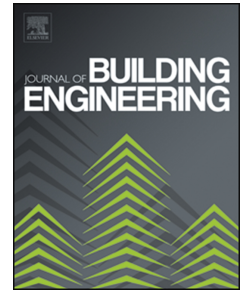


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EFFECT OF PORTLAND CEMENT AS A FILLER IN HOT-MIX ASPHALT IN HOT REGIONS

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ABSTRACT: Flexible pavement in hot regions often show significant signs of distress, like rutting and shoving. This distress is mostly caused by traffic, an inadequate viscosity of bitumen, and/or an insufficient aggregate angularity. At present, the conventional bitumen viscosity of 60/70 (B60/70) has many disadvantages in hot countries like Libya, where road-surface temperatures can reach up to 70°C. This paper reports on the use of Ordinary Portland Cement (OPC) as a filler substitute to improve the rigidity of asphalt concrete mixes made with B60/70 bitumen and low-quality aggregates. This new mixture increases the pavement's stability and resistance to high temperatures. To establish the effects of OPC on the performance of asphalt mixtures in hot climates, four different percentages of OPC (0%, 2%, 4% and 6%) are used as filler substitutes in three different mixes. The performance of the three mixes are assessed using the Superpave Gyratory Compactor and the Asphalt Pavement Rutting Analyzer. Findings indicate that mixtures containing higher percentages of OPC as a filler are significantly more resistant to rutting. These experimental results show that Portland Cement Filler Asphalts (PCFA) represents a more stable alternative to conventional asphalt that also reduces thickness requirements, because of the higher resulting modulus of rigidity. This is equally important in hot rural areas like those found in Libya, where they have very few quarries and aggregates are very costly to transport.

KEYWORDS: Portland cement, Hot Mix Asphalt, shoving, rutting, Gyratory Compactor.

1. Introduction

In hot countries and geographical regions such as Libya, road surface temperatures can reach up to 70°C (Salem, Uzelac, & Matic, 2014). However, Hot Mix Asphalt (HMA) pavement design still employs conventional bitumen penetration grade asphalt binders (e.g., B60/70) and other materials that result in substantial rutting and shoving. Making matters worse, current road construction in Libya uses the "Marshall Method," (MM) which is an older test dating back to 1939 (Zumrawi & Sheikh Edrees, 2016). This test was once widely used, but is now almost exclusively employed for roads in moderate climates, making it unsuitable for roads in Libya.

The present study uses the "Superpave Method" (SPM) developed between 1987-1993 by the Strategic Highway Research Program (SHRP) (Swami, Mehta, & Bose, 2004), since it has become increasingly popular over the last few decades (Almadwi & Assaf, 2017). One of the SPM's approaches consists of using different types of additives, such as fibers, polymers, or Portland cement, as a way to increase the performance of asphalt-concrete mixtures. The current

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