EFFECT OF TSUNAMI INDUCED CURRENTS ON FLOATING PONTOONS WITH THE MOORING LINES

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A strong earthquake (Mw=6.6) of normal faulting striking about E-W occurred on October 30, 2020, between offshore Seferihisar (Izmir, Turkey) and Samos Island (Greece). The earthquake generated a tsunami that affected a region in the Aegean Coast of Turkey from Cesme Alacati in the northwestern part to Gumuldur coast in the southeastern part. The tsunami caused a change in the sea water level, inundations, and severe damage to marine vessels and coastal structures. Especially, floating docks in Teos Marina, Seferihisar were highly damaged due to tsunami hydrodynamic forces (GEER, 2020). It was observed that the mooring chains and fairleads were broken, and the pontoons were dragged offshore. Moreover, the aluminum frames of docks and the moored ships were damaged. Fig1 shows the damaged floating docks of Teos Marina after the tsunami.


Figure 1- Damaged floating docks after the tsunami

The literature survey shows that although the effect of tsunami-induced currents on the floating docks with pile guides is investigated (Keen et al. 2017), there is not any study that calculates damages on the floating docks with connected units and the mooring lines and the assessment of the damage due to the tsunami-induced currents using a hydrodynamic numerical model. In this study, the effect of tsunami-induced sea-level changes and currents on the floating docks of Teos Marina are investigated by numerical hydrodynamic modeling. Firstly, currents and sea-level changes at Teos Marina are calculated using a high-resolution tsunami model, NAMI DANCE. NAMI DANCE solves the nonlinear form of shallow water equations using the water surface disturbances as the inputs and simulates propagation and coastal amplification of long waves. NAMI DANCE has been applied to specific long wave benchmark problems (Lynett et al., 2017; Sogut and Yalciner, 2019), and several tsunami events have also been reproduced by implementing NAMI DANCE (Sozdinler et al., 2015). Then the hydrodynamic response of floating docks and forces on the mooring lines and connectors between the docks in six degrees of freedom under the tsunami-induced currents are calculated using a hydrodynamic numerical model, ANSYS-AQWA. It can model the coupled motions of all six degrees of freedom of floating pontoons with connections under the influence of gravitational, hydrostatic, hydrodynamic, wind, mooring, and current loads either in the frequency-domain for rapid evaluation or in the more rigorous time-domain analysis (ANSYS Inc., 2013). It was shown that ANSYS-AQWA is capable of modeling floating structures under irregular waves and currents (Alkarem and Ozbahceci, 2021). Post-tsunami damage photos and measurements are used to verify the model. It is shown that tsunami-induced currents increase the forces on the mooring lines and connectors considerably and should be taken into consideration during the design stage.

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