BRIDGE BETWEEN LA MADDALENA & CAPRERA ISLANDS

Bridge between La Maddelena & Caprera Islands: Bridge, design, works supervision

Client
Presidenza del Consiglio dei Ministri – Dipartimento di Protezione Civile

Project and works supervision
Studio Calvi Srl
Project Manager:
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Classes and categories of works
Ex Ig ,IXc, Via, VIII Id € 2.464.031,52 IVA esclusa

Start of planning	**End of planning**
November 2008	January 2009

Start of works	**End of works**
April 2009	September 2009

DESCRIPTION OF PROJECT
The bridge replaces a temporary Bailey bridge connecting the islands of La Maddalena and Caprera.
The design bridge length is 52 meters, with three spans symmetrically arranged (two lateral spans 13.5 m long and a central one of 25 meters). The rise of the arch is about 5 m.

The bridge is composed by two double cantilever truss elements, connected at the middle of the bridge through X-crossed rebars which provide a hinged connection: the lower central span arch and the upper deck merge at the center in a flexural hinge transmitting shear forces.
The bridge made by this double cantilever truss elements is designed so that under a uniform distributed load the cantilever that is the edge arch balances perfectly the weight of the cantilever that is half of the central arch. This result is achieved by making vary the thickness of the arches that form each cantilever element, so that the vertical dead loads reaction is centered in each foundation.
The steel truss elements connecting the upper and lower arches have circular hollow sections (D=150 mm).
At each of the central arch foundations are placed three pot bearings to carry both axial forces and bending moment reactions, these bearings are also able to provide restrain tensile force reactions. The horizontal displacements are not restrained for the longitudinal direction, while they are fixed in the transverse one. Tension and compression axial force restraints are provided at each abutment. At these locations the designed support is a hinge which allows rotation about the horizontal transverse axis and restrains all the horizontal and vertical displacements.
The use of high performance concrete allowed to reduce the structural thickness and to use post-tensioning tendons in the upper deck, to equilibrate part of the tensile forces developed in the upper chord of the spatial trusses.

View of the completed bridge: it can be noticed the characteristic shape, made by 3 arches

In order to avoid any damage caused by the highly aggressive marine environment all the surfaces and materials were protected with white polymeric resin, to provide durability and at the same time to improve the aesthetics of the bridge.
All design choices are essentialy governed by environmental constraints:
1.the geometry of the fixed points derived from historical heritage.
2.the central span height was the best compromise between deck slope and boats clearance space
3.the arch shape and reduced element thickness minimizes environmental impact
4.horizontal reactions at abutments and foundations had to be limited due to soil properties
5.improved structural durability was dictated by marine environment
6.on-site work duration had to be minimized to reduce interference with local traffic
7.external light papapet complete the boat reminiscence of the whole structure, with only white resin and stainless steel used as finishing materials.

Above. Night view of the bridge.
Left. View of the steel truss at the central arch foundation