

ABSTRACT

Sivasubramnaiam, Sivaranjan. Ph.D., Purdue University, August 2005, Validation of Superpave Mixture Design and Analysis Procedures Using the NCAT Test Track. Major Professor: John E. Haddock.

The Indiana Department of Transportation was one of the first user agencies to adopt Superpave mixture design method and its relevant specifications. This adoption leads to considerable benefits however; long-term data is not yet available. When National Center for Asphalt Technology decided to build and test pavement test sections for accelerated testing, Indiana saw an opportunity to validate the new mixture design method. It participated in the pooled fund study by sponsoring two pavement sections. Further, efforts were made to establish rutting performance relationships between the APT, the PURWheel, and the in-service pavement and to investigate the temperature effects on the rutting performance. Finite element modeling technique was used to model rutting development. Hot-Mix Asphalt Mixture is a time, temperature, and stress dependent material and therefore characterized using a visco-plastic (creep) model. Commercial finite element software, ABAQUS was used in the finite element modeling analysis and it indicated that the finite element modeling is capable of capturing the rutting phenomena of the HMA. Track rutting was modeled by separating the rutting development into seven different regions to account for the temperature variation. Further, adjustments were made on the finite element modeling data to account for the initial densification of HMA. Using the rutting history data from the APT, and the PURWheel, the creep material properties were determined and used as inputs in the NCAT track model to estimate

rutting. Strong relationships were obtained between the predicted rutting using finite element model and the measured track rutting. Results indicated using the finite element approach strong relationships can be established between the APT, the PURWheel, and the NCAT test track rutting. A methodology of estimating in-service rutting using the APT and PURWheel rutting data is proposed. The rutting performance of the NCAT mixtures indicated that when the Superpave mixtures were constructed properly using quality materials, they provide adequate rutting performance.