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## **BLACK SPOT MANAGEMENT AND CRITICAL INFRASTRUCTURE**

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**Abstract:** *The contribution deals with black spot management and road safety in Slovakia. The principle of creating a safety communications is to avoid factors that give rise accidents, resp. factor that impairs their consequences. An important part of the problem of creating road safety is also a systematic search and elimination of the black spots. It is a matter of efficient, because more than one third of road accidents are concentrated in low 3% of the length of road network. The importance of the existence of black spots is mostly right in some circumstances the presence of road, which encourages the emergence of accidents. This circumstance is therefore necessary to find means of analysis of accidents and removed from the field of communication. There is no need to incur large financial packages to measures for reducing accidents in the area. Sufficient is in most cases a simple, inexpensive thoughtful action.*

*Professional public opinion in many European countries reinforces the idea of management development black spots in the traffic engineering, in the EU known as Black spot management. It is a system of working with traffic accidents, their statistical values, work with the accident site, with black spots. It is characterized by its simplicity, efficiency and visibility.*

**Key words:** *road safety, black spot management, accident, risk, critical infrastructure*

### **INTRODUCTION**

Motorization and road transport are still increasing. Except indisputable advantages also bring a big load growth and increasing road network demanding requirements for transport and its safety. Transport safety is not only traffic, social but also economic problem. Transport accidents are associated with great material damage, permanent injuries population and very often the loss of human life. Therefore, the road safety and the various factors affect special attention to an extraordinary world. Traffic accidents of the road traffic occur unevenly, resulting from the places where traffic accidents are cumulative. Such points are referred to as local part accident, accident zones, or black spots. Road safety is an explicit effort to eliminate such a place.

To implement methods of assessment and identification of black spots on the road communications need to work with an assessment of traffic accidents in the SR. Currently it does not exist an integrated database on accidents and orientation in reports of accidents is a laborious and tedious. In the first place it is necessary to create an integrated database into which will be inserted information about road accident.

## BLACK SPOT MANAGEMENT IN INTRAVILAN

It is important to establish the definition of accident site. The black spot on the road network is a site in the max. 0,250 km length, high number of road accidents or high number of consequences. Evaluation of black spots in an intravilan is based on the assessment of road communication and the traffic situation. For evaluation of black spot we use following relation:

$$(1) \quad RF = \frac{NA_A}{0,5 + 7 \cdot 10^{-5} \cdot DI_A}$$

RF      risk factor of road  
 NA<sub>A</sub>    average number of accidents over the last 3 years  
 DI<sub>A</sub>    average daily intensity per year

According to the risk factor can be compiled in order of greatest risk communication from the view of the possible emergence.

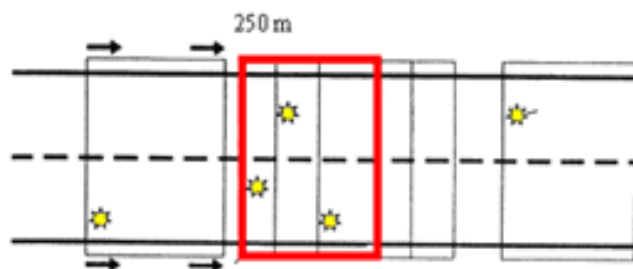
Calculate the safety index of road communication we can find, if the road communication is dangerous and therefore prone to bodily harm.

$$(2) \quad IS = (100 \cdot N_D) + (10 \cdot N_{SEI}) + N_{SLI}$$

IS      index of safety of road  
 N<sub>D</sub>    number of death in the area in the previous year  
 N<sub>SEI</sub>    number of people with severe injuries in the previous year  
 N<sub>SLI</sub>    number of people with slight injuries in the previous year

In cases where safety index of road is more than 20 should be classified as the black spots. This means to protect human health and life, so this limit is very low. Otherwise when the safety index of road is 20 or less, we classify road communication as relatively safe in terms of causes of road accidents.

The next step is the application of moving window in the field of communication. In the event that window appears 3 or more accidents in one year, consider this segment of the black spots. For the application will use the window length of 250 m. (Fig. 1).



**Fig. 1:** Methods of finding a black spot in intravilan

If the result  $RF \geq 0.8$ , we evaluate the road as a risk road track. If it is a black spot, it is necessary to be confirmed by an application of moving window methods too.

Figure 2 shows a graphical procedure for determining black spots on the road network.

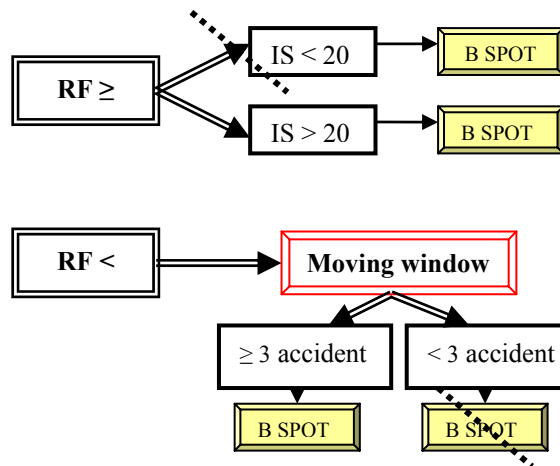


Fig. 2: Graphical procedure of determining black spot in intravilan

### BLACK SPOT MANAGEMENT IN EXTRAVILAN

In the fight against fatal accidents is needed an uncompromising approach. Therefore, in cases when the safety index of road is more than 20, it is necessary classify this communication as a black spot. Otherwise, we classify the road track as a safe in terms of causes of road accidents. The application of moving window, use a value of 1 km. Within one year, application of moving window has to record at least 5 road accident, although only material damage. Then stretch classify as black spots. (Fig. 3).

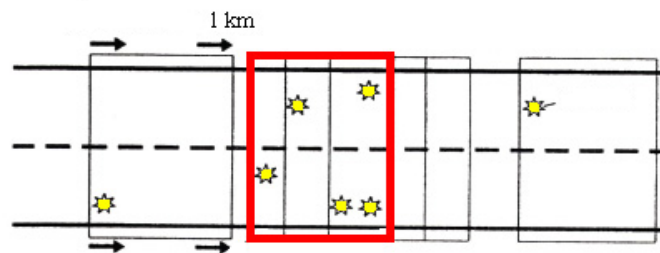


Fig. 3: Methods of finding a black spot in extravilan

Selection of the appropriate length of the moving window is conditioned by the fact that in extravilan are speeds of transport means much higher than in intravilan and the transport means travels a greater distance. In the case of roads in the territory of extravilan is appropriate to determine the risk factor. It is not as a condition for determining section for black spots, but is a factor for reference about increasing or decreasing number of accident. For the better orientation in methodology of evaluation of black spot management in extravilan see the figure 4.

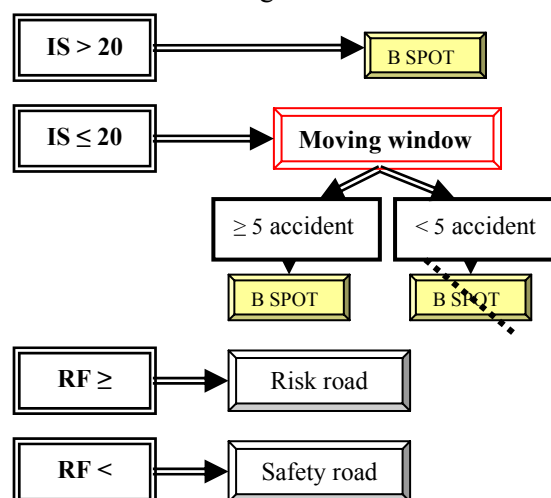


Fig. 4: Graphical procedure of determining black spot in extravilan

The essence of the existence of black spots usually lies in the presence of any circumstances of the road, which encourages accidents. This circumstance is therefore necessary to find means of analysis of accidents and remove them from the area of communication.

## **MAPS OF RISKS AND CRITICAL INFRASTRUCTURE**

According to the Regulation of the European Commission in December 2010, the role of every EU member countries is gradually create maps of risks in natural and industrial nature. These maps should be created till 2015 and based on current tasks of critical infrastructure issues. Currently usable map of risks is a map of the road network from Eurorap. (fig. 5)

Taking into account the density of road network, it is possible to conclude with situation, in which if it is not very widespread disruption to roads in the Slovak Republic is in principle possible to set a diversionary routes for the remaining land communications. It seems that the transport processes will be provided but with a time delay, which should not harm the operation of the national economy.

To critical transport infrastructure should include only those systems transport, whose loss, damage or destruction could result in loss of human life, serious damage to human health, property damage, or deterioration environment. The measures used to protect transport infrastructure should be to reduce the possibility of failure and to limit the effects of these failures.

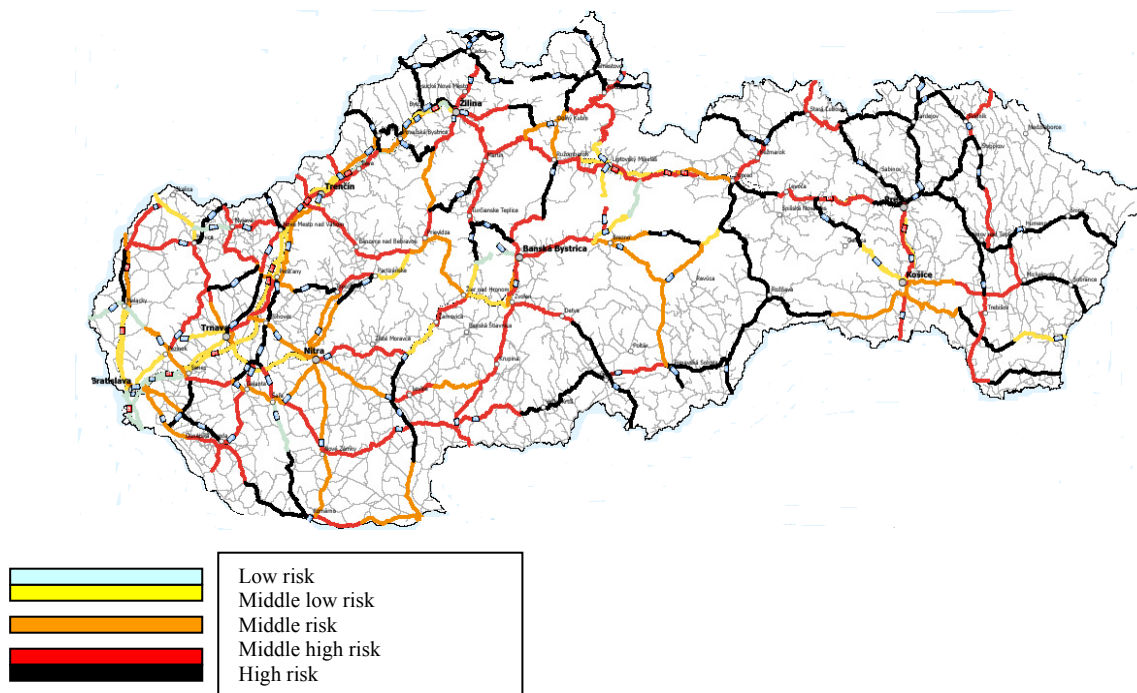
Critical infrastructure elements in the condition of Slovak Republic are only ways of I. class and bridges on them. Their disruption or destruction would affect the planned transfers forces, as well as supply and transportation during the war.

National Highway Company, Ltd. managed and maintained operating highways, roads for motor vehicles and first class roads in the area of roads. It is also an investor, which provides for the construction of highways. As elements of critical infrastructure may be under the motorway and road network selected some road tunnels and bridges and cable network contained intravilan and extravilan. These objects in the protection of critical infrastructure elements in the sub-sector of road transportation require a specific approach involved are often part of the black spots.

The tunnels would need to increase repression prevent shipments of dangerous goods because the signs are excluded, but unfortunately not respected. The fact could lead to incidents during normal transport and possibly be used for preparing a terrorist attack.

In terms of peace is hard to identify objects and roads covered by the Slovak Road Administration, that would be included in critical infrastructure and their removal should a major impact on activities of the organization. Evidence of this, there are relatively common serious accidents, which rejected a way of operation, to prevent passage, or it partially difficult. In a relatively short time adopted the solution by diverting traffic to other communication.

For the proper functioning of road infrastructure are all residents in need every day. In the future, defined critical infrastructure in road transport is very important for the state. Disruption of element of critical transport infrastructure has a negative impact on the functioning of the transport system. These consequences are more severe, more complex infrastructure system is disturbed. It is necessary to eliminate or at least mitigate the impact of potential risks. It is necessary to analyze risks, weaknesses and level of their own capacity. It is necessary to establish and consolidate minimum standards for protection of critical infrastructures, reduce vulnerability, to protect people and critical resources and systems on which depends the existence of society at the national level to harmonize rules for transporting hazardous substances, put great emphasis on a key transport points such as bridges, tunnels, intersections, or equipment designed to load or unload goods.



**Fig. 5.** Map of risks in road network in SR

## CONCLUSION

Annually there are many new cars on the roads.. In the Slovak Republic is road network branched, but it is not sufficient for the number of cars what we see every day on the road. First class road is enormously burdened. Construction of new roads, motorways and expressways needs to lighten the burden on existing roads. Congested roads are very dangerous and often occur in the accidents. These can accumulate in the vicinity of one point for various reasons. This produces black spots management. It is undesirable to transport and therefore it is necessary to work with black spots, and take action to preventing its further generation, or its elimination.

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# УПРАВЛЕНИЕ ЧРЕЗ МЕТОДА НА „ЧЕРНОТО ПЕТНО” И КРИТИЧНАТА ИНФРАСТРУКТУРА

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**Ключови думи:** *пътна безопасност, управление на “черното петно” злополука, риск, критична инфраструктура.*

**Резюме:** *Докладът разглежда тяка няручното управление на «ерното петно» и пътната безопасност в Словакия. Принципът на създаване на съобщенията за безопасност е да се избегнат фактори, които пораждаат аварии, респективно факторът, който засяга техните последици. Една важна част от проблема за създаване на безопасността на движението по пътищата е систематичното търсене и премахване на «черни петна». Това е въпрос на ефикасност, защото повече от една трета от пътнo-транспортните произшествия са концентрирани в по-малко от 3% от дължината на пътната мрежа. Значението на наличието на «черни петна» ке отнася най-вече до някои обстоятелства, съществуващи на пътя, които благоприятстват появата на инциденти. Това обстоятелство е необходимо да се намери място в анализа на аварии и да се отстрани от сферата на комуникациите. Няма нужда да се прилагат големи финансови пакети с мерки за намаляване на злополуките в областта. В повечето случаи са достатъчни прост, евтини, но обмислени действия.*

*Професионалното обществено мнение в много европейски страни поддържа идеята за развитие на управлението на «черните петна» в транспортното инженерство, което в ЕС, е известно като «Black spot management». Това е система на работа с пътнo-транспортни произшествия, техните статистически стойности, работа на мястото на произшествието с черни петна. Този метод се характеризира със своята простота, ефективност и видимост.*