

## **Long-term Study of Squat on the River Weser**

T. Berndt<sup>1</sup>, A. Härting<sup>2</sup> and J. Reinking<sup>1</sup>  
Fachhochschule Oldenburg/Ostfriesland/Wilhelmshaven  
University of Applied Sciences

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### **Abstract**

The WESER STAHL is a bulk carrier transporting iron ore to the steel works in Bremen. It is a maximum draft vessel and, therefore, passes the lower Weser in always the same tide phase with similar loading conditions. It has been equipped with a novel GPS assembly designed for routine data taking. About 30 passages have been analysed so far. We present an overview of the measurement technique and quality.

Our investigations are focussed particularly on the relation between squat and trim. It turns out that, for a given displacement, the dynamic trim change depends only marginally on the static trim. As long as the static trim to the stern is moderate the dynamic trim is always to the bow. The reduction of under-keel clearance can in fact be minimised by an optimal non-zero static trim.

Furthermore, the dynamic trim change is directly correlated to the observed squat. The new equipment's capability of measuring the dynamic trim in real time suggests the feasibility of an improved indication of the actual squat for on-board use. Extensive analyses are presented for the WESER STAHL, possible generalisations to other vessels and rivers are discussed.

Founded on the very large data base the dynamic behaviour of the WESER STAHL has been investigated in some detail. Squat predictions are usually based on an input speed-through-water, which, however, may not be available with sufficient accuracy. Using the dynamic trim as an additional input may help to overcome this problem.

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<sup>1</sup> Department of Civil Engineering and Geoinformation

<sup>2</sup> Department of Maritime Studies