

CETRA²⁰¹⁴

3rd International Conference on Road and Rail Infrastructure
28–30 April 2014, Split, Croatia

Road and Rail Infrastructure III

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BICYCLE TRAFFIC IN THE CITY OF OSIJEK

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Abstract

The city of Osijek is the fourth largest city in Croatia, with an area of about 171 km² and more than 107 000 inhabitants. It is located along the right bank of the Drava River whose flow defined the shape and development of the city. Namely, Osijek is positioned longitudinally along the Drava River and got a characteristic elongated shape which also defined development of the city traffic. Consequently, most of the city's main traffic routes are positioned longitudinally, along the larger residential areas and the transversal connections are intermittent by town squares and public rail route that runs through the city. In addition to public transport, city of Osijek has developed bicycle transportation. Since City of Osijek is situated in east-Croatian lowland, it has very favourable natural predisposition for the development of this form of transportation. Systematic thinking about bicycle traffic and infrastructure started in middle 1990s and few years later, first bicycle traffic counting was conducted. These days, with more than 30 km of bicycle paths and being part of international bicycle routes, Osijek is turning into a city of bicycles. Movement towards promotion of biking as fun and healthy alternative way of travel comes from different associations in Osijek. City government has also recognized the value of bike paths, which can be seen in continuous construction of new paths in different parts of Osijek and instalment of bicycle sharing system. In this paper main characteristics of bicycle paths network in the city of Osijek will be shown. Level of built of urban spaces presents a problem when planning new bike paths, therefore characteristics of bike paths vary depending on location. Special emphasis will be put on critical points of bicycle path network and comparison of bicycle paths with their presentation in Croatian legislation will be given.

Keywords: bicycle traffic, historic overview, infrastructure characteristics, legislation, city of Osijek

1 Introduction

Increase in number of personal cars causes a number of negative consequences. In addition to causing traffic jams and increasing the time of travel, high levels of motorizations reduce the quality of life through noise pollution, emission of toxic gases and deterioration of climate conditions. So, many governments resorted to promoting alternative modes of transportation and developed programs that aim to reduce the share of passenger cars in everyday travel. Studies have shown that increasing the use of bicycles as an alternative means of transport, on top of public transport and walking, may significantly reduce traffic congestions as well as noise pollution and toxic gases [1, 2]. For a shorter trip distances, bicycles can compete with public transport [3]. Also, it has been shown that besides being environmentally friendly, riding bicycles has a positive impact on the health of the individual. Cycling is an active mode of transportation and thus is a form of exercise, which means it has a positive effect on reducing heart diseases, high blood pressure and many other effects of passive lifestyle. Researches show that reasons for increase in bicycle usage can be found in the desire for a lifestyle change, increased awareness of bicycle importance, city administration that invests in

infrastructure and promotion of bicycles [3,4], better integration with public transit and higher number of bicycle parking lots [2]. The increase of cycling entails the issue of cyclists' safety in mixed traffic. Research has shown that actions aimed at promoting cycling and walking have a positive outcome on improving the safety of cyclists and pedestrians because of bigger number of cyclists and higher awareness for their safety [5]. After human error, deficiencies in infrastructure causes a large number of accidents [6]. Therefore, a comprehensive approach, consisting of adequate infrastructure, programs to promote cycling, limitation of car usage and appropriate urban planning is needed [7]. In order to detect and eliminate safety issues, review and design of infrastructure should be conducted through method called Context Sensitive Design, which aims to merge the function of traffic with its location [6].

In the last few years there is a substantial increase in bicycle traffic in city of Osijek. In addition to the recession and higher fuel prices, better interconnection and expansion of the bicycle paths network caused higher share of bicycles in everyday travel. Quality infrastructure is the basis for safe bicycle traffic, but the construction of the infrastructure is time consuming process which has difficulty in following an increase in bicycle traffic. In this paper, infrastructure characteristics encompassing all cycling traffic in the city of Osijek is revised and compared with existing legislation.

2 Croatian legislation on bicycle traffic

Planning, design, traffic and safety on bicycle paths should be defined and regulated by laws and regulations to ease the design and construction, to have it well and uniformly done and to ensure a comfortable and safe traffic for the end users. In Croatia, several laws and regulations mention bike paths and bike traffic, but very sporadically without giving clear guidelines. Both Roads Act [8] and the Law on Road Traffic Safety [9] define the bike paths and bike lanes. "Bike lane is part of the roadway intended for bicycle traffic, which stretches along the pavement and which is characterized by a longitudinal line on the pavement and the prescribed traffic signs." "Bicycle path is defined as traffic built area designed for bicycle traffic, which is separated from the roadway and marked with prescribed traffic signs." Regulation on basic conditions which public roads out of settlements and their elements must satisfy from the point of traffic safety [10] arising from the Law on Road Traffic Safety, stipulates the width of one lane to 100 cm and defines the traffic cross-section and clearance zone for bike paths as presented in Fig. 1. The same regulation allows the construction of bike paths along the driving lanes only if it is separated by curbs and 75cm wide road verge from those lanes.

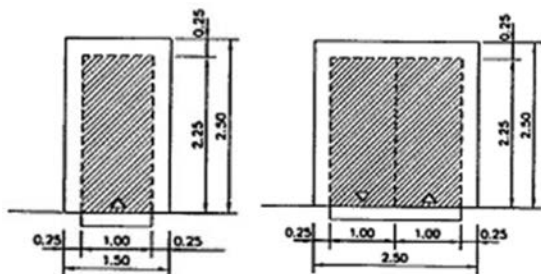


Figure 1 Clear zone and traffic cross-section for bike paths [10]

Roads Act also calls for creation of rules and regulations for the design, construction, maintenance, as well as traffic on bicycle paths but the detailed design characteristics of bicycle paths is left to the local government.

According to Urban master plan for the city of Osijek (GUP) [11], building of bike paths and parking lots is recommended, depending on urban conditions but it is not required. Also, width

for two-way bicycle traffic path of 160 cm and placing it immediately next to the pedestrian walkway is allowed, which is in contradiction with what is shown in figure 1.

When it comes to traffic safety [9, 12] only some of the rules and obligations are determined, such as rule to ride a bike on the right side of the paths or lanes, bike priority rights when in contact with a car cutting across bike lane, obligations to wear reflective clothing and use lights as well as necessary types of traffic signalizations.

A review of existing Croatian regulations shows that such regulation is either insufficient or non-existing in many infrastructure and traffic safety issues. Area of planning and infrastructure design lacks quality guidelines that would define all horizontal and vertical elements that depend on the amount of traffic and bike movement physics, position in space and interaction with other traffic participants. It also lacks guidelines on the way bicycle path are led through intersections, priority rules and rules of behaviour, speed limits, bicycle equipment and drivers' capabilities, all of which have a major impact on the safety, not only for cyclists but overall traffic.

Resulting from the increased bicycle traffic in the city of Osijek and in Croatia generally, there is a need for adequate policies which would consolidate and regulate all issues related to cycling infrastructure and traffic. City of Osijek is not the only example, infrastructure insufficiencies due to poor regulations and urban master plan can be seen in Zagreb as well [13]. Example of good legislation and its implementation in practice is found in Slovenia. Regard to the rich common history, similar mentality and civil engineering practice, this example could serve as a basis for the development of the Croatian legislation in the form of establishment of regulations and standards for the design and construction of these traffic areas.

Slovenian legislation on bicycle paths [14] holds as its main task to reduce the number of conflict points between cyclists and motor vehicles and thus increase safety and drivability. They require that the design takes into account the physical capabilities of bicycles, the number of vehicles per hour and the speed. As basic requirements for rider-friendly infrastructure singled out are: safe and comfortable traffic areas, extensive bicycle network, large number of direct links, attractive solutions and design of environment. Minimum widths for one-way traffic of 1,00 m, 2,00 m for two-way traffic and at least 2,30 m for bike paths used for recreational purposes are defined. Additional 25 cm are added on either side to get the clear zone of bike paths. Road verge should be from 0,5 to 0,75 m wide. Horizontal curve radii are also defined and should be at least 5 m (12 km/h), 8 m (16 km/h) or 10 m (20 km/h) depending on the potential bike speed. Longitudinal slopes should be 3% or less, though, they could go up to 10% but only on limited lengths. All curbs must be levelled to the ground, and manhole covers should be perpendicular to the driving direction.

3 History of cycling traffic in the city of Osijek

Situated in lowland along the river bank, with characteristic elongated shape, city of Osijek has very favourable natural predisposition for the development of cycling traffic. The beginning of cycling in Osijek dates back to the 19th century. Shortly after the first appearance of the bicycle in Croatia, the first cycling association "Concordia" has been established in Osijek [15]. It was involved in the advocacy of cycling, driver education and organization of competitions and other amusements. In 1895, first traffic timetable for bicycles in Croatia was created and drivers were obliged to take driving test, have license and register their bicycles [16]. After the First World War new cycling clubs were created and in 1927 the idea of building the first infrastructure reserved for bicycles was initiated [17]. After obtaining the land from the city, a racetrack for bikes has been built. It had elliptical shape with 400 m long trail. Later it was converted into a racecourse that could be used for motorcycle racing and a field for football matches. From the 1945 onwards bicycles become means of mass transportation. Today, there are few civic organizations promoting cycling as fun, cool and healthy way of commuting. Their work is oriented towards development of cycling traffic and safety through

organizations of many events such as cycling tours and fairs, and most importantly through educations of commuters on traffic rules and behaviour in traffic. In addition to civic organizations, city administration is also promoting cycling through continuous construction of new trails and introduction of city bikes modelled on European cities. In June 2012, the project City Bike was launched and six city bikes were placed in two town squares for public use. A plan is to increase this number in a foreseeable future.

4 Cycling infrastructure in the city of Osijek

Osijek has once proudly wore the name of the greenest cities in Croatia, today it can be proud on one of the largest mileage of bike trails. Building started in 1990s with only few paths and it grew to more than 40 km of trails in the city today. On top of that there is a large number of paths to the suburbs and many are in the phase of planning and construction which creates a foundation for the use of bicycles for commuting, but also for leisure activities. Infrastructure varies greatly depending on the time of construction and spatial conditions. In accordance with the longitudinal development of the city, bike trails stretch mostly in east-west direction and are connected by a shorter cross-connecting paths (Fig.2).

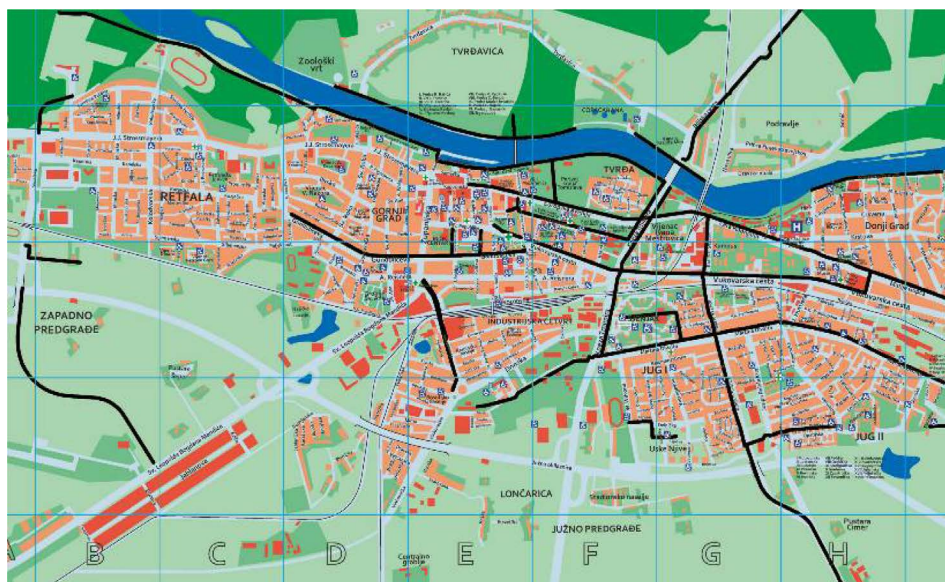


Figure 2 Map of bike paths in the city of Osijek [18]

Review of current condition of cycling infrastructure was conducted by utilizing the vehicle they were built for, a bicycle. Measuring and photographing was done in order to compare existing bike paths with effective legislation and to record discrepancy and shortcomings as well as possible safety issues.

The prevailing type of bicycle infrastructure in the city of Osijek are off road bike paths. Cycling tracks as a part of mixed traffic roads are not a solution that city officials opted for. That concurs with findings [19] that bike paths are generally perceived as safer and preferable than integration with motorized vehicles. In the streets with bike paths there is generally a road verge that divides lanes for motorized vehicles from pavement for bicycles and pedestrians. However, construction details of bike paths and sidewalks differs notably.

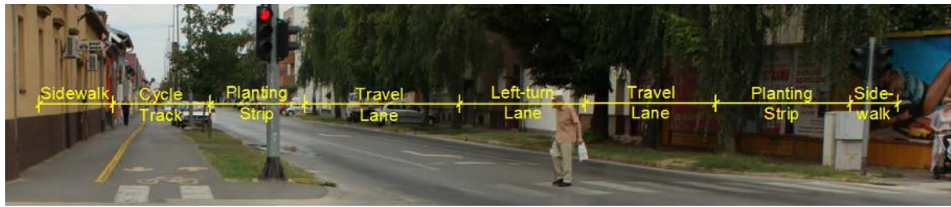


Figure 3 Typical cross section of street with bike paths

Dominant paving material on Osijek's cycling infrastructure is asphalt which, in terms of comfort is best solution for bicycle traffic. But, there are also some paths paved by concrete pavers which, on the other hand presents aesthetically preferable solution.

Distinction between bike and pedestrian paths is done in three manners. First is delevelling and instalment of shallow curbs between two paths which was one of the initial solutions, constructed mostly in early 2000s. Outlining a yellow line is a second solution for bike and pedestrian common surfaces done recently because of spatial conditions. Some bike paths built in outer zones of the city towards the end of 2000s have concrete pavers in different colour than those of sidewalks, with yellow pavers in between. All this solutions are presented in Fig. 4.



Figure 4 Different ways of bicycle and pedestrian paths separation

Separated bike paths are rare, but those are some of the first paths constructed. They were built in the 1990s in locations where level of development was lower so there was more available space for separated bike paths.

Bike paths are mainly built on only one side of the street, thus needing to accommodate two-way cyclist traffic. They have an average width of 2 m. Running on the both side of the street, allows the bicycle paths to be narrower since in that case, they are intended for one-way traffic. However, there are some examples of insufficient path widths, with widths less than 0,8 m. In such cases, safety of bicycles as well as pedestrians is being endangered. This solutions occurs on a very busy streets and were created in the last 2-3 years because construction of bicycle paths was needed in a matter of maintaining bicycle traffic network, but any other intervention would require a lot of resources.

In intersections, bike paths are marked by red lines and there are examples of joined traffic lights for both, cyclists and pedestrians. Even though on most of the intersections bicycle paths markings are clear, the problem are discontinuities at the intersections presented in high curbs. There are some examples where high curbs are not replaced by laid curbs during adaptation of existing pedestrian paths in mixed traffic paths (usually using only yellow marking). This disrupts the drive, but more importantly it is a potential for accidents and wheels damaging. The lack of legislation is particularly seen on roundabouts where only one roundabout of total seven constructed in the city of Osijek has appropriate bicycle traffic regulation.



Figure 5 Bicycle paths design and construction irregularities in the city of Osijek

Some of the downfalls of cycling infrastructure in the city of Osijek is lack of parking facilities and even more so intrusion of different obstacles in obligatory clear zone. Bicycle parking lots are placed in front of various institutions and schools, but highly functional and safe parking lots should be placed on more public places that have high frequency of people. When obstacles are concerned a multitude of lighting poles, traffic signs, fire hydrants and trees can be seen in clear zone of bike paths. On top of that, drivers tend to park their cars, motorcycles and even lorries on bike paths.



Figure 6 Bicycle traffic difficulties in the city of Osijek

5 Conclusion

Osijek is a city that has great predispositions for a vast network of bike paths. In Osijek but also throughout Croatia it is noticeable an increase in awareness towards benefits of cycling as a healthy and practical mode of transportation. At the time of writing this article, in Croatia relevant guidelines for the design of bicycle paths did not exist, but the need for them is recognized and the Ministry of Maritime Affairs, Transport and Infrastructure is preparing Rules for the design and construction of bicycle paths. Result of this current lack of adequate regulations are various solutions for bicycle traffic on the example of City of Osijek. Therefore, it is necessary to obtain the regulations, but also to educate designers as well as all road users in order to create an environment for comfortable and above all safe traffic for all parties.

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