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考虑沥青混合料泊松比影响的路面结构应力分析

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摘要 基于数字图像测量方法，通过间接拉伸试验测定了不同温度下沥青混合料的泊松比μ变化规律。低温下，μ在荷载比为0.3~0.8时保持相对稳定，而在接近峰值荷载时呈非线性增长；高温下，μ随荷载比的增大而增大。采用三维有限元计算模型，考虑不同温度下沥青层模量及泊松比的变化，对三种典型路面结构进行分析。结果表明，沥青面层的泊松比对沥青路面结构的最大横向应变和最大剪应变有显著影响；当上中面层模量比小于0.8且沥青面层泊松比增大到一定程度时，轮迹带边缘的沥青混合料在荷载作用下有向车辙两侧流动的趋势，容易产生失稳性车辙。这说明在进行沥青路面结构设计时，有必要考虑沥青结构层的协调组合关系和材料泊松比的影响。

关键词 道路公程 泊松比 荷载比 沥青路面 三维有限元 模量比 车辙

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Stress analysis of pavement structure considering Poisson ratio effect of asphalt mixtures

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Abstract The Poisson ratio μ variations of the asphalt mixtures versus temperature were measured by the indirect tensile test using the digital image processing technique. Under low temperatures, when the load ratio changes from 0.3 to 0.8, μ keeps relatively invariable, and increases nonlinearly while approaching the peak load. Under high temperatures, μ grows with load ratio increasing. A 3 D finite element analysis model was used to analyze the 3 typical pavement structures under rectangular uniform load considering the changes of modulus and μ of the top asphalt layer under different temperatures. The results indicate that the μ of the asphalt mixtures has significant effect on the maximal lateral and shear strains. When the modulus ratio of the top and middle lagers is less than 0.8 and the μ of the asphalt top layer increases to a certain extent, the asphalt mixtures around the edge of wheel mark tend to flow towards both sides of the rut under the action of load, leading to the unstable rut. It is necessary to consider the harmonized combination of the asphalt structure layers and the effect of μ in the structure design of asphalt pavement.

Key words road engineering Poisson's ratio load ratio asphalt pavement 3D finite element modulus ratio rutting

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