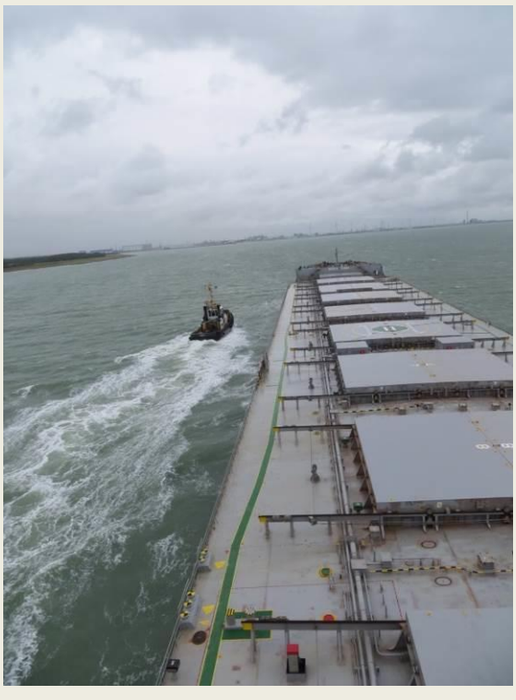
This is the 27th newsletter of the *Knowledge Centre Manoeuvring in Shallow and Confined Water*, which aims to consolidate, extend and disseminate knowledge on the behaviour of ships in shallow and confined water. This newsletter presents an item on a squat measuring campaign that was carried out for the Common Nautical Authority.

The shipping traffic to the Belgian and Dutch ports located at the Western Scheldt estuary and the river Scheldt follows an access channel of which the depth is restricted. As a result, deep-drafted vessels cannot always sail 24 hours a day on the River Scheldt. The period in which these vessels may proceed inbound or outbound is called the tidal window. The Common Nautical Authority (CNA) calculates these tidal windows and gives permission for the vessels to proceed. As mentioned in our 17th newsletter, the CNA is in the process of adopting a probabilistic access policy to determine the tidal windows.

Earlier research performed by the Knowledge Centre partners had revealed that the ship squat has a significant impact on the duration of the tidal windows when applying probabilistic criteria. In order to predict the squat as accurately as possible, the CNA asked the Knowledge Centre partners to develop a squat formula for cape size bulk carriers sailing inbound to the port of Flushing.

In the first phase of the project, a robust squat formula was developed based on captive towing tank measurements with a 1:70 scale model of a cape size bulk carrier at draft 16.5 m. The towing tank tests revealed that the squat by the bow is influenced by the ship speed, the under keel clearance and the blockage (which is the ratio of the midship section of the ship to the cross-sectional area of the waterway).

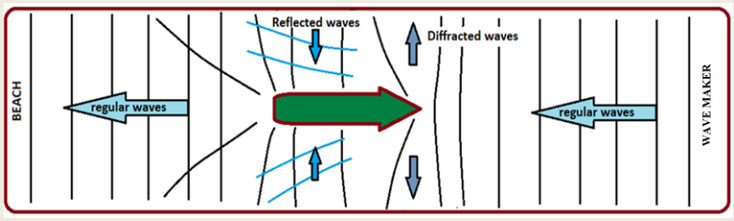


In the second phase of the project, the squat formula derived from the towing tank tests was compared to onboard squat measurements. The full scale measurements were provided by the Dutch Pilotage by means of positioning data from three RTK-GPS antennae that where mounted on both bridge wings and at the bow. These data were processed to determine the motions of the vessel in 6 degrees of freedom. By referring the ship motions to a static measurement (at near-zero speed), the ship squat could be derived. The main challenge during squat measurements in a tidal environment, is the accurate determination of the water level along the trajectory.

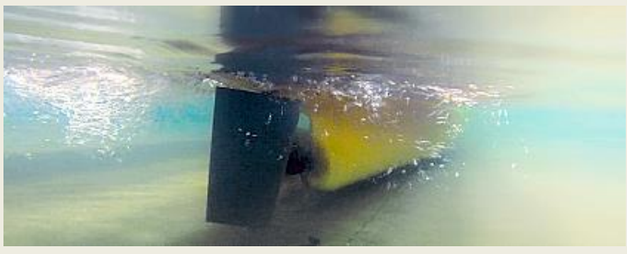
In addition to the squat, the ship speed through water was determined based on position measurements and hindcast calculations of the current carried out by Rijkswaterstaat. The under

keel clearance and the blockage were also determined using the most recent survey data at the time of the measurements. Any occurring ship meetings were also analyzed, based on AIS analysis.

At present four inbound trajectories have been analyzed. In general, good agreement between measured and predicted squat was found. Under some conditions the squat formula seemed to underpredict the squat by the bow. Further data collection will be used to refine the squat formula in order to improve agreement with the measurements. In this way, the CNA will be able to use a squat prediction formula, which is based on theoretical principles and which is fine-tuned by both towing tank and full scale measurements.



A partner of the Knowledge Centre has taken part in the 12th International Conference on Hydrodynamics, which was held from 18 to 23 september 2016 in Egmond aan Zee, The Netherlands. Manases Tello Ruiz presented a paper entitled "Challenges with Ship Models in Shallow Water Waves" explaining the difficulties when performing ship model tests in waves in shallow water. Based on recent captive and free running manoeuvring towing tank experiments in regular waves that have been conducted in shallow water conditions, it was found that the wave behaviour along the tank, the induced ship motions, as well as the interaction with the side walls of the tank are major constraints. Interaction with the side walls will always be present in following waves due to the limited speed of ships in shallow water. For tests in head waves, however, it is possible to obtain a limited combination of wave frequencies and ship speeds so that interaction with the side walls is limited.



A Participant satisfaction survey of the 4th MASHCON conference revealed that the majority of participants was satisfied with the conference overall and the quality of the presented papers, which are freely available online. Some very useful suggestions were given to further improve the conference and they will be taken into account. The organization of the 5th MASHCON conference, which will be held in Ostend in 2019, is already underway.

Knowledge Centre
Manoeuvring in Shallow and Confined Water

Berchemlei 115
2140 Antwerp
Belgium

T +32 (0) 3 224 60 35
E info@shallowwater.be

www.shallowwater.be
