



Above, below and below right: Boskalis used its MP40 backhoe dredger, the upper-structure of a 390-tonne Liebherr P995 mining excavator mounted on a spud-leg pontoon that measures 60m x 18m.



The dredged material was loaded on barges that made the short journey to the reclamation area, to be offloaded by a pontoon-mounted upper-structure of a Liebherr HS853 crane.

DREDGING FOR THE FUTURE

Eoghan Daly reports on the development of Peterhead Harbour

Having grown its operations considerably in recent years to cope with larger, more challenging projects, working away from its Northern Ireland base is now a fact of life for coastal defence specialist Ashleigh Contracts. We encountered some of their impressive fleet of machinery at Peterhead Port, working in conjunction with the main contractor and joint venture partners Boskalis Westminster (Dredging) and McLaughlin & Harvey to help deliver a £50m expansion and upgrade of the harbour's facilities.

As a sheltered deep-water port, Peterhead boasts three kilometres of berthing area

and has successfully served the oil and gas industries for the past 40 years, in addition to being the UK's premier white- and open-sea fish port. The current development project includes dredging the harbour to accept larger vessels and to reclaim an area of the site close to the west quay to allow for future expansion.

At the time of our visit Ashleigh Contracts was focused on the construction of a large revetment to protect the newly reclaimed area, which they had also completed. The arisings from dredging the north harbour area provided the material to infill this reclaimed area. However, in advance of

any dredging, comprehensive strengthening works to the quay walls had to be completed, which was undertaken by sub-contractor Quinn Piling (see panel overleaf).

DREDGING

As a consequence of the sheer volume of material being extracted and the hard rock geology of the harbour floor, a large backhoe dredger from the extensive Boskalis fleet was considered necessary to tackle the conditions in a reasonable time frame.

With the necessary quay stabilisation completed, the scene was set for the arrival



of the MP40 backhoe dredger to lead the operation. Its pontoon was built by MWB Motoren Werke Bremerhaven in 2008 and measures 60m long x 18m wide and features three spud legs that extend down to 25m.

The backhoe is based on the upper-structure of a 390-tonne Liebherr P995 mining excavator. It can be fitted with

buckets with capacities up to 22 cubic metres, but for this job it was configured with an aggressive rock bucket. Although nowhere near the largest bucket used by this dredger, the immense digging power afforded by this 1600kW excavator allowed it to derive maximum productivity in the hard rock conditions.

Guided by a dedicated GPS dredging system, the MP40 worked long hours on a multiple-shift basis to excavate material from the harbour and load it directly into a pair of large capacity barges. These barges made the short journey to the reclamation area where they were unloaded by Boskalis' barge-mounted Liebherr HS853 crane →



"WE ARE AFFORDED A TIME SLOT ON THE PIER FOR THE VESSEL. THE WHOLE OPERATION NEEDS TO BE COMPLETED TO A SCHEDULE"

QUAYSIDE WALL

In advance of any dredging, comprehensive strengthening works to the quay walls were completed. Sub-contractor Quinn Piling demonstrated its expertise with the use of a novel approach to this significant aspect of the project. This saw the installation of an anchored, rock-socketed, steel combi-wall directly in front of the existing quay, which would allow the deepening of the inner harbour area by dredgers.

The scale of the undertaking gets its sense of perspective from the need to install 1200 individual 610mm-diameter steel piles, ranging in length from 13.5 to 17 metres. The piles were drilled up to seven metres into granite rock using an innovative system similar to that employed in the Epiroc Odex overburden drilling system.

With the piling rigs operating mostly from the existing quay edge, a 4m-deep specially fabricated piling gate acted as a temporary guide. Once a complete gate of 14 piles was installed, the ring around the steel piles was pressure grouted using a specially developed high-pressure grout pump and methods developed by Quinn to cope with the demands of this project.

In addition to the steel piled combi wall, Quinn Piling also undertook the design, installation and testing of the 250 anchors necessary to ensure the stability of the new quay wall and ensure a safe working load of 110 tonnes. Using a 63.5mm threaded bar with double corrosion protection installed to 22 metres depth at a 45-degree angle, these were installed using a remote-controlled Komatsu PC450-6 excavator.

This machine features a specially modified dipper arm to host the drill mast. Like the piling rigs, the machine was also operated from the quay and through the flexibility of its boom design allowed it to reach the anchor location, three metres below quay level, and drill back beneath itself through the existing quay. Another attribute of the Komatsu rig was the extra-long drill mast. This allowed the anchors to be encased with a single long casing, dispensing with the need for welding in a tidal zone, which would have had obvious delays on progressing the works.

Time is money in this game, as the MV Liamare arrives at the port from Norway carrying around 5000 tonnes of rock armour.



A Cat 365C with a fixed rock grab immediately loads the armour into the waiting fleet of Volvo ADTs.



→ complete with a four-cubic-metre grab. This was used to cast the material directly on to the reclaimed area where it was retrieved by the Ashleigh Contracts fleet for placement. The scale of the operation is given a sense of perspective in that phase one of the dredging provided 115,000 cubic metres alone.

FLEET FOCUS

While material was coming ashore, the largest machine on the project from the Ashleigh fleet, a long-reach Hitachi EX1200 excavator, worked on the revetment slope below the water level. This giant machine was added to the fleet to coincide with works at Sumburgh Airport on the Shetland Islands.

Ashleigh Contracts' director Philip Conacher said, "Our EX1200 made a very important contribution to the Peterhead project as it worked primarily on the profiling and rock armouring of revetment slopes, as well as the construction of foundation toe mounds of armour along the revetment. Working in the same

28.5m super long-reach configuration as previous projects, it is running with the latest generation Prolec PCX-Pro GPS machine control system, which is invaluable due to the nature of the work the machine concentrates on."

This Hitachi, like the rest of the Ashleigh fleet, has benefited from a rigorous preventive maintenance and component monitoring programme, which sees in-depth checks well before the start of any new major project. This isn't a quick walk-round in the yard, but a comprehensive and honest evaluation of the machine's condition, which pays dividends when working in tidal projects with hard deadlines that must be met.

Philip continued, "All our machines are subject to continual monitoring of undercarriage, engine and hydraulic performance, and a full evaluation of all hydraulic hoses, with replacement as required before the commencement of all major contracts. Before we began the Peterhead project, this resulted in our 385C receiving undercarriage replacement and a



The MV Liamare's Hitachi 870-3 excavator is mounted on a carriage running the full length of the holds.

new intercooler and radiator, as well as a full respray and rebadging to a 390 since it has an additional five tonnes of rear ballast. Our 365C also received full refurbishment of the pumps and wiring loom replacement."

OFF-LOADING ARMOUR

The importance of machine reliability and availability comes into its own when

conducting extremely time-sensitive tasks, such as off-loading rock armour, as Philip continued, "For rock armour unloading we are afforded a time slot on the pier for the vessel to dock. The whole operation needs to be completed to a schedule to ensure the area is ready for the next vessel scheduled by the port authorities on time and without exception."

To protect the newly reclaimed area at Peterhead, some 58,000 tonnes of larvic rock armour was imported from a quarry in Norway, of which individual vessels carried between 4500 and 5500 tonnes at a time. A shipment typically arrived every three days and despite consuming a range of plant resources, normal site activity such as revetment construction still continued. →

"THROUGH THE USE OF THE LATEST MACHINE CONTROL SYSTEMS, ALL WORK COULD BE CO-ORDINATED EASILY"



The reclaimed area filled with dredged material is protected by a massive multi-layer revetment.



Like the big Hitachi, the Cat 390F and a long-reach 395 on rock armour placement duties are equipped with a 3D GPS machine guidance system.



→ Once a shipment was on course to discharge at Peterhead, the Ashleigh Contracts team set about preparing the pier. A range of measures needed to be put in place to ensure not only that the operation ran as smoothly as possible, but also that the pier was left in the same condition as it was before a few thousands tonnes of large rock boulders were deposited on it.

This saw the placement of a series of wooden mats covered by a layer of blinding

material parallel to the area to be occupied by the ship's hold during the discharging process. This protected the pier's surface and provided a suitable drop zone for the unloading excavator to place the material.

During our visit the *MV Liamore* arrived from Norway with the next load of rock armour, of which individual elements weighed between three and 10 tonnes. This vessel has a somewhat unusual offload capability thanks to its Hitachi 870-3

excavator mounted on a carriage running on side rails. The excavator operator controls the chains that move this carriage, allowing him to easily access all the hold areas. The Hitachi features an extended boom and long dipper arm that carries a large capacity orange peel grab, together with a second counterweight mounted above the standard unit.

Once the individual rock armour pieces are on the quayside they need to be →



The largest machine from the Ashleigh Contracts fleet on this contract was this 28.5m Hitachi EX1200 super long-reach equipped with the latest Prolec machine control system.



A large fleet of machines was deployed on this project; work on the reclaimed area and its revetment did not stop when another batch of rock armour was being unloaded.

→ immediately removed to prevent any backlog developing – this really is a case of time is money. Ashleigh used either their Cat 345B or 365C excavator with a fixed rock grab on this task, loading the material into one of three Volvo ADTs for the short haul to the stockpile in the works area.

Unloading the *MV Liamore* continued until 10.30 that evening, when operations were suspended until 6.30 the following morning. The remainder of rock armour was offloaded by 9.30am, and the Ashleigh team moved swiftly to remove the wooden matting and conduct a complete clean of the area and haul route. The quayside reverted to the port authorities in time and in a suitable condition to accommodate the next scheduled arrival.

REVTMENT CONSTRUCTION

Due to the need to afford a high level of protection from the North Sea to the newly reclaimed area, the design of the revetment was to a most comprehensive level.

Initially a bund was formed from processed dredged material, over which a geotextile membrane was placed. The actual armour facing was built up in a

series of layers along its 380m length. The initial layer was made up of 17,500 cubic metres of 600kg stones sourced from local quarries. The outer layers of primary rock armour was constructed with the imported material, which was sized to provide three classifications: three to six tonnes, four to seven tonnes and six to 10 tonnes.

Philip continued, "Once we had the first section of revetment bund in place we began placing the outer rock armour layers, which resulted in all stages of the revetment construction advancing simultaneously. Through the use of the latest machine control systems, all work could be co-ordinated easily without any manual intervention in the busy works area."

In addition to the big Hitachi EX1200, a long-reach Cat 395 and a Cat 390 were used to place the rock armour, all guided by a 3D GPS system. Ashleigh Contracts was a pioneer of such systems, having put its initial system into service back in 2007.

Philip concluded by saying, "The first version of the system we had was a Prolec



PCX3D GPS utilised on our Cat 395 long-reach excavator, which had a traditional solid state PC and separate monitor platform. In contrast, the Prolec PCX-Pro now uses a touch-screen rugged Toughbook making it ideal for working in our applications.

"Such systems have revolutionised the way we work and have really paid dividends when it comes to keeping project progress on target."