



MARITIME

FULL-SCALE MEASUREMENTS

A contribution to safer shipping

Ship design and construction is subject to change, mainly driven by economic needs, safety- and ecology-related requirements as well as technological developments.

Background

Recently, the size and capacity of size and capacity of container ships have increased rapidly to meet the unceasing growth of marine container transport needs. Although design experience is limited for such ships, design rules and guidelines are needed to ensure adequate structural safety.

Full-scale measurements are an important source of information for validating design rules and guidelines as well as formulating rule approaches and formulas. In particular, data from full-scale measurements can be employed for the validation

of design assumptions and design loads, and of calculation tools.

Furthermore, data can be acquired that cannot be generated by computations because the respective methods or tools are not yet or not far enough developed, or the required effort for such computations would be excessive. An example of the latter are long-term, high-frequency hull girder loads which are important for the hull girder ultimate and fatigue strengths.



Symbol	Sensor type
■	Central unit
■	Strain gage at primary hull structure
■	Strain gage at hatch corners
■	Strain gage at side longitudinals

Symbol	Sensor type
★	Accelerometer for global accelerations
★	Accelerometer for local accelerations
●	Pressure gage
☾	Wave sensor

Sensor arrangement of the Panamax ship

DNV GL contribution

Ongoing measurements

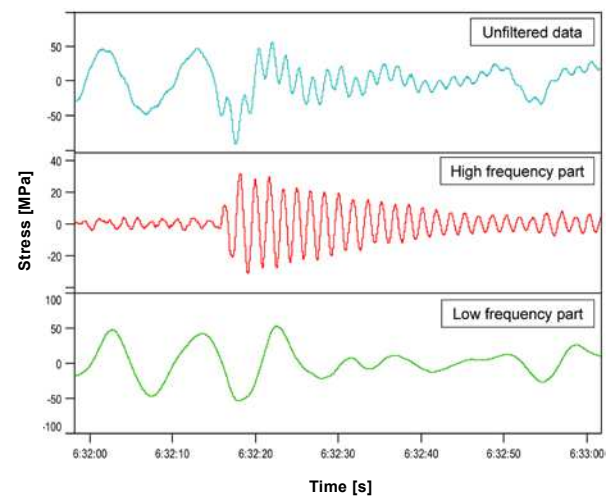
Full-scale measurement campaigns are currently being conducted on board a Panamax and three post-Panamax container ships. Operating worldwide, the trade route of the Panamax ship extends from Europe to North America and continues to East Asia. The trade route of one 8,400 TEU ship extends across the North Atlantic, from Europe to East Asia and across the North Pacific. Another 8,600 TEU ship was in operation in the Europe - East Asia service and now operates on the North Pacific. The largest container ship, a 14,000 TEU post-Panamax ship, trades between Europe and East Asia.

Planned measurements

A further measurement campaign is planned on a container ship with a cargo capacity of 18,000+ TEU. The measurement is planned as a joint industry project and mainly intends to give insight into the structural and acceleration response of the newest generation of container ships.

Main aspects for evaluation

The ongoing and planned measurement campaigns aim to gain insight into high-frequency loads of the hull girder caused by whipping and springing, amongst other things. The campaigns will also obtain data on global accelerations, which are important for containers stacked on deck. The procedures DNV GL has developed for the explicit assessment of high-frequency response for container ships mainly rely on results from full-scale measurements and model tests. The measurement results can also be used to validate the newly developed rules for route specific stowage of containers.



High-frequency stress response in upper deck of a container ship

Also, operational data such as ship speed, ship heading, ship positions and time in port and at sea is of high interest. From this, for instance, operational profiles can be derived and wave scatter tables for the ship route can be established based on available wave statistics.

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