I. RESEARCH PROJECT TITLE

Investigation of 4.75 MM NMAS Superpave Mix in Kansas

II. RESEARCH PROBLEM STATEMENT

Like many other states, dwindling budgets for pavement preservation program are forcing KDOT to look at the pavement preservation techniques that are less costly. Within the Superpave mix design system, there are mix design criteria for 9.5 to 37.5 mm nominal maximum aggregate size (NMAS) mixes. Many agencies including Kansas now are interested in using a 4.75 mm NMAS Superpave mix because such a mix should result in a very smooth riding surface, be used for thin lift applications, correct surface defects (leveling), decrease construction time, and provide a very economical surface mix for low traffic volume facilities. Past experience with thin hot mix asphalt (HMA) overlays in other states had been mostly positive. In Maryland, these mixes are used as part of a preventive maintenance program and have shown excellent rutting and cracking resistance. Maryland's thin HMA overlay mixes generally contain about 65 percent manufactured screenings and 35 percent natural sand. The Georgia DOT had used a 4.75 mm NMAS-like mix for over 30 years for low volume roads and leveling purposes. Good performance has been provided by the mix, provided it is placed in thin lifts (approximately 25 mm). These Georgia mixes have been primarily composed of screenings with a small amount of No. 8 sized stone resulting in approximately 60 to 65 percent passing No. 8 sieve and an average of about 8 percent dust. It is to be noted that both states have very good aggregate sources. Potential limitations for small aggregate size mixtures include concerns with permanent deformation, moisture resistance, scuffing, and skid resistance. In 2002, the 4.75 mm nominal maximum aggregate size designation and criteria were added to the AASHTO Superpave specifications to fit the need for small aggregate size mixtures. The 4.75 mm NMAS mix criteria were based on a combination of experience, limited laboratory research, and engineering judgment. An NCAT study[1] also recommended the use of polymer-modified binders to evaluate any enhanced performance. Currently KDOT is planning to implement this mixture in Kansas as a pavement preservation strategy. However, no performance data of this mixture is available to date. Some research is necessary before widespread implementation of this mixture.

III. RESEARCH PROPOSED

The objective of this project is to investigate the rutting and stripping performance of the 4.75 mm NMAS Superpave mix in Kansas. To fulfill the research objective, the study will have two parts. The first part will consist of testing of cores (if possible) and reconstituted mixtures from the actual projects where 4.75 NMAS Superpave mixtures will be used. The second part of the study will consist of a statistically-designed experiment to evaluate the performance of 4.75 mm NMAS mix as a function of binder

[1] Cooley, Jr., L.A., James, R.S. and M. S. Buchanan. Development of Mix Design Criteria for 4.75 mm Superpave Mixes. NCAT Report 02-04, Auburn University, February 2002.

type, aggregate types (crushed vs. natural ratio), fine aggregate angularity, and gradation. The Hamburg rut tester will be the primary test equipment in this study. The following tasks are needed to be accomplished to fulfill the objectives of this research. Kansas State University will be responsible for accomplishing all tasks.

Task 1: Evaluate the recommendations of the pooled fund study by NCAT for 4.75 mm NMAS mixture.

Task 2: Statistically design an experiment for mixture evaluation using typical fine aggregates from Kansas sources. It is anticipated that at least 3 to 5 aggregate sources will be used in the experiment. Some mixtures will be collected from the actual construction projects. Run KT-56 and Hamburg Wheel tests on all mixtures. If possible, run Hamburg Wheel tests on the cores from the actual projects.

Task 3: Statistically analyze the results. Comment on the influential/significant factors and current specifications. Make recommendations regarding changes in gradation, mixture composition, binder type, etc.

Task 4: Write the final report.

The detailed tasks of this project will be developed in consultation with the KDOT project monitor if this idea is selected for funding in FY 08 K-TRAN program. This project could be complemented by accelerated testing of a variety of surface treatment strategies at the Civil Infrastructure System Laboratory at KSU in a future testing program of the Midwest States Accelerated Pavement Testing Pooled Fund Program.

IV. ESTIMATE OF FUNDING AND RESEARCH PERIOD

Estimated project duration: 18 months (start: May 2007)
Estimated budget: $75,000

V. URGENCY AND PAYOFF POTENTIAL

The research should have a high priority. KDOT is currently trying to stretch the maintenance dollars through cost-effective pavement preservation strategies. This mixture has the potential to become the work horse of KDOT's thin overlay program and save millions of dollars in alternative maintenance treatments. This would result in a big return in exchange for the small investment in this research project. KDOT and the paving industry in Kansas will immensely benefit from this work.

VI. IMPLEMENTATION STRATEGY

Implementation of this study is expected to be carried out by the Bureau of Materials & Research.

VII. PROJECT PERSONNEL

This project will be carried out under the direction of **Mustaque Hossain**, Principal Investigator and **Stefan R. Romanoschi**, Co-Principal Investigator, in close cooperation with the Bureau of Materials & Research. One graduate students and one undergraduate student in civil engineering will also work on this project.

Mustaque Hossain is a professor of Civil Engineering at Kansas State University. His areas of expertise are pavement materials, pavement design, performance, management and non-destructive evaluation using Falling Weight Deflectometer (FWD).

Stefan Romanoschi holds an M.S. degree in Experimental Statistics and a Ph.D. in Civil Engineering from Louisiana State University. Dr. Romanoschi is currently an Associate Professor of Civil Engineering at KSU. He is highly experienced in the monitoring of pavement condition, pavement instrumentation and Finite Element Analysis (FEA). Dr. Romanoschi has also extensive experience in field and laboratory testing of soil and highway materials.

VIII. SUBMISSION INFORMATION

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