# Aspha-min Modified Warm Mix Asphalt: A Review

*Sandali Dilsara[1, *], Chamod Hettiarachchi[2]*

## Abstract

This review paper provides a comprehensive comparative analysis of the application of Aspha-min in Warm Mix Asphalt (WMA) technology, with a particular focus on its performance, environmental impact, and economic benefits in comparison to traditional Hot Mix Asphalt (HMA). HMA has long been the standard for asphalt pavement, known for its robust performance and durability. However, production and compaction of HMA requires high temperatures, typically between 140-160°C. Therefore, widespread use of HMA has raised concerns about its environmental impact due to high fuel and energy consumption and pollutant emissions. To address these concerns, WMA technology has been developed to meet the economic and environmental sustainability needs of pavement construction. The use of WMA technologies causes a reduction in mixing and compaction temperatures by about 20-40°C than those required in HMA and thereby causes reduced fuel consumption and lower emissions. WMA technologies consist of various methods that can be categorized into three main groups: organic additives, chemical additives, and foaming processes. These technologies work through specific mechanisms to reduce the production and compaction temperatures of asphalt mixtures. Among them, Aspha-min is a synthetic zeolite containing sodium aluminum silicate, specifically developed as an additive for WMA, which is categorized as foaming technology. The effectiveness of Aspha-min in WMA stems from its capacity to release chemically bound water at temperatures exceeding 85°C. With around 20% water by weight, Aspha-min steadily releases this moisture at elevated temperatures. The introduction of water causes a foaming reaction in the asphalt binder, resulting in increased volume and decreased viscosity. This foaming process is crucial for enhancing the workability and coating of aggregates at reduced temperatures, making it easier to produce and apply WMA at much lower temperatures compared to conventional HMA. In WMA production, Aspha-min is added directly into the mixer with the binder, at a rate of 0.2-0.3% by mass. The review consolidates findings from multiple studies regarding the influence of Aspha-min on various performance metrics such as moisture susceptibility, rutting resistance, indirect tensile strength (ITS), fatigue resistance, stiffness, and aging. A significant number of studies indicate that the incorporation of Aspha-min in WMA results in reduced moisture resistance, underscoring the necessity of using anti-stripping agents to counteract potential negative effects. The addition of Aspha-min enhances the aging properties of WMA, resulting in better long-term performance when compared to HMA. This is particularly beneficial for extending the service life of asphalt pavements. In terms of rutting resistance, fatigue resistance, ITS, and stiffness, the impact of Aspha-min addition is inconsistent and appears to be highly dependent on specific material sources and local conditions. While some studies report improvements in these properties, others suggest either negative effects or negligible changes. This variability highlights the need for localized studies and tailored formulations to optimize the performance benefits of Aspha-min in different contexts. From an environmental perspective, the incorporation of Aspha-min in WMA offers substantial benefits including significant reductions in energy consumption and greenhouse gas emissions. This

makes WMA a more sustainable option compared to HMA, aligning with global efforts to reduce the carbon footprint of construction activities. Furthermore, the economic benefits are noteworthy. The reduced energy requirements during the production of WMA translate to cost savings, although these must be balanced against the initial costs of Aspha-min. In conclusion, this review highlights the multifaceted advantages of using Aspha-min in WMA technology. While it enhances long-term performance and provides significant environmental and economic benefits, the variable impact on certain performance metrics necessitates careful consideration and potential use of supplementary materials like anti-stripping agents. Overall, the adoption of Aspha-min in WMA represents a promising advancement in asphalt technology, contributing to more sustainable and cost-effective road construction practices.

***Keywords:*** *aspha-min, warm mix asphalt (WMA), synthetic zeolite, foaming technology*

Authors Details;

1. Department of Civil Engineering, University of Moratuwa. sadalidilsara36@gmail.com
2. Department of Civil Engineering, University of Moratuwa. chamod.hettiarachchi@gmail.com

Acknowledgements:

The authors would like to acknowledge the Senate Research Committee (SRC), University of Moratuwa for funding this research.