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The performance of buffer bow structures against collision
-2nd report: the effect in preventing oil outflow-

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Summary: We still have experienced cargo oil spill from a struck D/H(double hull) tanker like the accident case of "Baltic Carrier (at Denmark in 2001)". "Buffer Bow" has come to be considered as an innovative strategy following after D/H system to prevent marine environmental pollution. The mission expected to buffer bow is "minimizing the damage on the struck ship" and thus "decreasing the risk of oil outflow from struck D/H tankers" when it encounters collision accidents. This performance is supposed to be realized by such structural characteristics as "to be crushable" and "to have high energy capacity in the internal mechanics". As the measures to represent the performance level of buffer bow the critical striking velocity ($V_{B,cr}$) and the critical collision angle (θ_{cr}) are proposed. Those critical events are defined as the threshold where the inner hull of struck tanker is ruptured or not.

As it has been confirmed in the preliminary investigation that the bulb structure is most threatening to struck ships, buffer bow design considered is focused on bulb structure. The buffer bow design items which are supposed to be effective are (1) blunt shaped configuration, (2) transverse stiffening system and (3) adopting minimum shell thickness. The advantage expected to those design items are the fact that no special equipments nor special materials are needed. Their contributions have been evaluated through a series of FEM simulation analyses adopting a VLCC as the model struck ship, and VLCC's and container ships as the threatening striking ships. The effectiveness of buffer bow is confirmed by comparing the performance of the critical striking velocity and the critical collision angle between buffer bows and standard bows.

At the final stage the effect of buffer bow is evaluated by focusing on the performance that how much the risk of oil outflow is decreased. "The mean oil outflow" is derived based on probabilistic procedure considering dangerous collision scenarios. The case study has

shown that the probabilistic oil outflow is decreased by about 80% if buffer bow design is adopted to VLCC.

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