HEAVY CIVILS

TEMPORARY WORKS DESIGN

TWD is an engineering company specialized in creating bespoke installation equipment and temporary works for on- and offshore infrastructure projects. You can regard TWD as your problem solver: the reliable partner that creates functional and creative solutions, no matter the time frame or complexity of the challenge. Our goal is to reinforce your project team's capabilities and complement them where required, so we can together achieve a successful project execution.

FLEXIBLE **PRACTICAL** **CREATIVE**

... are the driving forces behind each of our designs

All our designs aim to add value by reducing cycle times, improving the site-crew's safety or providing smarter, out of the box alternatives. Our thorough knowledge of structural and mechanical engineering, hydro-dynamics, marine and geotechnical engineering enables us to develop the optimal solution that meets the wide variety of your demands.

Being continuously focused on constructability and installability of a wide variety of infrastructure projects, gives us the expertise to provide tailored advice in every stage of the works. Aside of developing installation methods and corresponding equipment, TWD also assists during tender, procurement, fabrication, mobilization and project execution phases. This approach allows us to shorten the required lead times, properly integrate the contributions of different subcontractors and assure that our designs will function 'first time right'.

MARKETS

- OFFSHORE WIND
- OFFSHORE OIL & GAS
- HEAVY CIVILS
- SALVAGE
- DECOMMISSIONING

SERVICES

- STRUCTURAL & MECHANICAL DESIGN
- MARINE ENGINEERING
- GEOTECHNICAL ENGINEERING
- HYDRAULIC ENGINEERING & MECHATRONICS
- FABRICATION & PROJECT MANAGEMENT SERVICES

RIJKSMUSEUM AMSTERDAM
FREYSSINET

Temporary jacking supports allowing the replace of the masonry foundations by slender concrete columns

HEAVY CIVILS

Civil engineering works are regularly characterized by a high level of repetition: long dikes, hundreds of prefab bridge elements, kilometers of jetty, lengths of quay walls, and so on. This repetitiveness, combined with the specific boundary conditions of each projects, defines the need for tailored and innovative installation equipment. Smart solutions result in shortened cycle times and significant cost reductions.

TWD is specialized in the structural and mechanical design of these types of temporary works. For the installation of 800 tubular piles in port of Dover, TWD designed a ‘walking piling gate’ to achieve a 50% higher output. For the construction of a jetty in Australia, a highly effective ‘cantilevered bridge’ resulted in a construction speed of 2 sections of 24m jetty per week.

Besides the development of practical installation methods and the structural and mechanical design of the required temporary works, TWD operates a dedicated marine engineering department, specialized in the hydrodynamic challenges related to working on or near water. TWD’s expertise in mooring and stability analyses of floating barges, but also specialized analyses for submerging of tunnels and caissons, makes TWD the engineering partner of choice for marine civil schemes.

This document provides a selection of our track record of safe and robust designs used in civil projects. References and additional examples can be provided upon request.

OUR TEMPORARY WORKS EXPERTISE

- JETTIES, QUAYS & BREAKWATERS
- COFFERDAMS & BUILDING PITS
- SUBMERGED TUNNELS & CAISSONS
- WATER & SEWAGE FACILITIES
- PIPE & CABLE LANDINGS
- RAIL, HIGHWAY & BRIDGES
- INDUSTRIAL MODULES

CANTILEVER BRIDGE

BAM INTERNATIONAL

Cantilever Bridge constructing a 2.5km long LNG jetty in Papua New Guinea

CANTILEVER BRIDGE
BAM INTERNATIONAL
Overview of cantilever bridge for construction of LNG jetty

LNG JETTY - PAPUA NEW GUINEA

JETTIES, QUAYS & BREAKWATERS - BAM INTERNATIONAL

For the construction of a 2450 meter long LNG jetty in Papua New Guinea, BAM International and TWD jointly developed a highly efficient installation method. TWD provided the detailed design of this Cantilever Bridge (CLB), which was used to construct the piles, headstocks and concrete roadways of the jetty. To achieve this, the CLB was launched forward and supported on temporary spud units while new foundation piles for the next headstock were driven. After completion of the new headstock, the spud units were retracted, roller supports were placed, and the CLB was launched further. Behind the piling station, the roadways and outriggers were constructed. In the end, the bridge was equipped with the necessary pipe racks for the LNG pipelines.

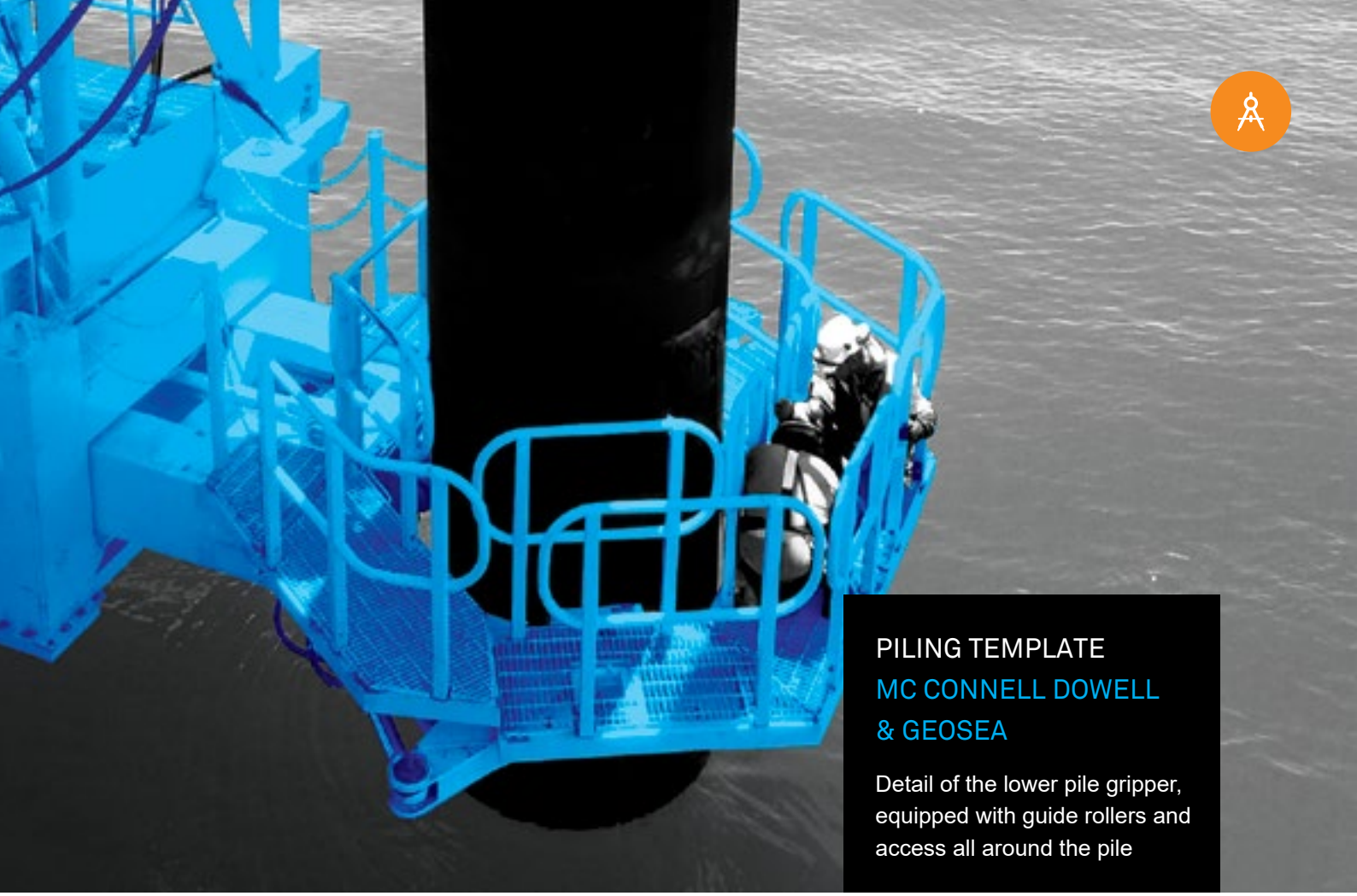
The cantilever bridge effectively deals with the complex logistics of a jetty construction project. With 3 serial work stations (piling – roadway elements – finishing bridge), smart access solutions and effective outriggers, a highly efficient installation method was achieved allowing to construct 3 bridge sections within one week.

After proven to be successful on the Papua New Guinea project, two redesigns of the cantilever bridge have been provided, for LNG jetties of the Ichthys and Wheatstone projects in Australia.

CANTILEVER BRIDGE

BAM INTERNATIONAL

Redesign of cantilever bridge, ready to construct jetty on the Ichthys project



PILING TEMPLATE
MC CONNELL DOWELL & GEOSEA

Detail of the lower pile gripper, equipped with guide rollers and access all around the pile

HAY POINT COAL JETTY - AUSTRALIA

JETTIES, QUAYS & BREAKWATERS - MC CONNELL DOWELL & GEOSEA

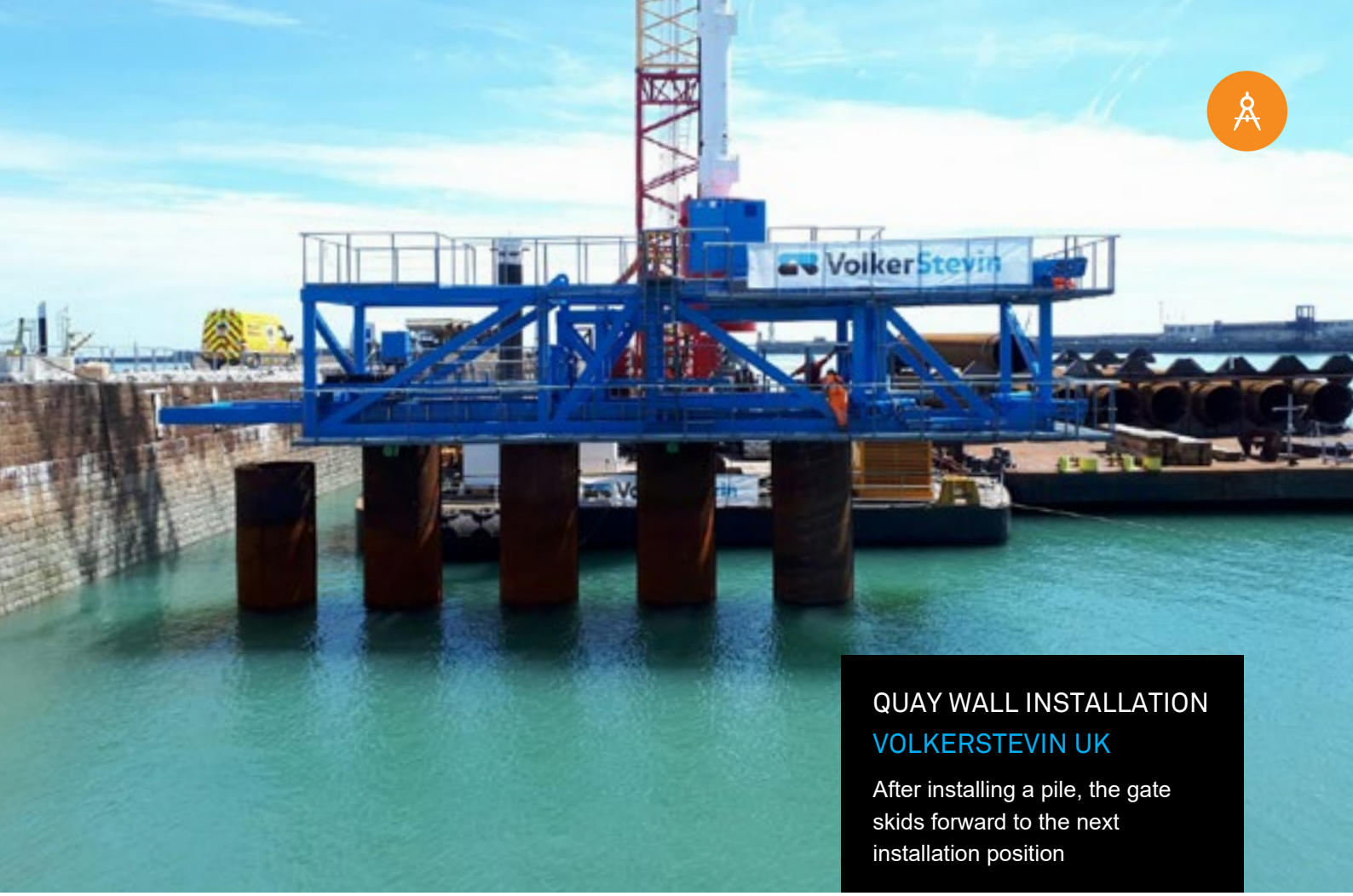
TWD designed a drilling and piling template applicable to three different jack-up barges in order to install piles for the mooring and berthing dolphins of the Hay Point coal terminal.

Each jack-up barge was equipped with bull rails on which outriggers were installed. The outriggers were able to slide along the rails by means of hydraulic cylinders. Each end of the outriggers was outfitted with a pile gripper, able to move independently. This resulted in a two-layer piling template capable of installing piles at various angle of inclination. The templates could also be used to support and position drilling equipment, by combining two outriggers to function as a movable support frame for the oscillator.

With the hydraulically actuated pile guides and sliding interfaces, sufficient flexibility was achieved to quickly install a large amount of piles within tight positioning and inclination tolerances. Due to this efficient piece of equipment, a significant reduction in installation time was achieved.

PILING TEMPLATE
MC CONNELL DOWELL
& GEOSEA

View on the piling template from the jack up barge during piling



QUAY WALL INSTALLATION
VOLKERSTEVIN UK

After installing a pile, the gate skids forward to the next installation position

WALKING PILING GATE - PORT OF DOVER

JETTIES, QUAYS & BREAKWATERS - VOLKERSTEVIN UK

Port of Dover's major Western Dock Revival Scheme involved the installation of over 700 tubular piles for the construction of two new quay walls, a marina curve and a marina pier. Given the large amount of piles, Volkerstevin UK decided to invest in two innovative first in class piling gates, significantly increasing the projected piling outputs.

The gates, clamped on the previously installed piles, are equipped with hydraulic roller boxes to guide the piles accurately in position. After driving a pile, the gate skids forward autonomously from the crane and hydraulically adjusts its position to prepare for the next pile. Repositioning and levelling of the piling gate without the need of the crane significantly shortens the critical path, as it can be achieved parallel to upending and pitching of a new pile.

Besides the piling gates, TWD assisted Volkerstevin UK with the majority of the marine temporary works packages. Effective designs for seafastening, access platforms, pile upending solutions and barge mooring were delivered substantiated with barge stability calculations.

QUAY WALL INSTALLATION

VOLKERSTEVIN UK

Detail of the piling gates roller boxes

DEWATERING SYSTEM
OVERSEAS AST

Block wall and dewatering system for the Al Bateem Marina development

DEWATERING SYSTEM - AL BATEEN MARINA

JETTIES, QUAYS & BREAKWATERS - OVERSEAS AST

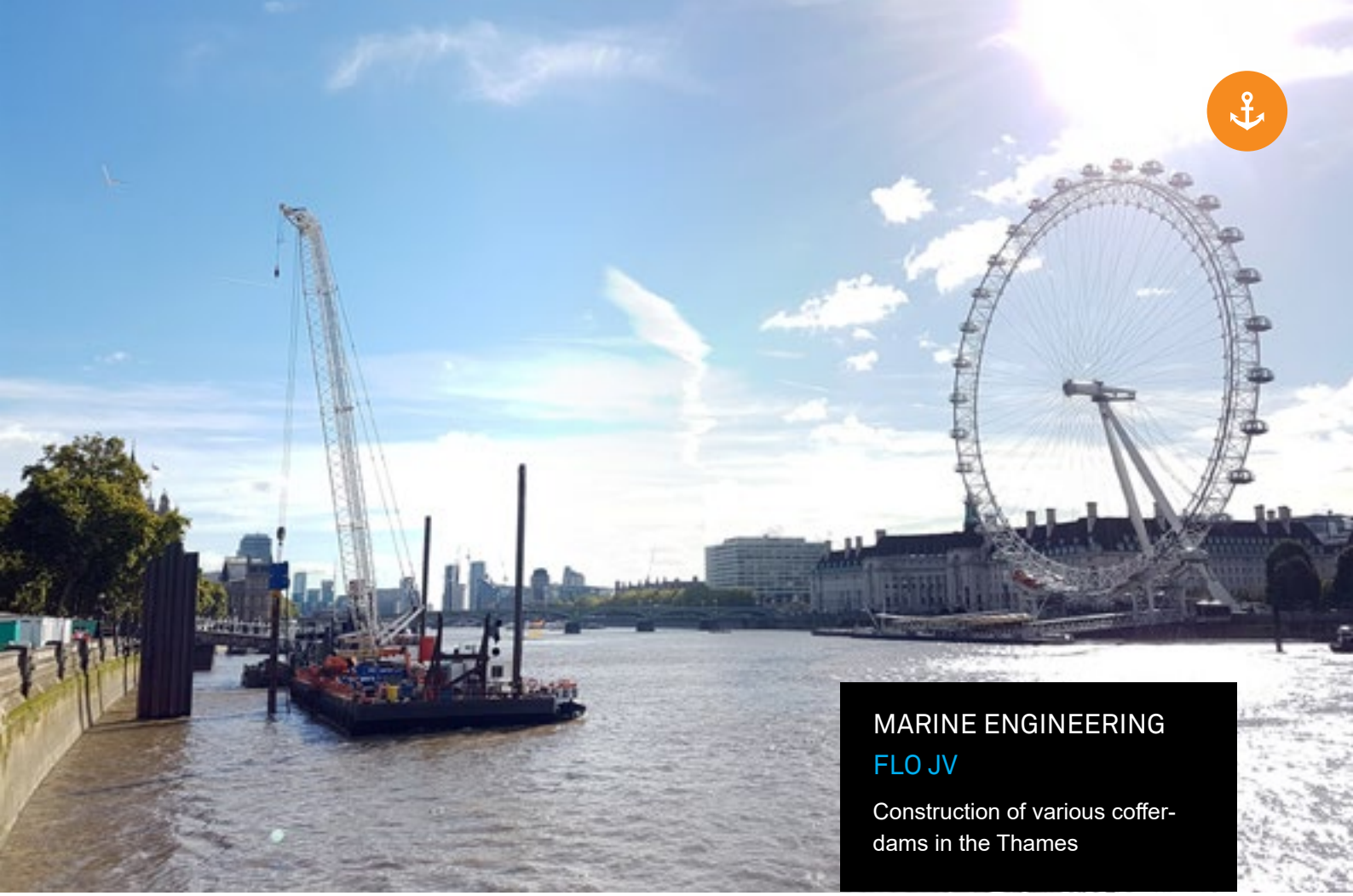
Temporary Works Design provided a dewatering design for the new Al Bateen Marina development in Abu Dhabi. The new quaywall for the marina was constructed “in the dry” and therefore the entire future development site had to be closed off and dewatered. In order to dewater the incoming waterflow from groundwater as well as from the seaside, several cofferdam, bundwall and sheetpile structures were designed by TWD. The total dewatered area was approximately 400 x 150 meter.

TWD also provided the design drawings and calculations for the blockwall formwork and lifting beams. The blockwall consists of approximately 2000 prefab concrete blocks. To cast the precast blocks an adjustable steel shutter was designed to accommodate for the curved shape of the overall quaywall. For fabrication of the concrete blocks a separate precast yard was set up nearby the future block wall location.

DEWATERING SYSTEM

OVERSEAS AST

Construction of block wall and sheet pile walls for the Al Bateem Marina development



MARINE ENGINEERING

FLO JV

Construction of various coffer-dams in the Thames

MARINE ENGINEERING – THAMES TIDEWAY

COFFERDAMS & BUILDING PITS – FLO JV

TWD designs are often used in projects involving inland, near or offshore marine installations. To support these works, TWD operates a dedicated in-house Marine Engineering team. The services of our Marine Engineers span from high level project planning, installation engineering and selection of suitable project equipment up to the execution of the detailed mooring and stability analyses required.

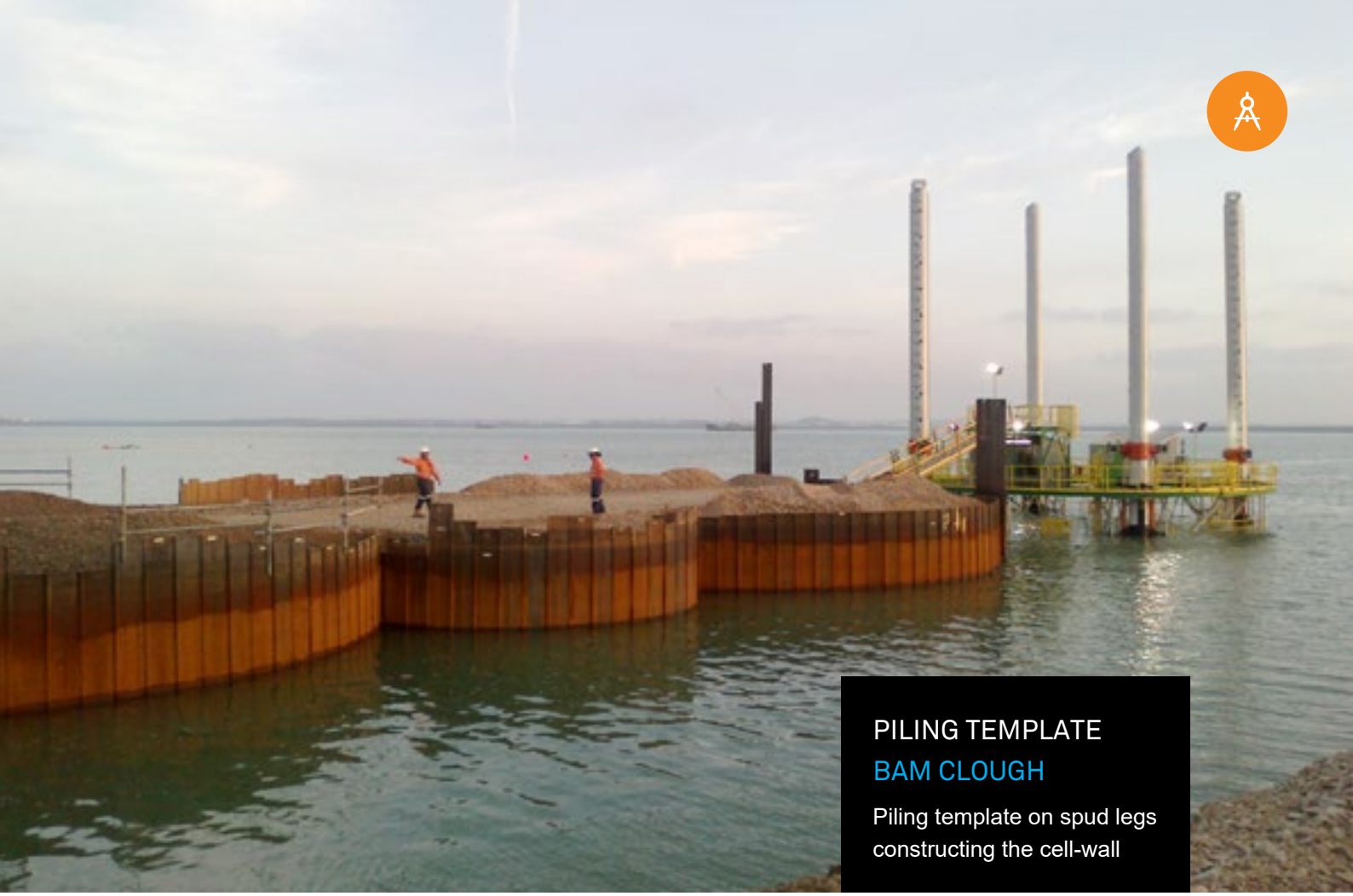
On the Thames Tideway project a new sewer for London is being constructed. For these works, multiple cofferdams are built in the Thames, with all construction works done from floating and jacked-up crane barges. To assure safe operations, TWD performed the mooring analyses, as well as the stability analyses during lifting for over 20 floating and jacked-up barges on the project.

By largely automating the repetitive aspects of a stability analysis, TWD's marine engineering department is able to provide highly reliable and high quality output on very short notice, which is essential to keep a major project as Thames Tideway running without downtime.

MARINE ENGINEERING

FLO JV

Crane barges constructing a cofferdam at Blackfriars bridge, London



PILING TEMPLATE
BAM CLOUGH
Piling template on spud legs constructing the cell-wall

MODULE OFFLOADING FACILITY – AUSTRALIA

COFFERDAMS & BUILDING PITS – BAM CLOUGH

At the Northern coast of Australia, a new hydrocarbon plant had to be constructed to process the gas of the Ichthys field. For the construction of this plant, BAM Clough JV had to construct a berth to enable the delivery of the modules required for the plant. This Module Offloading Facility (MOF) consisted of a cell wall construction.

TWD designed the cell wall template position frame. For the cell wall construction, a template with spud legs was used, which is positioned by a “W”–shaped pontoon. Since the center to center distance of the cell walls must stay the same after installation and settling, TWD designed a positioning frame to ensure that the manual distance stayed within the allowed range.

The position frame connects an existing cell wall with the front of the pontoon. A sliding functionality on the positioning frame allowed to adjust the distance between the existing cell wall and the cell wall template, while winches where used to force the template in the correct orientation.

PILING TEMPLATE

BAM CLOUGH

Positioning frame to assure the correct location of the template

CAISSON INSTALLATION - NADOR WEST PORT

SUBMERGED TUNNELS AND CAISSONS - STFA-SGTM-JDN

The consortium STFA-SGTM-JDN is constructing the new port of Nador West, Morocco. A total of 253 caissons, weighing up to 9000 tons, are currently being fabricated and installed for the construction of 2 breakwaters, petroleum stations and a container terminal. The consortium installs the caissons using a semi-submersible barge.

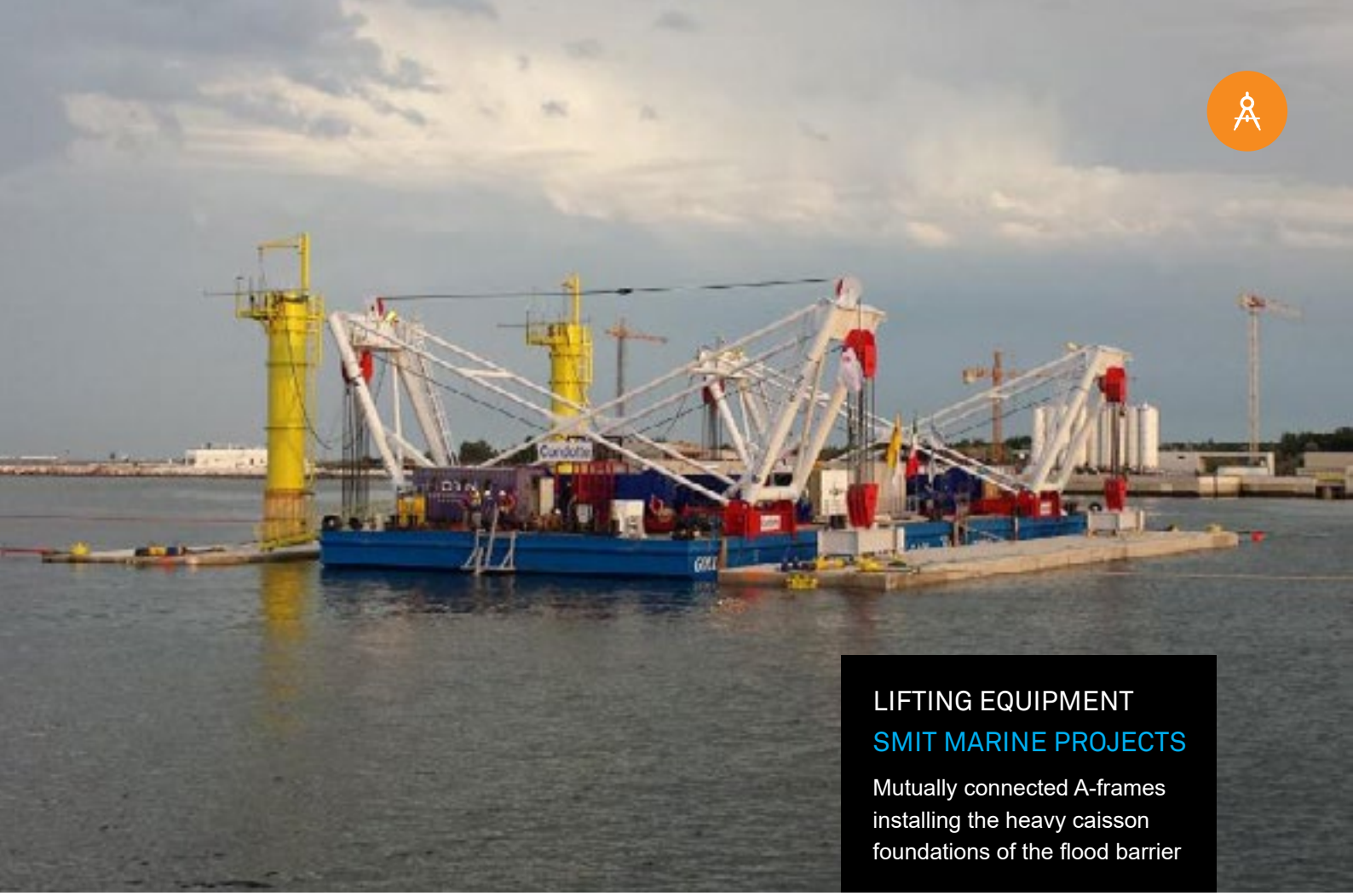
The TWD marine engineering team advised STFA-SGTM-JDN about best practices for their marine operations and assisted with all necessary marine engineering analyses. Besides all the engineering for the marine operations TWD designed the essential temporary works like the skidding grillages, barge reinforcements, caisson access structures and a reusable pump skid grillage on top of the caissons.

Our marine engineering department prepared the installation procedure encompassing every step of the operation: the loading of each caisson on the semi-submersible barge, towage, submergence to 20m below sea level, and final installation. TWD also advised on workable sea states for the operations and provided the required on-site engineering and operational guidance at the site in Morocco.

CAISSON INSTALLATION

STFA-SGTM-JDN

Caisson on deck of the semi-submersible barge



LIFTING EQUIPMENT
SMIT MARINE PROJECTS

Mutually connected A-frames installing the heavy caisson foundations of the flood barrier

VENICE FLOOD BARRIER – ITALY

SUBMERGED TUNNELS & CAISSONS – SMIT MARINE PROJECTS

To safeguard the Italian city of Venice from tidal rise as a result of storm surges, a new flood barrier had to be constructed to be able to close of the Venice Lagoon from the Adriatic Sea. TWD provided the front-end engineering design of the installation method for the concrete caissons of this barrier.

The heavy caissons, serving as the foundations for the final flood gates, are immersed and placed using four A-frame lifting arms which are positioned on skidding beams on the pontoon. The skidding system is used to reposition the A-frames on the pontoon to fit the applicable caisson length. The A-frames are mutually interconnected starboard to port with wires and stud beams to optimize the internal forces and minimize the additional structural loads on the pontoon. This way, a very efficient construction with minimal steel and maximal installation flexibility was achieved.

PILING TEMPLATE

BAM INTERNATIONAL

Combi-wall piling template used for the construction of the Aqaba Container Terminal in Jordan

LIFTING FRAME
JUMBO OFFSHORE
Installation of the concrete anchor blocks

FRESH WATER PIPE LINE – CYPRUS

WATER & SEWAGE FACILITIES – JUMBO OFFSHORE

Between the main land of Turkey and the island of Cyprus, a fresh water pipeline had to be constructed to secure the fresh water supply of the island. Due to the depth of the Mediterranean Sea along the pipeline's installation route (over 1.400m), it was chosen to construct a submerged floating pipeline, floating by submerged buoys installed at a constant depth of 280m. The buoys were connected via cables to heavy concrete anchors, positioned on the seabed.

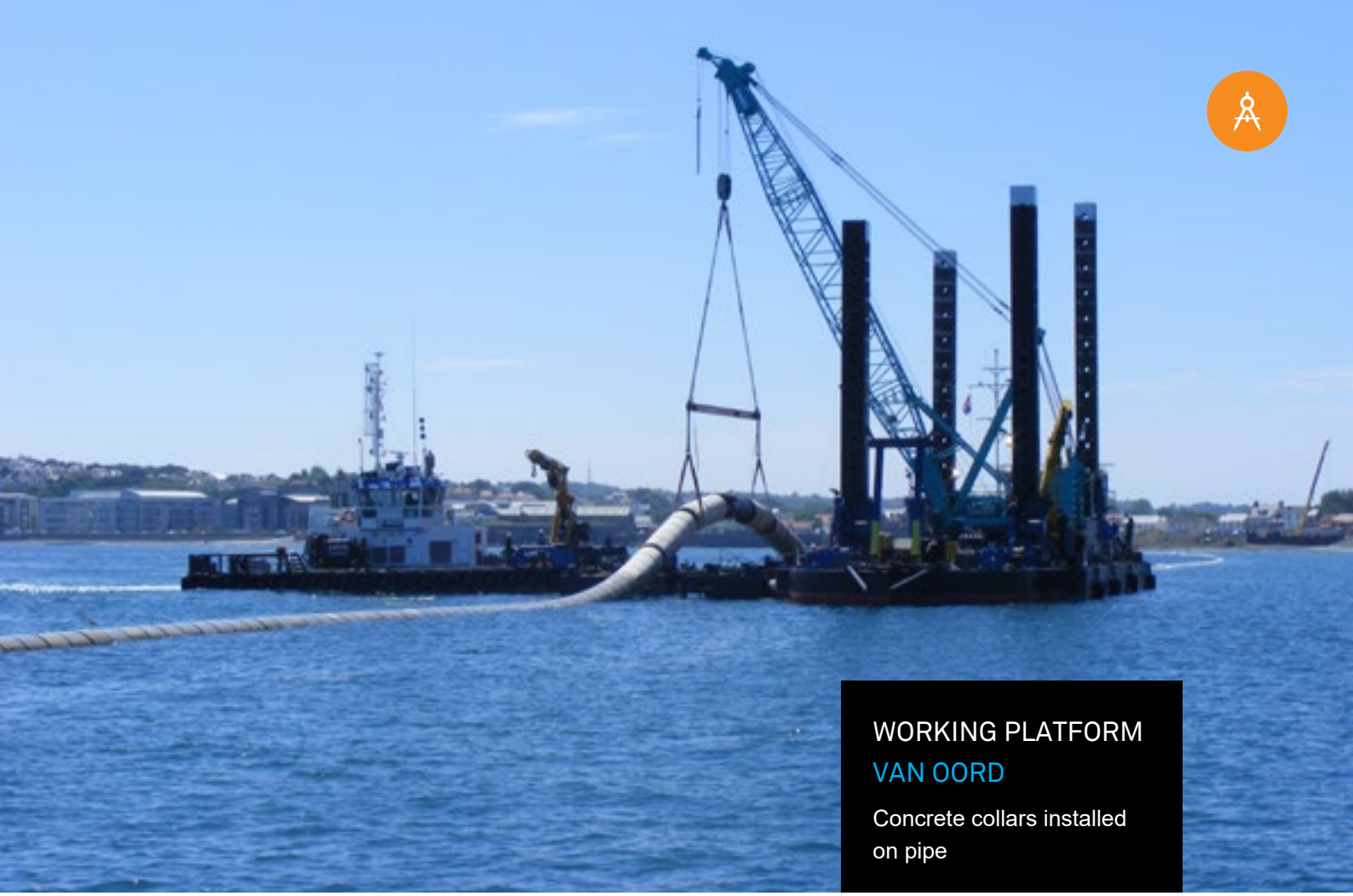
TWD provided the design and construction of three lifting frames for the installation of the anchor / buoy assemblies. The square frame is used to lower 240 ton anchors to the seabed. The buoy frame, equipped with ballast weight, lowers buoys (already connected to the anchor) to the target depths of 280 meters. Once in position, the buoy and anchor are hydraulically released.

Turnkey projects, such as this one, involve a wide range of TWD's fabrication services. TWD facilitated certification by Lloyd's Register, arranged procurement, supervised fabrication, and organized the load testing phase, all within a demanding time frame.

LIFTING FRAME

JUMBO OFFSHORE

Lifting frame used to install the buoys at a depth of 280m



WORKING PLATFORM
VAN OORD
Concrete collars installed on pipe

BELLE GREVE OUTFALL – GUERNSEY (UK)

WATER & SEWAGE FACILITIES – VAN OORD

Guernsey Water had to replace two of its outdated wastewater outfalls, used to discharge wastewater from the Belle Greve Wastewater Centre into the sea. The poly-ethylene pipes, consisting of 500 m long sections, had to be offshore connected to each other. Furthermore, concrete collars had to be carefully placed around the pipes, in order to protect the pipes and provide the required weight to keep the pipes submerged.

Van Oord was awarded with the assignment to install the two parallel outfall pipes and requested TWD to design the installation aids. In close collaboration with Van Oord, TWD designed the working platform including eight 6.1 m pontoons, connected by two truss frames. This custom made working platform was used to connect the pile sections and install the concrete collars.

The total available lead time on the project was very limited. In only 2 weeks after project assignment, the working platform had to be designed and ready for fabrication. Four weeks after, the construction of the platform had to be finished. TWD was able to meet these deadlines, such that the installation process offshore Guernsey could start right on time.

WORKING PLATFORM
VAN OORD

Working platform being used for the installation of a concrete collar

STINGER
FURIE OPERATING ALASKA
A stinger frame to guide the drill pipe

STINGER – COOK INLET

PIPE & CABLE LANDINGS – FURIE OPERATING ALASKA

TWD assisted Furie Operating Alaska and Heavy Lift at Sea in designing and constructing a Stinger frame to guide a drill pipe during a horizontal directional drilling operation. Furie Operating Alaska constructed a new Liquid Natural Gas (LNG) production platform in Cook Inlet, Alaska. The existing onshore pipelines had to be connected to the platform through subsea gas pipeline, installed by Heavy Lift at Sea.

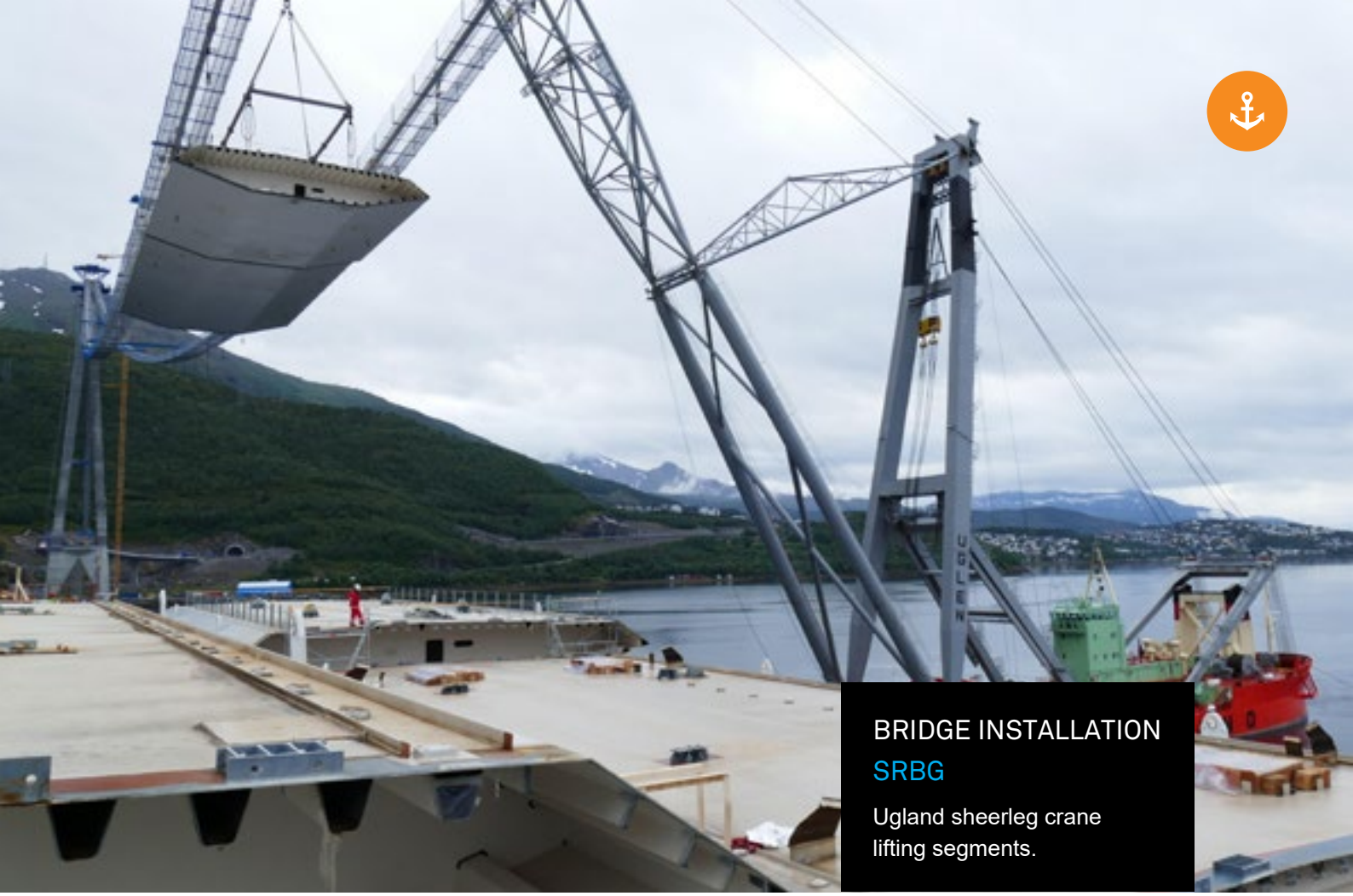
At last moment the choice was made to use a stinger frame to guide the drill pipe. Therefore, it was requested to design, fabricate and fit the stinger frame in less than a month onto the Spartan 151 rig. TWD took this challenge and managed to succeed.

Due to severe tidal currents at the project location, the Stinger frame needed to be able to handle large horizontal shifts of the drill pipe to ensure its integrity. Our integral team of engineers, designers and naval architects performed all dynamic analysis to ensure drill pipe integrity and delivered the required fabrication drawings within one week. Besides the complete design, TWD assisted on site with the fabrication and mobilization works.

STINGER

FURIE OPERATING ALASKA

Stinger mounted on the side of the Spartan Rig 151, ready for a horizontal drilling operation



BRIDGE INSTALLATION
SRBG
Ugland sheerleg crane lifting segments.

BRIDGE INSTALLATION – HALOGALAND NORWAY

RAIL, HIGHWAY & BRIDGES – SRBG

Just above the Arctic Circle, near the Norwegian town of Narvik, a 1200-meter-long suspension bridge over the Rombaksfjord had to be constructed to improve traffic on the E6. The contractor, SRBG, suspended 30 steel deck segments from two main cables resting on two 175-meter-high concrete pylons.

TWD assisted SRBG with the installation of the deck segments. They were fabricated in China and stacked on a supply vessel for transport to Norway. Each unique segment weighs up to 250 tons. Once all segments were connected to the suspension wires, final welding could commence.

Together with SRBG and crane operators TWD designed an efficient mooring system; using the supply vessel as a giant buoy to which the crane vessel was moored. With winches connected to the two pylons, the setup was able to move along the length of the bridge. With 4 additional anchors in the 300-meter-deep fjord the crane and supply vessel were kept precisely located underneath the bridge. By doing this, TWD combined the knowledge of our naval architects with our constant focus of optimizing operations, to deliver a fast and safe installation method. Besides the mooring studies TWD made a design to temporarily connect the steel segments and set up all rigging and lifting plans to make sure no clashes between the crane vessel and the bridge wires occurred.

BRIDGE INSTALLATION

SRBG

Supply and crane vessel moored in fjord.

SUPPORTS FOR CONCRETE FORMWORK

BAM

Demountable beam construction for concrete formwork of train bridge Amstel

TRAIN BRIDGE AMSTEL – THE NETHERLANDS

RAIL, HIGHWAY & BRIDGES – BAM

For the realization of a train bridge in Amsterdam, BAM designed a concrete bridge which had to be constructed on site. To achieve this, the formwork used for pouring the concrete had to be temporarily supported by a steel construction. TWD was requested to design these temporary supports.

To achieve an optimal and cost effective design, TWD included some simple ideas in the design. By using 12m long profiles, all connected by clamped treaded-bar connections, welding on and cutting of the profiles was avoided. This way, the reselling price of the profiles was maximized, resulting in an easy demountable construction with minimal costs.

BICYCLE BRIDGE FREYSSINET

Structural design of a bicycle bridge spanning a train track and a motorway in Zoetermeer

JACKING SUPPORT
FREYSSINET

Masonry column foundation replaced by temporary jacking support

RIJKSMUSEUM AMSTERDAM – NETHERLANDS

FREYSSINET

TWD designed the jacking supports for the renovation of the Rijksmuseum in Amsterdam. The steel supports were used as a temporary foundation for the museum. In total 24 supports and 2 stability frames were placed with a total jacking capacity of 3000 tonnes.

The ‘new’ Rijksmuseum was a large-scale renovation project of the 1885-building by Pierre Cuypers. In the new design the existing basement under the arcade was replaced by a new one. Thereby the masonry columns that supported the ground floor were replaced by slender, concrete ones, to create more free space in the basement.

TWD was requested by Freyssinet Nederland BV to design a temporary construction to support the arcade columns, with very limited deformation tolerances to avoid damage to the iconic building. The outcome was a construction of jacking supports and stability frames that support the columns during renovation. After completion of the new basement and columns the temporary construction was removed.

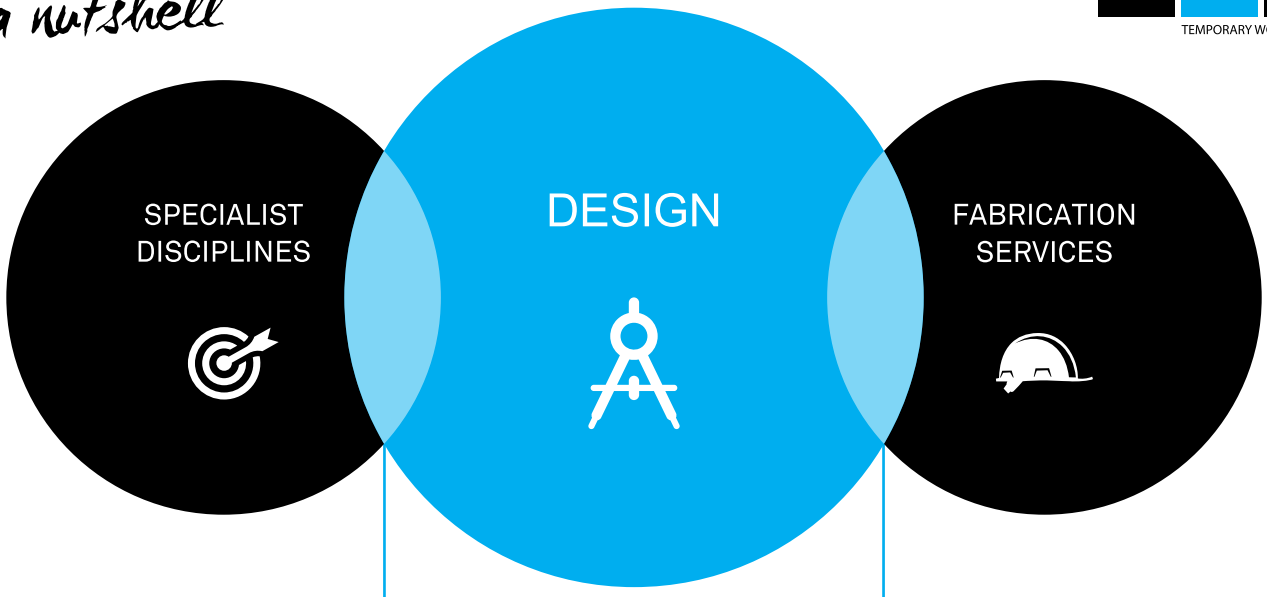
RIJKSMUSEUM AMSTERDAM
FREYSSINET

The Rijksmuseum basement during renovation. The masonry columns are supported by steel structures, to support the building during shrinking the size of the foundation columns

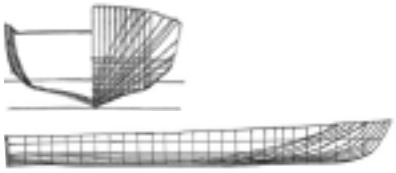
TEMPORARY WORKS DESIGN

In a nutshell

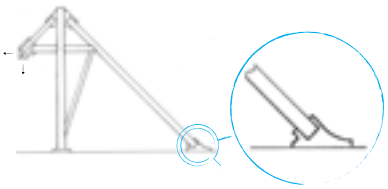
TWD
TEMPORARY WORKS DESIGN



NAVAL ENGINEERING

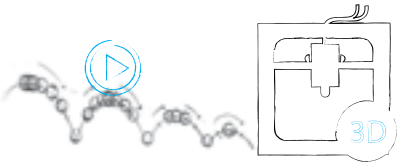


STRUCTURAL ENGINEERING

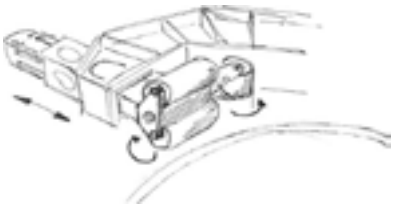


PROCUREMENT ASSISTANCE

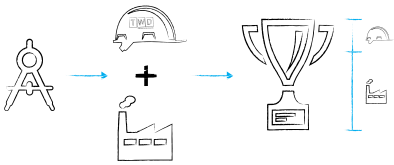
3D VISUALIZATIONS



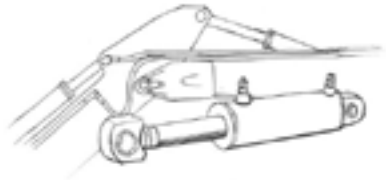
MECHANICAL ENGINEERING



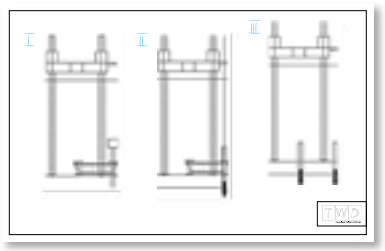
FABRICATION ASSISTANCE



HYDRAULIC ENGINEERING

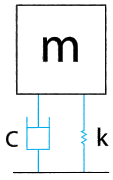


INSTALLATION ENGINEERING

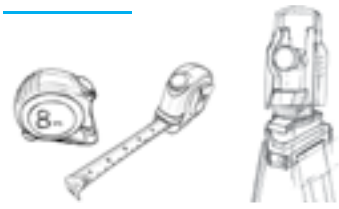


FIELD ENGINEERING

DYNAMIC ANALYSIS



MEASUREMENT SERVICES



Engineered to function

TAKE A LOOK AT THE
FABRICATION SERVICES PAGE
ON OUR **WEBSITE**

GET IN TOUCH

TEMPORARY WORKS DESIGN

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