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Laboratory and field investigation of interlayer bonding between asphalt concrete layer and semi-rigid base constructed by using continuous construction method

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HIGHLIGHTS

- Continuous construction method (CCM) is proposed to improve the interlayer bonding condition between semi-rigid base and asphalt layer.
- Mechanism of bonding improvement was studied using laboratory testing.
- Optimal base layer initial compaction degree and paving interval time are identified for construction quality control.
- Validate the effect of CCM by comparing the deflections and number of transverse crack measured from test sections.

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ABSTRACT

In asphalt concrete pavement layered system, interlayer bonding condition has significant effect on its behavior and performance. Bond condition between asphalt layer and semi-rigid base layer is more severe than others because of the different mechanical response under environmental and traffic loading. In this study, continuous construction method (CCM) is proposed to improve the bonding condition by increasing layers interlock depth. As a new construction method, the laboratory testing and field testing are conducted to understand the mechanism of bonding improvement. Quality control methods during the procedures of CCM are proposed. Optimal initial compaction degree of the base layer and paving time interval between base layer and asphalt layer are suggested for better bonding condition. According to the results of field crack survey and deflection testing, CCM can reduce transverse crack number and deflection level with better bonding condition between asphalt layer and semi-rigid base.

1. Introduction

Interlayer bonding condition has dramatic effect on asphalt concrete pavement behavior and performance under environmental and traffic loading. Roffe and Chaignon (2002) found 60% loss of fatigue life from full bond to no bond by using French pavement design program and analysis software ALIZE for a specific pavement structure with 6 cm surface layer on 13 cm hot mix asphalt (HMA) layer and 20 cm aggregate base [1]. King and May (2003) conducted an analysis of the effect of bond condition on asphalt pavement performance by using roads computer program BItumen Stress Analysis (BISAR) and found that fatigue life decreases 50% with 10% bond loss [2]. Previous researches also illustrated the effect of bonding condition on asphalt pavement mechanical response and life based on experimental results [3–7]. Chun et al. (2015) also confirmed the importance of interlayer bond condition on flexible pavement structure response and performance using analytical and experimental results [8].

In asphalt concrete layers, bonding condition can be improved by optimal pavement structure design, surface treatment before upper layer placement and applying tack coat. However, the distresses due to poor interface bonding between semi-rigid base and asphalt concrete layer can be more severe than others. The main reason is that the different behavior between semi-rigid base and asphalt concrete under traffic and environmental loading [9]. Interlayer bonding was found to have significant effects on reflective crack propagation [10,11]. Ge et al. (2015) mentioned good interface bonding between asphalt concrete layer and concrete can improve reflection cracking resistance by comparing shear testing and fatigue testing results [12].

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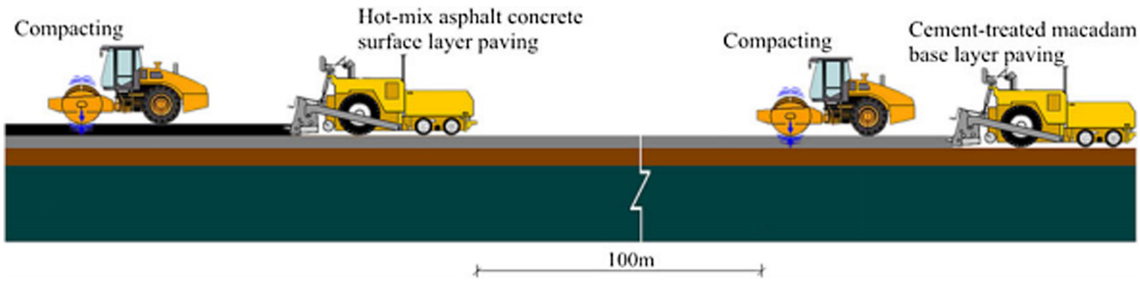

Fig. 1. CCM construction process [13].

Fig. 2. Pavement construction process of CCM.

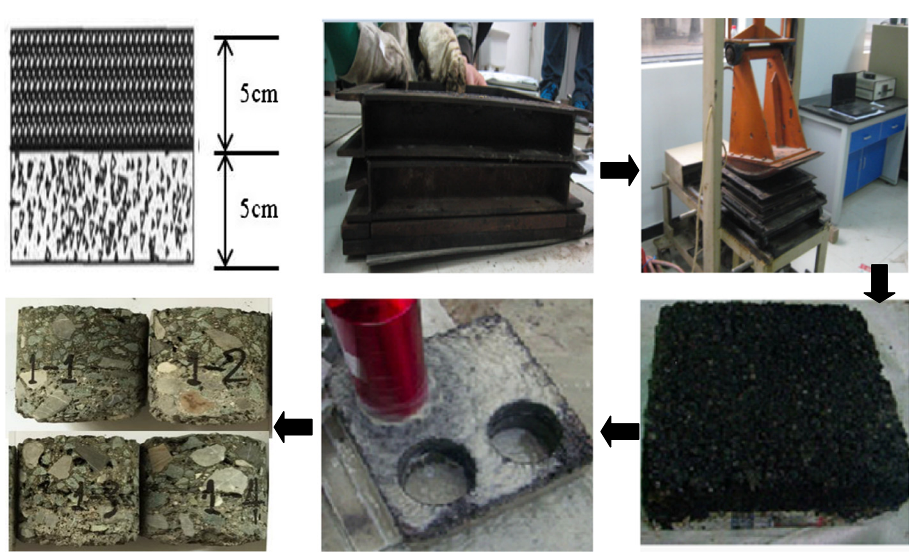

Fig. 3. Specimen molding and core drilling process.