Risk evaluation at Dique del Oeste breakwater in Palma de Mallorca (Spain)

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1. INTRODUCTION

Breakwaters are subject to coastal storms but also to climate change.

A risk analysis is a good tool to help decision-making related to adaptation or mitigation measures.

A methodology for risk evaluation based on the Project Management Institute risk management processes has been developed and applied to a rubblemound breakwater located in Palma de Mallorca (Spain).

2. METHODOLOGY

Risk management processes

Identifying risks → Risk register

Qualitative risk analysis → Prioritized risks

Quantitative risk analysis → Risk levels

Steps for risk evaluation

Gathering information
- Breakwater
- Facilities
- Other elements

Defining scenarios
- Met-ocean variables
- Parameters

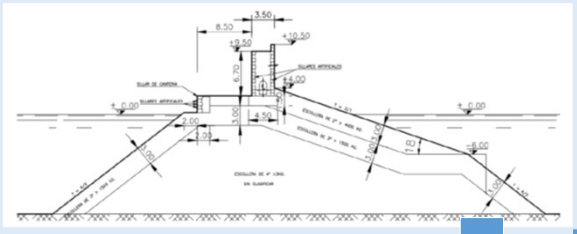
Failure & stoppage modes
- Verification equation
- Intensity levels

Risk components
- Probability (P)
- Intensity (I)
- Vulnerability (V)
- Exposure (E)

Risk level	Range
Very high	>0.6
High	0.36-0.6
Medium	0.2-0.36
Low	0.05-0.2
Very low	0-0.05
Null	0

$$RL = P \times I \times V \times E$$

3. RESULTS



Prioritized risks related to:
- Sliding
- Overturning
- Extraction
- Overtopping

Consequences to:
- Breakwater
- Human lives
- Facilities
- Access roads
- Operability
- Environment

	Sliding	Overturning	Extraction	Overtopping
$P \times I$	0.8	0.8	0.16	0.2
$V \times E$	0.8	0.8	0.4	1
Risk Level	0.64	0.64	0.064	0.2

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