OUR PASSION FOR INNOVATION AND THE IMPLEMENTATION
OF A PROACTIVE RESEARCH AND DEVELOPMENT POLICY TOGETHER WITH
CONTINUOUS TRAINING OF OUR TECHNICAL STAFF ALLOW US
TO KEEP PACE WITH OUR PARTNERS' AND CUSTOMERS' EXPECTATIONS

DEALMAG- 2

DEALMAG

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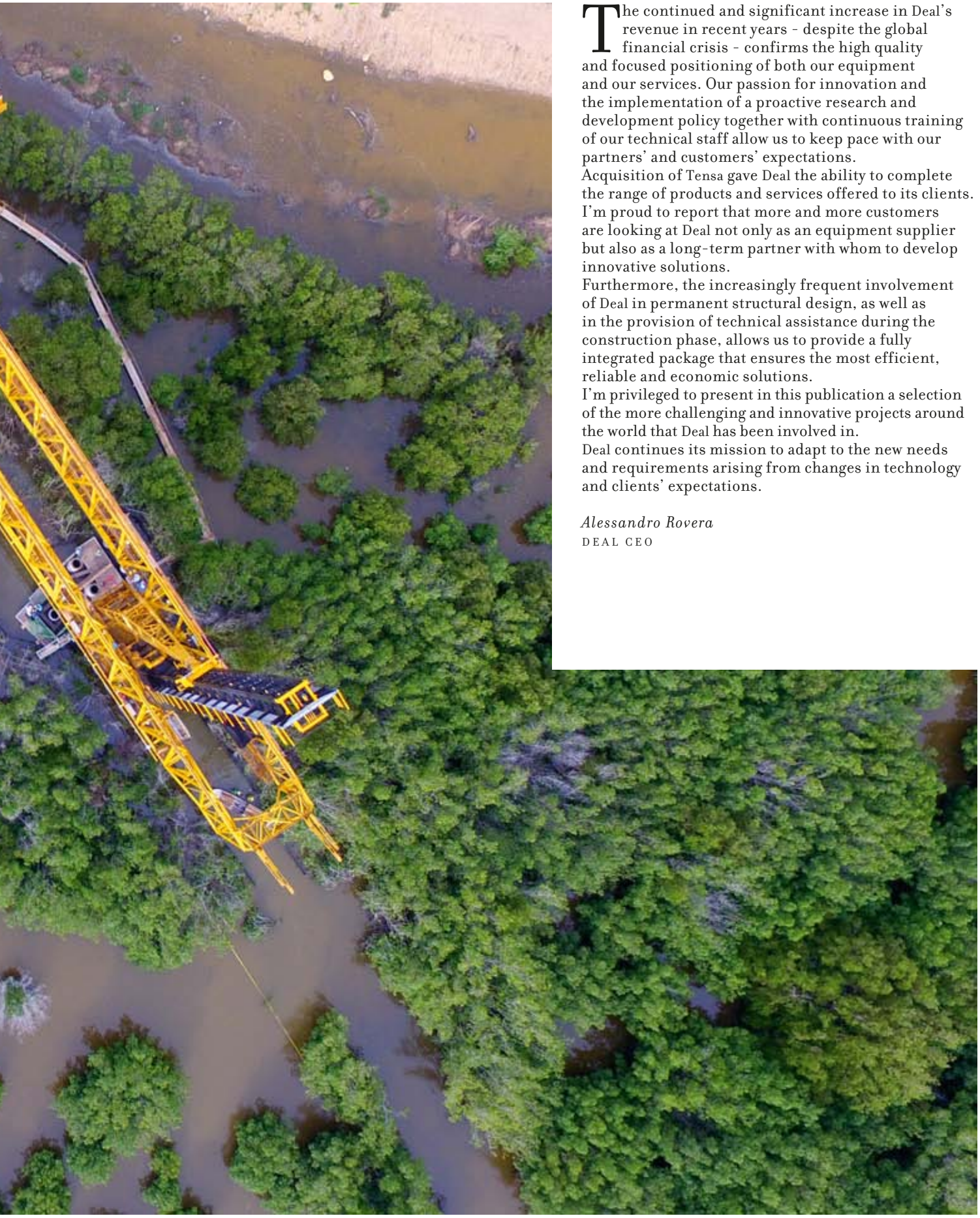
DEAL

SOLUTIONS THAT MAKE THE DIFFERENCE

We continue our mission to adapt to the new needs and requirements arising from changes in technology and clients' expectations



The continued and significant increase in Deal's revenue in recent years - despite the global financial crisis - confirms the high quality and focused positioning of both our equipment and our services. Our passion for innovation and the implementation of a proactive research and development policy together with continuous training of our technical staff allow us to keep pace with our partners' and customers' expectations.
Acquisition of Tensa gave Deal the ability to complete the range of products and services offered to its clients. I'm proud to report that more and more customers are looking at Deal not only as an equipment supplier but also as a long-term partner with whom to develop innovative solutions.
Furthermore, the increasingly frequent involvement of Deal in permanent structural design, as well as in the provision of technical assistance during the construction phase, allows us to provide a fully integrated package that ensures the most efficient, reliable and economic solutions.
I'm privileged to present in this publication a selection of the more challenging and innovative projects around the world that Deal has been involved in.
Deal continues its mission to adapt to the new needs and requirements arising from changes in technology and clients' expectations.

Alessandro Rovera
DEAL CEO

DEAL ALL AROUND

Talking with Gilberto Dreas, Deal Engineering Department Director

How were Deal's Engineering Services born and what makes Deal different from other engineering companies in development of such services?

To understand how Deal's engineering services department was created, we need to take a step back in time and start from the '80s, when a new division, specialized in bridges and viaduct construction, began to develop within Rizzani de Eccher's technical office. A few years later, in 1994, this division became a full-scale company named Deal which concentrated exclusively on provision of specialized equipment for construction of bridges and viaducts.
Soon, however, it was clear to all that Deal could not just act as a supplier. The market needed a partner, capable of developing design which took into account not only conventional demands, but, above all, work constructability.
This is how the Engineering Department was born.

— Which engineering services does Deal offer?

Deal's engineering services can be grouped into three major categories:

1. Tender and concept design
Particularly for design&build projects, Deal can assist the tenderers by providing design concepts for specialized works, developing construction methodology and schedules, preparing tender submittals and coordinating the activities of other specialist designers involved, in order to develop together the most suitable design and technical solutions.
When Deal is involved in post-tender stages, it not only executes the works

according to client's specifications but offers value engineering solutions to help reduce life cycle costs, improve quality and reduce environmental impacts.

2. Detailed design
To produce an efficient and buildable design, constraints imposed by construction methodology should be considered, as well as project specific design criteria. Deal's long-term experience in precast and erection of prestressed concrete structures adds significant value to development of any part of the design package.

3. Construction engineering
In addition to detailed design, a wide set of engineering activities is required to enable construction managers to perform in a safe and timely manner. Construction efficiency is the primary goal for Deal in developing construction engineering services. That's why Deal's project engineers have undergone training on construction sites around the world and 'speak the same language' as contractor teams.

— Could you highlight the last successful projects for Deal's engineering department?

Yes, among the projects of recent years, I would like to highlight these two in particular:

The first is the Gran Manglar Viaduct project, in Cartagena de Indias, Colombia. Initially, when we started working with Consorcio de Diseños Costera, which is responsible for implementing this project, the task was envisaged as a traditional construction which would involve invasive interventions into the lagoon area.
Based on the experience of designing and building pile-driving equipment for the Washington Bypass project, Deal has proposed a similar but revised solution, taking into account the specific characteristics of the site – first of all, the high seismicity of the region.
The concept design for this technological solution, delivered together with a cost budget, has been approved, resulting in a very limited environmental impact.
Under the agreement between Rizzani de Eccher Colombia and Consorcio de Diseños Costera, Deal has been responsible for implementing detailed design, construction engineering, and

construction sequences, by identifying specific solutions for this project, among which: 1) seismic isolation to reduce stress and 2) introduction of joints in the piles, due to continuous geological conditions that require longer piles.

The second project is Doha Metro - Red Line North, Elevated and at-grade, in which Deal was engaged, as early as from the tender stage, in the study of the structural solution.
At this phase, Deal has applied the experience gained in design and construction of similar works and introduced a series of optimizations in the structural concept which have allowed significant cost savings for the client.
After the award of the project to the RLR JV, Deal has been entrusted with the detailed design and construction engineering of all decks, and, at this stage, all optimizations, proposed at the tender stage, were put into practice. Consequently, prefabrication and launching of decks were completed without any problems and ahead of the schedule. Furthermore, in November 2016, a new record was set on this project: Deal used the span-by-span method to erect a section which included 52-m-long spans with a U-shaped cross-section. The work involved creating a continuous deck unit, composed of four spans with lengths of: 34m + 52m + 52m + 30m. This was a first for this kind of structure, and Deal had to push the limits both in the span-by-span methodology and for the erection equipment, in order to achieve this challenging goal. The innovative solution has also secured / gained cost benefits, compared to employment of the traditional balanced cantilever method

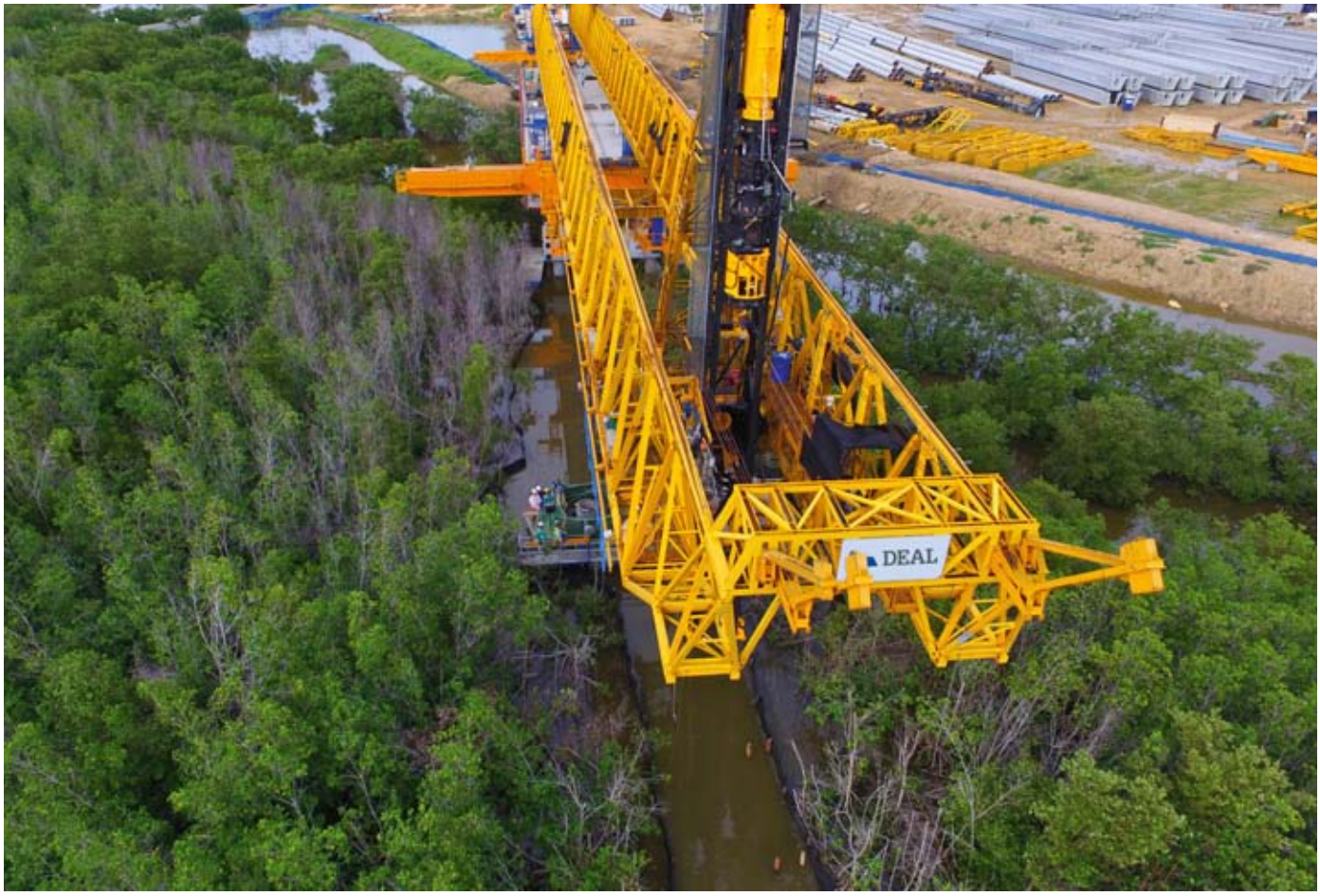
GRAN MANGLAR VIADUCT CONSTRUCTION OF COLOMBIA'S LONGEST BRIDGE

Use of an alternative construction method has overcome site challenges and brought considerable benefits in the construction of a major viaduct across environmentally sensitive wetlands

Colombia's National Infrastructure Agency – ANI – is building a 146km motorway to link the cities of Cartagena and Baranquilla. The goal is twofold: firstly, a wish to develop the Caribbean Coast into the most important logistics route in the country and, secondly, to facilitate better traffic flow, guaranteeing easy journeys for both tourists and locals.

Consorcio de Diseños Costera entered into a design, build and finance contract with ANI for the scheme, which is officially called 'Proyecto Cartagena-Barranquilla y circunvalar de la prosperidad'.

Only two out of 10 groups that took part in the prequalification process submitted a tender in 2013 for the challenging design, construction and maintenance of the highway. The contract required the route to pass through marshland that had already been seriously damaged by infrastructure that obstructed the water flow towards the Caribbean Sea. The marshland has now been restored and has become a nature reserve.



5.4km-long viaduct 'Top-down' construction method – enabling construction of the whole viaduct, including foundations, with access only needed from the section that has already been built
Solutions to environmental, social, programme and cost challenges

The call for tenders required construction input for the 5.4km-long viaduct, which was categorised as a cast-in-situ balanced cantilever bridge. The construction method for this type of bridge has two major issues. From an environmental point of view, installation of the foundation elements themselves presents challenges and there was also a social issue as the delivery of the project would have prevented local people from continuing their fishing activities. The main contractor had to demonstrate that it could solve these issues. Rizzani de Eccher and Deal presented an ingenious solution that led to the team winning the tender as the project's exclusive, strategic partner.
The innovative 'top-down' construction method is extremely high-tech but requires only a minimum amount of manpower and operations. The method had already been developed by Deal and used on the Washington Bypass project (North Carolina, USA), where it enabled the construction of the whole viaduct, including foundations, entirely by access from the section that had been already built. A twin set of specially designed launching trusses had been deployed in North Carolina to drive the precast piles, complete the setting of the precast pier caps and then launch and place the precast girders in record time. The system reached an impressive monthly production rate of five spans - typically 36m long - with minimal impact on the wetlands below.
Adopting a similar solution for the project in Colombia was dramatically different from the original proposal and resolves all of the project requirements and issues:

— Environmental – it avoids the need for dredging, concrete slabs and the construction of access roads, which otherwise would have damaged the environment for years;

— Social - despite the construction works, the local population can continue using the wetlands for fishing and agriculture;

GRAN MANGLAR VIADUCT CONSTRUCTION OF COLOMBIA'S LONGEST BRIDGE

— Programme - the use of precasting and industrial processes on the project allows the main contractor to keep in line with the scheduled delivery times;

— Costs - Rizzani de Eccher is able to deliver lower costs than the original tender estimates, thanks to high-quality value engineering and the input from the many companies of the de Eccher Group involved in the process

The innovative 'top-down' construction method is extremely high-tech but requires only a minimum amount of manpower and operations

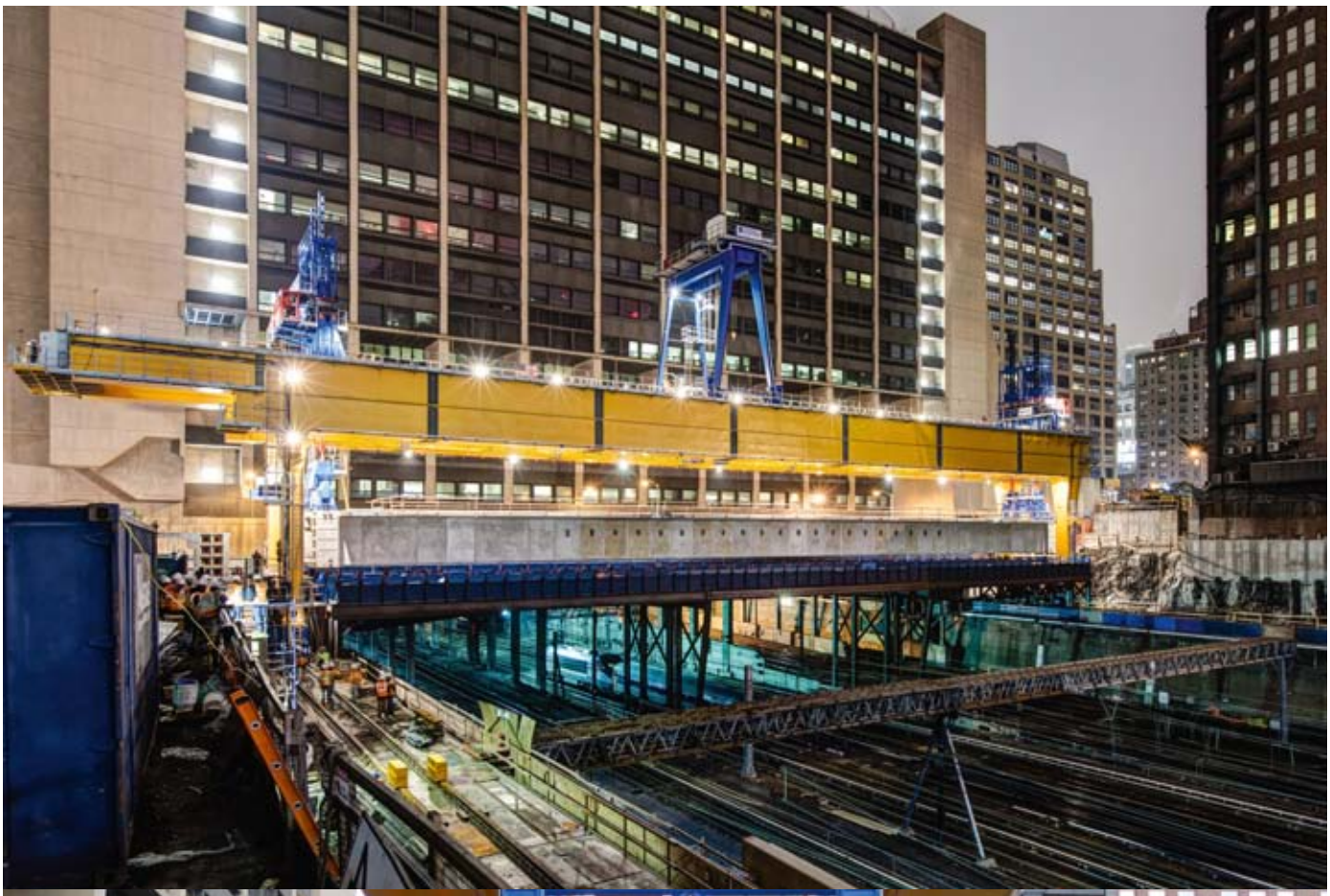
PROJECT TEAM

Client: Agencia Nacional
de Infraestructura
Contractor: MHC
and MECO Consortium
Sub-contractor:
Rizzani de Eccher
Sucursal Colombia
Designer: Deal

DEAL SUPPLIED

Design:
Final design of superstructure
and substructure.
Launching equipment:
2 launching girders
for driving piles and beam erection.
Precast yard equipment:
2 gantry cranes 10t
2 gantry cranes 25t
2 straddle carriers 55t

Precast moulds:
beam mould for girder 37m long
pile mould for pile 42m long
pile mould for pile 36m long
pile mould for pile 24m long
long line pile cap mould
3 pile moulds bulkhead
Engineering services:
Support for precast yard logistics
and design
Temporary works design
Geometry control
Erection sequences
Temporary structure pile driving



MANHATTAN WEST DEVELOPMENT

Placing a deck over live railway tracks in the 'city that never sleeps'

Bridge construction technology has been used in an innovative application to create a large plaza above busy rail lines in Manhattan

A scarcity of buildable land in NYC meant that the city's leading real estate developer was in search of a creative solution to maximise use of the limited space available on a prime development site.

Brookfield Office Properties, owner and developer of the Manhattan West Project, needed to close a large gap above the busy railway tracks in the middle of the 7-million-sq-ft site. The solution came from observing the bridge construction industry and using high-tech bridge erection machinery to create a deck over the lines.

The result is the Manhattan West Platform, a 10,200sqm segmental post-tensioned deck made up of 16 adjacent 'bridges', each with a length of 73m. It covers a record 73m x 146m gap over 15 live rail tracks that transport about 800,000 people per day, in and out of Penn Station.

Spanning the gap required extensive engineering work, which resulted in a custom-built launching gantry (LG) being used to position the 2,400t precast/post-tensioned segmental beams above the live rail lines and their electrified power systems. These beams now support a public plaza and a parking area between two high-rise buildings.

Precasting was an essential part of the project but these activities were not carried out in downtown Manhattan. Instead, the moulds were provided to Jersey Precast, a local fabricator located in New Jersey – where labour rates are significantly cheaper than Manhattan – for integration into its plant.

The length of the spans combined with the level of segmentation required highly accurate geometry control. The large number of segments derived from the need to limit the size of each one to 56t to allow for transportation through Manhattan. As a result, the maximum length for a typical segment was only 1.93m and the pier segments were as short as 1.27m.

There were between 37 and 39 segments per beam, which meant that even a slight deviation on the horizontal plane would have caused a major problem. The geometry control system provided by Deal and precise management of the moulds allowed the subcontractor to achieve excellent accuracy in the alignment.

Cycle efficiency for the segment prefabrication was maximised by Deal's provision of three short-line moulds for the typical segments, a mould for pier segments and an adjustable short-line mould able to cast segments with a variable web thickness.

A straddle carrier supplied by Deal serviced the staging area in Manhattan and was used to off-load the segments that were brought in at night and place them in their temporary storage locations. The segments had to be double-stacked to maximise storage capacity.

Two factors in particular contributed to the success of the Manhattan West Project:

— The skills of the deck engineer, McNary Bergeron, which designed a precast concrete beam that could

— An unprecedented precast solution
— Creation of a 10,200sqm segmental post-tensioned platform
— Launching of 16 adjacent 'bridges' to make the platform
— Installation of 2,400t precast/post-tensioned segmental beams
— Adoption of a PT ratio three times higher than for standard bridge applications
— Construction above 15 live rail lines
— Use of a launching girder with a 3,600t lifting capacity
— Remote connection of the lifting girder to engineers and technicians in Italy

MANHATTAN WEST DEVELOPMENT

accommodate 100t of post-tensioning strands inside;
— The ability of Deal to manufacture a high-tech LG with the capacity for smooth placement of the 16 beams.
The LG was essentially a gantry able to move sideways on rails; its main components were a winch and a lowering system. It was made from 1,100t of steel with a capacity to lift 3,600t and featured a 90t winch for handling the individual segments before they were joined with epoxy and post-tensioning to create a single giant beam. Every component was designed and manufactured in Italy and the LG was broken down into more than 90 containers to allow transportation by sea to New York.
The assembly process for the deck was very similar to that of a sequential span-by-span bridge. The key difference was that a single platform was being built so there was no need for a gantry that could launch segments from pier to pier. Instead, the equipment moved sideways to place one complete bridge span adjacent to the next.

CONSTRUCTION SEQUENCE

The first activity on site was the installation of a steel temporary protection platform (TPP) over the rail lines. This served the dual purpose of protecting the railways and providing an assembly bed - the 'beam factory'- from where the LG could be assembled and beam numbers 3 and 4 could be set into place. The whole operation was designed to minimise the time needed for PT bar tensioning and for the completion of the connections. The winch picked up each segment using a C-hook and carried it into place on top of adjustable screw jacks, over the two steel I-girders that made up the assembly bed. Epoxy was then applied to the joints and the first-stage tendons (24 cables) were connected with temporary PT bars and tensioned. After the first-stage tensioning, the lowering system was connected to the pier segments by means of eight threaded bars and then the span was moved to the second-stage area where the remaining 10 PT cables were tensioned and the final grouting was carried out before erecting the span in its final position.

The LG was connected remotely to engineers and technicians in Italy who monitored its functionality and ensured that all sensors and indicators were working properly. After the first two beams were set in place, the TPP was removed and the assembly bed was relocated over spans 3 and 4 and used as the stage from which subsequent beams were assembled.
The PT ratio for this project – the weight of the steel PT strand per square metre of deck area - is three times higher than for standard bridge construction applications.

Each beam required 100t of post-tensioning supplied by Tensa, a subsidiary of Deal, using 20 tendons with 37 strands and 14 with 31 strands.
Preliminary assessment of anchorage performance was through dedicated tests carried out in the Structural Laboratory of the University of Padua in Italy. All the types of anchorages used on the project (37MTAI15, 31MTAI15, 9MTAI15) underwent load transfer testing under the scheme's design conditions, including the correct concrete strength (9,500psi) and the anchorage spacing at the end segments

PROJECT TEAM
Project: 9th Avenue Development - Manhattan West Platform
Client: Brookfield Properties
Designer: McNary Bergeron & Associates
Design and build general contractor: Rizzani de Eccher (USA) Ltd.

DEAL SUPPLIED
Launching equipment
Design and fabrication of:
Launching gantry for span fabrication and span launching
Segment transporter on rails to feed the launching equipment with segments
Straddle carrier on tyres for the segment storage area
Mobile stressing platform
Precast segment moulds
Design and fabrication of:
3 short-line moulds for typical segments
1 short-line variable mould for transition segments
1 pier segment mould
1 segment manipulator
1 special trolley to transport segments to storage

TENSA SUPPLIED
Post-tensioning system
Supply of 320 complete tendons made up of 37 strands together with anchorages of type 37MTAI15
Supply of 212 complete tendons made up of 31 strands together with anchorages of type 31MTAI15
Supply of 72 complete tendons made up of 9 strands together with anchorages of type 9MTAI15
Total quantity of 0.6"steel strand: 1,600t
Installation equipment
Multi-strand stressing jacks complete with hydraulic pumps for use with 37-strand tendons
Multi-strand stressing jacks complete with hydraulic pumps for use with 31-strand tendons
Multi-strand stressing jacks complete with hydraulic pumps for use with 9-strand tendons
Strand threading machines
Grouting pumps

Technical assistance on site and engineering services

A CONTRACTOR WHO OVERSEES FULL-CYCLE DEVELOPMENT OF INNOVATIVE CONTRUCTION EQUIPMENT

Talking with Riccardo Castracani, Deal Business Development, USA

Deal's North American presence started over 20 years ago with the supply of a balanced cantilever launching gantry, on one of the most prestigious projects at that time – the Confederation Bridge to Prince Edward Island in Canada – and continues to date, solidifying its presence and becoming, in essence, the complete solution, from a means and methods point of view, to complex pre-cast segmental bridge projects.

Our scope has gradually grown from supply of existing equipment to the full-cycle development of innovative equipment solutions, influencing, at times, the actual design of bridges and bringing winning solutions to the table for our clients.

We have had the privilege of developing long-lasting relationships with the principal players of our industry and have worked on signature projects, such as: the Oakland Bay Bridge in San Francisco, Port Mann Bridge in Vancouver, Palmetto Interchange in Miami, Central Artery in Boston, the Dallas High-Five Interchange, and many more!

Starting from the design of the casting yards, we have gone all the way to the full supply of custom-designed equipment, including technical assistance, to help manage such equipment and projects.

A prime example of innovation is the creation of the 'Pile Driver' which was used to construct the seven-mile-long Washington Bypass bridge, completely in top down, by driving piles out in cantilever using an overhead truss, then using the same truss to erect the pre-cast cap and pre-cast beams, reducing the damage to environment to nearly nothing, as direct site access was provided only from the top. This resulted in a winning bid and an extremely successful and profitable project.

Over the years, Deal has dominated the North American market due to one primary difference over our competitors: we were contractors before becoming equipment suppliers, and this background is paramount in enabling us to understand the entirety of issues at hand and in finding the right solution that addresses such problems in the safest and most practical manner, giving us a distinct advantage.

Our past period of over 20 years has been a great success and has given us the tools to continuously deliver safety and efficiency

A single type of advanced technology to serve three major cable-stayed bridges in North America

— GOLDEN EARS BRIDGE (2007)
— PORT MANN BRIDGE REPLACEMENT (2009)
— GERALD DESMOND BRIDGE REPLACEMENT (ONGOING)

— Provision of equipment suitable both for erection of single components and for erection of an entire steel grid
— Designed to ensure accuracy in the positioning of elements
— Lifting capacity: Gerald Desmond 230t, Port Mann and Golden Ears 100t
— Record-breaking width of 46.7m Gerald Desmond
— Equipment lifting stroke: Gerald Desmond 75m, Port Mann and Golden Ears 60m

Innovative engineering has allowed Deal to adapt, reuse and develop the design of its special lifting frames to suit the requirements of three of North America's most significant bridge projects of recent years

The Golden Ears Bridge spans the Fraser River to connect the communities of Pitt Meadows and Maple Ridge to Langley, Surrey and beyond. The combination of the six-lane bridge and a 14km road network has created a quick and convenient link that reduces travel times and regional traffic congestion for both residents and businesses.

For this project, Deal designed and supplied a pair of special lifting frames for the erection of the grid of steel elements and the precast concrete panels for the hybrid cable-stayed/extradosed bridge. The equipment was flexible in design and was suitable both for erection of an entire steel grid by lifting it from the ground or, alternatively, for erection of single components, lifting them up from the back. One of the main characteristics of the equipment is its accuracy in positioning the elements, which is particularly important in the case of bolted joints.

Two years later, the same equipment was required for a new project in Canada, and this time Deal supplied two pairs of special lifting frames with the same characteristics as the previous pair. The new project was the replacement of the old Port Mann Bridge, which had been built in the early 1960s when the population of Metro Vancouver was 800,000 inhabitants. By the time of its replacement, the bridge was supporting traffic flows of over 800,000 vehicles every week. The five-lane bridge and adjacent highway could not meet the growing needs of the area and, as a result, there was congestion for up to 14 hours per day. The newly completed Port Mann/Highway 1 Improvement Project has now significantly reduced this congestion and was the largest transportation infrastructure project in the history of British Columbia.

The 2km-long bridge is made up of three key sections: the cable-stayed main crossing of the Fraser River, the South approach in Surrey and the North approach in Coquitlam.

The new ten-lane Port Mann Bridge is one of the widest bridges in the world, as it is also designed to accommodate light rail rapid transit in the future. The project also involved the widening of 37km of highway between Vancouver to Langley, including 30km of new lanes for high-occupancy vehicles and the replacement of nine highway interchanges.

In 2016, Deal became involved in the project to replace the Gerald Desmond

Bridge. The through-arch bridge in Long Beach, California, was built in 1968 across Cerritos Channel to provide a link to Terminal Island. The old bridge has recently been encountering structural and maintenance problems, so the Port Authority decided to replace it with a new cable-stayed bridge with 61m of vertical clearance. The new bridge will allow access into the port for the tallest container ships and will be the first long-span cable-stayed bridge in California.

For the erection of the main spans, Deal is suppling two pairs of special lifting frames. Even though the capabilities of the equipment are similar to those proven on the two previous projects - Golden Ears and Port Mann – the new project has posed real challenges for Deal's engineers. These have included the necessity of increasing the capacity of the lifting frames from 100t to 230t, the massive dimensions of the bridge (width of 47.6m), and the equipment's required lifting stroke of 75m. In addition, particular attention has had to be dedicated to the shape of the equipment's main structure as it cannot be allowed to interfere with the temporary stabilising structures of the tower cranes used for the construction of the main pylons.

On the first two projects, a steel frame called a 'spider' was used to deform bridge elements that were ready for erection to match the joints with those already assembled, which had been deflected by the deck loads.
A new concept for the 'spider' has been developed for the Gerald Desmond Bridge project in order to minimise the equipment weight, which is always critical in terms of the structural capacity. The innovation involves creating the required counter-camber of the steel elements by means of a tensioning system made up of cables and hydraulic jacks, which are remotely controlled

GOLDEN EARS BRIDGE

PROJECT TEAM
Client: TransLink
Contractor: Golden Crossing JV - Bilfinger&Berger and CH2M
Designer: Buckland&Taylor

DEAL SUPPLIED
Launching equipment
2 pairs of LF-100 lifting frames

PORT MANN BRIDGE

PROJECT TEAM
Client: Province of British Columbia
Contractor: Kiewit-Flatiron General Partnership

DEAL SUPPLIED
Launching equipment
2 pairs of LF-100 lifting frames

GERALD DESMOND BRIDGE

PROJECT TEAM
Client: State of California Department of Transportation
Contractor: SFI Shimmick – FCC – Impregilo JV
Designer: ARUP

DEAL SUPPLIED
Launching equipment
2 pairs of LF-230 lifting frames

LESNER BRIDGE REPLACEMENT OVERSLUNG OR UNDERSLUNG: ONE PIECE OF EQUIPMENT DOES BOTH

Corrosion had made replacement of the Lesner Bridge a necessity and the twin segmental structures of the new crossing now span Chesapeake Bay in the City of Virginia Beach, Virginia.

The replacement has been built using a specially refurbished launching girder that can be used in either 'underslung' or 'overslung' configurations.

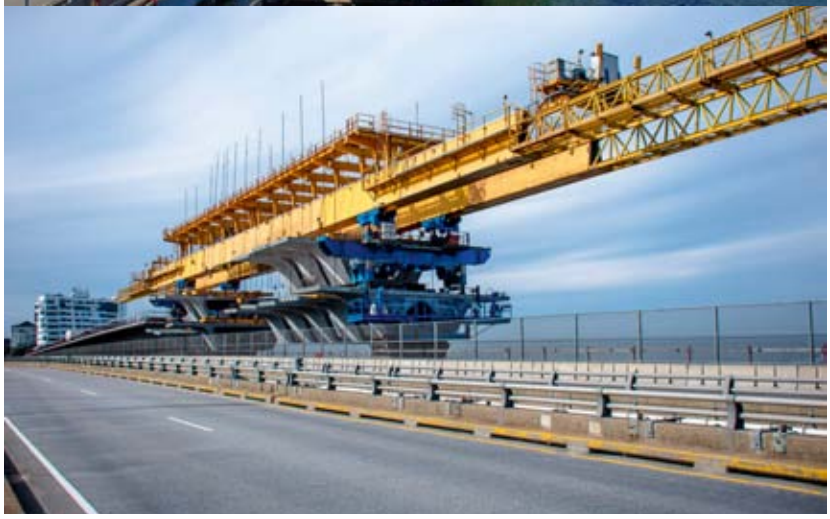
The aggressive marine environment had caused the corrosion that was found in sections of the original John A. Lesner Bridge, which had been constructed in 1957. The vital route along US60 carries 41,000 vehicles daily and connects the Northern part of Virginia Beach to the tourist destination at the oceanfront.

The replacement bridges have a curved box-girder superstructure on slender piers, which are accented with alternating sweeping curves intended to imitate the waves of the Lynnhaven Inlet.

Each of the two bridges feature a 16.4m-wide deck that accommodates two lanes of traffic, with shoulders on

The gantry enabled segments to be delivered from the previously-erected deck, avoiding the need for large cranes to be positioned in the waterway or in close proximity to the adjacent power lines

— Typical span length 45.7m
— Max span length 68.6m
— Provision of a refurbished launching girder
— Operation in underslung and overslung configurations



each side and a multi-use path in each direction. The eastbound and westbound structures could, if required, accommodate three lanes of traffic in each direction in the future.

Deal entered into an agreement for the supply of the refurbished launching girder, including carrying out the necessary modifications to enable construction of the segmental superstructure. Typical span length is 45.7m; however, the operation of the equipment can be tailored so that it can also erect the 68.6m-long main span.
The gantry enabled segments to be delivered from the previously-erected deck, avoiding the need for large cranes to be positioned in the waterway or in close proximity to the adjacent power lines.

The most innovative aspect of the refurbishment is the use of the 'second-hand' 123m-long launching girder, which was originally designed with an 'underslung' configuration and then reconfigured in 'overslung' mode for the current project. As a result, the client has the benefit of a sophisticated piece of equipment that can be used in either erection mode on future projects

PROJECT TEAM
Client: City of Virginia Beach, Virginia
Contractor: McLean Contracting Co.
Designer: FIGG

DEAL SUPPLIED
Erection equipment
Launching girder for span-by-span construction

THE EVERGREEN LINE PROJECT SAVING MONEY THROUGH RETROFITTING OF DEAL'S EQUIPMENT

Innovative adaptation of existing casting and launching equipment has resulted in an efficient and flexible solution for the elevated section of an LRT project in Vancouver

The Evergreen Line is the extension in East Vancouver of the Millennium Line, which was constructed in the late 1990s, also using Deal equipment. The overall extension involved a length of tunnel, various at-grade sections and also about 3.5km of elevated guideway, which was built using precast segmental-by-span erection method was not new to British Columbia, as two other elevated light rail systems had already been built with the same technology. For the Evergreen Line Project, existing casting machines that had been previously supplied by Deal were adapted and retrofitted to work on the new extension. Reusing the equipment eliminated the need for major investment, which was a particular benefit as the project's elevated section was in itself not very long.

Deal carried out the retrofit of the equipment and successfully reused the same casting machines without any impact on productivity or the quality of the segments.
The erection was carried out using a self-launching overhead span-by-span truss, which was of a 'hinged' type in order to accommodate the alignment's tight radius of curvature. This equipment had also been used previously on another section of elevated rail line in Vancouver and was adapted for the new project.

The 'hinged' feature of the equipment enabled a single launching truss to be used for the entire section of elevated line, with little disruption to the local traffic and neighbourhoods.
The state-of-the-art equipment deployed on the scheme ensured on-time and on-budget performance, and greatly reduced the learning curves for a project of this size, particularly as the equipment was not new to the area.
Deal worked closely with the designer to ensure that all aspects of the equipment were factored into the final design requirements, anticipating any issues before they arose. This was the perfect example of a design-build approach, with equipment availability driving the design choices as much as possible, and with the designers of both the equipment and the bridge working hand in hand in order to deliver the most efficient solution to the contractor

— DEAL's 3rd LRT project in Vancouver
— An innovative solution to deliver flexibility aiding overall project performance
— Adaptation and retrofitting by Deal of existing casting machines to reduce costs
— Installation using a 'hinged type' self-launching overhead span-by-span truss
— An on-time and on-budget performance
— Reduced learning curve
— A complete design-build solution
— Design choices driven by equipment availability

PROJECT TEAM
Client: Province of British Columbia
Contractor: EGRT Construction
Designer: International Bridge Technologies Inc.

DEAL SUPPLIED
Erection equipment
An articulated launching girder for a segmental elevated guideway
Prefabrication equipment
4 sets of short-line moulds


DEAL
SLCW

MOSES WHEELER BRIDGE RECONSTRUCTION
SMART TECHNOLOGY: USE OF A BESPOKE GANTRY CRANE ON A CURVED RUNWAY

A special gantry crane, given the code name 'G19', has been designed by Deal for the reconstruction of the Moses Wheeler Bridge linking Stratford and Milford in Connecticut, USA.

The project demonstrates how an extraordinary mechanical solution coupled with 'smart' electronics can work together to produce high-end equipment for a challenging task

The most distinctive feature of the specialist equipment is that its runway rails have a curved alignment, with different levels and gradients for each rail.
The left side of the gantry is arranged with a pendular leg to allow for the variation in rail gauge. This additional requirement for a variable gauge was born from the necessity to work on two different alignments, in order to demolish the old bridge and build its wider replacement.
An electronic system controls in real time the alignment of the top platform of the gantry to take account of the changes in level and gradient. The jacks are then automatically extended/retracted, to keep the top winch platform in a horizontal position.
The wheel groups are arranged with vertical pins to allow adjustment along the curved rail. In addition, the power output of the motors for the wheels on the outer rail is greater than that of the inner motors, to give a higher speed for the outer wheels on curved sections.
The equipment moves along its runway with a speed of up to 40m/min. As the runway's alignment and curvature vary so rapidly, it would be impossible for an operator to adjust the various parameters manually. A 'smart' control system monitors the position of the equipment through field sensors and automatically adjusts the telescopic legs and the travel speed as well as checking the load on the wheels to prevent derailment or overturning.
The crane operator performs the same activities as on a normal crane but is, in fact, managing a piece of sophisticated equipment that gives higher productivity and a safer work environment, despite operating in extreme locations that would be inaccessible for standard gantry cranes

— A special gantry crane moving along a curved alignment
— Different gradients and levels for each rail
— 'Smart' electronic control system to enable a speed of up to 40m/min
— High productivity and a safe work environment while working in a challenging location

PROJECT TEAM
Client: Connecticut DOT
Project: New Moses Wheeler Bridge
Designer: STV Inc. and GM2 Associates Inc.
Contractor: PCL Walsh

DEAL SUPPLIED
Lifting equipment
Design and fabrication of:
3 special gantry cranes of type GC 63/16.6

Provision of a safe and innovative gantry crane capable of resisting 240km/h winds

ROUTE DU LITTORAL HIGHWAY

— New coastal highway built over the Indian Ocean
— 5.4km viaduct on columns rising out from the sea
— Able to withstand 144km/h hurricane winds and waves of up to 10m
— Longitudinal travelling speeds pushed to the limit (20m/min fully loaded; 60m/min unloaded)

The wave erosion process brings constant danger for the coastal road around La Reunion Island, which is located East of Madagascar, in the Indian Ocean. Landslides and high waves force up to 40 closures a year of the existing route at the foot of the island's cliffs.

As a result, the French local authority decided to relocate the coastal road onto a bridge running parallel to the island's perimeter, standing on columns rising out of the Indian Ocean at a distance of 100m to 200m from the shoreline. Once completed in 2018, it will be the most expensive road ever funded by France in terms of cost per kilometre.

The new 12.3km offshore highway - Route du Littoral - will have three lanes in each direction and will connect Saint Denis, the administrative capital of La Réunion, with La Possession.

One of the most complex aspects of the work is the construction of the 5.4km viaduct on columns rising out of the sea

The structure is being built to withstand 144km/h hurricane winds as well as waves of up to 10m.

The project involves the use of a large fleet of heavy machinery. Deal has delivered a special gantry crane with a 65m span capable of handling the 350t prefabricated segments in the precast yard.

The challenges of the project meant pushing the equipment's longitudinal travelling speeds to the limit: the crane was designed to handle safe movements at 20m/min fully loaded and 60m/min unloaded. Strong winds and typhoons are common on the island and so the design of the 'parking' system has been challenging too, in order to resist winds with speeds of up to 240km/h

PROJECT TEAM
Project: Nouvelle Route du Littoral, Reunion Island (France)
Contractor: Chantier NRL Viaduc

DEAL SUPPLIED
Heavy lifting gantry crane with 350t capacity and 65m span

— A newly built, 178km-long metrosystem / 6 lines / 85 stations
— Deal provision of engineering services, equipment and post-tensioning to all three consortia

RIYADH METRO PROJECT

DEAL OFFERS ITS EXPERTISE AND EQUIPMENT TO ALL THREE CONSTRUCTION CONSORTIA

Riyadh's population currently stands at about 5.7 million but is expected to reach up to 8 million in the coming decade. However, only 2% of commuters use public transport and this led the Saudi Government to the idea of developing a 178km-long metro system for Riyadh. The resulting network, with its six planned lines and 85 stations, is the largest infrastructure project ever undertaken in the Kingdom of Saudi Arabia.

The metro comprises a mix of underground, elevated and at-grade sections. The work has been divided between three consortia:

— Arriyadh New Mobility Civil Work Group, a joint venture formed by Salini Impregilo Spa (Italy), Larsen & Toubro (India) and Nesma & Partners Contracting JV (Saudi Arabia);

— Civil Works Joint Venture, a joint venture between Bechtel (USA), Almabani (Saudi Arabia), CCC (Saudi Arabia) and Siemens (Germany);

— FAST Consortium, a joint venture between FCC Construccion (Spain), Samsung (South Korea), Alstom (France), Strukton (Holland), Freyssinet SA (Saudi Arabia), Typsa (Spain) and Setec (France).

Deal has been subcontracted by all three consortia to be involved in the project, providing engineering services, equipment and post-tensioning materials. This is an incredible achievement, as well as an significant challenge that demonstrates once again that the company is a worldwide leader in the bridge construction industry

RIYADH METRO PROJECT
BLUE AND GREEN LINES (LINES 1 AND 2)

Efficient construction by the span-by-span method

The span-by-span method is being used to achieve high erection rates in the construction of the elevated sections of two metro lines

Civil Works Joint Venture made up of the well-known companies Bechtel, Almabani, Consolidated Contractors Company and Siemens, is responsible for the design and build works of Lines 1 and 2 of the Riyadh Metro network.

Line 1 (Blue Line) runs in the North-South direction along Olaya and Batha Streets, starting from an area slightly North of King Salman Bin Abdul Aziz Street and ending in the Dar Al Badia neighbourhood in the South. The metro will be mostly underground, running in a bored tunnel along Olaya and King Faisal Streets, though it will be elevated on a viaduct along Batha Street and at the Northern and Southern ends. Line 1 extends over a length of approximately 38km and features 22 stations, in addition to four interchange stations providing connections to the other five lines.

Line 2 (Green Line) runs underground in a bored tunnel along King Abdulaziz Street, between King Abdul Aziz Historical Centre and the Riyadh Airbase, before connecting with King Abdullah Road. The line stretches for about 12.9km and features 10 stations, in addition to two stations connecting Lines 1 and 2.

All the elevated sections are being constructed using the span-by-span segmental method.
The span-by-span method is based

PROJECT TEAM
Client: Arriyadh Development Authority (ADA)
Contractor: Bechtel – Almabani – CCC - Siemens JV (BACS)
Designer: Aecom

DEAL SUPPLIED
Launching equipment
Design and fabrication of:
5 launching girders for span-by-span erection
2 new lifting frames for balanced cantilever erection
2 second-hand lifting frames for balanced cantilever erection
Gantry cranes for the precast yard
Design and fabrication of:
4 gantry cranes for segment handling and storage in the precast yard
Moulds for precast segments
Design and fabrication of:
13 short-line moulds for typical span-by-span segments
6 short-line moulds for span-by-span pier segments
2 short-line moulds for typical single-track span-by-span segments
1 short-line mould for single-track span-by-span pier segments
2 short-line moulds for typical balanced cantilever segments
1 short-line mould for balanced cantilever pier segments
1 short-line mould for balanced cantilever expansion joint segments
3 short-line moulds for station segments

on a production cycle that starts in the precast yard, where the segments are manufactured, and ends with the erection equipment that physically builds the bridge. All the items of equipment required for the entire process - 29 precasting moulds, four gantry cranes, five launching girders and four lifting frames – have been provided by Deal.
Deal has to design, manufacture and deliver all of the equipment in accordance with a strict schedule - a huge logistics effort, particularly as Deal designs all of its products in house and then involves a team of suppliers, located mostly in Europe and China, in all of the manufacturing activities. All the components then have to be partially assembled and tested before final delivery to the site.
More than 200 containers and flat racks – open-topped containers - have crossed the Mediterranean Sea and the Indian Ocean to deliver Deal's equipment to Riyadh. Once ashore, Deal's supervisors coordinate with local personnel and liaise with the BACS team in order to get the equipment assembled, tested and ready to work.
The first segment was cast in April 2015 and within just 18 months half of the elevated section had been erected thanks to the drive of the BACS team, with constant support from Deal's main office and Deal's supervisors, who are always present on site

RIYADH METRO PROJECT
RED LINE (LINE 3)

Astonishing productivity in span erection for the longest metro line

Deal has worked closely with the contractor for the metro's longest line to achieve an extremely high rate of span erection for the elevated section

Execution of the civil works for the infrastructure of Line 3 (Red Line) has been awarded to Arriyadh New Mobility Civil Work Group, a JV between Salini Impregilo, Larsen & Toubro and Nesma. The Red Line is the longest on the new Riyadh Metro, running from East to West for a total of 41.2km - of which 26.7km are formed by a viaduct – with 22 stations and six park-and-ride locations.

Arriyadh New Mobility Civil Work Group assigned to Deal the design and supply of almost all the construction equipment required for the prefabrication and erection of the elevated structures. Eleven simultaneous work fronts along Line 3 required the supply of an impressive quantity of specialised equipment with a total weight of approximately 7,000t, delivered to Saudi Arabia from overseas by means of 360 standard 40' containers.

Thanks to close and continuous coordination between the contractor's construction team and the Deal engineering team, the design of the equipment was defined and tailored to suit the actual construction requirements. The benefits of this collaboration were recently confirmed by the achievement of an astonishing productivity rate of just 1.5 days per cycle for span erection, using launching girders supplied by Deal

PROJECT TEAM

Client: Arriyadh Development Authority (ADA)
Contractor: Arriyadh New Mobility Civil Work Group:
Salini Impregilo Spa
Larsen & Toubro Ltd.
Nesma & Partners Contracting Co. Ltd. JV
Designer: International Bridge Technology (IBT)

DEAL SUPPLIED

Launching equipment
Design and fabrication of:
7 launching girders for span-by-span erection
2 new lifting frames for balanced cantilever erection
2 second-hand lifting frames for balanced cantilever erection
3 towers for launching girder erection
2 towers for span erection along curved sections
1 tower for launching girder load tests
8 towers for balanced cantilever stabilisation

Moulds for precast segments
Design and fabrication of:
6 short-line moulds for typical span-by-span segments
3 short-line moulds for span-by-span pier segments
4 short-line moulds for typical balanced cantilever segments
2 long-line moulds for station segments

RIYADH METRO PROJECT
LINES 4,5 AND 6

Rapid construction of almost 12km of viaducts

The FAST consortium is living up to its name, with rapid progress on Lines 4, 5 and 6 of the Riyadh Metro

The consortium, which is led by FCC Construccion, is designing and constructing the three lines, which involve extensive elevated sections.
In total, 11,904m of viaducts are being built using precast segments, with production taking place in a nearby casting yard. Most of the viaducts - 10,420m - will be constructed by the span-by-span method, with the balanced cantilever method used for the remaining 1,484m.
The planned number of segments for the span-by-span sections is 2,914, with a further 404 for the balanced cantilevers; all should be produced within a period of just 18 months.
The FAST consortium work that has been subcontracted to Freyssinet Saudi Arabia achieved all its objectives set for 2016, even surpassing expectations and targets for some activities. The results achieved by Freyssinet SA are due in part to Deal's involvement in the project both as a supplier of equipment and through the presence of supervisors and Deal employees on site for the prefabrication and the launching of segments.
Key achievements have included:
Commissioning in 2016 of a third launching girder for 'span-by-span' erection. This was manufactured, shipped and assembled on site in only five months - the order was issued at the beginning of March and the first span was launched in August.
In 2016, two sets of additional moulds were commissioned for the construction of segments: one for 96m balanced cantilever erection and the other for 120m balanced cantilever erection. Key geometrical characteristics of the segments that had to be achieved included a height of approximately 7.5m. Despite the challenging design, the two types of moulds - one for typical segments and one for pier head segments – were designed, produced, delivered and assembled in just six and a half months. The order was issued at the beginning of March and the first segment was ready at the end of September.
Segment production reached the programmed one-segment-per-day rate for the span-by-span work and one segment every two days for the balanced cantilever spans of 52m and 72m. Segment installation, which is currently ahead of programme, has averaged 2.5 spans per week, using two working shifts per day. A maximum output of four spans a week has been achieved with the two shifts

PROJECT TEAM
Client: Arriyadh Development Authority (ADA)
Contractor: FAST Consortium: FCC Construccion – Samsung – Alstom – Strukton – Freyssinet Saudi Arabia – Typsa – Setec JV
Subcontractor: Freyssinet Saudi Arabia
Designer: Atkins

DEAL SUPPLIED
Launching equipment
Design and fabrication of:
3 launching girders for span-by-span erection
1 lowering system for launching of the final spans of the viaduct (using span-by-span methodology)
Gantry cranes for the precast yard
Design and fabrication of:
2 gantry cranes for handling and storage of segments in the precast yard
Moulds for precast segments
Design and fabrication of:
6 short-line moulds for typical span-by-span segments
3 short-line moulds for span-by-span pier segments
For balanced cantilever spans of 52m to 72m
1 short-line mould for pier segments
2 short-line moulds for typical segments
1 set of accessories for expansion joint segments
For balanced cantilever spans of 96m to 120m
1 short-line mould for pier segments
1 short-line mould for typical segments
1 set of accessories for expansion joint segments
Engineering services
Production of the erection manual and loading sequence
Construction analysis
Provision of a geometry control system and drawings
Shop drawings for the segmental and balanced cantilever superstructure
Precasting yard and temporary works design

Supply of post-tensioning equipment and materials

Technical assistance on site – precasting yard and erection

WADI HANIFA BRIDGE
A LANDMARK STRUCTURE COMPLETED IN RECORD TIME

— Successfully completed in just one year
— A 77m span erected each week Deal involved in: estimating, engineering, procurement of special equipment, supervision of precasting and erection, quality control, cost control, scheduling and general management

Efficient adaptation of available equipment has enabled Wadi Hanifa Bridge to be completed successfully in just one year, from the start of activities at the precasting yard to the erection of the last segment.
Adding to the challenges of the project were the need to incorporate Ramadan into the schedule and the need to work through the summer in one of the world's hottest areas, with temperatures reaching 50°C. The location and related difficulties made the speed of execution particularly remarkable; the erection reached a completion rate of a 77m span each week following the initial learning curve.
The bridge crosses the Wadi Hanifa area in the Nejd Region of Central Saudi Arabia. The valley runs for 120km from North to South, cutting through the country's capital, Riyadh.
The new crossing of the 40m-deep valley is a 16.33m-wide two-way bridge with a length of approximately 512m made up of six 77m spans and two 25m-long side spans. The deck is a precast segmental concrete box girder with internal post-tensioning, erected using the balanced cantilever method.
The project, which was awarded to local contractor Al Ayuni, had been put on stand-by for various reasons, but failure to complete it would have compromised the opening to traffic of the entire highway.
It was therefore necessary to devise a new design solution that would make use of everything that had been built previously - in particular the piles and the foundation plinths of the piles and abutment - but would also allow for maximum optimisation of the erection process.
The geometry and positions of the piles were preserved, while the superstructure - originally designed to be cast 'in situ' on falsework, was completely re-engineered by Deal. The new solution involved precast segments, making use of prefabrication and launching

PROJECT TEAM

Client: Ministry of Transportation, Kingdom of Saudi Arabia
Contractor: Al Omaier Trading & Contracting Company
Subcontractor: Al Ayuni Investment & Contracting Company
General designer: EURO CONSULT
Superstructure design: Deal

DEAL SUPPLIED

Erection equipment
1 launching truss for balanced cantilever construction
1 trailer for segment transportation
2 finishing platforms
Moulds for segment precasting
3 short-line moulds for constant-height segments
1 short-line mould for variable-height segments
1 mould for pier segments
4 segment manipulators
Precasting equipment
1 gantry crane (100t capacity) for segment handling
5 jigs for segment rebar cages
10 moveable sheds for segment moulds and rebar jigs
Specialised materials
Supply though subsidiary of:
Post-tensioning hardware and specialised equipment
Pot bearings, shear keys and shock transmitter devices
Expansion joints
Engineering services
Redesign of the superstructure from the original cast-in-situ to precast segmental
Construction engineering and shop drawings for the superstructure
Detailed design of the temporary works and precasting yard
Project management
Provision of staff and management to ensure:
Timely execution of the bridge
The required quality of works
Remaining within the agreed budget

equipment that was already available and almost ready to use. Fabrication of the precast elements was able to start just four months after the award of the contract, thanks to the work done during the 're-engineering' stage to prepare and ship to site all of the specially modified prefabrication equipment.
At the same time, the launching equipment that was available was customised for the project and shipped to the site in time for the launching and erection phase of the segments and girders to start in March 2015.
The first carriageway was completed and opened to traffic in August 2015, while the entire project was delivered in November 2015.

Deal provided the client with extensive support throughout the project, including estimating, engineering, procurement of the special equipment and supervision of the precasting and erection operations, as well as quality and cost control together with programme and general management.

Deal was involved in the redesign of the viaduct, the supply of all the special equipment and the supply of all post-tensioning materials and equipment as well as bearings and expansion joints. In addition it provided the engineering for all construction phases and – most importantly – full work supervision for the viaduct construction, through its seconded technicians

JAMAL ABDUL NASSER STREET
UPGRADE OF KUWAIT CITY'S MAIN TRANSPORT ARTERY INTO A MOTORWAY

Use of an alternative method to erect most of the precast segments for a 7.2km-long elevated highway has enabled Deal to increase production rates and save materials

The Jamal Abdul Nasser (JAN) Project, also known as RA 167, is one of the main infrastructure and road development projects taking place in Kuwait and is part of the Ministry of Public Works' strategic plan to improve motorways and other roads.
The project will transform and upgrade the existing street into a motorway that meets international standards, with a structural design life of 100 years and capacity to accommodate growing traffic flows for many years to come. The upgrade will be achieved by constructing several complex bridges and elevated highway sections along the full length of Jamal Abdul Nasser Street and at intersections.
The scheme will guarantee smoother and more efficient traffic flow, as well as easier access to universities, hospitals and other key city buildings along the route. The scope of works also includes diversion and upgrading of a number of utility networks, including electrical and communications cabling, sewerage and stormwater drainage.

The project features:
a 7.2km-long elevated highway (approximately 8,500 precast segments);
six different types of segments (types 'DA', 'DB', 'DC', 'A', 'C', and 'E');
six to eight lanes on the elevated highway;
a four-level interchange at Ghazali Road;
three other interchanges.

The original design solution assumed that all 8,500 segments would be erected using the balanced cantilever method. Instead, Deal proposed adopting the span-by-span method for most of the project, in order to increase the produc-

PROJECT TEAM
Client: Kuwait Ministry of Public Works (MPW) – Roads Engineering Department (Motorways)
Contractor: Rizzani de Eccher Spa, OHL SA, Boodai Construction, Trevi Spa Joint Venture
Designer: Louis Berger

DEAL SUPPLIED
Launching equipment
2 launching girders
for span-by-span construction
a pair of lifting frames for balanced cantilever construction
Precast segment mould design and fabrication
6 short-line moulds
for segments of types 'A' and 'DA'
1 short-line mould
for segment type 'DB'
7 short-line moulds
for segments of types 'C' and 'DC'
1 short-line mould
for segment type 'E'
Other equipment
Design and fabrication of:
4 gantry cranes for the precasting yard
Engineering services
Support for precasting yard design and logistics
Temporary works design
Geometry control
Erection engineering


JLG LIFT
SLOW

— One of Kuwait's key infrastructure and road development projects
— Use of precast segmental erection methods to construct 395,000sqm of viaducts
— Design life of 100 years
In order to increase the production rate and to optimise the quantities of materials (rebar and tendons), Deal proposed an alternative construction method for part of the project
— Longest span 57m

tion rate and to reduce the quantities of rebar and tendons needed.
Both systems are used on the project:
6,800 segments erected using the span-by-span method (80% of segments);
1,700 segments erected using the balanced cantilever method (20% of segments).
A twin set of specially designed launching girders has been provided by Deal to carry out the span-by-span erection. The equipment is capable of erecting three different types of segments - types 'DA', 'DB' and 'DC'. Each type has a different distance between the webs and so Deal decided to develop a 'telescopic' system that allows automatic adjustment to take account of the distance between the girders. This innovation enables faster and easier installation while avoiding the need for any transverse hanging beams for the segments.
Another challenge is the great variability in the length of the spans on the project; the shortest span has a length of 32.5m, whereas the longest is 57m.
The equipment deployed by Deal has the capability to use a dual approach to construct the longest spans, by erecting a small section by the balanced cantilever method and then completing the erection using the span-by-span approach. In addition, a pair of lifting frames has been supplied to support erection of the balanced cantilever portion of the project. The lifting frames can be set both in static and mobile configurations:
the mobile configuration allows the lifting frame to raise the segments from any position underneath the portion of cantilever already erected, transport the load along the viaduct and install the segments in place;
the static configuration allows the lifting frame to raise the segments from the tip of the cantilevers and place them in their final positions.

Deal has also supplied 15 sets of moulds to cast all 8,500 segments, as well as the four gantry cranes for their handling.
In addition, Deal's technical office has been involved in the:
design of the precasting yard;
temporary works design;
geometry control;
erection engineering

KUALA LUMPUR MRT

SUPPLYING OPTIMISED CONSTRUCTION TECHNOLOGY FOR A MAJOR EXPANSION OF METROPOLITAN RAIL INFRASTRUCTURE

— Part of Kuala Lumpur's massive infrastructure improvement
— The launching gantry has a 'lowered configuration' operating mode to allow work in areas with restricted clearance such as airports
— Use of Deal's methods and guidelines ensured maximum savings and efficiency

Improvements being put in place for Kuala Lumpur's MRT system are designed to bring about a dramatic enhancement of the coverage of the city's public transportation network

The aim is for transport in the Greater KL metropolitan area to achieve the same ranking as the world's most modern and developed cities. As part of this upgrade programme, the existing Ampang Line is being significantly extended in its South-West direction. Contractors have invested heavily in technology and equipment in order to stay at the technological forefront and capitalise on the many opportunities offered by the new rail infrastructure projects in Kuala Lumpur.

Right from the tender stage, Deal has had a successful cooperative arrangement with a local company, Acre Works. This has involved deploying an in-house solution - including the provision of optimised construction methodology - that had been developed for a previous project in Vancouver.
For the KL project, Deal supplied Acre Works with four sets of launching girders for span-by-span erection. The equipment had been specifically designed to suit the project requirements; in particular, one of the launching girders has a 'lowered configuration' operating mode that allows work in areas with low clearance, particularly in close proximity to airports.

For the special structures being erected by the balanced cantilever method, Deal is providing three sets of short-line casting moulds.

Deal established a close working relationship with the client and the bridge designer from the very beginning of the project to ensure well-defined guidelines and methods so that savings and efficiency would be maximised during the prefabrication process. The special structures were erected using three sets of lifting frames that employed truly 'state-of-the-art' technology for this field. In particular, in addition to the usual static and mobile configurations, the lifting frames were designed to collect a bridge segment previously stored on the deck, travel forward fully loaded and then - once anchored at the tip of the cantilever - finally erect the segment in its place.

Deal's scope of works also included provision of geometry control for prefabrication and the erection of the bridge segments

PROJECT TEAM
Client: Kerajaan Malaysia Kementerian Pengangkutan, Prasarana
Contractor: Bina Puri – Tim Sekata JV
Subcontractor: Acre Works Sdn. Bhd.
Designer: Opu Ace Vector Konsortium, Hssi Consulting Engineers, MMSB Consult Sdn. Bhd.

DEAL SUPPLIED
Launching equipment
4 sets of launching girders
3 sets of mobile lifting frames
Precast segment moulds
3 sets of moulds for balanced cantilever segments
Engineering services
Geometry control

Talking about us

Venugopal Nambiar, Executive Director Acre Works

DEAL, PARTNER MORE THAN SUPPLIER

— Why did you chose Deal as a technical partner project?
— Deal has a strong global reputation as a launcher/lifter solution provider. Deal has a comprehensive expertise in design, fabrication and support of the end-user of specialist launching equipment. This rare combination supports the end-user, such as ourselves, in our pursuit for innovation. Deal was able to listen and respond accordingly to our specific requirements.

— How important was Deal's background and know-how for the success of the project?
— We were able to work closely with Deal on some very complex sections, by jointly developing some innovative solutions

— What is, in your opinion, Deal's best feature that you would recommend to other Clients?
— Deal is an honourable, reliable and fast-responding partner. They treat us more as a partner than just as a client

ULU JELAI HYDRO-ELECTRIC POWER STATION
SETTING NEW STANDARDS DEEP IN THE GROUND

Reaching high elevations isn't always the biggest challenge for lifting equipment

In the case of a Malaysian hydro project, Deal was requested to provide a gantry crane to transport personnel, materials and equipment down a vertical shaft, to a depth of 500m. The demanding safety requirements and exceptional depth as well as the constraints of a confined and barely accessible environment required a new approach to the design of the crane. The result has set new standards for equipment operating in this field of construction.

The work was for the Ulu Jelai hydro-electric power station.
The crane's working platform can either carry the people involved in the shaft construction or it can be used as a 'hook' with a 30t capacity to deliver drilling equipment down to the bottom.
Site personnel travel in an elevator basket at the considerable speed of 60m per minute; this speed was necessary to optimise the travelling times for the workers and to guarantee rapid evacuation in case of emergency.
In the unlikely event of a power breakdown, the gantry crane can still bring people back to the top of the shaft as it has also been equipped with a high-performance, self-propelled safety winch.

In addition to the safety winch, some other equally demanding safety requirements have guided the design of the equipment. A 'double-rope' system is automatically activated in case of rope failure; winches are equipped with double emergency brakes; a protection system is in place to prevent objects from falling while people are boarding the elevator.

— Demanding safety requirements
— Exceptional lifting range involving a 500m-deep shaft
— Confined and barely accessible environment
— Speeds of 60m per minute complete with personnel
— Two configurations of the gantry crane

The gantry crane has two configurations: one for 15m-diameter shafts and the other to set up equipment in smaller, 9m-diameter shafts. In both configurations, the crane can also be set up for use inside restricted-height tunnels thanks to its low profile.
The complexity of the equipment supplied coupled with the need to transport people meant that obtaining a CE stamp required the approval and monitoring of a third-party certifier

PROJECT TEAM
Contractor: Salini Impregilo Spa
Subcontractor: Edilmac
dei F.lli Maccabelli Srl

DEAL SUPPLIED
Shaft gantry crane

Talking about us

Giuseppe Gelmi, Technical Director Edilmac

BE ABLE TO UNDERSTAND THE CLIENTS REQUIREMENTS

— Why did you choose Deal as a technical partner in this project?
— We were evaluating the option of refurbishment or the replacement of our major piece of equipment: a gantry crane, used to reach the bottom levels of shafts, with depth up to hundreds meters.
One of our freelance supervisors, who is working for Deal too, proposed Deal as a possible supplier, and it was the right choice!

— How important was Deal's background and know-how for the success of the project?
— Very important, as from the beginning we have worked as a team: we proposed the methodology, while Deal provided technical guidance in the development and upgrade of the equipment, using the most innovative technological solutions.

— What is, in your opinion, Deal's best feature that you would recommend to other clients?
— Surely, the capability to understand the client's requirements and to design equipment that satisfies such needs

MRT SYSTEM FOR HO CHI MINH CITY THE FIRST METRO IN THE VIETNAMESE MEGALOPOLIS

High levels of quality and productivity are being achieved on the construction of the Ho Chi Minh City metro project, which is using Deal equipment

The aim of the first line of the new metro system is to provide alternative transportation methods to relieve heavy traffic congestion in Vietnam's southern economic capital.
An elevated viaduct approximately 11km long will connect the North-Eastern part of the city to its centre, starting from a depot area and passing through six stations. On the first section, the alignment runs parallel to an existing highway, while the second section, at the entry to the urban area, becomes curvy and crosses the Saigon River.
The U-shaped cross section of the viaduct takes as inspiration, in terms of both aesthetics and noise-reduction characteristics, the excellent results achieved by the Dubai Metro Project in the United Arab Emirates. Of note is that the same joint venture that executed the works in Dubai is now prefabricating and erecting the segments for the new project.
Deal has been asked to supply a full package of specialised equipment: three sets of long-line moulds for the straight spans, three sets of short-line moulds for the curved spans and four sets of short-line moulds for pier segments. In addition, Deal's scope has included modification and refurbishment of three launching girders that had been previously used on the Dubai Metro and have now been adapted to suit the specific characteristics of the Ho Chi Minh project.
An excellent level of quality and productivity is being achieved throughout the project thanks to the equipment supplied by Deal: every day 11 segments are cast in the precasting yard and every week six spans with a length of 37m are erected

— Supply of a full package of specialised equipment
— 11km-long elevated viaduct
— U-shaped cross section inspired by the Dubai Metro project
— Excellent levels of quality and productivity

PROJECT TEAM
Client: Ho Chi Minh City People's Committee Management Authority for Urban Railways
Contractor: Sumitomo Cienco6 Consortium
Contractor for civil works: GS E&C
Subcontractor: FVR (Freyssinet – VSL – Rizzani de Eccher JV)
Designer: Systra

DEAL SUPPLIED
Launching equipment
Design and fabrication of modifications to three existing launching girders for use in span-by-span construction

Moulds for segment precasting
Design and fabrication of:
3 long-line moulds for straight spans
3 short-line moulds for curved spans
4 short-line moulds for pier segments

DOHA METRO
CONSTRUCTION OF THE WORLD'S MOST TECHNOLOGICALLY ADVANCED RAIL TRANSIT SYSTEMS

The Doha Metro will service both Qatar's capital and the city's suburbs, providing easy and convenient access to all key locations.
The metro system is being built in two phases:
the first involves construction of three of the four lines (Red, Gold and Green) and 37 stations. The lines are expected to come into use in late 2019;
the second phase will be completed by 2026 and will involve the expansion of the phase one lines and the construction of the fourth route – the Blue Line. In total, another 72 stations will be built in phase two.
About 2,200m of the alignment runs on an elevated double-track viaduct composed of precast segments. The segments are fabricated in a dedicated precasting yard and then launched across the piers using a launching girder. Both the span-by-span and balanced cantilever methods are being used.
The main contractor, the RLR Joint Venture, brought in Deal right from the tender stage to work on the analysis of the structural solution for the elevated section of Red Line North. Deal drew on its experience in the design and construction of similar works and introduced a series of optimisations in the structural concept, which also allowed significant savings.

Following the award of the project to RLR, Deal has been involved in the detailed design and engineering for the construction of all the decks and has been able to put into practice all the optimisations proposed during the tender stage.

The extensive preparatory studies enabled the prefabrication and launching works to be completed without any problems and ahead of schedule.

In November 2016, a new record was set on the Red Line North Project: Deal used the span-by-span method to construct a section that included 52m spans with a U-shaped cross-section. The work involved creation of a continuous deck unit composed of four spans having lengths of 34m+52m+52m+30m. This was a first for this kind of structure and Deal had to push to the limits both the span-by-span methodology and the erection equipment in order to achieve the challenging goal. The innovative solution has also achieved cost benefits compared to the traditional balanced cantilever method

PROJECT TEAM
Project: Doha Metro project - design and build – Red Line North elevated and at-grade sections
Client: Qatar Rail
Contractor: RLR Joint Venture – Rizzani de Eccher – Lotte – Redco International
Designers: Typsa & Progin JV.
Alignment design, geotechnical design, station design, cut & cover and trough design, viaduct substructure design;
Salfo: design of traffic diversion and utilities relocation and protection;
Rizzani de Eccher: design of bridges

DEAL SUPPLIED
Launching equipment
Design and fabrication of:
Launching girder for span-by-span erection
Precast segment moulds
Design and fabrication of:
2 short-line moulds for typical span-by-span segments
1 short-line mould for span-by-span pier segments
1 short-line mould for typical and special segments

Gantry crane for segment handling and storage in the precasting yard
Transporter for segment handling behind the launching girder

Deck design

Engineering services and geometry control

Post-tensioning equipment and materials

Significant savings are being achieved on the Doha Metro project, thanks to optimisation of the design and construction methods

DOHA'S NEW CONNECTING HIGHWAY VIADUCT CONSTRUCTION by the balanced cantilever method

Construction is under way of a new 45km dual carriageway that includes four grade-separated interchanges. It is located to the South of Doha City and will connect Al Wakra – Mesaieed Highway and the New Doha Port to the East-West Corridor in the North as well as to Al Wakra Bypass in the East and to the Orbital Highway. The interchanges include 6,200m of viaducts to be built using balanced cantilever precast segmental technology. In total, 2,168 concrete segments will be installed by means of crawler cranes equipped with self-propelled remoted-controlled lifting spreader beams capable of positioning each segment precisely

PROJECT TEAM
Client: Public Works Authority, Qatar (Ashghal)
Contractor: J&P-AVAX S.A JV
Project management consultant: KBR
Supervision consultant: AECOM
Design consultant: WSP
Subcontractor for design and construction of bridges: Rizzani de Eccher Spa, Qatar Branch

DEAL SUPPLIED
Equipment
Design and fabrication of:
2 straddle carriers
3 motorised spreader beams for launching segments using mobile cranes
6 stressing platforms
Precast segment moulds
Design and fabrication of:
9 short-line moulds for typical segments for balanced cantilever spans
3 short-line moulds for pier segments for balanced cantilever spans
Deck design
Engineering services and geometry control design
Post-tensioning equipment and materials

Hong Kong-Zhuhai-Macao Bridge
THE RETURN OF THE RED DRAGON

The 'Red Dragon' has returned to bridge-building after a few years of inactivity. The distinctive launching girder is being used to construct prefabricated viaducts as part of a major bridge and tunnel project that will connect the cities of Hong Kong, Zhuhai and Macao on the Pearl River Delta

The longest bridge section of the Hong Kong – Zhuhai – Macao Project is 29.6km long and includes three cable-stayed spans with lengths of between 280m and 460m.
The equipment is being used for the construction of prefabricated elevated viaducts between the Hong Kong boundary and Scenic Hill. Work consists of two parallel viaducts - one for each carriageway - with a maximum span length of 75m; construction is by the balanced cantilever method.
Local people had become fond of the Red Dragon, which gained its nickname when it was deployed on the East Tsing Yi Viaduct. Its red steel coating and the fabled engineering feats it accomplished led the local press to liken the equipment to the mythological creature so popular in Chinese folklore.
Despite a nickname rooted in folklore, the launching girder had to be designed to overcome daunting real-world challenges on its latest project. These included variable dimensions of spans and segments, problematic access to the erection area and a very tight horizontal radius of curvature, not to mention the high performance standards required of the equipment in terms of erection cycles.

The Red Dragon is capable of picking up prefabricated segments delivered either from the already erected deck or from barges. During the self-launching operation, the equipment is positioned symmetrically between the two viaducts. The main supports are equipped with long rail tracks, which means that the launching girder can then erect alternate segments for each viaduct, by shifting transversally.
In terms of cycle times, this represents a significant saving for the project as post-tensioning operations can be overlapped with the assembly of the adjacent bridge, and vice versa

— Construction of two parallel viaducts
— Maximum span length 75m
— Balanced cantilever construction method
— Use of a launching gantry that can be used to erect segments of both viaducts by shifting transversally

PROJECT TEAM
Client: Hong Kong Highways Department
Contractor:
Dragages - China Harbour – VSL JV
Designer: Mott MacDonald – YWL Engineering

DEAL SUPPLIED
Launching equipment
'Second-hand' launching girder

Careful planning during design development has brought benefits in the construction of a new bridge in Iraq

AL SEWYRAH BRIDGE
DEAL HELPS CROSS THE TIGRIS RIVER

Setraco Contracting Offshore carried out a successful project to build the bridge over the Tigris River, close to the city of Basra.

The Al Sewyrah Bridge was commissioned by the State Corporation of Road & Bridges of the Republic of Iraq. All equipment for bridge construction was supplied by Deal, including moulds for self-compacting concrete T-beams, two 60t-capacity straddle carriers for beam handling and the system employed to launch the bridge girders.

The client approached Deal with an offer to develop a complete set of efficient, flexible and easily relocatable equipment for constructing the bridge deck using precast pre-stressed beams. Deal's scope also included design review & development for the bridge superstructure, in order to select the best construction methods.

The result was optimisation and full integration between the design of the permanent structure and the equipment needed for its construction. For example, the same mould can be used to cast both T- and I-shaped beam cross-sections and can accommodate different beam lengths

Charbet Abdallah, Technical Director Setraco Group

DEAL, A TRUSTWORTHY PARTNER THAT HELP CLIENTS WITH FULL COMMITMENT

PROJECT TEAM
Client: State Corporation of Road & Bridges, Republic of Iraq
Contractor: Setraco Contracting Offshore SAL
Designer: Deal

DEAL SUPPLIED
Precast moulds
Design and fabrication of a mould for T- and I-shaped beams
Launching equipment
Design and fabrication of:
2 straddle carriers of type SC 60/4.5
1 launching girder of type LG 120/40
Engineering services

— Why did you choose Deal as a technical partner in this project?

— Being one of the leading infrastructure contractors in Nigeria, we always search for a reliable and trustful partner to successfully deliver our projects. When we were awarded contracts for the construction of several long-span bridges in 2001, we began to look for a world leader in launching equipment for bridges, supplier of pre-stressing materials, and a strong technical partner – which was Deal.
The success of this partnership lead to several further cooperations in bridge construction, such as:
1. 612-m-long bridge composed of 36-m-long pre-stressed girders positioned in place using a launching girder;
2. 645-m-long bridge composed of 31-m-long pre-stressed girders, positioned in place using a launching girder;
3. 850-m-long bridge composed of 95-m-long spans, made of pre-cast segments, erected with balanced cantilever method using a launching gantry.

As we expanded our operations to Iraq in 2012, we continued our cooperation with Deal to execute a 420-m-long bridge over the Tigris river, composed of 35-m-long pre-stressed girders, positioned in place using a launching girder.

— How important was Deal's background and know-how for the success of the project?

— Deal's involvement was a key factor in the success of Al-Sewyrah Bridge construction. Their technical assistance in optimising the superstructure design, the construction method, as well as their staff presence on site with a day-to-day follow up of any modification or adjustment, was a major element of completing the project on time with a zero-accident result. Deal's know-how led to a successful selection and quantification of pre-stressing equipment and materials, making the on-site execution in a remote and risky region like Iraq smooth and punctual.

— What is, in your opinion, Deal's best feature that you would recommend to other clients?

— Deal is a trustworthy partner who can perfectly deliver:
1. the best suitable method for a bridge superstructure construction;
2. the exact equipment needed to perform the job;
3. cost-effective pre-stressed materials;
4. detailed superstructure design and, subsequently, all back-ups that might be required during the construction phase.
On top of that, Deal has very professional and dedicated commercial and technical staff that do their best to help clients with full commitment

The Liantang Project
A UNIQUE SOLUTION TO ACHIEVE FLEXIBILITY IN NARROW AND CONGESTED AREAS

An alternative and faster route is being created for the movement of people and goods between Mainland China and Hong Kong

— Unique equipment: the special mobile lifting frame
— Maximum flexibility
— Just one loading position needed for each cantilever

Contract 3 of the Liantang/Hueng Yuen Wai Boundary Control Point Site Formation and Infrastructure Works (Liantang 3) is located in the New Territories near the border between Hong Kong and Shenzhen.
The project's contractor is using a unique piece of equipment – a special mobile lifting frame - for the erection of prefabricated viaducts crossing over the MRT railway.

The lifting frame is able to pick up segments along the longitudinal axis underneath the bridge, move them to the end of the cantilever and load the segments inside the frame above deck level. It can then travel with the load up to the tip of the other side of the cantilever, where it finally erects each segment in its final position.

This unique working cycle ensures the maximum flexibility in terms of segment feeding, with just one loading position needed for each cantilever.
The special mobile lifting frame is a piece of equipment that had already been used successfully on the Dallas High-Five Project in Texas and has been modified to suit the characteristics of the new project. In particular, the segment spreader beam is now equipped with retractable arms in order to avoid any possible interference with the already erected and adjacent viaducts.
For safety purposes, arm extension/retraction and geometrical adjustment of the segment positions are performed by means of a hydro-electric system powered by an on-board electric generator that can be controlled via radio remote control

PROJECT TEAM
Client: Civil Engineering & Development Department
Contractor: Chun Who Construction & Engineering Co. Ltd.
Subcontractor: Freyssinet Construction Asia Ltd.
Designer: Meinhardt

DEAL SUPPLIED
Launching equipment
Redesign and adaptation of an existing special mobile lifting frame

HANGZHOU BAY BRIDGE PROJECT
Construction of a record-breaking sea bridge

Deal's extensive experience secured it a key role providing the highly specialised equipment needed for construction of one of the world's longest bridges.
The 36km-long Hangzhou Bay Bridge - the world's longest sea bridge at the time it opened in 2008 - is located near where the Qiantang River enters Hangzhou Bay, an inlet of the East China Sea. It consists of two parallel structures designed to carry a dual-carriageway road of six lanes; the main span of the cable-stayed bridge is 448m long, flanked by 50m-long prefabricated spans, each weighing 1,500t.

The main challenge for the project's contractor was finding a company capable of designing, manufacturing and supplying the high-quality specialist equipment needed for safe transportation and launching of such heavy spans.

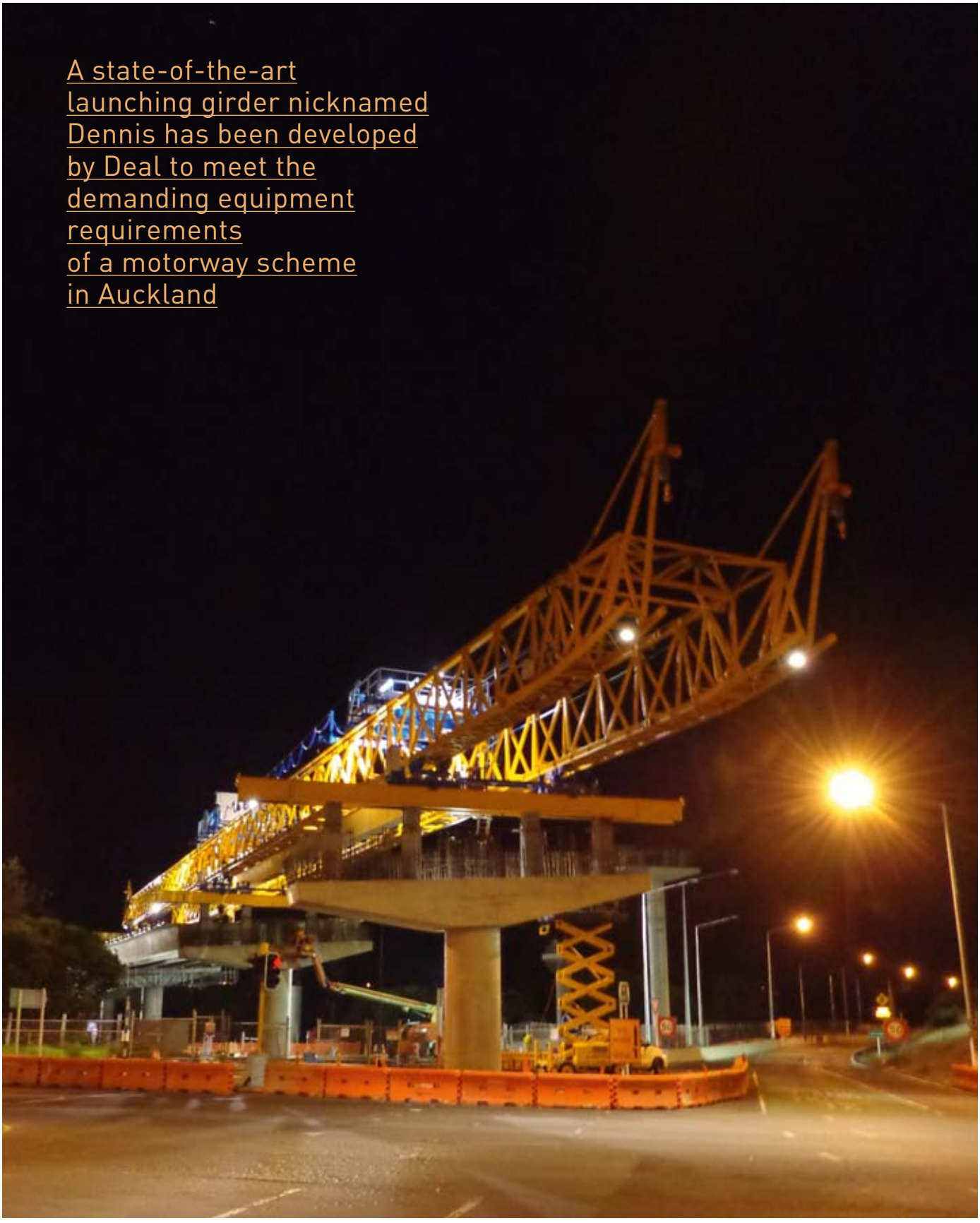
Thanks to its thirty years of experience in the field, Deal was able to develop the most suitable solution and was appointed to supply:

— two rubber-wheeled gantry cranes with a capacity of 50t to handle the rebar cages in the precasting yard;
— two rubber-wheeled gantry cranes with a capacity of 800t to handle the prefabricated elements in the precasting yard;
— two rail-mounted 800t-capacity gantry cranes for positioning the prefabricated elements on top of previously erected sections of the viaduct;
— a special 1,600t-capacity transporter to carry the full span to the erection area;
— a launching gantry for the final erection stage of the 1,500t prefabricated spans

Deal's equipment was highly successful, demonstrating the importance of entrusting such complex work to only the most experienced companies

PROJECT TEAM
Client: China Railway Bridge Bureau Group Co. Limited
Contractor: China Railway Erju Co. Limited
Designer: Hardesty & Hanover, LLP

DEAL SUPPLIED
Launching equipment
Launching gantry of 1,600t capacity
Other equipment
2 straddle carriers of 50t capacity
2 straddle carriers of 800t capacity
2 gantry cranes of 800t capacity
Transporter of 1,600t capacity



A state-of-the-art launching girder nicknamed Dennis has been developed by Deal to meet the demanding equipment requirements of a motorway scheme in Auckland

THE GREAT NORTH ROAD INTERCHANGE (GNRI) 'DENNIS' overcomes tight construction space and environmental restrictions

PROJECT TEAM
Client: NZ Transport Agency
Contractor: Well Connected Joint Operation (WCJO)
Subcontractor: Deal

DEAL SUPPLIED
Launching equipment
Launching girder for beam erection

The Waterview Connection Project is one of the most important infrastructure developments ever to take place in New Zealand. It will complete a motorway ring route around the city of Auckland and will bypass central Auckland to the West, State Highway 1 (SH1) and the Auckland Harbour Bridge).
The project includes construction of a major interchange - the Great North Road Interchange - connecting the new SH20 tunnel with the existing SH16 tunnel over an existing road. The interchange includes four ramps near the northern entrance, with a total length of approximately 1,700m.

Deal has supplied a self-launching truss for erecting the beams of the ramps. The choice of this type of equipment was dictated by the construction site's location within a heritage area and close to sensitive coastal marine environments, which prevented the use of conventional and invasive lifting methods.

Right from the tender stage, a truly cooperative spirit has developed naturally between the teams of the contractor and Deal. This resulted in the choice of clearly defined and highly suitable construction methods and design characteristics for the equipment.
The rather small diameter of the piers imposed a strict limit on equipment weight, while the particularly tight vertical radius of the alignment brought additional challenges. As a result, Deal introduced a new type of support that could be easily adjusted hydraulically.
In addition, the need to adapt to the combination of very tight horizontal and vertical curvatures, variable span lengths and the limitations on equipment weight contributed to the creation of a 'state-of-the-art' solution for this type of equipment.
The yellow launching girder nicknamed Dennis has become a 'partner' for Alice, the giant tunnel boring machine (TBM) excavating the motorway tunnels: a friendly face for a very complicated and challenging project!

— Strict limits on the equipment weight
— Tight curvatures, both horizontal and vertical
— Variable span lengths

M4 WIDENING
MINIMISING TRAFFIC CONGESTION ON AUSTRALIA'S LARGEST INFRASTRUCTURE PROJECT

The need to keep traffic flowing while beams are erected on a site with limited access is among the challenges that Deal has had to address on the project to widen the M4 in Sydney

The project is part of WestConnex, the largest integrated transport scheme under way in Australia. Work includes the renovation and upgrading of both public transport and critical road infrastructure. The M4 and M5 motorways are to be extended, widened and joined together to form a continuous, free-flowing motorway with connections to the city, airport, port and harbour.

The M4 Widening project involves upgrading the motorway from three to four lanes in both directions.

Deal was awarded a contract covering both the design of the project's elevated structures and the supply of specialist construction equipment.
The equipment provided includes two sets of moulds for casting T-shaped beams, as well as two gantry cranes and two straddle carriers for handling the beams and a beam launcher for the erection stage.

Special attention was needed during the structural design and equipment design phases to meet the challenges of erecting the structures for the new lanes while keeping traffic flowing on the existing ones. Adding to the complexity were further constraints resulting from limited access and the challenging erection procedures required.
An additional aim was to minimise the use of conventional lifting and handling equipment at the erection site

PROJECT TEAM
Client: New South Wales Government - Roads & Maritime Services
Contractor: WestConnex Construction JV
Designer: Deal

DEAL SUPPLIED
Precasting yard equipment
2 sets of moulds for T-shaped beams
2 gantry cranes of 80t capacity
2 straddle carriers of 60t capacity
Launching equipment
Launching gantry type 150/50

SYDNEY METRO SAVING TIME WITH DEAL'S INNOVATIVE DE-MOULDING TECHNOLOGY

Innovative solutions developed by Deal are helping cut the production times for segments on Australia's first fully-automated metro rail system

First fully-automated metro rail system in Australia

The Sydney Metro is Australia's largest public transport infrastructure project and includes the construction of 15km of twin tunnels and 6.3km of prefabricated viaducts.
The project is on track to come into service in the first half of 2019.
Its execution is taking place in two stages: firstly the Metro Northwest section (formerly the North West Rail Link) and secondly the Metro City & Southwest Section. The system will have eight new stations and there will be 4,000 commuter car parking spaces in Sydney's growing Northwest area.
Deal has been appointed to supply six sets of short-line casting moulds for the prefabrication of the viaduct segments.

The main challenge is that the equipment has also to be capable of casting the station segments, which have reinforcing ribs under their wings. Deal's engineers have addressed this by developing an innovative 'de-moulding' system that allows the sides of the moulds to be moved horizontally: this simplifies the release of the segment so that it can then be moved on using a motorised rail-based system.
Time is crucial on the project and so Deal's designers have paid particular attention to developing technical solutions that minimise the mould set-up time needed to adapt to the characteristics of the various segment types. There are typical, deviator and station segments, with lengths from 2.5m to 4m.
In addition, Deal has supplied the client with its state-of-the-art geometry control system, which has been developed and upgraded in recent years. The system is specifically designed to simplify operations in the precasting yard and, therefore, minimise the possibility of errors during the casting of segments

PROJECT TEAM
Client: Transport for NSW
Contractor: Salini Impregilo Spa Australia Branch
Designer: SMEC

DEAL SUPPLIED
Moulds for the precasting of segments
Design and fabrication of:
3 short-line moulds for typical span-by-span segments
1 short-line mould for span-by-span station segments
1 short-line mould for span-by-span pier segments
1 short-line mould for span-by-span station pier segments

Engineering services

Tajung Priok Road
A NEW 12.1KM ACCESS ROAD TO INDONESIA'S BUSIEST SEAPORT

Infrastructure cannot keep up with the economic growth in Indonesia, which has a population of 250 million. A new masterplan has been created by Japan International Cooperation Agency (JICA), in cooperation with the Government of Indonesia, to help address shortcomings in the Jakarta Metropolitan Area.

The Tanjung Priok access road is part of this massive programme: the project involves building a 12.1km, six-lane toll road to Tanjung Priok Port in order to create a connection between the North-Eastern section of Jakarta Outer Ring Road (JORR) and the Jakarta harbour road.

Deal had worked with client Obayashi on a previous project in the Gulf area and built up a strong spirit of cooperation. This led to Deal developing innovative equipment for beam erection in the congested areas of the Jakarta project.

It was important to avoid the use of large-capacity ground-based cranes for the handling of the prefabricated elements and so Deal designed, fabricated and supplied a special beam-lifter capable of erecting the 140t, 40m-long beams.

The system brought several advantages:
— reduced traffic impact;
— reduced capacity needed for the service crane;
— reduced impact on the permanent structure, thanks to the light weight of the equipment.

Heavy traffic in the project area meant that the beams were delivered in pieces and assembled underneath the spans. The equipment supplied by Deal was capable of moving outside the line of the pier caps, picking up the beam, lifting it to the pier height, shifting it transversally and then setting it in its final position

Use of an innovative beam lifter has proved ideal for the erection of precast beams in a congested area of Jakarta

PROJECT TEAM
Client: Obayashi - Jaya Konstruksi Joint Operation
Contractor: Ministry of Public Works
Subcontractor: Deal

DEAL SUPPLIED
Beam lifter for beam erection

Viaduct construction for Rennes Metro
DEAL'S FIRST LAUNCHING GIRDER CAPABLE OF ERECTING TWO SPANS SIMULTANEOUSLY

Deal is supplying special equipment for the construction of the segmental superstructure of one of the largest public works projects currently under way in France

— Reduced relocation time for the launching girder
— Faster erection cycle
— Reduced loads on the spans
— On-site support for the client from Deal's technicians during all operations

The 13.8 km, 15-station Line B is the second driverless VAL (Véhicule Automatique Léger) route to be built in Rennes and is expected to be used by 110,000 passengers a day.
Deal's L105 launching girder (LG) provides a great advantage compared to the usual span-by-span launching equipment designed to erect just one span at a time in simply supported conditions (isostatic configuration). Instead, the innovative design means that two 40m adjacent spans (also known as 'bi-travée') are temporarily hung from the main trusses and then simultaneously lowered into position, with the LG operating on three supports, sometimes on a tight horizontal radius too.
The design of the equipment and the method for anchoring to the permanent structures have been particularly challenging due to restrictions imposed by the architect arising from the futuristic appearance of the viaduct.

This has, however, given Deal the opportunity to design an innovative solution with many advantages, such as a reduced time for relocation of the LG from one pier to another, faster erection cycles and reduced loads on the permanent works.

Deal's technicians are supporting the client on site during all assembly and erection operations because of the high levels of accuracy required in the equipment positioning and the increased attention needed for load monitoring, geometry control and surveying checks

PROJECT TEAM
Project: Viaduct de Rennes – Lot 4 – Rennes (France)
Contractor: Eiffage Genie Civil
Designer: Egis

DEAL SUPPLIED
Double-span launching girder (two 500t spans, 40m long each)

DEAL APPROACH TO CONSTANTLY IMPROVE SPECIAL EQUIPMENT

To face new challanges, we stuck to our trademark approach to first understanding the client's specific requirements and then work out the solution that perfectly serves such requirements. We supply 'tailor-made' solutions, not only as a mere equipment supplier, but as a long-term partner with whom to develop innovative systems and methods. Providing design, special equipment and assistance, we define the ideal point of convergence between costs, efficiency and reliability

Hoppers

Underwater construction

Oil&Gas solutions

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