DESIGN OF THE UPGRADED NAUTICAL ACCESS TO THE SNIM IRON ORE PORT IN NOUADHIBOU

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The “Société Industrielle Nationale et Minière (SNIM)” (National Industrial and Mining Company) has completed in 2013 the construction of a new export facility (berth and associated 10,000 tph shiploader), with the capacity to load iron ore carriers up to 250 000 DWT.

Objectives and challenges of the study:

The existing channel is designed for vessels up to 170 000 DWT, but with load limitation (maximum draft of 16.15m).

The study aimed at upgrading the existing channel for Capesize vessels up to potentially 250 000 DWT.

The new channel will be 25 km long and will require between 15 to 25 million cubic meters to be dredged, including cemented sand layers and potentially sandstone. The metocean conditions are also challenging and covering a large range of conditions:

- Sheltered area where wind conditions can be strong and sustained (up to 15 m/s), and strong tidal longitudinal currents up to 3 knots.
- Exposed area to swell conditions where in addition to strong wind conditions, severe swell conditions are encountered (Hs up to 4 m)
- Transition area in front of Cap Blanc (zoom below) where tidal currents shift from longitudinally to transversally with intensity up to 4 knots with also sudden exposition to outer swell.

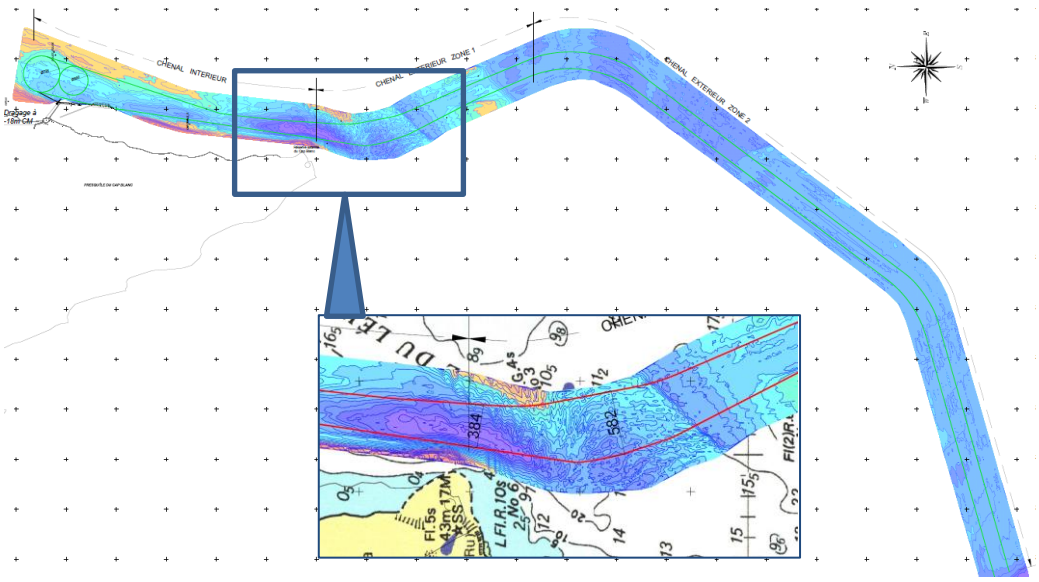

Figure 1: Final Nouadhibou channel layout

The detailed study has been performed for the new channel on basis of a state-of-the-art approach based on PIANC report No121. This included:

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Vertical design

- Bottom factors assessment, more particularly siltation provision in some specific areas exposed to the issue, including the transition area subject to seabed sandy wave behaviour.
- Ship factors detailed calculations and simulation: squat and wave response allowance. For this last parameter, a full probabilistic approach has been used thanks to the use of simulations through the “Response Amplitude Operator” Underkeel software (HR Wallingford). 136 simulations have been performed for the various ships and orientation compared to the incoming wave climate.

The main outcome have been related to the optimization of the depth of the outer channel in light of the severe wave conditions, in order to find the best compromise between the operational criteria and the project cost: 96.5% channel availability at low tide, 99% at high tide.

Horizontal design

The horizontal design has been supported by real-time and fast-time ship manoeuvring simulations in Transas Full Bridge Simulator:

- 51 runs in fast-time to optimize and verify the outer channel design.
- 55 runs in real-time to:
    - verify and optimize the manoeuvring area in front of the new berth, taking in due consideration the new use of tugs. This has allowed the reduction of the manoeuvring area to avoid sandstone dredging.
    - Verify and optimize the design of the nautical access at the passage of the Cap Blanc with the strong transversal current of 3 knots. The way forward has been to widen the channel South of the Cap Blanc and to confirm the operating way of sailing out of the channel in case of strong currents.

Operational design

The Nouadhibou Iron ore Terminal was previously operated without tug support. The study and associated ship simulation aimed also at confirming the towing functional requirements and new procedure in association with the pilots from the SNIM.