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Full - scale study of stress-strain state of ballastless upper structure construction of rail way in terms of train dynamic load

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Abstract

This article is about the ballastless upper structure track operation in Russia. The Rheda 2000 construction was laid at the experimental section of railway track. The problem of cracking was founded while using this construction. In order to determine the railway track stress-strain condition with terms of train dynamic load the experiments were carried out by using of strain gauges.

The experts got the following results: the cracks appeared at the main plate in the locations of the fixed maximum tensile stress. Furthermore, the rolling-stock speed grows up with increasing of vertical and longitudinal voltage on the primary site of the linear dependence.

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Keywords: ballastless construction, track structure, RHEDA 2000, cracking, trial operation

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Railway track reliability is determind by geometry feature stability over a long period. An intensive dynamics affects on the the ballast track which is under the high level axial load and high speeds influence. The dynamics reduces the strength of the single truck element such as ballast [1], [2]. A lot of trying of the application of the railway track design were taken in former USSR and abroad. A large research amount was carried out in the area of the railway track on a plate foundation. The railway track on a plate foundation is better than the ballast track because it can save it's position more longer. The railway track on a plate foundation is better than the ballast foundation track because it can save its position more longer [3], [4]. The following is the experience of the exploitation of the design of the permanent way Rheda 2000 at the railway stage Sablino-Tosno

There were a lot of cracks on the support plate surface while its inspection in 2011 and 2012. The cross cracks expanding from half railway sleeper to the centre of the plate and to its end face were detected. The crack expanding causes a corrosion of the reinforcement cage that reduces the design lifetime and consequently increases the maintenance costs during life cycle. But the track performances such as a track gauge a canting and rail elevation are still stable[5], [6].

Fig1. Cracks at the experimental stage Sablino – Tosno.

Railway stage is placed on the railway embankment wich is represented on the fig2. A locomotive VL-10 with empty freight cars passed the stage at the speed from 40 km/h to 90 km/h . A locomotive CHS-2T with a passenger cars passed the stage at the speed from 40 km/h to 110 km. And a suburban electric train ET-2 passed this stage at the speed up to 130 km/h. Besides the stress state measurements of the ballast bed were made while electric train "Sapsan" passed the stage at the speed from from 40 km/h to 200 km/h [7], [8].

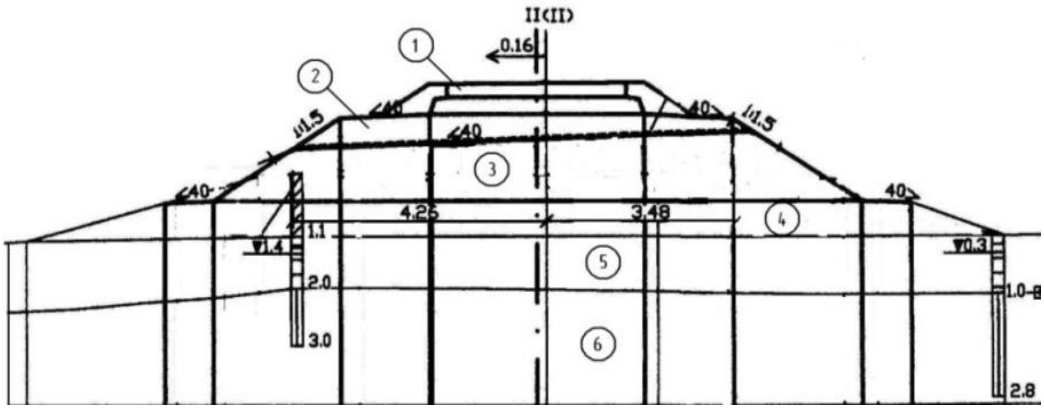

Fig2. The rail profile of the experimental stage Sablino – Tosno.