



Aerial view of the channel and the under-construction breakwater

Explosive Situation!

Belgian port town Ostend has created an integrated plan to tackle its two big problems – maritime navigation and the danger of tidal flooding – but, as *DPC's* BERT VISSER reports, it also had to cope with wartime bombs and mines

We first looked at Ostend's *Openbare Werken Plan* (OWP), or Public Works Plan, in 2006/07, when it was still in the preparation stage. At that time, the access channel was angled to the west and included an S-curve that bent it towards the port. The approach was complicated by open wooden jetties stretching out in front of the port to mark the access channel on either side. The jetties allowed the current to pass through, which meant that when vessels entered the channel, they had to use full throttle to manoeuvre through the curve, as well as deal with the transversal sea currents passing through the jetties. The most dangerous moment occurred when entering the port itself: the cross-currents suddenly fell away as the vessel was still at full throttle.

As one of the most important ferry ports between the UK and the continent, Ostend's tricky access channel had given ships' masters a headache, but entering the port became a particularly delicate operation for the new generation of large, modern vessels. On several occasions, accidents have happened or been narrowly averted.

AND So...

To improve the situation a completely new access channel was designed with the aim of allowing ships up to 200m in length to enter the port safely under all circumstances. The new channel:

- ◆ Is perpendicular to the coast, with a width of 150m closest to the port
- ◆ Has an enlarged turning circle, which is at about half distance, and beyond that a width of around 300m

◆ Now boasts a 900m-long x 150m-wide waiting zone just outside the port. It's a dramatic improvement that's also seen demolition of the eastern jetty and the construction of two new breakwaters. The western jetty, meanwhile, has been classified as a monument and will not be demolished, as it doesn't obstruct the new access channel.

The new approach has also been thoroughly tested via *Delft 3D* and *SIMWAVE* computer models, and there was further help from a nautical simulator and physical model at Borgerhout hydraulic laboratory.

To Work!

Phase one took place between 2005 to 2008, which involved crane barges from *DEME* subsidiary *Bayard* and *Bever* demolishing the eastern jetty to

allow the new access channel to be dredged. The operation also removed stony material that was to be reused in the foundation of what would later become the new eastern breakwater.

"Before dredging could begin, a comprehensive survey with magnetometers and sidescan sonar was carried out to detect obstructions and especially shipwrecks," Virginie Debuck, project manager of the Ministry of the Flemish Community's Maritime Access Division, told me.

"This survey showed that most of the wrecks lay beyond the projected depth – which varies between LAT [lowest astronomical tide] -8m and -8.5m and even below LAT -10m, which is an optional depth to be realised in the future," Debuck said.

The wrecks that posed a problem were removed with the help of crane barge *Bayard*. And dredging got under way in 2008 at two locations.

Offshore of Ostend lies the Wenduine sandbank, which is crossed by the new channel. Here it was *DEME's* trailing suction hopper dredger (TSHD) *Jade River* that carried out the work, with 600,000m³ of the sand dredged used to replenish the beach at Lombardsijde and 300,000m³ spread on the tern island at Zeebrugge.

All that was relatively routine, but dredging the new access channel

so close to the port was to prove a completely different story...

VERY RISKY

The underwater survey had revealed that, besides shipwrecks, the area near the port contained a large number of miscellaneous objects of over 1,000kg, and it soon became clear that some of them were Second World War ordnance.



Kevlar shields were fitted to Pinocchio



Shortest stick and boom used



Pinocchio's 21m³ bucket

Working carefully together...



Virginie Debuck, Vincent Fimmers and Danny van Dommelen



Routine - DEME's TSHD Jade River, seen here in 2009



That's a World War II mine being lifted

On top of that, engineers place a fascine mattress with a strong geotextile – no less than 105,000m² is required on this project – while on both sides there are toe berms: on the inside built with stones ranging from 1t to 3t; on the outside with stones from 3t to 6t. The actual breakwater core is built from rocks weighing between 15kg and 300kg and on the inside the slopes are covered with twin layers – the first of stones weighing between

300kg and 1,000kg, the second of boulders of 3–6 tonnes.

On the outer seaward side, the slope's first covered with rocks of 1–3 tonnes with the final layer consisting of 5,100 HARO blocks, each weighing 15 tonnes.

In total, the breakwaters will consume 810,000 tonnes of stone, supplied by quarries in Tournai, Belgium, and Cornwall, UK.

FINALLY...

Due for completion in Q1/2012, the new breakwaters are being built by the Stene-Twins joint venture, consisting of DEME subsidiary Dredging International, Herbosch Kiere and Depret. When completed, the breakwaters' top level will be at TAW + 6.7m – Tweede Algemene Waterpassing (vertical reference level), which is the standard Belgian reference level. In Ostend, it lies at around 0.5m above the LAT.

One of the main pieces of equipment being used to place the large stones is Herbosch Kiere's balance dredger *Albatros*, which is equipped with a special system from QPS (see DPC June 2010) enabling her to position each individual rock with very high accuracy.

And we'll have another look at her work as the project draws to a close. [More info at www.deme.be](http://www.deme.be)

Initially, dredging began using the crane barge *Bayard* and small TSHDs such as *Vlaanderen I* and *Vlaanderen XXI* – both in stationary mode. But after *Bayard* recovered a large mine on 19 March 2009, it was decided to carry out an additional survey and re-evaluate the dredging strategy.

G-tec was contracted to carry out the work and one of the new survey's findings was that dredging with a grab would pose too much of a risk, because it could detonate any mines found. So DEME came up with an alternative: dredge using a large backhoe.

The rationale was that this would allow explosive objects to be excavated from underneath, rather than grabbed.

DEME's proposal was accepted and the powerful backhoe dredger *Pinocchio*, equipped with a *Liebherr 996* excavator, was mobilised from South Africa.

"At Ostend, we decided to dredge using the largest possible bucket – 21m³ – and the shortest configuration of boom and stick, respectively 15m and 9.6m," DEME's project manager Danny Van Dommelen explained.

A number of other modifications were made to protect *Pinocchio* in this extremely risky environment. These measures included the installation of armoured glass in the control cabin and *Kevlar* shields on the dredger's pontoon to guard against flying fragments from exploding ordnance. Hopper barges *DI 68* and *DI 69* were equipped with similar *Kevlar* shields.

THE PROJECT CONTINUES

Belgian company aDeDe, which specialises in locating mines and other explosive wartime remnants, was brought in to oversee the dredging operation. To help detect explosive material, cameras were installed on *Pinocchio* and the hopper barges so operators could view the bucket and hoppers via close-ups during the excavating and loading process.

And during 2009 and at the beginning of this year, *Pinocchio* encountered four potentially dangerous explosive devices.

In each case dredging was stopped and Ostend's *Maritime Rescue and Co-ordination Centre* (MRCC) was alerted. In turn, the MRCC mobilised DOVO, the Belgian army's de-mining service.

Pinocchio completed the dredging campaign mid-June this year, by which time she had dredged around 650,000m³. However, by February, she had already progressed sufficiently to allow the new access channel to be brought into service.

In the meantime, construction of the two new breakwaters was also making good progress. Designed by several consultants and laboratories under the supervision of ir Luc Van Damme, head of the Maritime Access Division's coastal harbours unit, and described to me by his colleague ir Jan Goemaere, the ports and coastal districts chief, the design begins with a foundation layer of gravel topped by a layer of *tout venant* (quarry run) stone varying in size and mass from 2kg to 300kg.

Preparing to sink the fascine mattress by the western breakwater

