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Degradation of steel footbridges with neglected inspection and maintenance

Jaroslav Odrobiňák [a,*], Richard Hlinka [a]

[a] University of Žilina, Faculty of Civil Engineering, Univerzitná 1, Žilina 010 26, Slovakia

Abstract

Upon representative case studies, the paper illustrates importance of management, maintenance and reconstruction of steel footbridges. Particularly inspection importance for timely discovering imperfections, potentially reducing safety and load carrying capacity are illustrated at effected investigations of actually common structural systems. The paper presents a summary of the findings and conclusions from diagnostic of seven steel footbridges. Focus is paid on the corrosion of structural steel and its influence on overall condition of footbridge structures.

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Keywords: Footbridge; steel suprestructures; diagnostics; corrosion; maintenece.

1. Introduction

Ensuring the safe operation and investment decisions requires a precise and regular inspections of existing bridges, [1]. The frequency and extensity of the control generally depends on the age, transport type and intensity, maintenance, and known defects. An administrator can define the frequency of inspections on the basis of abovementioned factors. One of the main tasks of the supervisory activities is to identify problematic elements and details before the degradation or defects could lead to the requirement of their replacement, [2]. Underestimated monitoring usually results in poor condition of footbridges, requiring major repairs and reconstruction, [3]. The article presents a summary of the findings and conclusions from diagnostic of seven steel footbridges. Only the corrosion as a result of inadequate maintenance

* Corresponding author. Tel.: +421 41 513 5664; fax: +421 41 513 5690.
E-mail address: odrobinak@fstav.uniza.sk

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is the issue in the below chapters. Age of presented footbridges and corrosive environment of their location are very similar in all cases. Though, five footbridges are over rivers and two structures bridge railway lines. Some findings concerning footbridges numbered as #1 and #5 in the study have already been presented in [4].

2. Brief overview of footbridges and their condition

2.1. Two footbridges over railway lines

The first footbridge (#1) cross the railway yard of railway station, Fig. 1a. From the static point of view it is a continuous eight span girder steel superstructure consist on steel piers. The length of spans are 12.20 + 16.00 + 15.10 + 14.45 + 10.50 + 10.20 + 13.30 + 7.80 meters. The superstructure is formed by a pair of main girders connected through crossbeams and horizontal bracings.

Some of piers are affected by uniform corrosion, but without significant losses, Fig 1b. However, in the case of two piers large-scale crevice corrosion formatted due to water penetration into the gap between the plate and rolled sections where improper plug welds was used to create closed cross-section of the pier columns, Fig. 1c. Crevice corrosion is also evident between plates of bearings on the top of nearly all piers.

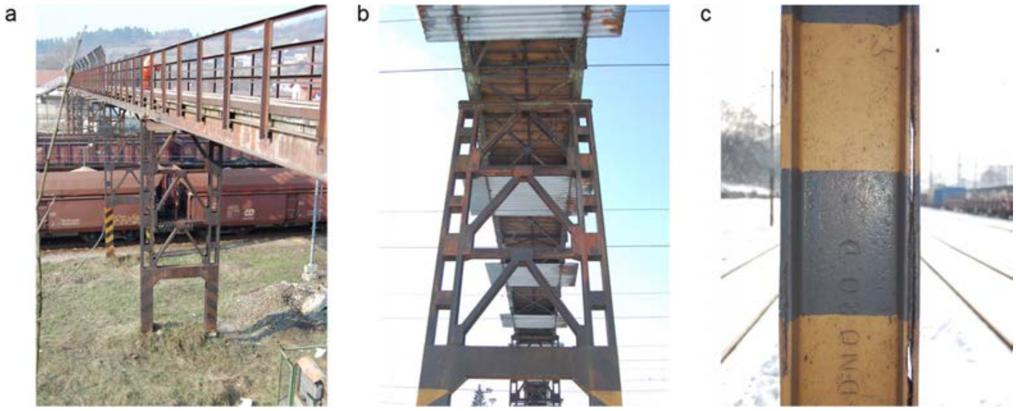

Fig. 1. (a) overall view of the footbridge #1; (b) bottom view; (c) crevice corrosion of the pier columns.

Definitely, the most affected by corrosion are the bridge deck elements, especially in older part of the footbridge. Corrosive losses on the crossbeams are significant and it is only a matter of time when their condition become emergency. Completely degraded by the corrosion are many members of horizontal bracings. Actually, some members are totally destroyed and the rest of them cannot satisfy expected static function, Fig. 2a. Application of road-spreading salt in winter leads to degradation of the individual parts of the side stairway. From the bottom view is evident degradation of steel plates creating stair steps, especially, Fig. 2b.

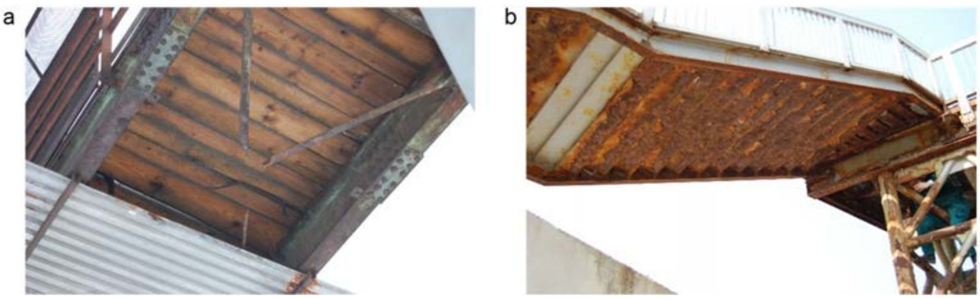

Fig. 2. (a) corrosion of deck members; (b) corroded steps of the staircase.