

MARITIME

PROCESS IMPROVEMENT FOR HULL DESIGN

Modelling the hull structure is a key cost factor both for yards and for classification societies. Therefore, the re-use of hull structure models has been a goal of CAD system manufacturers and classification societies for many years.

Background

Until recently, the transfer of complete 3D structural models to rule calculation tools has proven an elusive challenge. A joint development project (JDP) has now shown that the re-use of models can lead to significant savings in lead time and cost. The JDP "Process Improvement for Hull Design" aimed mainly at developing an interface to re-use a modelled ship structure in NAPA Steel for finite element (FE) strength analysis and prescriptive rule check connected with class approval. A "structure" in this sense could be a complete cargo hold area or the global ship model. Apart from class societies, major stakeholders in the JDP were Samsung Heavy Industries (SHI) and NAPA.

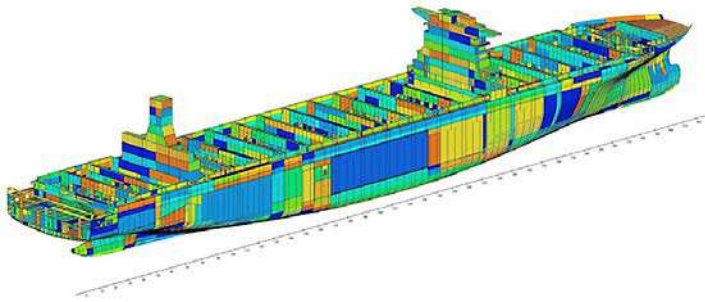
DNV GL contribution

A 14,400 TEU vessel project from our customer SHI was chosen to test the new procedures, in particular the software interface. In addition, it was agreed to test the advanced whole ship analysis

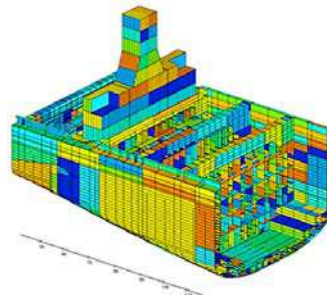
(AWSA) method on this project, which means performing cargo hold analysis within a global FE model.

In short, the project showed that:

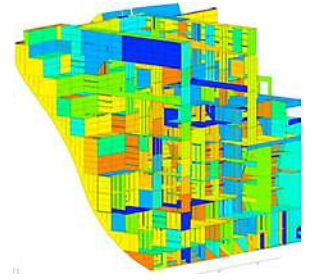
- The full 3D NAPA Steel model can be transferred to POSEIDON for productive use
- Total effort for building a global POSEIDON model is thereby reduced to one week, down from four to six weeks for a rule check model or eight to twelve weeks for a global model with-out the interface
- The POSEIDON model can be used for prescriptive rule checks and for the complete FE buckling analysis based on global FE strength results
- The calculated plate and stiffener dimensions are passed back to NAPA Steel



Structural model of the 14,400 TEU vessel as transferred from NAPA Steel to POSEIDON



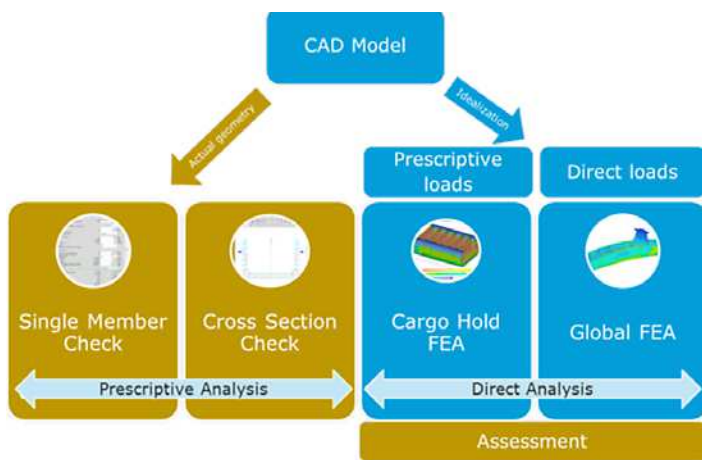
Block containing machinery space



Details of transferred model

Project results

The project made the hull design process at the yard much more efficient. A key decision for Samsung was then to use 3D modelling starting from the initial or basic design. As the recent project experience of the structural engineering team has confirmed, 3D modelling requires a bit more effort in initial design, but leads to major savings in later design stages.



Central 3D model allows for a class rules check and finite element analyses

Prescriptive rules check and finite element analyses (FEAs) require different models, for example with different levels of detail. Also, the structural information is stored differently in NAPA Steel and POSEIDON. A correct exchange of model information in both ways was the key challenge. The new interface, which is independent of ship type, allows for the transfer of complete 3D

blocks to POSEIDON. A typical block can contain three cargo holds with all longitudinal and transverse plates and stiffeners and is not limited to the prismatic midship part. POSEIDON then performs the rule check calculations at any cross-section inside the transferred block boundaries. The updated scantlings are automatically passed back to NAPA Steel. Furthermore, FEAs can either be performed in POSEIDON or FEA results are imported and assessed.

This process was first applied in practice by Samsung in 2014 for a 14,400 TEU container ship project. The total effort for building a global POSEIDON model was reduced from the previous four to six weeks to now only one week using the interface with NAPA Steel. In addition, all cargo hold analyses were performed as part of a single global finite element analysis, which resulted in additional time savings.

More details can be found in the Compit 2015 paper "3D Ship Design from the Start - An Industry Case Study".

CONTACT

Bernd Tietgen
 Head of Section Approval Technologies Development
 bernd.tietgen@dnvgl.com