

Passenger Movement Pattern during Ship Evacuation Considering the Combined Effect of Ship Heeling and Trim

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Abstract : Large passenger ship, especially luxury cruise, is one of the most prevalent means of marine transportation and tourism nowadays. In case of an accident, an effective evacuation would be the ultimate way to minimize the consequence. Ship heeling and trim has a considerable influence on passenger walking speed and posture during ship evacuation. To investigate passenger movement pattern under the combined effect of ship heeling and trim, a ship corridor simulator was developed. Both fast and freely individual walking experiments by male and female experimental subjects under heeling and trim conditions were conducted and recorded therein. It is found that routes of experimental subjects would change due to the heeling and trim angles, although they always walk along the right side because of cultural factors. Experimental subjects would also change their posture to adapt the combined heeling and trim conditions, such as leaning forward, adopting larger arm swaying, shorter and more frequent steps. While for individual walking speed, the speed would decrease with the increasing heeling and trim angles. But the maximum individual walking speed is achieved at heeling angle of 0° with trim angle ranging from -15° to -5° , instead of on level ground, which may be attributable to the effect of the gravitational acceleration. Female is approximately 10% slower than male due to the discrepancy in physical quality. Besides, individual walking speed shows similar trends in both fast and freely walking modes, and the speed value in freely walking mode is about 78% of that in fast walking mode under each experimental condition. Furthermore, to designate the movement pattern of passengers in heeling and trim conditions, a model of the walking speed reduction was proposed. This work would provide guidance on the development of evacuation models and the design of evacuation facilities on board.

Keywords : evacuation, heeling, individual walking speed, ship corridor simulator, trim

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