

Performance of hot mix asphalt using fine crumb rubber

Abstract

The concept of modifying asphalt mixes is not new in fact, since years ago there have been numerous efforts to modify asphalt mixes in order to get a better performance. The use of crumbrubber modifier (CRM) in hot mix asphalt can be traced back to the 1840s when natural rubber was introduced into bitumen to increase its engineering performance (Heitzman, 1992). However it was not thoroughly discovered until the late of 1980s when people start to realise about the need to improve the conventional asphalt mixes and recycled tire crumb rubber became one of the alternative materials (Epps, 1994). Initially, only coarse rubber was being used in dry process. However, experience with the mix indicated better durability with an increase of fine rubber content. Hence, after 1981, 20% of the originally used coarse rubber was replaced with fine rubber (passing 850 μm sieve) (Esch, 1984).

Takkalou et al., (1985) reported that the required asphalt content is 1.5 to 3% higher than the conventional mixes with similar size and type of aggregates. Koh and Talib, (2006) also agreed that rubber modified asphalt concrete (RUMAC) required higher binder content as the percentage of crumb rubber increased. Elliot, (1993) stated that the effect of CRM on the optimum bitumen content (OBC) and volumetric properties is significant for RUMAC mixes with 3% CRM. Studies by Troy, Sebaaly and Epps, (1996) discovered that gap graded CRM mixes. had lower Marshall stabilities than dense-grade CRM mixes. Rutting is a flexible pavement distress caused by the accumulation of permanent deformation in the pavement layers due to the repeated application of traffic. Stroup Gardiner and Krutz, (1992) discovered that the addition of CRM by using dry process does enhance the rutting resistance of the mixes at higher temperatures. Similarly, Rebala et al., (1995) stated the used of CRM in the dry process allows it to serve as discrete particles which may enhance the rutting resistance. While Koh and Talib, (2006) found that rutting of asphalt mixes at 2,000 load cycles was reduced by 22% with the addition of 3% crumb rubber. Another study did by Troy, Sebaaly and Epps, (1996) discovered CRM pavement sections done in Louisiana exhibit similar or lower rut depth than the control sections after five to seven years in service. However, Takkalou et al., (1985) stressed out that performance evaluation is significantly dependent on the crumb rubber gradation, air voids, aggregate gradation, mixing temperature and curing conditions.