

**Zeitschrift:** IABSE reports = Rapports AIPC = IVBH Berichte  
**Band:** 82 (1999)  
  
**Artikel:** Evolution of design trends in cable-stayed bridges  
**Autor:** Astiz, Miguel A. / Troyano, L. Fernández / Manterola, Javier  
**DOI:** <https://doi.org/10.5169/seals-62115>

### **Nutzungsbedingungen**

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

### **Conditions d'utilisation**

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

### **Terms of use**

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

**Download PDF:** 07.02.2026

**ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>**



## Evolution of Design Trends in Cable-Stayed Bridges

**Miguel A. ASTIZ**

Prof. Dr. Civil Engineer

Carlos Fernández Casado S.L.  
Madrid, Spain

**L. Fernández TROYANO**

Dr. Civil Engineer

Carlos Fernández Casado S.L.  
Madrid, Spain

**Javier MANTEROLA**

Prof. Dr. Civil Engineer

Carlos Fernández Casado S.L.  
Madrid, Spain

Miguel A. Astiz, born in 1950, received his civil engineering degree from the Polytechnical University of Madrid in 1973.

Leonardo Fernández Troyano, born in 1938, received his civil engineering degree from the Polytechnical University of Madrid in 1963.

Javier Manterola, born in 1936, received his civil engineering degree from the Polytechnical University of Madrid in 1961.

### Abstract

Cable-stayed bridge design is quite different now from what it used to be 25 years ago. Technology applied to analysis, materials fabrication and construction has driven the designers to face very different problems along these years. The present paper explains how this evolution is seen from the experience of designing many such bridges including the well known Ebro and Barrios de Luna bridges.

The fields which will be addressed in this paper are aesthetics, general structural design, coding, structural analysis and cable technology. The final item will consist in giving an answer to the following question: are we marching to optimal design or to a free field open to new architectural or sculptural ideas?

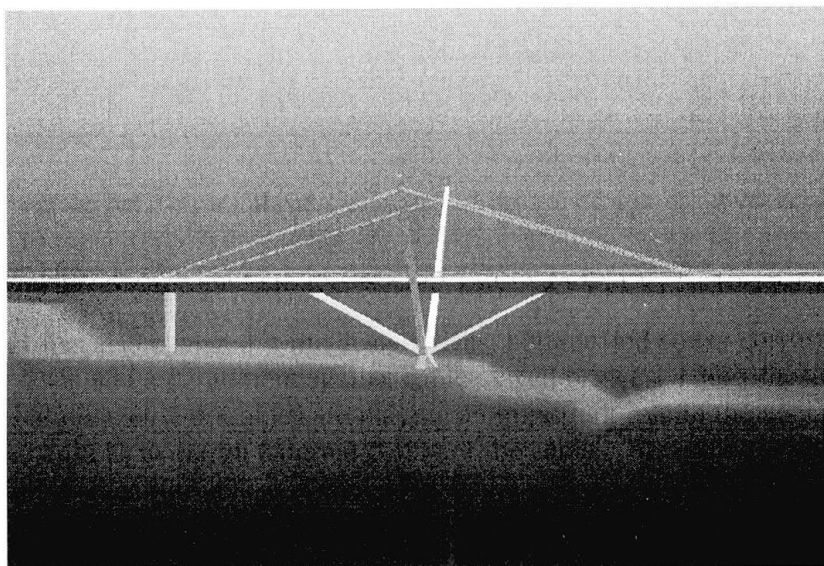
The towers and the cable system are the most visible elements of the bridge and those which determine its aesthetical qualities. As engineers we tend to see both elements as two opposite poles since the towers are mainly compression struts and stays are tension elements. Can we forget this duality when designing a bridge? How the different tower shapes (single pole, H, A, inverted Y, diamond, etc.) fulfill the structural role which is assigned to them?

Structural or bridge codes did not consider the cable-stayed bridge as different as to deserve special treatment. Is it so nowadays? Safety problems as related to limit states is an important item since a very strict application of structural codes may drive to unsolvable design problems. Fatigue and vibration problems have to be dealt in a specific way since many such problems are only found in cable-stayed bridges.

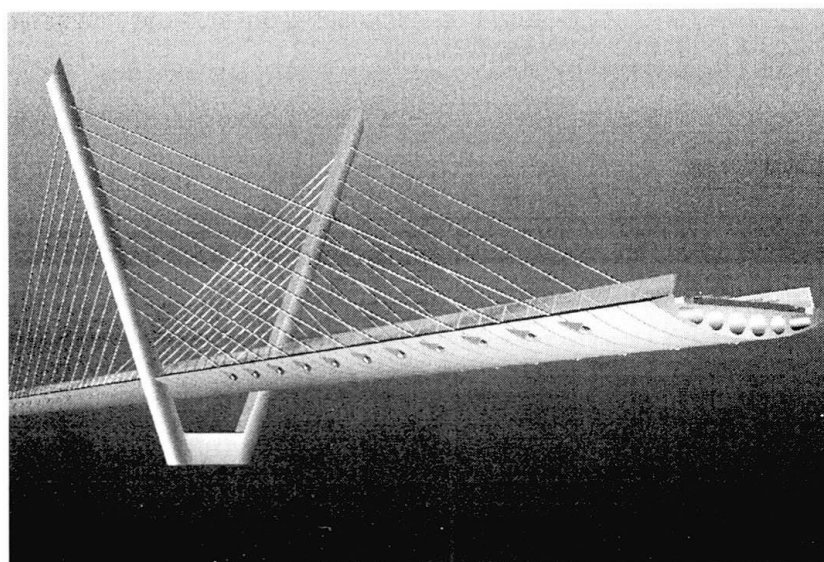
Structural analysis has also changed dramatically in the last twenty years. General static analysis of the bridge used to be the object of most discussions: step by step analysis of erection procedure, geometrical non linearity, creep and shrinkage effects were the big issues. Today more specific problems are being thoroughly analyzed: aeroelastic effects, local stress problems, cable anchorages. The availability of sophisticated computer codes allows the analysis of ultimate limit states by taking into account the properties of steel and concrete at this stage. Are the codes prepared for such kind of analysis?

Cable technology has also changed some design ideas. Fatigue and stress-corrosion problems used to be a big issue and an argument against cable-stayed bridges. Today these problems may be considered as almost solved. Cables are playing an important role in the visual impact of the bridge. Then we begin to worry on external colors of the cables. Nevertheless cable vibration is still a problem although solution to it is well advanced.

Finally some of our present views about cable-stayed bridge design are presented. They refer to the applications of the extradosed concept as a way to extend the range of applicability of cable-stayed bridges and to the ever increasing role of prefabrication to solve construction problems. Some of our most recent projects are presented (fig. 1 and 2).



*Fig. 1. Bocairente bridge, Spain, 1999*



*Fig. 2. Proposal for a new Ebro bridge.*

This paper tries to give a comprehensive perspective of the evolution of cable-stayed bridge design on the basis of our long experience in this field and on the analysis of the most recent designs.