

# Ziguinchor, SENEGAL

## Quay reconstruction project



The coastal town of Ziguinchor is situated on the banks of the Casamance River in southern Senegal. Founded by the Portuguese in 1645, the prosperous trading post has an easy connection to the Atlantic Ocean, 70 km downriver. In addition to ferry passengers, the harbour handles local produce e.g. groundnut products, fish, rice, fruit and cotton as well as imports of petroleum products and capital goods.

With the assistance of different international organisations, chiefly the French Development Agency, the Senegalese Government undertook a vast development programme including the 5.3-million-euro rehabilitation of Ziguinchor Harbour whose fifty-year-old structures had seriously deteriorated over the years. The two-phase reconstruction operation concerned the passenger quay, the goods quay and the tanker berth.



The Senegalese river port of Ziguinchor is situated 70 km from the Atlantic Ocean

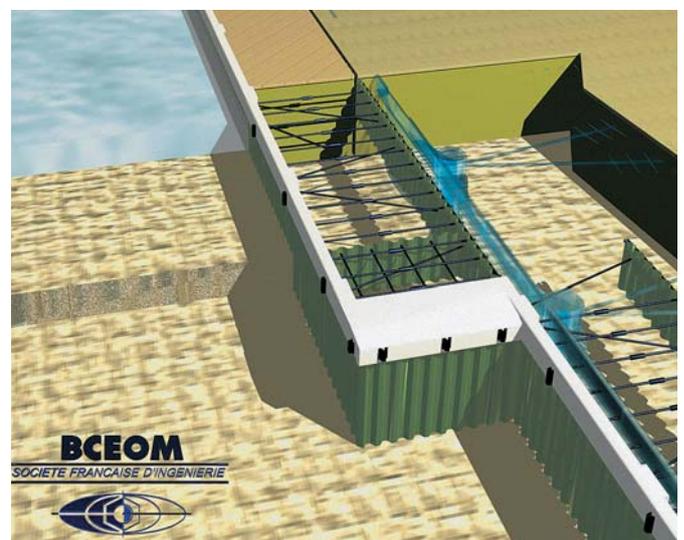


**The new quay wall was built with AU 21 sheet piles driven 20 m in front of the dilapidated structure**

The first phase began in August 2004 and lasted about 8 months. It involved the construction of an 80-m-long passenger quay wall directly in front of the existing wall with a 35-m-long return wall at the western end. It also included 31.5 m of goods quay and a 20-m-long roll-on roll-off berth. The goods quay is not aligned with the passenger quay but is located about twenty metres in front of and parallel to the old quay, enabling enlargement of the marshalling area reclaimed from the river.

The extension of the new goods quay was completed in July 2005 as part of the second phase. It included the construction of a 68-m-long return wall and backfilling of the new marshalling area. Once completed, the new quay had a total length of 265 m.

The soil conditions can be resumed as follows: soft to compact river mud overlying clayey sand. To ensure the stability of the structure, the soft mud was dredged before



**The reconstruction plans included passenger and cargo quays as well as the tanker berth**





**A three-layer coating system was applied to guarantee a long lifetime**

the sand backfill was placed. The river was deepened to 5.50 m to ensure sufficient water depth for vessels to dock.

AU 21 steel sheet piles (rolled-up AU 20 piles) were chosen in response to the strongly felt need for maximum protection against corrosion through greater thickness. Because of the tropical climate this protection was further enhanced by special coating and cathodic protection. The shop-applied coating consists of a zinc-rich epoxy primer and two coats of coal-tar epoxy. It was applied to both sides of the immersed part of the main-wall sheet piles. The 750-mm-wide AU sheet piles have about 10% less developed surface area than 600-mm U piles, thereby reducing the coating area. This advantage of the AU sections is complemented by excellent driving performance and toughness resulting from the particularly favourable geometry of the web/flange interface.

The 16-m AU 21 sheet piles forming the main wall were driven into the clayey sand to a depth of 14.50 m. They were tied back at the top to an anchor wall made of 5.50-m AU 16 piles. The angles in the wall alignments were made using Omega 18 or Delta 13 connectors or junction piles with welded C9 corner sections that were provided by

Arcelor together with the steel sheet piles. The front quay wall was topped with a capping beam made of precast reinforced concrete elements.

The quay-wall anchor system consisted of 65-mm-diameter S 335 J0 steel grade tie rods with upset ends. 152 anchors in lengths of 19 to 30 m were supplied. They were attached to a waling made of 400-mm channel sections. 38 additional tie rods with a diameter of 58 mm and in lengths of 20 m to 22.50 m were installed at coping level, behind the bollards, to take up the pull forces exerted by moored vessels. All these components were supplied by Arcelor's faithful partner for many years: Anker Schroeder from Dortmund, Germany.

The sheet piles, mostly supplied as double piles, were first driven with a Vibro Delmag rig placed on a barge, then impact driven with a Delmag D12 or D22 diesel hammer with a hanging leader.

The sheet piles produced in Luxembourg were transported by rail to the port of Antwerp, then by ship to Dakar where they were transferred to another ship bound for Ziguinchor. The passenger quay was completed in 2005, enabling the first ships to berth as specified from the outset. ■



**Following a construction time of slightly more than one year, all quays were reopened at the end of 2005**