

Marsden Point, NEW ZEALAND

Construction of new deepwater port

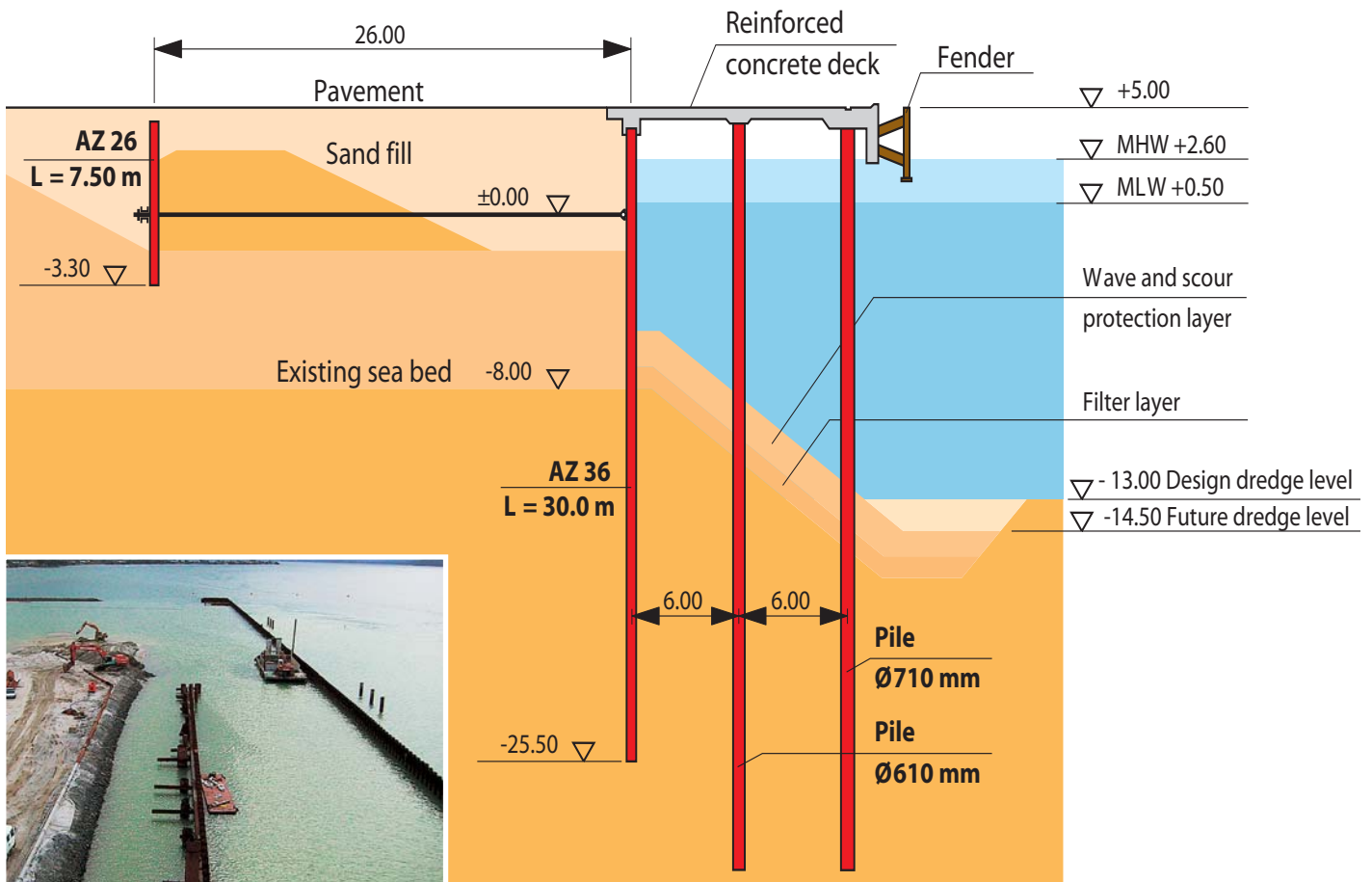
Marsden Point is situated on the northeast coast of New Zealand's North Island. It is here where the country's most modern and deepest port was constructed. Offering permanent shipping access and guaranteeing a continuous increase in traffic, the harbour is undoubtedly a key factor in the development of New Zealand's economy.

The idea of building a new port in this region goes back several decades. The Northland Port Corporation, which operates the nearby port of Whangarei, purchased the site in the 1960s when New Zealand's forestry was still in its infancy. With the passing of the years some 190,000 ha of

pine forest reached maturity, resulting in sustained growth of exports of forest products from Whangarei. Exports were predicted to increase fourfold between 2000 and 2004. Port Whangarei, whose wharf structures were not designed to carry today's heavy handling equipment, is incapable of handling this growth. The port accepts draughts of merely nine metres, which is inconsistent with the evolution of modern shipping fleets. Furthermore this capacity can only be assured at the cost of regular dredging. More recently the port has faced a shortage of dumping sites for the dredged material. These arguments made the construction of a new deepwater port unavoidable.



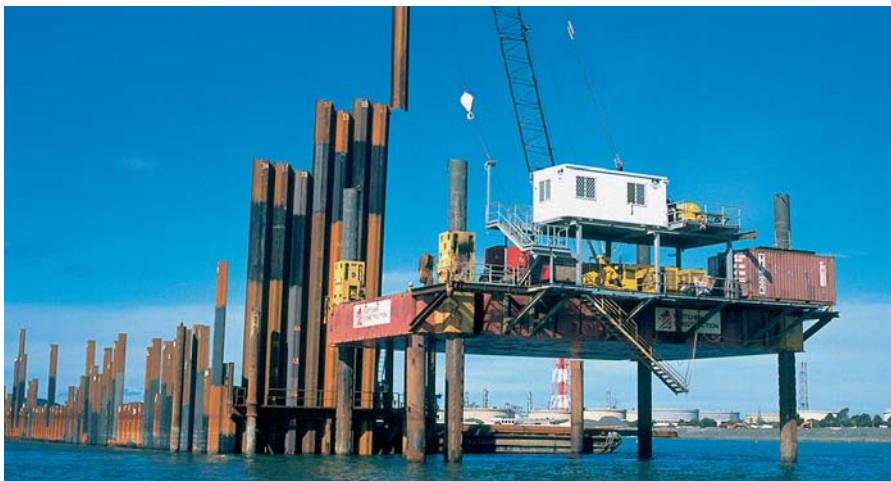
The new deepwater port was completed in 2002 after a construction time of less than 2 years



The originally planned HZ/AZ quay wall was replaced by a more economical AZ 36 wall



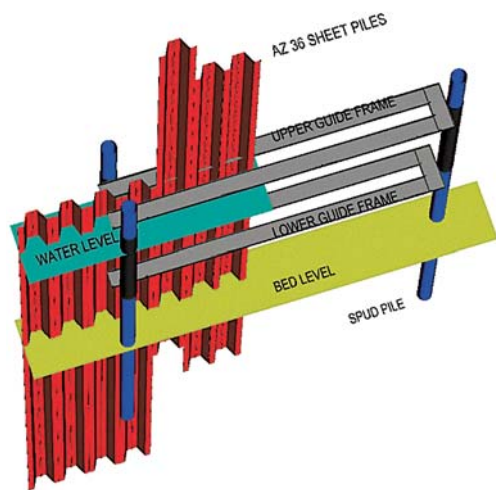
The project's design lifetime of 50 years called for two layers of tar-free epoxy coating



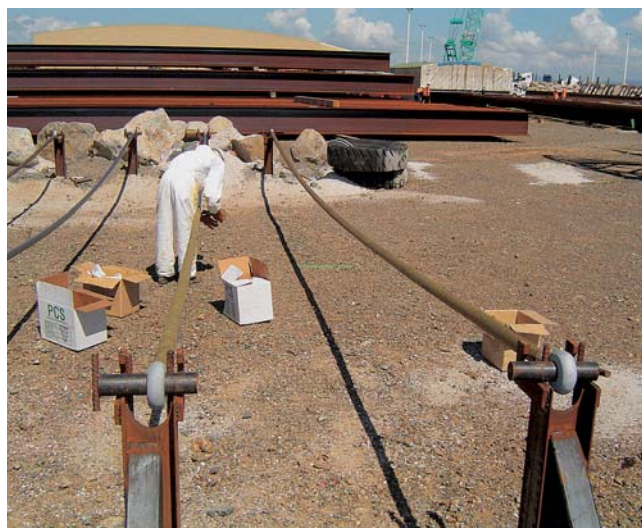
The main retaining wall was driven from a Flexifloat S-70 jack-up barge

Northport, a joint venture between Northland Port Corporation and Port of Tauranga, teamed up with Australasia's largest forest-products company, Carter Holt Harvey, for land operations at the planned new port. Following nearby construction of a very large laminated veneer lumber plant aimed principally at the export market, Carter Holt Harvey undertook a firm commitment to ship one million metric tons of wood and derivative products from the new port in its first five years of operation. A growing range of other exports were soon handled by the port. The annual cargo volume reached 2.8 million metric tons in 2005 including agricultural produce, fertilisers, cement and containers as well as wood.

Thorough studies concerning hydrographic and environmental aspects of the site had already been carried out in the 1970s. The area where the new port was built is situated between two inactive faults; its favourable geological conditions facilitated the construction works. The soil consists of alluvium,



Proper alignment of the piles was achieved with a template



Corrosion-protection tape was wrapped around the anchors



The driving gear consisted of a vibratory hammer...



... and a hydraulic hammer

essentially sand, with rare peaty areas, all overlying deep greywacke and argillite bedrock. This meant not only that reclamation could go ahead without any preparatory dredging but also that the dredged soil from the turning basin could be used as backfill material: several million cubic metres of sand were placed behind a 1,700-m embankment standing between 3 and 16 metres high. The embankment was also built from readily available local materials, mainly sand, and was protected by heavy rocks. Consolidation of the structure was achieved by loading the top of the embankment up to a height of two metres with backfill material before levelling it off to build the pavement.

Construction of the new deepwater port began in October 2000. Less than two years later, in June 2002, the first ship was able to dock at Northport. The second berth was completed only a few months after the first berth came into service. The project was built under a NZ\$30 million fixed-price design-and-build contract. The new port includes a 50-ha cargo-marshalling area (32 of which were to be on reclaimed land) and a 390-m wharf with two mooring spots able to handle 65,000-t bulk carriers with maximum lengths of 230 m and maximum draughts of 13 m. Fletcher Construction Company Ltd was the design-and-build contractor, with Beca Carter Hollings and

Ferner the designer. Initially an HZ/AZ combined sheet pile wall was proposed for the retaining wall to both contain the adjacent reclamation and support the rear of the wharf deck. The deck consists of a cast-in-place reinforced-concrete flat slab supported on the seaward side by two rows of concrete-filled steel pipe piles. However, BCHF's final design substituted the combined sheet pile wall with a more cost-efficient AZ 36 wall. The design takes account of the high loads present (dead load of 85 kN/m, live load of 240 kN/m). The considerable width of the AZ piles chosen (1.26 m per double pile) is an advantage in terms of construction productivity. Although manufactured on the other side of the world, the 3,000 t of sheet piles used for the Northport project were supplied to the site within 3 months.

The 30-m-high main retaining wall made of AZ 36 sheet piles was driven 16 m into the prevalent sand, the lower five metres of which are of a very compact nature. Two 15-m-high retaining walls connect the main quay wall to the backfilled embankments. The AZ 36 sheet piles were anchored by 26-m tie rods to a 7.5-m-high deadman wall made of double AZ 26 sheet piles.

The main retaining wall and the deadman wall were connected by 60-mm-

Owner:
Northland Port Corporation,
Port of Tauranga and Carter Holt Harvey

Designer:
Beca Carter Hollings & Ferner Limited (BCHF)

Contractor:
Fletcher Construction Company Ltd

Steel grade:
S 430 GP

Sheet piles:
AZ 36, L = 30 m; AZ 26, L = 7.5 m

Total quantity of sheet piles:
3,000 metric tons



Several exporting companies soon began to use the new port, making further expansion plans unavoidable



The 390-m wharf was completed with returning walls at each end

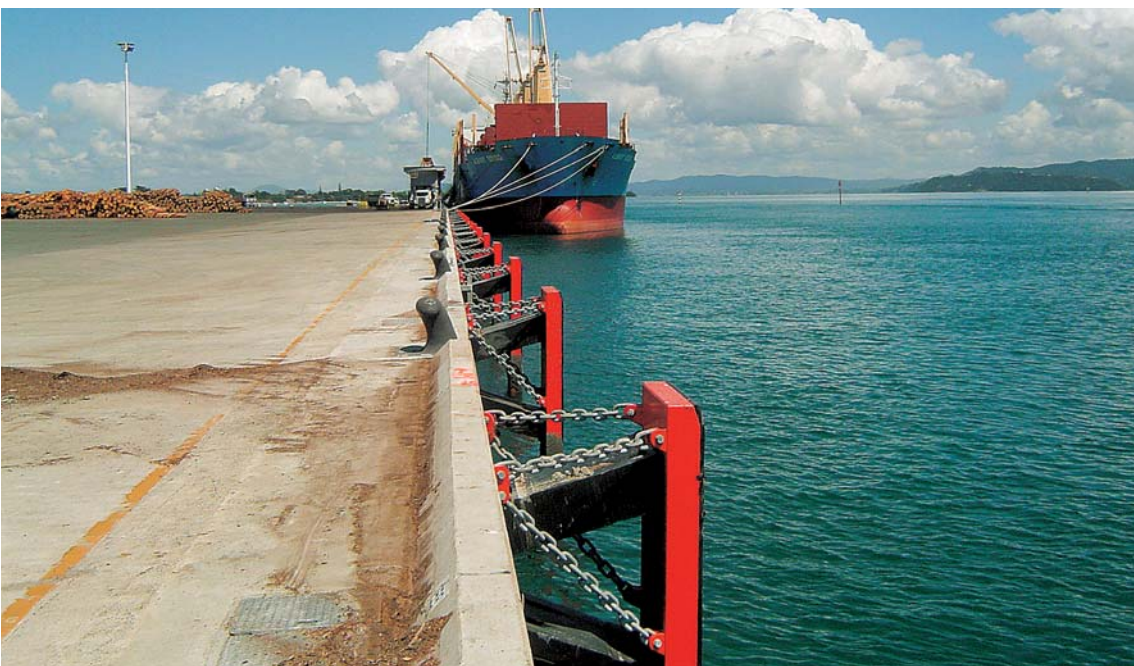
diameter steel tie rods provided by Anker Schroeder, consisting of two 13.45-m bars joined by a threaded coupler. Continuous steel-channel walers were bolted to the sheet piles by a team of divers who also installed the tie rods.

The site's geology and the depths involved meant there were no particular problems regarding pile driving. The main retaining wall was driven from a Flexifloat S-70 jack-up barge using a PTC 50 HL vibratory hammer operated with a P&H 5100 crane. In case of refusal prior to design penetration into the compact sand, a 9-t Junttan hydraulic hammer was used to complete the driving process. A guide frame with two supporting levels 8 m apart guaranteed the required alignment. The template was held in place with steel tubes that were driven until refusal with the same driving gear that installed the sheet piles. Nine pairs of AZ 36 piles were inserted into the guide frame and driven in panels to ensure the required verticality was achieved. The deadman's AZ 26 sheet piles did not require driving: they were simply set up from the embankment

and propped until enough sand had been placed on both sides.

With a design life of 50 years, special care was taken to provide adequate corrosion protection of the wall's most critical parts: the intertidal zone and the top of the immersion zone, which coincides with the level of the tie rods. The sheet piles were coated with two 175- μm layers of a tar-free epoxy coating known as Altra Tar. Once assembled, the tie rods were wrapped with Denso Ultraflex corrosion-protection tape, with heat-shrink sleeves around the couplers.

Right from the outset, plans were made for two further berths drawing 14.5 m. Construction of Berth No 3 started at the end of 2005 using a combined sheet pile solution delivered by Arcelor. ■



Due to the success of the Northport project, Arcelor also supplied the sheet piles for the 2005/2006 construction of the port's new Berth No 3