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Bridge and Landscape: reasons of the shape

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Abstract

The projects that are presented below are a further piece in the concept and operative puzzle in my study into the "reasons of the shape" of bridges.
This new experience has been gained further to my maturity in designing bridges, viaducts and walkways both professionally (having received some important national and international awards, not the least of which the recent recognition as Consultant Professor at Tangji University in Shanghai) and academically (I have held a number of academic courses into bridge and viaduct design at the Architecture Faculty in Venice University) and is, in my opinion, a very interesting and fascinating formal and composition outcome.

Keywords: conceptual design, morphology, bridge, structural design, aesthetics, landscape

1. Introduction

Bridges, which someone rightly defined as the *"transit portals into space"* are an excellent chance to reconsider the cultural codes of architecture and apply them to our territory. There are many ways to perceive a bridge and likewise planning approaches to design it. In all events, the outcomes refer to a "perceived" work. In fact a bridge or a viaduct can be perceived in a number of ways, or rather, by at least two different types of users; generally the first are those who go over it and the second are those who live with its constant presence. However, man's ability to absorb a visual (or environmental) impact and live with it, does not mean that we should offer low-quality panoramic structures which just cause general cultural decay. We are now used to seeing some of our most beautiful countryside broken up and fragmented by unattractive bridges that risk becoming the degraded "gates" to the modern walled cities. Involving the user does not only mean perceiving the form but also the function, or rather, the ability of a structure to "function" within its territory. In fact, if we need to join two sides of a river with a bridge or pass over physical obstacles with a viaduct and we do not consider the population in the area where the construction will rise and what it offers with its passage, we risk creating structures that do not represent the community that lives and moves in the area.
Work on the formal quality and the multifunction purpose of a bridge gives us the chance to escape from a cultural stalemate where, in the last thirty years, Italy has been dominated by

a monotonous system of girders placed on set architectural forms. It is of fundamental importance to maintain the technical function as main reference parameter, and paying attention to the economic limits, but also to work on the form and rational size of the structure at cultural, ecological and environmental level. The more we widen our points of view, the more a work of art can give quality and "added value" to its surroundings.

The three projects that I am presenting here, the traffic bridge over the River Taglio as part of the Mestre Bypass and the new cable stayed bridge in the city of Pescara, are all part of environmental and functional improvement plans that have recently been developed in Italy. These experiences have led to some very interesting and fascinating form and composition outcomes that are yet another piece in the conceptual and operative puzzle in my study into the development of the "reasons of the shape" of bridges.

2. The bridge over the River Taglio (Venice – 2007/2009)

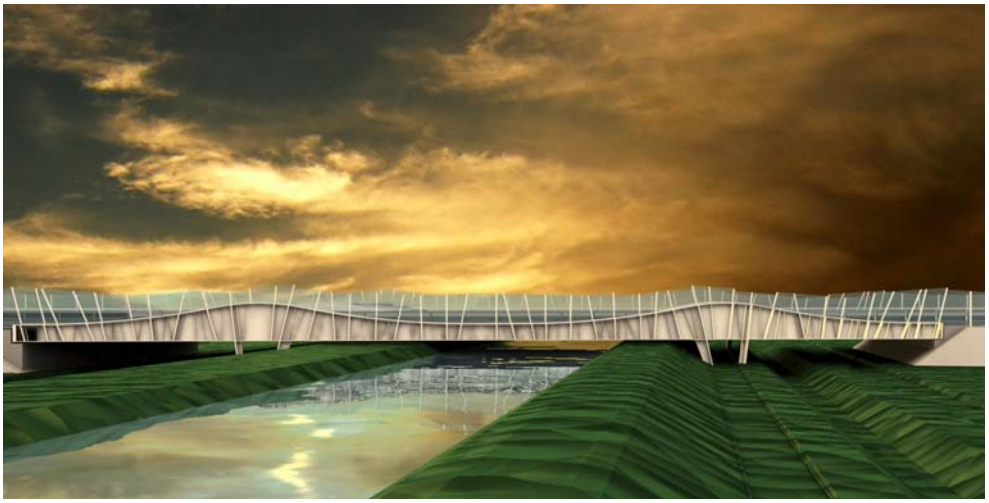

Figure 1: Virtual model of bridge across the Taglio Canal

The bridge over the Taglio Canal in Mirano was recently inaugurated and is part of the Mestre motorway bypass (the Venice Link) and involves a large area to the south of the town of Mirano which, over recent years, has been literally cut through by infrastructures to serve the complex road network in the western province of Venice. The bridge is near to an artisan area and a small rural zone that is subject to environmental protection due to the number of rivers dating back to Roman, Benedictine and Venetian eras, which have always played a fundamental role in the survival of the district. The Taglio Canal is part of these, an ancient goods transport canal which is now protected by the Council for the Environment and Architecture in Eastern Veneto.

2.1 Preliminary considerations about the project

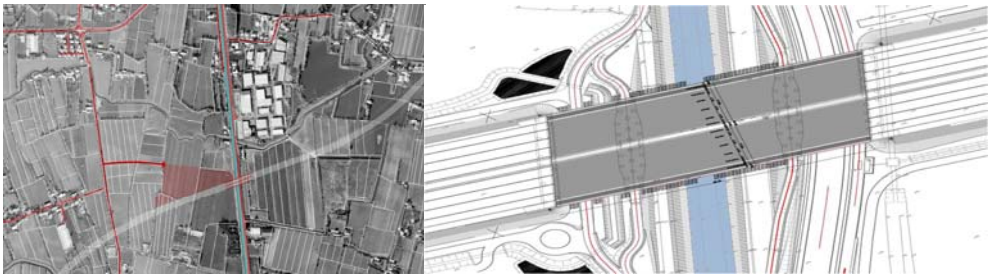

Figure 2: Overview of the area and general plan of the bridge

Right from the start of the planning phases, in agreement with the Council for the Environment and Architecture, the main aim the project pursued was to create a construction that did not upset the natural balance of this historically important river and the beautiful surrounding countryside, a balance that would have been completely ruined and hidden to the viewers with the construction of a motorway bypass creating a sort of dam, a visible barrier through the greater part of the area involved in the work.

For both functional needs and the conformation of the Padua plain, the Taglio Canal cuts through the area with a linearity that gives it its most recognisable and constant feature. The local traffic runs along the tops of the riverbanks and there is a pedestrian-cycle track that is very popular with the local people for footing. Numerous different aspects were considered during the planning phase: respecting the historic value of the canal, the continuity of the itineraries that are connected to it, the fact that, with time, it has become a very popular place and has a distinct identity with the people that was seriously threatened by the impact of the planned bypass. The bridge should have become a link between the canal and the motorway rise, a feature in the landscape with its own distinct role and identity, yet at the same time integrated into it in the same way that all the other local features are. To analyse the landscape we isolated certain features to try and understand the mechanisms that link them, and this led us to the shape for the bridge. At the same time we tried to imagine the impact that the structure could have and what were the best points of view to see it from. The outcome of this research led us to integrating the bridge in an itinerary along the riverbank, formed of grassy stretches already adjacent to the canal, which are always seen from a distance and consequently the dimensions seem more in fitting with the setting. As you slowly approach it, coming down from the banks, when the real and inevitable size of the bridge is about to appear, the attention is drawn to a grassy area adjacent to the motorway rise which softens its impact and which is equipped for sports and relaxation, and which incorporates a former small abandoned refuse dump that can now be improved and reutilised. This way the bridge takes on all those features that it should have to become a landmark. We then considered the view of the landscape by travellers along the motorway, given the speed and distracted attention that is paid to the surroundings when

travelling by car, and decided it should be as abstract as possible: the crossing of the motorway and the canal creates a sort of "disturbance", given by the fast view of the curves of the extrados of the girders.

2.2. The bridge

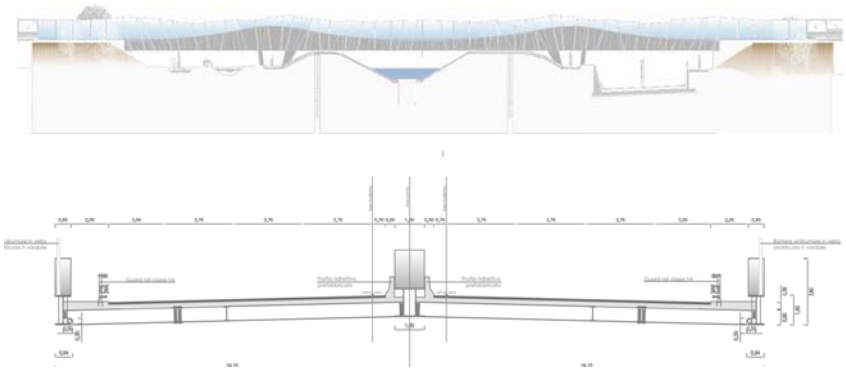

Figure 3: Frontal elevation and cross-section of the bridge

The bridge over the River Taglio is formed of three bays respectively 20 meters each the two side bays and 40 meters the central bay over the river.

The metal structure is a lower track type comprising two H-girders at the sides of different height which probably refer to the form of the stress diagram of the main bending moments. In the centre another H-girder with a closed section and an inertia equal to double that of the side girders separates the carriageways.

The static diagram of the main structure is a continuous girder along the entire length of 80 meters, fixed onto piers and shoulders with longitudinal expansion joints at the ends of the planking. The piers at the feet of the riverbank structures are again metal with H-girder profiles, but of varying size and irregularity. The metal structure has been painted white.

In line with the border girders special sound damping barriers are installed in strict formal correlation with the stiffening project for the birder girders, because the barrier support extends along the entire width of the border girder and acts as stiffener for the girder core.

The new bridge over the Taglio Canal will play an important role in qualifying the "green bypass" project which is still being developed, which, besides the natural sound and visual protection that will be given in respect of the exposed users, will also include large fitted parklands with games and sports itineraries. One of these equipped areas is situated next to the area involved in this project. Consequently, numerous Led-Line linear lights have been installed inside the structure along t

he external stiffening of the border girders, which light up as dusk falls and highlight the irregular forms of the bridge structure and give a very fascinating lighting effect, as shown in the pictures below.

Figure 4: The bridge under-costruction

Figure 5: The bridge under-costruction

3. The new bridge over the River Pescara (Pescara – 2008/2009)

On a geographic scale, Pescara is one of the main nodes of the Adriatic that extends from Ravenna to Ortona, involving sometimes widespread and sometimes dense constructions that follow the coastline resting on the railway and motorway tracks fitting into the valley routes running perpendicular to them.

Figure 6: Overview of Pescara

At the beginning of the XIX century, Pescara was an extremely elegant town surrounded by pine woods, with tree-lined avenues and parks dotted around the city, to gain it the name of «garden city». After the destruction mainly caused by bombing during the second world war, the city had to be rebuilt, leaving space to building and speculation. Uncontrolled development reached its peak in the sixties, virtually eliminating all the traces of the garden city that had been designed by the architect Luigi Piccinato back in 1947.
The infrastructures join Pescara now to the motorway network by a series of ringroads about 26 km long, articulated on two main roads: the so-called equipped axis, which joins the motorway to the Port of Pescara in the heart of the city, and the large north-south ringroad that crosses the western part of the city parallel to the coastline. These two roads enter the city from the west and are now the main entrance to the city, and give access to the suburbs to the various council services, such as the railway, hospital, university and port.
To prevent the difficult fusion of different traffic flows, over recent years greater continuity has been given to the north-south road network, which is interrupted by the River Pescara, to give access to the various town services without interfering with the internal widespread road network. The project for a new bridge is part of this project, to join the vehicle and cycle-pedestrian traffic between the two banks of the River Pescara.

The new bridge is in an area next to the "centre". The areas to the right and left of the river have been industrial areas until now: to the left there is still a large marble processing factory and to the right the former gasworks were recently demolished.
As the city has spread it has surrounded these areas and the urban improvement process aims at finally returning it to residential and service areas. On the left side urban reconversion projects are being studied, depending on what it will be used for, and on the right work will soon begin to build a residential and office complex after a large exchange car park.
The new bridge is part of this context and exponentially increases the process that is underway, helping define the strictly urban role of this part of the city. Given its functional architectural nature, the bridge substantiates and qualifies the area as another "centre" that will develop the planned multi-centre city.

3.1 Road network project

The project for the bridge over the River Pescara includes the construction of the needed links and the reorganisation of the current situation, so that all the work is incorporated in a single logic addressed to the correct function of the vehicle, pedestrian and cycle traffic, solving the interference with the existing services. Consequently a series of pedestrian-cycle tracks has been planned that guarantee continuity to the current tracks without interference with the road traffic, by building ramps on artificial grassed supports, containing walls, parapets and a cycle-pedestrian underpass underneath the bridge along the riverbanks.

3.2 The bridge project

Figure 7: Virtual model of the cable-stayed bridge

The new bridge over the River Pescara has a total span of 94.9 m and a total width of the planking of around 29.70 m. It is a cable stayed bridge with a single antenna in the centre of the north roundabout on the opposite side of the River Pescara to the equipped axis.

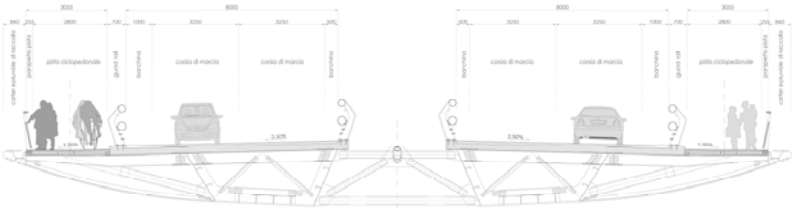

Figure 8: Cross-section of the bridge

The metal structure is formed of two steel bodies joined in the centre by a grid structure that the cable stays are hooked onto. This device allows a passage of light that enters from above and lights up the space beneath the bridge, which is crossed by cycle-pedestrian tracks following the riverbanks and by the passage of the pleasure sailing craft.
The antenna is bipartite shaped: it comprises two independent antennas with a curved trend inclined both laterally and in axis to the bridge that intersect each other at about one third of their height.

Figure 9: Virtual view of the bridge

The cable stays are hooked to the main antenna, which is about 50 m high, and between this and the second antenna of about 40 m high, there is a field of photovoltaic panels supported

by tubular crosspieces placed between the two antennas. Up to about 15 m high the base of the antenna is reinforced concrete cast on site and the rest of the antennas is steel continuing on from the part beneath.
The bridge cable stays have a "reversed" layout; this device, which is mainly for architectural effect, has been used to gain the third dimension in the configuration of thecable stays, which are usually placed on just the plane. Mainly steel has been used, painted white, so as to give a reflecting base for the light effect at night-time given by a series of leds and by day the natural reflecting capacity of this colour.
A photovoltaic field will be installed between the two antennas comprising 62 panels for a total of 103 sq.m.; they will produce around 14000Wp power, and the aim is to compensate the electricity used by the bridge in the lighting system.
The cycle-pedestrian tracks develop at the side of the structure, formed of prefabricated slabs that are simply placed on the jutting brackets in line with each bulkhead. The parapets on the two side walkways are about 1.50 m from the ground and have a metal structure that hold up glass panes, making the overall view of the bridge lighter and to prevent anyone climbing over the parapets.

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