Development of interlocking chained plasti-beads for use in stone mastic asphalt

ABSTRACT

The main objective of this study is to design and fabricate chained plastic beads as reinforcing and interlocking strands for use in asphalt mixtures such as Stone Mastic Asphalt mixtures (SMA). This research looks into the shape, size, dimension and type of plastic materials to be fabricated into chained plastic beads that can be used in SMA to provided added resistance in terms of fatigue and rutting. Waste plastics of Nylon 66 type was used in this study as it met the characteristic of melting point of above 220°C. A preliminary analysis was carried out to determine an appropriate shape that could provide a better interlocking in between the aggregates. Finally a diamond shape was adopted for the beads with two different selected sizes of 4mm and 6mm in diameter. The reason for the adoption 4 and 6 mm sizes is that small sized beads provide a better flexibility with the links compared to larger bead and link sizes which may pose rigidity problems during construction. The beads then were linked up with two different sizes of string of 0.5and 1.0mm in diameter with the beads spaced at 20mm interval. With two different diameters for beads sizes and two different diameters for string or chained sizes, this study was carried out in eight matrix combinations consisting of two and three beads system to be incorporated in the mix composition of SMA14 using the Malaysian Public Works Department's (PWD) specifications.A preliminary analysis on the plastic beads showed promising results. The percentage loss of soundness test ranged between 0.7% to 2.1% while the resilient modulus test results showed that, the 2 beads system performed up to 98% better compared to the 3 beads system. Overall none of the SMA mixtures with the chained plastic beads performed lower than the control mix. The wear and tear due to compaction of the mixtures was analyzed using an Asphalt Extraction Test that showed that the maximum tear of the chained plastic beads was less than 16%.

Keyword: Plastic beads; Fabrication; Physical properties; Interlocking mechanism; Tensile strength