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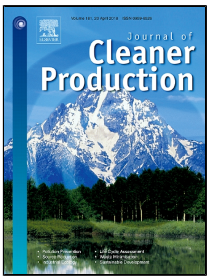

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Yong Wen, Yuhong Wang, Kecheng Zhao, Dan Chong, Weidong Huang, Gengren Hao, Shicong Mo

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The engineering, economic, and environmental performance of terminal blend rubberized asphalt binders with wax-based warm mix additives

Yong Wen [a], Yuhong Wang [a, *], Kecheng Zhao [a], Dan Chong [b], Weidong Huang [c], Gengren Hao [a], Shicong Mo [a]

[a] *Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University, Hung Hom, Hong Kong*

[b] *Department of Management Science and Engineering, Shanghai University, Shanghai, China*

[c] *The Key Laboratory of Road and Traffic Engineering, Tongji University, Shanghai, China*

ABSTRACT

Produced with fine crumb rubber (CR) particles and at demanding conditions, *Terminal Blend (TB)* asphalt binder is an alternative approach to incorporating CR from scrap tires into asphalt binders. It offers the advantages of convenient transportation, storage, and usage at asphalt mixture plants. In the study as presented in this paper, Sasobit® and Polyethylene (PE) wax were used as warm-mix additives to further modify the properties of TB asphalt binders. These additives are anticipated to reduce the production temperatures of TB asphalt mixtures, hence reducing fuel consumption and greenhouse gas (GHG) emissions in mixture production and reducing asphalt fumes in construction. It is also anticipated that the engineering performance of TB asphalt binders modified with such additives are not adversely affected. To gain a comprehensive understanding of TB asphalt binders modified with the two additives, a variety of laboratory tests were conducted, including storage stability, high temperature performance, low temperature performance, fatigue, and other basic rheological properties. The costs of producing TB asphalt mixtures with or without the additives were compared, using the conventional hot-mix asphalt mixtures as a reference. Energy consumptions and GHG emissions generated in mixture production were also evaluated. Actual field construction was performed using TB asphalt mixtures with Sasobit® and using conventional asphalt mixtures. Both aerosol and volatile organic compounds (VOCs) samples were collected at zones close to the loose mixtures and were analyzed. The two wax-based additives were found to enhance the storage stability and workability of the TB binders. The other engineering properties related to the use of wax-based additives are mixed. The selection of right type of additive depends on local climate conditions. While the costs of using the TB binders (with or without additives) are higher than the costs of using the base (neat) asphalt binder. Energy consumptions

* Corresponding author. Tel: +852 27664489; Fax: +852 23346389; E-mail: ceyhwang@polyu.edu.hk (Y. Wang)