

Analysis of the Current Situation and the Possibility of Introducing a Bike-Sharing System in the Cities of Vojvodina

MILJA M. SIMEUNOVIĆ, University of Novi Sad,
Faculty of Technical Sciences, Novi Sad
ORCID: 0000-0001-9650-2635

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VALENTINA B. MIROVIĆ, University of Novi Sad,
Faculty of Technical Sciences, Novi Sad
ORCID: 0000-0002-5609-1664

JELENA C. MITROVIĆ SIMIĆ, University of Novi Sad,
Faculty of Technical Sciences, Novi Sad
ORCID: 0000-0002-0603-7774

ZORAN M. PAPIĆ, University of Novi Sad,
Faculty of Technical Sciences, Novi Sad
ORCID: 0000-0003-1264-0913

DANIEL J. SUSEKAR, University of Novi Sad,
Faculty of Technical Sciences, Novi Sad

Bike sharing is being popularised and promoted in many cities. The introduction of this system is a way to increase the availability and use of bicycles. As part of this paper, an overview of the existing bike-sharing systems in the area of Vojvodina was made. The possibility of introducing this system in the area of Zrenjanin was also investigated. The results of the survey conducted in Zrenjanin show that there is a great potential for the introduction of a bike sharing system in this area, but that there are many shortcomings that need to be addressed. Over 82% of respondents have a high level of bicycle use during the week, so this is an excellent indicator to support the introduction of the bike sharing system. The biggest difficulty for them when cycling is disrespect by other traffic participants, and they think that a construction of new cycling paths will contribute to an increased bicycle usage as a transport means.

Key Words: *Cycling, Bike-sharing, Infrastructure, Survey*

1. INTRODUCTION

The use of non-motorised modes of transport in urban areas is a very important aspect of sustainable development. Next to walking, cycling is the healthiest and most environmentally friendly form of transport. For this reason, cycling is recognised as one of the most important forms of mobility in urban areas. Cycling has many advantages over other modes of transport. It is completely independent of available energy sources, it is economically profitable, it does

not emit harmful gases, it is accessible to a larger number of citizens, it has a positive effect on the health of the population, it contributes to reducing traffic congestion, etc.

The relief of the Autonomous Province of Vojvodina (APV) region makes it very suitable for the development of cycling. Most of the cities in this area are working to improve cycling infrastructure and develop this mode of transport. The best example is Novi Sad, where cycling increased from 2.5% in 2009. [1] to 9% in 2017. [2]. The development of the bike-sharing system in Novi Sad also contributed to the increase in cycling. This system is also present in the Subotica area, while in other cities in APV no initiative has been taken to introduce a bike-sharing system.

This paper analysed the state of cycling in the Zrenjanin area. A survey was carried out among

Author's address: Milja Simeunović, University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Trg Dositeja Obradovića 6

e-mail: m.lekovic@uns.ac.rs

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cyclists regarding their needs, attitudes and opinions on the current state of cycling infrastructure and signalling. A proposal was formulated based on the data obtained, which outlined the measures to be implemented in order to create the conditions for the introduction of the bike-sharing system

2. BIKE-SHARING SYSTEM IN NOVI SAD – NS BIKE

One of the ways to increase the availability and use of bicycles in cities is to introduce a bike-sharing system. Bike sharing is a short-term rental of bicycles available at different locations in a given urban area. A bicycle is available for rental at no cost or at a nominal fee at one location and subsequently returned to another location where the next user can rent it. This is why it is very important to have a large number of docks in urban areas, especially in areas of high attraction. Docks are automated systems for storing bicycles, the functions of which depend on the technology used (Figure 1).



Figure 1 - Bicycle storage dock (source: [3])

With smart technologies, it is possible to map all the existing bike docks in a given area and monitor the data of the bikes hired in real time. Users can check the location of docks in the desired area, the availability of bikes at specific docks, and the possibility of booking a bike through specially created applications.

The development of bicycle traffic is recognised as an important measure for sustainable mobility in many European and world cities, including Serbia. As mentioned above, the area of AP Vojvodina has extremely favourable topographical characteristics, which are suitable for the development of bicycle traffic. In recent years, intensive efforts have been made to promote and strengthen cycling in this area. International routes of cycle paths are marked in the corridors of existing roads, in the corridors of embankments, through the unclassified road network, as well as through the network within settlements, which coincides with the Euro cycle routes [4].

So far, bike-sharing systems have been introduced in two cities in APV, Novi Sad (NS bike) and Subotica

(SU bike). Bike sharing systems have been operating in both cities since 2011. The operating principle is the same. Users have to register, after which they receive a chip card. The chip card is required to rent a bike. The bikes are rented at bike docks located at various points around the city. All bike docks are equipped with video surveillance and a locking system. There are 16 docks in Novi Sad and 5 in Subotica. Bikes can be rented 24 hours a day in Novi Sad, while in Subotica they can only be rented between 7 a.m. and 10 p.m.

The results of a survey conducted in Novi Sad show that there is a lot of room for improvement in this system [5]. The aim of introducing a bike-sharing system is to attract as many users as possible who will use the service every day. However, a very small percentage of users of the bike sharing system in Novi Sad use a bike every day (5.9%), while the largest number of respondents use a bike 4 to 5 times a week (62.7%).

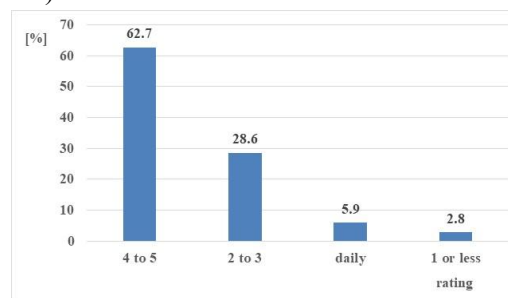


Figure 2 - Frequency of cycling

Figure 2 shows the frequency of use of bicycles in the NS bike system in Novi Sad. The latest research indicates that bicycles account for 9.9% of the modal share in Novi Sad [10]. However, there is a lack of data regarding the share of users of the NS Bike System. However, an analysis of the system operation data for 2023 reveals that during the season that lasted from April to November, a total of 16,679 rentals were recorded, with the highest number of uses occurring during the month of June (2,895).

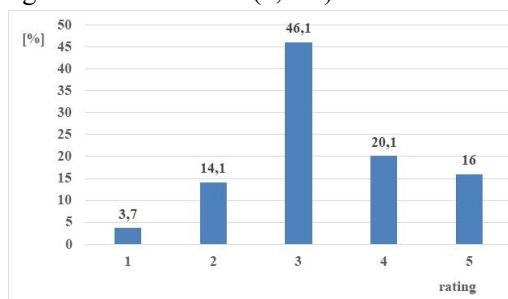


Figure 3 - Rating „NS bike“ system

Respondents were asked to rate the existing NS bike system on a scale of 1 to 5. The largest number of respondents gave the system a rating of 3 (46.1%), while the fewest respondents gave the system a rating of 1. If we look at the total number of users who gave

the system a rating of up to 3, we can see that even 63.9% are not satisfied with the existing system. Figure 3 shows the percentage of users who gave the NS bike system a rating of 1, 2, 3, 4 or 5.

The surveyed users also mentioned the negative aspects of the NS bike system and many of them made recommendations for improving the system. The main drawbacks identified by the users are the small number of bicycle parking spaces (33.1%) and the lack of bicycle paths in certain parts of the city (29.6 %). They also point to the insufficient number of bicycles in the system as a major drawback (25.3 %). In addition to these shortcomings, users believe that the operating season of the NS bike system should be extended. Younger users suggest the introduction of electric bicycles and electric scooters. Taking into account all the shortcomings mentioned by the respondents, it can be concluded that a lot of work needs to be done in terms of developing the bicycle infrastructure, purchasing new bicycles, introducing new bike docks, promoting the bike-sharing system, etc.

All of the above implies that it is very important, before introducing a bike sharing system in an area, to analyse the existing bicycle traffic and to examine the satisfaction of the users with this mode of transport. It is expected that the bike-sharing system will be much more effective if it is known in advance what users' expectations are and what are the general shortcomings of cycling in an area that need to be improved.

4. CYCLING IN ZRENJANIN

The Municipality of Zrenjanin is located in Banat, in the APV. According to the last census from the year 2022, there are 105,722 inhabitants living in the wider urban area, and 67,129 inhabitants in the town of Zrenjanin itself. In terms of the area of the territory administratively belonging to it (1326 km²), it is the largest city in the Autonomous Province of Vojvodina, with 23 villages in the wider territory of the City of Zrenjanin [6].

The degree of motorisation in Zrenjanin has reached one car per family. Furthermore, it is assumed that the passenger mobility is three trips per day, of which 30% are on foot or by bicycle, 30% by public transport and 40% by passenger car [7].

Due to its distinctly flat relief, it is very suitable for the development of cycling. In Zrenjanin and its surroundings, there are about 35 kilometres of cycling paths. In the previous period, 6,661 metres of cycling paths were built in the direction of Novi Sad, Kikinda, Ečka and Klek. In the next period, it is planned to continue the construction of cycling paths in the area of Zrenjanin [7]. The EuroVelo 11 route, which stretches from Norway across Europe to Greece, with

a length of about 6,000 km, is important for the area of Zrenjanin [8]. Apart from this route, the Zrenjanin - Temisoara route is another important international cycling route that passes through Zrenjanin. The construction of the cycle path from Zrenjanin to Temisoara is part of the cross-border project "Revitalisation of the Navigation Structure of the Begej Canal". In Serbia, the cycle path has been built from the village of Klek to the border with Romania [9]. For this reason, work is rapidly being done to connect the cycle network on these routes.

With regard to existing cycling infrastructure, the lack of maintenance results in many damaged paths, lack of bicycle parking, restricted access to the entrances of certain facilities, etc. Cycling infrastructure is still seen as an afterthought, with the result that even newly built sections are insufficiently adapted to real needs. As a result, some parts of the cycle network have high kerbs, illogical starts and ends, and unsafe sections, all of which discourage cyclists from using the dedicated infrastructure. For this reason, it is very important to study users' opinions about the existing cycling infrastructure and their willingness to use this mode of transport for their daily needs. In the case of small towns, the absence of data often necessitates the use of subjective research methods to define problems. This is also one of the SUMP (Sustainable Urban Mobility Plans) elements related to stakeholder involvement. The road network on the territory of Zrenjanin has a total of 380 km, and the city has almost 35 km of independent bicycle paths - 22.5 km in the city itself and 11.5 km to the surrounding populated areas. Figure 4 shows the existing cycling network, from which the paths towards the settlements of Aradac, Klek and Ečka can be seen.

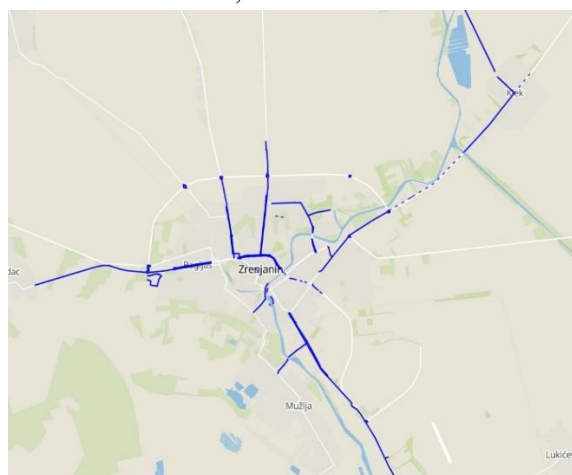


Figure 4 - Existing cycling network in Zrenjanin

5. RESEARCH METHODOLOGY

The survey of respondents was conducted online via a Google in June 2022. There were a total of 154

responses. The survey consisted of 16 questions and included the residents of Zrenjanin and the surrounding villages. The introductory questions were about age, gender and place of residence. The employment status of the respondents was recorded as well as the possession of a driving licence. The next set of questions related to the use of bicycles in terms of frequency, purpose, average distance travelled and how the bicycle was used on the road. Respondents were then asked to rate the condition of the current cycle paths in Zrenjanin, the connectivity of the cycle network, and the condition of cycle signals. The last three questions gave the respondents the opportunity to choose three priority answers out of several or to write down their specific observations regarding the advantages of using bicycles, the difficulties of using bicycles in the city and what would contribute to a more massive use of bicycles in Zrenjanin. When planning the implementation of a bike-sharing system, it's essential to thoroughly evaluate the existing demand for cycling and consider the needs of the population who will be the primary users of this transportation option. Some results of the survey are presented in the continuation of the paper.

5.1. Research results

Of the total number of respondents, the majority of users are women (56.5%), while 43.5% of respondents are men. The age structure of the respondents is shown in Figure 5.

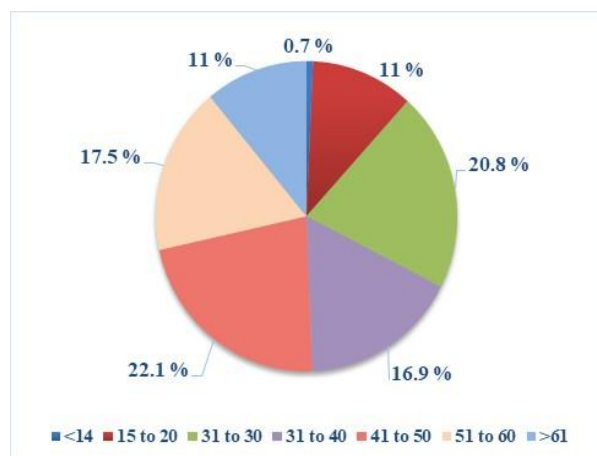


Figure 5 - Age of bike users

Of the 154 respondents, 90 live in the town of Zrenjanin and the remaining 64 respondents come from the surrounding villages. One of the most important nearby places for cycling is Aradac, which is about 4 km from Zrenjanin, so it is not surprising that most of the respondents came from the villages around this place (70.3%). From Aradac to Zrenjanin, a two-way cycle path has recently been built, which is lighted and protected by railings, with benches for resting along the way. This is one of the reasons why

many people use bicycles to go to town. Of the total number of respondents, 62.3% are employed and 65.6% have a driving licence and a car.

The highest number of respondents use their bicycle every day (53.9%), while 28.6% of respondents use their bicycle a few days a week. A certain percentage of users only cycle when there is no other means of transport available (12.3%) and occasionally, i.e. monthly, 5.2% of respondents use their bicycle.

The distances covered by cyclists are most frequently between 1 and 3 km (31.2%) and between 3 and 5 km (27.9%). At the same time, a high percentage of respondents cycle exclusively on the road (34.4%), while 40.9% of respondents are forced to combine different ways of cycling. A smaller number of respondents cycle only on existing cycle paths (18.8%), while the smallest number of respondents cycle on sidewalks (5.8%) because they do not feel safe on the road (Figure 6).

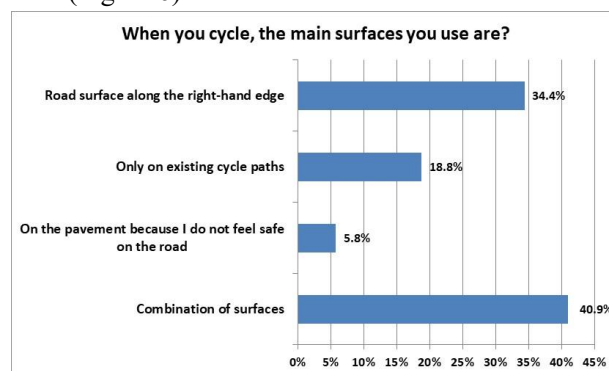


Figure 6 - Choice of surface for cycling movement

In the survey, the respondents had the opportunity to express their opinion on the quality of the existing cycling paths, connectivity of the cycling network, and the state of the existing cycling signaling (Figure 7).

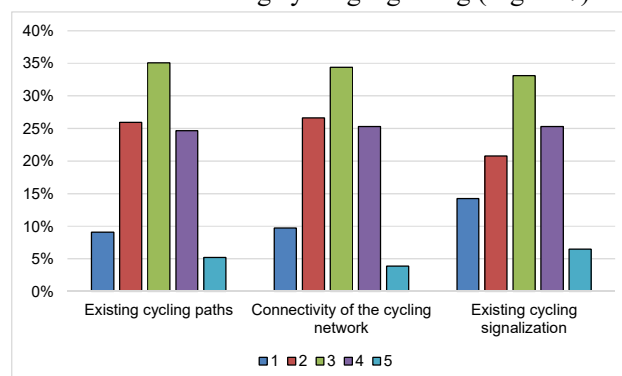


Figure 7 - Assessment by the surveyed respondents

Over 30% of the respondents expressed their satisfaction with the existing cycle paths, network connections and signage with a score of 3. However, it is worrying that over 30% of the respondents rated the same parameters with a score of 1 or 2. The results obtained show that only about a third of the

respondents are satisfied with the current state of the cycle network and the existing signage.

In the rest of the survey, the above-mentioned shortcomings were also highlighted in the responses. For example, when asked about the most common difficulties encountered by cyclists, 24% of respondents mentioned the lack of cycle paths and lanes as a problem. When asked what could contribute to a more massive use of bicycles in Zrenjanin, the majority of respondents again emphasised the network of bicycle lanes. 28.5% think that the construction of cycle paths has contributed to an increase in the use of the bicycle as a means of transport.

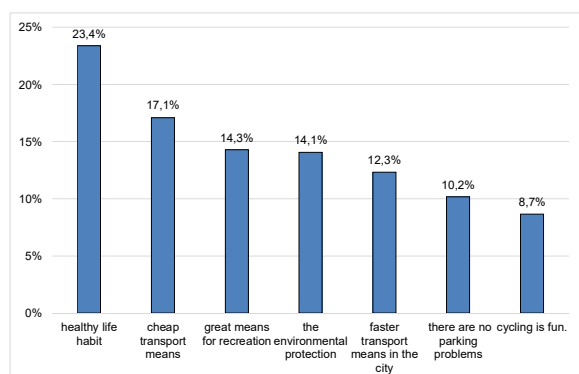


Figure 8 - The advantages of the bicycle using

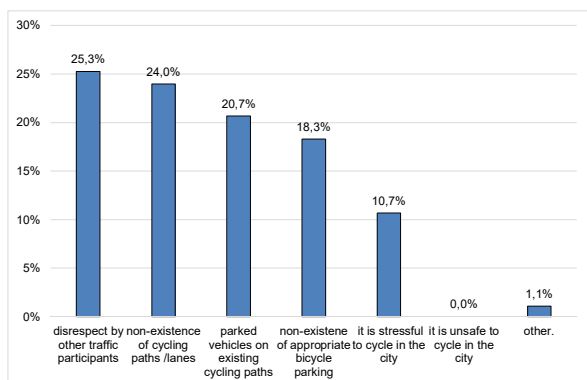


Figure 9 - The main difficulties for cycling in Zrenjanin

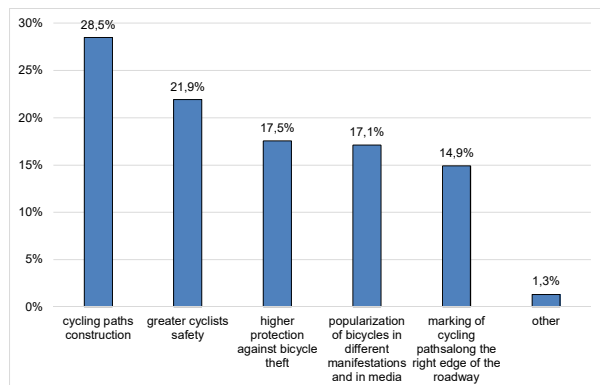


Figure 10 - Factors influencing the mass use of bicycles in Zrenjanin

Below are all the answers to the questions related to what are the advantages of the bicycle as a means of transport (Figure 8), what are the biggest difficulties for cycling in Zrenjanin (Figure 9) and what measures would influence the increase in the use of bicycles (Figure 10).

6. DISCUSSION AND CONCLUSION

In the strategic planning of the introduction of the bike-sharing system, it is necessary to properly assess the current state of the demand for cycling and to take into account the needs of the population, who are the main users of this mode of transport. In addition, the condition of cycling infrastructure in the Zrenjanin area plays an important role in the development and improvement of this mode of transport.

The analysis of the available data shows that the development of cycling in the Zrenjanin area has great potential. It has already been mentioned that important European cycling corridors pass through this area, the most important of which is the EuroVelo11 cycle route. Interconnection of the existing bicycle network with the European corridors and construction and reconstruction of bicycle infrastructure in the settlement itself will improve the existing conditions for bicycle traffic.

As the results of the survey show, there are many shortcomings in the existing cycling infrastructure in the Zrenjanin area. Many cyclists are forced to use only the road surface for their journeys, they are dissatisfied with the interconnection of cycle paths, the existing signage, etc. These are exactly the measures that they believe would increase the use of bicycles. A positive aspect of cycling in Zrenjanin is that 23.4% of users choose to cycle because of a healthy lifestyle and 14.1% because of environmental protection. However, these data show that there is still a lot of room to attract more users to the system. There has been a particularly significant to increase the number of users whose main purpose of travel is to work/school, which is 22.7%. One of the most important data from the survey is the frequency of cycling during the week, which shows that 82.5% of respondents have a high level of cycling during the week.

In general, there is considerable potential for the introduction of a bike-sharing system in the Zrenjanin area. The frequency of bicycle use supports this thesis, as the bike sharing system is primarily intended for users who frequently use bicycles as a means of transport. It is also significant that the participation of respondents who use bicycles for a healthy lifestyle and environmental protection is very high. One of the main reasons for cycling is to reduce pollution and protect the environment. Of course, in addition to these

users, it is necessary to increase the number of everyday cyclists whose main purpose of travel is to work/school. The results of the research on the structure of bicycle users support the thesis that it is necessary to consider the introduction of a bike-sharing system in the Zrenjanin area. The rental stations should first be introduced in the more attractive areas connected by cycle paths. During the research, it was found that there is a high frequency of bicycle traffic between Zrenjanin and the nearby settlement of Aradac. These two places are also connected by bicycle infrastructure, so Aradac would be included in the bike sharing system from the start. Before introducing the bike sharing system, it is necessary to carry out additional analyses and improve the state of the existing infrastructure in order to achieve the best possible effect of its application. The introduction of a bike-sharing system would certainly contribute to the popularisation of this mode of transport in the Zrenjanin area. A well-organised bike-sharing system is an example of good practice that has been implemented in many cities around the world. A well-designed and well-placed concept of these systems facilitates their use by users from the start to the end of their journey. However, in order for this system to realise its full potential, it is first necessary to build adequate cycling infrastructure and address the shortcomings highlighted in the respondents' responses.

7. ACKNOWLEDGEMENT

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REZIME

ANALIZA POSTOJEĆEG STANJA I MOGUĆNOSTI UVOĐENJA „BIKE-SHARING“ SISTEMA U GRADOVIMA VOJVODINE

U mnogim gradovima, sve više se popularizuje i promoviše „bike-sharing“ sistem. Uvođenje ovog sistema je jedan od načina povećanja i dostupnosti upotrebe bicikala. U okviru ovog rada, dat je pregled postojećih „bike-sharing“ sistema na području Vojvodine. Takođe je analizirana mogućnost uvođenja ovog sistema na području Zrenjanina. Rezultati ankete koja je sprovedena na području Zrenjanina, pokazuju da postoji veliki potencijal za uvođenje „bike-sharing“ sistema na ovom području, ali da pre toga postoji mnogo nedostataka koje prethodno treba otkloniti.

Ključne reči: biciklizam, „bike-sharing“, infrastruktura, anketa

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