Enhancing Port Infrastructure: Gellibrand Spring Mooring Dolphins Upgrade

Gellibrand Pier

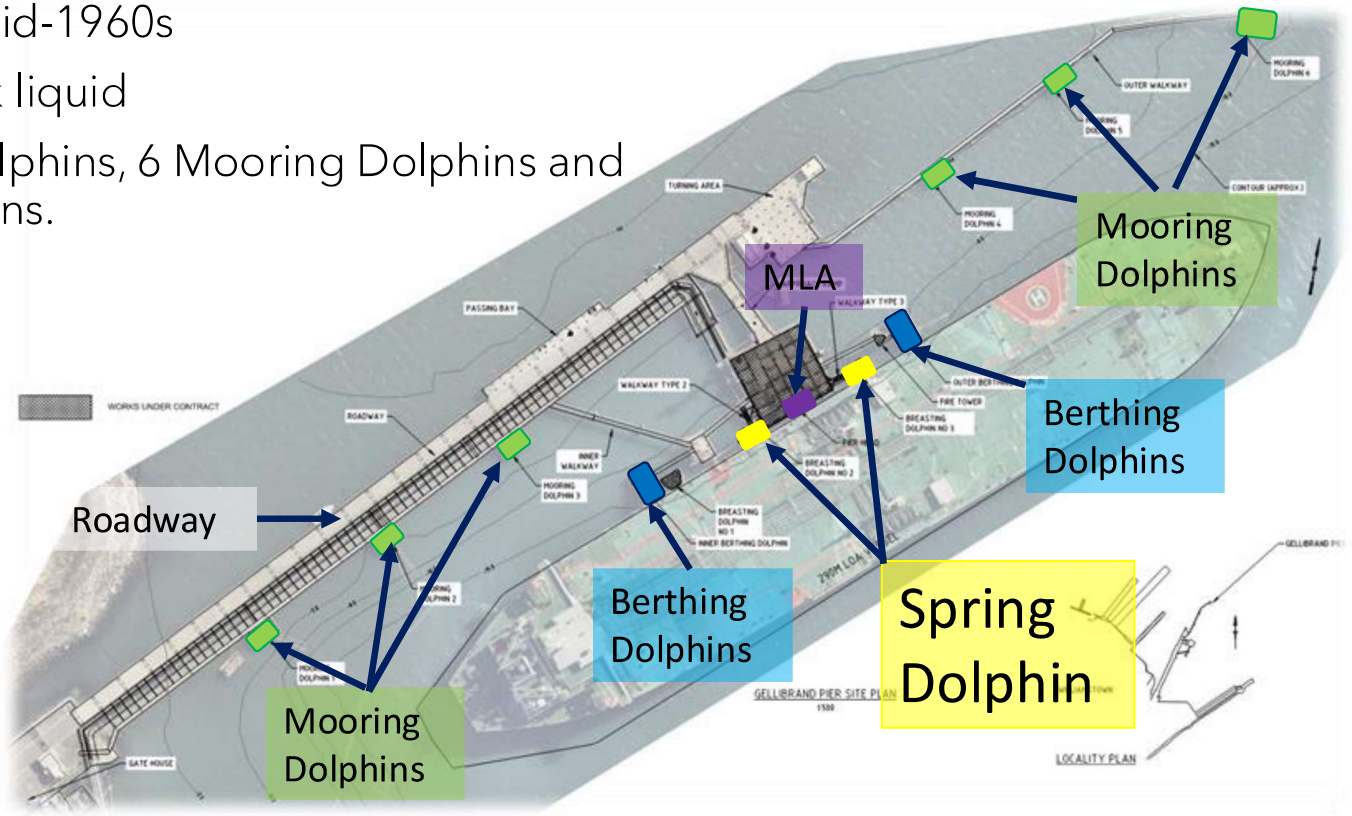
- Williamstown, Melbourne
- Built in 1850s for wool & grain trades

Gellibrand Pier

- Major upgrade in Mid-1960s
- Island Berth for bulk liquid
- MLA, 2 Berthing Dolphins, 6 Mooring Dolphins and TWO Spring Dolphins.

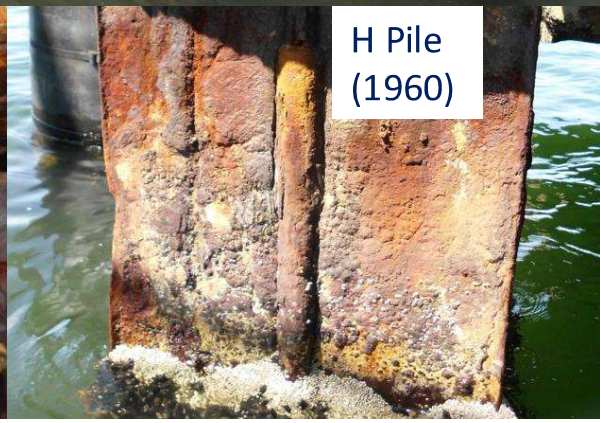
Berthing Dolphins

Mooring Dolphins



Existing Dolphins (BD2 & BD3)

- Built in 1960s
- 7 H piles (1960) + 2 x 900CHS Piles (2009)
- Used as breasting dolphins + spring mooring dolphin
- Piles with high corrosion in the tidal and splash zone (up to 10.5 mm corrosion loss)
- Concrete cap in very poor condition with exposed reinforcement



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Upgrade of Spring Dolphins

Main Goal: Enhance the capacity with minimum distruption to operation

- Design for a 176-tonne safe working load to build resilient infrastructure in line with United Nations Goal 9.
- The dolphin will not experience structural failure before reaching the ship's design minimum breaking load

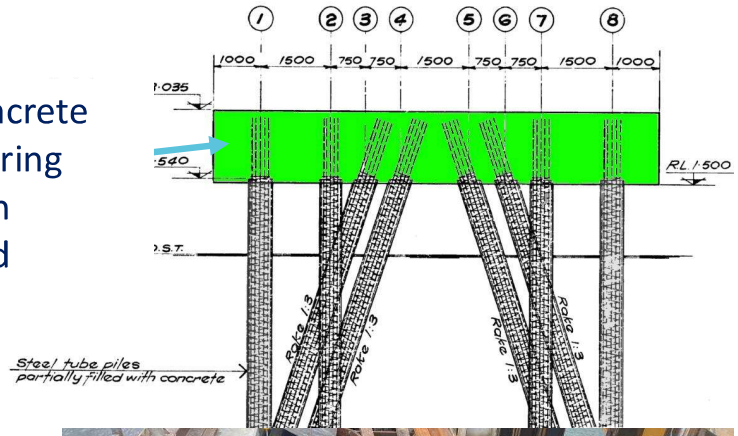
UNITED NATIONS

Goal 9
Build resilient infrastructure

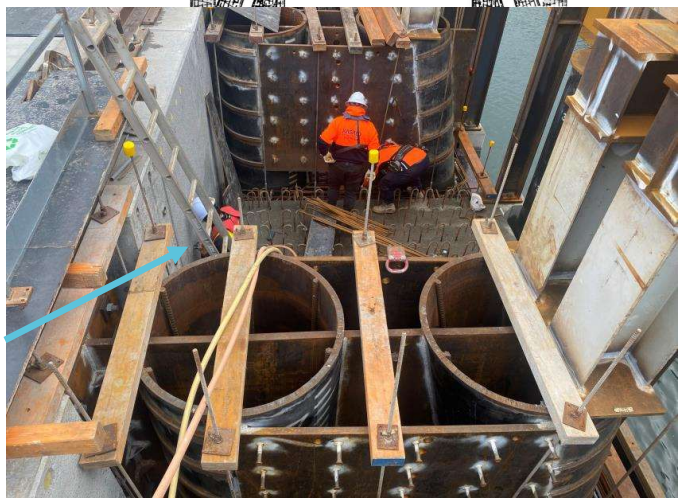
Site Specific Constraint

- Max planned shut down time = 2 weeks
- Use of precast concrete cap rather than a conventional in-situ concrete cap.

Insitu Concrete Cap, Mooring Dolphin in Gellibrand



Insitu Concrete Cap



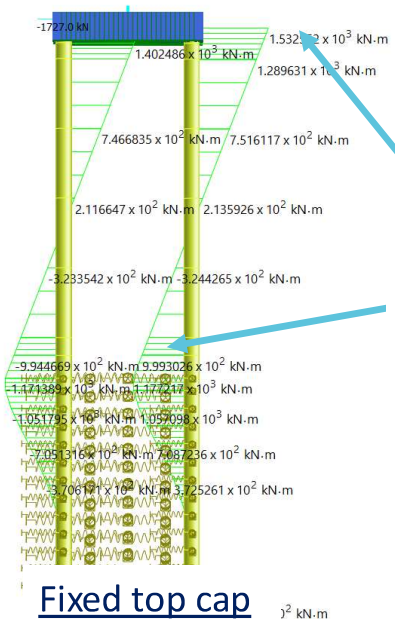
Precast Concrete Cap

- Limit weight to 70 tonnes.
- Adequate footprint for new piles
- Thin Cap (740 mm)
- Pin-top Pile Connection

Precast Concrete Cap, 740 mm thickness, weight 65 tonne

Pinned versus Fixed Top

- Fixed top requires a deep concrete cap, but piles are more efficient.
- Pinned top has a relatively thin concrete cap, but the bending moment at the fixity depth may double the amount of fixed top.

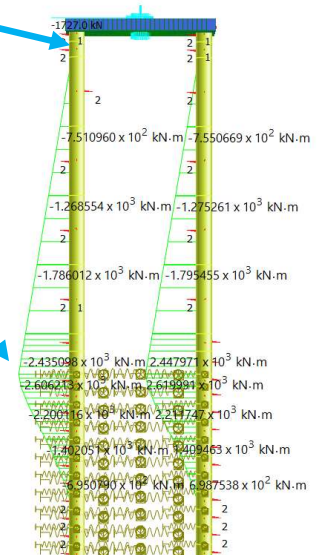


Bending is shared between the top and bottom of the pile (Portal Frame Action)

Fixed top cap

Bending 0

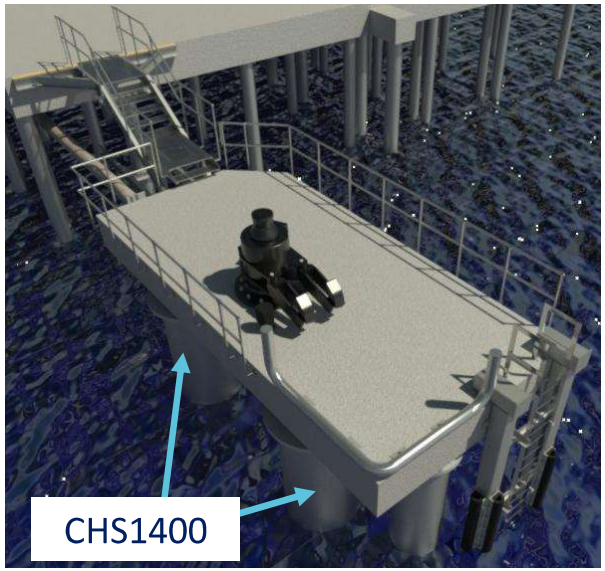
Bending at fixity is about double the fixed top cap

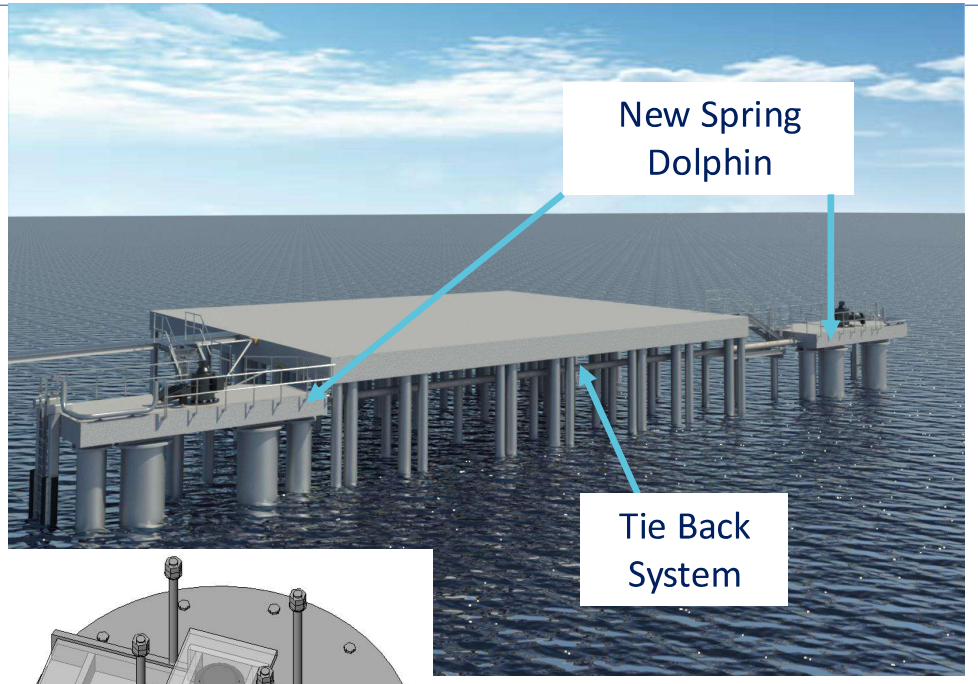


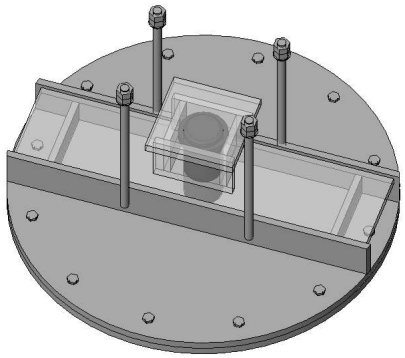
Pinned top cap

Design Development

- Connect dolphins using a tieback system.
- Drive the minimum number of new piles to reduce the time on site.



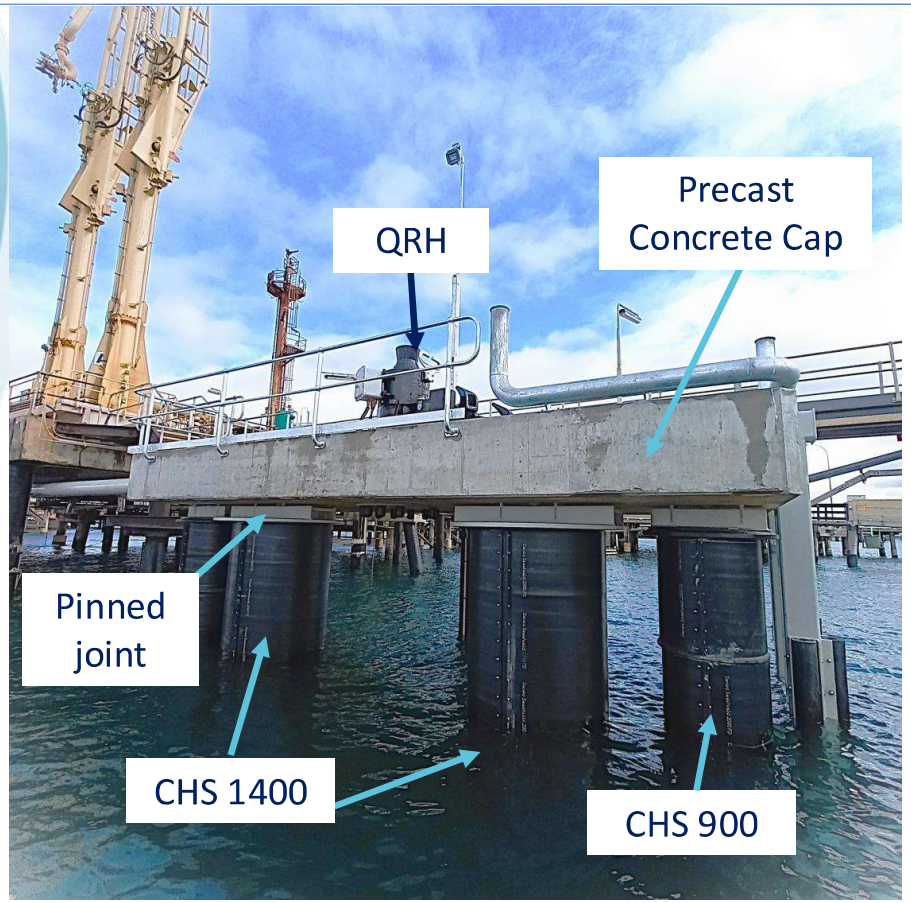


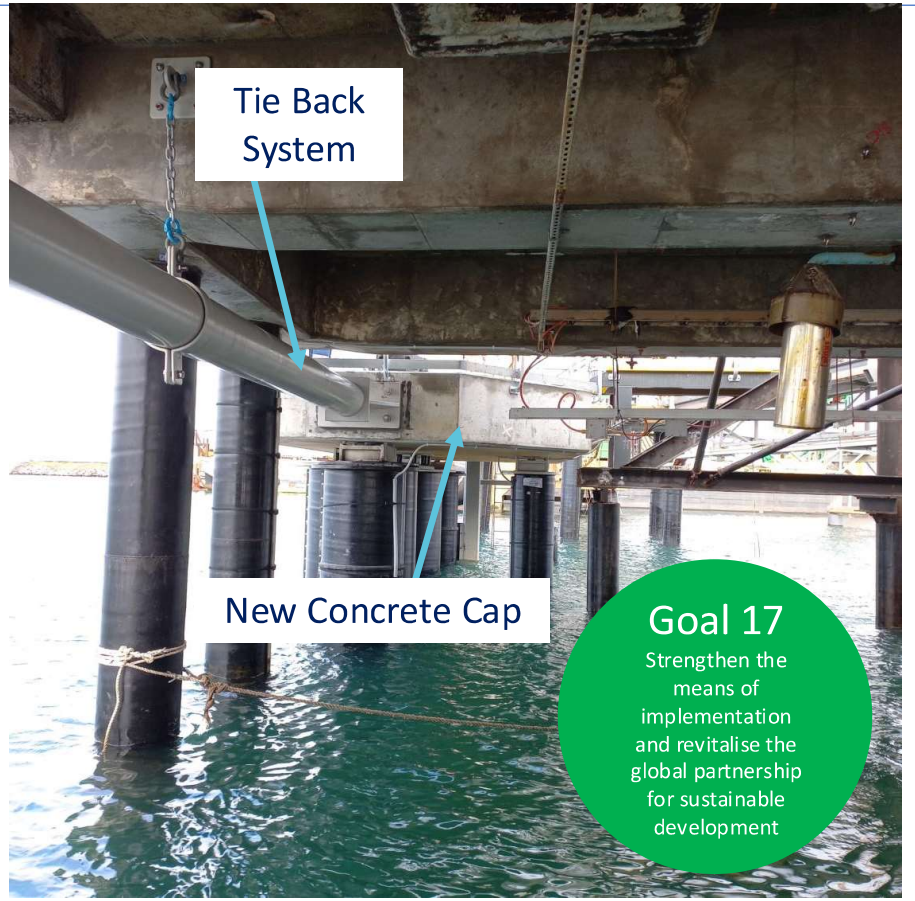


Construction Work

- ON-SITE work: Start March 2022, Finish June 2022 (four months).
- Demolition of existing dolphins and existing H piles.
- Install all new piles, concrete cap, QRH and modify existing 900 piles in less than ten days.

Final Product





Q & A