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AN AESTHETIC SOLUTION FOR A PEDESTRIAN BRIDGE

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Abstract: *This paper presents a short overview of the process of choosing a suitable and original solution for a steel concrete composite footbridge crossing the Bega river in Timisoara. Its special shape fits harmoniously in the environment of the main project, the solid body of the bridge will be covered with COR-TEN® steel envelope. By choosing a rational and efficient solution, an economic, aesthetic and sustainable structure has emerged, having an emblematic character for the locality.*

Key words: *pedestrian bridge, arch, integral structure, SSF-Rapid systems.*

1. Introduction

A pedestrian bridge is the best symbol for the art of Civil Engineering, representing the simplest and most elegant structure to pass an obstacle. Pedestrian bridges are constructions of social importance, especially in the case of historic sites and crowded part of towns.

These structures will become a "witnesses of the past" [1], that is why the engineer together with the architect must conceive technical monuments with emblematic character. Then, the duty of the administration is to maintain them in service in proper conditions.

Sustainable development is a fundamental objective of the European Union and it is designed to meet the needs of the present without compromising the ability of future generations to meet their own needs. It seeks to continuously improve the quality of life and well-being of present and future generations through an integrated approach between economic development and environmental protection [2]. The construction of pedestrian bridges which ensure the cross of an obstacle in order to avoid high detours (sometimes kilometres) for local people is an integral part within the concept of sustainable development with positive socio - economic impact and improvement in the

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quality of daily life, having a favourable influence on the environment.
Because the loads for the pedestrian bridges are lower than the road or railway bridges, these structures have slender elements. Therefore, special attention must be paid to the shape and dimensions of the cross section, aiming aesthetic and economic structures.

2. A Witness of the Past - an Old Pedestrian Bridge

A special example - a veritable witness of the past - in this direction is the metal arch bridge in Baile Herculane (a well-known Spa from the Roman times), also known as the *Iron Bridge* (Fig. 1). The arch bridge is one of the oldest structure types for bridges, characterized by a special charm and a lot of advantages. The arch is the quintessence of the bridge [3].

This footbridge occupies an important place in Europe because of his architectural value from the end of the 19^{th} century.

The structure has a span of 32,20 m crossing the Cerna river and it's 3,00 m large. It has an historical value and it is emblematical for the city [4].

The technical solution that was adopted for this pedestrian bridge was a revolutionary one for that time, the engineers of the structure have demonstrated their genius. The bridge was concept using a resistant structure in form of a double articulated arches connected by a wind bracing support the deck by vertical elements with a series of Renaissance ornaments and it is amazing by its slenderness (**Fig. 2**).

All the connections are riveted; the material is wrought iron typical for that time [5].

The bridge infrastructure is made of limestone masonry and it is founded on rocks. It has also retaining walls from the same limestone masonry as the abutments.

Fig. 1 *General view of the arch bridge [5].*

Fig. 2 *Structure elements: arches, wind bracings, verticals (with ornaments) [5].*

It is noteworthy that there is a small number of similar structures in Europe, as why keeping such a monument of technical art is compulsory.

It is regrettable and unacceptable that the bridge is currently closed to traffic having an advanced degradation state, despite the fact that during the last decade projects with various solutions for its rehabilitation were developed, but none of them was implemented because of bureaucracy and lack of financing.

Saving this splendid structure is a duty of the current administration and the new day generation of engineers. The bridge, with its historic monument character, must be kept the same solution and in use for as long as possible.

3. A New Pedestrian Bridge over Bega Channel in Timisoara City

Designing a new bridge in an historical place situated in the middle of Timisoara, is a real challenge and it must be taking into consideration many factors to succeed in the integration of the structure to the surrounding environment.

Unfortunately, Timisoara has no new bridge since decades ago. Nowadays, creating new possibilities to cross the Bega channel is required, due to of the continuous and rapid developing and expansion of the city. The charm of this city, settled on the northern bank of the Bega River, lies in its distinct architectural character and vibrant cultural life, being a cosmopolitan place.

Together with a new urban attraction poll development prepared to be given to the city, starting this year, a functional need for crossing the canal for all traffic participants (road, cyclists and pedestrian) appeared by default.

The structural engineers and the architects, with the approval of the developer, were

coming with a proposal for a public utility that is practical anywhere in Europe, from a functional and aesthetic perspective, in harmony with the urban development of the area. The traffic was divided in two parts by providing for each traffic component its own crossing solution, which can be treated as main separated components in the traffic zone without disturbing each other: a road bridge and a pedestrian one. Therefore, making this separation from the start, it could be considered that on the foot or bicycle passenger traffic does not strain the bridges with much weight, designs of those bridges can be made to be more extravagant, elegant, sleek and better integrated with the urban environment [6].

Being situated within an historical place, the technical and architectural solutions were very difficult to decide. Another important condition was the insurance of the minimum navigation height imposed by the authorities. Along this process many proposals were made, all by taking also into consideration the main requirement of the developer that the future structure to become an architectural symbol of the city, bringing a plus value to the urban life.

All the technical solutions that reached the finals were all integral bridges, characterized by short execution time, having aesthetic qualities and architectural character, assuring equilibrium between cost and quality.

The three proposed cross sections by the engineers were:

- an elegant pedestrian bridge maid by steel (Fig. 3) with only 56 cm construction height on the middle of the span, L=32,00 m;
- a composite structure with a variable steel box girder, h_{min} = 72 cm and L=32,00 m (Fig. 4);
- a bridge way down with interesting steel girders that are raising together with the entire new developed urban area sit in neighbour. A composite structure with 60 cm construction height; a three spans bridge: 4,50 m + 26,00 m + 4,50 m (Fig. 5).

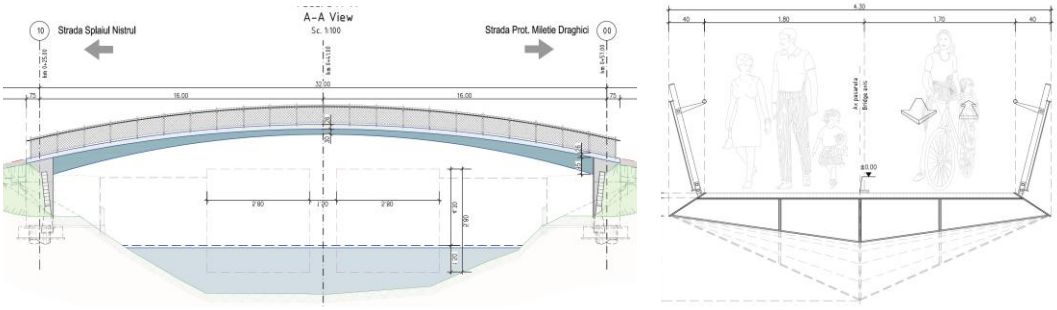

Fig. 3 *A steel pedestrian bridge proposal.*

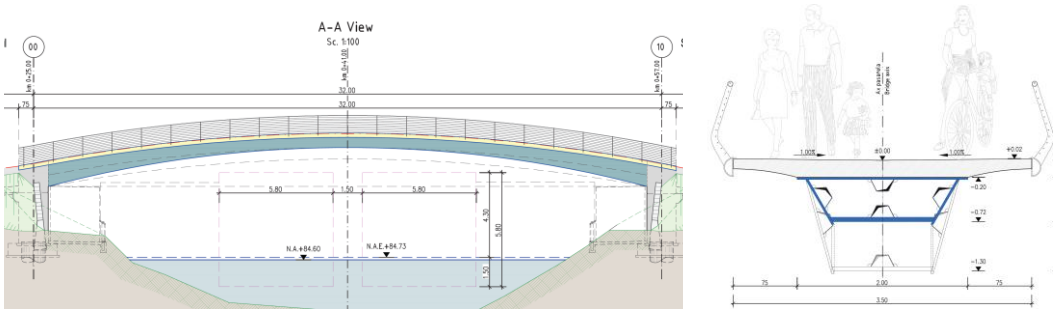

Fig. 4 *A composite pedestrian bridge proposal.*

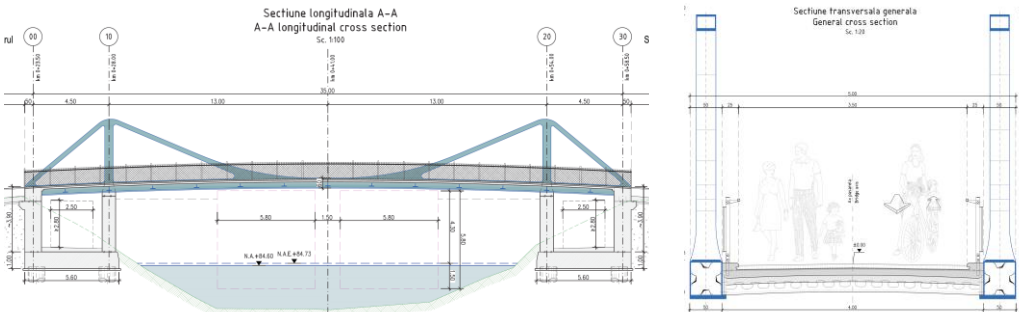

Fig. 5 *The trough bridge proposal.*

Finally, the chosen solution for the pedestrian and cyclists bridge was the one considers being efficient and innovative from the both perspectives: architectural and technical aspects.

Its special shape fits harmoniously in the background of the main project and from the technical point of view it is using one of the SSF-Rapid systems, known as VFT-WIB® girders with composite dowels. The bridge is an integral one, with jointless structure, whose deck is rigidly connected to the abutments. Thus, many important aspects were obtained: reduced costs, fast and simple erection, durability and robustness, low maintenance costs and an appealing aesthetical aspect.

The integral structure has variable curvatures according to the required architectural perspective, with a total length of 41,25 m, the superstructure cross section being made of 5 composite VFT-WIB® girders and a concrete deck. The width of the transverse section of the superstructure is variable, approximately 6,00 m to 12,00 m. The thickness of the superstructure plate is 20 cm [7]. The bridges infrastructure is straight, asymmetrical and placed parallel to the channel.

The whole concept has many components aiming to increase the quality of traffic participants (pedestrian and cyclists). The principal architectural element of the assembly is the solid body of the bridge covered with a COR-TEN® steel envelope. The architect provides also for this area the idea of a sharing space, an amphitheatre, a multi-function ramp network and a shipping station for water navigation [8].

Fig. 6 *General of the new pedestrian bridge [8]*

Fig. 7 *The abutment amphitheatre of the new pedestrian bridge [8]*

4. Conclusions

By using new concepts and innovative ideas, the design team managed to create a fluid structure that connects the two parts of the city, increasing the quality of public

space, intended to be a new social pole and an architectural attraction in the city.

Fig. 8 *The general top view of the new pedestrian bridge together with the road bridge and the surrounding new design urban area*

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