

Theory Model and Computing Method for Dynamic Mechanical Responses of Asphalt Pavement under Complex Vehicle Loads

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ABSTRACT

Great changes of vehicle characteristic on the road have taken place with the economy development in many countries, and the phenomenon of overweight vehicles running on the major highway has become widespread. The overweight vehicles create vehicular load with complex form. But existing calculation models and methods for structure mechanics of pavement could not analyze the mechanical response of pavement under vehicular load with complex form and could not explain a series of problems such as irregular property degradation and earlier damage of asphalt pavement. Intensive study was restricted for people are impercipient to this problem. Thus, researching calculation theory and its numerical implementing for dynamic mechanical response of asphalt pavement under vehicular load with complex form become the urgent affairs.

Firstly, complex property of working load was described as dynamic, moving and non-uniformly distributed three-dimension based on comprehensive analysis, and based on the results of former researches, the model for vehicular load with complex form was proposed, and analyzing the deficiency of existing calculation model for mechanism response of pavement and the difficulty of using this method for mechanism response under vehicular load with complex form.

Secondly, based on theory of three-dimension elastodynamics, problem of three-dimension elastodynamics under moving load was solved using and multidimensional Fourier converter techniques and their inverse transformation techniques through transforming of moving coordinates, and based on which general solution for multilayers elastic system under complex vehicular load with property of dynamic, moving, non-uniformly distributed and three-dimension were derived. Calculation model for dynamics mechanical response of asphalt pavement under any complex deterministic vehicular load without speed change.

Thirdly, critical issues for numerical implementing of above calculation theory were analyzed, which emphasis was put on probing numerical calculation method for multidimensional Fourier inverse transform of continuous function, and analyzing source of error during numerical calculation with corresponding regulatory measures, which formed systems method for calculation model of numerical implementing.

Finally, computational procedure was drawn up from above results, and the calculating results were contrasted with results of spot test, which inspected and verified calculation theory and its numerical implementing for dynamics mechanical response of asphalt pavement under vehicular load with complex form put forward in this paper.

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