

Stiffness and Rutting Assessment of Asphalt Mixtures Using Steel Slag Aggregates

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Abstract - Road infrastructure is one of the most important public assets. The asphalt-paved road network infrastructure represents the main means of transporting people and goods within the United Arab Emirates (UAE). Asphalt pavement surface offers many benefits including cost efficiency, reduction in noise pollution, and comfort. Stakeholders unanimously agree that enhancing the sustainability of asphalt pavements can deliver significant environmental, social, and economic benefits. Recycling of waste materials in asphalt pavements is one of the most successful sustainable practices to reduce construction cost and to save natural resources. In the UAE, steel manufacturers have been stockpiling millions of tons of steel slags that occupy large land areas which could have adverse effects on the surrounding environment. This study presents an assessment of the effectiveness of using steel slag aggregates in local hot mix asphalt (HMA) used in the wearing (surface) asphalt concrete (AC) layer. The mix designs of conventional and steel slag AC mixtures were performed to incorporate the steel slag aggregates at a 50% replacement to the natural aggregates while maintaining the same aggregate gradation for both mixtures. The testing plan of this study included advanced characterization of the conventional and steel slag HMA mixtures. The laboratory tests conducted on the two HMA mixtures were Dynamics Modulus $|E^*|$ test and the Repeated Load Permanent Deformation Test (RLPDT) test, known also as Flow Number, for the assessment of stiffness and rutting respectively. The test results showed a positive impact of the steel slag aggregates on the measured laboratory performance through increasing the $|E^*|$ values at all test temperatures and frequencies by 37% and enhancing the rutting susceptibility of the HMA mixture through decreasing the cumulative permanent strain by 41%.

Keywords: Hot Mix Asphalt – Steel Slag Aggregates – Dynamic Modulus – Rutting – Waste Materials.