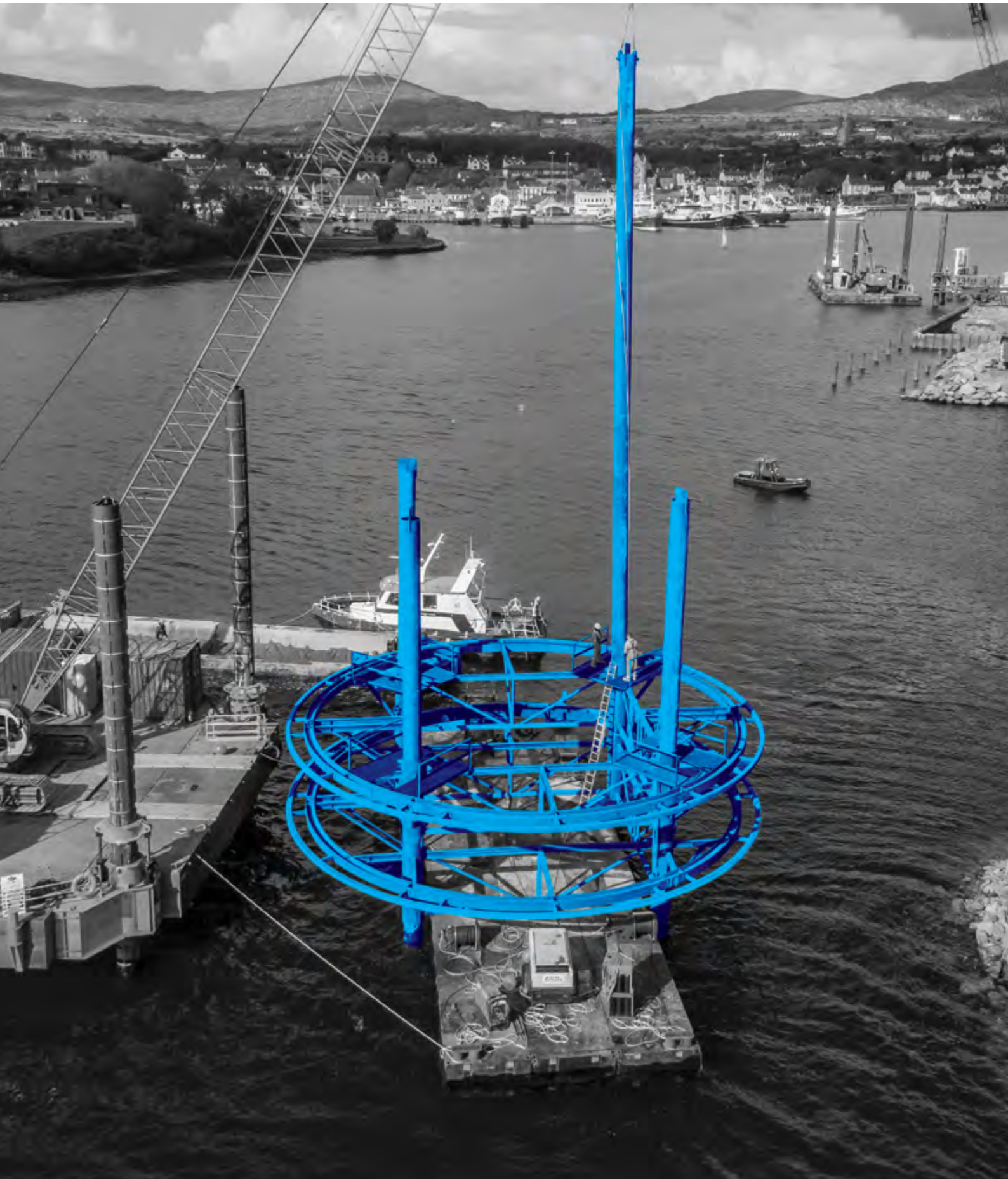
MARINE PILING



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

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

SERVICES

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

PILING TEMPLATE
MC CONNELL DOWELL & GEOSEA

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

MARINE PILING

Marine transportation and installation remain a major part of global trade and international projects making coastal infrastructure a critical bottleneck for businesses and governments. The construction of ports and harbours composed of quays, jetties and berthing structures as well as coastal protection schemes are characterized by piling works. For large and small projects the repetitive piling operations are assisted using project-specific tools that handle and install sheets and tubular piles.

TWD is specialized in designing methods and equipment tailored to improve efficiency and safety during construction. We review the full operation to set out the key equipment functionalities required for the best operational gains. Our structural and mechanical designs shorten cycle times to reduce expensive operational costs at the site.

For the installation of over 700 tubular combi-wall piles in Dover, TWD designed a ‘walking piling gate’, the first of its kind, and achieved a 50% higher output. For the installation of raked jetty piles at Hay Point in Australia, we designed a hydraulic pile gate cantilevered off the side of a jack-up vessel. And for the installation of a subsea sheet pile wall at Tilbury 2, TWD designed a floating sheet gate that simplified piling operations.

Drawing on experience from offshore construction projects and with a dedicated marine engineering team, TWD’s designs come with full consideration of harsh marine conditions. We offer mooring, stability and ballasting analyses of floating and jack-up barges which are widely used for transportations and heavy lifts by cranes.

With 180+ designers and engineers in our team, we can take on large design scopes for complex boundary conditions as well as provide an ad-hoc service to your project’s planning and site teams. We’re only a short call away to take on your challenges and allow you to focus on other areas.

This document provides a selection of our track record of safe and robust designs used in civil projects. For more information about our capabilities and other projects, just get in touch!

OUR METHOD ENGINEERING & EQUIPMENT DESIGN EXPERTISE

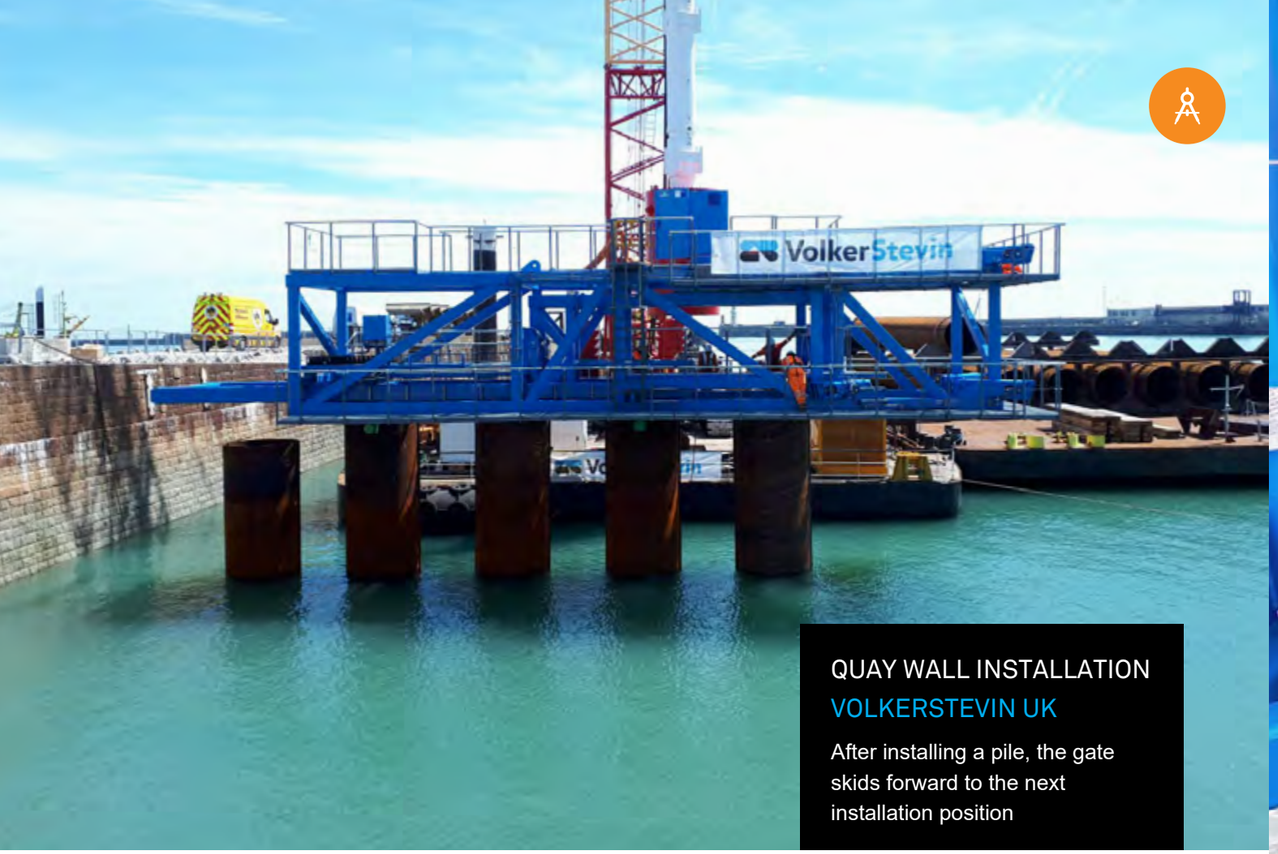
- QUAY WALL & BREAKWATER CONSTRUCTION
- JETTY CONSTRUCTION
- DOLPHIN CONSTRUCTION
- COFFERDAM CONSTRUCTION
- CELL WALL CONSTRUCTION

Take a look at our websites!

TWD.NL
TWD-UK.COM

CANTILEVER BRIDGE
BAM INTERNATIONAL

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



QUAY WALL INSTALLATION
VOLKERSTEVIN UK

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

QUAY WALL & BREAKWATER CONSTRUCTION

WALKING PILING GATE - PORT OF DOVER - 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

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

JETTY CONSTRUCTION

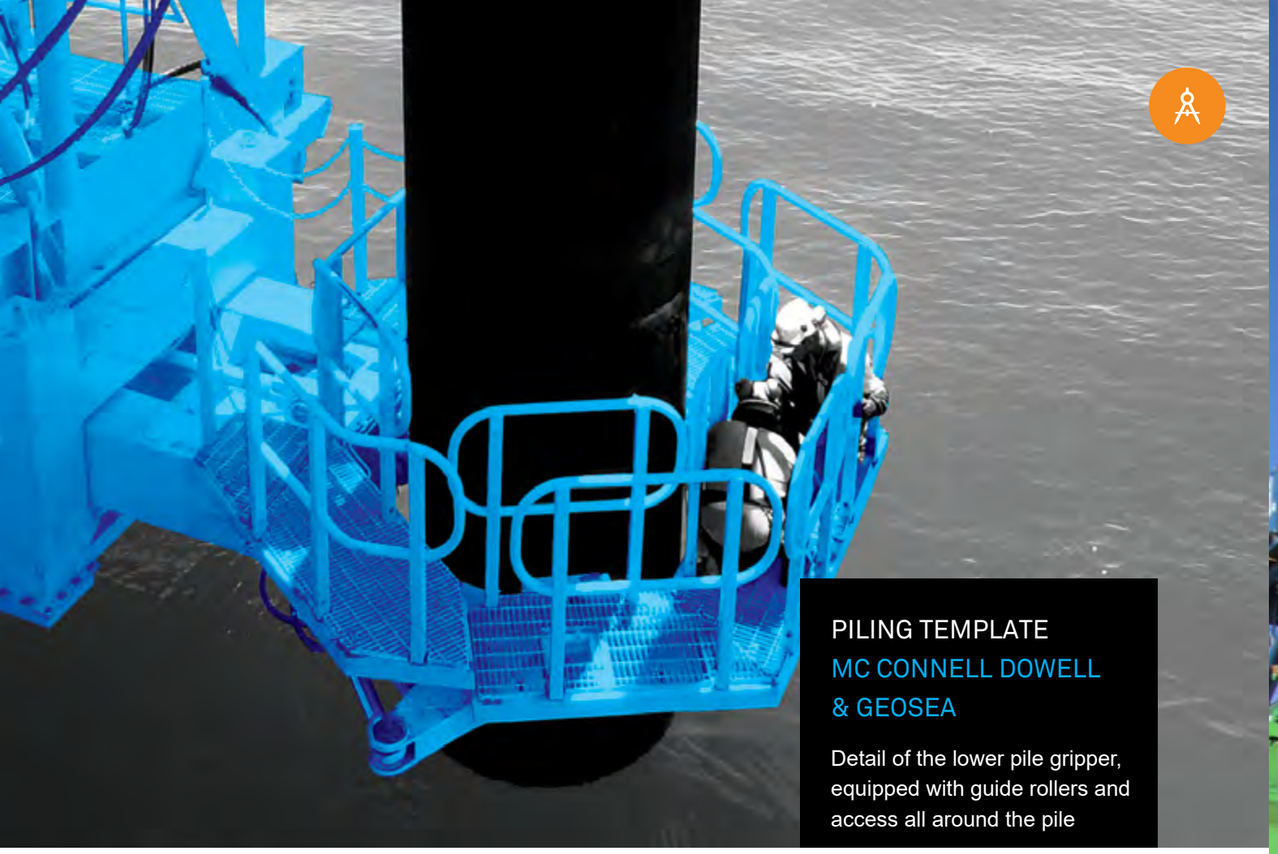
LNG JETTY - PAPUA NEW GUINEA - BAM INTERNATIONAL

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

JETTY CONSTRUCTION

HAY POINT COAL JETTY - AUSTRALIA - 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 of the piling template onthe jack up barge during piling

RAKED PILING GATE

RED7 MARINE

Raked pile gate positioned in the field and supported on the previ-ously installed vertical piles.

JETTY CONSTRUCTION

LIVERPOOL TWELVE QUAYS – UNITED KINGDOM– RED7 MARINE

To install a cluster of four raking piles for the Twelve Quays Jetty construction in Liverpool, TWD designed a double-layered pile gate supported on previously installed vertical piles. The proximity and opposing angles of the raked piles posed geometric and loading challenges in the design. Using two modular jack-up barges, the drill rig could approach the pile gate and reach its maximum drilling radius from either side of the cluster. As the drill rig tracked over the edge of the deck, a cantilevered frame also featured in the pile gate design to support the onerous tracking and drilling loads.

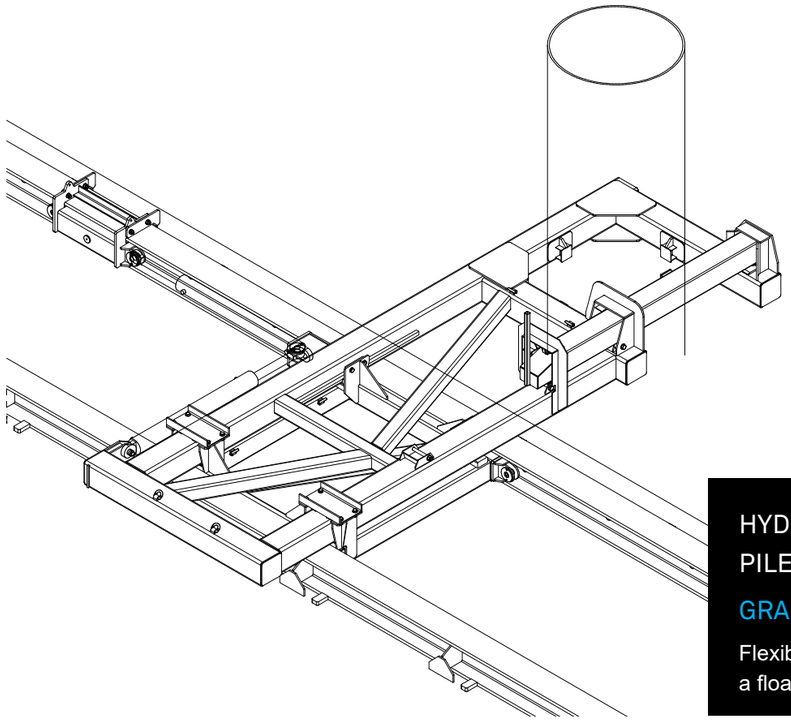
Using TWD's design, the piles were pitched and driven within the required installation tolerances. Since this was a one-off cluster, the structure was designed without articulating and mechanical functionalities but with specifically designed features to be easily cut and removed after installation.

This functional approach to its design allowed it to fulfill its requirements whilst being fabricated more quickly and cheaply. Finally, with slight alterations to the design, portions of the pile gate were also used as support for concrete formwork – thus extending the effectiveness of the design.

RAKED PILING GATE

RED7 MARINE

The first raked pile is suc-cessfully installed to its design depth.



HYDRAULIC TUBULAR
PILE GATE

GRAHAM CONSTRUCTION

Flexible pile gate positioning on a floating barge.

DOLPHIN CONSTRUCTION

CMAT BERTH -TILBURY 2 (UK) - GRAHAM CONSTRUCTION

For the construction of a new CMAT berth at a new terminal for the Port of Tilbury – Tilbury 2 – TWD developed a new method to install a 330m sheet pile wall using a floating sheet pile design.

To reduce the project schedule, a solution which allowed piling across tidal levels was required. TWD designed the sheet guiding structure in between two rows of modular pontoons which also served to provide access for personnel irrespective of the level of the tide. To continue piling below water, a wider pile interface towards the aft end of the pontoons allowed the larger follower structure to pass through the gate.

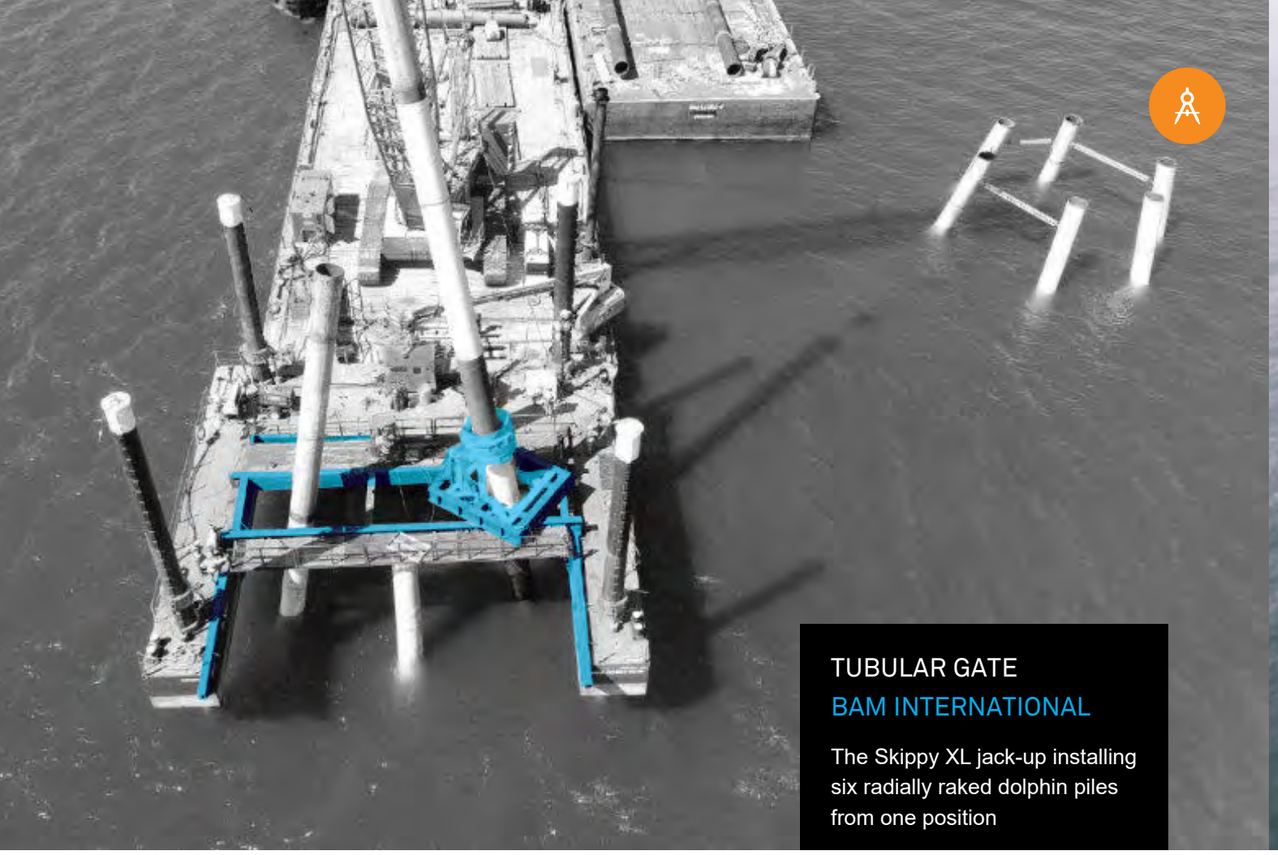
The designed structure is easily repositioned by opening the gate around a hinge and floating it to the next position. It keeps its position using side-released temporary spud supports or against previously installed long sheets piles. Using this design, the piling operations required less handling on site and safely increased the rate of piling.

On this project, TWD also designed a barge-mounted dolphin pile gate that can install multiple tubular piles from the same barge position by skidding on deck rails using hydraulic power from other barge systems.

FLOATING
SHEET PILE GATE

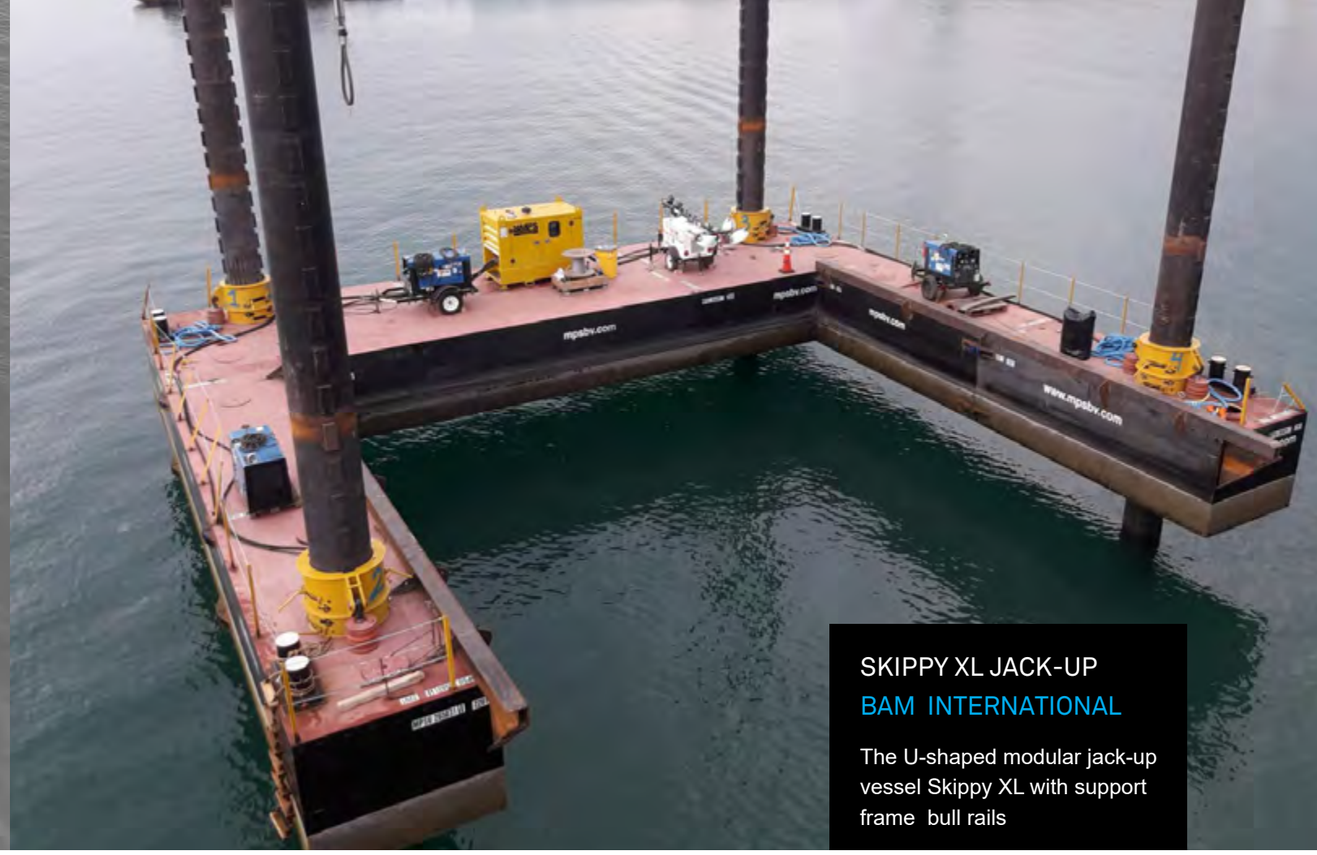
GRAHAM CONSTRUCTION

Floating piling operations and access at Tilbury 2



TUBULAR GATE
BAM INTERNATIONAL

The Skippy XL jack-up installing six radially raked dolphin piles from one position



SKIPPY XL JACK-UP
BAM INTERNATIONAL

The U-shaped modular jack-up vessel Skippy XL with support frame bull rails

DOLPHIN CONSTRUCTION

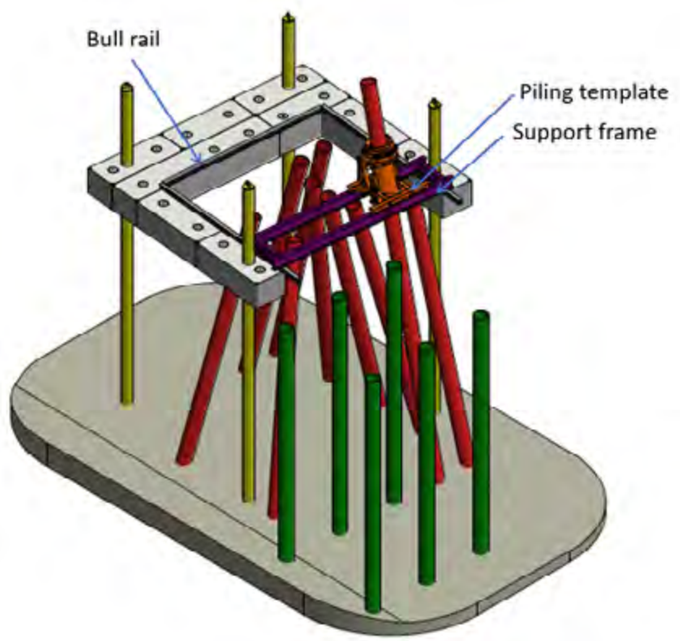
GAS LOAD-OUT DOLPHINS -PANAMA - BAM INTERNATIONAL

To construct breasting and berthing dolphins for a gas load-out facility in Colon, Panama, TWD designed a support frame to install six radially raked tubular pile foundations. The project utilized a U-shaped modular pontoon jack-up, the Skippy XL, to install the foundations between the pontoons.

The feasibility of the method was initially verified by TWD to ensure that all piles could be installed and that the strength of the selected pontoon components was suitable. TWD then designed a support frame for the raked pile gate to allow the installation of all six piles from the same jack-up position.

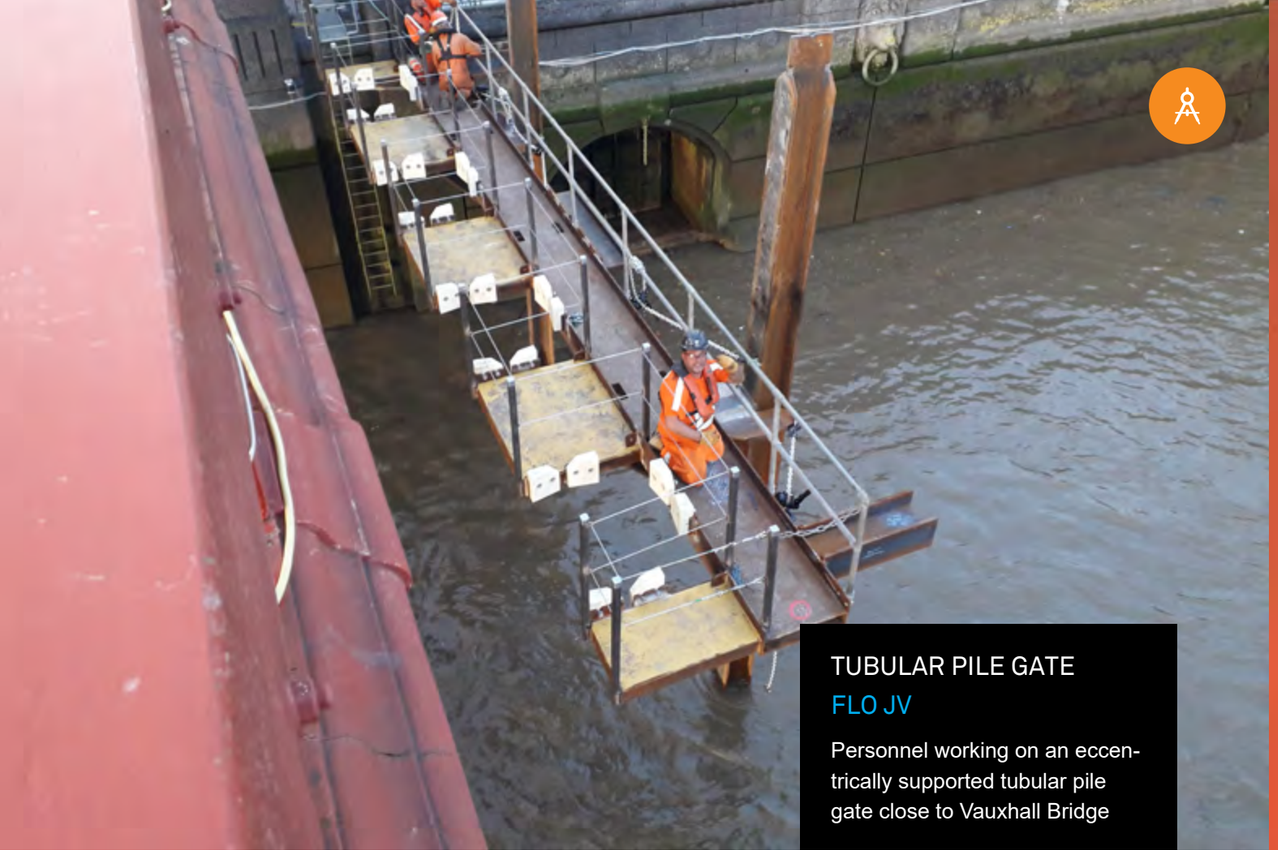
This was achieved by a spanning frame that was shifted on rails and a base frame for the pile gate which could be placed on the span and rotated at any angle.

Apart from the geometric challenges of the project, the heavy loads from the raked pile weight and the installation equipment required sensible and functional structural design. In this way, the foundation installation progressed more efficiently than in conventional methods.



DOLPHIN CONSTRUCTION
BAM INTERNATIONAL

Close cluster of radially-raked dolphin piles installed from one vessel position



TUBULAR PILE GATE

FLO JV

Personnel working on an eccentrically supported tubular pile gate close to Vauxhall Bridge

COFFERDAM CONSTRUCTION

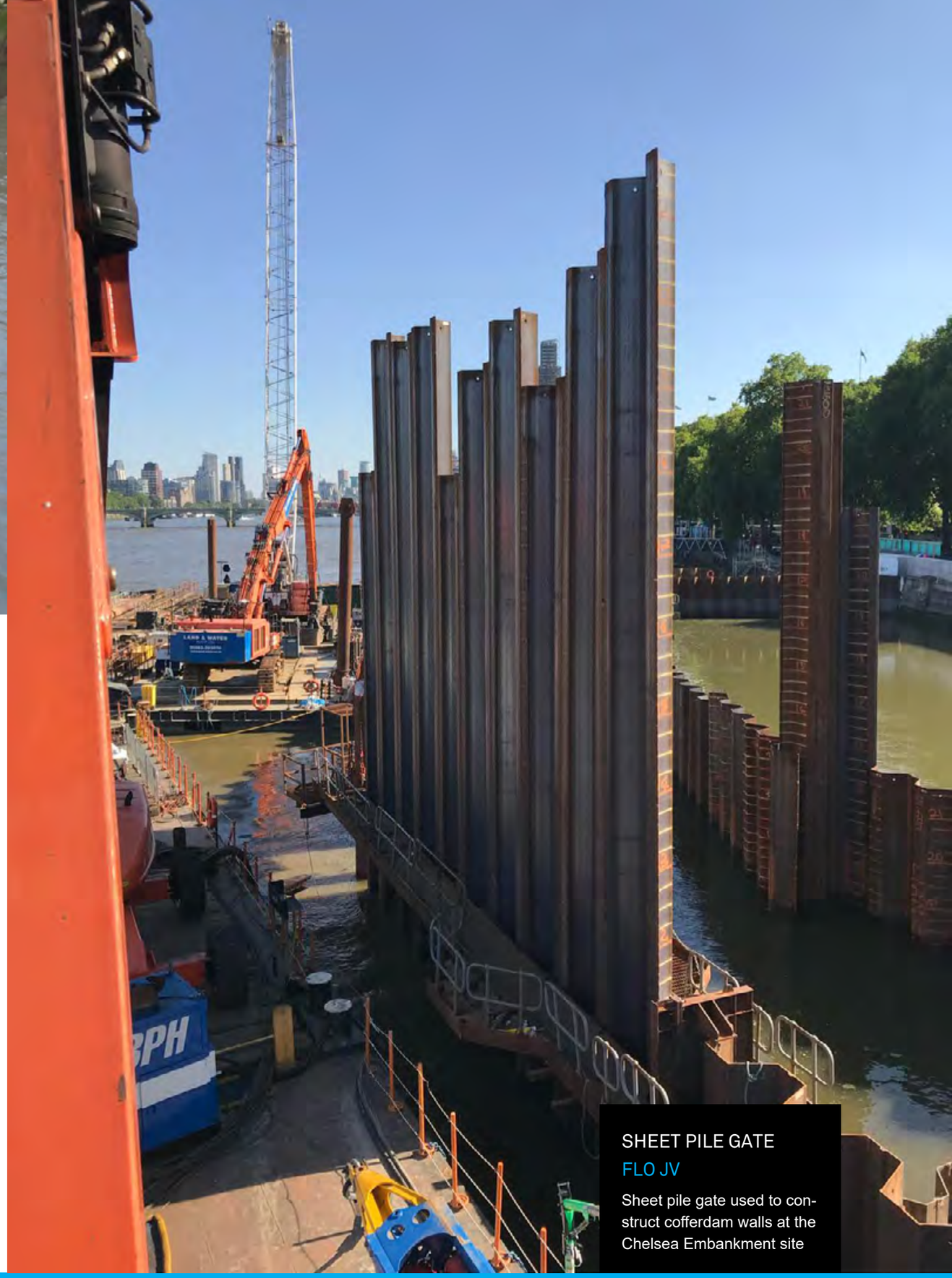
THAMES TIDEWAY – UNITED KINGDOM – FLO JV

The Thames Tideway project is comprised of an underground tunnel and a series of surface cofferdam sites along the River Thames. TWD designed various piling gates for each of the cofferdams at the five central locations of the project.

Whether constructed using sheets, tubulars or combi-wall steel piles, a pile gate is required to drive the foundations into the soils in the designed positions. Whilst countering environmental and operational loads, the gate allows the pile to pass through the supports in the desired tolerances.

Our designs included tubular pile gates connected to couplers on the side shells of modular jack-ups, sheet pile gates supported on temporary spuds, and eccentrically supported tubular gates to avoid close operations next to protected structures. In support of the cofferdam construction, TWD also assisted with marine engineering assessments of the marine plant which carried out the works and marine access designs fit for the temporary and operational purposes of the project.

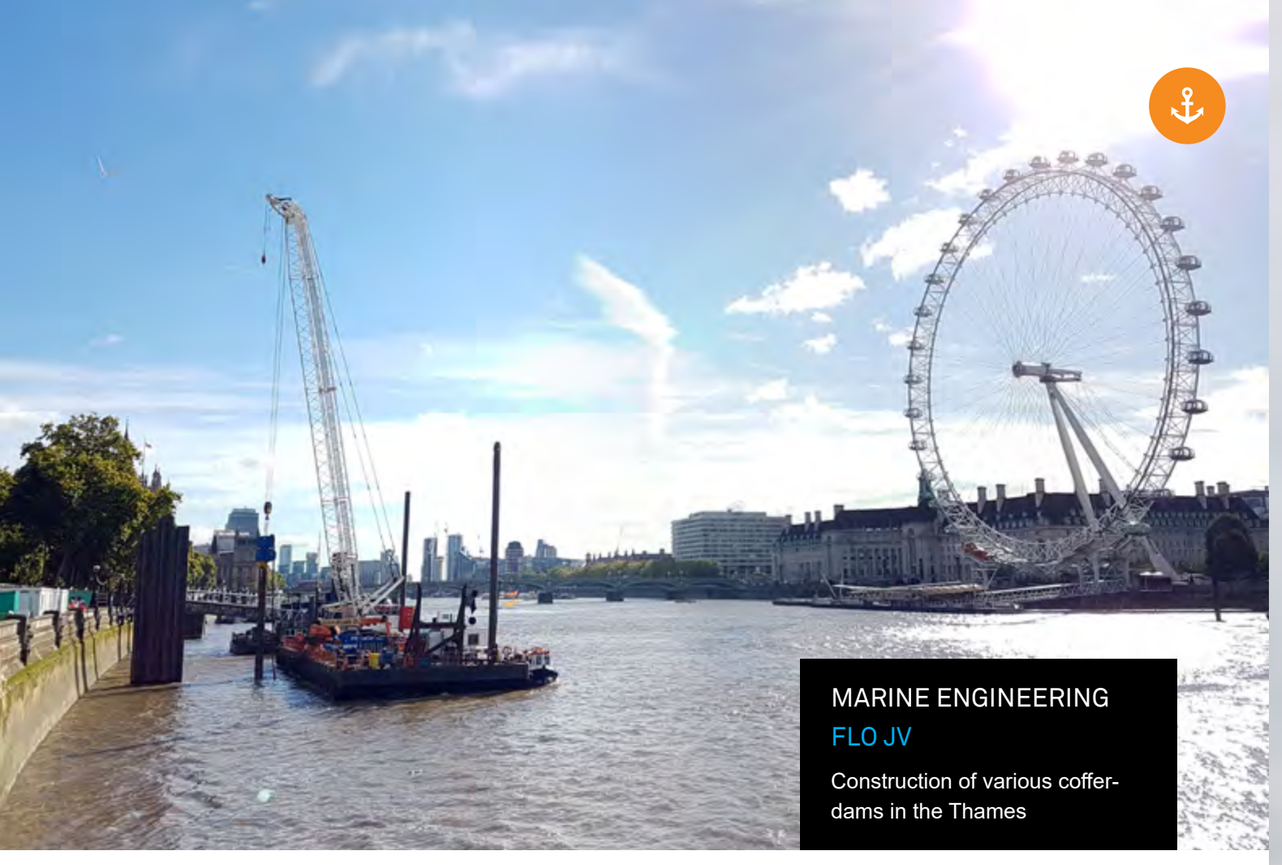
Our ad-hoc support and close relationship with the site teams resulted in a mutual understanding of the challenges and tight scheduling requirements. Our aim to provide functional designs and analysis made us a reliable partner, as exemplified by the returning requests.



SHEET PILE GATE

FLO JV

Sheet pile gate used to construct cofferdam walls at the Chelsea Embankment site



MARINE ENGINEERING
FLO JV
Construction of various coffer-dams in the Thames

COFFERDAM CONSTRUCTION

MARINE ENGINEERING – THAMES TIDEWAY – 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. Our marine consultancy spans from high-level project planning, installation engineering, and selection of suitable project assets up to the detailed mooring and stability analyses required for project execution.

On the Thames Tideway project, multiple cofferdams are built in the Thames, with all construction done from floating and jacked-up crane barges. To assure safe operations, TWD performed the mooring analyses, ballasting calculations, as well as the stability analyses for transportations and heavy lifts for over 40 floating and jacked-up barges on the project.

Our experience and volume with these assessments allows us to respond quickly and efficiently. In this way, we assist in informing safe and reliable marine construction decisions - essential to keep running a major project as Thames Tideway without downtime.

MARINE ENGINEERING
FLO JV
Crane barges constructing a cofferdam at Blackfriars bridge, London

CELL WALL TEMPLATE
KEATING CONSTRUCTION

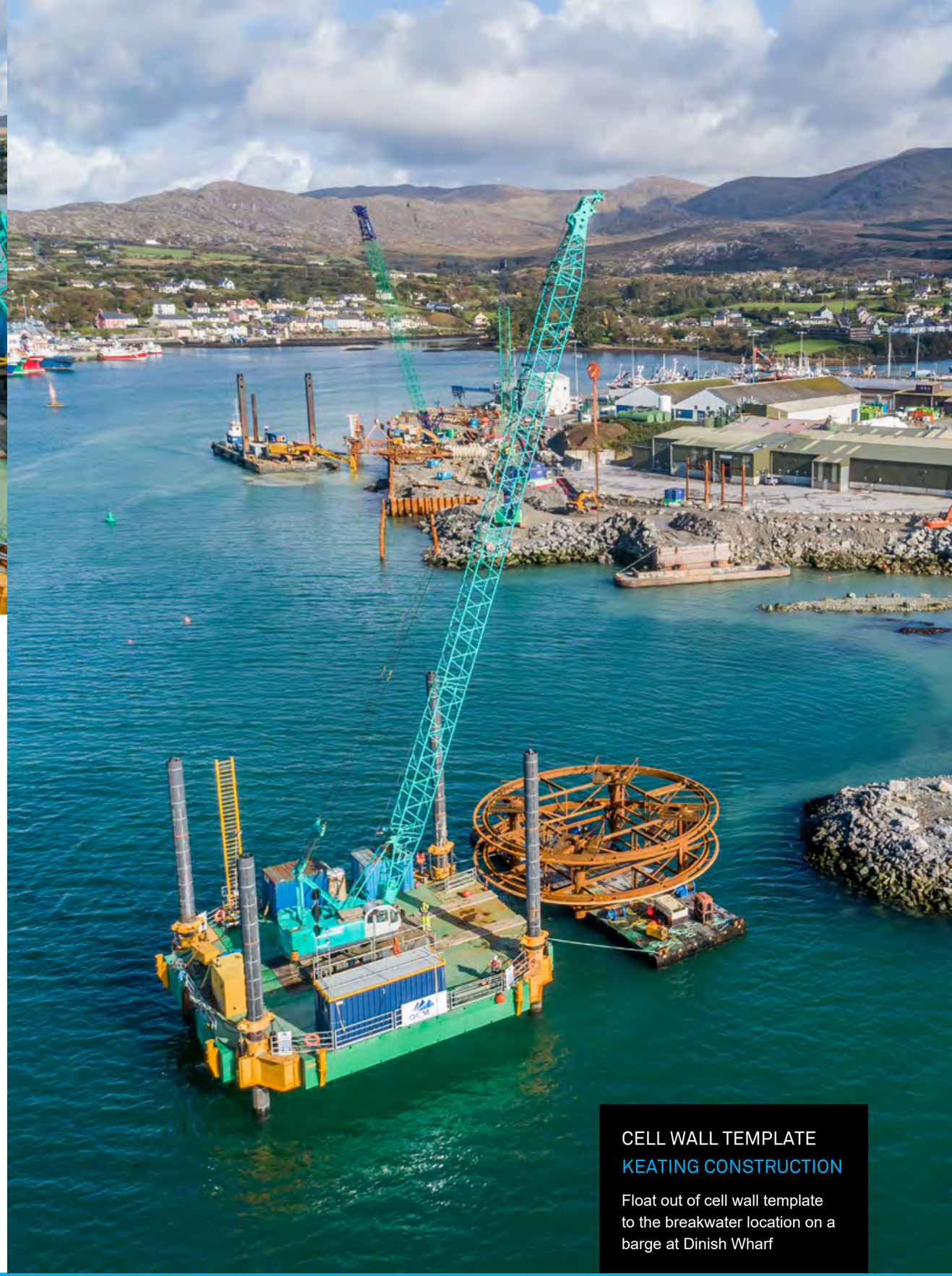
Double-level cell wall template spud deployment over a floating barge

CELL WALL CONSTRUCTION

DINISH WHARF EXPANSION– IRELAND – KEATING CONSTRUCTION

In County Cork, Ireland, five cell walls were installed as part of the breakwaters in the expansion of Dinish Wharf. TWD designed a template against which the sheet piles are placed to form the closed-cell walls. The template, which is assembled and deployed from a barge, is supported on temporary spuds that are used to lower and elevate the template on winched systems.

Consisting of up to three guiding levels, the template can be used for various water depths and provides access to the upper level. Since the project also consisted of different cell wall diameters, TWD design bolted interfaces to attach an external guiding ring allowing the same template to be used across the project.



CELL WALL TEMPLATE
KEATING CONSTRUCTION

Float out of cell wall template to the breakwater location on a barge at Dinish Wharf

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

CELL WALL CONSTRUCTION

MODULE OFFLOADING FACILITY – AUSTRALIA – 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.

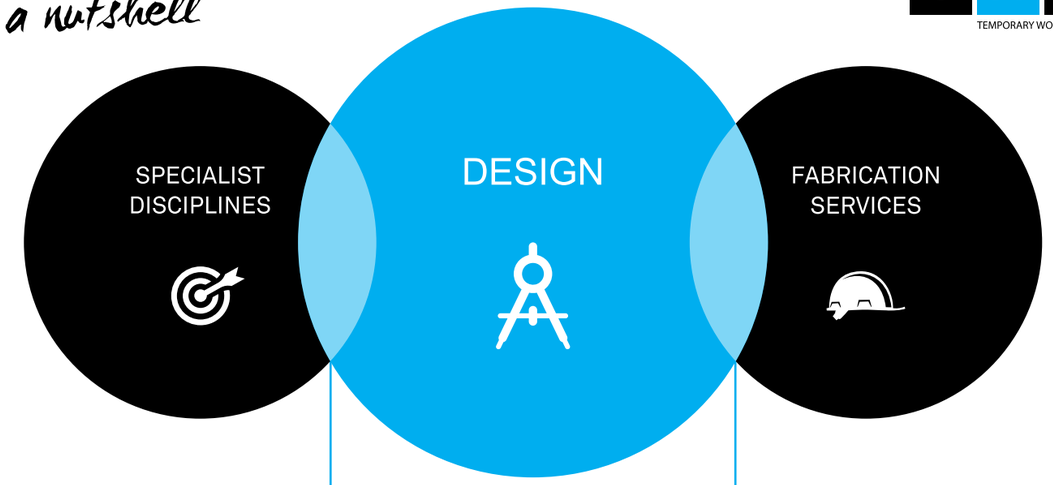
The position frame connects an existing cell wall with the front of the pontoon. A sliding functionality on the positioning frame allowed to adjust the distance between the existing cell wall and the cell wall template, while winches where used to force the template in the correct orientation.

PILING TEMPLATE
BAM CLOUGH
Positioning frame to assure the correct location of the template

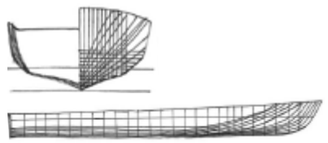
TEMPORARY WORKS DESIGN

In a nutshell

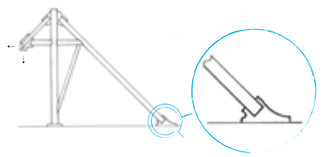
TWD
TEMPORARY WORKS DESIGN



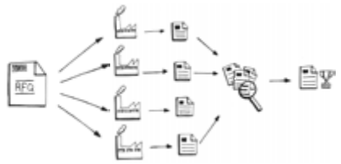
NAVAL ENGINEERING



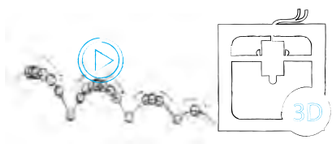
STRUCTURAL ENGINEERING



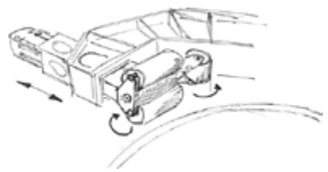
PROCUREMENT ASSISTANCE



3D VISUALIZATIONS

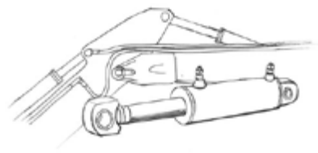


MECHANICAL ENGINEERING

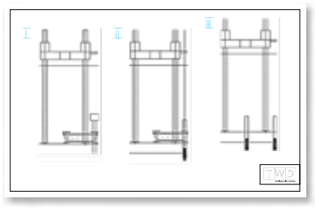


FABRICATION ASSISTANCE

HYDRAULIC ENGINEERING

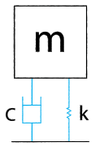


INSTALLATION ENGINEERING

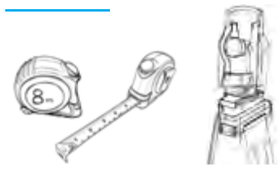


FIELD ENGINEERING

DYNAMIC ANALYSIS



MEASUREMENT SERVICES



GET IN TOUCH

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