Behaviour of Foamed Bitumen (FB) mixes with Reclaimed Asphalt Pavement (RAP) Material

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1. Problem Statement

Unlike Hot Mix Asphalt (HMA) in which bitumen and aggregate are primary components, in foamed bitumen (FB) mixes, water and, often, active fillers are the additional ingredients. Therefore, FB mixes involve more variables, have a less controllable mixing procedure, and are expected to exhibit more complex behaviour than HMA.

2. Aim and Objectives

The primary aim of this research is to understand the behaviour of FB mixes with cementitious additives and RAP material.

The objectives of the research are as follows;
1. Detailed literature review of mix design and structural design procedures that are being followed by different agencies.
2. Studying fatigue behaviour and durability of FB mixes with cement and RAP material.
3. Developing strength-maturity relationships for FB mixes.
4. Understanding the stress dependency behaviour FB mixes.
5. Conducting mechanistic (non-linear elastic) analysis of pavements with FB layers .

3. Methodology

Mix design:

The methodology adopted for selection of number of gyrations and compaction moisture content is as follows
1. Determine optimum moisture content (OMC)
2.Compact aggregates with OMC with the gyratory compactor and determine number of gyrations (NG) needed to achieve 100% modified proctor density.
3. NG will be the number of gyrations that will be used when compacting FB mixes
4. For DBC determination, both ITS and UCS test in dry and soaked conditions will be employed.

It was also understood from literature that the cement addition in the mix does not affect the DBC (*He and Lu, 2004*).
However, RAP addition affects the DBC (*Wahhab et al., 2012*). So, accordingly mix design procedure will be carried out.

Stress – strain behaviour:

The experimental work aims to obtain the response of FB mix at various stress levels (50kPa, 100kPa, 200kPa, 500kPa) at various loading rates (0.1 Hz to 25Hz) and temperature (10°C, 25°C, 40°C, 50°C). Study stress dependant behaviour (non-linear) and frequency dependent behaviour (visco – elastic).

Fatigue behaviour:

The tests shall be repeated at different levels with respect to the chosen loading test condition to obtain a fatigue line. A plot of number of cycles (N) against N divided by vertical deflection (VD) will be used. The N value at which N/VD reaches its maximum value will be considered as $N_{critical}$.

Response analysis:

A comparative analysis using both linear and non-linear using analytical tool will be carried out.
Implementing structural design of the pavements with FB treated mixes studied in this research using MEPDG will also be studied.

4.Results