

# **Marine Vessel Wave Wake: Focus on Vessel Operations within Sheltered Waterways**

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5 June 2012

## **Abstract**

This thesis reports on an investigation into the characteristics of the wave wake generated by vessels that typically operate within sheltered waterways. It is well known that these waves can result in issues for other users of the waterway and the surrounding environment. These issues include erosion of the surrounding banks, damage or nuisance to moored vessels and other maritime structures and endanger people working or enjoying activities in small craft or close to the shore.

A review of the wave patterns generated at sub-critical, trans-critical and super-critical depth Froude numbers has been conducted, with an emphasis on those craft that commonly utilise sheltered waterways, namely small commercial vessels and recreational craft. Particular attention was given to planing and wakeboarding vessels, given the large and increasing number of these craft. One of the major issues often confronted is that of bank erosion and a study was conducted to determine which measures of erosion potential are the most descriptive in these circumstances.

Over recent decades it has been common to quantify a vessel's wave wake using the characteristics of just a single wave within the entire wave train, usually the highest. However, in this study it has been shown that this is generally inadequate when considering craft operating at trans-critical or super-critical speeds. Three significant waves of interest were described and quantified in this study.

A comprehensive set of model scale experiments was conducted to investigate the effect that water depth, hull form and vessel speed has on the waves generated by nineteen different hull forms, including a mixture of typical monohulls and catamarans. Four primary measures were quantified for each of the three key waves, including wave height, wave period, decay rate and wave angle.

The results from the experiments were used to develop an empirical tool to provide wave wake predictions and to investigate the effect that water depth, hull form and vessel speed has on each of the four primary wave measures. Predictions from the tool were validated against measured data from several independent full scale trials.

A wave wake regulatory criterion, suitable for the operation of typical recreational craft and small commercial vessels operating in sheltered waterways, was proposed and incorporated within the prediction tool.

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