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3D Physical model study for the Haifa breakwater retrofit design

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Since the original designs were performed without current wave forecasting data that accounted for climate change and sea level rise, the Port of Haifa is becoming more frequently subjected to extreme storm events. These storms have caused major damage to the port's main breakwater, and the rock used in the 1930 vintage portion of the structure has deteriorated. A 3D physical model study was commissioned with the objective to assess and verify the stability of a retrofit design proposed to enhance the structural integrity of the main breakwater. The design included major modifications to the structure, with the most prominent being a new armour layer. This would result in the widening of the breakwater, as well as raising the crest. Results from this study showed that a single-layer Cubipod armour layer would be sufficient to cope with the extreme conditions tested. A variation to the design was, however, required at two sections of the breakwater where World War II vintage historic fire command towers are located. This is because design restrictions prohibited any alterations to these towers and the adjacent crest areas. The variations included a milder seaward slope, as well as constructing a double-layer armour layer at these locations.