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A new Approach to Identification of Critical Elements in Railway Infrastructure

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Abstract

The paper contains a presentation of new approaches to solving the problem of identifying critical infrastructure elements in the railway sub-sector. The research objective was to analyse the procedures which are used to identify the potential elements of critical infrastructure in the transportation sector. Specific attention is paid to criteria of methods developed in Germany, the Czech Republic and Slovakia. The objective of the work is based on the analysis of the current state of art. The research also attempted to design an effective methodology which allows assessing the significance of rail infrastructure elements. The developed methodology should help to set a group of potential elements of critical infrastructure in the railway sub-sector.

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1. Introduction

The problem of Critical Infrastructure (CI) and its security, especially the resilience assessment of most important elements and services of infrastructure systems and their efficient protection is a topical problem nowadays. The crucial problem here is how to identify the potential CI elements, based on their parameters and properties or mutual

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relations [1]. The Slovak methodology of the national and the European CI elements determination is regulated by the Act No. 45/2011 on critical infrastructure [2]. Due to this act, the proposal of procedures for objective determination of the set of so-called “potential CI elements” is an important objective not only of field experts but also in academic environment. The paper focuses on the problem of identification of important infrastructure elements in the transport sector – railway sub-sector. It contains characteristics and main features of the proposed theoretical approach to the identification of importance of defined typological elements of railway transport infrastructure. By applying the original developed procedure, it is possible to decide objectively about the structure of the subset of potential CI elements in the railway sub-sector. At present, a software support for its practical application is being developed.

2. Procedure for identification of potential CI elements in the railway sub-sector

The procedure is based on the assessment according to [3] and applies multi-criteria assessment. The purpose of the multi-criteria assessment of selected sections and objects is to select the most significant ones from the point of view of maintaining railway operability. The criteria generally focus on assessment of transport infrastructure performance [4] and at the same time on its possible failure impact [5]. On the basis of the above mentioned approaches [6–9] a universal procedure for identifying the set of potential CI elements in the railway sub-sector was designed and verified. The selection is conducted using the assessment of a section or an object following pre-defined criteria. The structure of proposed criteria for importance assessment is demonstrated by Fig. 1.

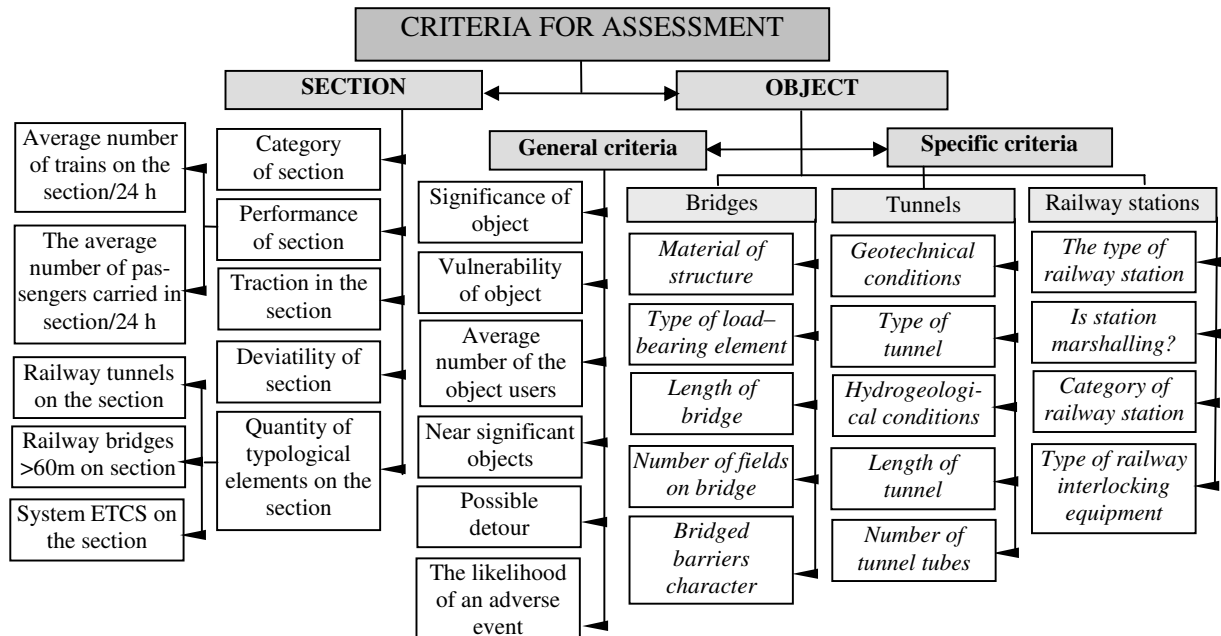


Fig. 1. Structure of assessment criteria used in the proposed procedure.

The proposed procedure consists of subsequent steps:

1. Defining and assessment of basic characteristics of line elements – sections – in the area of infrastructure,
2. Identification of important sections and determination of the “*Index of Section Importance I_U* ” – it means selection of the most important sections,
3. Defining and assessment of basic typological objects in a section (tunnels, bridges, stations, centralized traffic Control and other important technological elements of railway infrastructure,

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