The Influence of Superstructure on the Longitudinal Ultimate Strength of a RO-RO Ship

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ABSTRACT
Superstructure of a RO-RO ship plays an important role to allocate things inside the ship, for instance passengers, cars, goods and so on. Superstructure consists of transversal and longitudinal deck beam to support the structure. It is well known that the superstructure has significant contribution to the longitudinal strength. The investigation of the superstructure of a RO-RO ship particularly its influence to longitudinal strength is very limited. In addition, this influence is not clearly explained in the regulation for the structural strength under longitudinal bending. In conjunction with this, the influence of superstructure is therefore must be considered. To investigate the influence of superstructure on the longitudinal strength of RO-RO ship, the Smith’s method implemented into Beam-HULLST is applied and the formulation in Beam-HULLST is based on the thin-walled beam theory. As a simple calculation, the cross section of RO-RO ship is taken to be analyzed. The results obtained by Beam-HULLST with and without the superstructure are compared with one another for the investigation of the cross section’s progressive collapse behavior.

KEY WORDS: RO-RO ship; cross section; hull girder; superstructure; ultimate strength.

INTRODUCTION
Superstructure of RO-RO ship has a role as a place for accommodation. The ship’s type is different comparing with the others such as bulk carrier, tanker or other ship type. The ship consists of several decks such as superstructure, car deck and so on. Those structures are almost placed along the ship. The structural component on the superstructure for instance deck beams and longitudinal must be included in the calculation. In addition, the section modulus measured from neutral axis up to the deck part is bigger than bottom part. Clearly, the section modulus gives significant influence to the longitudinal ultimate strength. Therefore, by additional of these superstructures, the longitudinal ultimate strength must be taken into account.


According to several studies, the investigation of superstructure on the longitudinal ultimate strength for RO-RO ship is very limited. The influence is not clearly explained in the regulation for structural strength under longitudinal bending, so that must be considered.

BEAM FINITE ELEMENT
The most important of ship structural design is the ability to predict accurately the longitudinal ultimate strength of ship hull girder. One of the theoretical approaches used to assess the ultimate strength of ship’s hull is beam theory. Practically, beam theory is a simple one to analyze progressive collapse behavior of ship cross section under longitudinal bending. Many researchers have clarified that the bending behavior of ship agrees quite well with the beam theory. The hull girder of the cross section describes the bending strength of the main hull structure. It means that the hull girder cross section is very important for ship design. The members in longitudinal direction are classified into several elements such as plate and stiffened plate with attached plating.