A MODERN CYCLONE HARBOUR FOR ESCORT CLASS TUGS IN NORTH-WEST AUSTRALIA

by

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ABSTRACT

This paper describes the design and layout of the marine facilities associated with the recently constructed Hunt Point Tug Harbour in Port Hedland. Port Hedland is located 1,322km north of Perth in Western Australia. The DMS latitude:longitude coordinates for the harbour are 20°18'14"S, 118°34'11"E. It is Australia's highest tonnage port and one of the largest iron ore loading ports in the world. Port Hedland is situated on one of the most cyclone affected stretches of coastline of the southern hemisphere with a tidal range of 7.5m.

The key design challenges addressed in the design were:

1. A requirement for post-cyclone operability up to and including a 500 years ARI cyclone event.
2. Safe egress from the tugs following completion of the cyclone mooring procedure in up to gale force winds (35 knots).
3. A design storm tide (including an allowance for 0.4m sea level rise) of 9.2m above LAT.
4. Cyclone berths catering for *RAstar 85* Escort Tugs with maximum displacement 1175t.
5. Minimise the environmental footprint and any regret capital expenditure associated with the potential future expansion of the harbour.

The resulting harbour design has met with approval from all stakeholders including the operations personnel.

1. INTRODUCTION

BHP identified a requirement to increase their towage services in Port Hedland. The strategic aims achieved through the recently completed harbour include:

- Mitigate the significant risk associated with the potential grounding of a vessel blocking the shipping channel which is 42km in length, tidally constrained and uni-directional.
- Provide new state-of-the-art tug berths to support the increased towage requirements associated with the planned future expansion of the iron-ore export operations at the port.
- Reduce the cyclone related disruption to port operations.

The new facility at Hunt Point has been designed to accommodate eight (8) new escort class tugs. Located behind an existing seawall, the environmental footprint, impact on recreation at the adjacent public beach and the requirement for marine based construction plant have been minimised. Four (4) berthing pontoons are located within the harbour catering for two (2) tugs at each berth. To provide for improved operability of the berths, the following features have been included on each pontoon:

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- Fixed rotating access brows at two locations to allow bow-in and bow-out operational mooring of the tugs.
- Cyclone mooring line reels.
- Mooring line hangers.
- 1.8m wide gangways (of maximum 1:4 slope at LAT) providing a zero-step access to each pontoon through the full 7.49m tide range.
- Along-side cyclone mooring arrangement capable of surviving cyclones up to 500 years ARI (compared with a four-point cyclone mooring arrangement used elsewhere within Port Hedland).
- Mooring line snap-back guards for safe egress after mooring the tugs in pre-cyclonic conditions.
- Shore power, compressed air, drinking water and fire-water provided via the gangway.

In addition to the eight (8) tug berths, a pontoon for small boats is provided in the south-west corner of the harbour, as are navigation aids (including day-night lead marks designed in accordance with IALA specifications), revetments and other associated shoreside facilities.

2. TUG HARBOUR LOCATION AND LAYOUT

The Hunt Point Tug Harbour location was selected as the preferred location as it provides a number of benefits including:

- No increase in environmental footprint.
- Least energetic conditions within the lease boundary enabling a safer, less complex cyclone mooring design.
- Located within an existing seawall allows for shelter to be achieved with minimum effort.

The general arrangement of the harbour can be seen in Figure 1 and photos of the completed harbour are presented in Figure 2.

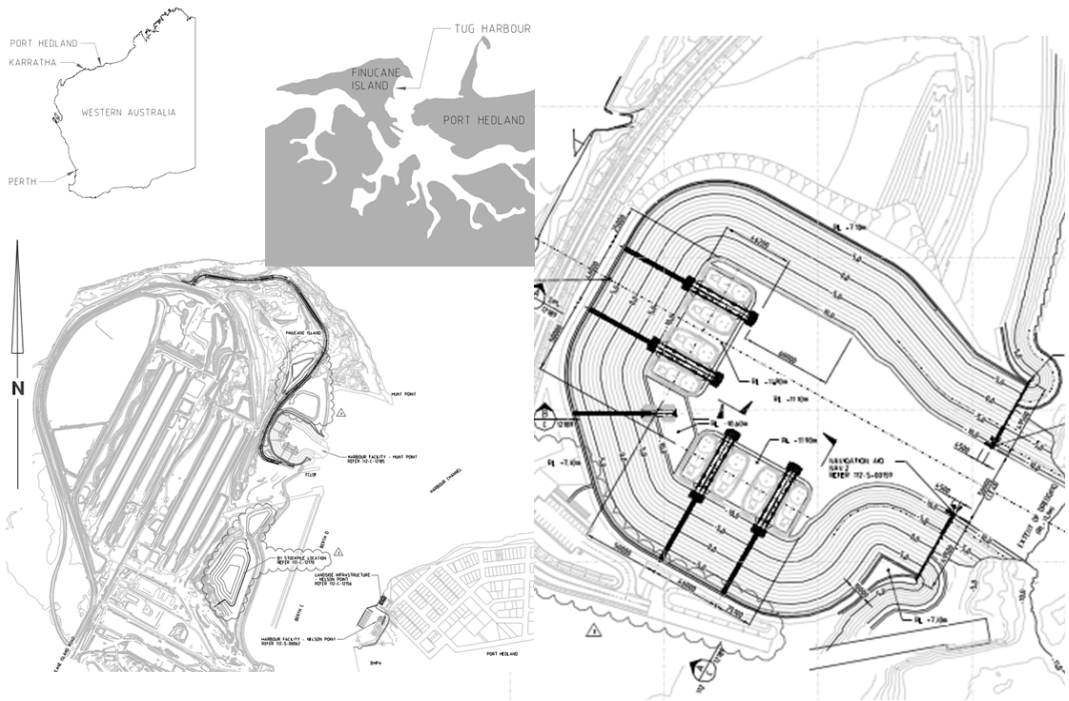

Figure 1: General arrangement and locality of the harbour

Figure 2: Panoramic view of the completed tug harbour from the northern revetment (top) and an *RAstar 85* Escort Tug moored at one of the berthing pontoons (bottom)

Part of an existing sea wall was removed to create the 50m wide (at the toe of the entrance channel) entrance to the facility. Two 45m long piled sea-walls are located either side of the entrance to the harbour to protect the heads of the revetments in severe weather conditions and minimise wave penetration into the harbour.

2.1 Operational and Cyclone Berthing Arrangement

A cyclone mooring arrangement alongside a pontoon has been adopted in lieu of the four-point arrangement used elsewhere in the port. This provides the following benefits:

- Reduced per-berth footprint.
- Safe for access to shore following completion of cyclone mooring procedure.
- Reduced cyclone mooring procedural complexity.
- Simpler tide-following mooring point details integrated into the pontoons.

The facilities provided within the Hunt Point Tug Harbour satisfy the requirements of operational and cyclone berths for eight (8) escort tugs. This is provided via four (4) 52m long, 5.85m wide pontoons. The pontoons are arranged so that two are parallel to the adjacent coastline (NNE-SSW) behind the causeway to the south of the entrance and two lie WNW-ESE on the far side of the harbour. Each of the four pontoons has been designed to be capable of berthing two (2) of the escort tugs. The operational mooring berths for four (4) crew transfer vessels are provided by a 21.6m long by 4.5m wide pontoon running E-W.

Each tug pontoon has been designed to allow the tugs to moor either bow-in or bow-out during non-cyclonic periods. For cyclone mooring, the tugs are required to moor bow-out. The crew transfer pontoon is for operational use only and is not required to moor boats during cyclonic conditions.

The mooring of the vessels alongside the pontoon prior to the onset of gale force winds (pre-cyclonic conditions) enables landside access via the pontoon and access gangways for the crew to go ashore after completing the cyclone mooring procedure.

The fendering system comprises two twin air-block fenders per tug (four per pontoon). Low friction facing is used on a 2.4m wide fender panel to increase the contact width on the tug sponson. The air-block fenders provide a low reaction at small deflections making them ideal for use on the pontoons and with the tug hull geometry. The size of the air-block fenders is governed by the design cyclonic conditions. The energy absorption requirements during normal and abnormal berthing are significantly lower than those for peak cyclone events.