

## **Mitigation Of Tsunami Disasters In Ports**

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### **Abstract**

Tsunami' means 'harbor/port wave' in Japanese, as tsunamis seem to appear suddenly and become very violent in shallow areas, attacking low-lying port areas that are actively used and densely populated. Port areas around the world have suffered from many tsunami disasters with large numbers of casualties. The major cause of tsunamis is earthquakes occurring at the edges of the plates, where subduction zones develop due to the everlasting movement of tectonic plates.

A tsunami can directly cause human casualties and building destruction, as well as seriously damage moving and moored ships. In particular, small ships such as fishing boats and pleasure boats are easily tossed about by a tsunami because of their small displacement volume.

Once a tsunami occurs, it can be devastating. However, since the probability of its occurrence is very low, only a very limited number of port engineers and administrative personnel have had actual experience with tsunami disasters. This means that actual experience with tsunamis is very limited.

Because the Makran fault for almost half a million years has not experienced a major earthquake and a tsunami and historical evidence in Makran, the probability occurrence of tsunami in Oman sea is too high. The investigation about tsunamis off the coast of Iran and the probability of their occurrence in the future is necessary because the areas which is closed to Makran subduction zone is prone to tsunami attacks.

To prevent such disasters, the design and construction of coastal defenses is most important. However, it is almost impossible to prevent disasters by huge tsunamis which very seldom occur. We can only aim for mitigating the disaster. It is very important to prepare for disaster by considering the whole damage process

including rescue and recovery from the damage.

Mitigation of disaster starts from understanding the disaster. The primary objective of this report is to disseminate knowledge about tsunamis to port engineers and administrators in order to prepare for tsunami disasters. We summarize the fundamental mechanics of tsunamis including simulations of tsunami generation and propagation and describe the damage that can be inflicted upon a harbor.

Furthermore, recommendations are presented for disaster management in ports based on two kinds of scenarios. The scenario for current preparedness (C-scenario) is disaster assessment in the current situation, which allows us to understand the existing risks including risks of damage to facilities and the impact on business. The planned scenario of a disaster (P-scenario) is disaster mitigation planning in which actual and concrete target levels of 'Human Safety', 'Economic Loss' and 'Business Continuity' are determined. Measures to reach the target should be discussed and prepared including structural and non-structural countermeasures with consideration of resilience. Not only structural countermeasures but also non-structural countermeasures are indispensable for mitigating very rare but severe disasters like tsunamis. Especially vital for saving lives is evacuation, making early warning very important.

**Keywords:** tsunami, harbor, port, mitigation of tsunami, subduction zone