



## Design and construction of the new St. Elmo Breakwater Footbridge in Valletta (Malta)

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## Summary

St. Elmo breakwater was constructed between 1903 and 1909 to convert the unique Valletta Grand Harbour in an all-weather port. An opening near its land end was left to prevent water stagnation and shorten routes for smaller crafts. Accessibility to the breakwater was possible by means of a two-span steel footbridge, erected in 1906, which was partly demolished in 1941 during WWII. The breakwater and its lighthouse remained isolated until 2012, only accessible by boat. Transport Malta organized a design-and-build competition for the reconstruction of the footbridge by the end of 2009. The new bridge successfully solves, using an innovative design concept, a complex problem: the reconstruction of a piece of Valletta's history, in harsh environmental conditions, and with exceptional construction constraints due to site inaccessibility. The new design is functional, contemporary, transparent, durable, with easy maintenance, sustainable and respectful with history.

**Keywords:** Valletta Grand Harbour; WWII attack; arched truss; asymmetrical section; observatory; out-of-plane buckling; dynamic behaviour; durability; sustainability.



Fig. 1: Fort St. Elmo (right), the new footbridge and St. Elmo Breakwater and its lighthouse (left)

## 1. Historical context and antecedents

Valletta Grand Harbour has been used as a port since Roman Empire times thanks to its magnificent natural characteristics, with a number of inlets which provide adequate shelter to naval vessels. It served as a naval station for the Knights of Saint John from their settlement in the island to their expulsion after the Napoleonic invasion by the end of the 18<sup>th</sup> century. Almost immediately after then and until the 1970s, it served as a British naval station. The exceptional protection qualities of the natural harbour were increased during this period after the construction, between 1903 and 1909, of a breakwater consisting of two arms made of limestone and concrete bricks, which made the port suitable for all weather conditions.

The Fort St. Elmo arm, the longer of the two (378 m), was constructed with a 70-meter gap in proximity to Valletta foreshore, in order to prevent water stagnation whilst shorting the distance between Grand Harbour and the adjacent Marsamxett Harbour for smaller craft. Accessibility to the