TRACK RECORD HEAVY CIVILS

TWD
TEMPORARY WORKS DESIGN BV

Engineered to Function

TEMPORARY WORKS DESIGN

TWD is an engineering company specialized in creating custom-designed tools and structures that allow you to perform transport & installation projects safely and on time. You can regard TWD as your problem solver. The reliable partner that creates functional and creative solutions, no matter what the time frame is, or the 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

Our thorough knowledge of structural and mechanical engineering, hydro-dynamics, finite element methods and design for offshore conditions, enables us to develop the optimal solutions that meet the wide variety of your demands.

Besides the development of practical installation methods and the design of the required tools, TWD engineers can assist during the procurement, fabrication and mobilization phase. This approach allows us to shorten the required lead times, properly integrate the contributions of different subcontractors and assure that our constructions will function as intended.

This document provides an overview of our track record of safe and robust designs used for on- and nearshore civil construction works. The document provides a selection of projects. References and additional examples can be provided upon request.

MARKETS

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

TAKE A LOOK AT THE HEAVY CIVILS PAGE ON OUR WEBSITE

CANTILEVER BRIDGE

BAM INTERNATIONAL

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

HEAVY CIVILS

Effective and fit-for-purpose temporary works are key to the success of any construction project. As designers specialized in this particular niche, TWD engineers understand how smartly developed tools could contribute to safer, quicker and more cost effective installations. All our solutions, tools and methods aim to make a difference for your projects, both in the tender- as in the execution phase.

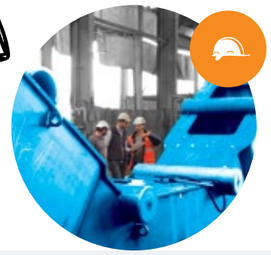
Our designers listen carefully to your specific requirements and work in close cooperation with your project teams. The impact of major design decisions on the project is clearly presented, allowing you to make well informed choices throughout the entire design process. This cooperative approach allows us to match our ideas with your preferred construction methods, where we strive to smartly use available materials and maximize the reusability of tools and components.

Whether the challenge is simple or complex, a temporary access platform or a piling template, our functional design method leads to logical and cost effective solutions. Our track record, from which examples are included in following sections, illustrates how our designs could contribute to your future civil construction project.

OUR EXPERTISE

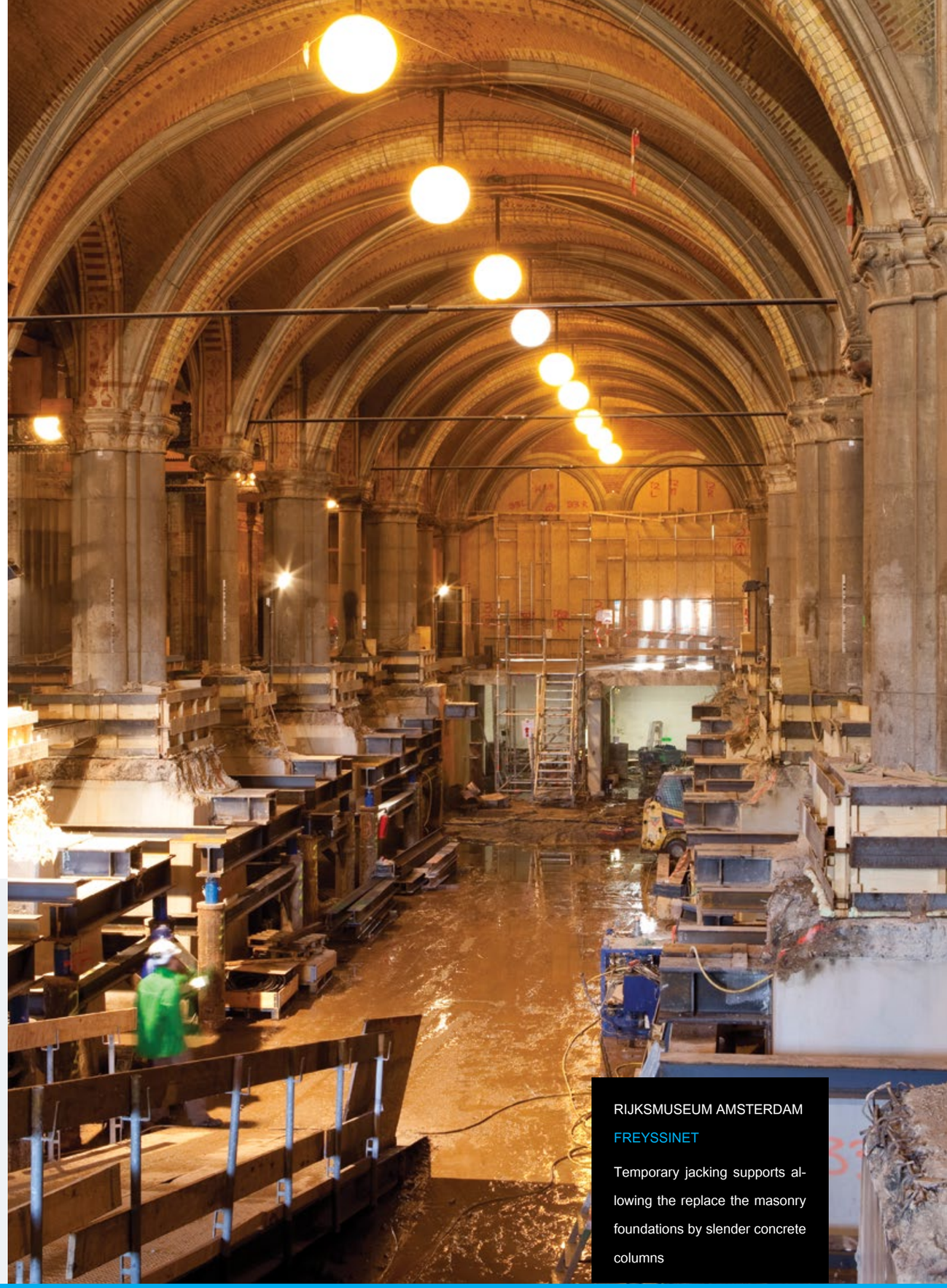
- JETTY CONSTRUCTION
- QUAYS, BREAKWATERS & PORT DEVELOPMENT
- INSTALLATION OF WATER AND SEWAGE FACILITIES
- RAIL, HIGHWAY & BRIDGE CONSTRUCTIONS
- SPECIAL CIVIL PROJECTS

TAKE A LOOK AT THE FABRICATION SERVICES PAGE ON OUR WEBSITE



OUR SERVICES

- DESIGN
  STRUCTURAL ENGINEERING, MECHANICAL ENGINEERING, INSTALLATION ENGINEERING, DRAFTING
- FABRICATION SERVICES
  PROCUREMENT ASSISTANCE, FABRICATION ASSISTANCE, MOBILIZATION ASSISTANCE, FIELD ENGINEERING
- NAVAL ENGINEERING
- HYDRAULIC ENGINEERING



RIJKSMUSEUM AMSTERDAM
FREYSSINET
Temporary jacking supports allowing the replace the masonry foundations by slender concrete columns

CANTILEVER BRIDGE

BAM INTERNATIONAL

Overview of cantilever bridge for construction of LNG jetty

JETTY CONSTRUCTIONS

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 head stock were driven. After completion of the new head stock, 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.

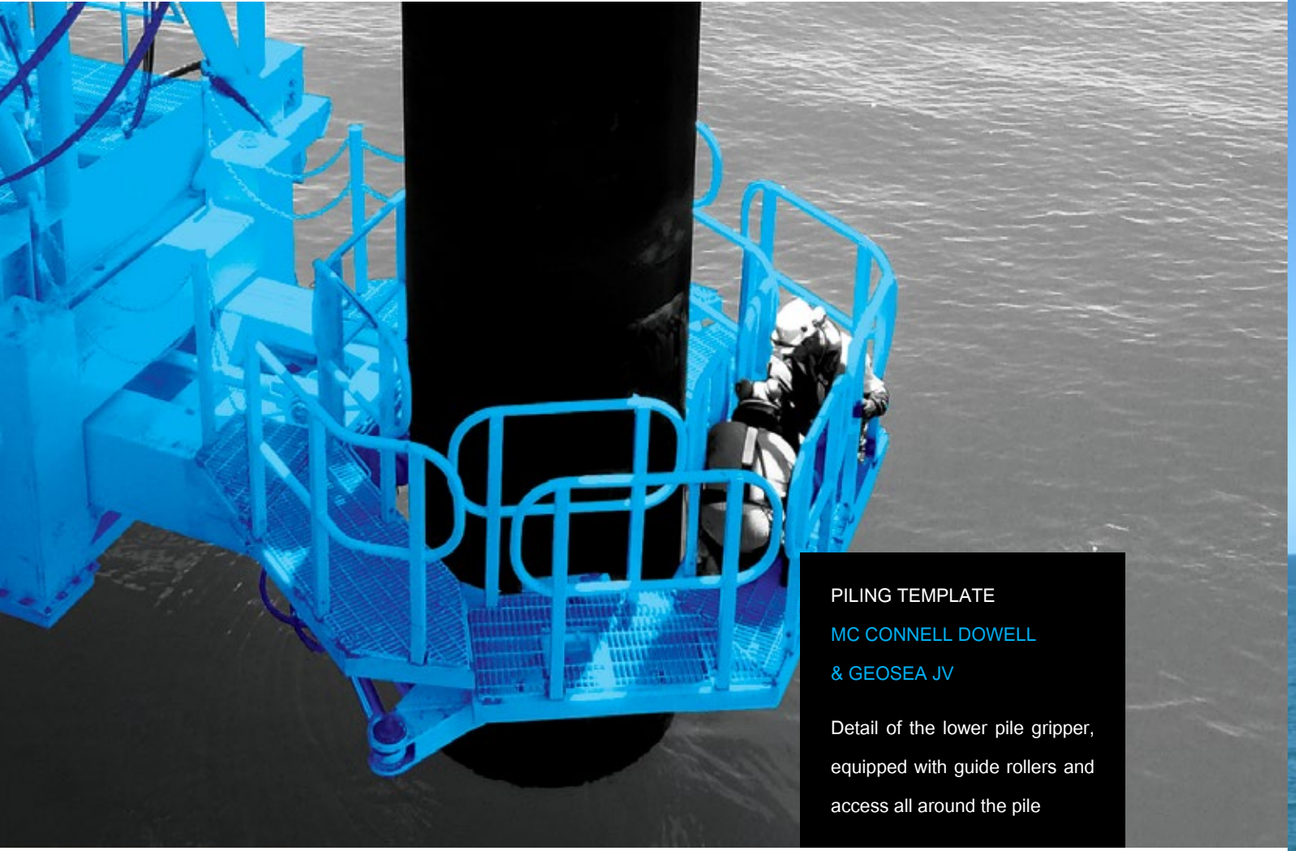
The cantilever bridge effectively deals with the complex logistics of a jetty construction project. With 3 serial work stations (piling – roadway elements – finishing bridge), smart access solutions and effective outriggers, a highly efficient installation method was achieved allowing to construct 3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

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

JETTY CONSTRUCTIONS

HAY POINT COAL JETTY - AUSTRALIA - MC CONNELL & GEOSEA JV

TWD designed a drilling and piling template applicable to three different jack-up barges in order to install piles for the Hay Point coal jetty construction.

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 inclination angles. The templates could also be used to support drilling equipment when the two outriggers function as a movable support frame for the oscillator.

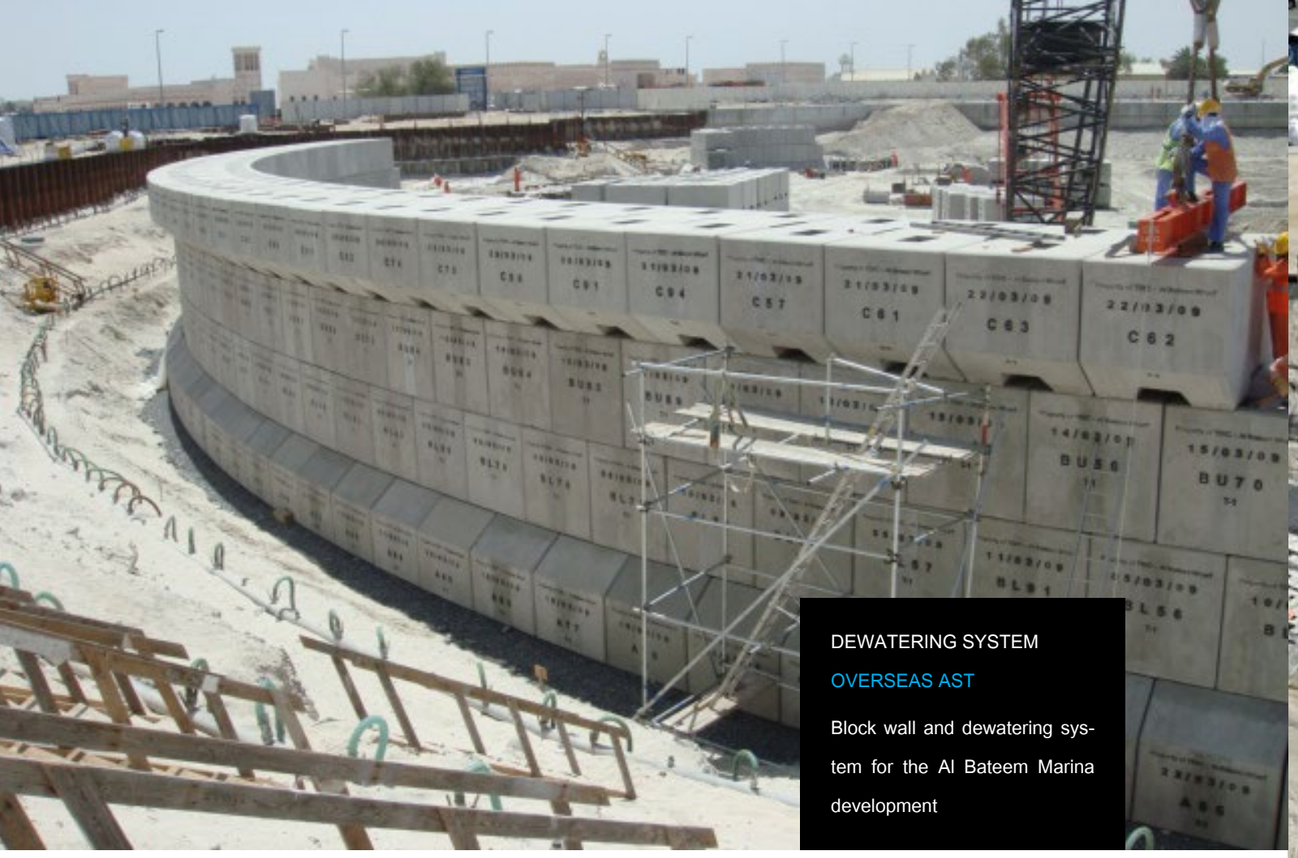
With the hydraulically actuated pile guides and sliding interfaces, sufficient flexibility was achieved to quickly install a large amount of piles within tight positioning and inclination tolerances. Due to this efficient piece of equipment, a significant reduction in installation time was achieved.

PILING TEMPLATE

MC CONNELL DOWELL

& GEOSEA JV

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



DEWATERING SYSTEM

OVERSEAS AST

Block wall and dewatering system for the Al Bateem Marina development

QUAYS, BREAKWATERS & PORT DEVELOPMENT

DEWATERING SYSTEM - AL BATEEN MARINA - OVERSEAS AST

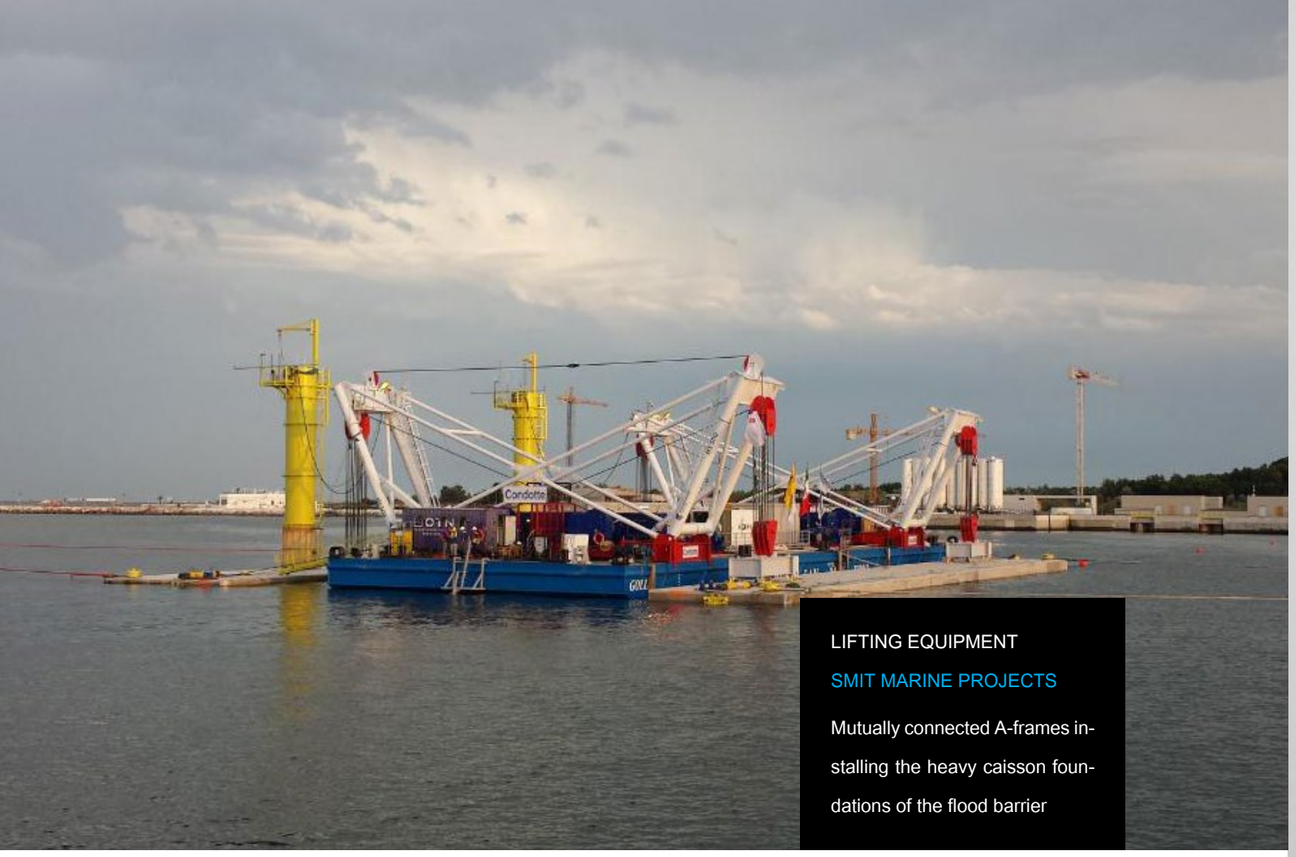
Temporary Works Design provided a dewatering design for the new Al Bateen Marina development in Abu Dhabi. The new quaywall for the marina was constructed “in the dry” and therefore the entire future development site had to be closed off and dewatered. In order to dewater the incoming waterflow from 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



LIFTING EQUIPMENT

SMIT MARINE PROJECTS

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

QUAYS, BREAKWATERS & PORT DEVELOPMENT

VENICE GLOOD BARRIER – ITALY – SMIT MARINE PROJECTS

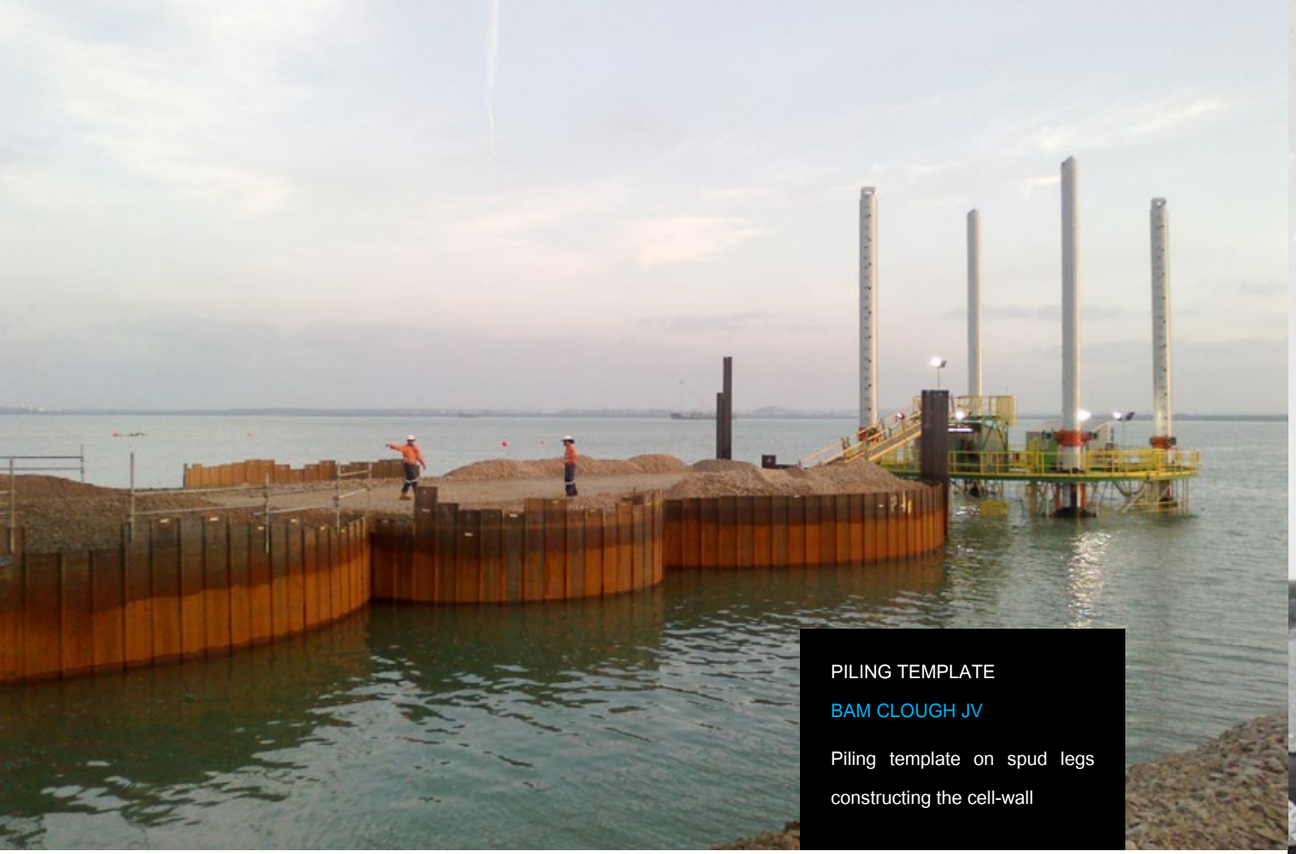
To safeguard the Italian city of Venice from tidal rise as a result of storm surges, a new flood barrier had to be constructed to be able to close of the Venice Lagoon from the Adriatic Sea. TWD provided the front-end engineering design of the installation method for the concrete caissons of this barrier.

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



PILING TEMPLATE

BAM CLOUGH JV

Piling template on spud legs constructing the cell-wall

QUAYS, BREAKWATERS & PORT DEVELOPMENT

MODULE OFFLOADING FACILITY – AUSTRALIA – BAM CLOUGH JV

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 JV

Positioning frame to assure the correct location of the template

LIFTING FRAME

JUMBO OFFSHORE

Installation of the concrete anchor blocks

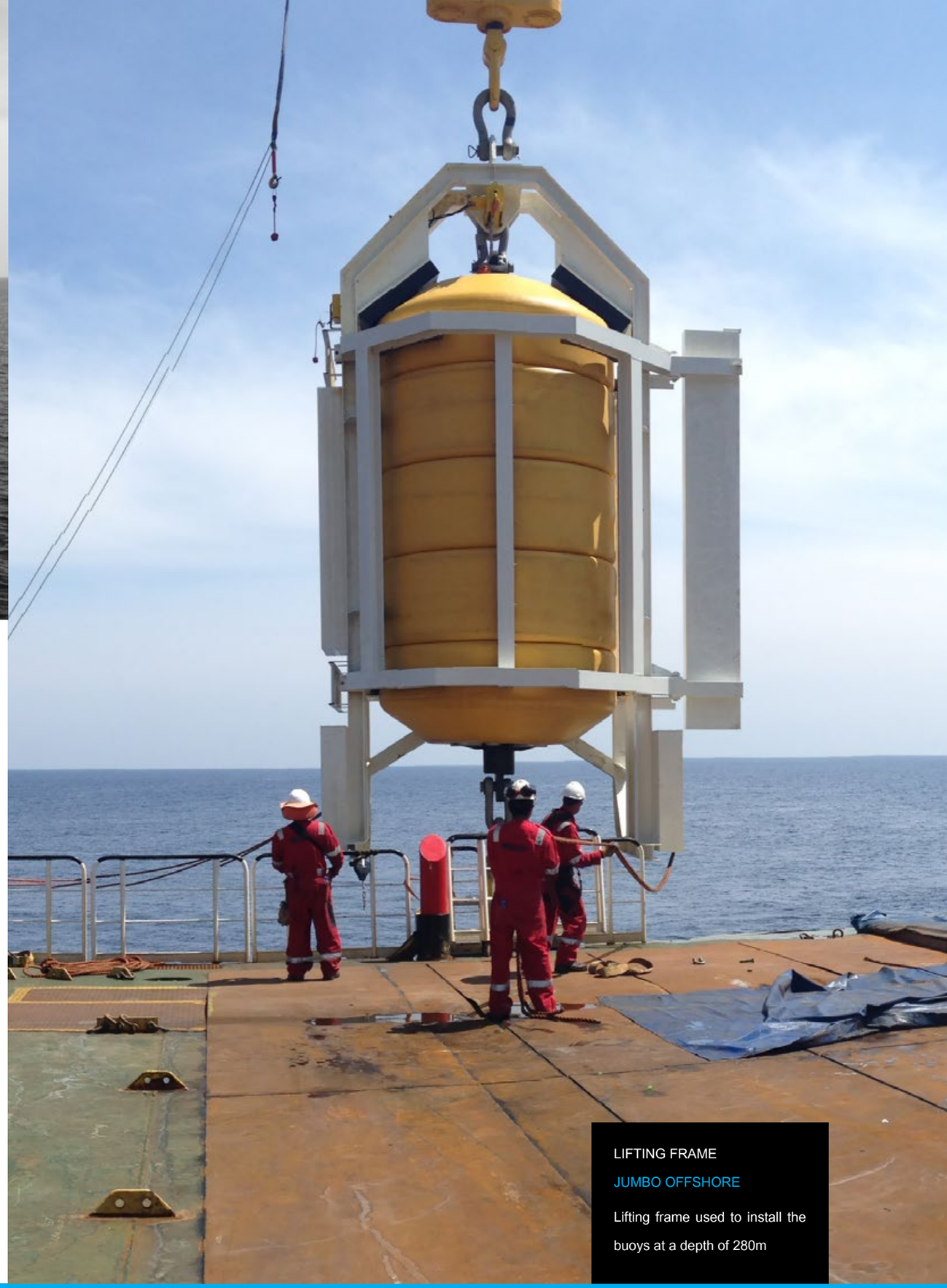
INSTALLATION OF WATER & SEWAGE FACILITIES

FRESH WATER PIPE LINE – CYPRUS – 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

INSTALLATION OF WATER & SEWAGE FACILITIES

BELLE GREVE OUTFALL – GUERNSEY (UK) – 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 off-shore 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.

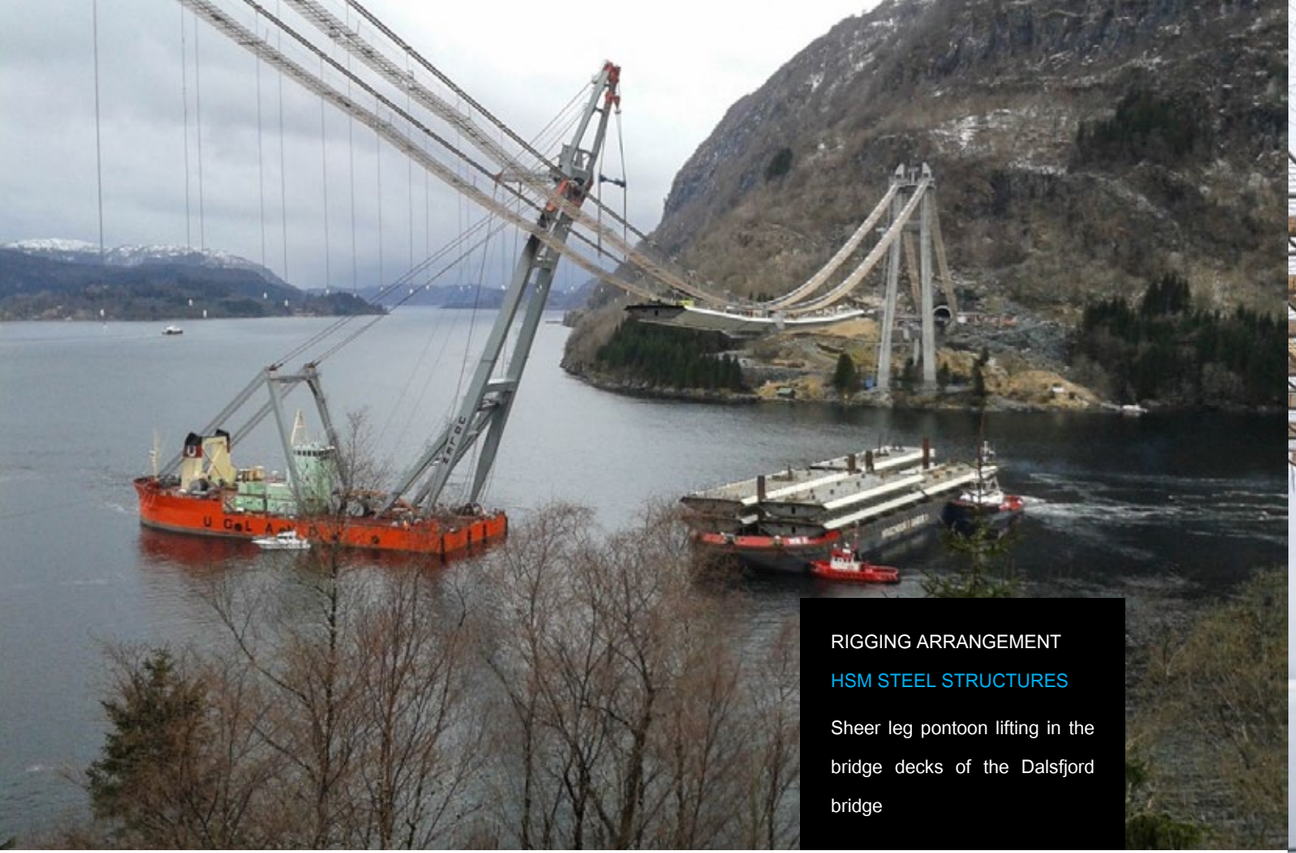
Van Oord was awarded with the assignment to install the two parallel outfall pipes and requested TWD to design the installation aids. In close collaboration with Van Oord, TWD designed the working platform including eight 6’ pontoons, connected by two truss frames. This custom made working platform was 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



RIGGING ARRANGEMENT

HSM STEEL STRUCTURES

Sheer leg pontoon lifting in the bridge decks of the Dalsfjord bridge

RAIL, HIGHWAY & BRIDGE CONSTRUCTIONS

DALSFJORD BRIDGE – NORWAY – HSM STEEL STRUCTURES

The Dalsfjord bridge was built to improve accessibility to the city Askvoll. The total span of the bridge is 525 meters and the roadway runs at a height of 35 meters above the fjord. HSM Steel Structures asked TWD to determine the rigging arrangement for the bridge segment, 11 segments in total. Each segment had to be lifted separately and connected to the main cable of the bridge.

Furthermore, TWD was requested to design the sliced nut and cable sleeve, which were required for the installation and tensioning of the suspension cables of the bridge.

RIGGING ARRANGEMENT

HSM STEEL STRUCTURES

Detail of the rigging arrange-ment of the bridge decks

SUPPORTS FOR CONCRETE FORMWORK

BAM

Demountable beam construction for concrete formwork of train bridge Amstel

RAIL, HIGHWAY & BRIDGE CONSTRUCTIONS

TRAIN BRIDGE AMSTEL – THE NETHERLANDS – BAM

For the realization of a train bridge in Amsterdam, BAM designed a concrete bridge which had to be constructed in-situ. 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

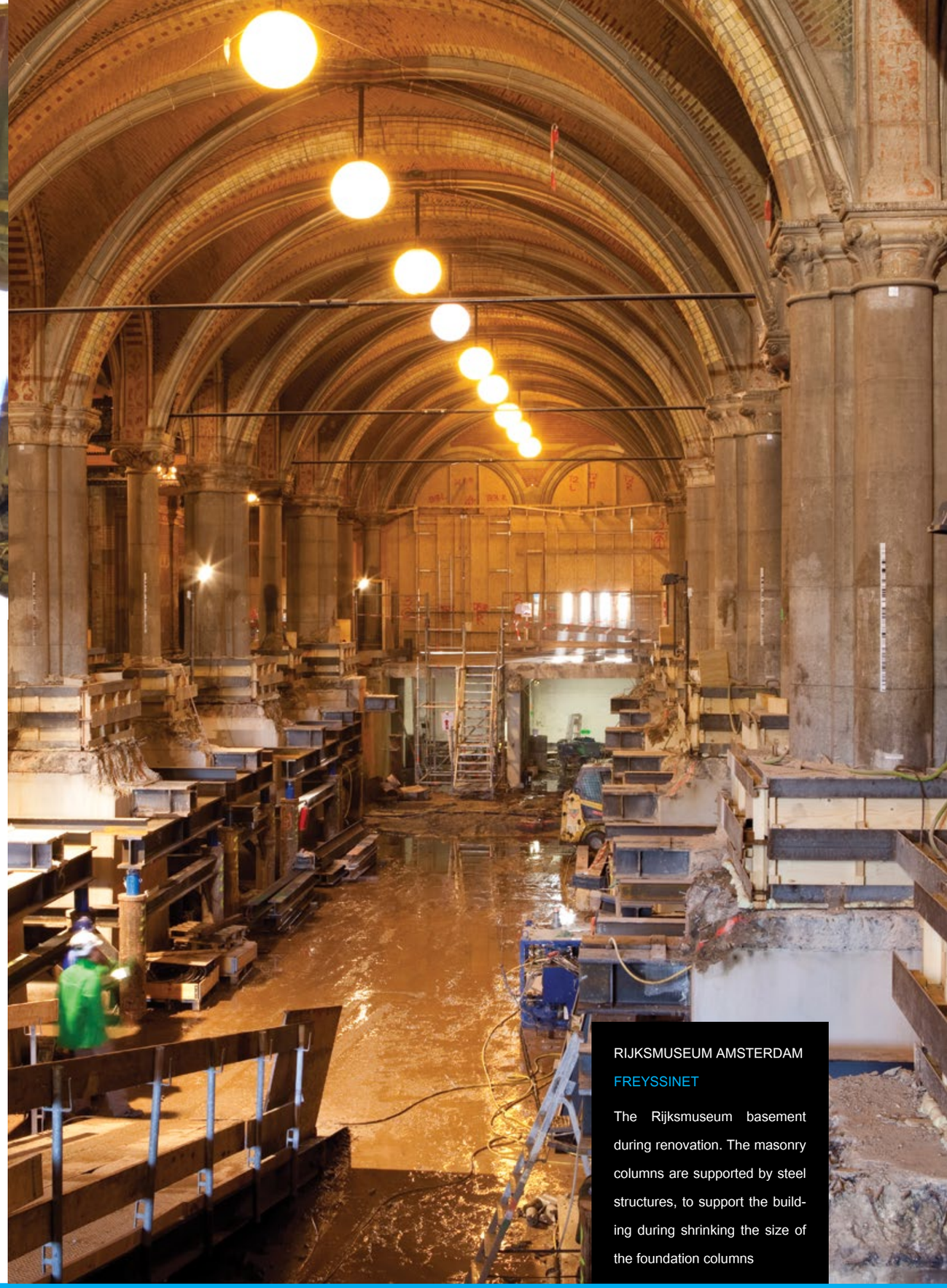
SPECIAL CIVIL PROJECTS

RIJKSMUSEUM AMSTERDAM – THE 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.



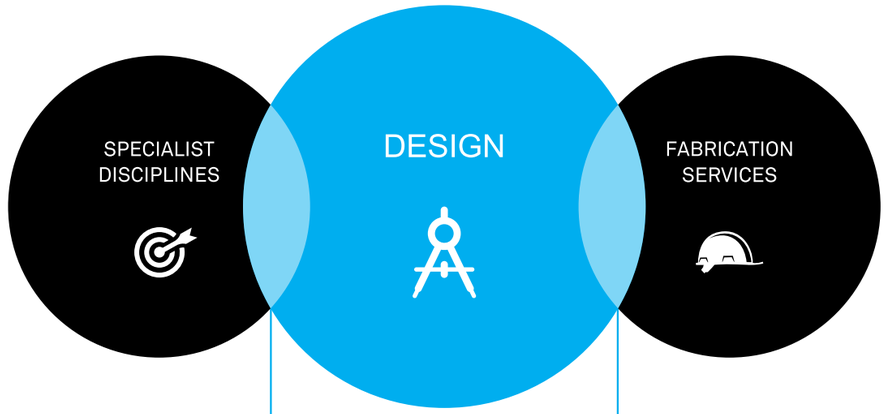
RIJKSMUSEUM AMSTERDAM

FREYSSINET

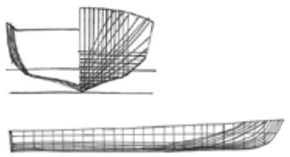
The Rijksmuseum basement during renovation. The masonry columns are supported by steel structures, to support the building during shrinking the size of the foundation columns

TEMPORARY WORKS DESIGN

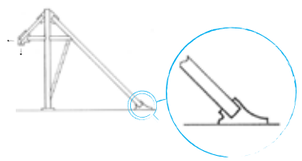
In a nutshell



NAVAL ENGINEERING

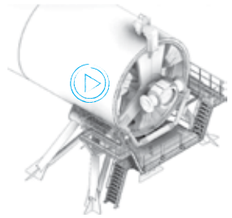


STRUCTURAL ENGINEERING

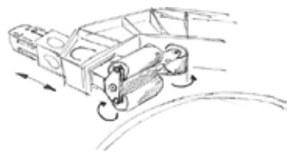


PROCUREMENT ASSISTANCE

3D ANIMATIONS

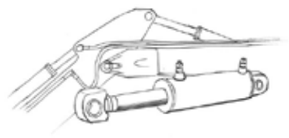


MECHANICAL ENGINEERING

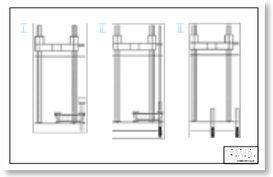


FABRICATION ASSISTANCE

HYDRAULIC ENGINEERING



INSTALLATION ENGINEERING



FIELD ENGINEERING

Engineered to function

GET IN TOUCH

TEMPORARY WORKS DESIGN BV

T +31 10 294 03 74
W www.twd.nl
E info@twd.nl

Rotterdam Science Tower - Marconistraat 16
3029 AK Rotterdam
The Netherlands