

ROMAN BRIDGES ON THE LOWER PART OF THE DANUBE

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Abstract: *The purpose of the paper is to present the Roman bridges built across the Romanian natural border, the Danube, during the Roman Empire expansion. Some of these are less known than the famous Trajan's Bridge in Drobeta-Turnu Severin. The construction of bridges on the lower part of the Danube showed the importance of conquering and administrating the ancient province of Dacia. The remaining evidences prove the technical solutions used by the Roman architects at a time when public works had developed.*

Key words: *Danube, bridge, pontoon bridge.*

1. Introduction

The Danube River flows through our country on around 1075 km, of which 225 km on Romanian territory exclusively. Among the riparian countries, Romania has the longest access to the river, including the Danube Delta. Romania also put into operation since 1986 the Danube – Black Sea Channel (Cernavoda – Constanta). The Danube with the Main – Rhine channel forms Europe's blue diagonal for river transports. Few are the permanent crossings built on the lower Danube (Figure 1).

To investigate the origin of the "DANUBE" name we have to go back to the Celtic tribes who lived in the upper Danube basin. The word "Danu" is of Celtic origins and signifies "swift, rapid, violent, undisciplined". Emperor Cesar in his work "De Bello Gallico" had named the stream Danubius. Phoenicians and Greeks had

explored the river from the delta upstream but knew only the lower course, known as Istros or Iстриa. The name Danubius can be found in the work of Aristotel, Ovid, Strabo, Plinius the Second. "Istros" is mentioned by Herodot and Virgil. Other nations migrating along the stream called the river Donau, Dunaj, Duna, Dunav, Dunarea, the name being transformed and modified according to the language of the country.

During the Roman Empire public works had known a great development. Temples, arches, basilicas, baths, aqueducts are well known even in our days. As a first priority roads were constructed ("via vita"). A network of roads covered the entire surface of the Roman Empire. 40000 km of principals roads covered had been built. The construction of roads and bridges reached a very high level during the period of the roman emperor TRAIAN (98 – 117 A.D.) A main road starting from the north of Italy

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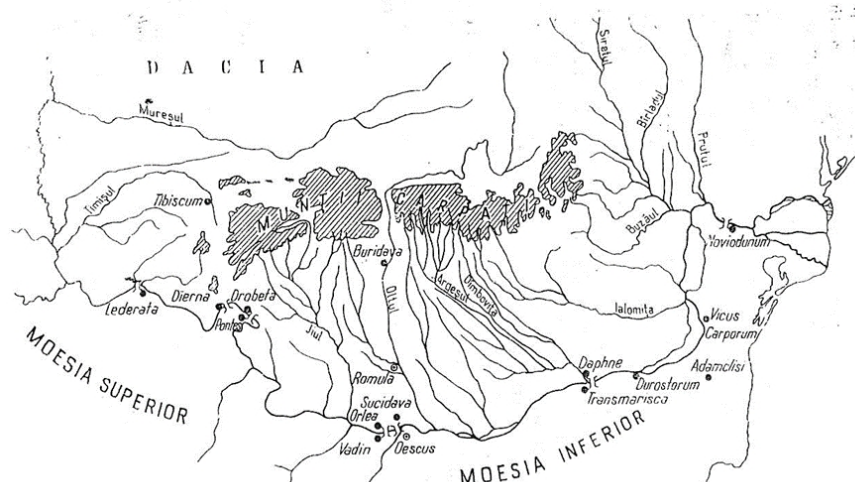


Fig. 1. Roman Bridges on the lower Danube

During the Traian's rule the road reached the zone of Turnu – Severin, the border of the Roman Empire. On the other side of the Danube was Dacia.

In 101, Emperor Traian started the first war for conquering Dacia. The Roman army crossed the Danube near Drobeta on a pontoon bridge. A series of wooden and stone bridges were built to provide access to the ancient province of Dacia on the other side of the great river Danube. Some of them had a long exploitation, whereas the others served only temporarily for military purposes [3].

The majority of the bridges were built on the lower part of the Danube from the Iron

Gates to the Black Sea (Figure 1). The most important of these are the following:

- Cornelius Fuscus' Pontoon Bridge from Vadin (86-87 A.D.);
- Traian's pontoon Bridges in Lederata and Dierna (101 A.D.);
- Traian's Bridge in Drobeta-Turnu Severin (103 – 105 A.D.);
- Constantine the Great's bridge from Celei, the ancient Oescus-Sucidava (328 A.D.);
- The pontoon Bridges of Emperor Valens in Daphne (367 A.D.) and Noviodunum (365 A.D.).

Among these, there are five bridges that are related to the need of movement for military purposes during the wars between the Romans and the Dacians (the inhabitants of the territory of today's Romania) at the time of emperors Domitian and Traian.

The following part describes four of these bridges whose archeological evidences survived until today. Due to their previous significance, these have been analyzed in the last time, in the hope of discovering the enigma of their technical solutions.

2. Cornelius Fuscus' Pontoon Bridge from Vadin-Orlea

The ruins of this bridge were mentioned for the first time by the Italian-born scholar and eminent natural scientist Luigi F. Marsigli in his paperwork "The Description of the Danube". He visited during his research on the Danube river banks the Roman fortress from Vadin (today Bulgarian location). He made a detailed description of the bridge built by the Dacians (and Thracians), providing a sketching of the position of the stone pillars and wooden piers (Figure 2).

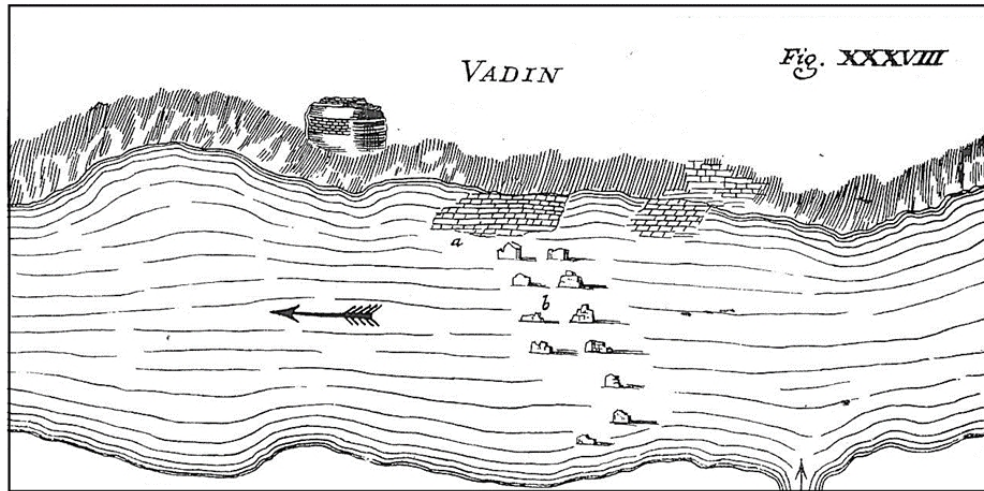


Fig. 2. The ruins of the roman bridge in Vidin-Orlea (after Marsigli 1691)

The ruins of the bridge can be seen even in the present. Strong pillars were battered down vertically in two rows across the river. Perhaps it was used the same practical technique as the one that helped Cesar's legions to cross the Rhine. At Vidin-Orlea the bridge stretches over a length of 1000-1100 m someplace where the water reaches 6-7 meters depth. The pillars were probably introduced into the riverbed during summer with the help of a battering ram fixed on the ships [3].

The crossing was made then on the ships thus linked together. It is more than certain that it did not possessed vaults of wood or any kind of deck. At the same time the navigation was obstructed. Compared to the bridge across the Rhine, the pillars stood vertically and were not inclined as in the solution of permanent wooden bridges.

The pillars served for anchoring the ships only. As it was only a short-term exploited military construction the bridge was, of course, immediately dismantled, as to avoid a possible invasion.

Historical sources tell that, the year of the construction is the same with Cornelius Fuscus' failed expedition in Dacia in 87 A.D.

Further research of the underwater ruins

would be necessary for finding more answers concerning the historical and technical nature of the pontoon bridge [1].

3. Traian's Pontoon Bridges from the Year 101 A.D.

In the field of bridge constructions across the Danube, the conqueror of Dacia the Roman emperor Traian (98-117 A.D.) is well-known for the bridge of Apollodor of Damascus, one of the most important construction work achieved by Romans. The interpretation of Traian's Column in Rome gave many answers to different questions.

In the spring of the year 101 A.D. emperor Traian started the first war for conquering Dacia and the Roman army crossed the Danube near Drobeta Turnu Severin town on two pontoon bridges. This is an archeological and logical fact confirmed by the scenes IV-V represented on the memorial Column (Figure 3).

The fourth scene from the Column, shows a military procession passing on the bridge made of the six ships of the same

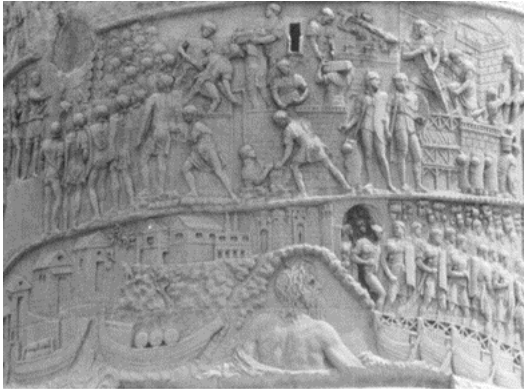


Fig. 3. *Scenes from Traian Column, showing legionaries crossing the Danube river on a pontoon bridge with timber walkways*

size and length bound together by wooden beams. An interesting outstanding constructive element, is the arch of masonry on the left of the scene, which could only be the portal of the bridge situated on the right bank of the Danube. The stone blocks are sustained by two pillars with capitals.

While the location of the first bridge is known to be the ancient Lederata (in present Ram) on the Serbian river side, the second one is thought to be difficult to appreciate. However these two locations were definitely chosen far one from the other, to avoid the unfavorable conditions encountered at the narrow passage of the Danube at "Cazane" near the Iron Gates.

4. Traian's Bridge Over the Danube at Drobeta-Turnu Severin

After defeating Decebal's army and peace conclusion, Traian realized that domination over Dacia province could not be achieved without building a fixed bridge across the Danube. Consequently the need of movement for military purposes and the need to administrate the newly conquered province, located on the Danube left side, imposed the construction

of this bridge, between 103-105 A.D.

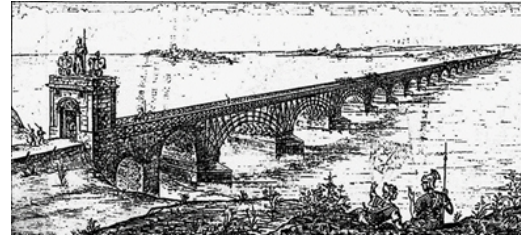


Fig. 4. *Traian's bridge over the Danube in Drobeta-Turnu Severin*

Having a length of over 1200 m, Traian's bridge, astonished modern researchers for the enigma of technical building solution. The bridge was considered superior to all other bridges built by the Romans. Some hypothesis about the bridge construction and its service life can be presented. Unfortunately, the monograph of the bridge, written by Apollodor from Damascus who was the architect and builder of the bridge, had been lost. The documents elaborated by the researchers of the bridge indicate that the more plausible assumption regarding the bridge site selection is the possibility of temporary deviation of a part of the Danube; therefore some of the piers could be built on land. In 1853, a great lowering of the Danube offered to a team of Austrian specialists and to a Romanian engineer, the possibility to make an inspection on site.

The investigations performed in 1858 showed that the lower part of the bridge piers, differently damaged in time, were made of broken stone masonry with mortar binder. The whole structure being surrounded by a strong wall made by blocks of crushed stone. The ruined piers length varied from 21.50m to 22.75m and their width from 14.22m to 14.85m [2].

Further information concerning the substructure of the bridge, was obtained in 1909 when the Romanian Hydraulic Service ordered the demolition of two

ruined piers located close to the Romanian shore, because they obstructed the navigation along the river. On this occasion when divers worked in the Danube area, they discovered traces of wooden caissons used for the construction of the piers. The piers were erected by two methods:

1. A part of the piers were constructed on the land subsequent to the Danube deviation along the southern channel;
2. The other piers located in the Danube were constructed with open wooden caissons provided with two walls sustained by wooden piles, between which hydraulic concrete (mortar) was cast. The sediment inside of the caissons was removed out, the ground consolidated by broken stones (Figure 5).

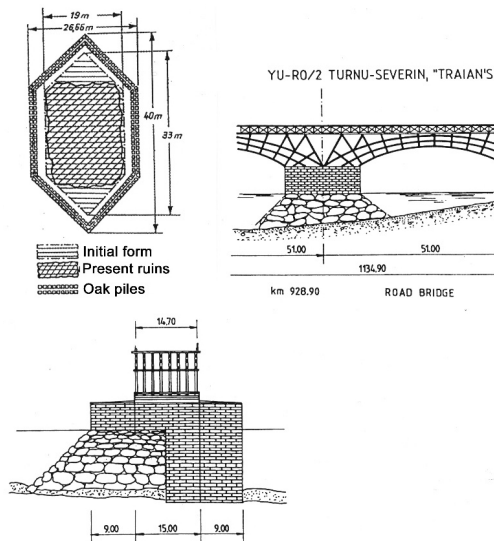


Fig. 5. Bridge end with portal and foundation (reconstruction)

The most difficult aspect of the construction seems to have been the foundation of the piers on the riverbed. These 20 piers were provided with front-breakwaters and downstream-breakwaters of the same shape. On the outside of the pier two rows of wooden piles were identified having a square cross section

and with wooden planks inside, which would lead to the idea of a cofferdam. On the outline of this enclosure regularly wrought stone blocks were identified, in the form of a dry masonry. Inside of this masonry blocks of Roman cement concrete were found. Some of these blocks would have pieces of broken bricks inside as aggregates. The concrete and stone blocks of the foundation were tied together by means of lattices made from oak tree trunks. The foundation was laid directly on the bottom of the Danube River (Figure 5).

They would support the superstructure, that was conceived by wooden arches (with a remarkable span of 51 m). The abutments are today the best preserved elements among the ruins of the bridge thanks to their special masonry.

The images shown on Traian's Column in Rome, as well as ancient coins clearly indicate a wooden structure combined with arch structural elements (Figure 6).



Fig. 6. Scene from Traian's Column in Rome

After the demolition of the piers, the oak beams were preserved at the museum from Drobeta - Turnu Severin. In 1906 at the National Romanian Exhibition, the French engineer Edgar Dupereux, tried to restore the bridge; he achieved a model scale 1:100, completed with the portals of the bridge (Figure 4). This model is nowadays in the museum from Drobeta-Turnu Severin) [2].

At the end of these considerations, some hypothesis about the destruction of the

bridge is presented; there are two theories: subsequent to Traian's death in the year 118 the destruction of the superstructure was ordered by the emperor Hadrianus his successor. Probably this decision was taken when the barbarians got into Dacia; the second view indicates that the bridge destruction was caused by the floods. We do not know the exact details.

As a conclusion, the bridge over the Danube in Drobeta - Turnu Severin was one of the most important constructions of the Roman empire. It is sure that the bridge was not built only for a single military company; it was constructed for years on the purpose of strong connection with the territories over the Danube.

Even nowadays the ruins of one pier can be admired on the Romanian river side.

5. Constantine the Great's Bridge from Celei

Information about this bridge is found in the late Roman literature. The ruins of this bridge can be observed until today but in a very modest condition. The bridge can be also easily located between the Bulgarian village Ghigi and Celei (near Corabia) in Romania (Figure 7 a). At that time two prosperous cities existed here: Oescus on the right, respectively, Sucidava on the left bank of the Danube [1].

The bridge was inaugurated by Constantine the Great in 328 A.D. and it realized a permanent contact with the northern Danubian territories.

Archeological discoveries and historical research conducted to the same technical solution adopted for Traian's bridge (Figure 7 b).

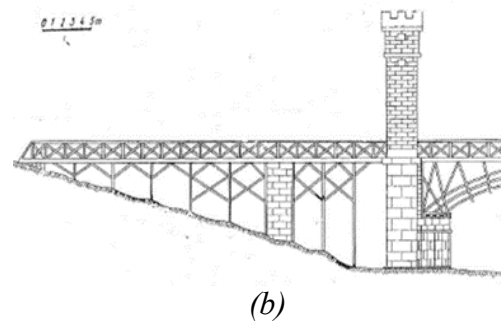


Fig. 7. *Final span of the bridge (reconstruction)*

6. Conclusions

Historical data and archeological evidences prove that a significant number of bridges were built on the lower part of the Danube, in comparison with other regions situated at the border of the ancient Roman Empire. These bridges were constructed in this area on the purpose of achieving a strong connection between Dacia province and the Roman Empire.

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