The World's Largest Circulation Marine Industry Publication • The Information Authority for the Global Marine Industry since 1939

MARITIME REPORTER AND ENGINEERING NEWS

MARINELINK.COM

"We Build Composites"

Navy's DDG 1000 deckhouse takes shape at HII

Ship Repair
ASRY Lays Foundation for Global Expansion

Eye on Design
The Impact of Ships

Technical/Legal
Ballast Water Management Technologies

Offshore
Bergen Bound

Insurance
Shipyards: Hotbeds of Ingenuity & Risk

MARITIME REPORTER AND ENGINEERING NEWS

Reprinted from the January 2012 Edition of Maritime Reporter & Engineering News

Passing in the Night (or Day) ...

The Impact of Ships

MARIN (Maritime Research Institute Netherlands) is involved in several projects examining the effects of passing ships. Here we present the many ways MARIN helps to shed light on this phenomenon.

BASIN TESTS

MARIN's Shallow Water Basin facilitates a wide range of model testing. A recent ship passing study again showed this versatility when two complete harbours were modelled, including more than 4,000 m of their surrounding shoreline. This ship passing study aimed to investigate the feasibility of two possible new barge dock locations at an existing terminal in Beaumont. The main objective was to assess the mooring line loads on two barges moored in the dock when a vessel passes. Model testing of passing ship effects in narrow waterways requires special attention. Modelling the approach of the passing vessel is one of the points that needs additional care. When the passing vessel is not accelerated appropriately in the basin, unwanted shock-type waves propagate in front of it. For the Beaumont terminal study the model setup of around 4,000 m ensured that no shock-type waves were generated.

An additional point of interest is the modelling of the mooring system. Monopiles, fenders and mooring lines can all be modelled in the basin. However, for this project a numerical model was set up for the mooring system of the barges. The barges were rigidly moored in the basin and the measured (time-dependent), total mooring forces were used as input for the numerical model. This means different mooring layouts could be studied without carrying out additional model tests. By changing the harbour depth and the speed and dimensions of the passing vessel in the basin tests and by varying the mooring layout in the numerical simulations, a complete series of tests was performed that provided the customer with the information they needed to continue the project.

Joop Helder & Willemijn Pauw, j.helder@marin.nl

NUMERICAL TESTS

The effects of passing ships on moored vessels can also be investigated numerically. An investigation was made into the applicability of MARIN's in-house tools to predict passing ship effects. A distinction was made between the flow around the passing ship and the effect of this flow on the moored ship. When the passing ship sails under a drift angle, or when the keel clearance is small, viscous effects are expected to be important. Therefore, the flow around the passing ship was analysed by the RANS code ReFRESCO which accurately takes into account the viscous boundary layer and lift effects on the hull.

The effect of the flow on the moored ship and the resulting forces were then analysed using the linear diffraction code DIFFRAC. For this purpose, a coupling between the two codes was made. Passing ship model tests in the Shallow Water Basin were then used for the validation of the coupled tools. This validation showed that viscous effects are indeed important in the case of drifting ships. Forces on the moored ship can be computed with satisfactory accuracy up to drift angles of at least 15 degrees (see figures) and a considerable improvement was obtained compared to a full potential flow approach. For small drift angles, a potential flow solution for the passing ship turned out to be sufficient.

Serge Toxopeus & Tim Bunnik, s.toxopeus@marin.nl

COMPUTER MODELLING AND FULL-SCALE MONITORING

Existing ports have to accommodate ships with ever increasing sizes. ROPES, a new Joint Industry Project, is developing reliable computer models to predict motions and the mooring loads of moored ships and at the same time, it is contributing to innovative, dynamic berth systems. Moored ships experience suction effects from passing ships and this increases in relation to the restriction of the waterway and the size and speed of the passing ship. The passing distance is obviously a critical variable. Passing events can threaten loading and discharging operations in both a safety-related and economical sense; excessive motions may lead to interruptions, damage and even to dangerous situations. ROPES is developing a numerical prediction method to quantify these effects for arbitrary ship and port geometries. To investigate the physics of the real world and to validate the numerical model an extensive, full-scale monitoring campaign is being conducted by MARIN.

On May 2, the first series of full-scale measurements started at ECT's Delta Terminal in Rotterdam. In close cooperation with the Port of Rotterdam and the pilots and boatsmen, MARIN's Trials & Monitoring team instrumented the mooring lines with load cells and installed a motion sensor set on each vessel calling into the terminal around the clock for a period of two weeks. While building a database of passing vessels in the busy harbour of the Maasvlakte, moored ships' motions, line loads, and the metocean conditions were measured from the moment of arrival to departure.

This first series of measurements spanned six ships being passed by more than 30 vessels, ranging from feeders to the very largest container carriers. While analysis continues, the ROPES monitoring campaign will continue at three more jetty locations, including a riverside mooring and a ship-to-ship offloading site. In phase II the potential of dynamic berthing systems, where the mooring is dynamically controlled from shore, will be investigated and a control algorithm for such systems will be developed.

The ROPES JIP is still open for new participants. Henk van den Boom & Eric Wictor, h.v.d.boom@marin.nl

ROPES, a Joint Industry Project, is developing reliable computer models to predict motions and the mooring loads of moored ships and at the same time, contributing to innovative, dynamic berth systems.