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## Method of Assessment and Prediction of Temperature Conditions of Roadway Surfacing as a Factor of the Road Safety

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### Abstract

The purpose of the article is the assessment and prediction of temperature conditions of roadway surfacing. The article states that the solution of this task makes it possible to reduce socio-economic losses caused by road traffic accidents. The solution of the task is provided by predicting average temperatures that are used to calculate parameters of roadway surfacing in different road building climatic zones (RBCZ); these calculations would determine a set of actions on the improvement of road conditions and the traffic safety in general. This would allow control of roadway surfacing performance based on effective prediction of its temperature conditions.

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### 1. Introduction

Increasing complexity of transport facilities, use of new construction materials and technologies of transport construction, growth of traffic intensity and loads require consideration of temperature conditions of roadway surfacing during feasibility study of the project design Unconventional structure of transport infrastructure facilities,

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their components and subsystems, as well as a probabilistic nature of strength characteristics of construction materials and process parameters can cause hundreds of small failures and thousands of their combinations. These factors together sometimes lead to early failures and damages of road structures, cause road traffic accidents and crashes. It is not by chance that the cause of every fifth road traffic accident (RTA) is a poor condition of roads [Lazarev (2015)].

The stated circumstances reveal that the issue of the assessment and prediction of temperature conditions of roadway surfacing during road construction is of great importance, manifesting itself in the possibility to reduce socio-economic losses caused by RTAs. Annual losses from RTAs in Russia total about 3% of the GDP, which is more than 500 bln rubles, according to expert calculations [Evtiukov and Tyulkin (2015)].

The current practice of account and prediction of temperature conditions of roadway surfacing underrated these parameters. It was believed that changes in temperature conditions should be excluded fundamentally during engineering and designing of roadway surfacing. Understanding of the above stated issues is clearly defined with the fact that the quality of construction is introduced during the development of project concepts, definition of project strategies and development of the schedule of main actions [Silyanov (2009)].

A more detailed study of the issue has shown that it is precisely the stage of project designing and its subsequent realization when predictions of temperature conditions of roadway surfacing should be considered [Lazarev et al. (2016)]. In this connection, it must be admitted that the problem of prediction of temperature conditions of roadway surfacing really exists and we should consciously face the conceptual basis of its analysis, assessment and determination of actions on efficiency improvement of prediction of temperature conditions of roadway surfacing as a factor of the traffic safety improvement.

It is indicative that the foreign literature has been considering the stated problem for a long time up to now [Laaksonen (2016), Jansson and Almkvist (2006)], both in terms of control of prediction of temperature conditions of roadway surfacing during project designing, control of prediction of temperature conditions of roadway surfacing during project implementation, and simulation of temperature conditions of roadway surfacing in variety of conditions as well as their evaluation in terms of the traffic safety. However, it should be noted that these studies carried out in the respect of roads and highways consider changes in temperature conditions of roadway surfacing as its possible malfunction.

However, in recent years, the issues of prediction of temperature conditions of roadway surfacing have been paid enough attention in the Russian Federation during road construction and maintenance [Kokodeyeva and Mokhnev (2004), Zavyalov (2007), Uglova and Savenko (2014)].

It should be noted that the presented works state that prediction of temperature conditions of roadway surfacing usually depends on one of the numerous factors aimed at maintaining proper road conditions. Not enough attention is paid to justification and determination of a set of actions on the improvement of road conditions, aimed at increase of the traffic safety; uncertainty factors are not paid due regard during feasibility study of project designs. This approach does not allow the assessment of temperature conditions of roadway surfacing in terms of systemic impact on condition of road structures and facilities and the traffic safety, as well as the determination of the most effective actions for their improvement.

A natural way out of this situation is either establishment of a function of distribution of probabilities of RTAs with victims as a multidimensional random variable dependent on changes of temperature conditions of roadway surfacing, or development of a simulation model for determination of an empirical function of density of probabilities of road structure destruction as a result of non-compliance with temperature conditions.

## 2. Statement of the problem

Draft normative documents for new construction, reconstruction, major repair and operation of public roads do not provide a detailed description of the process of change in temperature conditions allowed by road conditions, level of maintenance, transportation and operational conditions of roads, which, in its turn, is characterized by a state of the roadway surfacing. These documents do not contain definitions of the systemic evaluation of temperature conditions and prediction of temperature conditions of roadway surfacing, possible destruction of road structures under sharp temperature changes, as a result of weak correlation between road structure integrity and human safety.

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