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Impact of Curvatures in the Dike Line on Wave Run-up and Wave Overtopping, ConDike-Project

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Abstract : Wave run-up and overtopping are the relevant parameters for the dimensioning of the crest height of dikes. Various experimental as well as numerical studies have investigated these parameters under different boundary conditions (e.g. wave conditions, structure type). Particularly for the dike design in Europe, a common approach is formulated where wave and structure properties are parameterized. However, this approach assumes equal run-up heights and overtopping discharges along the longitudinal axis. However, convex dikes have a heterogeneous crest by definition. Hence, local differences in a convex dike line are expected to cause wave-structure interactions different to a straight dike. This study aims to assess both run-up and overtopping at convexly curved dikes. To cast light on the relevance of curved dikes for the design approach mentioned above, physical model tests were conducted in a 3D wave basin of the Ludwig-Franzius-Institute Hannover. A dike of a slope of 1:6 (height over length) was tested under both regular waves and TMA wave spectra. Significant wave heights ranged from 7 to 10 cm and peak periods from 1.06 to 1.79 s. Both run-up and overtopping was assessed behind the curved and straight sections of the dike. Both measurements were compared to a dike with a straight line. It was observed that convex curvatures in the longitudinal dike line cause a redirection of incident waves leading to a concentration around the center point. Measurements prove that both run-up heights and overtopping rates are higher than on the straight dike. It can be concluded that deviations from a straight longitudinal dike line have an impact on design parameters and imply uncertainties within the design approach in force. Therefore, it is recommended to consider these influencing factors for such cases.

Keywords : convex dike, longitudinal curvature, overtopping, run-up
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