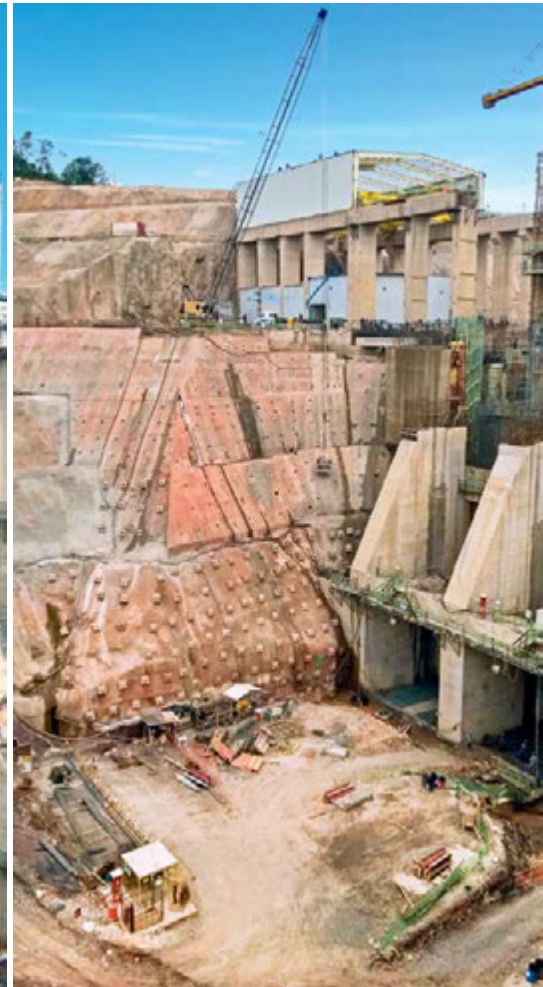
The DYWIDAG Bar Anchor Systems were especially suitable for this project because of their excellent load-bearing capacity.

Owner
MRV Engenharia e Participações
S.A., Brazil
General Contractor
MRV Engenharia e Participações
S.A., Brazil
Subcontractor
Esteio - Engenharia e Fundações
Ltda., Brazil

Unit
Protendidos DYWIDAG Ltda., Brazil
Scope
Supply
Products
66 permanent, epoxy coated, 32mm Ø,
14m long DYWIDAG Bar Anchors

Energy for 1.6 Million People: DSI Prepron and Protendidos DYWIDAG supply DYWIDAG Systems for the Sinop Hydroelectric Power Plant

The Sinop Hydroelectric Power Plant in Brazil is currently under construction on the Teles Pires River approx. 70km from the city of Sinop in the federal state of Mato Grosso. With two generators, the power house will have an installed capacity of 408MW and thus be able to generate electricity for approx. 1.6 million people, which is equivalent to approx. 50% of the population of Mato Grosso.



The reservoir will have an area of 337km² at a maximum water level of 302m. The volume will equal approx. 3 billion m³ at a maximum depth of 48m.

To keep project costs low, a large scale slope stabilization was realized using soil nails consisting of low strength steel. However, afterwards, a landslide occurred which fortunately did not injure anyone, but which destroyed the complete slope stabilization.

As a safe and permanent solution, a slope stabilization using permanent 32mm Ø, St 95/105 DYWIDAG Bar Anchors was chosen.

Within a short period of time, Protendidos DYWIDAG supplied more than 10,000m of DYWIDAG Threadbar for approx. 800 bar anchors to make up for lost time.

DSI Prepron's post-tensioning systems were used in 4 of the trunnion girders supporting the dam's 3 radial gates. In each girder, 18 Type 22-0.6" DYWIDAG Strand Tendons were used for longitudinal post-tensioning and 12 Type 14-0.5" DYWIDAG Strand Tendons were used for transverse post-tensioning. A force of 4.415kN was applied to the longitudinal tendons and a force of 1.962kN to the transverse tendons. DSI Prepron installed all tendons and provided the required equipment.

Owner
CES Cia Energética Sinop, Brazil
General Contractor
Triunfo, Brazil

Units
DSI Prepron and Protendidos DYWIDAG Ltda., both Brazil
Scope
Supply, installation, engineering services
Products
800 permanent Ø 32mm DYWIDAG Bar Anchors,
72 Type 22-0.6" DYWIDAG Strand Tendons,
48 Type 14-0.5" DYWIDAG Strand Tendons

The Line 13 Jade: DSI Prepron supplies DYWIDAG Post-Tensioning Systems for connecting São Paulo with the International Airport

The new Line 13 Jade of the São Paulo metro system in Brazil will connect the city with the São Paulo International Airport in the municipality of Guarulhos. The line has a total length of 12.2km, 4.3km of which will be built at ground level and 7.9km of which will be elevated.



Work is divided into four lots, two of which are being built by the Consortium CST Linha 13-Jade. In these sections, DSI Prepron supplied post-tensioning systems for one of the elevated structures that will accommodate the new metro line.

The structure was built using the free cantilever method, and 3 successive cantilevers were post-tensioned using Type 15-0.6" DYWIDAG Strand Tendons.

Owner
CPTM – Companhia Paulista de Trens Metropolitanos, Brazil
General Contractor
CST Linha 13-Jade Joint Venture, consisting of Consbem Construções e Comércio Ltda, Grupo Serveng and TIISA, all of them Brazil

Unit
DSI Prepron, Brazil
Scope
Supply, installation, engineering services
Products
Type 15-0.6" DYWIDAG Strand Tendons

New Tamoios Highway: DSI Prepron supplies DYWIDAG Strand Tendons for several Bridge Structures

Currently, the New Tamoios Highway bypass is being built around Caraguatatuba and São Sebastião, two coastal towns on the northern coast of the federal state of São Paulo, Brazil. The 33.9km long road includes 5 tunnels, 44 bridges and viaducts.



DSI Prepron has already contributed to the expansion of the Tamoios Highway, the main access to the north coast, and is now supplying high quality products and services for several bridges and viaducts for the extension of this highway.

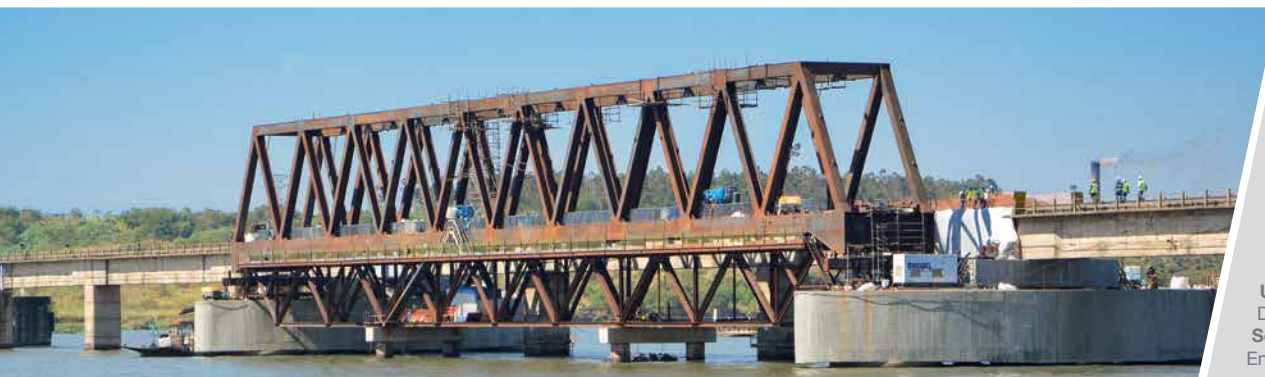
Type 6-0.5", 10-0.5" and 12-0.5" DYWIDAG Strand Tendons were used for post-tensioning the different bridge girders. Furthermore, DSI Prepron supplied specialists on site during the installation of the post-tensioning tendons.

Owner
DERSA Desenvolvimento Rodoviário S.A., Brazil
General Contractor
Grupo Serveng and Construtora Queiroz Galvão, both Brazil

Unit
DSI Prepron, Brazil
Scope
Supply, installation, engineering services
Products
Type 6-0.5", 10-0.5" and 12-0.5" DYWIDAG Strand Tendons

Precision Work with DYWIDAG Systems: Lifting a new Span for the Ayrosa Galvão Bridge

The Ayrosa Galvão railroad bridge crosses the river Tietê in the town of Pederneiras in the federal state of São Paulo, Brazil. Since traffic volume on the river has significantly increased over the last few years, the free span of the railway bridge had to be enlarged in order to support the new traffic volume and also to permit larger ships to pass under the bridge.



For this purpose, the existing free span was imploded and replaced by a new 1,400t steel truss girder structure. This new structure was erected next to the bridge and then lifted into its new position.

In order to comply with an imposed time limit of 16 hours for the work, the new steel structure

was lifted into its new position using 8 simultaneously acting Type MPR 320 Jacks, supplied by DSI Prepron. For the displacement of the new span, DSI Prepron also supplied special rollers, Type MPR 200 Jacks and 32mm Ø, St 95/105 DYWIDAG Bar Tendons. Furthermore, the company provided all the technical service on site.

Owner

DNIT - Departamento Nacional de Infraestrutura de Transportes, Brazil

General Contractor

TIISA/ETC/DP BARROS Joint Venture, Brazil

Engineering

RMG Engenharia, Brazil

Unit

DSI Prepron, Brazil

Scope

Engineering services, technical support, supervision

Products

32mm Ø DYWIDAG Bar Tendons, 8 Type MPR 320 Jacks, Type MPR 200 Jacks

Tanks using Post-Tensioning with DYWIDAG Strand Tendons: Expansion of Isabela's Plant in Brazil

The Isabela brand is one of the leading brands for biscuits in southern Brazil and forms part of the food manufacturer M. Dias Branco S.A. The Isabela plant in the town of Bento Gonçalves, close to Porto Alegre, in southern Brazil, produces biscuits for the entire country.



The expansion project includes 36 40m high new flour storage tanks. The tanks were horizontally post-tensioned using 45 unbonded 4 strand DYWIDAG Ring Tendons.

DSI Prepron supplied and installed the ring tendons and supported the jobsite with services related to the construction and post-tensioning of all tanks.

Owner

M. Dias Branco S.A. Indústria e Comércio de Alimentos, Brazil

General Contractor

M. Dias Branco S.A. Indústria e Comércio de Alimentos, Brazil

Unit

DSI Prepron, Brazil

Scope

Supply, installation, engineering services

Products

45 unbonded horizontal DYWIDAG Tendons with 4 strands each

DYWIDAG Micropiles stabilize Tanks against Tensile Forces: The Ageo Terminal at the Port of Santos

The Port of Santos near São Paulo, Brazil, is the country's largest harbor and one of the most important container harbors in Latin America. The Ageo Terminais e Armazéns Gerais Ltda Company operates one of the terminals located in the harbor.



The company is active in the field of liquid bulk storage. Recently, 5 new tanks with capacities ranging from 4,000m³ to 8,000m³ were built at the terminal.

As the tanks are subject to high pressures, tensile forces can occur and potentially could lift the tanks from their foundations.

For this reason, the foundations were anchored using DYWIDAG Micropiles. To stabilize the foundations, Protendidos DYWIDAG supplied a total of 2,148m of 36mm Ø DYWIDAG Micropiles.

Owner
Ageo Terminais e Armazéns Gerais Ltda, Brazil
Contractor Geotechnics
Tecnogeo Engenharia e Fundações Ltda., Brazil
Engineering
Ber-Fac Consultoria de Solos e Fundações Ltda., Brazil

Unit
Protendidos DYWIDAG Ltda., Brazil
Scope
Supply
Products
2,148m of 36mm Ø DYWIDAG Micropiles

GEWI® Piles for Electrical Transmission Tower Foundations: The Nueva Esperanza Project in Colombia

The Nueva Esperanza Project in Colombia is a government plan in which the electrical energy supply for more than 12 million Colombians in Bogotá and the Cundinamarca, Meta, Guaviare and Tolima Departments will be expanded.



Photos reprinted courtesy of GEOFUNDACIONES S.A.S., Colombia

Within the scope of the project, the new Soacha transformer station is being built. It will be connected to the Guavio transformer station via a 230KV high-voltage line and to the Bacatá transformer station via a 500KV high-voltage line.

The Nueva Esperanza Joint Venture was awarded the contract to build the 45.5km long 500KV high-voltage line. Individual tower foundations were realized on agricultural ground for this purpose.

In order not to impair the work of the farms and to avoid possible damage to the agricultural areas, the foundations for 9 transmission towers were built using the 50mm Ø GEWI® Pile System.

DSI Colombia supplied a total of 6,573m of GEWI® Bars and accessories for this project. The foundations were successfully executed within the determined time frame.

Owner
Unidad de Planeación Minero Energética (UPME) del Ministerio de Minas y Energía, Colombia
General Contractor
EPM, Colombia
Contractor
Nueva Esperanza Joint Venture, consisting of FCC Servicios Industriales y Energéticos S.A. and Ingeomega S.A., both Colombia
Subcontractor
GEOFUNDACIONES S.A.S., Colombia
Engineering
FCC Servicios Industriales e Ingeomega S.A., Colombia

Unit
DSI Colombia S.A.S., Colombia

Scope
Supply, technical support

Products
6,573m of 50mm Ø GEWI® Bars including accessories

DYWI® Drill Hollow Bar Soil Nails for efficient Slope Stabilization: The Chilina Bridge

Arequipa, the economic and political center of southern Peru, now features one of the longest bridges in the country: The 562m long Chilina Bridge.



Photos reprinted courtesy of PERCOSUR E.I.R.L., Peru



As approx. 80% of the heavy goods vehicle traffic now bypasses the city, the center of Arequipa is considerably relieved from traffic by the new bridge.

The project also includes two access roads. The northern road provides access to the bridge from Avenida Chilina via a 60m long tunnel that was built using the open cut method.

The construction of the tunnel also required a slope stabilization of the lateral precut. DSI Peru supplied more than 1,600m of R32-360 DYWI® Drill Hollow Bar Soil Nails in individual lengths of up to 6m that were installed in layers. Following the soil nail installation, reinforcing steel mesh was applied, and the soil face was further stabilized by a layer of shotcrete.

Owner

Regional Administration of Arequipa, Peru

General Contractor

Consorcio Constructor Puente Chilina, consisting of Metric Engineering Group Peru S.A.C., Corsán Corviam Construcción S.A. and Incot SAC Contratistas Generales, all of them Peru

Contractor

PERCOSUR E.I.R.L., Peru

Unit

DSI-DYWIDAG Construcción Peru S.A.C., Peru

Scope

Supply, technical support

Products

1,600m of R32-360 DYWI® Drill Hollow Bar Soil Nails

DYWI® Drill Hollow Bar Anchors ensure better Connections: The IIRSA Sur in Peru

The Corredor Vial Interoceánico Sur or IIRSA Sur is a large-scale road project that will connect several harbor cities with the border of Peru and Brazil through Bolivia in order to enhance Peru's decentralization and its connection with its neighboring countries.



Section 3 of IIRSA Sur connects Peru with Brazil and has a total length of 403km.

In this section, a slope below the road in the area from km 255+198 to km 255+221 had

to be stabilized using anchors and reinforcing steel mesh. For this purpose, DSI Peru supplied a total of 270m of R38-500 DYWI® Drill Hollow Bar Anchors.

Owner
Government of Peru, Peru
General Contractor
Concesionaria Interoceánica Sur - Tramo III S.A., Peru
Contractor
Desnivel Perú S.A., Peru
Consulting Engineers
Sept-Ing Perú S.A., Peru

Unit
DSI-DYWIDAG Construcción Peru S.A.C., Peru
Scope
Supply, technical support
Products
270m of R38-500 DYWI® Drill Hollow Bar Anchors

Toquepala: DYWIDAG Strand Anchors stabilize Anchor Wall in the World's fifth largest Copper Mine

The Toquepala open pit mine in the Tacna region of southern Peru is the world's fifth largest copper mine that also produces molybdenum, silver, gold and zinc.



The owner, Southern Copper Corporation, is building a new copper concentrator in order to double its copper production from 60,000t to 120,000t per day.

Within the scope of the capacity expansion project, earth work had to be carried out. During the work, a massive anchor wall had to be built and tied back with permanent DYWIDAG Strand Anchors.

The strand anchors were installed in 7 layers, grouted and tensioned. To anchor the wall, DSI-DYWIDAG Construcción Peru produced and supplied more than 1,000m of permanent Type 7-0.6" and 9-0.6", 40m and 45m long DYWIDAG Strand Anchors.

Owner
Southern Copper Corporation,
Peru

General Contractor
Mota Engil Perú S.A., Peru

Subcontractor
Mota Engil Perú S.A., Peru

Unit
DSI-DYWIDAG Construcción Peru
S.A.C., Peru

Scope
Supply, technical support

Products
1,000m of permanent Type 7-0.6" and
9-0.6", 40 and 45m long DYWIDAG Strand
Anchors

Reducing Traffic Congestion: DSI supplies DYWIDAG Strand Tendons for the new Villena Rey Bridge in Miraflores

In the district of Miraflores in Lima, Peru, the new Villena Rey twin bridge was recently opened to traffic. The new bridge was built parallel to the existing bridge. Consequently, the daily rush hour traffic tie ups could be reduced by 40%.



The bridge structure is 114m long, 11.70m wide and consists of reinforced concrete arches that support the bridge deck and hollow box girder. In order to reduce traffic as little as possible, the bridge deck was constructed using the free cantilever method with a form traveller.

To post-tension the bridge deck, DSI Peru supplied 36 Type 15-0.6" and 19-0.6" DYWIDAG Strand Tendons with MA Anchorages that were post-tensioned using two HOZ 5400 Jacks.

Owner

Municipal Administration of Miraflores, Peru

General Contractor

Consorcio Villena, consisting of Corporación Mayo SAC, Constructora Duran S.A. and Constructora y Promotora Balzola S.A., Sucursal del Perú, all of them Peru

Contractor

Balzola S.A., Peru

Subcontractor

Samayca Ingenieros S.A.C, Peru

Consulting Engineers

Samayca Ingenieros S.A.C, Peru

Unit

DSI-DYWIDAG Construcción Peru S.A.C., Peru

Scope

Supply, technical support

Products

36 Type 15-0.6" and 19-0.6" DYWIDAG Strand Tendons with MA Anchorages

Imprint

Published by

DSI Holding GmbH
Destouchesstrasse 68, 80796 Munich, Germany
Phone +49-89-30 90 50-200
E-mail info@dywidag-systems.com
www.dywidag-systems.com

Design and Editorial Content

DSI Holding GmbH
Marketing Department
Chief Editors

Gerhard Kahr
Christine Nohl

Revision

Ron Bonomo
Naperville, Illinois, USA

Design, Layout, Typesetting and Picture Editing

d-formen.de, Volker Heise
Solingen, Germany

Printing

Holzer Druck und Medien
Weiler im Allgäu, Germany

Picture Credits

Construction of the TAZ Publishing Building in Berlin: International DSI Cooperation for fast Construction Progress
Photo reprinted courtesy of contempo Zeitraffer Filmproduktion, Germany

DSI supplies *GEWI*® Anchors for Ackermann Bridge Project in Augsburg
Photos reprinted courtesy of D&K Spezial Tiefbau GmbH & Co. KG, Germany

Stabilization of an Excavation using *DYWI*® Drill Hollow Bar Anchors: New Residential Building at the Dietl Brewery Site in Straubing
Photos reprinted courtesy of Hans Eberhardt GmbH, Germany

DYWIDAG Strand Anchors stabilize Supporting System against Water Pressure: Construction of the B 15neu Federal Road
Photos reprinted courtesy of G & R Spezialtiefbau GmbH, Germany

DYWIDAG Systems for the Conversion of Augsburg Main Station
Photos reprinted courtesy of Max Bögl Stiftung & Co.KG, Germany

Stuttgart 21, Feuerbach Tunnel: Conversion of Feuerbach Station using *DYWIDAG* Systems
Photos reprinted courtesy of Kurt Motz Baubetriebsgesellschaft Hoch-, Tief-, Straßen- und Spezialtiefbau GmbH & Co. KG, Germany

The Aldingen/Remseck Lock: Rehabilitation using permanent *DYWIDAG* Strand Anchors
Photos reprinted courtesy of PST Spezialtiefbau Süd GmbH, Germany

Trouble free Removal of *DYWIDAG* QuickEx® Strand Anchors: trivago, Duesseldorf
Photos reprinted courtesy of GUP Geotechnische Untersuchungen und Projekte GmbH, Germany

The Syracuse-Gela Motorway on Sicily: *DYWIDAG* Strand Post-Tensioning Tendons for an important Part of the Road Network
Photos reprinted courtesy of CO.SI.GE. SCARL, Italy

The Kirchberg-Pfaffenthal Station: *DYWIDAG* Systems ensure fast Connection to Luxemburg's City Center
Photos reprinted courtesy of CFL, Luxemburg and aventas.grundbau GmbH & Co. KG, Germany

GEWI® Piles against Uplift: New Aqueduct on the "Centrale As" Motorway
Photos reprinted courtesy of TBI Infra B.V., Netherlands

DYWIDAG Bar Anchors and *DYWI*® Drill Hollow Bars stabilize a steep Cliff on Tenerife
Photos reprinted courtesy of v-traverca, Spain

DSI Canada Civil receives PTI Award of Merit for Slab on Grade Project
Photos reprinted courtesy of Post-Tensioning Institute, USA

DYWIDAG THREADBAR® saves Time and Money: The One Bennett Park Tower in Chicago
Photos reprinted courtesy of Case Foundation Company, USA

Cantilever Construction for unhindered Traffic: *DYWIDAG* Tendons for the new Brattleboro Bridge in Vermont
Photos reprinted courtesy of PCL Civil Constructors Inc., USA

The Park District Project in Dallas: Top-Down Method minimizes Construction Time
Photos reprinted courtesy of Oscar Orduno, Inc., USA

DYWIDAG Post-Tensioning Tendons for a new Project in the Center of Veracruz: The Villa del Mar
Photos reprinted courtesy of *DYWIDAG* Systems International Mexico, S.A. de C.V., Mexico

DYWIDAG Bar Anchors stabilize 24m deep Excavation: The Centro Médico ABC in Santa Fé
Photos reprinted courtesy of *DYWIDAG* Systems International Mexico, S.A. de C.V., Mexico

GEWI® Piles for Electrical Transmission Tower Foundations: The Nueva Esperanza Project in Colombia
Photos reprinted courtesy of GEOFUNDACIONES S.A.S., Colombia

DYWI® Drill Hollow Bar Soil Nails for efficient Slope Stabilization: The Chilina Bridge
Photos reprinted courtesy of PERCOSUR E.I.R.L., Peru

Copyright © DSI Holding GmbH, 2018

All rights reserved.

The articles in this brochure are protected by copyright. No part of *DYWIDAG* Info 24 may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or any information storage or retrieval system, without the express prior written consent of DSI Holding GmbH.

This publication is printed in English (5,000) and German (1,000)

