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CURRENT PROBLEMS OF THE CRITICAL INFRASTRUCTURE SAFETY MANAGEMENT OF ROAD TRANSPORT

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Abstract:
The rethinking of the importance and managerial process of transport infrastructures has become more than a imperative today, the quantity of elaborations made at EU level especially in the domain of applied research being also an indicator in this respect. It can not be said that there is a trend of convergence of certain points of view on the issues specific to the critical road transport infrastructures, while at the same time displaying under the imperative of the emergence of increasingly more sophisticated cyber technologies and the need for complex interdisciplinary subjects to be clarified in the following period of time. In this framework, terms such as security, protection, governance and architectures are also brought to attention, and their complementary character is emphasized, the purpose being on focusing on advanced technologies that will provide robustness in researching viable solutions specific to this field of activity.

Key words: critical infrastructure, road transport, security, management

1.Introduction

Regardless of the dimension of security (individual-collective, national-international, etc.), the idea of investigating the proposed subject was also based on the fact that, by the way of definition and content, the critical road transport infrastructures (Figure 1) are the closest both as architecture, but also from a time and space point of view of everything that means human existence (both as an individual consumer and as an industrial producer), while road transport is still placed in an area of economic optimum for a multitude of situations. More specifically, here is what is designated as a critical local or regional road transport infrastructure (transport corridors), through concatenated elements (production systems, multimodal distribution facilities, power supply, intervention support services, etc.), virtually ensuring the social vitality and continuity.

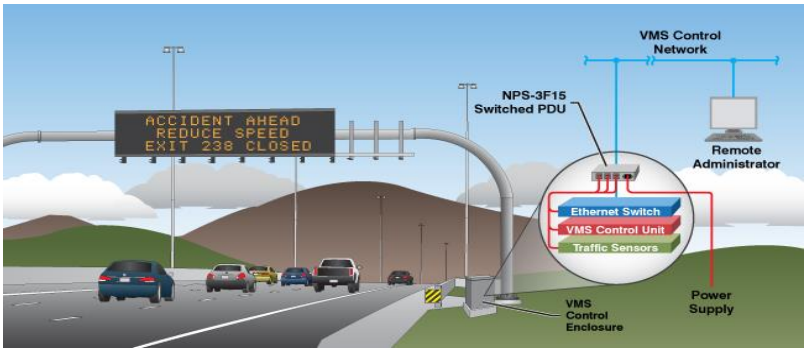

Fig. 1 Elements of a smart road transport system [1]

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The main issue, which involves aspects specific to a wide range of research directions and fields, is to address the resilience of road transport infrastructure based on SMART, integrative determination, with the provision of updates and upgrades for the advanced technologies involved, the results of the research (e.g. CIPRNet - Critical Infrastructure Preparedness and Resilience Research Network; CRISADMIN - Critical Infrastructure Simulation of Advanced Models on Interconnected Networks Resilience) or in the US not yet converging towards a standard methodology. For this article security has been considered as an essential component to ensure resilience, and there is also the possibility of observing a certain nuance (military versus civil) used in the literature approaches.

2.Research methodology

The conceptual model presented in Figure 2 highlights the complexity of approaching such a theme (12 x 6 x 5 aspects to be analyzed), and this is similar for other types of critical infrastructure, and much more complicated in discussing different types of existing interdependencies. Simplified, the main components and relationships have been considered for the road transport system. The resilience analysis can also be approached as a mediation between the internal, specific and functional conditions of this system and the PESTLE (political, economic, social, technological, legislative, environmental) external factors considered here as carriers of threats. To address resilience, the model developed by the Italian Association of Critical Infrastructures' Experts [2] in 2016, in which the meaning of the terms is hierarchically, the following: dimensions (technical, personal, organizational, cooperative) contributing to some capacities (predictive, absorptive, reactive, restorative), features (redundancy, segregation, etc.), indicators (quantifies the previously listed components) and importance coefficients (considered necessary to be added by the research team to weigh the indicators).

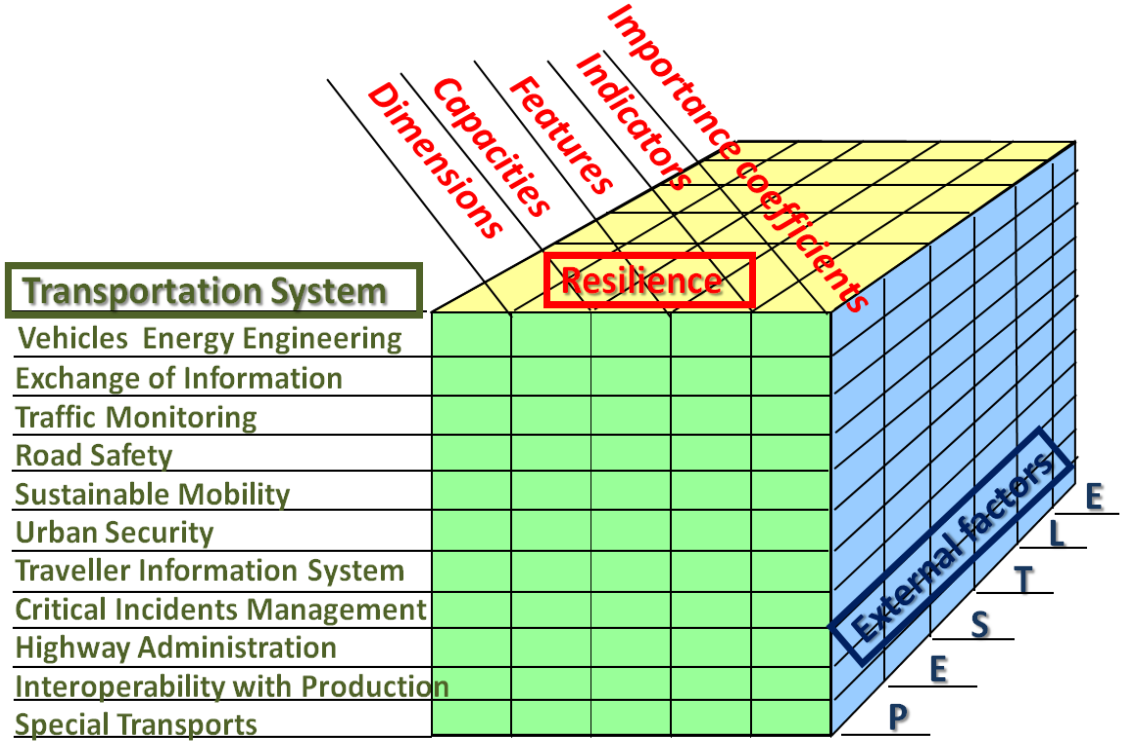

Fig. 2 Conceptual research model of the resilience of road transport infrastructure

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The difficulty and necessity of approaching the subject is also evidenced by the existing achievements in the form of research projects, developed at both international and national level. In this respect, the concerns and results obtained by ITS Romania (Romanian Organization for the Implementation of Intelligent Transport Systems), the Romanian Association for Security Technique (one of the most credible partners of public and private organizations in the management of any aspects related to private security and related risks), the Romanian Association for the Promotion of Infrastructure Protection and Critical Services - ARPIC, etc. are most suggestive.

As a critical infrastructure sector, despite efforts to streamline the existing EU-wide efforts, a comprehensive definition is made at the Department of Homeland Security / USA, which mentions the management of seven key subsectors, including the Highway and Motor Carrier, described in the following terms [3]: "*encompasses more than 4 million miles of roadway, more than 600,000 bridges, and more than 350 tunnels; vehicles including trucks, including those carrying dangerous materials; other commercial vehicles, including commercial motor coaches and school buses; vehicle and driver licensing systems; traffic management systems; and cyber systems used for operational management*."

As shown in Figure 2, the current problems of the critical infrastructure safety management of road transport bring to attention modern technologies, based on developments in information technology. In this framework, as a general way of defining it, the intelligent transport system is a system in which information and communication technology is applied on the one hand to urban transport and, on the other hand to infrastructure, vehicles, users and management responsible for traffic and mobility, mobile phones and all equipment incorporating such data management technologies are valuable capabilities for traffic applications, especially in areas near urban settlements or highways. Obviously, a great advantage of mobile data is access to useful information in real time. At EU level, Directive 2010/40 / EU of 7 July 2010 [4] on Intelligent Transport Systems in the field of road transport aims at ensuring a coordinated and coherent implementation of interoperable intelligent transport systems within the Union. Intelligent transport systems are approached as advanced applications that aim to provide innovative services and enable different users to be better informed and make use of transport networks in a safer, more coordinated and smarter way. These systems include, for example, automatic speed controllers, track-maintenance equipment, collision alert devices, or automated emergency call systems.

Subsequent and much more current is the concept of Internet of Things (IoT), a vision in which it is desired to unify all devices connected to the Internet, which comes from a certain point of view to supplement the limitations of another paradigmatic concept, Big Data, developed to describe the enormous volume of structured and unstructured data that gathers from a multitude of sources and becomes very difficult to control and process. For a better awareness of the importance, it is necessary to give an easy-to-understand example: how to conduct daily activities in the absence of GPS, which can determine the location of a device, equipment, vehicle etc.? The IoT also represents the ubiquitous interoperability concept for different types of businesses, governments and various consumers, with their own management, monitoring, statistical calculations and data analysis systems. In the field of transport, the driver has to manually configure their devices and functions from radio to heating / air conditioning, navigation and more. It is appreciated that IoT will turn these devices into objects of minor importance.

Having these "classes" defined, the next useful level to be presented is the cybernetic space defined by national legislation [5] as the virtual environment generated by cyber infrastructures (information and communication technology infrastructures, consisting of

computer systems, related applications, networks and electronic communications services), including the processed, stored or transmitted information content, as well as user actions in it.

Turning to the subject, beyond the benefits of computerization of road transport, a certain degree of insecurity is implicitly induced when the actions of individuals or groups unintentionally or deliberately exceed the established usage conventions, that is to say, that characteristic of criticality is displayed, contained otherwise latently, inherently by the respective transport systems. Consequences may be the worst, from derailment from an established route and the creation of traffic jams through the operational incapacitation of traffic monitoring systems, to accidents or even catastrophes. Things are even more complicated and more severe from this point of view when considering the constructive elements of the road infrastructure required to be built under certain geographic conditions, the achievements of the German SKRIBT [6] project (Protection of critical bridges and tunnels in the course of roads) highlighting these aspects. Therefore, the current issue of these types of infrastructure should be centred around the idea of building road transport architectures resilient to such threats, with some possible operational directions being: completing a comprehensive study of general technical, systemic and operational implications of the use of IoT technologies in road transport infrastructures; socio-technical research on the economic performance of the system considered under those conditions; setting the main risk scenarios; determining the main points on a regional risk map and determining the viability of the infrastructure operator's security plan at macro level; designing an application for critical infrastructure safety management of road transport that integrates traffic data through IoT equipment.

3. Conclusion

Innovative elements of complex research projects dedicated to critical infrastructures should be centred on the idea of providing specialist knowledge to communities, in line with technological and technological progress that puts its mark at a rapid pace on all the economic and social processes specific to the current society. Past experiences in this context of analysis have often shown that innovative disruptive products have not been accompanied by the improvement or upgrading of the skills required for human resources, which leads to lower performance in the respective socio-technical system. The use of IoT and cyber-physical devices applied to road traffic management needs to be done in an interdisciplinary and multi-level manner, with the involvement of all interested and involved stakeholders, specialized education, focusing on the stakeholders' needs, thus having a major role in the wider context of achieving at least a satisfactory level of social performance, irrespective of indicators (economic, environmental, safety, etc.). The use of the Internet in all areas of activity is a present reality, and, at the same time, an irreversible road in the social development in an increasingly globalized world. The problem of using it is to minimize the negative effects and breaches of insecurity it can generate, in the absence of an awareness of its role and benefits.

By synthesizing it, one can advance the idea that the impact of complex research projects on national security is contributing to the creation of a safer society in a socio-economic field of major importance for human communities, through ways involving the commitment of national urban communities, and, more specifically, the value of such an approach is being underlined by the reputed professor Andrei Marga [7] as follows: "*Exit from uncertainty can not be approached without engaging other concepts. For example, rationality – since what is rational is sure; argumentation - what is arguable in valid forms*

is a greater generator of safety; reflexivity - what is passed through reflection has greater ability to sustain life."

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