CONDITION CHARACTERISATION OF COASTAL INFRASTRUCTURE USING EXPERIMENTAL MODAL ANALYSIS

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ABSTRACT
As coastal infrastructure built in the mid and late 20th century reaches the end of original design life span, assessing the structural condition of these assets is becoming critical. In an age of sustainability where remediation rather than replacement is now the preferred strategy due to lower carbon footprint, condition analysis enhances the remediation potential of such marine structures. Understanding the residual functional capacity of coastal structures such as jetties, dolphins and piers can enable asset managers make informed decisions on when and what form of intervention is required to extend their operational life. This work aims to characterize the condition of aging and potentially damaged coastal infrastructure utilizing experimental modal analysis similar work has looked previously at breakwaters (Lee et al., 2018). The study examines 3 typical structures including a gravity based reinforced concrete (RC) pier figure 1, a suspended mooring dolphin on concrete piles, figure 2 and an RC jetty supported on steel piles, figure 3.

Figure 1 - RC Pier, Co Kerry, Ireland

Figure 2 Mooring Dolphin, Shannon Estuary, Ireland

Figure 3 - RC Jetty on steel Piles, Cork Harbour, Ireland

METHODOLOGY
The condition of the three structures was assessed utilizing a modal sledge hammer as an excitation forces (Mironovs et al., 2022). Each structure was instrumented with a set of accelerometers, figure 4. Where possible longer term ambient operational modal analysis was also undertaken to compare the effectiveness of both modal methods on different marine structure types. An analysis of the original structures was also undertaken using FEA software based modal analysis, Figure 5 and used as a comparison to the fieldwork.

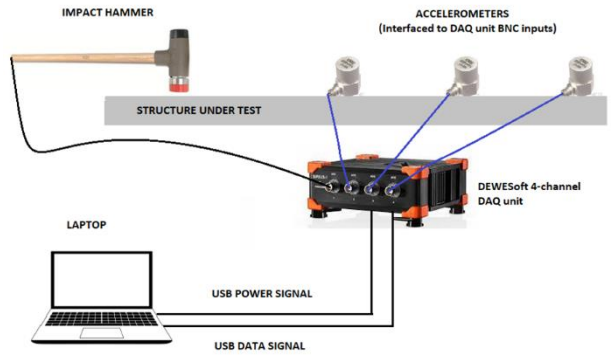

Figure 4 Experimental Setup

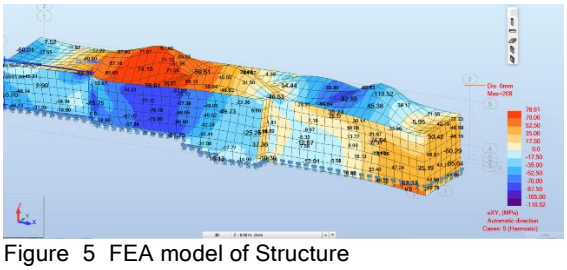

Figure 5 FEA model of Structure

RESULTS

A capacity index for each structure was calculated in reference to the modelled original capacity. Where possible both EMA and OMA capacity factors were compared. The results provide guidance in the form of case studies for three of the most prevalent types marine structures requiring damage or residual capacity assessment. This guidance will be valuable to both structural design engineers and coastal infrastructure asset managers who are increasing faced with the task of extending the operational life of ageing structures in a marine environment.

REFERENCES

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