Assessment of larger ships berthing at a salt export terminal

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Summary
Shark Bay Salt Pty Ltd (Salt) own and operate Onslow Salt in the north west of Western Australia. The salt is exported in ships from the single berth which can currently accommodate Supramax sized ships. Salt desired to increase this to Ultramax or Panamax sized ships.

HR Wallingford was commissioned to conduct an assessment of the existing infrastructure and navigation manoeuvres, to ensure safe operations with the increased ship size. The study included an engineering assessment of the berth, as well as mooring and navigational assessments.

Keywords: engineering, mooring, navigation, shipping

1. Introduction

Shark Bay Salt Pty Ltd (Salt) owns and operates two salt fields, one of which is Onslow Salt in the north west of Western Australia. The company has been exporting salt by ship since 2001, with volumes of up to 2.7 million tonnes per annum, using a nearby berth. The single berth (Figure 1) can currently accommodate Supramax sized ships and Salt desired to increase this to Ultramax or Panamax sized ships.

As a part of the expansion plans and to gain approval from Department of Transport Western Australia (DoTWA), Salt needed to assess the existing infrastructure and navigation manoeuvres to ensure safe operation with an increase in the size of the ship. Salt commissioned HR Wallingford to conduct an engineering assessment of the berth and infrastructure, as well as a mooring and navigation assessment.

Figure 2 Photograph showing the Onslow Salt Jetty with ship alongside (Source: www.salt.com.au)

2. Design ships

The Onslow Salt marine terminal has a limitation on the draft of the vessels for departure. It was proposed that this remained in place for this study as there were no plans for deepening the channel or manoeuvring area, so all vessels were examined with a maximum of 11.8m draught.

Whilst the ships did not vary in beam or draught, the length of the ship would result in an increased capacity for export.

Table 1 summarises the characteristics of the ships that were examined at the specified 11.8m draught and includes the existing design ship.

Table 2 Design ships

	Supramax	Ultramax	Panamax
Deadweight (tonnes)	56,557	63,464	81,000
LOA (m)	190	200	229
Breadth (m)	32.26	32.24	32.26
Authorised draught (m)	11.8	11.8	11.8
Maximum draught (m)	12.74	13.42	12.20
Displacement at authorised draft (tonnes)	61,679	65,013	75,182

3. Engineering assessment

The first part of the study was to assess the structure of the berth, which included the fenders, mooring hooks and berthing dolphins.

3.1 Site inspection

A site investigation was carried out to conduct a visual berth inspection and collect data for the assessment. The inspection also allowed for the berthing operation to be observed and procedures to be examined to inform the mooring and navigation elements of the study.

The inspection showed areas of corrosion in the splash zone of the dolphin piles, however Salt were in a process of wrapping and installing jackets to protect from further corrosion. Steel thickness measurements were considered satisfactory and the berth (including fenders and mooring hooks) was generally in good condition with only minor defects observed.

3.2 Fender capacity calculations

The fender capacity was examined to evaluate the suitability of the installed fender against the berthing energy of the proposed ships. The calculations followed British Standard BS6349:4-2014[1] and PIANC guidelines Report WG33-2002[2]. The calculations included berthing against one fender and quarter-point berthing, with the vessels at the authorised draught of 11.8m.

The calculations showed the maximum berthing velocity for the different class ships examined which were as follows:

- Supramax – 0.15m/s
- Ultramax – 0.15m/s
- Panamax – 0.14m/s.

The berthing velocities were subsequently considered as part of the navigation assessment.

4. Mooring assessment

The mooring assessment included a static and dynamic mooring analysis and focused on the Ultramax bulk carrier.

The mooring layouts were established in conjunction with the local marine pilots and included a forward hold loading, aft hold loading and midship hold loading (Figure 2) configurations. The study used PIANC guidelines Report WG24-1995[3] for assessing motions of the ship alongside the berth.

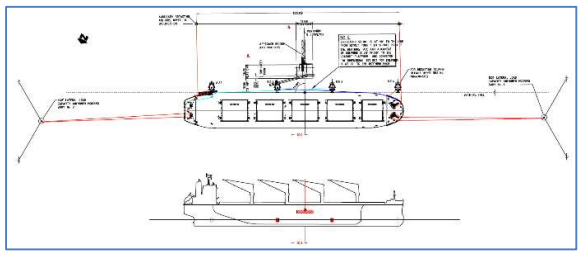

Figure 2 Midship hold loading mooring layout (Source: HR Wallingford)

The study used the mooring equipment to the specification of the berth and mooring lines typical of the ship type.

The static mooring assessment examined the effects of wind on the 3 mooring configurations. The worst-case scenario was the forward hold loading with an off berth wind condition. This resulted in a maximum of 20 knot limit with the ship in ballast condition at highest astronomical tide (HAT). The existing Supramax ship was also examined, with the limiting windspeed being 22 knots.

The dynamic assessment included the effects of wind, current and waves, and used HR Wallingford's fully dynamic mooring analysis tools known as SHIPMOOR. A total of 28,000 combinations of environmental conditions which were generated from a timeseries of wind and wave conditions. These conditions were used to examine the ship motions alongside the berth which subsequently led to a berth downtime analysis. The results showed that when loading the centre hold, there was a berth downtime of 13.4%, based on the number of instances where the limiting criteria for mooring was exceeded.

5. Navigation assessment

An assessment of the navigational elements was the final part of the study and used HR Wallingford's Australia Ship Simulation Centre to examine the Ultramax ship at the port. Arrival and departure manoeuvres were examined as well as several emergency scenarios. Procedures were based on existing practise and towage at the port and used the local marine pilots to conduct the runs.

A total of 19 real-time navigation simulation runs were conducted and showed that the environmental limits for berthing were lower in some circumstances, when compared to the Supramax bulk carrier. This was largely due to the additional windage and displacement of the Ultramax bulk carrier, meaning greater amounts of tug power were required to assist the pilot in handling the ship.

6. Conclusions

The study showed that it was feasible for the larger Ultramax bulk carrier to operate to the Onslow Salt Berth. A number of restrictions were required to be adhered to, due to the ship being larger than the existing design ship and to ensure the operation is safe.

References

[1] British Standard, "Maritime works – Part 4: Code of practice for design of fendering and mooring systems", BS 6349-4:2014, August 2014

[2] PIANC, "Guideline for the Design of Fender Systems", Report of Working Group no33, 2002.

[3] PIANC, "Criteria for movements of moored ships in harbours", Report of Working Group no.24, 1995.