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Durability issues related to detailing links of steel crane runway beams to columns

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Abstract

The paper presents results from several condition surveys of existing steel crane-supporting structures with a focus on the performance of the links of the runway beams to the supporting columns. These links require careful detailing in order to safely transfer the crane lateral forces to the columns and accommodate the beam end rotations. Different types of industrial buildings have been inspected and the major factors contributing to the observed damages are identified. An overview of several typical connections between the runway beams and supporting columns representative of Bulgarian design practice is included along with newly proposed detailing concepts. The analysis of survey findings shows that the amount of the observed damage and failures can be directly related to link detailing. Recommendations are made for improving the long-term performance of the links connecting the steel crane runway beams to the supporting structures via better detailing.

Keywords: steel structures, crane-supporting structures, crane runway beams, surge connections, damage, detailing.

1 Introduction

The experience from long-term service of industrial buildings with overhead traveling cranes suggests that the crane-supporting structures, including crane runway beams, surge girders, crane rails and their fixings and the surge connections (the links connecting the crane girders to the supporting columns) are typically the most rapidly deteriorating structural members. Past research on the topic has pointed out that the major factors contributing to these durability issues are the dynamic nature of the overhead crane actions on the structure, the discrepancies between the design assumptions and the true behaviour of the crane supporting structures, the underestimation of the actual vertical and lateral crane loads in design codes, etc. [1].

The loads induced by overhead crane operation are applied directly on the crane supporting structure as a set of concentrated vertical and lateral forces of high intensity. These moving forces act along the full length of crane runways, thus producing a high number of load cycles and related fluctuating stresses, often in reversal from tension to compression and vice versa. The dynamic crane wheel actions on the crane-supporting structure are often a kind of impact loading which may result in premature damage to the joints and connections. The actual magnitudes of the vertical and lateral forces applied on the crane rails are often significantly higher than those prescribed by the applicable codes and standards used for their design. It is understood that these codes and standards do not adequately account for several important factors such as the stiffness of the crane bridge structure, which cannot follow well the vertical deflections of the crane runway

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