

CROATIAN BRIDGE-BUILDING HERITAGE

Srđan Uzelac*, Ana Hranilović Trubić & Dalibor Sekulić*****

*B.Sc. (Civ.Eng.)

Civil Engineering Institute of Croatia

** B.Sc. (Civ.Eng.)

Civil Engineering Institute of Croatia

*** Phy.B.Sc.

Civil Engineering Institute of Croatia

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Abstract: *Cultural heritage has always been and especially today in the globalization process which is joining nations together, the most significant factor of the national values' affirmation. Thus, the heritage becomes an identification symbol which aligns Croatia with the European community of nations. This perception is also very important concerning the bridge-building heritage in Croatia which is presented in this paper. It imposes obligations of the preservation of bridge-building heritage for our descendants.*

1. INTRODUCTION

To keep our bridge masters and their achievements in memory is not just a formal gesture of common human kindness or mere collection of old times knowledge but the age-long human aspiration, immanent to all the people in the world, for a self-affirmation through a heritage protection. Lack of concern and oblivion transform everything to a heap of rubble, ruins and weed implicating thus our own disappearance. It can be said that in time of rapid development of the technology and construction industry, innovations and hectic life pace, today's generation of civil engineers has already been building their own past, the heritage of their descendants. There is an increasing collective awareness about the protection and preservation of not only the ancient monuments but also of structures preserved as the architecturally valuable units which represent the significant characteristics of the historical setting and spiritual identity. And, as our 1961 Nobel laureate in literature Ivo Andrić wrote in his masterpiece novel "The Bridge on the Drina": "There are no random structures isolated from the human society where they have occurred, isolated from the society's needs, wishes and perception, the same as that there are no arbitrary lines and shapes without any reason in building efforts". It is true that bridges, out of all the structures conceived by man, are attached to man and homeland to the greatest possible extent. So many human individual and national destinies have been determined by or on bridges. They symbolize human need to connect everything, need to erase dividing lines and separations. Likewise, our bridges have been witnessing turbulent times in Croatia and ancient desire of people to belong to some better world."After all, everything about our life - thoughts, efforts, beliefs, smiles, words - it all streams to the other side, and only there it gets its real meaning. All our hope is on the other side." (Ivo Andrić)

2. CROATIAN BRIDGE-BUILDING HERITAGE

Today, when almost any gap can be bridged over, beauty and harmony with a surrounding landscape have become an increasing challenge for bridge designers. Our predecessors, thanks to the age-long need to conquer the barrier, had successfully solved the challenge. A series of small and mid-size stone bridges along the route of old roads in Croatia witnesses about it. This kind of folk bridge-building, versatile with respect to the climate and place of construction and using available materials, has created many structures which represent peculiarities characteristic for the respective landscape and homeland (Fig. 1-2).



Fig. 1. Generalski Stol



Fig. 2. Oštarije

Also, preserved structures from the Roman Age should certainly be mentioned like the impressive remains and a reconstructed part of the original aqueduct in Split (Fig. 3) which fed the Diocletian's Palace with water, an aqueduct in Trsteno close to Dubrovnik, and a bridge in Beli at Cres (Caput insulae) (Fig. 4-5) island which bridged the abyss on the way to the Beli fortress in ancient time. But today, forgotten with a grey covering of moss, it truly astonishes the traveller who passes the bridge.



Fig. 3. Aqueduct, Split



Fig. 4. Trsteno, Dubrovnik

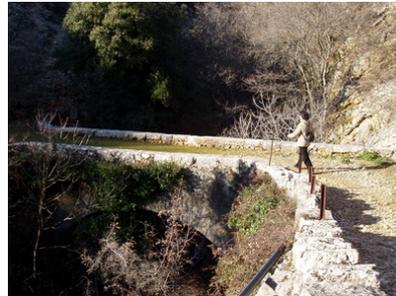


Fig. 5. Beli, Cres

In the Middle Ages, bridges in Dubrovnik city were built. The whole city of Dubrovnik is a cultural monument and it was included in the world's heritage list in 1979. At the west entrance to the Old Town is a stone bridge (Pile Gate) with two Gothic arches, designed by Paskoje Miličević (1471). That bridge ends at another bridge, a wooden drawbridge which used to be pulled up every evening. Above the bridges, over the arch, the statue of city patron St. Blaise (Sv. Vlaho) is set. Entrance to the Old Town from the East, outer gate of Ploče, is built by Miho Hranjac in 1628, while wooden drawbridge and twin-spanned stone bridge (15th c) by Paskoje Miličević are similar to those at Pile Gate. Over the bridge there is the statue of St. Blaise. (Fig. 6-7).



Fig. 6. Vrata od Pila, Dubrovnik



Fig. 7. Vrata od Ploča, Dubrovnik

Out of 20th century structures, we single out bridges in Drniš, Crikvenica, Sisak and Slunj (Figures 8-11) designed by Croatian great bridge designers K. Tonkovic (Fig. 8; 11) and M. Frkovic (Fig. 9;10).



Fig. 8. Drniš (Čikola) 1950



Fig. 9. Crikvenica (Dubračina) 1937



Fig. 10. Sisak (Kupa) 1934



Fig. 11. Slunj (Korana) 1958

Among contemporary achievements for which we cited in Introduction that the today's engineers have already been building their own past, the concrete arch bridges at the Croatian coast should certainly be pointed out. These bridges are well-known like the Krk bridge, one of the largest in the world with two arches of extreme span lengths (Fig. 12), Šibenik bridge (Fig. 13), Pag (Fig. 14), Maslenica (Fig. 15), and the bridge over Krka river in Skradin (Fig. 16). These concrete arch spans were executed by means of the Freyssinet's cantilever construction method (1952), without classic scaffolding, which has been widely applied and improved in Croatia [3]. Besides aesthetic values, often connected with arch bridges, significant economic advantages have been achieved.



Fig. 12. Krk, L=250m and 390m, 1980



Fig. 13. Šibenik, L=246m, 1965



Fig. 14. Pag, L=193m, 1968



Fig. 15. Maslenica, L=200m, 1996



Fig. 16. Skradin, L=204m, 2005

Harmony with the extremely demanding area has been achieved with two different bridges in Slunj (Fig. 11;17) and another one in Selište at the entrance of National Park „Plitvice lakes“ (Fig. 18) where the Korana river is bridged in a single span (designed by K. Tonkovic). The third bridge designed by Kruno Tonković over the river Korana has been made in Karlovac (Fig. 19).

Since recently, Croatian first large, single pylon cable stayed bridge (2002) has become the north-west landmark of Dubrovnik (Figure 20).

More details about these bridges can be found in Literature [1,2,3]



Fig. 17. Slunj L=72,61m, 1958



Fig. 18. Selište, L=60m,



Fig. 19. Karlovac, L=56 m, 1972



Fig. 20. Dubrovnik, H=141.5m, 2002

3. OTHER BRIDGES NOT TO BE FORGOTTEN

Crossing over a middle-age small bridge in Tribunj one late summer day (Fig. 21), whose grade level line has stunning resemblance with a famous bridge in Mostar, we came to an idea to visit some almost forgotten bridges on the way back to Zagreb.



Fig. 21. Tribunj, 16th century



Fig. 22. Kaštel Žegarski (Zrmanja), 1885

Since Croatian new high-ways mainly trace the more or less age-old corridors (Roman routes, mountain roads), these bridges are not out of reach any more. We crossed the Šibenik bridge and turned towards Skradin where a new arch bridge dominates the landscape (Fig. 16). The old road took us close to the National park Krka through Kistanje and Ervenik to Kaštel Žegarski. The mix of mediterranean and continental climate has created the magic combination of vegetation and relief where numerous remains of old fortresses and other ruins are evidence of the lasting Croatian rule in this area but also of the recent homeland war. We visited a stone bridge (1885) over the Zrmanja river in Kaštel

Žegarski (Fig. 22) and upstream, a similar bridge (Fig. 23) with gravel wearing course, even older according to local inhabitants' stories.



Fig. 23. Bridge near K. Žegarski



Fig. 24. Krupa

All the time during travelling over almost deserted region one cannot help thinking about how to preserve the cultural heritage in these depopulated regions which people left as a direct consequence of war and moved to larger centers. Without working population, incentives and challenging programs for social and economic development of the mentioned region, there are no programs for preservation of cultural heritage. Over the Krupa river (Fig. 24) and close to a monastery, we climbed Velebit (The Park of Nature) which offered a breathtaking view of the Zrmanja canyon, probably one of the most beautiful in Europe recognized by rafters from all over the world. It is a beautiful mixture of natural and cultural heritage which needs to be preserved. We came to the Lika side and visited bridges in Gračac, Bilaj, Gospić, Kosiinj (Fig. 25-28).



Fig. 25. Gračac (Otuča)



Fig. 26. Bilaj (Lika)



Fig. 27. Gospić (Novčica), 1890



Fig. 28. Kosiinj (Lika), 1926

Close to Otočac, we entered the highway, came to Ogulin and visited stone bridges on the Dobra and Tounjčica rivers (Fig. 29-32). At the end of the day, satisfied and full of impressions, we already plan new visits. Since this first tour of Croatian historic bridges, our travel companions have been sending photos of bridges from their trips all over Croatia. Some of them are presented in this paper (Beli).



Fig. 29. Toplice Lešće (Dobra) 1885



Fig. 30. Tounj (Tounjčica), 1779, 1836



Fig. 31. Ogulin-Molinarijev (Dobra)



Fig. 32. Novigrad (Dobra) 1885

4. CONCLUSION

Preservation of cultural heritage in Croatia should be based on the raising of awareness about its value. Today, the loss of heritage means the loss of identity and mere blending within the multitude of other countries.

The preservation itself and its continuous presence in the minds of generations, achieved by the systematic raising of awareness about our own values preserve the identity itself.

With the adoption of such perception, institutional measures for the cultural heritage protection become even more efficient and get their full meaning. The beginning of such a relation to the heritage is the prerequisite for a continuous transfer of the cultural heritage awareness from generation to generation.

5. LITERATURE

[1] Radić J., Mandić A., Puž G. 2005. Konstruiranje mostova, Hrvatska sveučilišna naklada Sveučilište u Zagrebu-Gravevinski fakultet, Jadring, Zagreb

[2] Radić, J. 2002. Mostovi, Dom svijet, Zagreb

[3] Šram, S. 2002. Gradnja mostova, Golden marketing, Zagreb