UNIVERSITI TEKNOLOGI MARA

PERFORMANCE OF COLD MIX ASPHALT INCORPORATED WITH AROMATIC POLYAMIDE FIBRE AS DISTRESS MAINTENANCE

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ABSTRACT

Permanent deformation, raveling, and potholes are signs of surface deterioration that if left untreated, can get worse rapidly. A practical alternative for these failures is Cold Mix Asphalt (CMA), which eliminates the requirement for hot mix manufacture and enables quick repair in a variety of weather and road conditions. Due to Malaysia's frequent rainfall, potholes filled with CMA exhibit a more severe affinity and bonding mechanism. Since CMA requires more time to cure before reaching its final strength and has poorer mechanical performance, it should only be used as a short-term solution to pothole maintenance issues. Therefore, this research encourages a new approach to the maintenance issue of pothole patching in order to provide a long-lasting and durable CMA. This study focuses on the interaction between potholes in the pavement and the adherence and affinity of the CMA combined with Aromatic Polyamide Fibre (APF). The morphology and microstructure of the asphalt mixes are analyses by using AFM and FESEM test. This research also summarizes the adherence adequacy of the APF-CMA used in the permanent maintenance of potholes in the pavement industry. The result shows that CMA incorporated with APF improved the Marshall Stability from 7.480 kN to 7.674 kN. It also enhances the Indirect Tensile Strength with an increment of almost twofold from control sample while reducing the air voids. Besides that, the microstructural analysis indicates that CMA incorporated with APF gives better resistance towards moisture and adhesion hence, it can be concluded that CMA with APF has excellent mechanical and adhesive properties, which makes it a viable option for long-term pothole repair.

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CHAPTER 1
INTRODUCTION

1.1 Research Background

Road in Malaysia specifically has been experiencing numbers of unsolved and reoccurring distress that causes a lot of heated discussions and complaints among the people. A common problem that keeps on reoccurring is the potholes; which without proper mitigation will lead to fatigue and breakage to the pavement. Besides that, this road surface problems also put drivers at risk for injury, lower ride quality, and raise maintenance expenses (Nazri et al, 2025).

Resurfacing pavements usually cost lots of money and time. It also uses quite a number of labor and workforce; hence CMA is the fast and easier approach compared to HMA. In contrary with HMA, CMA bonds its aggregate and residual asphalt at ambient temperature causing reduction in energy requirements. Therefore, the usage of CMA as patching materials is efficient, time saving, and economical (Huang et al, 2020).

CMA is preferred for its energy efficiency, lower emissions, and easier logistics. It is made at room temperature using bitumen emulsions like MS-IK. Nevertheless, the mechanical and durability properties of CMA frequently fall short of those of traditional HMA. Specifically, its delayed curing time, diminished load-bearing capability, and vulnerability to water degradation make it unreliable for long-term pothole repair applications (Zaumanis, 2015).

Recent research has investigated the incorporation of different fibre reinforcements into asphalt mixtures as a means of addressing this performance gap. It has been demonstrated that fibres such polyester, polypropylene, glass, and basalt improve the cold and hot asphalt mixes' tensile strength, moisture resistance, and fatigue life (Du et al, 2021; Chegenizadeh et al, 2022). By creating a network inside the asphalt matrix, these fibres enhance the material's internal cohesiveness and stress-distribution capabilities.

Of the fibres choices, APF, also known as aramid fibres, are synthetic fibres that have proven to offer exceptional mechanical qualities, such as high tensile strength, thermal stability, and resistance to environmental deterioration. Applying aramid fibres