CENTER FOR
PORTLAND CEMENT CONCRETE
PAVEMENT TECHNOLOGY

Fly Ash Soil Stabilization for Non-Uniform Subgrade Soils, Volume II: Influence of Subgrade Non-Uniformity on PCC Pavement Performance

Final Report
April 2005

IOWA STATE UNIVERSITY

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The Center for Portland Cement Concrete Pavement Technology (PCC Center) is housed at the Center for Transportation Research and Education (CTRE) at Iowa State University. The mission of the PCC Center is to advance the state of the art of portland cement concrete pavement technology. The center focuses on improving design, materials science, construction, and maintenance in order to produce a durable, cost-effective, sustainable pavement.

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16. Abstract

To provide insight into subgrade non-uniformity and its effects on pavement performance, this study investigated the influence of non-uniform subgrade support on pavement responses (stress and deflection) that affect pavement performance.

Several reconstructed PCC pavement projects in Iowa were studied to document and evaluate the influence of subgrade/subbase non-uniformity on pavement performance. In situ field tests were performed at 12 sites to determine the subgrade/subbase engineering properties and develop a database of engineering parameter values for statistical and numerical analysis. Results of stiffness, moisture and density, strength, and soil classification were used to determine the spatial variability of a given property. Natural subgrade soils, fly ash-stabilized subgrade, reclaimed hydrated fly ash subbase, and granular subbase were studied. The influence of the spatial variability of subgrade/subbase on pavement performance was then evaluated by modeling the elastic properties of the pavement and subgrade using the ISLAB2000 finite element analysis program.

A major conclusion from this study is that non-uniform subgrade/subbase stiffness increases localized deflections and causes principal stress concentrations in the pavement, which can lead to fatigue cracking and other types of pavement distresses. Field data show that hydrated fly ash, self-cementing fly ash-stabilized subgrade, and granular subbases exhibit lower variability than natural subgrade soils. Pavement life should be increased through the use of more uniform subgrade support. Subgrade/subbase construction in the future should consider uniformity as a key to long-term pavement performance.

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INFLUENCE OF SUBGRADE NON-UNIFORMITY ON PCC PAVEMENT PERFORMANCE

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Principal Investigators
David J. White
Department of Civil and Construction Engineering, Iowa State University

Dale S. Harrington
Center for Transportation Research and Education, Iowa State University

Technical Contributor
Halil Ceylan
Department of Civil and Construction Engineering, Iowa State University

Research Assistant
Tyson Rupnow

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A report from
Center for Transportation Research and Education
Iowa State University
2901 South Loop Drive, Suite 3100
Ames, IA 50010-8632
Phone: 515-294-8103
Fax: 515-294-0467
www.ctre.iastate.edu

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