

AIR

2010/2

Arhitektura, raziskave
Architecture, Research

UDK 725.2 : 664.71.05 (497.11)
COBISS 1.02

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59 - 62

ARHITEKTURA VODNIH MLINOV V
JUŽNI SRBIJI

*THE WATER MILLS ARCHITECTURE
IN THE SOUTH OF SERBIA*



Fakulteta za arhitekturo
Inštitut za arhitekturo in prostor
Ljubljana 2010

ISSN 1580-5573

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Fakulteta za arhitekturo
Inštitut za arhitekturo in prostor

ISSN 1580-5573
ISSN 1581-6974 (internet)
<http://www.fa.uni-lj.si/ar/>

revija izhaja dvakrat letno / published twice a year
urednik / editor
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prelom / setting
Astroni d.o.o.

lektoriranje, slovenščina / proofreading, Slovenian
Karmen Sluga

prevodi, angleščina / translations, English
Milan Stepanovič, Studio PHI d.o.o.

klasifikacija / classification
mag Doris Dekleva-Smrekar, CTK UL

uredništvo AR / AR editing
Fakulteta za arhitekturo
Zoisova 12
1000 Ljubljana
Slovenija
urednistvo.ar@fa.uni-lj.si

naročanje / subscription
cena številke je 17,60 EUR / price per issue 17,60 EUR
za študente 10,60 EUR / student price 10,60 EUR
urednistvo.ar@fa.uni-lj.si

revija je vpisana v razvid medijev pri MK pod številko 50
revija je indeksirana: Cobiss, ICONDA

za vsebino člankov odgovarjajo avtorji / authors are responsible for their articles

revija sofinancirata / cofinanced

JAK, Javna agencija za knjigo RS

tisk / printing
Tiskarna Pleško

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izvleček

Vodni mlini so bili do polovice 20. stoletja gosto posejani po podeželju južne Srbije. Njihova arhitektura je posebna, v glavnem so zgrajeni v regionalnem moravskem stilu. Na žalost pa so bile te enkratne zgradbe zavoljo brezbriznosti ne le zapuščene, ampak večinoma tudi opustošene. Po zaslugi ugodnih naravnih pogojev so se mlini na tem območju domnevno nahajali že v starem veku. Obstajali so skozi ves srednji vek. Zemljiški posestniki so imeli navado samostanom in cerkvam podarjati vasi in hkrati z njimi tudi vodne mline. Za takšne mline je veljala posebna pravna ureditev. Srednjeveški zgodovinski viri poročajo, da so poleg samostanskih in cerkvenih vodnih mlinov obstajali tudi mlini v lasti celih vasi ali vaških okrožij. Proti koncu turške vladavine in med obema svetovnjima vojnima je število prebivalstva po vaseh naraščalo. Zato je bila tedaj zgrajena večina vodnih mlinov. Običajno so jih postavljali na tistih odsekih rečnih dolin, kjer so bile brzice. Vodo iz rečnih strug so s pomočjo kanalov speljali do potrebne višine vodnih mlinov. En kanal je lahko oskrboval dva, tri ali celo šest vodnih mlinov.

ključne besede

vodni mlini, dediščina, zgodovina arhitekture, izročila, etnografija, moravski stil

abstract

The water mill structures were very frequent in the rural territory of south Serbia until the half of 20th century. Their architecture is unique, and mostly in the regional Morava style. Unfortunately, due to neglect these unique structures were not only abandoned but in most part devastated. It is supposed that they existed in these areas as early as in the ancient times, due to the favorable natural conditions. The land lords used to bestow villages to monasteries and churches, and with them, sometimes, the water mills. For such water mills there were special legal regulations. In the medieval historical sources, apart from the monastery or church water mills, there were those belonging to entire villages or village districts. In near past one could find a favorable river location for a water mill without the actual water mills. The population swelled in villages, in the periods nearing the end of the Turkish rule, and between the two world wars. For this reason, the major part of the watermill was constructed then. The water mills were usually constructed at those parts of river valleys with rapids. From the riverbeds, water was conducted, by means of flumes to the required height of the water mills. One flume could accommodate two, three even six water mills. The water mills remained what they used to be in the ancient past: form, structure, certain parts with names, order, manner of usage etc.

key words

water mills, heritage, history of architecture, traditions, ethnography, the Morava style

According to archeological research, sets of mill stones intended for grain milling occur very early. They were made of a slightly concave lower stone (bed stone) and cylindrical or convex upper stone (runner). The remained this form, unchanged for a very long time. A small figurine from Egypt, from the time of 5th dynasty (around 2500 BC) represents a servant woman who, kneeling mills the grain on a large, slightly concave stone slab by using her both hands on a smaller, rounded stone. At a site in China, in the Gobi desert, a large number of smooth mill stones was found dating back to 4000 BC. In Serbia, such mill stones dating back to 4700 BC were discovered in Lepenski Vir. Probably the oldest such stones, well dressed and polished, were discovered in Libyan part of the Sahara, whose age is estimated to around 14 000 years.

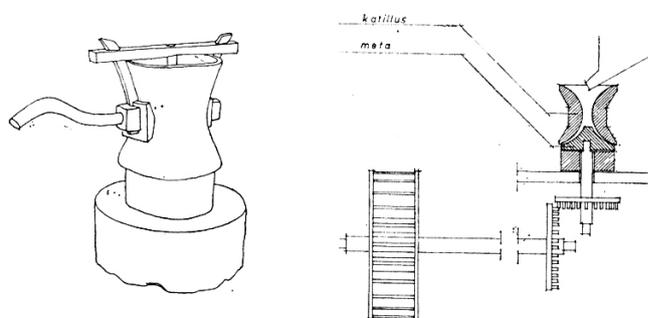
It cannot be positively certain when the transition to a mill composed of two circular stones, of which the rotation of the upper one mills the grain, took place. It is certain that this could not happen prior to discovery of the wheel.

Hand-driven, rotating mill was very wide-spread and remained in use for a very long time, almost until present time. So early as in the 3rd century BC the first hand-driven mills were found. In the same century, near the city Arles, the first water-driven mill was constructed. The water fell from the height of 20 m and drove 8 mill stones. Soon after, the water-mills were being constructed all over Europe.

In the Slavic people, the mills were found in Poland dating back to the 1st century BC. In the long period of its usage, the design was improved: the runner got two handles mounted opposite to one another, which made operation easier, and later a device adjusting the fineness of the flour was invented – a vertical lever lifting and lowering the runner. Regardless of the design

improvements, the milling was a hard work performed almost exclusively by women. (Findrik, 1983)

The Roman mill, though the same in working principle with the other milling facilities, had somewhat a more complex structure, for which reason it could not spread widely to other regions. It consists of two parts, the upper and the lower. The upper or outer is a hollow stone cylinder, narrow around the middle. The lower or inner stone is in a shape of circular cone, on which the upper stone rests. The upper part – stone was movable. A wooden shaft which drove the millstones by transmitting the beast or manual power passed through its narrowest part. The grain was run into the upper, hollow part of the cylinder, and the flour issued from the along the entire edge of the lower part, which was incised in a lead hurst.



Slika 1: Rimski mlin na vodni pogon (Findrik, 1983).

Figure 1: Roman mill – driven by water; (Findrik, 1983).

The Romans used water to power the mill. The Mill mechanism

had a vertical water wheel and transmission cogwheel. It drove the lower stone through a vertical wooden shaft.

The water powered mill did not expand particularly quickly, even though the way in which the water power could be used had been already known. A good part of oriental cultures, including China, early adopted the water-powered mill wheel, while Germanic tribes use water to power the mills since 4 century AD. The oldest records of mills in Great Britain date back to year 838, in Hungary the first water powered mills emerge by the end of 11th century, in the Czech lands by the end of XII century and in Dalmatia in the second half of 11th century. There are no exact data and material evidence about the time when the first water mills occur in Serbia. There are written records only by the end of 13th century. On the basis of the Turkish tax lists, there is significantly more data on the mills of that period. By the end of 15th century, in the area of the Nis kadiluk (Turkish administrative unit) there were 195 water mills in 120 villages. In the same period, in the Sabac district, there were 16 water mills in about a hundred villages. In area of Leskovac district, in the second half of 16th century, there were 313 water mill and about three hundred villages. Since the middle ages, when the firsts records of the mills occur, until the beginning of the 20th century, there were almost no changes to the construction of the water mill. The grain milling technology, mill facilities, material of the mills and milling equipment remained unchanged. (Findrik, 1983)

Nowadays a small number of water mills are being "modernized" adapted to new conditions, while the majority of them is gradually abandoned and left to fall to disrepair. The consequences of these facts, and the neglect of the society, brought about extinction of some types of mills, and even those that survived are not operational and it is a matter of days before they disappear. In the following figure, one of the examples of the attempts to reconstruct a water mill can be seen:

The history of water mills in south Serbia

There are no reliable data when the water powered mills appeared in the south of Serbia. Yet, there is no doubt that this occurred early, in the time of late Rome and early Byzantium, as in the archaeological sites of Caricin grad near Lebane and Zlatski grad in Pusta reka, dating back to this period, the remains of dams used to form dam lakes for the purposes of fortification and for powering the mills. (Jovanović, 1987: 117-124)



Slika 2: Primer rekonstrukcije vodnega mlina na območju Crne Trave (južna Srbija).

Figure 2: An example of reconstruction of a water mill in the area of Crna Trava (south of Serbia), photo Ana Momčilović- Petronijević.

In 7th and 8th century, the Slavs settled in these regions who destroyed the Roman and Byzantine civilization, and thus water mills. A long period was to pass before they started to build water mills, for whose operation, they used the natural river flow, similarly to other European nations.

In the time of Serbian mediaeval state, water mill trade flourished. During the several century of Turkish rule over the area, the water mills kept a prominent status. In this period, the most of the water mills in the Nis area were built. According to the data from the Turkish census in the Nis kadiluk by the end of 15th century (in 1498) there were 195 water mills and 120 villages. (Zirojević, 1978)

By the end of the 19th century (1878), after the liberation, as the reins of power were taken from the Turks, the auctions were organized where property of the over-indebted Turks was sold and their estates bought. Among the first public assets bought in 1878 were a large number of water mills. (Niški zbornik, 1973) M. Milicevic, (a Serb travel writer, who after the Serbo-Turkish wars 1876 – 1878 visited the newly liberated areas) wrote that by the end of 19th century, there were 20 water mills on the Jelasnica river. The supplied floured to bakeries and restaurants of Nis. Majority of these water mills operated throughout the year due to abundant waters of the Studena and Kunovica rivers, and due to the fact that they did not freeze in the winter. The capacity of these water mills was used not only by the Jelasnica village and its immediate neighborhood, but also distant villages, particularly in summers when a lot of streams dried up. The population structure of the period (according to the census of 1884) showed that the Nis district had 70% of rural population, which meant certain sustainability of water mills in the area. (Niški zbornik, 1978)

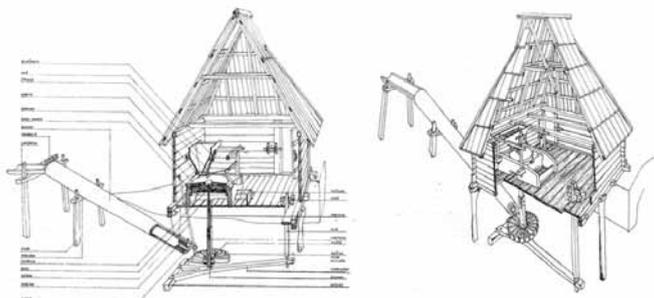
Times changed and industrial and urban revolution caused a decrease of the number of active village population and brought about radical changes in the economy. Certain villages stopped producing grain, and new milling technology (electric powered mills) lead to abandoning water mills. Water mills were also abandoned due to tapping of the streams, for water supply. The neglect was also caused by joint ownership with clearly defined rules and duties, according to which everyone was obliged to cover the maintenance costs according to their ownership share. As many owners went to live in the city, they neglected their obligations. Poor husbandry is reflected in the poor realization of good initiatives to preserve the old and abandoned water mills and start their operation. Inadequate reconstruction, changing of technology and materials and changes disrupting their authenticity resulted in the structures of diminished value and quality, and in the quasi – water mills.

Structure and architecture of water mills

There are two basic types of water mills – the horizontal water wheel and vertical water wheel. The horizontal water wheel is driving the mill stone directly, via a common vertical shaft, whereas the vertical wheel has an indirect drive via a horizontal shaft, which requires more water because of more power losses in the transmission.

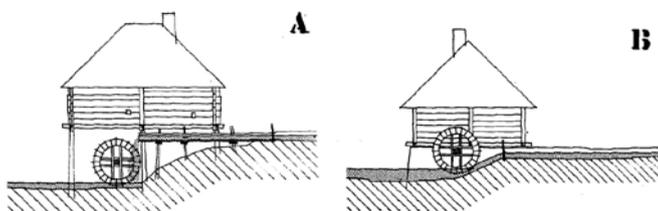
In the south part of Serbia, water was mostly used for powering water mills. Both types, the horizontal and vertical, of water wheels were constructed. The vertical water wheel has a horizontal shaft, so the mill stone is driven indirectly, whereby a part of energy is lost. The water is brought to the vertical water wheel in two ways: by undershot, when the water stream drives

the vans and turns the wheel (fig. 4 B) or by overshot, when the weight of the water table and impact of water mass turns the wheel (fig. 4 A).



Slika 3: Prečni prerez in aksonometrični pogled na vodni mlin ob rečni strugi; fotografija (Findrik, 1983).

Figure 3: Cross section and axonometric view of a stream water mill; photo (Findrik, 1983).



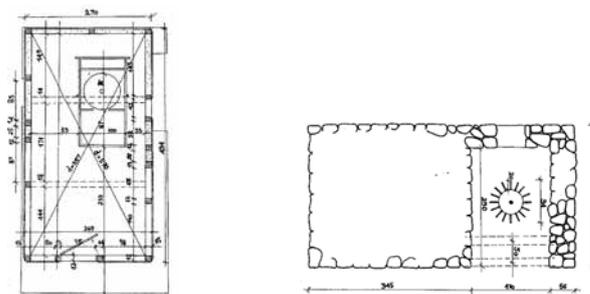
Slika 4: Shematični prikaz vertikalnega kolesa vodnega mlina; A – s pogonom od zgoraj, B – s pogonom od spodaj (Findrik, 1983).

Figure 4: Schematics of a vertical wheel water mill; A-overshot, B-undershot; photo (Findrik, 1983).

The water mills known as moravka, are structures characteristic for the Southern Morava river area. In order to build a moravka, it was necessary to select a favorable place on the riverside and obtain a location plan and a layout of the moravka from an engineer. Then, the water mill future owner was obliged to obtain permission for construction from the owners of surrounding property (250 m upstream and 250m downstream of the moravka). The water mills were constructed exclusively at the sites with rapids on the river.

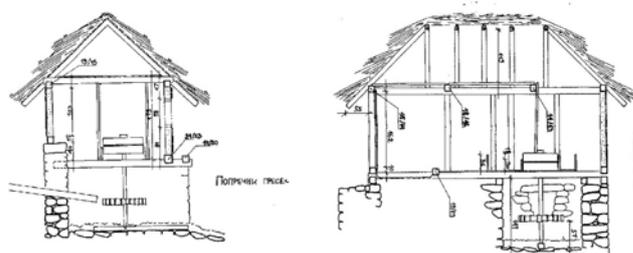
The favorable place is determined and location plan is produced by an engineer, and the water mills are constructed by the farmers – millers, usually in winter. The moravka is made of timber, usually of oak wood or some alternative hard wood. The structure consists of three main parts: a boat – logov, water wheel, and a hut which lies on the boat. The logov is a plain, sturdy boat tied to the bank with a thick chain fastened into a trunk dug deeply into the riverside soil. Across the logov, two beams 15x20 cm are nailed at a distance of 0.5m, with a wooden rest fastened to the beams. The water wall consists of a shaft 12 m long with a diameter of 0.4m at a narrower end, and 0.5 m at a wider end. This shaft is called vaona. (Radović, B).

The water mill structure was simple, and locally available material was the most present in construction. Retaining walls, if there were any was from a locally sourced stone. The support structure was mostly made of timber, post and pan with the filling of wicker, seldom of wattle-and-dub and dressed stone. The attic structure, if any, was made of boards. The floors were also made of boards, plastered with mud. The internal walls were made of mud mortar.



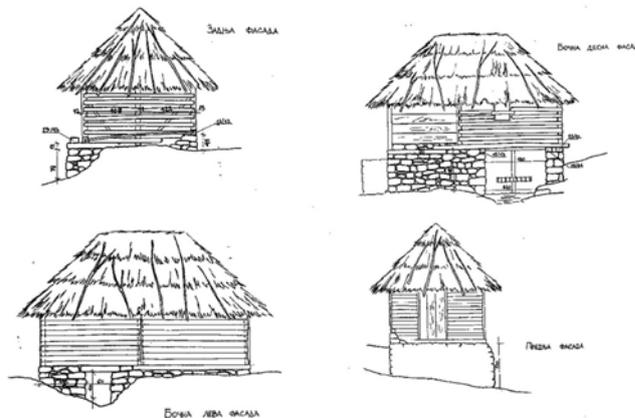
Slika 5: Tloris: mlin Čedomirja Pejića, fotografija iz arhiva Zavoda za spomeniško varstvo v Nišu.

Figure 5: Layout: Cedimir Pejic's mill, Ravno Bučje, photo from the archive of the Institute for monument protection of Niš.



Slika 6: Prečni prerez (levo) in vzdolžni prerez (desno): mlin Čedomirja Pejića, Ravno Bučje, fotografija iz arhiva Zavoda za spomeniško varstvo v Nišu.

Figure 6: Cross section (left) and lengthwise section (right): Cedimir Pejic's mill, Ravno Bučje, photo from the archive of the Institute for monument protection of Niš.



Slika 7: Fasada: mlin Čedomirja Pejića, Ravno Bučje, fotografija iz arhiva Zavoda za spomeniško varstvo v Nišu.

Figure 7: Façade: Cedimir Pejic's mill, Ravno Bučje, photo from the archive of the Institute for monument protection of Niš.

The architecture of the water mills was modest, humble, without complex spatial or structural designs. The purpose of the water mills is to provide operation of the grain milling machinery. The simply constructed buildings, most often of timber, supported by columns only enclose and cover the milling machinery, and almost give impression of makeshift, mobile structures. The space around the mill stones is sufficient only for the milling operation.

The water mills were not built exclusively of timber. Mixed type construction was even more frequent, such as wattle-and-dub

and in karst regions (kraški predeli) it was stone, and not all of them had so poor a spatial composition. The water mills with two or three wheels were somewhat more spacious, and usually with a retaining wall in the part where they rest on the riverside. If a water mill is made of timber, very often the wall with the entrance was made of stone or brick, and a small hearth is made in this part. Fires used to burn also in the cases when the entire water mill was made of timber. Beams and floor boards were coated with a layer of mud, for the purpose of protecting the wood.

The space was divided only in the water mills with multiple wheels. Most often a small part of space near the entrance was separated and turned into the miller's room, a small room where a bed or a stove or hearth could be placed. In those mills used by several villages, the rooms were larger, so that they could accommodate several persons for a night. There are examples of multi-storey Turkish water mills in the Pirot area. There, the mill is located at the ground level, whereas the upper floor had several nicely furnished rooms for summer sojourn. The water mill façades were simple, smooth almost without any ornaments. The window apertures were minimized. The rooms usually have a small window, while the room with a mill stone was most frequently without window. There were only small slits in the wall through which the dam can be observed. Smaller mills had only one door, and larger – two of them, the entrance to the mill and the small one for access to the dam.

The same construction procedures and structural elements as in building the other rural buildings were used. Only the lower, foundation part of the wall, which was in contact with water built with a mortar of red soil mixed with lime, which is resistant to dampness. The larger mills had retaining walls, and the smaller ones just raised on a big stone blocks, following the natural contour of the terrain. Construction of small mills was not different from building any other structure in a village. Even raising the mill on the timber beams, a very frequent case, was nothing special because even nowadays a good part of rural structures is even nowadays built without foundations, so the building procedure is usual and familiar. A great deal of mills on the large rivers was raised on the beams. On some rivers, those are large buildings, veritable stilt houses built on a forest of pillars. (Findrik, 1983)



Slika 8: Zapušeni vodni mlinci u južni Srbiji; vas Krastavče.

Figure 8: Abandoned water mills in the territory of the south of Serbia; village Krastavče, photo Ana Momčilović- Petronijević.

Conclusion

The water mill trade died away till 1961, when the majority of springs were tapped for water supply. The reason why the mills in the flat regions vanished is because the large grain production by far exceeded the milling capacity and required a new, faster way of milling. The mountain villages being less accessible and less well-off than the flatland ones with the better living conditions had less crop yield, so no real need for electric powered mills. Simultaneously, the electric powered mills appeared, which accelerated the extinction of water mills. We can state that in almost all the villages of southern Serbia, the water mill structures have been abandoned, disused and prone to collapse, ruinous or already demolished. Perhaps the only exception is the village of Donji Dušnik (municipality of Gadžin Han). Out of a total of 20 water mills in this village, 11 structures are in good condition, and 8 of them are still operational. However, this is the sole example. In the villages southeast of Nis, which are in a sub-mountainous area, there are only several watermills milling mostly the flour intended for the beasts, exclusively for the water mill owner's needs.

After the field research (done by A. Momcilovic-Petronijevic), as well as on the basis of the written records, it has been concluded that a large number of remaining water mills is in the state of decay. The reason is the material fatigue and migration of population into the urban centers. The water mills have been witnesses of the past and an important part of life of the people from the area of south Serbia. The water mills were not only places for flour milling, but also important part of lives of people who held celebrations and feasts there. All the remaining structures are in a very poor condition.

References

- Zirojević, O. (1978): Mlinovi u vreme turske vladavine (od XV do XVIII veka)-Simpozijum VI „Seoski dani Sretna Vukosavljevića“.
- Findrik, R. (1983): Uvod u proučavanje starih vodenica-Saopštenja XV.
- Radović, B.: Moravke-vodenice na Velikoj Moravi - Glasnik Etnografskog muzeja IX.
- Trifunovski, J. (1972): Vodenice u Skopskoj Crnoj gori; Narodni muzej u Vranju, Vranjski glasnik, knjiga VIII, Vranje.
- Turnšek, B., Vasić M., (2008): Vodenice na prostoru grada Niša, kao mogućnost proširenja turističke ponude etno sadržaja, promocije i afirmacije regiona. Zbornik Vlasinski susreti, Vlasinsko jezero.
- Momčilović A. (2009): Stanje objekata vodenica na prostoru Nisa, Zbornik radova INDIS 2009, Novi Sad str. 321 – 328.
- Pesić D. i Stojčić-Dragičević Z. (2004): Izložba fotografija – Vodenice naseg kraja u okviru projekta Dani Evropske Baštine u Nišu, Zavod za zaštitu spomenika kulture Niša i Narodni muzej u Nišu, Niš.
- Niški zbornik, (1973): br. 1, Gradina, Niš.
- Niški zbornik, (1978): br. 5, Gradina, Niš.
- Jovanović, J. (1987): Vodenice i valjavice u leskovackom kraju, Leskovacki zbornik, Leskovac, br. XXVII, str. 117-124.

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