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SUGGESTIONS FOR UPDATING AND CHANGING THE REGULATIONS WITH THE GOAL OF IMPROVING TRAFFIC SAFETY AND EFFICIENCY

Key Words
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Traffic safety

Abstract

Road traffic stands as a dynamic branch of economy which is in constant development and change as well as main entities of that system, "user" and "technology", thus a conclusion is imposed that regulations following road traffic should be periodically renewed and updated for it to be applicable in real situations. Paper covers the observations and suggestions for changing and updating the existing legislative documents with the focus on *Law on road traffic safety* (Law) (1) especially in areas covering the traffic signalization. Conclusion is that preceding updates of these acts did not address these areas sufficiently. Suggestions for update of regulations would contribute fixing some of traffic system problems, both formal and practical, with the goal of reaching a sustainable long-term advancing of traffic safety system. The basis of such set of suggested measures for improving the regulations would be introduction of legislative framework for adopting and creating the missing acts and rulebooks to further organize specific areas of road traffic. During the process, new terms should be defined (the old ones redefined if it is necessary) in area of traffic signalization, given the fact that it is one of main constructing elements of the road. Specific proposals for updating the regulations will be further explained in detail.

1. EXISTING REGULATIONS, UPDATING EXISTING RULEBOOKS AND INTRODUCING NEW RULEBOOKS

Managing the traffic system through legislative means is quite challenging and seeks great responsibility from system creators and establishers. Main problem in application of legislative documents which are not periodically updated is the fact that the area impacted by those documents is advancing in practice while the legislative framework does not provide adequate support for that advance. Practice shows that as a solution to that problem adequate rulebook is often introduced since the procedure for creating and introducing specific rulebooks is much quicker and less complex than the procedures of changing legal acts.

Changes and updates to existing Law on road traffic safety should introduce following rulebooks:

Rulebook on traffic lights, Rulebook on traffic signalization in school zones, Rulebook on traffic signalization on railway crossings, Rulebook on traffic signalization for bicycle and pedestrian tracks, Rulebook on road admission control, Rulebook on criteria for designing pedestrian tracks, Rulebook on traffic signalization in roundabouts.

Existing rulebooks that should be updated:

Rulebook on technical measures for traffic calming and Rulebook on traffic management in construction zones which should be updated with missing typical schemes for placing temporary traffic signalization on state and local roads.

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By introducing some of suggested rulebooks specific areas would be withdrawn from the actual *Rulebook on traffic signalization,* which would facilitate its further changes and follow-up.

Since the detailed explanations and specific details for introducing rulebooks represent a complex subject, too extensive for this paper, only the main observations and suggestions will be explained in further text.

2. SUGGESTED RULEBOOKS AND BRIEF OBSERVATIONS

2.1. Rulebook on traffic lights

Necessity for introduction of *Rulebook on traffic lights* is imposed for a long time, especially given the fact that several of leading world countries already introduced such rulebooks (*Guidelines for Traffic Signal, RILSA), (9).* It would organize in detail the criteria for introducing, designing, installing, and operating modes for traffic lights. Impact of traffic lights on traffic flow and traffic safety on one side and professionally insufficient approach on criteria for introducing, designing, and operating modes of traffic lights both solidify the need for introduction of the rulebook.

Updates made to *Rulebook on traffic signalization (2)* in 2017. defined more precisely operation and designing of traffic lights and gave the basic safety precautions necessary for safe operation of traffic lights. As a very specific and comprehensive engineering subject, traffic lights should be legally defined in detail. Suggested rulebook would normalize traffic-lights introduction criteria, level of technical documentation, technical conditions and characteristics and safety precautions for the installed equipment. Modern concepts in traffic management impose usage of ever complex technical solutions and approaches for traffic lights management and operating (from fixed program modes, coordinated sections and modes which include usage of vehicle and pedestrian detectors for more efficient functioning). In addition to the mentioned operating modes, *adaptable traffic lights operating* is more and more present in urban networks today, managing traffic lights signal plans and functioning through specific sections or parts of network by the means of real time traffic flow measuring and vehicle detecting.

Rulebook on traffic lights should organize and redact in detail this subject by introducing different procedures, protocols, legal and technical requirements for introducing, installing, managing and maintenance of traffic lights equipment. Special attention should be given to creating and adopting standards which further normalize operating of traffic light devices and equipment (such as operating mode shifts, shift to safe operating mode (*yellow blinker mode)* in the case of logical errors (multiple conflicting signal groups given green light as a worst-case scenario)). Certificates issued by accredited institutions should be requested by the *Rulebook* as mandatory for all works, equipment and its functioning after installation of traffic light systems.

It is inadmissible for a traffic signalization subject as important and complex as traffic lights not to be normalized with adequate legal acts, both as a part of permanent traffic signalization and temporary traffic signalization in construction zones. Such acts and rulebook should normalize the domains of traffic lights operating modes, safe procedures for shifts between operating modes, safe operating modes (*yellow blinker)* and operating modes dependent on real time traffic data (traffic flows, vehicle speed and type etc.) gathered on the network. It should also provide necessary steps and mandatory parts for the *Main traffic design* for each intersection managed with traffic lights.

2.2. Rulebook on traffic signalization in school zones

This rulebook should further define school zones on public roads and normalize the traffic signalization placement in such zones through typical schemes of traffic signalization depending on school type, size, and location (elementary schools, high schools, schools for children with special needs etc.). It should also consider road rang in school zones, safe paths for children (pedestrians), school yard and entrance placement relative to roads and intersections on site etc. Rulebook should suggest and normalize the use of safety guardrails, technical means for traffic calming, uniform marking of busy pedestrian crossings and typical schematic presentation of other traffic signalization necessary for adequately and clearly signifying the school zone.

2.3. Rulebook on traffic signalization on railway crossings

There are some existing rulebooks covering this important domain of traffic signalization, but all were issued by railway authorities and do not address traffic signalization thoroughly. Therefore, new *Rulebook* should address traffic signalization in detail, intersecting road and railroad categories and extent of sufficient traffic signalization to be placed on crossings to ensure safety for all traffic modes (vehicles, trains, pedestrians etc.). Rulebook should be in accordance with existing rulebooks and should normalize the responsibilities of road authority in the domain of designing, installing and maintenance of traffic signalization and equipment on railway crossings. That means that the relations, responsibilities and obligations between road and railroad authorities and third parties using that railroad should be also legally normalized. Special focus should be brought to normalizing jurisdiction and maintenance of traffic light signals on crossings.

2.4. Rulebook on traffic signalization for bicycle and pedestrian tracks

Prior to updates and changes made to respecting Law to enable introduction of such a rulebook, it is necessary to define which road category bicycle and pedestrian tracks should be a part of, and which road authority (state or local) has jurisdiction on them. That should legally normalize exact responsibilities and jurisdictions over conditions and criteria for traffic signalization (such as language on informative signs, colorization of traffic signs etc.) issuing construction permits and detailed designs, and specific criteria and demands if the bicycle route represents a part of EuroVelo routes. As a specific part of the rulebook should be also the domain of relations between pedestrians and bicyclists and criteria for incorporating mixed tracks on site, especially in the field of traffic safety since more than one death was noted in traffic accidents between pedestrians and bicyclists. One of the upcoming problems in this domain is incrementing number of e-bikes, e-scoters and other electrified means of transport which mainly use the existing pedestrian and bicycle infrastructure. Therefore, conditions, obligations and responsibilities of those categories of traffic contestants should be addressed in the new rulebook as well.

2.5. Rulebook on road admission control

Although as a domain admission control is very comprehensive and complex matter, and contrary to the fact that it is already a part of several legal documents (*Law on planning and construction (5), Law on roads (4) and Law on traffic safety (1)*), it is concluded that it is still insufficiently addressed and as a part of traffic management domain, wrongfully secluded comparing to its status abroad. According to simplified regulations in domains of urban development and construction specific terms which address the admission control are defined: access (every direct connection of the pavement of public road with private lots alongside that road), lot access (means of reaching the lot from pavement and sidewalks for vehicles and pedestrians), and yard access (means for accessing yards from public road space). Access paths

could be reserved for vehicles, pedestrians or mixed. Conditions and methods to ensure lot access are normalized in *Law on planning and construction (5)* and its respecting legal acts. Access path is defined by the *Law on roads (4).* In contradiction with the two mentioned laws, *Law on traffic safety (1)* nor its respecting legal acts do not define terms such as *access path (both for vehicles and pedestrians)* nor the criteria for its adequate marking, which is a source to many problems (both legal and practical). *Rulebook on traffic signalization (2)* defines the marking for vehicle access path as "*spot on which stopping and parking on the sidewalk is forbidden, and which serves as access path*" (marking code: V-16), and "*spot on which stopping and parking on the pavement is forbidden, and which serves as access path*" (marking code: V-16.1). Inconsistency and uncertainty of term *vehicle access path* in existing legal acts imposes several important questions: is the term *vehicle access path* identified same as terms *access path* and *lot access?; for which road categories is the term applicable?; does the term differ respective to road category?; does the term differ respective to surroundings of the road (open section or urban road)?.* Besides existing regulations, existing practice recognizes access control only for highways and some sections of two-way state roads, which is insufficient from aspect of road safety considering the size of other roads network. Practice shows that service roads are insufficiently applied on site on one side, and that citizen requests for approving *vehicle access paths* along state and urban roads are granted without criteria. It is important to mention that road access (especially state road) through direct pats from lot imposes considerable negative effects on road's safety, service level, average speed, and capacity. Therefore, updates to respective laws and introduction of new *Rulebook on road access control* would legally normalize specific conditions for granting and controlling access to public roads and adequate measures to organize and normalize this domain.

2.6. Rulebook on criteria for designing pedestrian tracks

Suggestion for updates to respective law and introduction of new Rulebook mainly covers the criteria for using pedestrian crossings, methods for properly marking pedestrian paths, and methods for guiding pedestrian flows since the pedestrian crossings represent important and potentially "dangerous" spots in which different road user categories intersect (motorized vehicles and different categories of pedestrians). Those spots thus become places with great safety risks for all users of the road with the most severe consequences for pedestrians (pedestrians, children, elder people, people with special needs etc.). Additional attention should be brought to this subject when the crossings are regulated with traffic lights. During the recent updates and changes made to *Rulebook on traffic signalization (2)* and Serbian standard which defines in detail the "pedestrian crossing" marking (marking code> V-4), more than once an open discussion with a goal of changing and updating of that specific marking were unsuccessful, during which the party mostly opposed to the suggested updates was the Police authority. Thus, opinion is that this domain should be primarily legally normalized with law changes, and then with changes and updates to *Rulebook on traffic signalization (2)* which would allow a more thorough approach to definition of pedestrian crossing marking. By introducing the *Rulebook*

on criteria for designing pedestrian tracks missing criteria should be added (which should take to account expected traffic flows and paths, attraction zones, surroundings, motorized traffic flow, traffic speed, road width, placement of the road (urban or open), number of traffic lanes etc.). Subsequently, Rulebook should normalize the criteria for designing and constructing pedestrian under-passes and over-passes (taking to account potential users with special needs, and signaling and physical measures preventing the possibility for pedestrians occur on the road surface in such areas).

2.7. Rulebook on traffic signalization in roundabouts

Legal acts and existing rulebooks do not address thoroughly the design and construction of roundabouts in the domain of traffic signalization and right of passage regulation, and therefore this domain should be legally normalized with adequate updates to existing laws and introduction of new rulebook. As the constant road network reconstructions and updates occur, incrementing number of roundabouts are constructed as an alternative and more efficient way of intersecting same (or in some cases different) road categories. Nevertheless, most of the recently constructed roundabouts do not meet requirements technically and in terms of road safety. Due to the lack of normalizing legal acts, a number of different design solutions are applied in practice ant therefore there is no uniformity of necessary traffic signalization (sometimes the solutions are too complex and sometimes insufficiently thorough in terms of proposed traffic signalization). Therefore, Rulebook main objective would be to introduce adequate and uniform criteria for designing, constructing and necessary (and sufficient) traffic signalization on new (and existing if possible) roundabouts. That would even facilitate introduction of so called “turbo rotors” which rely mostly on proper traffic signalization for its safe functioning. It is important to mention that changes made to existing *Rulebook on traffic signalization (2)* in year 2017. Introduced new road markings for roundabouts, which could be further improved if needed.

2.8. Rulebook on technical measures for traffic calming

By updating and changing the *Rulebook on technical measures for traffic calming (3)* it is necessary to define the conditions and criteria for installation of those technical measures, precisely define their technical specifications, materials for its construction, looks, colour and levels of required retroreflective capabilities of their markings (foils), etc. Necessity of these updates and changes is imposed because of the situations and bad practices in which the technical measures for traffic calming are applied to public roads without clear criteria and justified causes, causing therefore a fall in efficiency, level of service and traffic safety in those sections of the road. While creating the new rulebook, special focus should be drawn to the question of application of these traffic calming measures on the roads used by the means of public transportation (buses, trolleys, taxis etc.).

3. EXISTING REGULATIONS STATUS, INTRODUCTION OF MISSING ACTS, UPDATES AND CHANGES TO EXISTING LAWS AND TERMS

Terms that are missing and should be defined by updates and changes to the Law (1) are: *school zone, vehicle access path, vehicles of micro-mobility (e-bikes, e-scooters etc.), Main traffic signalization design* etc.

It is suggested to reassess the validity of the existing procedures and exchange the term “accordance” with precisely defined form and new term for legal act “Rescript” in every Law (1) article which addresses it.

Main traffic signalization design should be introduced as a term along with the desirable and normalized *level of technical documentation* which makes it for different road categories and situations. In articles 157. and 158. of the Law (1) levels of necessary level of technical documentation should be defined for different road categories (state, local and urban roads) since in practice it happens that level of technical documentation defined by existing *Rulebook on traffic signalization (2)* is not always met.

It is necessary to define which authority conducts *regulation of traffic in noncategorized roads* and other responsibilities and obligations on such roads.

It is necessary to define *responsibilities and obligations in management and regulation of traffic on bicycle tracks* in manner that enables the tracks to be different in appearance than bicycle lanes. Bicycle track should be represented as a separate road, with adequate categorization, and well-defined obligations and responsibilities of the road authority which has jurisdiction over it. If the bicycle track is constructed on the territory of different states, as a part of international bicycle route, it should be defined as a state road and logically be in jurisdiction of such an authority.

4. OTHER OBSERVATIONS, REMARKS AND SUGGESTIONS FOR LAW (1) CHANGES

General remark is that specific articles of the *Rulebook on traffic signalization (2)* should be transferred to the *Law (1)* and vice versa. The law should define general terms, in accordance with other relating laws, and rulebooks should further define in detail the terms from the law.

Some of the suggested articles to be changed in the *Law (1)* are: *introduction of orange colour for marking road construction zones* in order to lessen the unclarity for the drivers in urban areas since yellow markings are also used to define road surfaces indented to be used by public transport vehicles.

Rulebook on traffic signalization should be updated by adding traffic signalization intended to be used by motorcyclists and micro-mobility vehicles.

Obligation of use of traffic sign “mandatory stop” (II-1) and road mark “uninterrupted stop line” (V-1) should be defined.

Obligation of use of different languages and letters on traffic signs should be defined, taking to account languages of national minorities. This subject should be defined by the law, not by the rulebook.

Priority of regular and interchangeable traffic signs should be defined in situations in which they are placed at the same location along the road.

5. CONCLUSION

Some of the main and most important tasks of engineers working in road authorities is introducing, improving and innovating the existing legal acts and the follow up of its application in practice through cooperation with colleagues who implement them in practice, gathering information about new international legal acts and standards (in the same domain, road traffic), constant improvement through education courses, conferences, etc. This should be achieved with conceptual approach and attitude that the system creators are responsible for its “adaptation to users”. In the past period a number of regulations was introduced, with especially important regulations which are in accordance with European directives in domain of roads and road safety. It should be taken to account the fact that those are technically good practices since a lot of transit traffic passes through our country and a lot of foreign drivers and vehicles use our roads. Unfortunately, the number of road accidents is still too high on our road network. In accordance with everything said, the intention of authors of this paper was to encourage the engineers and the rest of professionals from the domain of road traffic to try to improve and innovate the domain and its parts. Since the domain of road traffic is too comprehensive and complex to be adequately represented and improved in a single paper, the idea of authors of the paper is for it to help the future attempts and workgroups in their work.

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