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# Changing the Stress State of the Track Superstructure while Strengthening the Subgrade

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**Abstract.** Strengthening the subgrade with the help of various technologies significantly affects the stress state of the track superstructure. The strengthening of the subgrade with piles, leads to an abrupt stiffening of the track superstructure, which is problematic for its normal operation. Two finite element models were created to determine the change in the stress state of the track superstructure when strengthening the subgrade. They fully reflect the geometric, deformation and power characteristics of a real subgrade, which is strengthened by piles. Individual finite elements of the models are provided with the deformation characteristics of the steel rails, reinforced concrete sleepers, soil subgrade, ballast and soil-cement material of piles. The authors carried out the calculation of stress state of the track superstructure for two finite element models. Results are obtained and analyzed to help in choosing the most effective option for strengthening the subgrade.

## Introduction

At the current stage, among the many issues in transport improving traffic safety is relevant. It depends on many factors including the interaction of parts in the "rolling stock – track superstructure – subgrade" system. A comprehensive analysis of these parts involves the research of the stress state when the rolling stock operations, taking into account the features of the track superstructure (TS) [1]. For example, geometrical irregularities and rails unevenness [1,2], their geometric position in the plane (circular and transition curves) [1,3], parameters of TS [4], etc. Since the rolling stock operation is characterized by significant dynamic loads [5,6], they, in turn, move in the form of impacts on the "track superstructure – subgrade" system.

Physical modelling is an important part of the researches that provides possibilities to correct theoretical foundations [7–10]. A number of methods are existing for solving the problem of straightening of the subgrade in transport [11–15]. One of which there is strengthening the subgrade by various technologies, which significantly affects the stress state of the track superstructure.

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