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Advances in Structural Mechanics and Applications

Proceedings of ASMA-2021 (Volume 2)

Editors: José António Fonseca de Oliveira Correia, Satyabrata Choudhury, Subhrajit Dutta

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The proceedings of the conference is going to benefit the researchers, academicians, students and professionals in getting enlightened on latest technologies on structural mechanics, structure and infrastructure engineering. Further, work on practical applications of developed scientific methodologies to civil structural engineering will make the proceedings more interesting and useful to practicing engineers and structural designers.

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Sustainable and Resilient Structures

Smart Structures

Fluid-Structure Interaction

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Editors and Affiliations

Faculty of Engineering, University of Porto, Porto, Portugal
José António Fonseca de Oliveira Correia

Department of Civil Engineering, National Institute of Technology Silchar,

Silchar, India
Satyabrata Choudhury, Subhrajit Dutta

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Study on the Effect of Wheel Load and Temperature on Rutting Damage of Composite Flexible Pavement Using Finite Element Method

Arijit Kumar Banerji, Pijush Topdar & Aloke K. Datta

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Abstract

Rutting is a significant type of damage that reduces the serviceability of flexible pavements. The main reasons for rutting are the loss of stiffness of the asphalt mix as a result of high temperature in the pavement surface and densification under repetition of heavy wheel loads. As a result, depressions are created on the pavement surface in the wheel path under heavy traffic loads. Most of the existing studies have focused on predicting the rutting failure due to heavy wheel loads only. However, the effect of environmental temperature

on rutting failure is not explored much in literature. Hence, the present work makes an effort to investigate the influence of pavement temperature, in addition to the impact of wheel loads on rutting failure of the pavement. For this purpose, a finite element model of flexible pavement is simulated, where, in addition to the conventional layers, an extra inter-layer membrane is also introduced across the pavement thickness. In order to study the critical strain and deflection, a three-dimensional finite element model formulated with ANSYS software is used for the analysis. Under the application of static loading, linear material parameters for the asphalt layer, WMM base, and granular sub-base are characterized, and the subgrade is simulated by Drucker Prager non-linearity. Rubber asphalt composite having 1cm thickness is used as interlayer and the thickness of pavement layers is used according to the provision of Indian Roads Congress (IRC: 37-2018). The result prediction of rutting failure shows realistic responses when the effect of temperature is considered. With increasing pavement surface temperature, the maximum number of repetitions required to cause rutting decreases. Furthermore, the combination of temperature and wheel loading model yields a higher damage induced maximum number of repetitions than the finite element model of wheel load.

Keyword

Rutting **Flexible pavement** **Wheel load**

Temperature **Rubber asphalt composite**

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Author information

Authors and Affiliations

Dr. B C Roy Engineering College, Durgapur, India

Arijit Kumar Banerji

National Institute of Technology, Durgapur, Durgapur, India

Arijit Kumar Banerji, Pijush Topdar & Aloke K. Datta

Corresponding author

Correspondence to Arijit Kumar Banerji .

Editor information

Editors and Affiliations

Faculty of Engineering, University of Porto, Porto, Portugal

José António Fonseca de Oliveira Correia

Department of Civil Engineering, National Institute of Technology Silchar, Silchar, Assam, India

Prof. Satyabrata Choudhury

Department of Civil Engineering, National Institute of Technology Silchar, Silchar, Assam, India

Prof. Subhrajit Dutta

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