



10th International Scientific Conference Transbaltica 2017:
Transportation Science and Technology

Reflection on the Possibilities for Monitoring the Aging Bridge Structures

Věroslav Kaplan, Petr Dvořák*

Faculty of Military Technology, University of Defence, Brno, Czech Republic

Abstract

The paper contains an analysis of the current state of road bridges in the territory of the Czech Republic. The basic types of defects and several usual faults of road bridge structures and their influence on bridge load capacity are described. The inspection of bridges as an important part of the general reliability theory includes three subsystems: structure, load, and environment. In addition, the article gives examples of inspections of three different road bridges. The conclusions are based on the bridge structures behavior under oversize traffic load. All the above mentioned activities aim for the preservation of the bridge load capacity and for the extension of the bridge service life.

© 2017 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of the 10th International Scientific Conference Transbaltica 2017

Keywords: road bridge, oversize traffic load, inspection, deflection

1. Introduction

The basic characteristic of the bridge structure is its ability to transfer the traffic load, defined by required intensity, while maintaining the reliability, durability, serviceability, and maintainability. To ensure the abovementioned functions, it is necessary to know the state of the bridge and then to react properly to its changes.

* Corresponding author.

E-mail address: petr.dvorak@unob.cz

A load test of the bridge structure is very expensive, but using oversize traffic load as the burden, enables to significantly reduce costs for assessing the behavior of the bridge structure.

2. Road bridge structures in the Czech Republic and their state

The difference between a poor road and a poor bridge is that any modern heavy vehicle can follow the poor road with low risk, but it cannot pass the bridge in bad state. The importance of bridges to the traffic on the roads of all categories is indisputable. It is necessary to mention that 95 % of the road bridges in the Czech Republic were built in the century before last and in the past century. The bridge state significantly affects the structural stability of individual elements of the bridge structure and load capacity of bridges, and objective knowledge of the structural state of the bridge structure is a prerequisite for determining the current load capacity of the bridge structure.

The construction state of the bridge structure is determined by inspection of the bridge structure in compliance with the Czech technical standard ČSN 73 6221 Inspection of road bridges [1]. To unify the procedure for conducting inspections, the Ministry of Transport and Communications issued a guideline “Methodical instruction for performing the inspections of road bridges”. According to this guideline, each of the candidates for “Permission to perform road bridge inspections” must demonstrate the appropriate education, experience and equipment to perform the inspection. In practice, this means that each candidate must prove before a committee of the Roads Department of the Ministry of Transport and Communications:

- Completion of adequate education,
- Obtaining of sufficient experience,
- Submission of a list of its own inspection equipment for consideration.

Building constructions are during their lifetime exposed to various stress effects. These effects are attributed to different types of external load, but they are also affected by changes in the properties of the building materials or by the overestimation of the performance of the proposed load-bearing structures. Along with the development of new building materials and construction systems, the possibility of variety of new defects and faults in construction also increases. Any faults and defects can occur in all types of bridge structures regardless of their age, exploitation intensity, construction system, foundation system or type of building material. The bridge structure may even have hidden defects, which can be overlooked due to hidden defects or other hidden causes. Their occurrence is probabilistic in nature and it is possible to partially assume their existence based on the apparent defects. The bridge structure may also include faults without affecting the reliability of the bridge structures. These faults are marking with the lowest degree of severity and they are referred as secondary or irrelevant ones.

3. Reliability system of bridges

The failure of the bridge structure occurs for various reasons in disrupting the balance between the load capacity and the effects induced by load. This relationship may be distorted in the process of exploitation, for two reasons: load capacity of a bridge element is smaller than the effects induced by load, or load effects are greater than stated in the static assessment.

Reliability system of bridges has clearly defined purpose according to limit states theory, but its determination is difficult, especially in terms of assessing the durability of bridge structures. The complexity especially lies in expressing effects of bridge construction as the reliability system, because usually there is a lack of information about the random variables, such as load, the environment, the actual cross-sectional values, the values of structure shapes and material characteristics. Very often, the behavior of the structure is not clear at various stages and levels of stress, also history of bridge construction is not always known, or information on the recent repair and maintenance of the bridge is missing. The determination of the bridge reliability is a process with many challenges which influence the judgment of the reliability level of the bridge structure. If there is not any detailed information about the technical state of the bridge, and the actual load on the bridge structure, their history, and the influence of the environment, it is not possible to capture the real reliability of the bridge structure by any accurate and detailed calculation.

Download English Version:

<https://daneshyari.com/en/article/5027931>

Download Persian Version:

<https://daneshyari.com/article/5027931>

[Daneshyari.com](https://daneshyari.com)