UNIVERSITY TRANSPORTATION RESEARCH CENTER

RESEARCH BRIEF

PROJECT TITLE: DETERMINE VISCOELASTIC MECHANICAL PROPERTIES OF WARM MIX ASPHALT (WMA) – RECLAIMED ASPHALT PAVEMENT (RAP) MIXES UNDER HIGH STRESSES IN AIRFIELD FLEXIBLE PAVEMENTS AND ITS IMPACTS ON DESIGN LIFE

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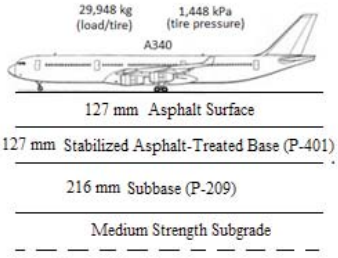
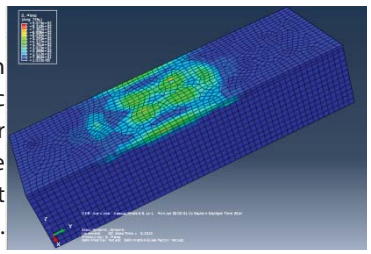
The introduction of larger aircrafts on flexible airfield pavements has led to a need for asphalt mixtures capable of sustaining such heavy loads. This laboratory and analytical study investigated the mechanical responses of a number of modified asphalt mixtures to identify their potential for use in airfield aprons and taxiways that are subjected to heavy, static or slow-moving aircraft loads. The mixtures analyzed in this study consisted of a P-401 mixture (used as baseline); a warm mix asphalt (WMA) with 35% reclaimed asphalt pavement (RAP) added to the aggregate portion; a SMA mixture; two HMA mixtures with two different modified binder grades (PG82-22 and PG70-22); a dense-graded asphalt (DGA) mixture; and a BRIC mixture. The airfield flexible pavement section constructed at the Federal Aviation Administration's (FAA) National Airport Pavement Test Facility Construction Cycle – 1 was modeled using the three-dimensional finite element analysis (FEA) software ABAQUS™.



Laboratory-compacted specimens of each modified asphalt mixture were tested using AASHTO standards to determine volumetric properties and mechanical responses. The effects of static and dynamic aircraft loading were evaluated in ABAQUS™ using the material properties of the mixtures determined in the laboratory.

Based on the findings of this study, it appears that a number of mixtures more commonly used in highway pavements, including modified mixtures, warm mix asphalt, and reclaimed asphalt pavement perform similarly to or even outperform the FAA standard asphalt mixture.

A combined approach with FEA and layered elastic analysis was effective for discerning the performance potential of various asphalt mixtures for airfield pavements.



It was found that higher flow time values resulted in lower stresses and deflections in the asphalt surface course. Flow time was found to be closely related to the performance of the modified asphalt mixtures. The rutting performance of all mixtures analyzed in this study, except for HMA PG70-22 and DGA mixtures was comparable to the performance of the baseline (FAA P-401) mixture. Based on the overlay test results, it was found that all of the mixtures analyzed in this study, except for the SMA, exceeded the minimum threshold value and might be comparable to the baseline (FAA P-401) mixture. The FEA confirmed that except for the SMA, all mixtures performed better or were comparable to the FAA P-401. Overall, the overlay test was also found to correlate well with the mixture fatigue cracking performance. The BRIC asphalt mixture was predicted to perform better than the FAA P-401 mixture based on the laboratory testing results and the predicted mechanical responses. This mixture had the highest flow time, highest cycles to failure, lowest stresses, strains and deflections. It was also predicted to perform to the longest service life. The results of this initial study support the idea that an opportunity exists for airports to implement emerging asphalt paving materials without compromising the pavement design life.