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Impacts of Low-Density Polyethylene (Plastic Shopping Bags) on Structural Strength and Permeability of Hot-Mix-Asphalt Pavements

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Abstract : This paper experiments the effects of low-density polyethylene (LDPE) on the structural strength and permeability of hot-mix-asphalt (HMA) pavements. Different proportions of bitumen (4%, 4.5%, 5%, 5.5% and 6% of total aggregates) and plastic (5%, 10% and 15% of bitumen) contents in HMA mixtures were investigated to estimate the optimum mixture of bitumen and plastic in HMA pavement with long-term performance. Marshall Tests and Falling Head Tests were performed to experiment the structure strength and permeability of HMA mixtures with different percentages of plastic materials and bitumen. The laboratory results show that the optimum binder content was 5.5% by weight of aggregates with higher contents of plastic materials, increase structural stability, reduce permanent deformation, increase ductility, and improve fatigue life of HMA pavements. The use of recycled plastic shopping bags can reduce the use of bitumen content by 0.5% - 1% in HMA mixtures resulting in cheaper material costs with better long-term performance. The plastic materials increase the impermeability of HMA pavements. This study has two-fold contributions: optimum contents of both bitumen and plastic materials in HMA mixtures and the impacts of plastic materials on the permeability of HMA pavements.

Keywords : plastic bags, bitumen, structural strength, permeability
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