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1 DEME IN 2019

2019 was a milestone year for DEME as the ambitious fleet investment programme continues apace. The Group is striving for improvements in its productivity and environmental performance and this year will again see a whole plethora of new vessels arrive.

The next generation of trailing suction hopper dredgers entered the fleet with the arrival of the pioneering 15,000 m³ ‘Bonny River’, which has been making her mark on projects throughout Europe. This unique vessel is able to dredge very hard soils and can work in deep waters to an impressive 103 m.

1.1 Giant CSD ‘Spartacus’

DEME’s new giant cutter suction dredger (CSD) ‘Spartacus’ is the most powerful CSD in the world and 50% more powerful than any other CSD currently operational in the market. ‘Spartacus’ represents the next step in terms of production rates, pumping power, water depth and unmatched workability. It is also the first CSD that is capable of running on LNG.

The 8,400-m³ TSHD ‘Meuse River’, as well as the 2,500-m³ TSHD ‘River Thames’ are also set to be delivered in 2020. DEME also has two large split barges under construction to deploy alongside ‘Spartacus’ and other larger cutters.

Additionally, DEME’s next generation offshore installation vessel ‘Orion’ will be delivered in the next months and will head straight to her first project at the Moray East offshore wind farm. ‘Orion’ will feature a unique combination of exceptionally high transport and load capacity, impressive lifting heights and green technology. The 5,000-tonne crane can hoist heavy loads over an exceptional radius to an unrivalled height of more than 180 m.

DEME has been busy in all corners of the globe in 2019 and has secured a series of new contracts across the globe.
1.2 River Elbe Deepening

In Europe, DEME was particularly proud to be awarded the prestigious River Elbe deepening contract. DEME understood that this contract is not just about a complex hydraulic engineering project, but primarily a complex environmental engineering concept where sustainable construction methods and planning for the sake of protecting the environment are the main and primary focus.

Dredging started with an official launching ceremony on 23 July. Operating on LNG, DEME’s TSHD ‘Scheldt River’ kicked off the works. As well as the dual fuel TSHD ‘Scheldt River’ DEME is deploying ‘Bonny River’, backhoe dredgers and spreader pontoons for the dredging, transportation and relocation of around 32 million m$^3$ of material.

The modernisation of the Świnoujście-Szczecin fairway in Poland dredging works will also start in 2020.

Closer to home in Belgium, DEME has been awarded a contract for the construction of a new marina in Nieuwpoort. As part of a consortium, DEME will perform the dredging works. At the same time, DEME’s long-term maintenance dredging contracts on major waterways and along the coast continued, highlighting DEME’s focus on developing fruitful and trusting relationships with its customers.
1.3 Historic Viaduct Works in La Réunion

In another equally historic project, DEME successfully concluded the "Nouvelle Route du Littoral" viaduct works in La Réunion, when the final and 48th gravity-based foundation was installed for the 5,400 m viaduct, which is France’s longest offshore viaduct. We have been performing dredging, gravel bed installation and backfilling works for this unique project.

Then on the African continent we completed the challenging Tema Port expansion project in Ghana. Two main challenges arose during the project. Firstly, the rock was very hard, which was taking a heavy toll on our cutter teeth. There were also very unusual weather conditions for the time of year, which meant that there was a much harsher wave climate outside of the port. But DEME took swift action mobilising the TSHD ‘Breughel’ to enable us to successfully achieve the project by the completion date. The scope included dredging 2 million m$^3$ of rock.

In 2019 DEME also concluded the coastal protection works along the Cotonou shoreline in Benin. Additionally, DEME has been awarded a contract for deepening works in Congo-Brazzaville and secured three new contracts in Gabon, all in Owendo Port.

1.4 TTP1 Megaproject

Meanwhile in Singapore, the majority of the marine works for the huge Tuas Terminal Phase 1 (TTP1) megaproject were concluded. Under this phase, a staggering 88 million m$^3$ of land has been reclaimed. The size of the project is perhaps best attested to by the fact that around 2,500 people and 150 vessels were working on the project at any given time. Over the years, TTP1 has been awarded several safety-related awards recognising its top-notch performance. In a joint venture, DEME also secured a major contract for dredging and land reclamation works for an LNG terminal and a greenfield harbour development in Taiwan.

1.5 Successful Completion of Major Projects in Qatar

In the Middle East, DEME completed two major projects in Qatar, including the Old Doha Port redevelopment and the Gewan Island dredging and land reclamation project. In India, where the company has a strong track record, DEME was awarded three new contracts in the seaport of Kakinada. As well as this DEME will perform land reclamation works for a new coastal road in Mumbai.
Two large projects were underway in Russia in 2019, one on the Black Sea and one in the far north, as DEME returned to the Arctic. In Taman, DEME deployed two TSHDs for dredging works in a dry bulk terminal. For the Utreniy LNG terminal in the Arctic several TSHDs and a CSD were mobilised to fulfil the contract in the limited northern weather window.

1.6 Canal Martín García Deepening and Maintenance

In 2017, we were awarded a five-year contract in a joint venture for the deepening and maintenance of the Canal Martín García. The project is in full swing. DEME successfully completed the capital phase in early 2019. The company deployed its TSHD ‘Minerva’ for maintenance work which will see the vessel continually busy for the next three years. The main objective of the dredging programme is to deepen the Canal and subsequently maintain it to a depth of 34 feet.

1.7 Becoming a Port Authority in the Port of Duqm

In another important milestone for the company and in a first for DEME Concessions, DEME has become a port authority in the Port of Duqm in Oman, teaming up with the Port of Antwerp International and the Government of Oman. DEME Concessions and the Port of Antwerp International have a 50-50% share in the joint venture with the government.

Meanwhile, DEME continues to push for more sustainable solutions within its portfolio so that its operations become more environmentally friendly. DEME has identified eight key sustainability themes supporting the Sustainable Development Goals of the United Nations, and on which DEME has an economic, environmental or social impact: climate and energy, natural capital, sustainable innovation, waste and resource management, health, safety & wellbeing, diversity & opportunity, ethical business and local communities.
1.8 Launch of Marine Litter Hunter

In line with this, DEME turned its attention to the increasing problem of river pollution. In a pioneering project, DEME launched its ‘marine litter hunter’ on the River Scheldt in Belgium. This innovative project combines artificial intelligence, virtual reality and autonomous navigation to detect and collect marine litter. In 2019, DEME focused on the design and engineering of the marine litter hunter and a test phase is due to start in February. With the company’s vast expertise in environmental remediation, it is a logical step for DEME to use its expertise to find solutions to tackle the plastic soup problem.

1.9 Leading Players Team Up to Explore the Potential of Hydrogen

DEME recognises that the ambitious European climate targets to reduce CO₂ emissions are a major challenge. Therefore, it is exploring where hydrogen can play a role in the mix of solutions to achieve the best results. As a pioneer in the development, construction and financing of offshore wind farms, DEME wants to make full use of its expertise for the production, transport and storage of hydrogen from renewable energy sources. This is why DEME is joining forces with six other leading players, including the Port of Antwerp and Port of Zeebrugge. The partners will make a joint analysis of the entire hydrogen import and transport chain to map the financial, technical and regulatory aspects of the various components of the logistics chain.
2 JAN DE NUL IN 2019

Creative, Sustainable and Innovative Solutions

Jan De Nul Group shapes water and land. Worldwide. From complex offshore services for oil and gas and renewables, to large dredging and both land and coastal reclamation projects, to challenging civil construction programmes. Well integrated competences and investments lead to creative, sustainable and innovative solutions. In this way Jan De Nul Group delivers results that produce satisfied customers. Building a better future.

2.1 Ambitious CO₂ Reduction Targets

In 2019, Jan De Nul Group revealed ambitious CO₂ reduction targets, starting with the reduction by 15 % a year, during maintenance dredging works at the Nieuwpoort coastal marinas in Belgium. It is the first dredging company in the world to aspire to such a reduction in a commercial application for a project.

The announcement of these ambitious CO₂ reduction targets comes shortly after the Flemish Government’s decision to agree to a three-year pilot project for testing the CO₂ performance ladder for government contracts. This ladder was developed in 2009 in the Netherlands as an instrument and certification scheme to stimulate CO₂ reduction and turned out to be very successful.

In order to achieve this ambitious CO₂ reduction target in the Benelux, Jan De Nul Group focuses on green technology and the sustainability of its fleet and infrastructure.

2.1.1 100 % Renewable Fuel

Jan De Nul Group targets a Benelux fleet sailing on 100 % renewable fuel, more specifically drop-in biofuel. This is a high quality, sustainable replacement of fossil diesel, made of vegetable oils or waste flows.

End 2019, Jan De Nul Group has initiated a test phase to carry out dredging works in the Benelux with this 100 % renewable fuel. This intervention made Jan De Nul Group at least 80 % CO₂ neutral on this project.

For the use of drop-in biofuel engines do not have to be adapted. Furthermore, not only are CO₂ emissions reduced, but far less fine dust is released in the air. Drop-in biofuel also burns a lot more efficiently than conventional diesel. Since drop-in biofuel uses waste flows as a raw material, it is also beneficial to the circular economy. Finally, it is a very clean fuel that is extremely suitable for high-grade engines.
2.1.2 Emission Control Technology

Early 2020, the brand-new Trailing Suction Hopper Dredger Sanderus will come to Belgium to execute maintenance dredging works on the river Scheldt and alongside the coast. This new dredger is a ULEv, an Ultra-Low Emission vessel equipped with a state-of-the-art exhaust gas treatment system that extracts up to 99% of the nanoparticles from exhaust gases. Add to this the renewable fuel, a huge CO₂ reduction and strongly decreased air emissions can be achieved.

2.1.3 Ultra-Low Emission Vessels

Watch our video on the working principles of ULEv’s

When designing new vessels, Jan De Nul Group takes into account the environmental impact. Jan De Nul tackles environmental challenges by focusing on reducing the footprint of its activities, particularly on water and air quality, and on the climate. Air pollution is one of the greatest threats to public health. Construction activities at sea are usually located close to coastlines, large and small ports, and densely populated areas. For that reason, Jan De Nul Group decided to invest in a highly advanced emission control technology. Jan De Nul is aware that, regardless of the choice of fuel or engine technology, the exhaust gases must always be filtered.

As one of the world’s leading players in hydraulic engineering, Jan De Nul Group pioneers in the field of such an emission treatment. The latest generation of Jan De Nul’s vessels is equipped with a highly advanced exhaust gas filtering system by means of a Selective Catalytic Reduction (SCR) system and a Diesel Particulate Filter (DPF). This exhaust gas filtering technology complies with the strict European EURO STAGE V guidelines for emissions on land and inland waterways.

2.1.4 Energy-Efficient Infrastructure

Jan De Nul Group also invests in the energy efficiency of its infrastructure. In 2019, the Group introduced its energy-efficient site office. Through the extra insulation of walls, roof and floor, combined with triple glass, door pumps and an improved air density, heat and cold losses are minimised. Solar panels on the roof provide energy, a heat pump ensures heating and cooling. Conventional lights are replaced by LED lighting.

All these measures result in 80% less energy consumption. With the construction shed 2.0, Jan De Nul Group shows both employees and clients his high sustainability ambitions throughout all his business operations: from the very smallest to the highest energy consumers.
2.2 Innovative and Sustainable Solutions

2.2.1 Two New Next Generation Offshore Installation Vessels for the Offshore Industry

In 2019, Jan De Nul Group ordered two next generation offshore installation vessels to service the global offshore wind industry in the future: the Offshore Jack-Up Installation Vessel Voltaire and Heavy Lift Crane Vessel Les Alizés.

The offshore wind sector is developing the next generation of offshore wind turbines. These turbines can be more than 270 metres high and are fitted with blades of 120 metres long. Offshore installation vessels currently available on the market are facing increasing difficulties to install these types of turbines due to the turbines’ sizes and installation heights, as well as the ever-increasing foundation dimensions.

Both the Voltaire and Les Alizés have all the required specifications to meet these upcoming challenges. Upon the delivery of these vessels in 2022, Jan De Nul Group will be capable of efficiently installing the next generation of offshore wind turbine generators and foundations. This investment is a logical step forward in the development of Jan De Nul’s offshore wind capacities.

Both vessels are also extremely suitable for decommissioning offshore oil and gas platforms thanks to their impressive crane on board.

2.2.2 Offshore Jack-Up Installation Vessel Voltaire

On 5 April, Jan De Nul Group announced the order of the Voltaire, its third Offshore Jack-Up Installation Vessel, at COSCO Shipping Heavy Industry in China. With an unrivalled crane capacity of over 3,000 tonnes, this jack-up vessel will be able to support the renewable energy industry to build the future wind farms at sea. The vessel is set to be delivered in 2022.

In October, the Voltaire secured her first contract for the transport and installation of the world’s largest offshore wind turbines HE’s Haliade-X, at the Dogger Bank Wind Farms, 130 km off the UK coast.

Watch our video on the Voltaire

2.3 Heavy Lift Crane Vessel Les Alizés

On 26 November, six months after the investment announcement for the offshore installation vessel Voltaire, Jan De Nul Group ordered Les Alizés, a floating installation crane, equipped with a crane having a lifting capacity of 5,000 tonnes and equally impressive lifting heights. The vessel will be built at the CMHI Haimen shipyard in China.

Watch our video on Les Alizés
2.3.1 Further Investments in a Green Sustainable Fleet

With the order of Les Alizés and the Voltaire, the fleet of Ultra-Low Emission vessels was again extended in the course of 2019. Moreover, these seaworthy installation vessels will be the first in the world with extremely low emissions.

Because of the green emissions reduction technology they take on board, Jan De Nul Group was able to conclude an agreement for a green loan with a consortium of five banks, led by KBC Bank, for the financing of both investments. This transaction is an important milestone and first for both Jan De Nul Group and KBC Bank. For Jan De Nul Group this is the first green loan, and for KBC it is the first syndicated green loan within the shipping sector. A green loan should be used in its entirety to finance green projects.

Les Alizés will also have a Cleanship NDO7 label and a Green Passport EU label. The Cleanship label confirms that the vessel checks and minimises the waste water and all other residual waste. The second Green Passport label means that all materials and hazardous substances are mapped out during the construction phase, in order to facilitate the recycling of the vessel when decommissioning. Both certificates are issued by a specialised external agency.

2.3.2 Charter Sustainable Entrepreneurship from Flanders’ Chamber of Commerce

In 2019, Jan De Nul Group was once again singled out for sustainable entrepreneurship. Jan De Nul Group’s environmental subsidiary Envisan was awarded the VOKA (Flanders’ Chamber of Commerce) Sustainable Entrepreneurship Charter for the second year in a row for the implementation of its sustainability plan. This Charter will enable Jan De Nul to continue to work intensively on sustainable entrepreneurship.
2.3.3 Green Deal Circular Construction Project

Jan De Nul Group and 230 other participating public and private organisations kicked off the Green Deal Circular Construction project in February, an initiative of the Flemish Government in cooperation with ‘Vlaanderen Circulair’, the Flemish Construction Confederation ‘VCB’ and Public Waste Agency of Flanders ‘OVAM’.

Over 60% of our CO₂ emissions relates to the materials that we use: the circular economy offers solutions to reduce this impact. To realise a circular economy in Flanders by 2050, with closed cycles of resources, we need other products, services and business models.

By joining this initiative, Jan De Nul Group shows its climate commitment: within this innovative learning network, the dredging and construction company commits itself to share practical experiences with other companies and organisations.

2.3.4 Galgeschoor Plastic Challenge

End 2019, Jan De Nul won the Antwerp Port Plastic Challenge. The port has to cope with small plastic particles left behind by the tides. These plastic particles have a considerable impact on the local vegetation and ecosystem. To solve this problem, the Port of Antwerp launched its Galgeschoor Plastic Challenge. The mission was: think of an innovative, eco-friendly and economically viable solution to clean up millions of plastic particles without disrupting nature. Envisan accepted the challenge, submitted its in-house designed Nul-O-Plastic and was chosen as all-out winner out of 55 entries.

Watch our video on the Nul-o-Plastic

The Nul-o-Plastic is a flexible and compact vacuum cleaner on rubber caterpillar tracks to ensure minimal impact on the soil. Its long hose is easy to operate and hoovers up the plastic particles in its container. Once the container is full, it is emptied in a central depot. A major advantage of the Nul-o-Plastic is its mobility. Thanks to the caterpillar tracks, the hoover can easily ride on the sloping Galgeschoor embankment. It can also be easily deployed on other sites, which makes it an interesting investment.

The Galgeschoor Plastic Challenge rewards Jan De Nul Group for its motivation and commitment to work out innovative and sustainable solutions that are tailored to every individual project. Innovation is indeed one of Jan De Nul’s main driving forces and a very important pillar of Jan De Nul's strategy to find circular solutions for a better planet.
2.3.5  Jan De Nul Supports Academic Chair at the University of Leuven

Together with the Belgian Port of Zeebrugge and four other engineering and construction companies, Jan De Nul Group invests in research and education by financially supporting the academic chair Coastal Hydraulic Engineering and Soil Mechanics at the KU Leuven in Bruges.

With this financial support, the partners aim at making the engineering training at the KU Leuven Campus Bruges more appealing in general, and at enthusing engineers for the coastal and hydraulic engineering industry in particular. Eventually, this will lead to more graduates entering the professional market of maritime engineering (port, construction and dredging companies, engineering companies, etc.).

Jan De Nul Group supports not only the University of Leuven, but also other educational institutions in Belgium by giving guest lectures on dredging, offshore engineering and maritime construction to engineering students.

2.3.6  High-Wave Solar Panels Soon a Reality

Jan De Nul Group joined forces with Ghent University and industrial partners to launch an innovative project in the field of marine floating solar technology. The partners strongly believe that solar photovoltaic (PV) panels in offshore waters are one of the essential future green energy sources. Combined in the same location with aquaculture and offshore wind power, this innovative technology will allow for a more efficient use of available space.

The partners of the consortium are the first in Belgium to explore this pioneering offshore solar solution. Their ambition is also to be the first to realize offshore solar farms in the Belgian North Sea - eventually in combination with windfarms or aquaculture. In this way, the partners position themselves in this new, fast-evolving market.

2.4  2019 Dredging and Marine Construction Projects

2.4.1  Sustainable Development of the Vulnerable Coastline of Texel

Jan De Nul Group delivered in 2019 one of the biggest dyke reinforcement operations in the Netherlands ever: the Prince Hendrik Sand Dyke in Texel. The design of Jan De Nul Group won the tender, because of its sustainable and nature-based character. Between July 2018 and January 2019, TSHD Bartolomeu Dias dredged 5.5 million m$^3$ of sand for the construction of a new 3-km long safety dune and connected nature area. The sand dune and nature reserve will protect the coastline of Texel in a sustainable way. After delivery of the project, Jan De Nul remains responsible for its maintenance for a period of 5 years.
2.4.2 Princess Beatrix Lock Officially Inaugurated

In February 2019, the Dutch Princess Beatrix officially inaugurated the Princess Beatrix lock near Utrecht. During 2.5 years, Jan De Nul Group built the lock together with its Joint Venture partners and dredged the access channel to the lock. The two lock heads are each 30 x 60 metres. Each lock head contains two lock gates, each weighing 490,000 kilos and measuring 28 metres wide, 14 metres high and 6.25 metres thick. In total, 44,875 m$^3$ of concrete and 17,900 tonnes of reinforcement were used to build this new lock.

2.4.3 Important Concession in Bangladesh

Jan De Nul Group’s subsidiary Payra Dredging Company Limited (PDCL) entered into a concession agreement with Payra Port Authority for the capital and maintenance dredging of the Rabnabad Channel at Payra Port. Under this agreement, Jan De Nul Group is responsible for the development, dredging and commissioning of the access channel, turning basins, anchorage and berthing areas with the goal to accommodate larger sea-going vessels. The contract includes a maintenance period of 10 years.
2.4.4 Key Dredging Works in Port Hedland Successfully Completed

Jan De Nul Group completed the capital dredging works for the Channel Risk and Optimisation Project (CROP) in Port Hedland, Western Australia. Over the past three years a combination of Hopper Dredgers, a Cutter Suction Dredger and Split Hopper Barges were deployed to dredge sections of the 42-km long navigational channel and to further enhance the safe and sustainable access to the port of Port Hedland. The project, part of the Channel Risk and Optimisation Project (CROP), included the removal of high spots and the creation of two refuge zones and an emergency passing lane alongside the outer section of the shipping channel.

2.4.5 Jan De Nul Helps to Boost Mauritania’s Iron Ore Export

Jan De Nul Group kicked off the deepening and widening dredging in the inner port channel and turning basin of the large ore export port of Nouadhibou, Mauritania. With the deepening and widening of the 25-km long entrance channel to the mineral terminal of Port of Nouadhibou, the National Industrial and Mineral Authority of Mauritania opens the port for vessels with a capacity of up to 250,000 tonnes.

Jan De Nul Group will remove about 21.6 million m³ of sediments and transport them to a dedicated offshore location. The turning circle of the port will be deepened to -20.3 m. In order to be able to dredge and dispose these significant quantities within the set period of 12 months, the mobilised Cutter Suction Dredger and Trailing Suction Hopper Dredger will work simultaneously: the CSD will pre-cut the sandstone after which the TSHD will dredge the sediments and dispose them offshore.

Awarded working method

Jan De Nul Group was previously awarded by the DPC Innovation Awards for this efficient working method in 2018. In Taiwan, a cutter suction dredger pre-cut hard mudstone in the Port of Linkou which was subsequently dredged by a trailing suction hopper dredger for the extension works in the Port of Taipei. This pre-cutting by a cutter dredger and subsequent dredging with a hopper dredger, on this scale, is unprecedented.
2.4.6 Wrapping up Liepaja Port Works

Jan De Nul Group completed the capital dredging works for the improvement of Liepaja Port in Latvia ahead of schedule. The scope for Jan De Nul Group entailed the removal of 2.7 million m³ of clay and stone to deepen the port access channel from 12.5 m to 14.5 m, and to create a new navigation channel of -14 m towards one of the main bulk terminals within the port area.

2.5 2019 Offshore Services

2.5.1 Landmark Achievement for Jan De Nul in Asia

After four months of installation activities, Jan De Nul Group completed Formosa 1 Phase 2 Offshore Wind Farm scope in Taiwan. The project included an extensive EPCI scope for foundations, power cables and scour protection on the offshore wind farm located in Miaoli County. Jan De Nul Group engineered, procured and installed twenty offshore wind turbine foundations consisting of a monopile and transition piece with a grouted connection. Around the monopile foundations 56,000 tonnes of scour protection have been installed. In addition, seventeen inter array cables and three subsea export cables of 33 kV were designed, procured, installed, buried, terminated and tested. On land, the connection with the substation was made through 12 km of land power cables.
2.5.2 Formosa 2 OWF Contract Awarded to Jan De Nul

Jan De Nul Group was awarded in 2019 the Engineering, Procurement, Construction and Installation (EPCI) of both foundations and subsea cables for the Formosa 2 Offshore Wind Farm (OWF). Developed by Macquarie Capital Ltd. and Swancor Renewable Energy Company Ltd., the 376 MW Formosa 2 OWF will have 47 Siemens 8 MW turbines on jacket foundations in up to 55 m water depth. Under this contract Jan De Nul Group will be responsible for the foundation design, fabrication and installation, as well as for the design, supply and installation of the subsea cables.

2.5.3 Voltaire Secured its Very First Contract

The world’s largest offshore wind farm, Dogger Bank Wind Farms, welcomed Jan De Nul’s Voltaire to the project. The new offshore jack-up installation vessel, with a lifting capacity of over 3,000 tonnes and standing taller than the Eiffel tower, is the largest of its kind in the world. The Voltaire will transport and install the world’s largest offshore wind turbines, GE’s Haliade-X, at Dogger Bank, which sits 130 km off the Yorkshire coast. When completed, Dogger Bank will generate enough energy to power over 4.5 million homes every year – around 5% of the UK’s electricity needs. This is the first contract placed for Voltaire, which will enter into service in 2022.

2.5.4 Jan De Nul Entered the French Renewables Market

Jan De Nul Group has signed its very first offshore wind contract in France. Its French subsidiary Sodraco International SAS will be responsible for the transportation and installation of 80 Offshore Wind Turbines on the 480 MW Saint-Nazaire Offshore Wind Farm (OWF). The contract was awarded by Parc du Banc de Guérande, a Joint Venture between the French renewable energy company EDF Renewables and the Canadian energy infrastructure company Enbridge.

2.5.5 Jan De Nul Signed the 600 MW Kriegers Flak Contract

Jan De Nul Group signed a contract with Vattenfall Vindkraft Kriegers Flak P/S for the transport and installation of 72 8.4MW Siemens Wind Turbine Generators (WTG) for the Kriegers Flak Offshore Wind Farm (OWF) in Denmark. The Kriegers Flak OWF is located in the Baltic Sea in water depths varying between 15 and 30 metres, at 15 kilometres from shore. In 2017-18, Jan De Nul Group already built, towed and installed two large Gravity Based Foundations for the Offshore High Voltage stations of the Kriegers Flak OWF.

2.5.6 Northwestern 2 Kicked Off at Sea

Construction works for the seventh offshore wind farm off the Belgian coast started in 2019. The Northwestern 2 wind farm will count 23 V164-9.5 MW MHI Vestas Offshore Wind turbines and will be the first project to ever install this model. The turbines on monopile foundations will link through an offshore high voltage station to Elia’s Offshore Switch Yard (OSY) to export its electricity. As of 2020, the Northwestern 2 wind farm will power approximately 220,000 households in Belgium.
3  VAN OORD IN 2019

Van Oord
We are a Dutch family-owned company with 150 years of experience as an international marine contractor. We value open communication with our clients and stakeholders. Our company culture is one of entrepreneurship and engaged employees. We think and act with responsibility and focus on the long term.

Vision
Our vision is to create a better world for future generations by delivering Marine ingenuity.

Mission
As a global maritime contractor, we focus on dredging, oil & gas infrastructure and offshore wind. We work safe and closely with our clients and stakeholders to create innovative and sustainable solutions.

3.1  Dredging

More than half of the world’s population lives in cities. The world’s urban population currently stands at 3.7 billion people and is, with an expected to double by 2050. This has resulted in a growing worldwide demand to create more living space. Van Oord is adapting to these changing market conditions with our global marine engineering projects.

Dredging is our signature talent, one that we have perfected continuously since our business was founded. We maintain our position in traditional dredging markets and in our home markets thanks to the best dredging equipment and operational experience, supported by our local branches.

3.1.1  Romanian Coastal Reinforcement Project Awarded to Van Oord

Van Oord has been awarded a contract to reinforce the coast at the Romanian seaside resort of Eforie. Existing coastal defences will be redeveloped to make way for more nature-friendly alternatives.

3.1.2  Van Oord Strengthens Dredging Fleet with Third New Hopper

Van Oord has decided to use the option of ordering a third trailing suction hopper dredger at Keppel FELS Limited. The vessel is similar to the two vessels that Van Oord ordered in May 2018. Each one has a hopper capacity of approximately 10,500 cubic metres and measures 138 metres in length and 28 metres across the beam.
3.1.3 Van Oord Awarded Large Mexican Land Reclamation Project

The Mexican President Andrés Manuel López Obrador, gave the ‘go-ahead’ for the land reclamation associated with the new PEMEX (Petróleos Mexicanos) refinery in Dos Bocas, Tabasco. Within 10 months, Van Oord will reclaim 12 million cubic metres of sand to create 600 hectares of new land.

3.1.4 Werkendam Starts its First Job

Werkendam started work on its first project in May. The world's first LNG-powered crane vessel, it is carrying out maintenance work in the Port of Rotterdam.

3.1.5 Reinforcement of Afsluitdijk Getting Started

The Afsluitdijk will be revised in the coming years to prepare the dyke for the future. On 1 April, the Minister of Infrastructure and Water Management, Cora van Nieuwenhuizen, gave the official starting signal for work to reinforce the dyke on the Frisian side of the Afsluitdijk. The work will be carried out by consortium Levvel (BAM, Van Oord, Rebel) and will be completed by the end of 2022. After the work has been completed, Levvel will remain responsible for maintenance for a period of 25 years.

3.1.6 Van Oord and BAM International Complete State-of-the-Art Container Terminal in Costa Rica

In March, a consortium of Van Oord and BAM International completed the construction of the APM Terminals Moín in Costa Rica. The container terminal will enable products to be shipped on transatlantic routes to European and Asian markets without transshipment.
3.1.7 Van Oord Orders New Generation of Water Injection Vessels

In February, Van Oord has ordered the construction of two state-of-the-art water injection vessels at Kooiman Marine Group. The new vessels will be multifunctional and will include systems that ensure optimal deployment. The first vessel will be commissioned in late 2020.

3.2 Offshore Wind

Climate change and the need to reduce CO₂ emissions are drivers for the rising demand of renewable energy sources. With proven experience and an impressive 15-year track record, Van Oord is leading the way in the energy transition towards renewable energy by constructing offshore wind projects. We are the proud builder of the Gemini Offshore Wind Park, one of the largest offshore wind projects in the world. With its 150 wind turbines, it supplies 600 megawatts of renewable energy to 785,000 households.

3.2.1 Specialised Offshore Wind Equipment

Our vessels are solid evidence of our Marine ingenuity. With our specialised offshore wind equipment, we remain competitive in the fast-growing offshore wind market. Van Oord’s offshore installation vessel Aeolus, which we designed in-house, is purpose-built to transport and install foundations and offshore wind turbines. Heavy lift installation vessel Svanen is the largest crane vessel in the world, with a lifting capacity of 8,000 tonnes. The Nexus, Van Oord’s first cable-laying vessel, is equipped with a deck layout that was designed and developed in-house to anticipate future market requirements for challenging cable installation works.

Like our clients, Van Oord operates according to the highest Quality, Health, Safety and the Environment (QHSE) standards. Our latest safety programme, say YES to safety, reflects our attitude about working safely.

3.2.2 First Borssele III & IV Monopile in Place

After two years of preparation, the first monopile has been installed for the Borssele III & IV offshore wind farm by Van Oord's offshore installation vessel Aeolus. In the coming months, Van Oord will place a total of 77 monopiles for the Borssele III & IV and 2 for the innovation site Borssele V.
3.2.3 Ørsted Contracts Van Oord for Cable Installation at Greater Changhua Offshore Wind Farms

Van Oord has been awarded the contract by Ørsted for the cable installation works at the Greater Changhua 1 & 2a offshore wind farms. The wind farms are located between 35 and 60 kilometres off the west coast of Changhua County, Taiwan. Greater Changhua 1 & 2a offshore wind farms will supply sustainable energy to approximately 1 million households per year.

3.2.4 Aeolus Completes Turbine Installation at Deutsche Bucht Offshore Wind Farm

Van Oord’s offshore installation vessel Aeolus has successfully completed the installation of 31 turbines on monopiles at the Deutsche Bucht offshore wind farm. As the Balance of Plant contractor, Van Oord was responsible for the design, engineering, procurement, construction and installation of the foundations, inter array cables and offshore substation. The Aeolus was deployed for the transport and installation of the wind turbines.

3.2.5 Van Oord Completes Foundations for Offshore Wind Farm East Anglia ONE

Van Oord installed the last jacket foundation for offshore wind farm East Anglia ONE and delivered it to client ScottishPower Renewables in July. This achievement marks the marine contractor’s completion of its work for this major UK wind project. As a main contractor, Van Oord transported and installed all 102 foundations. This is the largest number of three-legged wind turbine foundations ever installed offshore. Due to be completed in 2020, East Anglia ONE is expected to supply the equivalent of more than 630,000 British households with green electricity.

3.2.6 Another Innovation in the Construction of Offshore Wind Farms

Van Oord and AdBm Technologies have demonstrated the new AdBm Noise Mitigation System (NMS), with support from TNO. The NMS reduces underwater noise resulting from offshore pile driving wind turbine foundations. This means less disturbance for marine mammals near the construction site. The test results are favourable. For this reason, Van Oord will be able to use the NMS in future wind farms, amongst others during the construction of the Borssele wind farm.

3.2.7 Van Oord Completed the Installation of Belgium’s Largest Offshore Wind Farm

Van Oord successfully installed the last of the in total 44 wind turbines of the Norther offshore wind farm. Achieving this milestone and already delivering renewable energy makes an important contribution to the energy transition. At the end of February, the first electricity has been generated by the Belgian
offshore wind farm Norther. Only 7 months after starting the installation of the first foundation the first power is delivered to the grid. As main contractor, Van Oord started the offshore execution in August 2018. The modified offshore installation vessel Aeolus has installed all 45 foundations at the designated locations in a record time.

3.2.8 Arkona Offshore Wind Farm Switched On

The Arkona offshore wind farm has been officially opened by German Chancellor Angela Merkel on 16 April. 'Arkona is an iconic project for future generations – built today!' The opening ceremony was held in Sassnitz, Germany, on board one of Van Oord’s installation vessels.

3.2.9 Substation Milestone for Deutsche Bucht Offshore Wind Farm

In April, Van Oord has completed the installation of the offshore substation at the 269 MW Northland Power’s Deutsche Bucht offshore wind farm in Germany’s Exclusive Economic Zone. The supersize substation with a 2,700-tonnes topside is the centrepiece of the wind farm. It houses all electrical equipment needed to transform the power from the 33 turbines to a higher voltage for further transmission.

3.2.10 Windpark Fryslân Awards Contract to Van Oord and Siemens Gamesa

Windpark Fryslân awarded the contract to build the large-scale nearshore wind farm in the Frisian part of the IJsselmeer in the Netherlands to Zuiderzeewind, a consortium consisting of Van Oord and Siemens Gamesa Renewable Energy. The contract comprises the construction of the 380-plus MW nearshore wind farm as well as service operations for at least 16 years following completion.

3.3 Offshore Oil and Gas

The growth of the world economy and population is driving the global demand for energy. To meet this demand, Van Oord delivers ground-breaking projects in a challenging offshore market. Our offshore oil and gas activities provide integrated solutions with a focus on the installation, stabilisation, and protection of offshore oil and gas infrastructure. Van Oord has led the market in subsea rock installation for more than thirty years. We have managed to maintain that position by continuously challenging ourselves and improving our expertise.

Van Oord is a niche specialist in two services.
3.3.1 **Subsea Rock Installation**

We are market leader in the seabed intervention technique Subsea Rock Installation (SRI). Our fleet of flexible fallpipe vessels enables us to stabilise and protect pipelines, cables, and other installations.

3.3.2 **Offshore Pipeline Installation**

We provide integrated solutions for the installation of nearshore pipelines, cables, and offshore constructions. With over fifty years of experience in this niche market, Van Oord offers the best specialists on the job.

3.3.3 **Van Oord Awarded Large Contract for Mozambique LNG Project**

Van Oord in consortium with TechnipFMC has been awarded a contract by Anadarko Moçambique Área 1, Lda, a wholly owned subsidiary of Anadarko Petroleum Corporation, for its Area 1 Mozambique Golfinho/Atum development. The contract will cover the Engineering, Procurement, Construction and Installation (EPCI) of the subsea systems1. Van Oord will execute the shallow offshore installation scope while its consortium partner TechnipFMC is responsible for the deep-water scope.

3.4 **Other News**

3.4.1 **A12/A15 Motorway Project (ViA15) Provisionally Awarded to GelreGroen**

Rijkswaterstaat intends to award the DBFM project A12/A15 Highway Ressen-Oudbroeken (ViA15) to the GelreGroen consortium, consisting of Dura Vermeer, BESIX, HOCHTIEF and John Laing. Dura Vermeer, BESIX, HOCHTIEF and Van Oord are responsible for the project design, construction and maintenance.

3.4.2 **Van Oord Shares Its Energy Transition Vision via White Papers**

This year, Van Oord presented two white papers. The first paper on ‘Accelerating Climate Initiatives’ to underline its sustainable ambition and to inspire everyone involved. In the white paper, the focus is on the acceleration of climate initiatives. It highlights the scale and scope of the climate challenges the world is facing and Van Oord proposes ways of meeting these challenges using adaptation measures. The second white paper sets out Van Oord’s contribution to the global energy transition.
3.4.3 Van Oord Partners with Dutch Pavilion at Expo 2020 Dubai

Van Oord is the first National Partner of the Dutch Pavilion at Expo 2020 Dubai. Netherlands Consul General and Commissioner General to Expo 2020 Dubai Hans Sandee and Van Oord’s Area Manager Koen Sweers signed an agreement sealing the partnership for the Dutch Pavilion at the next World Expo.

3.4.4 New Executive Governance Structure

The Executive Board of Van Oord is pleased to announce that as of 1 January 2020, Paul Verheul will take over the position of Hans van der Ven and has been appointed as Executive Director of MerweOord B.V., the Van Oord family holding company. Furthermore, the Executive Board would like to announce that, in close consultation with the Supervisory Board, Van Oord has decided to strengthen the governance structure. As a consequence of the Business Unit structure, initiated in January 2019, Van Oord is adjusting its leadership team with direct involvement of the Business Units. An Executive Committee will be installed to replace the current Executive Board. The Executive Committee will be responsible for managing Van Oord as a whole with a view to short and long-term goals.

3.4.5 Waterwoud Lookout Point for the City of Rotterdam

Views of the Rotterdam skyline, ships passing by and wild ducks swimming quietly: this is the setting for the city’s very first riverside landmark or ‘Maaspoint’. Known as the Waterwoud lookout point, it has been gifted by Van Oord to the people of Rotterdam to mark its 150th anniversary. The official opening by Rotterdam executive councillor Bert Wijbenga took place on 5 November 2019.
3.4.6 Second Sand Motor Successfully Completed

In September, Van Oord, working as part of Team Van Oord, successfully completed the Bacton to Walcott Coastal Management (Sandscaping) Scheme. During the festive ceremony, the project was handed over to client North Norfolk District Council (NNDC). The project milestones include the decommissioning of existing outfalls and installing a new outfall. To protect important infrastructure from flooding and benefit local communities, sand will be placed on the beach off Bacton Gas Terminal, Bacton village and Walcott village. Van Oord will be deploying a large trailing suction hopper dredger and a backhoe dredger.

3.4.7 Biofuel Pilot for Vessels

Together with Shell, Van Oord is testing the use of biofuel on its fleet. The biofuel reduces CO₂ emissions by more than 40% compared with conventional marine fuel. This test fits in with the ambitions of both parties to reduce the CO₂ emissions in the maritime industry. The first pilot will take place during a dredging project in Germany on Van Oord’s trailing suction hopper dredger HAM 316.

3.4.8 Partner in Nature Documentary The New Wilderness

Van Oord and film companies EMS and Veldkijker have signed a sponsorship contract for a new nature film, Wild Port of Europe. The film will be screened in 2021 and is a dramatised nature documentary about the Rotterdam port area.

3.4.9 Van Oord and Mammoet Enter into Promising Cooperation with Scale-Up Verton

Van Oord and Mammoet are joining forces in a partnership with the promising scale-up Verton to develop a new lifting method for installing wind turbine blades. The company was scouted via the maritime innovation platform PortXL.

3.4.10 Revenue and Profit

In 2018, Van Oord recorded €1.88 billion in revenue (2017: €1.53 billion) with a net profit of €92 million (2017: €78 million). The increase in revenue was mainly driven by offshore wind activities, which realised €706 million of revenue (2017: €403 million). Revenue in the Netherlands also increased to €115 million (2017: €82 million). In Dredging the revenue from international activities (€852 million) was similar to 2017 (€841 million) reflecting ongoing difficult market circumstances. The same applied to Offshore with a revenue level of €203 million (2017: €204 million).

3.4.11 Van Oord and PortXL: Frontrunner in Innovation

Selecting the best start-ups and scale-ups for the maritime industry, that is the goal of the innovation programme PortXL. The names of the start-ups and scale-ups were announced in February. Van Oord is one of the founding partners and for the fourth time in a row main sponsor of the PortXL programme. By means of this port and maritime accelerator platform, we encourage innovation within the global maritime industry.

3.4.12 Sustainable Earth Actions

In 2019, Van Oord introduced the programme S.E.A which stands for Sustainable Earth Actions. Sustainability, innovation, and collaboration are key to facing global challenges successfully. That is why we have started our game-changing programme to live up to the promise of the world that was left for us, and to leave a world behind worthy of future generations. There is no time to waste. It is time for action, time for S.E.A.
4

4 PORT OF ROTTERDAM IN 2019

The Port of Rotterdam is Europe’s largest seaport. It owes its leading position to its excellent sea access, intermodal connections and the 385,000 people who work in and for the port and industrial area. It’s the place to realise boundless ambitions! The core tasks of the Port Authority are to develop, manage and exploit the port in a sustainable way and to deliver speedy and safe services for shipping.

Together with our partners and clients, we experienced special moments and took fantastic steps in 2019 to make the Port of Rotterdam even smarter, safer and more sustainable. If you would like to know what went on in the world’s most stunning port this year, view our year film. Click here.

4.1 Smartest Port. Connecting the World.

The port extends over an area of more than 40 kilometres, welcoming 30,000 sea-going vessels and 120,000 inland navigation vessels annually and handling 470 million tonnes of goods. Earnings of 45.6 billion euros, about 6.2% of Dutch GDP, are generated in the area. More facts & figures about the port? Click here.

Port of Rotterdam is the largest port in Europe and in the last years recognised as the port with the best infrastructure in the world [source: World Economic Forum]. To keep our position the port has to be transformed into the smartest port. Only then we will be able to deal with challenges such as climate change and embrace new developments such as digitalisation. We have to adapt to the changing world by transforming ourselves into a completely digital and climate-neutral port. Digitalisation is vital to work with the autonomous ships of the future: we expect to see the first autonomous vessels arrive in our port before 2030. In this summary, we will focus on examples of digitalisation. Click here for a film about digitalisation in the Port of Rotterdam.

4.2 Below we Highlight Some Recent Projects that Contribute to this Ambition.

4.2.1 IoT Platform

The development of the IoT platform is a joint effort with strategic partners (Cisco, IBM, Esri and Axians) led by the Port Authority. The Internet of Things refers to use of semi-intelligent objects that communicate independently with each other and exchange data through the Internet. The sensors installed on and in the port infrastructure transmit a constant stream of monitoring data to the platform. Thanks to the cloud platform and the real-time information generated about, for example, infrastructure, water and weather conditions, we can further improve (mission-critical) processes in the services we deliver to our clients.

The generic building blocks that have been implemented in our platform provide the Port of Rotterdam Authority with a secure and reliable basis for rapid innovation, with access to the latest technologies such as edge computing, real-time analytics, artificial intelligence, hyper-precise data and blockchain. And this is essential; the port area is developing rapidly all the time, and new physical infrastructure is increasingly digital. Sensors on and in quay walls, bollards, roads, waterways and traffic signs generate continuous information flows and communicate with other autonomous systems.

The core of the platform was completed in January 2019. The first application implemented on the IoT platform was the hydro/meteo application. This is the first time the generic IoT platform has been used for a mission-critical application. It goes without saying that the strictest standards apply in terms of security, reliability and standardisation because the application is essential to support the decisions that ensure the safe and efficient handling of shipping.

The Port of Rotterdam Authority will continue to invest in the coming years in the IoT platform, real-time data, cognitive cloud services, future AI and the development of a Digital Twin (in other words: the digital representation of physical reality). These are developments that we can only realise jointly, therefore we invest in strategic partnerships.
4.2.2 Programme Innovation Infrastructure (I²)

In 2019, Port of Rotterdam divisions Harbour Master, Asset Management and Port Development jointly work on the programme Innovation Infrastructure (I²). The aim is to realise lower costs over the lifetime of the port assets, more cargo per berth and less emission. The projects are diverse: from scientific to practical research, but always with a strong civil engineering character. Figure 1 shows how port authorities or terminals can make better use of data by distinguishing and connecting commercial, asset-management and data-management cycles. In the asset-management cycle, data allows us to lay foundations for data-driven and risk-based decisions to optimise the required maintenance. In addition, data-driven information will enable us to continuously improve our understanding of our port. In the data-management cycle, data analytics in combination with advanced models can be used to update function requirements, which boosts the commercial cycle, e.g. by creating new business opportunities.

![Diagram](image)

**Fig. 1:** Optimising functionality, maintenance and guidelines using quay-wall data [Roubos, 2019]

4.3 We Are Pleased to Describe Some of the Research Projects:

4.3.1 Project 1: Asset Lifetime Extension

In the coming years, fifty percent of the quay walls in the port of Rotterdam will approach the end of their intended fifty-year design lifetime and become part of lifetime extension programmes. A recent study [Roubos, 2019] shows that most of the marine structures in Rotterdam are still in good condition. New methods were developed to determine the remaining service life, to make better use of existing structures and to improve the design of new quay walls.
4.3.2  Project 2: Field Test Quay Walls

In addition, the Port of Rotterdam authority invests in full scale field tests in order to derive insight into the actual capacity of critical structural components of their assets. In 2019, the effects of bow-thruster induced currents on the stability of bottom protection were tested using the largest inland barge in the Netherlands (‘Vorstenbosch’, Fig. 2). Propellers of ships generate high flow velocities adjacent to quay walls, jetties and locks. Generally, a bottom protection is installed to prevent to scour and resulting instability of the structure. Although design guidance exist, propeller-induced loads are far from understood and have predominantly been derived on the basis of model tests. A series of new field measurements has therefore been conducted in November 2018 and in June 2019, in which the propeller-induced flow velocities were measured. The objective of the measurements was to obtain a better understanding of the flow velocities that occur near the bed and to verify the applicability of design methods presently in use. The results will be presented at the PIANC-COPEDEC Conference in 2020.

![Fig. 2: Bow-thruster induced loads acting on a quay wall (left); Test setup foundation piles at Maasvlakte 2 (right)](image)

4.3.3  Project 3: Field Test Foundation Piles

In 2017, the pile factors were significantly reduced. This led to an increase in construction costs and has a negative influence of the carbon footprint of marine structures, while no damage was recorded in practise. Port of Rotterdam tested 12 foundation piles until failure in December 2019. The goal of this static load testing programme was to acquire insight into the actual bearing capacity of these foundation piles and to optimise the design of future quay-wall projects. The test setup consists of an anchored steel spider-shaped frame and 6 hydraulic jacks (Fig. 2). With a maximum test load of no less than 2,500 tonnes (2,5 million kg) and state-of-the-art measurement techniques. The results will be published and presented at one of the future PIANC conferences.

4.3.4  Project 4: Predictive Modelling

Since quay walls are increasingly equipped with sensors, a great deal of data has become available. This data in combination with the results of full-scale failure tests can serve as input for predictive modelling and fostering reliability and safety (see Fig. 1). Data-driven research is of the utmost importance to support maintenance of design guidelines and to validate new methods.

4.4  Upgrade Your Knowledge

Would you like to be informed about the developments in the port? Check out our online magazine Rotterdam Port Magazine (theme of the first edition: digital transformation!). Or subscribe to our newsletter here or get inspired by our white papers, reports and expert videos.
5 TRELLEBORG IN 2019

Trelleborg’s Marine and Infrastructure Operation: A 2019 Review

2019 was a notable year for Trelleborg’s marine and infrastructure operation with the business widening its remit to include the manufacture and supply of advanced polymer solutions for railways, bridges, tunnels, buildings and power plants in addition to marine fenders, docking and mooring, navigating and piloting and oil and gas transfer link solutions.

5.1 Driving New Standards for Marine, Port and Built Infrastructure

Through its ongoing investment into fender performance research and development, Trelleborg continues to meet the market's demands for high-performance, smart, sustainable solutions that protect assets, the environment and people across marine, port and built infrastructure.

In 2019, Trelleborg’s ability to do exactly that strengthened with the appointment of technical expert, Mishra Kumar, as Research & Development Director. For over 18 years, in his previous role as Technical Director for Marine Fenders, Mishra has been instrumental in several breakthrough research findings and has authored and presented numerous white papers at conferences across the globe. The most recent paper he authored was a new five-step guide to authenticating fenders. This will help designers, operators and owners of port infrastructure procure these systems more confidently, safe in the knowledge that they are investing cost-effectively in equipment that guarantees quality and reliable performance over the long term.

His unrivaled technical expertise has helped Trelleborg to continue leading the conversation in best practice fender specification, design and manufacture, refocusing the industry on high quality solutions that will help to protect port infrastructure and investment. In his new role, Mishra will help Trelleborg to better harness its research and development capabilities, in particular its knowledge and skills associated with rubber materials and applications engineering. As such, Mishra will facilitate the alignment of Trelleborg’s research and development activities with market demands and will spearhead business future research and development projects.
Mishra is Trelleborg’s representative for PIANC’s Working Group (WG) 211, which aims to update its 2002 ‘Guidelines for the Design of Fender Systems’ – marking a significant step towards industry-wide fender best practice. These changes will include updated guidance on the design, manufacture and testing of fender systems, including both the rubber element of the system and associated components. The group will also review guidelines for durability, maintenance and repair of fender systems and the implications of automated mooring systems on fender design.

5.1.1 PIANC YP-Com

As a PIANC Platinum Partner since 2014, Trelleborg is a longstanding advocate of the Association and its tireless efforts in driving up standards for fender best practice. Over the course of 2019, Trelleborg further strengthened its relationship with PIANC.

As a main sponsor, Trelleborg delivered a presentation on marine fender performance verification at The Biennial Technical Event (BTV) PIANC conference. BTV, which took place in Singapore in June, is an important and prestigious event in the PIANC YP-Com calendar for professionals working in maritime and waterfront infrastructure. At the event, Mishra discussed the issues that exist with the current performance reporting of fenders by manufacturers, as well as full scale testing on finished products, to guarantee fender performance.
5.1.2 Technical Seminars

Trelleborg hosted multiple Smarter Approach technical seminars across the globe for port owners, operators and consultants. This included a session on fender performance on board The Queen Mary Hotel in California, USA, covering the history of fenders in North America, rubber fender chemical composition, TGA Testing, and more.

The seminar at the Queen Mary Hotel touched on Trelleborg’s mooring expertise and SmartPort technology. SmartPort powers the critical interface between ship and port, on land and at sea, connecting port operations, allowing operators to analyze performance and use data to improve decision making. SmartPort integrates a number of intelligent assets which turn operational data into actionable insights. The sensor-equipped assets – including fenders, mooring equipment, ship performance monitoring and navigation systems – capture every aspect of the critical events at the port and vessel interface.

5.2 Updated Online Tool

In 2019, Trelleborg launched a new release of the online fender tool, with enhanced features, including specification generators for fenders and bollards and a fender system selector for ship-to-ship applications. Developed in accordance with PIANC guidelines and British Standards, the tool simplifies fender selection, reducing hours of work to a few clicks. In 2020, it will also be available for use on smartphones and tablets, and in different languages.

5.3 Capturing the Critical Events at the Port and Vessel Interface

Progressive ports have acknowledged that a digital mindset and smart technologies are now a crucial requirement in preserving a competitive advantage. Of the many areas that can benefit from digitalisation, the port and vessel interface is perhaps the one with the greatest potential. The challenges
at the interface are increasing the need for an integrated offering. One that can manage communication and data capture for shared standards and processes, while delivering technology driven insights.

Leading the way in digitalising a critical piece of the port puzzle, SmartPort by Trelleborg provides a solid foundation for the continued journey towards the port of the future. The technology encompasses a package of capabilities, which addresses a versatile range of client challenges at the port and vessel interface. These enable all parties to corroborate each other’s critical data points, such as position, speed and angle, at any one moment in time. In turn, this is improving safety, efficiency, sustainability and throughput for all, in a variety of port environments.

All sensor-equipped assets are connected through the SmartPort cloud, which can be accessed by operators using any hand-held device. Information in SmartPort is captured in real-time and stored for historic accessibility, in a clear and uniform manner. It covers every aspect of the critical events at the port and vessel interface to keep users up-to-date with any activity taking place. Time-consuming paperwork and mistakes due to poor communication or information asymmetries are things of the past.

SmartPort by Trelleborg is already operating and adding value to ports and terminals around the globe, providing ports and operators with as much real-time intelligence and line-of-sight as the vessel they are managing into berth has.

A Middle Eastern port has been retrofitted with the SmartFender monitoring system. The fender boxes enable the port to accurately capture vessel berth and performance data in real-time, including fender deflection, distance to vessel and jetty, and vessel velocity. The data is continuously and wirelessly fed to the SmartPort cloud and is available via a mobile or desktop device.

By utilising the insights from heavy berthing events provided by the SmartFender, the port operator, aims to improve operations by swiftly pinpointing vessels operating outside the set parameters and prevent accidents. For example, operators will be immediately aware of approaching vessels exceeding velocity limits, angle restrictions or any other defined parameter. In doing so, the port operator is set to significantly reduce its spending on replacing damaged fenders every year.

5.4 Eliminating Passing Ship and Wave Effects to Improve Efficiency

Increasing operational efficiencies is a key goal of most ports and the shipping industry as a whole. External forces such as inclement weather, long period waves and the effects from passing ships can reduce berth efficiencies by increasing the motions of the ship at berth. In the worst-case scenario, it can result in reduced throughput and downtime.
However, more progressive ports are incorporating automated and technology-driven equipment, to reduce and even eliminate these effects, enhancing safety and efficiency in berthing and mooring operations.

To highlight the benefits of using technology-driven solutions, Trelleborg has launched two white papers. The first, titled ‘Application of Dynamic Mooring System’, highlights the elimination of passing ship effect to allow for a greater product transfer window. To do so, it compares the performance of a traditional static mooring line arrangement with Trelleborg’s DynaMoor. DynaMoor combines Trelleborg’s class leading Quick Release Hooks with an innovative constant tensioning system. The product’s objective is to maintain tension on vessel-at-berth mooring lines in order to reduce vessel motions caused by environmental, metocean or passing vessel effects. A second form factor from the linear Type-L unit developed in 2018 is the compact rotary DynaMoor Type-R, that has the potential to be installed on limited mounting space areas such as mooring dolphins, which will be a definite benefit to port operators worldwide.

The second white paper, titled ‘The Effects of an Automated Mooring System’, shows the results of a study that applies long period wave forces to a moored vessel, benchmarking AutoMoor, Trelleborg’s automated mooring system, against a conventional static mooring line arrangement. The white paper demonstrates the effectiveness of AutoMoor, explaining how AutoMoor units showed that the peak and average motions in surge and sway were reduced substantially. It also explains how AutoMoor achieved 75 % of motion off berth at a level less than the lowest 25 % of that with mooring lines. The reduction in vessel motions indicates an increase in berth operability for product transfer from 65 % to 95 %.

5.5 Notable Contracts

5.5.1 Marine Fenders

In recent years, Trelleborg has strengthened its position as a world leader in the design and manufacture of high-performance, advanced marine fender systems, with several high-profile contract wins.

This year, Trelleborg supplied its Cone fender systems to a port in Australia. 42 ready-to-install units were supplied to a berth at the port, enabling the port to cope with high utilisation of its berth. The supply of the pre-assembled fenders means the port will be able to install the fenders in a timely, two-week shutdown window, helping to minimise downtime.

In 2019, Trelleborg supplied its Cone fenders to a separate port in Australia, which helped the port meet the demands of the growing cruise industry.

Trelleborg’s Cone and Foam fenders were supplied to various other projects in 2019, in addition to mooring equipment to a chemical berth in Qatar.

Predominantly driven by the global demand for LNG throughout 2019, Trelleborg’s Pneumatic fenders were supplied to a multitude of global ship-to-ship operations.

Major cruise terminals in the US also installed Trelleborg’s Foam fenders to accommodate the latest generation of cruise vessels.
5.5.2 Docking & Mooring

AutoMoor continues to gain traction as the preferred automated vacuum mooring solution, with two new orders received from Port of Tallinn in Estonia and Port of Mariehamn in Finland. Both sites will commence the servicing of large RoPax ferries operating in the Baltic region in 2020.

5.5.3 Navigation and Piloting

Trelleborg supplied its latest navigation and piloting solution to PrimePort Timaru in New Zealand, as part of an upgrade in order to increase capacity at the port and facilitate the accommodation of larger vessels.

Enabling the port to berth Rio-class ships, which can handle up to 5,900 TEUs, PrimePort installed Trelleborg’s SafePilot CAT MAX. The solution consists of heading and positioning units, which can communicate with each other and the pilot’s display via Wi-Fi. It also boasts an integrated six-axis gyro/motion sensor, offering precise and independent rate of turn, roll, and pitch. This, coupled with the capability to charge wirelessly, makes SafePilot CAT MAX an ideal solution for ports where accurate under-keel clearance is of significant importance.
5.5.4 Infrastructure

Following the success of its partnership for the construction of the Hong Kong Zhuhai Macau Bridge, in 2019 Trelleborg signed another contract with CCCC Fourth Harbor Engineering Co., Ltd, one of China’s largest infrastructure construction services institutions. This time for the supply of its industry leading Gina gaskets and Omega seals to China’s Shenzhen-Zhongshan Link.

The link, which connects Shenzhen and Zhongshan, is 24 kilometres in length and consists of two artificial islands, two bridges and a two-way, eight-lane tunnel that has a width of up to 46 metres, making it the largest and widest immersed tunnel in the world upon completion in 2024.

5.6 Continued Manufacturing Capabilities Investment

Trelleborg is committed to continually enhancing its operations across its manufacturing facilities in, Berryville in Virginia and Broussard in Louisiana, USA., Qingdao in China, Melbourne in Australia, and Ridderkerk in the Netherlands. The foam product manufacturing facility in Berryville, Virginia, supports global sales, application engineering and design, as well as the manufacturing of Foam-filled marine fenders and specialty buoys.

The large steel production capabilities of our Louisiana based fabrication facility in Broussard enables us to effectively deliver turn-key fabrication projects on time, on budget and of the highest quality. The strategically located waterfront facility positions the company to accommodate contracts requiring US domestic content as well as support water loadout of fully assembled marine fender systems and dockside equipment. This includes components that are typically too large to import to customers across North and South America in a commercially feasible manner.

Trelleborg’s docking and mooring manufacturing facility in Melbourne includes a state-of-the-art office environment which enables the teams there to provide enhanced customer services. Incorporating the latest technologies, the layout provides a greater experience for Trelleborg’s customers, while also improving Trelleborg’s internal project workflow, product development and inter-team collaboration.

In 2019, Trelleborg’s facility in Qingdao, celebrated its 10-year anniversary since its inception. Upon opening in 2009, Trelleborg Qingdao specialised in the development of polymer-based solutions for infrastructure projects, including fender systems for harbours and dredging hoses. With its expansion, the 40,883 m² manufacturing facility and sales office, with approximately 230 employees, now supports the operation’s marine fender, marine technology and infrastructure product areas across Chinese markets.

2019 also saw Trelleborg begin production of its Gina Gasket locally for the Chinese market, following the addition of a new manufacturing line at the Qingdao-based facility. Gina Gaskets have historically been designed and engineered at Trelleborg’s Ridderkerk facility. However, now with the capability to produce these solutions in Qingdao, water management
projects across China can benefit from Trelleborg’s long-standing Dutch heritage, unrivaled knowledge and engineering expertise.

Trelleborg’s Ridderkerk manufacturing facility also had cause for celebration in 2019, celebrating its 140-year anniversary since its inception. The factory has a proud history which began back in October of 1879 when Bastiaan Bakker started the company. It remained a family-owned company (Bakker Rubber) until 1985 when it was acquired by Trelleborg. Over the years, the company has produced a range of high-quality, high-performance solutions ranging from dredging hoses and fenders all the way to rubber hammers, bicycle and airplane tires as well as parts for the Dutch Royal Family’s Golden Carriage.

Today, Trelleborg is the global market leader for sealing systems for immersed tunnels and grout seals for the installation of offshore wind farms. Building on Dutch heritage, Trelleborg is also one of the leading companies to design and produce water management sealing and damping solutions. The history and expertise of its Ridderkerk facility has resulted in a portfolio of major projects such as the Øresund tunnel project connecting Denmark and Sweden and the second Coen tunnel project in Amsterdam, in addition to the Hong Kong Zhuhai Macau Bridge and the ShenZhong Link.

5.7 2020 and Beyond

2019 has proved yet another extremely exciting and successful year for Trelleborg. With PIANC continuing to enhance best practice across the industry, Trelleborg looks forward to continuing its support of this important organisation throughout 2020 and beyond.
Over the course of more than 50 years of work in the fender industry, the ShibataFenderTeam Group has made it one of their main responsibilities and core values to develop a holistic approach for fender design. 2019 was strongly characterized by the consolidation of our integral strategy to designing and manufacturing fender systems and continuing to share our profound knowledge with the industry.

Our unconditional commitment to engineering excellence, value engineering and dedication to high-quality fender solutions remains undiminished. As a PIANC Platinum Partner, we actively keep contributing to the fender industry’s standards and guidelines with the publication of the second part of our White Paper Series, the participation in technical Working Groups and the support of local, regional, and international networking meetings and events for PIANC’s Young Professionals to name only a few of our engagements to research and education in the fender industry.

But even as a world-leading company in fender production and our ever exciting and growing international projects, our role goes beyond that of a designer and manufacturer. We consider our clients part of the team, supporting them as partners and providing excellent products as well as technical expertise. In 2019, we have further extended our global presence, strengthened our position in the global market and consolidated our focus on the holistic approach to fender design – setting our sails to an even more successful 2020.

6.1 Mixing. A Step by Step Operation

In 2019, we focused on research, responsibility, and engineering excellence with the second part of the SFT White Paper Series. The series that was introduced in 2018 with the first part on the correlation between the performance properties of a superior fender and its constituent components. With Paper number two of the four-part series, we are providing an overview of the rubber compound’s mixing process and sharing expert insights with our stakeholders on the preparation and blending steps of the raw materials and how this impacts the performance of a rubber fender. Since no two fender projects are alike, the individuality in the production process for each project is essential.

'Mixing. A Step by Step Operation' outlines the individual steps of rubber mixing in order to create an insight in this very sensitive part of fender manufacturing. By examining the complex interaction between materials and their processing and presenting the various available mixing devices, it becomes clear to which extent high-quality fender production depends on the expertise of the manufacturer. Choosing and properly operating the equipment is subject to long-standing experience in this significant part of fender manufacturing.

The complexity and the infinite number of possible rubber compound compositions and various mixing techniques, as well as individual requirements for each different rubber product, make it difficult to determine unifying procedures.

The SFT White Paper Series provides unbiased facts on fender manufacturing and will continue with part 3 that will delineate the manufacturing and curing process.
6.2 Factory Breakthrough in Malaysia

Providing safety critical equipment, ShibataFenderTeam has a strong focus on producing all major components in-house ensuring highest quality and reliability at their own production facilities in Europe and Asia.

In 2017, Shibata Industrial continued to expand their global rubber production capacities with an advanced new facility in Klang, Malaysia.

The factory already started with rubber mixing in 2018 and initiated the fender production in 2019. One of the first orders has already been the most comprehensive one for the company to date: 199 CSS 1700 Cell Fenders with 6,100 mm x 3,370 mm steel panels for the new mega port in Tuas in the West Region of Singapore are scheduled for delivery and installation in 2021.

For the production of the fenders, 645 t of rubber compound will be produced in-house in the new factory. Next to the rubber compound production, all the other fender manufacturing steps from compounding to curing and testing will be taking place on-site in Klang pursuant to the SFT Group’s high-quality standards.

![First fenders at the new factory](image)

The complete in-house production, including state-of-the-art fender testing equipment, and certified laboratories for all rubber batches, provides the SFT Group with the opportunity for full quality management, thus responding to the high demand for their world-class rubber fenders.

6.3 Fender Systems – Made in Germany

One of the largest projects executed in our production facility in Rechlin, Germany, in 2019 had been the exclusive overhaul and extension of a layby and waiting pile position at Finkenwerder at the entrance of the Port of Hamburg.

Our long-established German production facility is located approx. 100 km north of Berlin and was founded in 1993. Having started as a small steel workshop with only 4 welders back then, it is an ISO 9001 certified production plant which employs approximately 35 people today and one of our flagships for our proven tradition in fender manufacturing with its three production lines:
1.) Our ISO EN 1090 certified steel workshop produces steel fender panels and other steel constructions up to execution class 3 with sizes of up to 15 metres length, 5 metres width, and individual weights of up to 30 tonnes – including sandblasting and painting.

2.) Our extrusion line produces eco-friendly HD-PE Sliding Fenders made from recycled PET bottles with various cross sections of up to 300 x 300 mm and lengths of up to 6,000 mm to replace tropical hardwood.

3.) Our foam line manufactures foam filled fenders, such as Ocean Guard, Ocean Cushion and Donut Fenders as well as buoys of different types of up to 4,000 mm.

For the Port of Hamburg, 10 berthing piles were equipped with 4 fully refurbished and 6 totally new fender systems made with steel panels of 11 metres height, 3.5 metres width and a weight of over 20 tonnes each. All steps of the refurbishment process had been performed in Rechlin, including the dismantling of the PE plates, the blasting and coating of the steel panels and the mounting of the PE plates.

Besides the extensive experience in the production of all kinds of fender systems and solutions, we are keeping a large stock of all raw materials in Rechlin in order to serve our customer’s needs within the shortest possible time.

This package of high-quality production in the heart of Europe plus a full installation and after sales service package has convinced several customers to place exclusive and long-term contracts with us.

6.4 Keeping Competence within Reach: Global Presence of SFT

At ShibataFenderTeam, we have attached a great emphasis to a well-established global network of local representatives on six continents. Our local contacts provide our clients with regional support and customized fender solutions all over the world - no matter where they are.

One of the events that foster our SFT network via personal contact and exchange is the biennial Agent Meeting, where our agents gather to stay informed on industry developments to keep up our high internal quality standards.

In 2019, our Agent Meeting took place in Kuala Lumpur where we took the opportunity to show the new factory to our sales teams and agents. The focus was placed on our holistic approach as well as the steps of fender system manufacturing which were demonstrated on-site.
The benefits of the broad positioning of our local representatives is also reflected in our customer proximity: we have opened a new office in the Netherlands that is going to be staffed with 7 industry experts by the end of 2020. Our new office which is based near Eindhoven has an immense impact on our leading position in the world markets. Its successful launch is reflected in supplying fenders for a new multi-million GBP project: Tilbury2, a new port terminal for the Port of Tilbury London Limited (PoTLL).

6.5 The Heart and Soul of ShibataFenderTeam: An Insight into SFT Engineering

With the overall target to protect people, ships, and port infrastructures, engineering excellence and project-specific solutions are crucial in the fender industry. With many decades of experience, the SFT Group has increased its engineering capabilities to a point where the emphasis on a holistic approach to fender systems is stronger than ever before. The focus on customised and ideally balanced fender system designs is one of SFT’s main strengths, improving the fender systems’ performance as well as its service life. Our holistic approach reduces maintenance, replacement, and consequential costs at the terminal.

Our engineers design high-quality fender solutions taking into account all the individual elements of a fender system, thus following a genuinely holistic approach. With our engineering expertise, SFT views beyond to what looks good in a drawing, because it might not work in the field. Each project has diverse requirements that are all equally important when designing a fender system and we are highly committed to increase the industry’s awareness of the relevance of a comprehensive concept. The consequences of overall design problems and typical failures should never be underestimated which is why we at SFT make it our effort to clear up common misconceptions about fender system design.

Our advanced engineering services are available in all our regional offices, providing our stakeholders all around the world with the opportunity to directly communicate with our experts at all times. In-house seminars and workshops on this topic round out SFT’s portfolio of activities to share experiences, strengthen customer knowledge of fender design, and at the same time learn more about their particular needs.
6.6 Promoting Progress with PIANC Working Group 211

The new MarCom Working Group 211 is working on an updated version of PIANC’s ‘Guidelines for the Design of Fender Systems’ in order to meet the latest requirements set by stakeholders and to ensure an approach to fender testing and design that leaves no room for interpretation. The Working Group is making rapid progress, with ShibataFenderTeam as an active and leading industry member contributing their expertise.

With our holistic approach to fender systems, we commit to conveying our knowledge to the Working Group as an independent body in order to ensure transparent international quality standards as a firm and reliable basis.

The new guidelines should encompass a unified verification for the performance and the correction factors of a fender, while considering that the complexity of manufacturing as well as individual requirements for each different fender project make it difficult to determine unifying procedures.

The SFT Group advocates for the inclusion of design aspects for the entire fender system to the new guidelines that ensure a high-quality fender product for the client. The guidelines should at the same time be open for innovations and every high-quality fender manufacturer.

SFT actively supports the combined focus of all parties to ensure that the new guidelines offer increased transparency on test procedures and verification for clients.

6.7 International Innovation Network: PIANC YP

Within our role as a PIANC Platinum Partner, we are happy to be able to continue cooperating and contributing not only to the high quality of PIANC’s publications and guidelines, but to encourage aspiring Young Professionals, too.

In 2019, one of the events that SFT took part in as a gold sponsor was PIANC Singapore’s and YP-Com International’s first Biennial Technical Visit (BTV) that was held in Asia. In June, experts from around the world had the chance to present the results of their latest research. Shibata Industrial shared their knowledge with a presentation on state-of-the-art rubber fenders.

From 11 to 13 September, SFT attended and sponsored NordPIANC, a bi-annual event organised by the PIANC National Section of Denmark where we presented our holistic approach to fender system design and a special focus on the Nordic countries.

In early October, the Spanish PIANC Young Professionals invited their members to a 2-day technical conference hosted in Menorca. As both PIANC Platinum Partner and Corporate Member of ATPYC in Spain, we took the opportunity to once again engage closely with the successful future of the industry. We contributed to the event as one of the sponsors and presented key aspects for the holistic approach to durable, high-quality fender systems.

It is always a pleasure and an honour for us at SFT to share our experience in fender design with the industry and its ambitious Young Professionals and we would like to thank PIANC at this point for organising the events and are looking forward to continue networking and sharing our insights in 2020.
6.8 Our Projects

SFT's orders continue to speak their very own language in 2019: The demand for our high-quality marine fenders has seen a continuous growth over the last years which has led to an increasing worldwide project volume and recurring opportunities for major contributions to the international waterway infrastructure. Looking back at a year of so many meaningful and successful projects, we would like to thank everyone who devoted their expertise to growing with us.

6.8.1 Tema Port, Ghana

Our most comprehensive project of 2019 provided fender systems for the expansion of the Tema Port infrastructure in Ghana which is facing 1,400 m of new quay wall, 127 hectares (314 acres) of new terminal, 3,550 m new break water and four deep-water berths for container ships with up to 16 m draft and 20,000 TEU capacity. The extent of the project is currently unprecedented and contributes to the role of Tema Port as the most important container ports in the sub-Saharan region.

SFT delivered 107 SPC 1300 Cone Fender Systems and 144nos. 150 t T Head bollards. With the advanced design and value engineering of the fender systems, SFT was able to find the best technical and economical solution for Tema Port.

6.8.2 Aqaba Container Terminal, Jordan

In 2013, SFT equipped the newly built Aqaba Container Terminal with SPC Cone Fenders. Following the successful construction of the terminal, the second order for the extension of the terminal contained 82 SPC 1300 Cone Fender systems, 100 V Fenders, 46 T Head Bollards with 100 t capacity and 48 steel safety ladders for the 460 m berth extension of the container terminal.

The Aqaba New Port is a significant Red Sea hub as the only container port in Jordan, with capacities of 1.2 million TEUs and 1 km of berthing. The SFT Group is very proud to have contributed its high safety standards to this 2-phase-project which is essential to the economic growth of Jordan and surrounding countries.

6.8.3 Amador Cruise Terminal, Panama

With the new Cruise Terminal in Amador, Panama seeks to increase cruise tourism with an eye to potentially serving as a home port for cruise vessels. Subsequent to dredging the navigation canal and terminal area, the new terminal consists of a pier with two berths and a total length of 366 m and can accommodate 2 mega cruise ships and handle all their passengers simultaneously.
SFT successfully developed a customized solution to accommodate the fenders to a broad range of tides and delivered 18 Ocean Guard Fenders of the size of 3,300 x L 6,500 mm within a short time frame. Ocean Guard Fenders are foam fenders which are the perfect choice for cruise terminals since their urethane skin does not leave marks on the white hull of cruise vessels.

SFT congratulates on the first cruise season in Amador and is happy about this contribution to Panama’s tourism sector and the sustainable development to the country.

With the foundation that the ShibataFenderTeam Group has laid over the last 50 years and the continuing pioneer work in 2019, we are looking forward to a fruitful and innovative 2020 – further incorporating our holistic approach and expertise to keep operating as a world-leading fender system manufacturer and an advisor guide for the industry.
CREATING INNOVATIVE NAVIGATIONAL INFRASTRUCTURE

Boskalis continually invests in the development of new methods and technologies to make our work more sustainable, efficient and effective. Innovation is crucial to retaining our position as a leading maritime services provider. This is required, to keep up with trends, be able to execute more complex projects and be competitive. Boskalis staff is encouraged to be actively involved in the development of innovations and solutions. This year the Boskalis Innovation Challenge was again organised, where employees could pitch their ideas. A number of these ideas are chosen to be tested and successful ideas are taken into use.

A number of innovative projects and developments have been realised this year of which a few are highlighted below. The projects illustrate the broad portfolio of Boskalis’ specialist activities:

- Construction of dykes
- Marine heavy lift transport
- Dredging and dry earth movement
- Dredging and construction
- Dredging in sensitive environments

Boskalis is a leading dredging and marine expert, providing a wide range of services comprising of:

- the construction and maintenance of ports and waterways, land reclamation, coastal defense and riverbank protection
- the execution of projects and marine services for the offshore energy sector including subsea, heavy marine transport, lift and installation services
- marine geophysical and geotechnical surveys
- towage and terminal services
- marine salvage services and projects

With safety as our core value we provide all-round, tailor-made innovative and sustainable solutions for infrastructural challenges in the maritime, coastal and delta regions of the world. Realising projects in remote locations – with a heightened environmental focus – is one of our specialties.
7.1 **Houtrib Dyke – World’s First Sandy Dyke Protection in a Lake Environment**

Boskalis has been working on strengthening the 25-kilometre long Houtrib dyke, located between Enkhuizen and Lelystad in the Netherlands. An innovative solution was used to strengthen the dyke, located in a lake environment, with the use of sand instead of hard material.

The project is being executed for client Rijkswaterstaat in a joint venture with Van Oord. The Houtrib dike divides the IJsselmeer lake into two large water bodies, limiting the storm surge and therefore the rise in the water level on the coast of the IJsselmeer. The dyke no longer complied with the latest safety standards. That means the most important objective was to keep the provinces around the IJsselmeer safe. Even so, nature management plays a major role. The Houtrib dyke has had a negative effect on the ecology of the Markermeer lake. A thick layer of silt formed on the bed, threatening the quality of the water and the ecological systems. The Marker Wadden, constructed earlier by Boskalis, are aimed at improving the solution.

During the design of the Houtrib dyke, insights and experiences developed during the Marker Wadden project were taken into account. Work is taking place on the creation of wide sandy foreshores on either side of the dike between Enkhuizen and the Trintel harbour, halfway along the dyke. This Building with Nature approach in a large freshwater lake without tides is a first. The idea is to create sheltered areas and soft banks with gentle inclines that give new plant and animal species a chance. A pilot was first conducted by the Ecoshape consortium, from which lessons were learnt on the design of the sandy foreshores and ecologic enhancement which were taken into account in the design of the Houtrib dyke. The sandy beach will be 150 metres wide on either side, with about 75 metres being under water. Approximately eight million cubic metres of sand from two nearby borrow areas is used and pump it to either side of the dyke. To protect the sandbanks on the Markermeer lake side, new rock moles are built on the foreshore.
7.2 Transport of Cruise Vessel Carnival Vista

The BOKA Vanguard made global headlines this summer by serving as a floating dry dock for the Carnival Vista, a gigantic cruise vessel, and a world’s first operation. Carnival Vista is the second largest cruise ship in the Carnival fleet with a capacity of nearly 4,000 passengers and a length in excess of 300 metres. Due to technical issues with Carnival Vista’s azipods, the ship’s main propulsion system, the vessel had to be repaired in a dry dock which was currently not available in the region.

Boskalis offered a unique solution to facilitate this dry dock repair by deploying the world’s largest semisubmersible heavy lift vessel BOKA Vanguard. The cruise ship Carnival Vista was lifted out of the water onto the BOKA Vanguard off the coast of Freeport, Bahamas. The Carnival Vista was then transported safely to a nearby shipyard facility where repairs to the ship’s main propulsion system occurred, whilst the cruise ship was resting on the BOKA Vanguard. Upon completion of the repairs, Carnival Vista was offloaded in time for its next cruise destination.

7.3 Fingerpier – Big, Bigger, Biggest

In Singapore, Boskalis is executing the port development project Tuas Terminal Phase II, also referred to as Tuas Terminal Finger Pier 3 in a consortium with Penta Ocean Construction Company and Hyundai Engineering & Construction Company.

The Tuas Terminal Phase II development is part of the Tuas Port project and includes the design and construction of 405 hectares of land reclamation works that will be enclosed by 9.1 kilometres of caisson walls. Measuring 40 x 20 x 30 metres the caissons designed for this project will be amongst the largest ever used in the world. Boskalis executes various dredging and civil engineering activities within the above scope, including the deepening of the port basin and access channel, dredging of a sandkey and managing the supply of sand to create the new land. The dredging and land reclamation activities are executed with a combination of a medium-sized trailing suction hopper dredger, grab and backhoe dredgers and long-distance bulk carriers. The construction activities commenced in 2018 and will take place over a 9-year timeframe and are expected to be completed in 2027.
7.4 Duqm – Constructing Port Facilities by Using Polder Techniques

The Duqm Liquid Bulk Berth project involves the construction of a port area that will be home to a bulk terminal. Boskalis is executing this engineering, procurement & construct contract for the Special Economic Zone Authority Duqm. This unique project includes deepening a port basin to a depth of 18 metres, major land rejections, intensive soil consolidation, the construction of a kilometre-long quay wall and the construction of two 400-metres long jetties. About 1,200 people are working every day on the Duqm project. The size of the project is reminiscent of major projects such as Maasvlakte 2 and Khalifa.

The unique thing about this project is that Boskalis first drained a large part of the future port by constructing a large temporary ring dike and pumping out all the water so that all the structures could be built in a dry polder. In the polder, partner Six Construct constructed a kilometre-long quay wall. The thousands of large concrete blocks required for this operation were produced elsewhere on the site. Operations for the project began in mid-2017, after extensive soil surveys and an intensive design phase. Early 2019 the construction pit was successfully submerged using siphons. Works are planned to be finalised in 2020.
7.5 Adelaide – Dredging with Strict Environmental Standards

In 2019, Boskalis also widened the Port Adelaide Outer Harbor shipping channel in Australia, which included strict environmental requirements. The project included the widening of the shipping channel to 170 metres from the current 130 metres and extending the turning basin to accommodate the larger and more efficient Post Panamax container ships. The expanded channel will also accommodate larger cruise ships to support a stronger tourism industry. Approximately 1.5 million cubic metres of sand clay material was removed with a trailing suction hopper dredger and a large backhoe dredger and placed in a designated area 30 kilometres offshore.

Flinders Ports and Boskalis were committed to minimising the environmental impact of the channel widening programme and maximising the ongoing health of the marine environment in line with the strict requirements of the Environment Protection Authority dredging license. Seagrass meadows located near the dredge area can be affected by turbidity generated from dredging activities. Therefore, continuous, real-time and publicly available turbidity monitoring was conducted using special environmental buoys. Works were checked by the Australian Environmental Service EPA to ensure compliance with the agreed standards. With the aid of adaptive environmental management techniques, the works were completed in the required timeframe and in compliance with the dredging licence. A project like this is a good example of the increasing complexity of the dredging activities conducted by Boskalis, on the one hand because of the strict regulations and on the other due to the increasing need for coordination with clients and supervisory authorities.

7.6 Safety Award for Innovative Floating Line Connection System

Boskalis has won the Safety Award 2019 from IADC (International Association of Dredging Companies) with its Floating Line Connecting System. From fourteen nominations, the association’s Safety Committee and Board of Directors selected the Boskalis nomination as the winner.

Connecting floating pipes is an operation that can cause risks for the people involved and for this reason Boskalis developed a system that enables the lines to be connected without using any manpower. Floating pipes are connected safely by remote control, without the need for people to get close to the
pipelines, eliminating manual operations entirely. This results in fewer crew transfers and fewer safety risks.

The high-risk operation of connecting pipelines was identified by the crews doing the work and the consensus was, there must be a better way. The first step was developing a self-floating pipeline that could handle sharp materials.

The flexibility of this pipeline meant that 100-metre long pieces could be placed instead of 20 metres long as is normal with steel pipes. This resulted in an immediate reduction in the number of connection points so fewer people were put in risky situations. Yet manual activities were still required.

Brainstorm sessions led to various designs and demands, but it took ten years before all the pieces fell in place and a final design was made. A patent has now been applied for and the Boskalis inventors continue to look at ways to improve the design.

In many ways, the system represents a tremendous safety innovation. People are less at risk of hurting hands or fingers or come close the waterline.

The system has already been applied to the port construction project in Duqm, Oman and it will soon be rolled out and be applied to future Boskalis projects.

7.7 Let’s Talk!

For over 100 years, Boskalis has helped clients meet some of the toughest challenges. We operate in 90 countries, across 6 continents. We have an extensive network of offices worldwide and are available to discuss sustainable initiatives, projects and opportunities with you. Visit our website www.boskalis.com for more information.