ABSTRACT

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Thesis title: **Evaluation of Antioxidation Property of Lignin in Bitumen Binder**

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Bitumen is majorly used as binder for aggregates in flexible pavements. But due to exposure to environmental conditions, aging of bitumen occurs which results in failure of flexible pavement and reduces the service life of pavements. Aging occurs due to oxidation of bitumen. Aging occurs during mixing, laying and compaction called as short term aging and also occurs during service life of pavement called as long term aging. Accelerated laboratory aging techniques like TFOT, USAT, etc are used to achieve field aging. Lignin as an antioxidant has been used in this study to reduce the aging of bitumen. But lignin gets oxidized at temperature of 130^0C. So USAT test for short term aging was modified from 150^0C for 50min to 125^0C for varying time period which came out to be 3 hours by comparing kinematic viscosity and FTIR aging indexes. Long term aging was done using USAT test at 100^0C for 40hours. Rheological, chemical, thermal and morphological characterization of lignin modified bitumen was done to observe antioxidation properties of lignin. Addition of lignin increased viscosity of bitumen but the increase was not consistent for different concentrations of lignin. Complex shear modulus increased and phase angle decreased due to addition of lignin. Increase in G* was negligible for LMB4% and 6% from short term aging to long term aging indicating negligible aging dur-

ing long term aging after short term aging. Rutting resistance improved and has shown positive impact for LMB4% and 6% but fatigue resistance has shown negative impact. Atomic Force Microscopy (AFM) indicated higher surface roughness after aging for LMB4% than 6% indicating higher aging of LMB4%. Carbonyl index indicated antioxidation at LMB4% and 6% but sulfoxide index was influenced due to release of sulfur from lignin.