RISK EVALUATION AT DIQUE DEL OESTE BREAKWATER IN PALMA DE MALLORCA (SPAIN)

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INTRODUCTION AND MOTIVATION

Breakwaters are subject to coastal storms but also to climate change. The stochastic nature of both wave loading and structural response is different nowadays (and in the near future) from those at the time they were designed and the main investments are related to conservation and maintenance. Therefore, an updated risk analysis is needed in order to decide about adaptation or mitigation actions.

When evaluating risks, several elements should be included:

- the probability of occurrence of different failure modes,
- the intensity of the failure,
- the vulnerability of the structure and the activities that take place on and/or at the lee of the structure and, finally,
- the exposure (these last two being the possible consequences of the failure with the given intensity)

All these 4 terms combined provide risks levels ranging from no-risk to very high risk.

Once all the risks are listed and classified, it is possible to proceed to the decision making process among several alternatives.

Palma Port is located in the Mediterranean Sea and it is the biggest of the five ports managed by the Port Authority of the Balearic Islands.

Dique del Oeste is located at the Southern end of the port.

Figure 1 - Port of Palma (Google Earth)

METHODOLOGY

In the past few years, several examples dealing with risk assessment and vulnerability have been addressed in the Spanish ports (see Abanades et al., 2012; Alises et al., 2014 or Campos et al, 2012). The present example differs from the previous attempts in the number of failure modes under consideration and the terms included in the risk description.

The methodology is structured as follows:

- Characterization of the structure (gathering of information): this includes not only the geometrical and structural description of the breakwater but also the activities taking place on and/or at the lee of the breakwater.
- Definition of scenarios for the risk analysis (present and future): stochastic nature of different met-ocean variables for several scenarios under study
- Identification and description of failure modes: affecting both structural and operational conditions; includes verification equations and intensity level definition of each failure
- Computation of the 4 components included in the definition of risk: probability, intensity, vulnerability and exposure.
- Assignation of risk levels

RESULTS

The methodology has been applied to Dique del Oeste, a rubble-mound breakwater located in the Port of Palma (Spain) for different scenarios (met-ocean variables) and different geometries (assuming changes in geometry are adaptation or mitigation alternatives).

The latter cases provide information on how efficient the alternatives are for risk reduction by comparing their risk levels with the unaltered alternative.

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