

Research in Progress Abstract - Construction Practice (Non-Pedagogical Content)

Evaluating the Performance of Fiber Reinforced Asphalt Mixtures in Cold Regions Construction

Chun-Hsing Ho, Ph.D., P.E.
Department of Civil Engineering
Construction Management and
Environmental Engineering
Northern Arizona University
Flagstaff, AZ

Mengxi Du, Junyi Shan, Darius Ikan-Tubui Ishaku, and Jonathan Lance
Undergraduate Research Assistant
Construction Management and Environmental Engineering, Northern Arizona University
Flagstaff, AZ

Dry freeze areas in Southern Utah and Northern Arizona have been well known by their high frequency of freeze-thaw cycles (approximate 200-250 cycles per year). In the winter months with high attitude (7,000 feet), temperatures in Flagstaff, AZ are extremely cold giving the fact that daily minimum temperature is often below freezing. Under such severe climatic conditions, fatigue cracking and low temperature cracking have been appeared to be a challenge for engineers in the City of Flagstaff to maintain the asphalt pavements and keep them in a good condition. In the past five years, the rubberized asphalt mixtures have been used by the city government engineers in an attempt to address pavement deterioration. However, the current cost of rubberized mixtures is estimated at approximate $40-50/ton which is not considered as an affordable construction material. As of 2013 spring, the addition of fibers in asphalt mixtures has been considered by the city government to be used for asphalt paving due to its construction estimation of $10-20/ton. While the performance of fiber reinforced asphalt pavements can be found in journal papers and technical reports, however, the concern on its resistance to the high frequency of freeze thaw cycles and fatigue/low temperature cracking has not been well studied. Therefore, an exploratory research project has been implemented to investigate the mechanical response of fiber reinforced asphalt mixtures at low temperatures in comparison with rubberized mixtures. A testing section was selected in a local street and an asphalt paving project was constructed on June 4, 2013 using fiber reinforced and rubberized asphalt mixtures placed on each travel lane. The objectives of the study are to (1) compare the performance of fiberized and rubberized asphalt mixtures at low temperatures and varying traffic loading, and (2) provide a cost-effective analysis for both pavement constructions. Asphalt mixtures with and without fiber additions were collected from the paving project and shipped back to the Materials Laboratory where two types of asphalt mixtures (with and without fibers) were reheated and then compacted to asphalt specimens using a Superpave gyratory compactor. Creep compliance data of specimens were obtained using the bending beam rheometer to evaluate the viscoelastic responses of both asphalt mixtures. Dynamic module tests were performed to simulate mechanical behaviors of both mixtures under varying traffic loading frequencies. In addition to lab experiments, field investigation works including monitoring surface settlements and surface condition assessments have been taken to help with the better understanding of fiberized asphalt mixtures on its resistance to low temperature cracking and dynamic traffic loading. The information of the presentation will include the mechanical responses, field observations, and cost-effective analysis of fiber reinforced asphalt mixtures in comparison with currently used rubberized asphalt mixtures.

Key Words: Fiberized asphalt pavements, low temperature cracking, creep compliance, dynamic modulus