



SYSTEMATIC ARRANGEMENT OF INTERSECTIONS ON THE PRIMARY ROAD NETWORK IN BANJA LUKA

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Abstract

The City of Banja Luka experienced construction of eleven roundabout intersections of different type and functional level in the recent period. Previously adopted planning documents and conclusions of the City's Expert Team provided a stronghold for these activities, while positive experiences influenced the commitment to continue with similar activities in the future. In order to answer this question in a quality way, it is necessary to lay down strategic foundations for the systemic arrangement of intersections on the primary network of the City. The paper presents initial research regarding the definition of potential locations for the application of this type of intersections in the Banja Luka urban area as a basis for a strategic development document, i.e. an urban plan.

Keywords: urban road network, intersections, roundabout, strategy, location

1 Introduction

The role of urban traffic is to integrate city amenities, direct and synchronize activities and set the pace of urban life. In addition, urban roads limit the space for the development of physical structures so that traffic is an inevitable factor in the spatial organization of the city. Therefore, the city and its traffic present unique planning and design complex with the same temporal and spatial dimensions [1].

Urban transport network needs to justify its functionality by the rapid and reliable transportation of people and goods within the impact zone. For this, urban street network must be divided into primary and secondary networks that provide traffic connectivity and support urban content, respectively. Primary routes, due to their role of connecting remote contents and driving-dynamic requirements, should occupy a position that will lean to boundaries of consolidated urban entities. In order to ensure the functioning of the network and connect different levels of urban roads, intersections are formed at nodal points. Their distance and access control aim at maintaining certain level of service for particular urban road, as well as for the urban road network as a whole.

In the past period, eleven roundabouts of different types and functional levels have been built in Banja Luka. This number does not include three roundabouts built as temporary solutions from assembly/dismantling elements at slightly less busy, but still problematic intersections from the safety point of view. The justification for these activities was found in the previously adopted planning documents (regulation plans), and partly in the conclusions adopted by the City's Team for Defining and Designing New Roundabouts at Urban Roads.

Thus, the action was guided by the goal to increase the degree of safety and to solve traffic flow problems at individual intersections, to the contrary of a conceived concept derived from serious traffic research in the City area. Still, given the positive effects of the implementation of such solutions, the City's commitment is to continue with similar activities in the future.

This paper, in the absence of an official and serious traffic study, and planning basis for organization and management of urban traffic, is an initial proposal for further analysis and consideration of strategic issues in the development of the Banja Luka urban road network and planning documents. The authors intend to present their thoughts regarding the arrangement of the Banja Luka urban road network, primarily in relation to recently performed activities that were not based on basic research on traffic flows, safety, accessibility and environmental impacts.

2 Banja Luka transport network

In the past two decades, Banja Luka has witnessed a significant expansion of individual motorized traffic, accompanied by a high degree of urbanization and negligible correction of the capacity and/or organization of traffic areas. At this point, it is no longer questionable whether the City's road network will collapse, but only when it will happen. Over the last few years, it has been noticeable that morning and afternoon peak loads are being extended to more and more streets, and that in some parts of the central City area peak loads have a practically continuous duration from early morning to early evening [2].

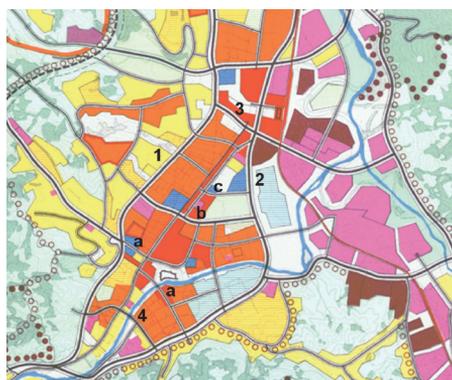


Figure 1 Primary urban roads within the 1975 Banja Luka Urban Plan [3]

Following the general principles of urban road network organization, the 1975 Banja Luka Urban Plan [3] (Figure 1) defined that West (1) and East (2) Transit roads are primary urban roads - City's magistral roads interconnected into a ring by streets Ivana Gorana Kovačića (3) in the North and Gavriła Principa (4) in the South. Beside the ring, transverse connections were planned at the perimeter of the inner City center, namely Bulevar Cara Dušana - Cara Lazara Street in the South (a) and Vuka Karadžića Street - Aleja Svetog Save in the North (b). The same consistency in development still exists, except that the role of Aleja Svetog Save is taken over by the new Olimpijskih pobjednika Street (c) with a part of Vidovdanska Street as a consequence of the new contents distribution in the area.

However, in the absence of the updated Urban Plan in these days, the only valid implementation planning documents that form the basis for spatial planning are regulation plans. Several documents of such type exist for the City area. Although the regulation plans need to define the conditions for equipping certain spatial units with traffic and municipal infrastructure, and accordingly define the function and rank of individual traffic (infrastructure) corridors, this is not the case in practice. All regulation plans are generally similar to one another, and the main focus is on the layout and design of structures (residential and administrative buildings), while at the same time missing to define the conditions for improvement and/or development of traffic infrastructure.

As a consequence, planners involved in the development of spatial planning documents for implementation (regulation plans) do not have a valid information base that clearly defines the overall concept and hierarchy of the City's transport network (urban plan and related traffic study). Even more, it is not clear when it will be available. Therefore, the primary task of the City is to define its strategic commitments in this regard and to make such commitments a firm planning basis.

By defining the concept of primary urban roads (in addition to improving the service and facilities for other modes of transport such as public transport, bicycle and pedestrian traffic), followed by creation of relevant planning documents, corridors, interconnections and connections will be clearly established, thus setting the scope of public areas required for the realization of the outlined concept (regulation line). In addition, such primary corridors will also define individual spatial blocks/scope for the development of regulation plans.

The following Figure 2 presents one vision/concept for the development and organization of the primary urban road network in the City of Banja Luka which was created based on previous experience and knowledge of past plans of higher order. The concept also defines the inner City center within which the movement of passenger cars would be restricted, with the priority given to public transport, pedestrian and bicycle traffic. The functioning of the concept is supported by the construction of capacity public parking garages on the perimeter of this zone (G1-G6), as well as by the proper positioning of roundabouts (R1-R24). The above mentioned, already built, roundabouts are: R1 and R4 at the West Transit, R7, R10 and R11 at the East Transit, and R13, R17, R18, R20, R23 and R24 as part of transversal primary links. The potential roundabouts at the most important locations will be analyzed in more detail below, individually.

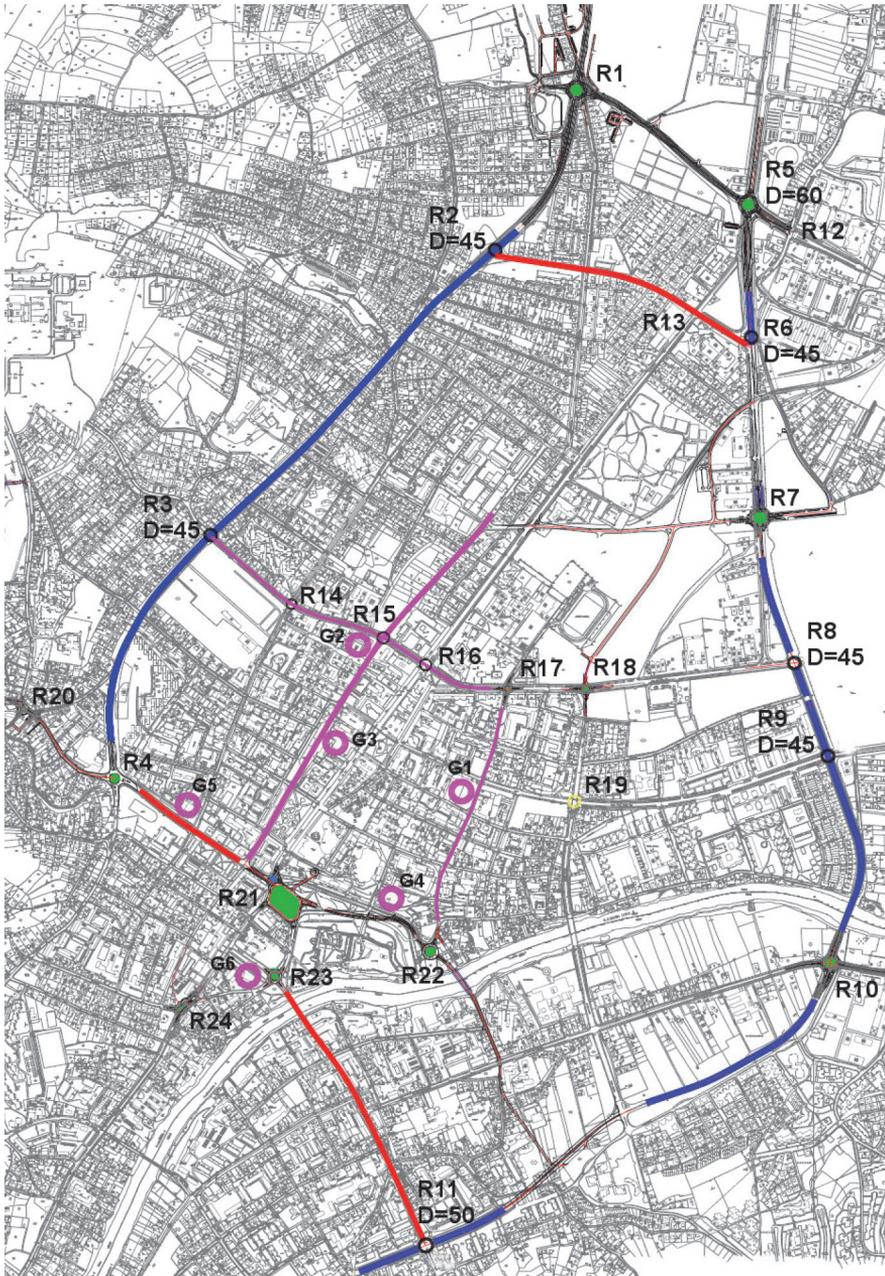


Figure 2 Concept of the primary urban road network and intersections [authors]

3 Roundabout locations for the primary network

The main urban magistral roads (MUMR) in the City of Banja Luka, as already mentioned, are the West and East Transit. The process of roundabouts construction on these MUMRs started in the previous period, showing individually good results, but also creating problems in some other sectors of these, as well as the surrounding streets. An important fact, which must be especially emphasized as an element of not so good practice, is that none of the solutions made was based on research of traffic loads, capacity of intersections and free sections, safety levels and environmental impacts. All designed and so far applied solutions are based on general conclusions about the level of traffic volume and possible ways of managing transit traffic.

In order to complete the solution and utterly resolve the congestion, the process along the West Transit must continue with the construction of two new roundabouts at the intersections with streets Trive Amelice (R2) and Vuka Karadžića/Ranka Šipke (R3) (Figure 3). The continuity of traffic flow would be achieved in this way, the causes of traffic jams at traffic lights would be eliminated and the level of service would be raised. In both cases, this is a 2:1:2:1 type of roundabout, however having only three branches at the intersection with Trive Amelice Street. The peculiarity of the intersection with the Vuka Karadžića/Ranka Šipke Street (R3) is that it is necessary to perform additional analyzes from the pedestrian movement point of view for the West/East direction, which in this case is intense, and to consider the need for the denivelation of pedestrian movements in the said direction.



Figure 3 Intersections at Trive Amelice (left) and Vuka Karadžića/Ranka Šipke streets (right) [authors]

One of the first locations and priorities in respect to solving problems at the East Transit is the intersection with Ivana Gorana Kovačića Street (R5 in Figure 2). The design for this intersection has been already prepared (Figure 4, left), so the implementation phase can start quickly after updating the existing documentation and resolving property-legal issues. In addition, jointly with these activities, it would be good to analyze the possibility of introducing another roundabout at the intersection of Braće Podgornika and Pilanska streets (R12 in Figure 2; Figure 4, right), given the fact that the stretch between the new roundabout (R5) and Braće Podgornika Street is rather short, and that, in addition to access for bus and train stations, and to business zone in Pilanska Street, the construction of a new business zone in the Livnica complex is planned in the near future.

What is important for this location is that in parallel with the creation of conditions for the realization of the R5 intersection, it is necessary to modernize Ivana Gorana Kovačića Street as a connection with the main intercity road M16 (West Transit) through two roundabouts. Its cross section requires redesign involving an additional lane for diversion into the local trade zone (Tropic) and pedestrian paths, which would significantly increase the level of service and safety on this traffic route.



Figure 4 Intersections of East Transit and Ivana Gorana Kovačića Street (left) and of Braće Podgornika and Pilanska streets (right) [authors]

The following location for the roundabout would be the intersection with Trive Amelice Street (R6) (Figure 5). In this case, one might consider that the junction of Frane Supila Street and the extension of Gundulićeva Street (x-x in Figure 5), due to existence of another roundabout at the intersection with the Olimpijskih pobjednika Street (R7), could be reconstructed on a right-right basis, which would significantly contribute to continuity of flow.

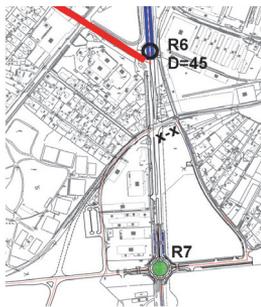


Figure 5 Intersection of Trive Amelice Street and East Transit [authors]

Further South, after the construction of the roundabout at Rebrovac (R10 in Figure 2), it became apparent that traffic lights at the intersections of East Transit with Aleja Svetog Save and Bulevar vojvode Živojina Mišića caused the peak hour crowds at the East Transit and these two streets (Figure 6). These are two typical examples of how independent solving of intersection can do more harm than good. Roundabouts should also be built at these two locations.

In this way, the entire East Transit route would be made passable with a high level of service, better access to the inner City center and better transit flows in the North-West - South-East direction. As this is a MUMR-ranked street with priority for motor traffic, there is a need for additional analysis of transverse pedestrian movements at both intersections. Underground pedestrian passage already exists at the University Campus (Aleja Svetog Save), but it is certainly necessary to inspect the condition of the underpass since it was never opened for use, and assess the possibility of reconstruction in order to obtain an eventually better crossing solution. An above ground pedestrian crossing would be one of the options at the intersection with Bulevar vojvode Živojina Mišića. Such structures can, in addition to their functionality, be very attractive in space.

According to the established approach, construction of roundabout was completed at the intersection of East Transit with Cara Lazara and Krfska streets (Figure 6). Since East Transit is MUMR and Cara Lazara Street is the magistral urban road, with two lanes in each direction, it was necessary to build the roundabout at the highest functional level for this location. However, end part of Krfska Street is a public transport terminal, and the major deficiency of the implemented solution is that the opportunity to establish a quality solution for locating and organizing the terminal was missed.

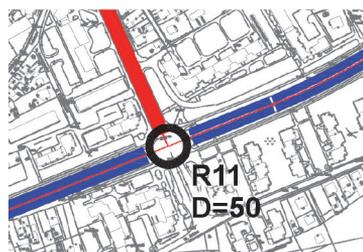


Figure 6 Intersection of East Transit with Cara Lazara and Krfska streets [authors]

In addition to systemic arrangement of roundabouts along West and East Transit roads, for good quality access to the inner City center, taking into account the consistency in solving intersections, it would be desirable to reconstruct the existing classic surface intersections along the Vuka Karadžića Street - Aleja Svetog Save stretch into roundabouts, at the locations of crossroads with Jovana Dučića, Vidovdanska and Kralja Petra I Karađorđevića streets (R14, R15 and R16 in Figure 2) in addition to the already existing roundabouts with Vase Pelagića and Gundulićeva streets (R17 and R18 in Figure 2). Considering that there is intensive pedestrian and bicycle traffic around the inner City center, and given the intensive construction of residential and administrative buildings in the area immediately adjacent to this zone, it is necessary to further consider and analyze pedestrian flows and options for cross-communication through street profiles.

Finally, an extremely significant location in the City of Banja Luka is the intersection of Kralja Petra I Karađorđevića Street and Bulevar Cara Dušana (R21 in Figure 2). Initially adopted concept [4], fully in line with and supporting the planned concept of street network development, was to build a square with a park at this location (Figure 7). The “square” intersection, with virtually roundabout traffic, would thus become an important point of acquisition and distribution of flows for various purposes through which other parts of the City (South and East) would be connected to the central zone. At the same time, the square would also represent an initial step towards the calming, i.e. destimulation of motorized traffic at the entrance to the inner City center.



Figure 7 Square (R21) at the intersection of Kralja Petra I Karađorđevića Street and Bulevar Cara Dušana [4]

4 Conclusion

A quality answer to the question of designing the urban road network and solving the main flows is obtained only through a specific strategic development document in which a significant segment would be traffic. The urban plan is therefore a basic document since it contains a traffic study that defines the strategic choices for the further development of the street network. Bearing in mind that the adoption process of the Banja Luka Urban Plan has no definite end, it is considered necessary to adopt a certain strategy for the benefit of further activities, and in that sense to adopt a certain document that would clearly define the relationship between the City and the interurban road network, as well as complete the concept of primary urban roads from the aspect of hierarchy and corridors. The possible systemic arrangement of intersections on the primary network, presented in this paper, represents the authors' contribution to the considerations regarding the arrangement of the urban road network in the absence of planning documentation and relevant traffic analysis. In this way, several goals would be achieved, of which the most important is the identification of a basic traffic matrix, which defines urban blocks and entities of different contents and purposes. Additionally, a balance could be established between the use of space, movement, traffic needs, traffic base, accessibility and therefore the value of urban land.

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