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Analysis of a Crane Runway Failure

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Abstract

In recent years the pressure on economy of design for all civil engineering structures has been more and more increasing. In case of steel structures cost saving measures have led to reduction of their own weight and thus as well to their total stiffness. Insufficiently rigid structures are usually influenced by unfavorable effects, which some of them cannot be anticipated at the beginning of their design. In these cases less or more important failures occur. An example of such failures is a two bay industrial steel hall equipped by four runway cranes. Operation of these cranes have caused failures of load bearing joints. The object of this paper is analysis of cause of failure of this structure.

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Keywords: crane runway; failure; diagnostics

1. Introduction

Object of this paper is analysis of a two bay hall structure with crane runways (see Fig. 1). On this hall structure was performed diagnostics. Results of the measurements should clarify reason of failure of the crane runways, where load carrying bolted joints on main girders of crane runways were repeatedly damaged. Construction of this industrial building was in 2014. Failures on this structure began to appear immediately after commissioning. This is a modern, very lightweight construction, where it was taken to the minimum weight. Not here dealt with the robustness of the construction. To identify the causes of these disorders was conducted diagnostic tests. To achieve relevant results were ingested two diagnostic methods. The static load test was chosen for the detection of stiffness of the crane tracks and related elements. For detection of the influence of the dynamics of the operation of an industrial building was chosen the dynamic test. This article focuses on the results of static load tests.

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2. Description of load carrying structure

Load carrying system of the two bay steel hall structure with saddle roof consists of frames. Span of individual bays is 36 m and 24 m. Axial distance of frames is 6 m. Frames consist of fixed columns and partially trusses, which are connected to the tops of middle columns by pinned joints. Lateral frames are formed by main fixed columns (HEA 320) and columns swinging wall columns, between which are screwed trusses. Transverse stiffness of the gable walls is ensured by three fixed columns supporting crane girders.

Fig. 1. Steel hall with a crane runway.

Schemes of the cross-section and plan are shown on the Fig. 2 and 3. Crane girders are designed as continuous with two bays. Rails are squared 80x80 mm from the steel S 355, replaceable and connected to the crane girders in such a way to be ensured full cooperation of the profiles. Main supporting beams of the rail are formed by the profile HEA 450. The hall is equipped by four runway cranes (two cranes per one hall bay). Each crane has lifting capacity 8 tons. Cranes in the bigger bay weight 34 tons, in the smaller bay 22 tons.

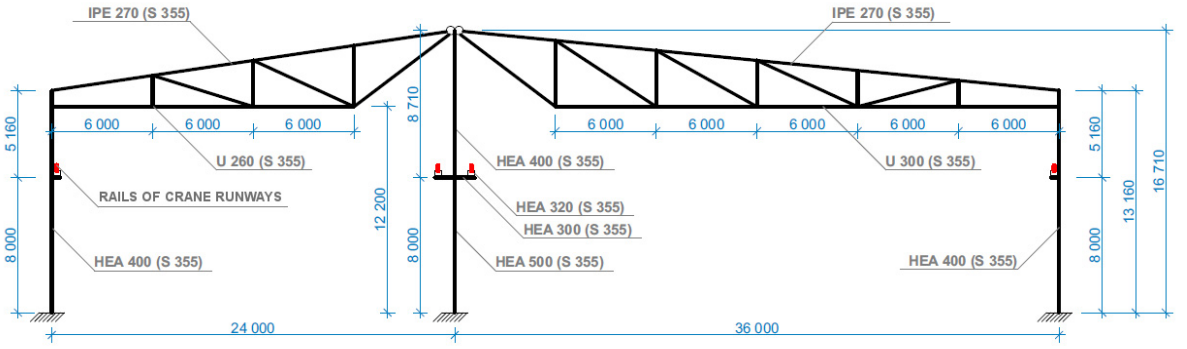

Fig. 2. Schematic section of the hall structure.