Analysis of fatigue cracking of Warm Mix Asphalt. Influence of the manufacturing technology

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PII: S0142-1123(18)30035-5
DOI: https://doi.org/10.1016/j.ijfatigue.2018.01.029
Reference: JIJF 4558

To appear in: *International Journal of Fatigue*

Received Date: 2 October 2017
Revised Date: 26 January 2018
Accepted Date: 28 January 2018

Please cite this article as: Sol-Sánchez, M., Fiume, A., Moreno-Navarro, F., Rubio-Gámez, M.C., Analysis of fatigue cracking of Warm Mix Asphalt. Influence of the manufacturing technology, *International Journal of Fatigue* (2018), doi: https://doi.org/10.1016/j.ijfatigue.2018.01.029

Analysis of fatigue cracking of Warm Mix Asphalt. Influence of the manufacturing technology

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Abstract

In recent decades, warm mix asphalts have been proven to provide a series of benefits in the field of asphalt mixture production. However, to exploit these advantages it is essential that these materials present a mechanical performance and durability that is at least equivalent to traditional hot mix asphalts. The short-term mechanical behavior of warm mix asphalt has been widely studied and compared to that offered by hot mix asphalts, however few analysis have been made in the long-term. Among the various failure modes, fatigue cracking is regarded as one of the main concerns that can arise during the long-term service life of asphalt pavements. Based on these considerations, the present paper conducts a comparative analysis of the fatigue cracking life of hot and warm mix asphalts produced through the three main technologies currently used to reduce the manufacturing temperature (chemical additives, organic additives, and the foaming process). The results reveal that warm mix asphalts present similar resistance to micro and macro-cracking development to that measured for hot mix asphalts under the different testing conditions, whilst there are no significant differences between the various types of technologies evaluated.

Keywords: warm mix asphalt, fatigue, cracking, UGR-FACT, additive, foaming**.**

1. Introduction

In the last two decades, in order to reduce emissions and fossil fuel consumption, cleaner manufacturing processes have begun to emerge in the production of asphalt mixes. Warm Mix Asphalt (WMA) represents a group of technologies that allow for this goal by working at reduced temperatures. In fact, while Hot Mix Asphalt (HMA) are manufactured at 160-170°C, WMAs are produced and mixed at temperatures from 20 to 55 C° lower (D'Angelo et al., 2008; EAPA, 2010; Rubio et al., 2012). In general, these technologies tend to reduce the viscosity of the asphalt or increase the surface tension and adhesiveness between binder and aggregates, improving the coating of the latter at lower temperatures (D'Angelo et al., 2008). WMA technologies are usually classified into three main categories: (i) foaming processes (subdivided into water-containing and water-based processes); (ii) addition of organic additives (Fisher-

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