

Royal HaskoningDHV - Smart Mooring

addresses the safety of moored vessel operations in sheltered and exposed ports by predicting excessive vessel motions and mooring line forces

the challenge

Smart Mooring addresses the safety of moored vessel operations in sheltered and exposed ports by predicting excessive vessel motions and mooring line forces.

Smart Mooring focuses on the Harbour Master's community. Engaging with this community made us realize how challenging the work of the Harbour Master and port control is: keeping port staff and vessels safe is a massive responsibility that requires port control operators to see and foresee what is happening in their port.

With so many things going on at the same time, that central role in port control is highly challenging. And looking at some key trends in the Maritime industry that role is becoming even more challenging over time. Because what we see in the Maritime industry is that:

- Ships become larger
- Storm events become heavier and more frequent due to climate change
- Old port infrastructure remains in use, thereby stretching the initial limits and capacities

At present, operational decisions are mostly based on manually compiled data and years of experience. Still, unforeseen conditions lead to dangerous outcomes: Mooring lines fail when under peak tension and cause damage or even injury; Ships break loose and lead to consequential damage of various kinds; Excessive movement of ships cause damage to the ship or the port infrastructure, harm to the environment or lead to inefficient cargo handling.

Smart Mooring has been designed to mitigate these risks by providing insights into the safety levels of vessel moored in a port.

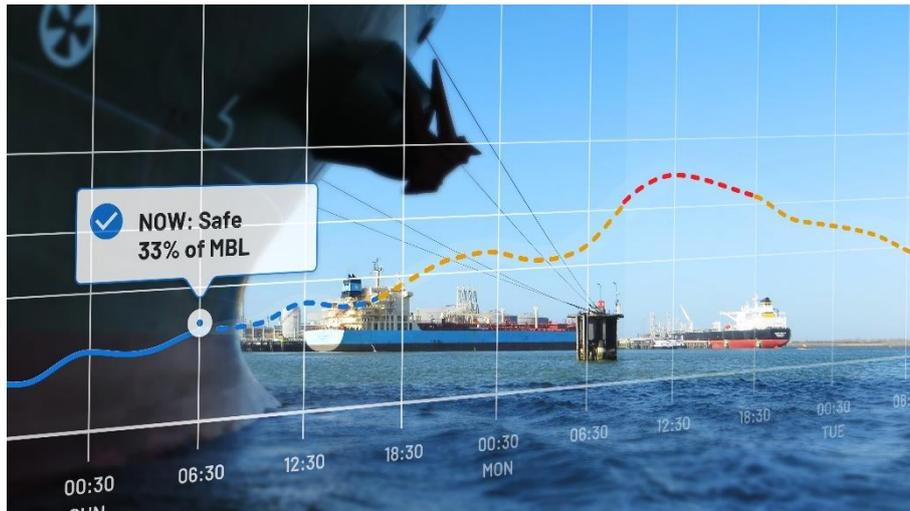
the innovation

- Smart Mooring is a software application that actively warns the port control operator or Harbour Master for expected unsafe situations of a moored ship.
- The software predicts mooring forces and ship motions days in advance and for a specific location (berth view) or for multiple locations in the port (port overview). It is simple to use and intuitive, even though it combines the dynamics of moored ships with port data and weather forecast (wind and/or waves).
- One could describe Smart Mooring as a Digital Twin, having a central role in the ship-shore interface. The engine of Smart Mooring turns data into information by describing and predicting the behaviour of a moored ship in the days ahead. The

results shown on the dashboard provide insights that support operational decisions in port control operations.

The key business question it answers is:

- Can this vessel moor here safely: now and in the days to come?
- Smart Mooring bridges the gap between engineers and operators by putting science behind the operational decisions.



how it was implemented

In 2019 we created a prototype, which we used as a basis to build up a Minimum Viable Product (MVP), which we tested in the Port of Rotterdam (Netherlands) for wind and in RAK Ports (United Arab Emirates) for waves. Both ports became our launching partners in this development. That was important, because it gave us a short and direct connection with the actual users in port control.

Their feedback from real storm situations (including actual moored vessel incidents) has been vital for the early development of our system, not only technical, but also for its user friendliness. Besides the user feedback we connected to available data flows, like Smart Bollards and Smart Quick Release Hooks, which we (still and ongoingly) use for validation of our predictions.

After various improvements to the system, we further expanded the product with our early adaptors in 2022: Belfast Harbour, Groningen Seaports and Port of Algeciras. Building up the system for those ports required significant further developments and associated RHDHV investments. Yet, it also paved the way for a product that is suitable to serve multiple ports with similar issues in the Maritime market, which makes it a Minimum Marketable Product.



result

The result can best be translated through text from an interview with **Kevin Allen, Harbour Master, Belfast Harbour** ([Link to article](#))

“With Smart Mooring, we can immediately see where and when we could have a potential problem with moored ships, and take appropriate mitigating action. This software plays a key role in helping us to protect against bollard overloading and failure due to excessive forces imparted by large cruise ships and additionally providing coverage for other critical and at-risk berths,” said Kevin Allen, Harbour Master at Belfast Harbour.

“It’s fascinating, because until you engage with technology, you don’t know how better informed your decisions could be. This software provides an opportunity to mitigate risks and maintain operational efficiency with support from a digital solution, rather than investing in additional quay furniture and very much aligns with our smart port strategy.”

And

An example where **Captain Michael Magee, Group Harbour Master, RAK Ports** used Smart Mooring in his operational decision:

A Capesize ship sat alongside the outer berth being unloaded and a Panamax vessel sat at one of the inner berths. As port staff unloaded cargo and the crew departed and boarded via gangways, the Smart Mooring system alerted to incoming bad weather.

With the two specific ships selected within the tool, Captain Magee saw that the Panamax ship was at risk of rolling and breaking its mooring lines; endangering the staff who were currently unaware of the incoming storm. At the same time, the position of the Capesize ship at the outer berth, along with the nature of its build, meant it could remain and unload safely and efficiently.

“We responded to the software and moved the Panamax ship out to anchor, until the weather passed.” Captain Magee says, and it was the right call: “Everything panned out as the software predicted. The Capesize ship put out some extra mooring lines for precaution, but we were able to make the right decision to keep our vessels and staff safe.”

And

A quote from **Pieter van de Wal, Harbour Master at Groningen Seaports, the Netherlands**

“Ships are becoming bigger and bigger, so they are more sensitive to wind. We are limited in space and we want to make sure that the ships that are moored in our harbour, can be safely moored without us having to worry about whether the lines will hold, whether it is moored well enough.”

conclusion

Additional references via Weblink:

- Product website: <https://www.twinn.io/en/services/smart-mooring>
- Groningen Seaports – case movie: https://www.youtube.com/watch?v=fjy3CYTx_qs
- Belfast Harbour – magazine article: <https://www.thedigitalship.com/news/maritime-software/item/8429-belfast-harbour-implements-royal-haskoningdhv-s-twinn-software>

