Cruise ship designs are getting increasingly complex, especially for large vessels. Novel features such as large open areas and areas with large glass surfaces and little traditional steel structure are added in order to stay ahead of the competition, which may lead to challenges for the structural strength and vibration performance and in turn passenger comfort.

Due to the complexity and large number of analyses, shipowners see a need for a systematic approach to the review of analyses related to vibrations, comfort and structures.

**Benefit Case – Cruise ship strength and vibrations HAZID**

**SITUATION AND CRITICAL ISSUE**

Cruise ship – Third-party review for strength and vibrations using HAZID

**DNV GL SOLUTION**

- A systematic approach for the structural review and analysis activities, using a risk assessment framework
- HAZID workshop to identify and rank all conceivable and relevant risks/hazards, leading to a risk mitigation action plan
- Follow up actions, deadlines, risk status, etc. and review material according to the risk mitigation plan
- Focus on structural topics going beyond the classification and regulatory framework, placing emphasis on dynamic behaviour of the hull (machinery/propeller- and wave-induced vibrations)
- Other topics that are important to the shipowner can also be emphasised in the HAZID and risk mitigation

**VALUE DELIVERED**

- Increased confidence in the structural design and behaviour ("fit for purpose")
- Increased probability of not having missed major concerns, and traceability throughout the process
- Hazards can be uncovered at an early stage, before major costs are incurred
- Ensure that focus is given to the most challenging concerns that are identified
- Structured approach to communication of risks and mitigating actions between all stakeholders

For more information please contact: Kristin.Wilhelmsen@dnvgl.com
Benefit Case – Strength Evaluation of Passenger Vessel

SITUATION AND CRITICAL ISSUE

Global strength evaluation of passenger vessel

To keep the contracted delivery dates the ship Yard requested DNV GL Maritime Advisory to verify the hull strength of the new design in less than 8 weeks.

The objective was to verify and document the hull strength based on a global 3D FE Model.

DNV GL SOLUTION

- A global 3D FE Model of the complete vessel was done in less than 4 weeks. Openings in sidewalls were represented by orthotropic elements.
- A total of four load cases were evaluated, and results reported:
  - Maximum hogging bending moment
  - Maximum sagging bending moment
  - Transverse racking
  - Pillar loads

VALUE DELIVERED

- Global strength assessment delivered according to requested schedule.
- Based on the results, local reinforcements were suggested.
- Documentation delivered according to Class requirements.

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Benefit Case – Structural Analysis of Ships

SITUATION AND CRITICAL ISSUE

Tight schedule for steel ordering for a 14,000TEU container ship project

To keep the contracted delivery dates the ship yard urgently needed to finalise steel ordering. DNV GL was asked to verify the strength, fatigue life and ultimate strength of the new design in less than 8 weeks.

DNV GL SOLUTION

- The generation of the FE-model was started by the yard based on the preliminary steel design
- In parallel DNV GL prepared automated direct wave load analysis, stress checks and fatigue and buckling strength evaluation
- Scripted load generation, FE-analysis and post processing could be immediately started as soon as the FE-model was provided by the yard
- The results were intensively discussed with the yard so that modification proposals could be optimized and checked by variant analyses

VALUE DELIVERED

- Reliable and specific steel ordering for ship series resulting in less material cost
- Weight optimized and rule-compliant design with high structural and operational reliability
- Leveraging more than 30 years of DNV GL experience in analysis and verification of container ships

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