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Introducing Tblock™: An Innovative Solution for Enhanced Coastal Stability

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Résumé

This study introduces Tblock™, a new interlocking block designed for use as a single-layer armor in coastal protection and breakwaters. Tblock™ offers simplicity in placement, leveraging weight, interlocking features, and friction as a stability mechanism. As Tblock™ is placed regularly and provides an appealing finished surface for the breakwater, it can be a good option for breakwaters near tourist areas. Positioned optimally on a 3V:4H slope and utilizing a smaller (1/8th to 1/20th of the unit mass), Tblock™ presents a cost-effective solution for coastal engineering. The research, conducted through 2D physical modeling experiments at UNICAEN, France, delves into the hydraulic stability of Tblock™ under various conditions.

Observed destructions showcased a brittle destruction of the breakwater. During all the tested cases, Nod (relative damage) of 1 and Ns were equal, meaning considering the conventional criteria for the start of damage by extraction of units and final destruction happened in the same stability number.

Testing two different porosities revealed an 11% decrease in stability with the lowest porosity. Despite observing destruction for both tested porosities at similar stability numbers, emphasizing the importance of the lower range of recommended initial shake-down tests proved crucial for reliable results. Physical experiments revealed a notable absence of the typical damage mechanism in breakwaters but identified group uplift as a significant occurrence, leading to the extraction of blocks and exposure of underlayer material. At the highest packing density, the armor porosity was deemed acceptable at 44%, but a decrease to 20.5% within the armor layer indicated potential early occurrences of group uplift due to under pressure. This suggests that low permeability within the armor layer may contribute to decreased stability.

The study also investigated the impact of a fixed beam and a quarry stone toe on Tblock™ stability. Contrary to previous research, the use of a fixed beam decreased stability, causing destructive group uplifts. In contrast, a quarry stone toe improved the stability number of the armor layer by 29%, highlighting the critical role of proper toe design and construction for successful Tblock™ application in coastal engineering.

Results from tests 5 and 6 demonstrated that an armor layer with Tblock™ at a packing density of 0.57, coupled with a properly designed toe, achieved a stability number (Ns) of

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4.75. While acknowledging the need for additional tests to assess stability behaviour in lower Iribarren numbers and a broader wave steepness range, the study affirms the structure's resilience in the event of single-block failure. No rocking, settlement, or regional change in packing density was observed at the recommended value, underscoring Tblock™'s potential as a robust solution for coastal protection.

Mots-Clés: Breakwaters, Revetments, Single layer armour unit, Stability of armour units, Porosity, Physical modelling