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ROLE OF FUNCTIONAL CLASSIFICATION OF HIGHWAYS IN ROAD TRAFFIC SAFETY

Summary. This paper is focused on the functional classification of highways and its part in the process of achieving road traffic safety as an element of sustainable and integrated transport systems.

According to functional classification, the character of service highways are intended to provide, is the main criterion for grouping into various classes and systems. Road safety is an important component in this process of forming the hierarchical structure of road network function, as a base for rational network organization.

The inclusion of the elements of road design programmes in functional classification, contribute towards higher road safety level.

РОЛЬ ФУНКЦИОНАЛЬНОЙ КЛАССИФИКАЦИИ СКОРОСТНЫХ ШОССЕЙНЫХ ДОРОГ В БЕЗОПАСНОСТИ ДОРОЖНОГО ДВИЖЕНИЯ

Аннотация. Данная статья посвящена функциональной классификации скоростных шоссейных дорог и ее значению в процессе обеспечения безопасности дорожного транспорта, как элемента устойчивых и интегрированных транспортных систем.

Согласно функциональной классификации характер обслуживания шоссе является главным критерием для того, чтобы группировать их в различные классы и системы. Дорожная безопасность - важный компонент в этом процессе формирования иерархической структуры функции дорожной сети, как основа для рациональной организации сети.

Включение элементов программ проектирования дорог в функциональной классификации способствует более высокому уровню безопасности дорожного движения.

1. INTRODUCTION

Road safety is one of the main goals of the European Transport Policy, as well as the policies of many countries in the world. Still, a large number of people are killed or seriously injured in road traffic accidents every year. According to the data of the European Road Safety Charter [1] in 2007, 43 000 people died in road accidents all over the countries of the European Union, and the economic damages were about 2% of the European Union's Gross National Product. So, road deaths and serious injuries are considered a serious social and economic problem.

Compared with traffic safety in Europe, the situation in other continents is much worse. For example, expressed in (person car kilometer), or per registered motor vehicle, the traffic safety in developing countries in Asia and Africa, is ten to thirty times worse than in some European countries, such as Norway, England or Sweden.

Having in mind the proposals of EU Commission, oriented towards sustainable road network development, [2], the measures for improving of road safety must be taken in all phases of road infrastructure management, such as: planning, design and operation of roads.

Various road classification systems are very useful in the process of road network development. They are based on different criteria, as resulted from several reasons why roads ought to be classified. These divisions are the base for defining the jurisdiction of the road, its geometry, traffic volume, traffic type, origins and destinations it connects.

In accordance with the relevant literature, there are several basic road classification areas:

- functional, (express a road's functional importance in the whole network),
- administrative, (it is based on the jurisdiction of individual administrations on various roads),
- traffic, (volume, type),
- environmental (heavy vehicles, transport harmful impact on the environment).

Different classifications of roads have the significant influence on traffic safety, so that they determine the safety-related task ought to be undertaken in order to provide an acceptable safety level. It means that it is impossible to prevent traffic accidents altogether. But it is possible to alleviate the consequences of a collision to make roads and vehicles become safer, and drivers become more careful. Moreover, the risk can be reduced through greater insight into the impact of various roads classifications, first of all, functional classification on road safety.

2. THE BASIS OF FUNCTIONAL CLASSIFICATION

Functional classification is primarily based on a road function in the frame of a state highway network, but also, there are methodologies for roads division having in mind their physical settings.

According to two basic types of service that roads carry out, access to surroundings and level of mobility, this classification is based on two criteria: land access and mobility. The significance of mentioned two basic characteristics is different according to the road type (fig. 1) [3]. In general, the mobility function decreases as access increases.

Federal functional highways division [3], made by American Association of State Highway & Transportation Officials (AASHTO) [4], specifies these three basic types of roadways in rural, urbanized and small urban areas:

- arterials (principal and minor roads/streets),
- collector (major and minor roads/streets),
- local roads/streets.

In order to insure higher level of adaptability for use of various facilities, there are additional classifications, such as:

- interstate, other principal arterials and minor roads in the frame of rural principal arterial system,
- major and minor collector roads, in collector road system,
- local roads,
- roads in the frame of urban principal and minor arterial system, collector and local street systems in urbanized and small urban areas.

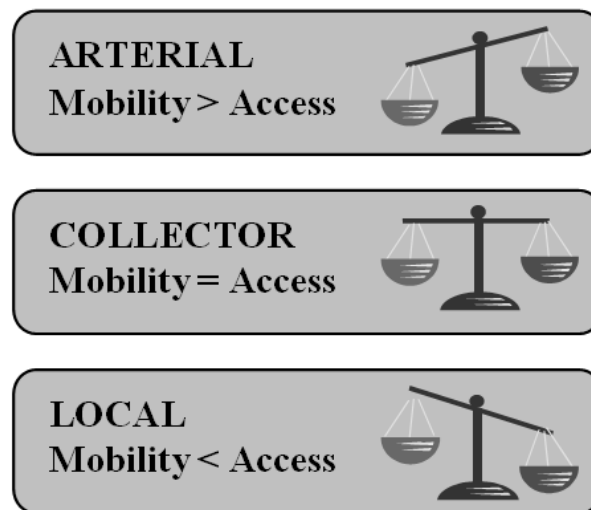


Fig. 1. The domination of the functional classification basic criterion

Рис. 1. Доминирование функциональной классификации как основной критерий

The main characteristics of mentioned categories in rural areas are:

Arterials have high mobility level. It means they connect major trip generators which demand long trip length and high traffic volumes. Rural arterial highways provide higher vehicle speed, link major cities, travels across the whole state, and so called inter-county travel.

The principal arterial system is divided in two subsystems, such as: interstate system and other principal arterials. The design parameters of rural minor arterials should be provide relatively high travel speeds, with minimum interference to-through movements.

The component part of the urbanized areas are: urban principal arterial system,(streets and highways significant to the correspondingly area, assigned to serve the major activities, highest traffic volume corridors and longest trip desires. In accordance with the above mentioned items, it can be said that all controlled access facilities are part of this streets category), and urban minor arterial street system, (offer lower mobility level; put the accent on land access).

As it can be seen from the used term, collector roads collect traffic from lower category, connect local and arterial highways and serve subordinate traffic generators. Rural collector highways serve for realizing shorter trips with moderate speed and lower traffic volumes.

The characteristic of major collector roads is connection between larger cities the position of which is not on arterial links, as well as, service to the more important intracounty movements and corridors. Minor collector roads link the smaller communities and locally important traffic generators.

Urban collector street system has these two significant features: land access service and connection of the urban areas. It also links the collector and arterial streets.

Local roads are characteristic of low volume public facilities, and their primary function is adjacent land, so, they mainly provide access. Shortest distances, low speed and low volumes are the basic characteristics of these types of roads.

The lowest level of mobility and the highest land access are the basic characteristics of the urban local streets.

According to National Law of Highways in Republic of Macedonia [5], the highway network consists of so called state highways. They can be freeways, expressways, trunk roads, regional roads of first and second category, municipality roads and streets in urban and in small urban areas.

Based on “National Standards Statute for Urban Planning” [6], urban network consists of primary and secondary street network. Primary street network is divided into trunk and collector streets, while the first one is classified into through trunk streets and urban trunk streets.

Secondary street net, consists of service, urban, industrial, pedestrian streets and parking lot.

Streets which are part of primary network should provide the high level of mobility, while secondary net streets provide, first of all, land access.

Through trunk streets are the integral part of trunk and regional highway system. Their basic task is to enable links between towns and rural trunk and regional roads, and the design standards should provide the highest level of service.

Urban trunk street connects the urban area and rural trunk and regional highways, while collector streets ought to link the primary and secondary net.

Service street connects collectors and urban and industrial streets. Urban streets provide, first of all, land access and link to service streets. Industrial streets are such a kind of urban streets located in industrial areas.

On the base of the above mentioned classifications, the following conclusions might be derived:

- AASHTO road division is known for its simplicity. It means, there is a quite small number of various highway types, ranging from rural arterials to urban local roads. Compared to this system, the Macedonian system of road division is more complex;
- There is an overlapping between functional and administrative (determine the road jurisdiction) classification in Macedonian road division;
- Both systems of classification treat roadways in an urban area, differently from highways in rural environment;
- The basic roadway features, which are considered to be of great importance to determine its role in the network, in both system of classification, are: the mobility level provided by the observed road, and its physical setting;
- In accordance with the highway function in the frame of the network, its setting is different. In both systems, the various highway categories are based on the area population density.

3. FUNCTIONAL CLASSIFICATION AND TRAFFIC SAFETY AS AN ELEMENT OF ROAD NETWORK DEVELOPMENT

The process of road network development consists of several phases: planning, design, construction and maintenance, which are connected between themselves. If this connection is not taken into consideration, there will be negative consequences for the future highway development, as a whole.

The essential element of each of these stages in road network development is traffic safety. It means that, safety must be integrated and regarded in planning, design and operation of road infrastructure. In this respect, there is a Directive of November 2008, passed by European Commission which refers to the role of traffic safety in the process of comprehensive system of road infrastructure safety management.

In accordance with Directive, road safety is an element on which, a great deal of activities in highway network development is focused.

The basic feature of planning activity is permanent check of the impact of road net development circumstances on spatial and sociable-economic progress, as a whole. So, having in mind the set of stages used for mentioned activity, the aspect of safety has the central position in the process of spatial and roads planning, too. In that way, the analysis of proposed project alternatives impact on safety must be integrated in planning stage, and that results should be taken into consideration in selection of the routes, too.

The task of road network design is to produce so called “safe roads” which will be in harmony with road user behaviour, vehicle characteristics, living and environmental conditions. It means that the used design elements should be enabled to:

- prevent unintended infrastructure use, (functional criterion);
- avoid large differences in speeds, directions and masses at moderate and high speed, (criterion of homogenous);
- prevent uncertain behaviour of the road users (predictability).

In accordance with highway design guidelines and principles, there is a detailed systematic and technical safety check of the design characteristics as an integral part of road network development process. Its basic task is to identify, in all stages from planning to operation, unsafe features of a road infrastructure projects.

Various types of evaluation have a crucial place in the process of systematic, coordinated and complete management of roads in the country. The evaluation of the roads, from the safety point of view, implies identification, analysis and ranking the whole net, or its sections, in accordance with their potential for traffic accidents. The results of such a kind of activities are used as a tool in proving needs for undertaking certain technical measures for reasons of safety, as prevention.

The role of highway functional classification in the mentioned process of highway net development, especially in the area of traffic safety, is a very important question. The following figures may be used as an illustration of the connection between safety and functional division of highways [10].

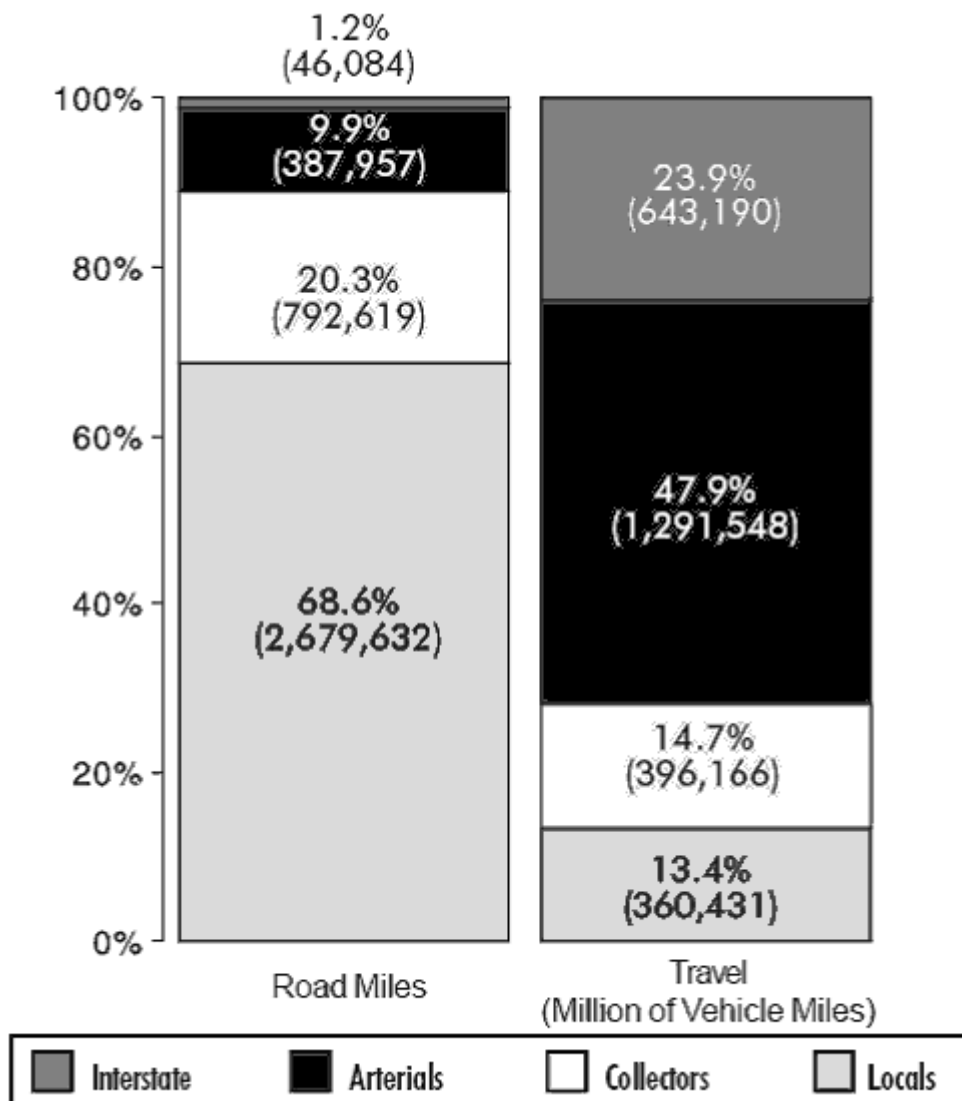


Fig. 2. Total road mileage and travel by road function in USA (1999)

Рис. 2. Функциональная зависимость общей протяженности дорог и количества поездок в США (1999)

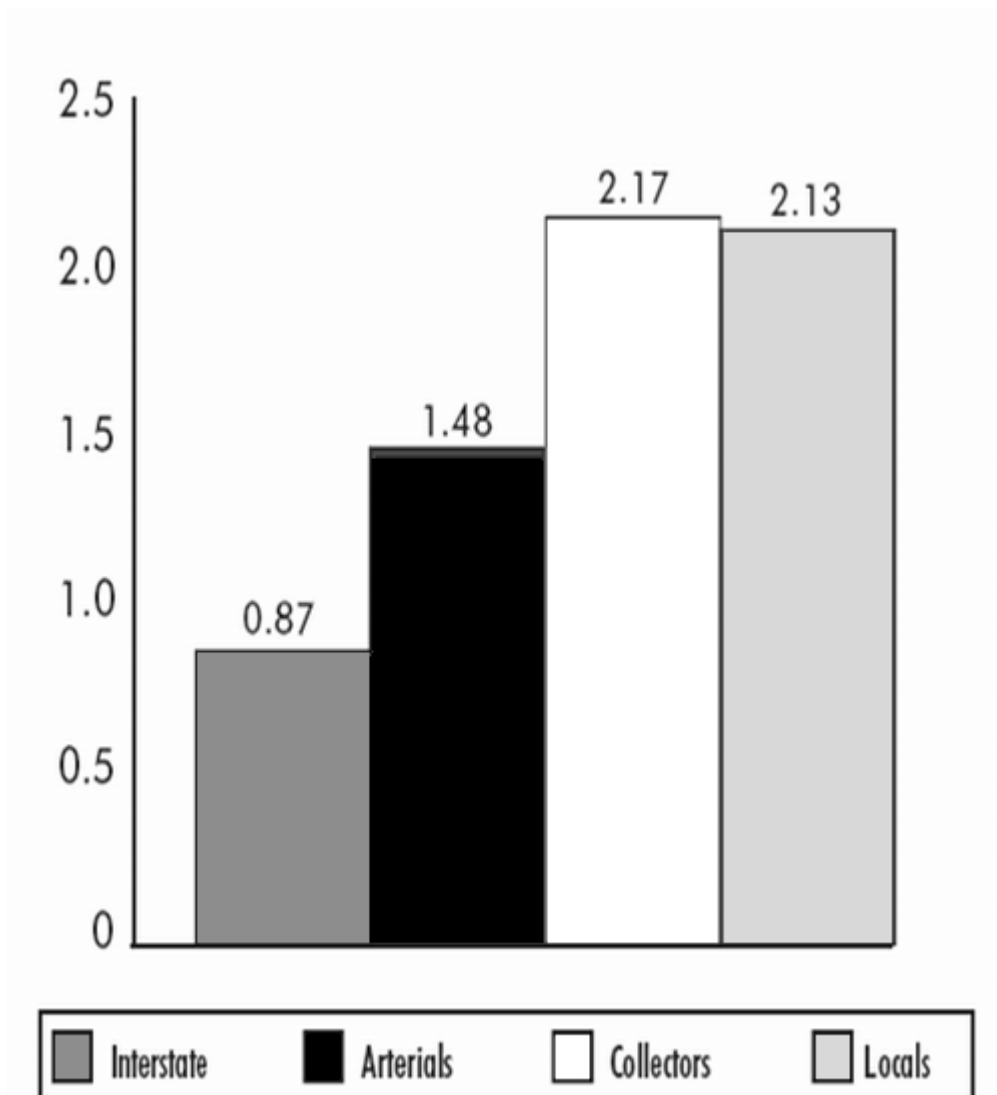


Fig. 3. Overall Fatality Rates by Function Class in USA (Fatalities per 100MVMT, speeding-related and nonspeeding fatalities combined - 1999)

Рис. 3. Классификация несчастных случаев в США (Несчастные случаи, зависмые и независмые от скорости движения, в 1999)

Sustainable road traffic safety is a new approach in the process of road net management. Among other things, (Figure 4), it is directed on road infrastructure and the improved management of traffic flows on it, first of all, in the relation between:

- function, (through, distributor, access. It results from the way of use the infrastructure, as intended by the road authority);
- form, (it means physical design compatible with its function and layout features);
- legislation, (regulatory requirements for the infrastructure use);
- usage. (it means the behaviour of the road user).

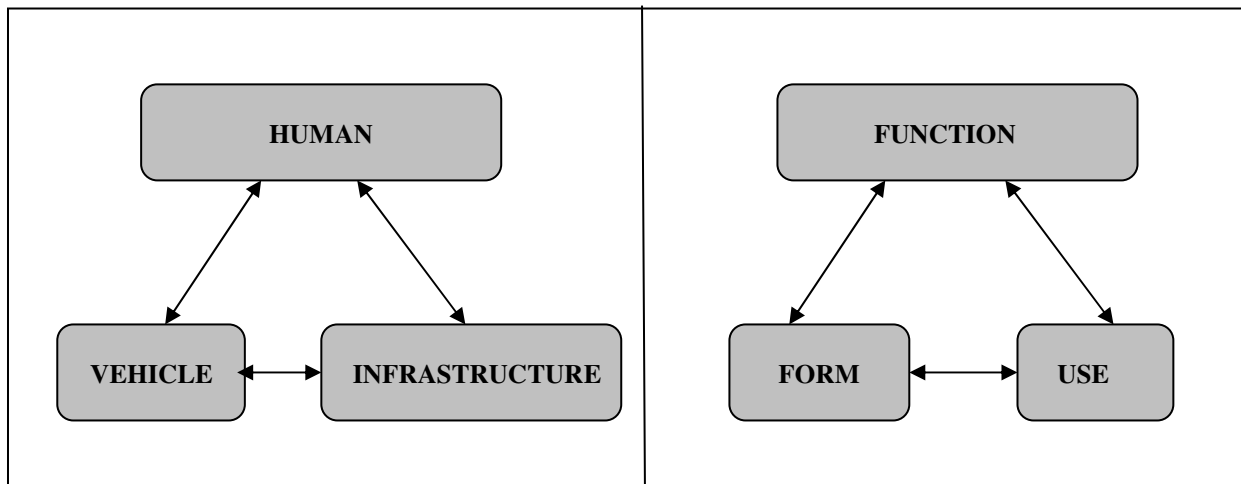


Fig. 4. Sustainable safety concept

Рис. 4. Концепция устойчивой безопасности

Multi-functionality of roadways is a classic case in the frame of network. Functional classification enables transfer to the mono-functional road. This approach leads to homogeneous design requirements, and higher safety level.

One of the basic characteristic of sustainable safety is that form and layout of the road should be the result of its function, and appropriate to it, while legislation relates to regulatory requirements for the use of the infrastructure.

Highway functional classification system facilitates the realization of the road usage as an integral element of sustainable, safe traffic system. It means that, when clear road division exists, road users will be able to recognize the road category. This feature of sustainable safety is known as predictability, in other words, road users ability to predict possible traffic situation in accordance with road category.

The classification of highways which is based on their function within the entire roadway network is the base for defining the roads characteristics for planning purpose in the frame of road net management. It means that it is important to distinguish clearly, roads with various function, such as roads with a through and roads with an access function, with the aim, among other things, planning an access to new development and regulation of access permits. This requirement which is the prevention tool for unintended use of roads is valid for the design process, too, and it leads towards reduction of the total number of potential accidents.

Having in mind the possible change of traffic service patterns and as a consequence, change of the road function, proper functional division system enable to identify the preferred design of each class of road so that as opportunities arises, roads can be improved. It ought to note that it is very important to update the state functional classification system, because it might happen having a situation in which roadways may be designed using inappropriate design standards.

The goal of managing mobility and access in order to increase the safety level, relates to the activities in designing of new roads and reconstruction of existing ones, as well as redevelopment of already formed corridors. In accordance with this, it is necessary to stress that design standards are tied to function class, concerning the components of the roads, their design parameters and geometry elements. This approach insures relatively uniform vehicle speed, little or no variation in direction and vehicle mass on the highest road class, as well as, small speed differences, despite the variations in the directions and mass of vehicles, on the roads designed to provide a greater access degree to land uses.

The standards used in the design process have the consequences on the construction, and lately, on operating the roads, as well as on traffic safety.

The integral part of road net development is the maintenance activities. The division of roads in accordance with their function is also used for setting capital improvement and maintenance priorities.

4. CONCLUSIONS

The crucial element of road traffic safety is human being. Since people sometimes make mistakes, it is impossible to prevent traffic accidents altogether. However, it is possible to reduce the consequences of a collision thus making roads become safer.

The purpose of this paper is to promote the consideration of functional highway classification role in road traffic safety area.

Functional division road system represents the various classes of highways based on their use relating to mobility and accessibility. All roads that are a part of the public road system are to be functionally classified as an integral system regardless of jurisdictional control of them.

It ought to be stressed that this classification type transforms the multi-functionality, as a customary road feature, in mono-functionality, and in that way decrease the accident risk.

Having in mind that our roads must be managed in the way which will provide safe movements of various users, assigning this classification to a specific roadway is very useful tool to attain the satisfactory level of safety in all different phases of highway network management: planning, design, construction, operation and maintenance.

The successively application of the activities for systematic, coordinated and complete road development, is based on clear and proper distinction between various road types, applied, by all of the participants which are responsible within the traffic safety area.

References

1. *European Road Safety Charter*. <http://www.erscharter.eu/>
2. *Commission of the European Communities-CEC (2006): Open Roads across Europe. Road Transport Policy*. Office for Official Publications of the European Communities, Luxembourg, 2006.
3. *Federal Functional Classification of Highways*.
<http://www.maine.gov/mdot/maines-transportation-systems/classification-highways%20.php>
4. *President Signs SAFETEA-LU. Safe, Accountable, Flexible, Efficient Transportation Equity Act for the 21st Century – A Legacy for Users*. <http://transportation1.org/aashtonew/>
5. *Zakon za javni papista*. Sluzben vesnik na R.Makedonija, br.84/08 od 11.07 2008.
6. *Pravilnik za pobliskata soдрzina, razmer i nacin na graficka obrabotka na urbanistickite planowi*. Sluzben vesnik na R.Makedonija, br.78/06 od 28.06 2006.
7. *Commission of the European Communities-CEC (2001): White Paper. European Transport Policy for 2020: time to decide [COM(2001)370]*. Office for Official Publications of the European Communities, Luxembourg, 2001.
8. *Road function classification*, US Department for Transportation, Federal Highway Administration, 2000.
9. *Our Common Future*. Report of the World Commission on Environment and Development, 1987.
10. *Highway Statistics 1999*. <http://www.fhwa.dot.gov/ohim/hs99/index.htm>

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