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Linear elastic analysis of pavement structure under non-circular loading

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Abstract

Conventional methods for road and airport pavement analyses, such as BISAR and GAMES, were developed based on a cylindrical coordinate system. Because of the loading symmetry due to the assumption that a circular uniformly distributed load is acting on the pavement surface, it was useful to use a cylindrical coordinate system. However, depending on the magnitude of the tire load, several research reports on tire–pavement contact stresses have shown that the contact patch is predominantly rectangular and not circular in shape. Based on this observation and the fact that it may be difficult for most multi-layer linear elastic software packages to make use of the field measured tire–pavement contact stresses, which are rectangular in shape, this paper presents the development of a method for pavement structural analysis considering both uniform and non-uniform loads acting over a rectangular area. In this approach, three components of displacements, which satisfy Navier's equations, are expressed using Neuber-Papkovich functions.Worked examples for vertical and horizontal loads acting over rectangular area are presented in this paper. In order to verify the validity of the solutions obtained, the results are compared with those obtained from freeware GAMES software, which analyses loads acting over a circular area and is widely used in Japan and South Africa and a number of institutions in Australia, Europe and US.