

ASSESSING LONG PERIOD WAVE MITIGATION

Contributing to solving operational problems caused by harbour surges

Agitation by long waves often causes mooring lines in the Port of Geraldton to break, endangering both staff and vessels. The Geraldton Port Authority (GPA) – now known as Mid West Ports Authority – organised a workshop with national and international experts to find ways to address this problem. As part of the workshop, we provided a preliminary assessment of potential offshore mitigation schemes that could solve the long wave problems in the Port of Geraldton. As a result of the presentations and discussions, GPA decided not to proceed with the originally envisioned solution – a major extension of the west breakwater – because it was questionable whether sufficient benefits could be obtained, even with very large capital investments.

SUPPORTING INFORMED DECISION-MAKING

The Geraldton Port Authority (GPA) wanted to reduce the cost and impact of surge delays on port operations. Mitigation of surge incidents is beneficial to port operations as these incidents cause critical situations for the vessels themselves and other vessels in the port as well as present a high risk to the safety of staff and potential damage to port structures.

Several studies have been carried out since the turn of the century in order to understand the origin of long waves and their interaction with the port itself as well as moored vessels in the port.

CLIENT

Geraldton Port Authority (now known as Mid West Ports Authority)

CHALLENGE

Need to reduce the cost and impact of surge delays on port operations

SOLUTION

Provision of a preliminary assessment of potential offshore mitigation schemes to solve long wave problems in the port

VALUE

- Greater appreciation of the complexity of the Port of Geraldton's long period wave climate
- Realisation that the mitigation effort is likely to involve a combination of smaller initiatives rather than the delivery of a single solution

LOCATION / COUNTRY

Port of Geraldton, Western Australia, Australia

SOFTWARE USED

MIKE 21 Boussinesq Wave (BW)



Port of Geraldton viewed from the northeast. © Geraldton Port Authority



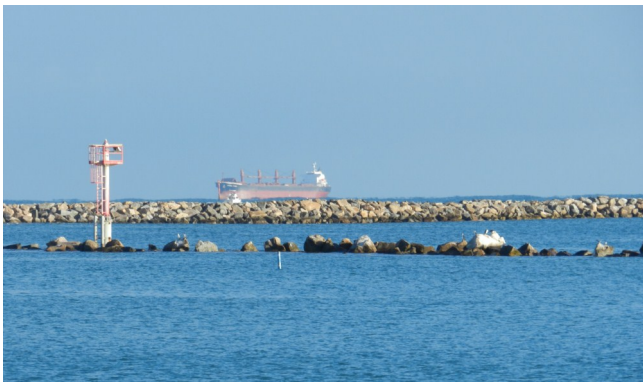
Bulk loading at Geraldton grain berth 3. © DHI

Economic studies have also been conducted to assess the financial consequences of lost productivity in the port. GPA needed a firm basis for making decisions related to ways to mitigate the problems in the future.

Consequently, they invited experts from a number of experienced institutions, laboratories, and firms to participate in a workshop in order to arrive at an informed decision basis. The objective of the workshop was to create a foundation for new initiatives to solve the serious problems caused by long waves in the Port of Geraldton. The workshop topics included:

- long wave generation over reefs
- numerical modelling of long wave propagation into the port
- characteristics of long waves in the port
- resonance consideration and mitigation
- ship motions and mooring line tension
- improvements of mooring systems
- early alert systems for swell and long waves

Following the presentations, the attendees also had open group discussions on the topics and outlined ideas for further studies to address knowledge gaps.



Geraldton entrance channel and west breakwater. © DHI

OUR CONTRIBUTION

Representatives from DHI were among those invited to contribute and participate in the workshop. Using MIKE 21 Boussinesq Wave (BW), we analysed long wave generation and propagation into the Port of Geraldton.

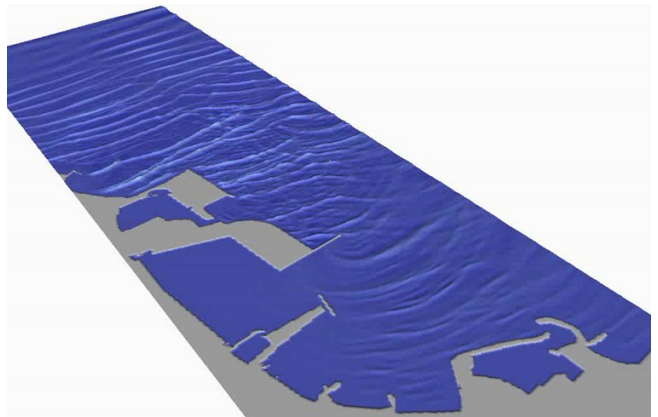
DHI experts presented the results from the preliminary numerical analysis of mitigation measures at the outer fringe of the reef outside the port. These mitigation measures were designed to address long wave generation at the source, thereby reducing long wave energy entering the port.

We found that a breakwater structure at the fringe of the reef has the expected effect, but the costs of such measures would be prohibitive. A realignment of the access channel might have beneficial effects as well. That useful realignment, however, would lead to navigational difficulties for vessels transiting the channel.

Based on the presentations given at the workshop and during the open group discussions, GPA concluded that there was no single measure that could significantly improve the conditions in the harbour within the economic constraints of the originally envisioned breakwater solution.

A number of measures could potentially improve conditions in the port and, when combined, might provide acceptable conditions, including:

- modification of breakwaters
- dredging
- alternative mooring systems
- improved management systems based on wave forecasting



Wave transmission around the Geraldton modelled by MIKE Powered by DHI's MIKE 21 BW. © DHI

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