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Cracking Performance of Bituminous Concrete Mixes Containing High Percentage of RAP Material

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Abstract : India ranks second for having the largest road network in the world after the United States (U.S.). According to the National Asphalt Pavement Association (NAPA), the U.S. produced about 94.6 million tons of Reclaimed Asphalt Pavement (RAP) in 2021. Despite the benefits of RAP usage, it is not widely adopted in many countries, including India. Rising asphalt binder costs and environmental concerns have spurred interest in using RAP material in asphalt mixtures. However, increasing RAP content may have adverse effects on certain characteristics of asphalt mixtures, such as cracking resistance. Cracking is a common pavement issue that affects the lifespan and durability of hot-mix asphalt pavements. Assessing cracking resistance is crucial in pavement design. Various laboratory tests and performance indicators are utilized to evaluate cracking resistance. This study aims to use the Texas Overlay Tester (TOT) to assess the impact of reclaimed asphalt pavement (RAP) on the cracking resistance of Bituminous Concrete (BC-II) mixes. Following the Marshall Mix Design method, asphalt mixes with RAP contents of 0% (Control), 30%, 40%, 50%, and 60% were prepared and tested at their Optimum Binder Content (OBC). The ITS results showed that the control mix had an ITS value of 1.2 MPa, with slight decreases observed in mixes containing up to 60% RAP, although these changes were not statistically significant ($p=0.538>0.05$). The TSR tests indicated that all mixes exceeded the minimum requirement of 80%. The Texas Overlay Test (TOT) was used to evaluate cracking performance and revealed that higher RAP contents had a negative impact on fatigue resistance. The 50% RAP mix exhibited the highest CFE, indicating that it has the best resistance to crack propagation despite having a lower number of cycles to failure. All mixes were categorized as falling into the Soft-crack-resistant quadrant, indicating their ability to resist crack propagation while being more susceptible to crack initiation.

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