DOI: 10.7251/JTTTP2601047D
UDC: 656.1.08:621.039.58

REVIEW SCIENTIFIC PAPER

Improving Traffic Safety at Two-Lane Roundabouts Through Legal and Technical Regulatory Measures

Danislav Drašković
Full Professor, PhD, Faculty of Traffic and Transport Engineering, Pan-European University Apeiron, Banja Luka, Bosnia and Herzegovina, danislav.m.draskovic@apeiron-edu.eu; ORCID ID: 0000-0002-7809-377

Vuk Bogdanović
Full Professor, PhD, Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Republic of Serbia, vukbogdanovic1966@gmail.com

Zoran Injac
Assistant Professor, PhD, Faculty of Traffic and Transport Engineering, Pan-European University Apeiron, Banja Luka, Bosnia and Herzegovina, zoran.dj.injac@apeiron-edu.eu; ORCID ID: 0009-0005-4692-3307

Boris Mikanović
Senior Assistant, MSc, Faculty of Traffic and Transport Engineering, Pan-European University Apeiron, Banja Luka, Bosnia and Herzegovina, boris.r.mikanovic@apeiron-edu.eu

Recived: June 8, 2026
Revised: June 15, 2026
Accepted: June 26, 2026

Abstract: The title of the paper reflects the traffic-related issues associated with two-lane roundabouts, from the perspective of the level of service and traffic safety. Particular focus is placed on establishing traffic rules in two-lane roundabouts and eliminating ambiguities regarding the right of way of vehicles when exiting the circulatory roadway.The research results enable a higher level of quality in the training of new drivers, as well as in the work of police and judicial-prosecutorial authorities, which will contribute to improving traffic safety in roundabouts. In addition to proposing amendments and supplements to the legal framework, the research findings also provide guidelines for the technical regulation of traffic in two-lane roundabouts.

Keywords: Roundabout, Level of service, Traffic safety

INTRODUCTION

In order to resolve ambiguities regarding the rules of vehicle entry, circulation, and exit within two-lane roundabouts, it is necessary to clearly prescribe or amend the existing regulations and, crucially, to establish the technical elements of traffic control to eliminate current dilemmas [1], [5],[6], [10], [11].

Roundabouts are designed and constructed for two fundamental reasons:

- Traffic calming in urban areas / safety aspect,
- Improving the intersection level of service (LOS) / increasing vehicle throughput.

From a traffic safety perspective, single-lane roundabouts—featuring a single traffic lane both within the circulatory roadway and at the approaches and exits—are the safest configuration. Specifically, the number of potential conflict points at these intersections is equal to the number of approaches, which is minimal compared to all other types of at-grade intersections.

However, there is an increasing number of two-lane roundabouts where traffic flows are not governed or regulated by clear legal, and in most cases, technical standards. Consequently, these issues directly affect driving schools during candidate training, police officers managing traffic control, insurance companies during the claims liquidation process, as well as court experts and judiciaries in identifying the root causes of traffic accidents. Therefore, it is essential to clearly define traffic rules in two-lane/multi-lane roundabouts based on robust legal and technical regulations [8], [9].

METHODOLOGY

The research methodology is based on a comparative analysis of traffic flows within the orthogonal projection of a conventional four-leg (crossroad) intersection and its subsequent transformation into a two-lane roundabout. A specific aspect of analyzing vehicle flows focuses on achieving a strategic objective: increasing the intersection level of service (LOS) compared to its previous configuration—either a three-leg or a four-leg intersection. Given that several distinct descriptive analyses of this problem exist, a specialized approach is required to integrate them into a cohesive whole, followed by a discussion that will ultimately utilize the scientific method of synthesis to establish traffic regulation rules for two-lane roundabouts.

The strategically set objectives relate to the speed of the traffic flow in the inner lane, which must not approach a breakdown flow state (stop-and-go regime). Since the highest concentration of vehicles is located in this lane, facilitating its continuous discharge is directly aimed at improving the level of service. In the context of the previous orthogonal projection of the intersection, traffic within the inner circulatory lane corresponds to "through" and "left-turning" vehicle flows, whereas traffic in the outer circulatory lane corresponds to "right-turning" and "through" vehicle flows.

ROUNDABOUTS

The assumption of proper vehicle maneuvering within a two-lane roundabout is based on the principle that both lanes can be utilized for through-movements, whereas the right lane is strictly used for right turns, and the left lane for left turns or U-turns. In this regard, three categories of conflict exist within a roundabout: merging, diverging, and crossing. If the right traffic lane were restricted exclusively to right turns, the safety aspect would be satisfactory; however, the intersection level of service would be significantly reduced [2], [3], [4], [7].

Conventional roundabouts are categorized as shown in Table 1.

Table 1. Types of Conventional Roundabouts

Intersection Type	Outer Diameter (m)	Function/Objective
Mini roundabout	12-24	Traffic calming
Compact roundabouts	24-30	Traffic calming
Standard single-lane roundabouts	30-45	Increasing vehicle throughput
Standard two-lane roundabouts	45-55	Increasing vehicle throughput

The focus of our research is on the standard two-lane roundabout, with an outer diameter ranging from 45 to 55 meters. Unlike a single-lane roundabout, this configuration generates a conflict within the right/outer circulatory lane in the exit zone, specifically when a vehicle is exiting from the left/inner circulatory lane while another vehicle in the right/outer circulatory lane continues its permitted and ongoing circulating movement.

Increasing the number of traffic lanes within roundabouts reduces traffic safety, primarily due to the emergence of conflicts at the roundabout exit lanes.

TRAFFIC RULES WITHIN A ROUNDABOUT

Traffic rules within a roundabout are established by legal regulations, as well as by vertical (traffic signs) and horizontal (road markings) traffic control devices. The described regulations in Bosnia and Herzegovina, as well as in the region, are vague and very often conflict with the actual traffic control devices installed at the intersection.

Article 50, Paragraph 3 of the Law on Basics of Road Traffic Safety of Bosnia and Herzegovina (ZoOBSBiH) imperatively obliges the driver of a vehicle:

(3) Before entering an intersection, a driver shall position the vehicle at a sufficient distance within the traffic lane through which they must pass the intersection.

From the aforementioned paragraph, it follows that the central dividing line within the circulatory roadway cannot be broken, and that this provision rules out the possibility of changing lanes within the circulation zone (which is also partially emphasized in Figure 1 – Traffic rules for vehicles within a two-lane roundabout).

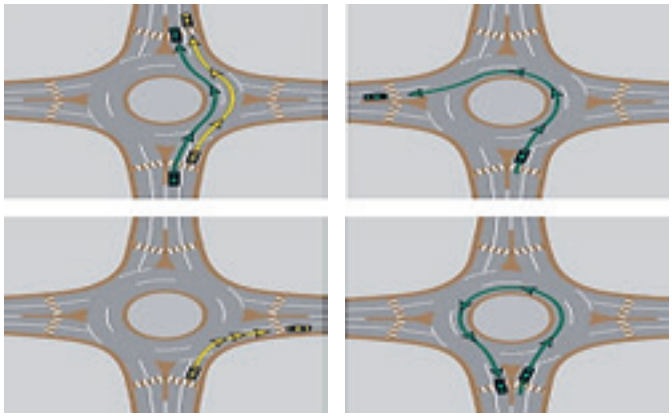
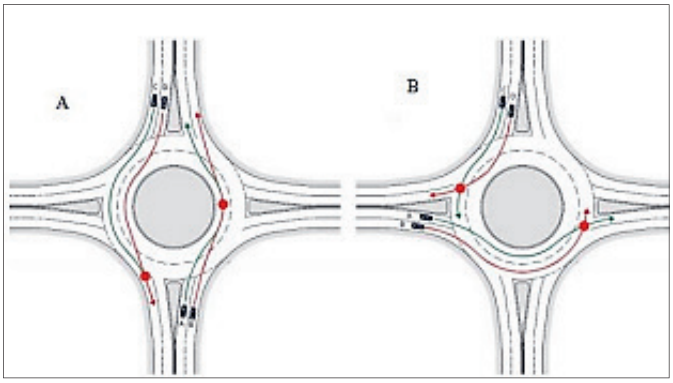


Figure 1. Traffic rules within a two-lane roundabout
Source: WSDOT2 , 2015

A specific safety issue arises when two vehicles simultaneously enter the roundabout from the same approach roadway (using both the left and right traffic lanes), as illustrated in detail in Figures 2A and 2B, and subsequently circulate within the circulation zone where the traffic lanes are divided by a broken longitudinal marking.



Figures 2. A and 2B. Conflicts caused by prohibited vehicle maneuvers within a roundabout

Source: Bastos Silva et al., 2014

In Figure 2A, the vehicle from the left approach lane properly enters the left/inner circulatory traffic lane and, intending to make a permitted exit at the second outlet, does so via the right exit lane, which is designated for traffic coming from the right/outer lane. In the second scenario on the same figure (Figure 2A), the vehicle from the right/outer lane performs a prohibited lane change into the left/inner traffic lane.

Figure 2B also illustrates two scenarios. In the first scenario, the vehicle from the left approach lane properly enters the left/inner traffic lane but makes a prohibited exit at the first outlet. In the second scenario, vehicles properly enter the circulatory roadway from the same approach, after which the vehicle in the right lane unlawfully continues its circulating movement past the second exit location. These specific conflict cases within the roundabout occur despite the proper initial entry of the vehicles from the same approach and direction into the circulatory roadway. However, once the described conflict situations arise, it becomes difficult to determine the previous direction of travel for both vehicles, which subsequently complicates proving the root cause of the traffic accident.

Article 50, Paragraph 4 of the ZoBSBiH clearly and unambiguously regulates the right-of-way priorities between vehicles entering the roundabout and vehicles that are already within the roundabout:

(4) When regulating traffic within a roundabout, traffic shall be regulated in such a manner that vehicles within the roundabout have the right-of-way.

The aforementioned provision eliminates any possible type of conflict between a vehicle from the left/inner traffic lane and a vehicle moving along the far-right traffic lane, provided that the latter vehicle had previously properly entered the roundabout (in compliance with the II-2 "Yield" sign), given that the conflict point between these vehicles is located within a very short distance traveled by the vehicle in the right/outer traffic lane (π/2 radians). In the event that these vehicles meet at the described conflict point within the right/outer traffic lane at the first exit—observed from the entry direction of the vehicle moving along the right/outer traffic lane—it can be characterized as a failure of the driver in the right/outer traffic lane to yield the right-of-way previously. This necessitates a specific method of traffic regulation.

Article 42, Paragraph 3 of the Law on Road Traffic Safety of Republika Srpska (ZoBSRS) additionally regulates the traffic of vehicles within a roundabout:

(3) A driver entering a multi-lane roundabout with a vehicle shall use the far-right lane to exit at the first and second outlets, unless otherwise regulated by a traffic sign.

Bearing in mind that a vehicle entering the roundabout from the right approach lane into the right/outer circulatory lane must exit the roundabout at the second outlet at the latest, it follows that a conflict with a vehicle from the left/inner lane can only occur at the first exit, at a distance of π/2 of the lane arc length. In the event that this vehicle continues its permitted circulating movement toward the second outlet and a conflict occurs with a vehicle from the left/inner lane during its exit phase from the roundabout, such a scenario can then be characterized as a failure of the driver in the right/outer traffic lane due to non-compliance with the obligation imposed by the II-2 regulatory sign at the intersection entry.

In order to enhance traffic safety within roundabouts, it is necessary to eliminate ambiguities through additional standardization, as well as legal and technical regulatory measures.

In practice, various and often conflicting expert opinions exist, such as:

1. According to the general traffic rules, specifically the right-hand rule, a vehicle from the left/inner lane changes its direction of travel and thereby "takes" the right-of-way from a vehicle in the right/outer circulatory lane that is not changing its direction of travel.
   This standpoint "mandates" stopping the traffic flow in the left/inner lane in order to "yield" the right-of-way to the vehicle in the right/outer circulatory lane, which subsequently:
   - Derogates the positions established by the designer when deciding on the construction of the roundabout, as it forces a halt on the permitted traffic flow in the left lane along its entire length, thereby degrading the intersection's level of service. The length of the inner traffic lane (2 π radians), with a radius of 10 meters, where the traffic flow is halted, amounts to:

$$L_{LT} = 2 \cdot 3.14 \cdot 10{,}00 = 62{,}8\ m \quad (1)$$

2. In addition to the obligations arising from the meaning of the II-2 traffic sign, a vehicle from the right/outer circulatory lane is obliged to yield the right-of-way for the exiting vehicle from the left/inner circulatory lane. This is intended to facilitate the intensive clearing of the inner lane and to increase the intersection's level of service, which will result in a significantly smaller impact in terms of occupying the surface of the right/outer lane along a roadway length of (π /2 radians), namely:

$$L_{DT} = 3.14/2 \cdot 12{,}50 = 19{,}62\ m \quad (2)$$

Bearing in mind the ratio between the calculated and saturated traffic lane lengths, it explicitly follows that it is more expedient to halt traffic in the right/outer lane and allow the left/inner lane to clear along its entire length.

CONCLUDING REMARKS

In order to eliminate the thoroughly described ambiguities, it is considered expedient to standardize and amend Article 42 of the ZoBSBiH by adding Paragraph (4).

Article 42, Paragraph (4) of the Law on Road Traffic Safety of Republika Srpska (ZoBSRS) additionally regulates the traffic of vehicles within a roundabout:

(4) A driver who has entered the roundabout into the outer/right lane and intends to exit at the second outlet shall yield the right-of-way at the first exit to vehicles from the inner traffic lane that have commenced or intend to execute an exit at the first outlet.

In this regard, there is a need for horizontal traffic markings within the roundabout to prevent lane changing or vehicle sorting inside the circulatory intersection, and to regulate the priorities previously elaborated.

Namely, it is necessary to design the central dividing line as a double line, specifically at the locations of permitted 'merging' or 'entry' into the roadway surface that has priority over other flows, as shown in more detail in Figure 3.

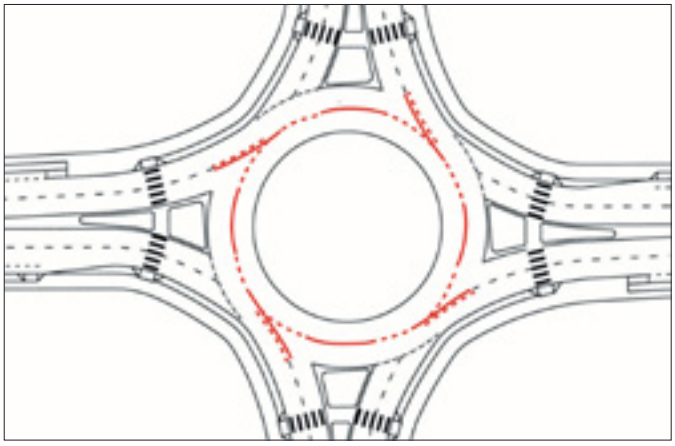


Figure 3. Proposed horizontal road markings at roundabouts in accordance with the suggested amendments to traffic rules within the circulatory zone

REFERENCES

[1] AASHTO (2011). A Policy on Geometric Design of Highways and Streets 2011. American Association of State Highway and Transportation Officials.

[2] Bastos Silva et al.(2014). Moving from Conventional Roundabouts to Turbo-roundabouts. Procedia

[3] CROW (2008). Turborotonde, Publicatie 257. Dutch Information and Technology Platform.

[4] Cabarkapa, R. M., Vukanovic, M. S. (2015), „Access control eliminates vehicle conflict at the exit of a multi-lane roundabout", Tehnika - Saobraćaj 62, 842-843 Review of Systematic Reviews. Curr [2]Envir Health Rpt 11, 300–316 (2024). https://doi.org/10.1007/s40572-024-00431-0.

[5] FHWA (2000). Roundabouts: An Informational Guide. Report 672. Federal Highway Administration. Virginia, USA.

[6] DfT (2007). TD 16/07 - Geometric Design of Roundabouts. In Design Manual for Roads and Bridges (DMRB). Volume 6. Section 2. Part 3. The Stationery Office. London

[7] Maric, B., Brankovic, N. (2020) ''The problem of vehicle movement in roundabouts", Put i saobracaj, Belgrade.

[8] Law on Basics of Road Traffic Safety in Bosnia and Herzegovina – Consolidated Text ("Official Gazette of BiH", No. 6/2006).

[9] Law on Road Traffic Safety of Republika Srpska ("Official Gazette of Republika Srpska", No. 63/2011 and 111/2021).

[10] Gladović, P., Višković, R., and Đurić, Ž. EU Recommendations for Sustainable Development of Cities. Journal for Traffic and Transport Research and Application, Vol 9(2), 2024, pp. 130–135.

[11] WSDOT (2015) „Rules of the roundabout".