

Further development in logistic process of dredging for Dubai coastal developments

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In Dubai several large land reclamation projects are going on for the expanding tourism business in this part of the Middle East. The 'Palm Jumeirah', 'The World', 'Dubai Maritime City', 'Deira Corniche' and 'Palm Deira' are the most striking examples.

Van Oord is putting a lot of effort in creating the dreams of Dubai, carrying out the dredging works, using an 'army' of dredgers and coastal construction equipment.

In 2005 the project 'Palm Deira' was awarded to Van Oord by the premier real estate developer 'Nakheel'. This project needs a quantity of sand of over one billion m³, to be constructed within a period of eight years. (See article in Port Technology International 27th edition, autumn 2005 for more details.)

Logistic process

Due to the high demand and short turn around time for large infrastructural and land reclamation projects, Van Oord, has developed another view on the logistic process of dredging.

The basic cycle of dredging with a hopper dredger is the pumping of the soil into the hopper, transport of the dredged soil from place A to place B, discharging the soil from the hopper and sailing back to the winning area. In this process the 'winning' and the 'transport' of the soil is combined within one piece of equipment.

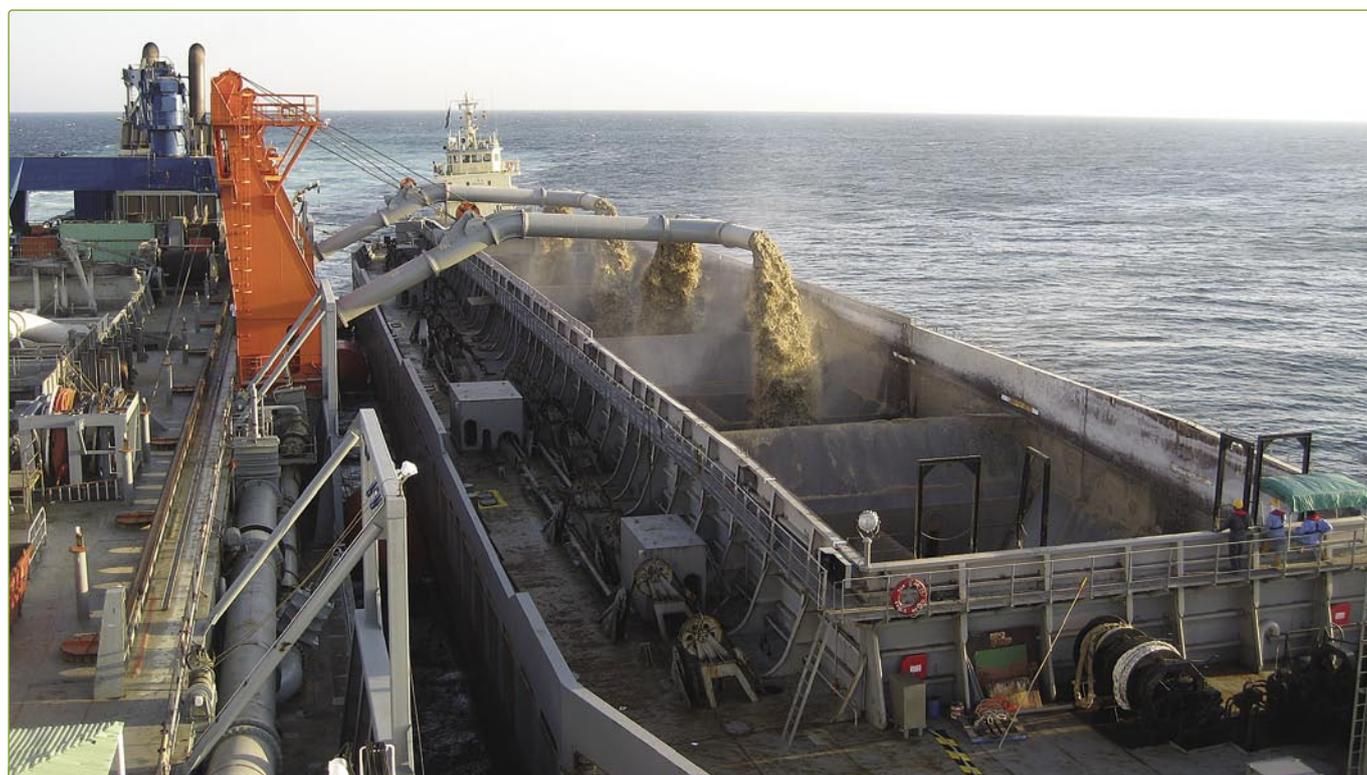
By separating the function of winning and transport Van Oord has developed a significant increase of scale in sand transport. This development is a system to load large hopper barges, offshore with a jumbo trailing suction hopper dredger for which existing techniques have been used. Solving the classic problem of offshore transshipment of the dredged soil was especially quite a challenge.

Barge loading

Loading barges is not a new idea in dredging. Smaller barges are often used in combination with cutter suction dredgers or with backhoe or clamshell dredgers in coastal waters. This method is more or less a stationary working method and has a limited dredging depth. Barge loading with a trailing suction hopper dredger is different.

A trailing suction hopper dredger sails with a low speed while filling its own hopper. While loading barges, the hopper dredger has to sail as well, which means that the barge has to be towed alongside the hopper while dredging. Trailing suction hopper dredgers can nowadays dredge the sand at water depths of over 100 m.

As the dredging areas are offshore where wave heights are up to 3.5 m, the combination of hopper dredger and barge are exposed to rather high dynamical forces.



Loading barges with Volvox Terranova along portside hull.



Loading barge nearing full capacity.



Volvox Terranova with barge alongside.

Van Oord's jumbotrailer Volvox Terranova was selected to be fitted with a barge loading installation.

The Volvox Terranova was delivered to Van Oord in 1999 by IHC Holland N.V. and has one suction pipe on starboard; this suction pipe is fitted with a 6,000 kW underwater pump which pumps the dredged mixture directly inside the hopper. The trailer can discharge its load via bottom doors or via the bow coupling or rainbow nozzle with two discharge pumps with a total available pump power of 13,900 Kw and has a hopper capacity of 20,000 m³.

As the Volvox Terranova does not have a suction pipe on portside there is enough space available for mooring a barge along portside hull. Instead of filling its own hopper, the underwater pump pumps the mixture towards the spray pipes from which it is sprayed into the hopper barges.

The hopper barges have a capacity of 8,000 m³ and therefore by employing three barges more than doubling the capacity of the Volvox Terranova. The barges including pusher tug are over 140 m long and 26 m wide. The pushers are connected to the barges with a special articulated connection.

At the beginning of 2006 Van Oord started developing a barge loading system for the Volvox Terranova. The barge loading system mainly consists of two spray pipes through which the mixture is sprayed into the barges. The hopper barges are moored alongside the Volvox Terranova which is protected by floating fenders; during dredging the barge is kept alongside with wires at the front and aft ship.

The Volvox Terranova started its barge loading operations last January. The dredging cycle is as follows: When the Volvox Terranova arrives at the borrow area, dredging starts and fills the hopper. Meanwhile the first hopper barge moors along portside hull and the spray pipes are lowered above the barges. By closing and opening the dredge valves the mixture of sand and water is pumped towards the spray pipes and the hopper barges are filled.

When the barge is completely filled, the Volvox Terranova shifts

back to hopper loading again. The first barge is unmoored and starts sailing towards the dump area. The second barge moors alongside and is filled as well. This process continues up to the third barge.

When the third barge is filled, the Volvox Terranova ends up filling its own hopper. When the hopper of the Volvox Terranova is completely filled, the suction pipe is hoisted on deck, the fenders are hoisted and it starts sailing to the dumping area as well. At the dumping area each barge will dump its load via the bottom doors. The bottom doors of the barges are constructed in such a way that the barges can dump in shallow water. The Volvox Terranova dumps its load via the bottom doors or discharges ashore by rainbow or pipeline.

Workability

Because weather circumstances can vary significantly with the possibility of offshore waves up to and over 3.5 m, the workability of the combination of the hopper dredger while dredging with the barge alongside, 30 miles offshore, was a serious question.

For this, the Maritime Research Institute in Wageningen, The Netherlands, was consulted to investigate the behavior of the two vessels moored alongside each other for several wave heights and directions. The movements and resulting forces in the mooring lines were forecasted and formed the boundary conditions for the dimensioning of the mooring winches, mooring wires and towing hooks on the barges.

Conclusion

By using existing techniques combined in an innovative working method Van Oord has made another step in the logistic process of sand transport to fulfill the demand for large scale land reclamation projects.

ABOUT THE AUTHOR

Gerrit Jansen finished his bachelor degree in mechanical engineering at the Hogeschool Gelderland in Arnhem in 1994. He continued studying mechanical engineering at Delft University, specialisation dredging technology and finished his study at the end of 1996.

He joined Van Oord as Project Engineer and supervised the development of the new barge loading system for the Volvox Terranova.

ABOUT THE COMPANY

Van Oord is a dredging and marine contractor with a focus on dredging, coastal engineering and offshore. Van Oord employs more than 3,000 people in some twenty offices around the world and owns the largest state-of-the-art fleet in the world. Van Oord is the result of the merger between Ballast Nedam Dredging and Van Oord ACZ in December 2003.

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