Project Sheet

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Delta Marine Consultants is a trade name of BAM Infraconsult bv

Monrovia Quay Wall

In 2010 the National Port Authority of Liberia awarded the Concession Agreement for operating the Freeport of Monrovia to APM Terminals (APMT). As part of the Concession Agreement, APMT had to construct a new Main Wharf in the Port. APMT awarded BAM International the Design and Construct contract for the Work. BAM International appointed Delta Marine Consultants (DMC) for the Basic- and Detailed Design of the Quay Wall.

Main Client
National Port Authority

Client
BAM International

Location
Freeport of Monrovia, Liberia

Type of Contract
Design & Construct

Consultancy Fee
Category 5 (see page 2)

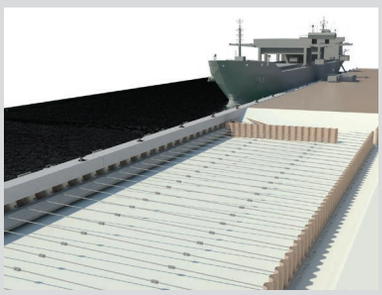
Completion
2012 (design)
2013 (construction)

Scope
Design of 600m of Quay Wall with tie-back anchors including drainage systems

Services
Basic Design
Detailed Design
Site Support / Site Engineering

Delta Marine Consultants

Monrovia Quay Wall



Project Description

The APMT Container Terminal at the Freeport of Monrovia, Liberia consists of a quay wall with a total length of 600 metres and a quay apron with a width of 40 metres. The new structure was to be constructed in front of an existing wharf structure that was constructed in the 1950's. It was a suspended deck structure with a length of 610m and a width of 11.75m. The piles were steel H-piles with an approximate size of 14x15 inches and a concrete casing for the top part of the pile, which was affected by tidal water level variation. The new facility accomodates Panamax vessels of 55,000 DWT and 4000 TEU approximately and 65,000 DWT dry bulk vessels as maximum design vessels.

The new quay wall is executed as a combined wall of steel tubular king piles with steel sheet pile infill elements. The anchorage of the quay wall consists of tie rods each connected to the tubular king piles an tied back to a sheet pile anchor wall. On top of the combi wall a concrete coping beam with its top elevation at +3.45m CD and with section lengths of approximately 12 metres provides load distribution of forces from bollards, fenders and non-uniform tie rod forces. At both ends of the quay wall perpendicular to the quay's orientation two wing walls of the very same structural concept are constructed. Dredging of the berth pocket over the entire quay length to an elevation of -12m CD was also part of the scope of work. In addition, the quay structure had tob e designed for a future dredge level of -15m CD resulting in a design level of -16m CD and a total retaining height of the structure of almost 19.5 metres.
From coping beam to 40 metres landinward pavement consisting of concrete block pavers is sloping down towards a box-shaped concrete quay apron gutter with perforated concrete cover. This concept has been chosen to resist the relatively high wheel loads an twisting forces from the reach stackers. Parallel to the quay gutter a hinterland collection drain is executed in order to collect and discharge the stormwater from the area behind the quay apron.

A concrete oil-water-separator treats the stormwater from the quay apron before discharging it to open water.
Along both wing walls a new revetment provides geotechnical and hydraulic stability of the re-profiled slopes.

APMT required to construct this new quay structure in three sections of 200m each to minimise interference with ongoing port operations. APMT indicated that port operations prevailed above any construction activities. Therefore APMT involved BAM International as early as possible in the design and construction process to optimise the design and construction process asmuch as possible.

Role DMC

Throughout the tender process before contract award, the stage of Early Contractor Involvement (ECI) with BAM International and APM Terminals finally resulting in basic and detailed design as well as the stage of site engineering during work execution DMC provided its design services to BAM International. It involved the following engineering disciplines: geotechnical, structural, material technology and coastal . The following structures and elements were part of the design scope of work:

- Combi wall with anchorage;
- Coping beams;
- Berthing analyses and fender selection;
- Interpretation of geotechnical investigations;
- Drainage gutters and oil water separator;
- Slope protection along wing walls;
- Temporary works such as: lifting provisions precast concrete elements, support structures for precast concrete formwork for the coping beam sections , compartment walls for phased construction of the quay.

Consultancy Fees: 1: 50.000€ 2: 50 - 150.000€ 3: 150 - 300.000€ 4: 300 - 600.000€ 5: > 600.000€

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