

FOOTBRIDGES OVER THE RIVER DOURO AT PORTO / GAIA

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Summary

This paper presents the conception and design of two world record footbridges over the River Douro, linking the river margins ("Ribeiras") at Porto and Gaia

Keywords: footbridge; urban planning; arch bridge; suspension bridge; structural concept; structural design.

FOOTBRIDGES OF THE 21st CENTURY

The city of Porto stretches inland from the Atlantic Ocean on the shore plateau and hills north of the River Douro. On the south margin of the river, the Port wine cellars take the vintage views over the Douro and the steep slopes of the medieval quarters of the city of Porto. Just before the end of the 20th Century, UNESCO has declared the entire area as part of the World Heritage.

The population of Porto and its surrounding municipalities on the north has grown to more than half a million and the town on the south of the river has developed also to the same size under the name of Gaia. In this metropolitan area, the river is crossed presently by four major road bridges, but only one serves the old quarters bordering the two sides of the river. This 19th Century bridge, designed by Theofil Seyrig and named "King Luiz Bridge", is 120 years old and has two decks, the upper one at the height of around 70 m and now providing the passage of the Central Line of the Metropolitan Light Railway and the lower one at the height of around 12 m and providing the connection of the medieval quarters. The bridge is very well maintained and its useful life will go for many years to come.

Navigation by tall ships is possible up to Seyrig's bridge and the river margins are becoming major leisure, cultural and touristic areas. But the lower deck of the King Luiz Bridge can not be closed for the road traffic and its narrow sidewalks are uncomfortable and even dangerous.

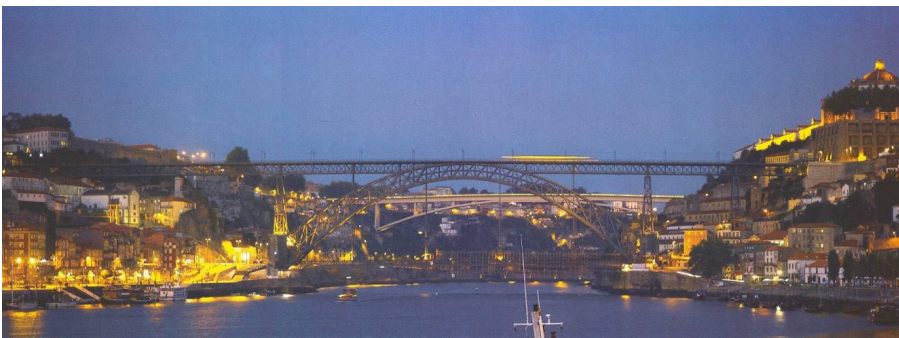


Fig. 1 Porto – river Douro, world record bridges and night life – Gaia

Consequently, the Porto and Gaia Municipalities got together just before Summer 2000 and asked Structural Engineer Adão da Fonseca / AFAconsult for a "21st Century" pedestrian bridge to be studied for the exact location of the suspension bridge that existed in the 19th Century, 11 m downstream the King Luiz Bridge. Obviously, this location would not affect the navigation of tall ships. The challenge was to conceive a truly state-of-art bridge that would enhance the beauty and character of the entire site.

A single arch would span 156 m with a shallowness ratio of 1:13 that would raise the arch slightly above the King Luiz Bridge lower deck in order to secure the "reading" of the latter. The arch would be made of stainless steel and clamped to the granitic rock foundations. The cross-section would have a hydrodynamic shape to account for the high water level of the river in case of major floods ("design flood" is 1.8 km³ per day – second in Europe to River Volga – Russia).