Environmental Engineering and Management Journal

October 2025, Vol. 24, No. 10, 2139-2150
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu
http://doi.org/10.30638/eemj.2025.165

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SYNERGISTIC EFFECTS OF REJUVENATORS AND WARM MIX ASPHALT: A LIFE CYCLE ASSESSMENT FOR SUSTAINABLE ROAD CONSTRUCTION

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Abstract

Atmospheric emissions have recently reached extremely high levels, approaching a point of no return. For this reason, global policy is moving towards reversing this trend. In road construction, two technologies are gaining importance: rejuvenators for reusing recycled asphalt pavements (RAP) and thermos regulators to lower asphalt concrete (AC) production temperatures. However, the need for the asphalt plant to simplify logistics led to the development of a single product that could fulfil both objectives.
This paper therefore aims to evaluate the environmental impact of a new bio-based single product for this dual functionality. In order to estimate the environmental impact, a Life Cycle Assessment (LCA) analysis was carried out. LCA estimations were carried out for CO_{2eq} and energy consumption to produce 1 ton of asphalt concrete. Three types of asphalt concrete were evaluated: AC with neat bitumen, AC with modified bitumen (PMB-wet modification method), and AC with neat bitumen and polymeric compound (PMA-dry modification method). Results showed that using more RAP could lead, on the one hand, to significant environmental (up to 44% reduction in CO_{2eq}) and energy savings (up to 78% reduction in energy consumption). On the other hand, the decrease of production temperatures allows a reduction of CO_{2eq} and energy up to 7% and 6% respectively, regardless of the percentage of recycled material used. The synergy between the two technologies leads to a maximum reduction of about 50% in CO_{2eq} and 80% in energy consumption. These results align with the European Green Deal's goal of reducing emissions by 50% by 2035.

Key words: life cycle assessment, sustainability, reclaimed asphalt, rejuvenator, warm mix asphalt

Received: May, 2025; Revised final: August, 2025; Accepted: September, 2025; Published in final edited form: October, 2025

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