

Research paves way for better roads

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The next generation of asphalt and concrete pavements used to build and rebuild roads, bridges and other paved surfaces in much of the world likely will be based on a design guide produced by researchers in ASU's Ira A. Fulton School of Engineering.

Officials with the Transportation Research Board of the National Academy of Sciences, in addition to the American Association of State Highway and Transportation Officials (AASHTO), have approved new design guidelines for pavements developed by a team led by Matthew Witczak, a professor in the Department of Civil and Environmental Engineering.

Guidelines used in the United States typically are adopted by many countries throughout the world.

Witczak says he expects the new guidelines soon will be used in the Middle East, parts of Europe and South America.

The project stems from AASHTO's decision in 1999 to launch a study into upgrading the methods by which asphalt and concrete pavements were designed. It included everything from pavements for roads and bridges to airfields, shipping ports and rail lines.

Soon after, the Transportation Research Board gave the go-ahead to ASU engineering researchers to study new ways to design and construct asphalt and concrete pavements. They worked with Applied Research Associates Inc., a nationwide engineering and technical services company.

The project became the largest transport study to be conducted in the United States, leading to an extensive update of the design guide.

"It's the kind of major project most universities don't get to work on," Witczak says. "It's very rewarding to know the outcome is going to affect the way people design structures nationally and internationally."

In developing one of only a few major pavement design upgrades in the past several decades, Witczak was assisted by ASU civil and environmental engineering assistant professor Claudia Zapata and research professor Mohamed El-Basyouny.

Zapata added a new feature to pavement design guidelines by including climatic and environmental aspects.

Older guidelines don't deal with effects of climate on pavements, she

says. The new version provides different design and building guidelines for different locations based on varying climate, soil and other environmental conditions.

“We researched how soil changes due to climate conditions and how that affects pavement performance. That will allow you to know how well a road will be holding up in 10 or 15 years,” Zapata says.

The new design guide uses a “mechanistic” approach over a purely “empirical” approach to designing and constructing pavements.

“That means we’re using pure science and pure engineering rather than experience,” Witczak says. “It’s a very significant advancement in the way we’ve used technology to integrate the environment with material properties.”

The complexity of the design guide requires the final analysis to be done with the use of a specially designed computer program. El-Basyouny developed the program software, which enables assessment of how much stress will make pavements crack.

“We took 94 different pavement sections from throughout the United States to test in our labs,” El-Basyouny says. “If you have a lot of good information but don’t have good analysis and good predictions, your assessments are no good. This is a complete software program that helps with inputting the data and analyzing, it and then it gives you the results at the end.”

Source: ASU

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