



Preliminary Analyses for the Study of the Effects of an Explosive Action on a Long-Span Suspension Bridge

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Abstract

Terrorist attacks have nowadays become an important issue for the structural design of constructions such as bridges. Indeed, during the last decades, the increase in the number of terrorist attacks has resulted in the loss of many human lives and socio-economic impact on our society. The aims of this research consist in a series of preliminary analyses in view of a study of the effects of an explosion on a long-span suspension bridge. As a suspension bridge was considered the project of the bridge over the Strait of Messina, having as main span of 3300 meters. The structure was modeled using ABAQUS/Explicit software using beams-type 3D finite element modeling. The objectives of the research are double. The first one is the study of the pressures generated by an explosive charge to model the phenomenon during numerical simulations while, the second objective, is to test different discretizations to have a reliable numerical response.

Keywords: long-span suspension bridges; blast loading; mesh-size problem; fast dynamic; numerical simulations.

1 Introduction

Suspension bridges are the longest-span structures of any type. Typically, this type of structure consists of two piers, two main cables passing through the top of the towers and anchored to large foundations at the ends of the structure, as well as the deck, which is suspended along its entire length from the main cables by multiple suspension hangers. Throughout history, technical and scientific advances have made it possible to build ever larger suspension bridges.

The first of them was the "Jacob's Creek Bridge" built in 1801 in Pennsylvania in the United States with a span not exceeding 21 meters. Since then, the engineers of the last two centuries have been constantly improving the original concept, materials, and calculation methods. Today, the records of span easily exceed the one and a half kilometers and the maximum span ever built reaches almost two kilometers with the famous Akashi Kaikyō Bridge of Japan that crosses the Seto Inland Sea linking the cities of Kobe and Awaji.