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## Search for Quality in the Vasco da Gama Bridge Project

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### Summary

A description of the Vasco da Gama Bridge crossing is presented, highlighting the special design studies developed to achieve the quality standards defined for this large project.

**Keywords:** Bridge; design; durability; quality; Vasco da Gama

### 1. Introduction

The Vasco da Gama Bridge Project consists of a 12km crossing of the Tagus River in Lisbon, being the longest bridge in Europe. This large project was developed under the supervision of a Government Office, GATTEL, who was quite active during the tender, design and construction phases, aiming to obtain a bridge with high quality standards. In this paper some of the studies developed to achieve quality in terms of structural safety, durability and aesthetics are presented.

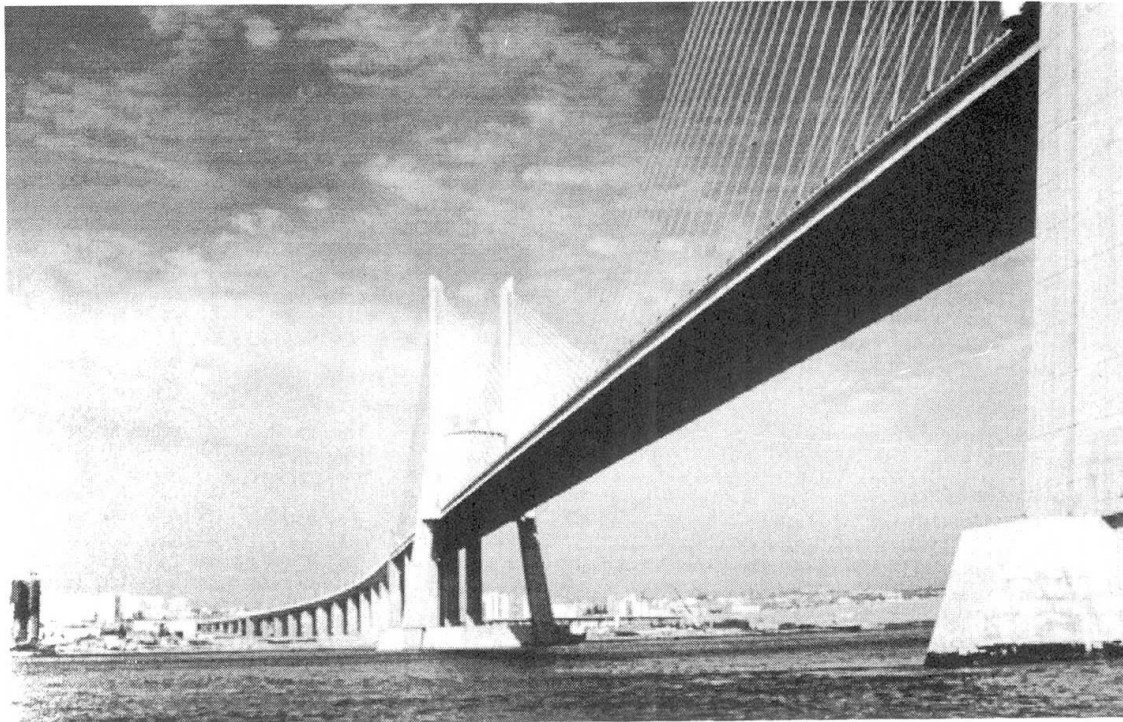
### 2. Structural Behaviour

The structural design was developed for all the structures of the crossing, considering national and recent EC codes and deep seismic analysis with soil-structure interaction. Due to the importance of the main bridge over the navigational channel (a cable-stayed solution, with 420m central span) special research studies were also developed at IST related to the behaviour of the main bridge.

The initial deck configuration led to aerodynamic instabilities when analysed at the wind tunnel. Considering an innovative CFD analysis and further tunnel tests, a stable final solution was achieved with two baffles under the deck. The dynamic behaviour of the deck under wind gusts was also analysed as well as the cable stays behaviour.

The flexible solution adopted for the deck led to important longitudinal displacements at the abutments under the seismic action. To reduce these displacements steel hysteretic dampers were then studied and their optimal characteristics were determined, leading to an innovative solution.

The situation of a ship fire under the deck was also studied to estimate its effects in the bridge safety and the time for protection measures.



*Fig.1 The Vasco da Gama Bridge*

### 3. Durability and Maintenance

The bridge is located in the mouth of the Tagus River which is a sea type salty environment, subjected to tides and waves. The tender specifications defined for the crossing a service life of 120 years. The implementation of this requirement led to several actions, at design stage, as the definition of geometry and materials (considering the study of the degradation of the materials and components and the associated mathematical models) and the study of a durability monitoring system.

To achieve durability, during the construction stage, a quality control program was defined with procedures to fulfil the durability specifications. This included the implementation of periodic in-situ measurements of the degradation of the materials.

### 4. Aesthetics

Special attention was also paid to the aesthetics of the crossing. This included several studies related to the crossing layout in the river, global uniformity, gradual evolution of the structures geometry and colour. Local studies were also developed related to the shapes of the towers, cornices, lamps, etc., aiming to obtain a final aesthetic pleasant solution.

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