

IDENTIFY THE HAZARDS AND RISK CALCULATION OF CRITICAL INFRASTRUCTURE IN ROAD TRANSPORT

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Summary: The benefit of this article is to present methodology for the identification of threats, through estimates of the probability of the event, through the possible impact on the calculation of specific risks.

Key words: Critical infrastructure, identification, road transport, risk

1. INTRODUCTION

The issue of critical infrastructure is very timely, each country seeks to protect and defend the property, the destruction or disruption could result in partial or complete failure of national security. In many countries, including the Slovak Republic, this issue is not regulated legislatively yet. Transport is one of the basic sectors that significantly affect the socio - economic development and rising living standards. Recently, transport has become a popular target of terrorist attacks. Critical infrastructure includes transport by road, rail, air and waterways. Aim of this article is to identify threats, the size of their impact and calculate the risks that may disturb or destroy CI in a road transport.

2. IDENTIFYING THREATS TO CRITICAL INFRASTRUCTURE IN ROAD TRANSPORT

The risk analysis is important to consider possible threats to assess vulnerabilities and potential impact of disruption or destruction of infrastructure. For the preliminary assessment of the size of the identified risks are selected on two criteria namely, the possibility of risk and

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its impact. The likelihood of danger is the possibility that the threat will be carried out. This probability is measured at increasing levels of categories and these categories must be defined. They are divided into five grades from very low (the lowest) to very high (the highest) probability.

Table 1 Possibility of hazard

Probability of occurrence	Definition of criteria
Very high (5)	Threats can be made at any time, or has already been made repeatedly (daily)
High (4)	It is necessary to calculate the threat carried out repeatedly (about a hundred times a year)
Possible (3)	With the threat to be reckoned (about 25 times per year)
Low (2)	Threat is carried out only rarely, but in rare cases have occurred (a maximum of once per year)
Very unlikely (1)	The threat is very unlikely (once per 100 years)

Source: Author

As in the previous table and the individual impact categories of threats are defined in detail. The Impact threats are sorted into four categories by increasing levels of noncritical to the disastrous.

Table 2 Impact / Impact Hazard

Impact	Definition of criteria
Disastrous (4)	Several deaths and many serious injuries or the most serious damage to property and the environment (more than 10 mil. euro)
Critical (3)	The low number of deaths or serious injuries (or in severe damage to property and the environment (1-10 mil. euro)
Marginal (2)	Minor injuries or substantial damage to property and the environment (up to 1 mil. euro)
Uncritical (1)	Possibility of some minor injuries or minor damage to property and the environment (up to 30 000 euro)

Source: Author

3. RISKS OF ROAD TRANSPORT

Risks operating on the IC are defined as the possibility of a potential crisis situation (CS). This CS may occur under certain circumstances, or can be reduced to the analysis.



Figure 1 CI risks affecting road transport

Source: Author

Technological and technical risks

Vehicle and its technical condition affects the reliability and safety in transport of critical infrastructure. Also, the fluency and road traffic safety largely affects the quality and technical condition of the road risks reduction, we can ensure regular inspections, quality vehicle service and compliance with safety regulations.

- quality of transport infrastructure takes the values 8 (4x2), possibility of occurrence * probability of impact.

Quality of transport infrastructure denouncing the drivability or road about their treatment, condition and availability of noise and dust, the performance of transport organizations, the spread of information technology, environmental impact and others. All these characteristics have an impact on safety.

For explanation: data (4x2) based on two parametric evaluation, with the first parameter, the probability of occurrence has a value of 1 to 5 and the second parameter, the impact hazard, it is possible to write by value from 1 to 4 (based on Tables 1 and 2. Expression means that the probability of a negative phenomenon affecting the quality of transport infrastructure is high

(4) and the impact of this phenomenon is marginal (2). Based on expert assessment of risk, the risk according to Table 4 will include the risks that are uncertain.

- vehicle **15** (5 x 3)

Technical condition of the vehicle affects its reliability; its unsatisfactory condition may cause an accident and the impact on safety.

- transport of dangerous goods **12** (4x3)

Technical condition of vehicles carrying dangerous goods is influenced by the possibility of adverse situations that may lead to an accident or incident caused by the carriage of dangerous goods. Also, transport of dangerous goods may be targeted of terrorist attacks or sabotage.

- condition of roads **5** (5x1)

In Slovakia, the adverse condition of roads (such as broken in, shoulders of roads or unpaved ruts) in combination with distraction significantly affects the flow and road safety.

- condition of bridges **4** (1x4)

Unsatisfactory technical condition, poor construction, depreciation can affect the stability and safety of bridges.

- conditions of tunnels **4** (1x4)

Unsatisfactory technical condition, poor construction, depreciation can affect the stability and safety of tunnels. As well as bridges, accidents, respectively extraordinary events affecting these buildings are more demanding for the removal of undesirable consequences, as well as the number of participants is usually more accidents and rescue requirements for the integrated system are more complex.

Natural Hazards

Some of these natural hazards man is able to predict (f.e earthquake, snow disaster, frost), which can promote security field replacement detours or select another mode of transport.

- earthquake **4** (1x4)

Earthquakes threaten higher levels of road transport in Slovakia are rather exceptional, but the occurrence of such risks undermining the stability of road structures, with the largest impact will be for CI in the case of bridges and tunnels.

- landslide **6** (2x3)

Landslides are frequent in Slovakia, but the risks resulting from their impact is less than for earthquakes. Soil slip road to reduce traffic only for the time necessary to remove the event (which is much lower than for example to remove the impaired stability of bridges after the earthquake). Landslide underground places higher demands (financial and time) in the first example.

- flood **6** (3x2)

Swollen streams and the subsequent outpouring of the road, as well as excessive rainfall and the resulting standing water, any road undermine can compromise road safety.

- snow calamity **9** (3x3)

Snow on the ground reduces the braking ability of the vehicle during heavy snowfall is significantly reduced visibility. Large amount of snow combined with wind caused drifts, thus worse rideable a greater likelihood of accidents.

- frost **4** (4x1)

Frost on the ground reduces the possibility of vehicle brakes, as well as one's ability to lead vehicle. For icing are often skid and subsequent to the accident.

- fog **4** (4x1)

Dense fog reduced visibility; the risk of accidents is high in these conditions. From the perspective of a driver that does not see the traffic going around well enough and also that he is not seen. During the mist is increased humidity, it follows slicker road, the greater possibility of an accident.

Terrorism risks

Terrorism is politically motivated violence perpetrated against political, economic, or even natural to multinational groups or individuals. Terrorism in the SR is not current but in the overall identification of risks to be reckoned with this threat.

- terrorism **4** (1x4)

Slovak Republic is not among the states sought by terrorists, but a targeted attack on critical infrastructure facility can disrupt the smooth operation and security.

The human factor

Risks resulting from exposure of the human factor may be intentional or unintentional. Risk due to human factor may occur in all activities of the transport process.

Involved in the transport

- inattention **12** (4x3)

Carelessness and negligence of road traffic accidents occur often, causing damage to property, environment and human life.

- ignorance **4** (2x2)

Failure to comply with road traffic regulations because of their ignorance also adversely affects road safety.

- negligence **6** (3x2)

Intentional non-compliance is frequent, causing traffic accidents in adverse consequences.

- ingestion of drugs **4** (2x2)

Ingestion of drugs before (or during) driving motor vehicles reduced reaction capacity and thus contributes to the accident.

Bystanders to transport

- vandalism **9** (3x3)

Damage caused to the road buildings by vandals.

- sabotage **6** (2x3)

Targeted road objects damage with pre-planned intention to dispose of all or part of road building.

- war **4** (1x4)

Objects of critical infrastructure during the war can be used as a target to the breach SR security.

Table 3 graphic risk assessment is based on the previous tables 1 and 2. Is determined by two criteria, namely, the possibility of occurrence and the impact hazard based on numerical values assigned to the table is divided as follows:

Table 3 Graphical evaluation of identified risk

Probability of occurrence	Risk categories			
Very high (5)	Acceptable (5)	Uncertain (10)	Unacceptable (15)	Unacceptable (20)
High (4)	Acceptable(4)	Uncertain (8)	Uncertain (12)	Unacceptable (16)
Possible (3)	Negligible (3)	Acceptable (6)	Uncertain (9)	Uncertain (12)
Low (2)	Negligible (2)	Acceptable (4)	Acceptable (6)	Uncertain(8)
Very unlikely (1)	Negligible (1)	Negligible (2)	Negligible (3)	Acceptable (4)
	Uncritical (1)	Marginal(2)	Critical (3)	Disastrous (4)
	Impact/Severity			

1-3 Negligible risk

4-6 Acceptable Risks

- condition of roads, bridges, tunnels, earthquake, landslide, flood, frost, fog, terrorism, ignorance, ingestion of drugs, sabotage, war

8-12 Uncertain risks

- quality of transport infrastructure, snow calamity, carelessness, vandalism

15-20 Unacceptable risks

- transport

Based on expert evaluation of each CI risks in road traffic has been assigned a numerical value. The preliminary assessment of the risks identified, and then their classification according to specified criteria, the possibility of occurrence and impact of risk based on the identified risks are mainly found in the range of acceptability and / or uncertainty border risks. While the most threatening factors for CI in the road transport as a heavy snow, vandalism and the resulting threat. As the smallest risk based war and earthquakes, although the impact would be disastrous but the probability of the occurrence is very low.

4. CONCLUSION

If action has potential negative effects despite some security measures to cause damage, destruction or removal of critical infrastructure, critical infrastructure level can be identified as inadequate. To assess the degree of protection of critical infrastructure should be considered in particular its vulnerability and resilience. It is very important to address the development of methodologies that are appropriate and applicable to the specific and complex approach for critical infrastructure. The benefit of this article is to present methodology for the identification of threats, through estimates of the probability of the event, through the possible impact on the calculation of specific risks. The risk assessment in relation to individual objects is also important to determine the limits of acceptability of risk.

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