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Abstract

Investigating Tools for Sustainability Assessment of Road Pavements in Europe †

Gabriella Buttitta, Gaspare Giancontieri, Silvia Milazzo, Chiara Mignini, Patricia Hennig Osmari, Usman Ghani and Davide Lo Presti *

Department of Engineering, University of Palermo, Building 8, Viale delle Scienze, 90128 Palermo, Italy; gabriella.buttitta01@you.unipa.it (G.B.); gaspare.giancontieri@unipa.it (G.G.); silvia.milazzo02@unipa.it (S.M.); chiara.mignini@unipa.it (C.M.); patricia.hennigosmari@unipa.it (P.H.O.); usman.ghani@unipa.it (U.G.)

* Correspondence: davide.lopresti@unipa.it

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1. Overview and Motivation

Sustainability assessment (SA) is a method to support decision making processes through the evaluation of system effectiveness, environmental integrity, economic valuation, and social implications [1]. SA can be carried out through the application of life-cycle-based techniques for quantitative assessment, or by performing a mainly qualitative approach via sustainability rating systems (SRS).

In the field of civil engineering, many SRS have been proposed, all based on assigning point values to actions that are determined to contribute to the overall sustainability of the project. However, only few of these systems can be applied specifically to compare road pavement technologies and/or maintenance and rehabilitation strategies. This study focuses on adapting two of these tools: GreenPave [2], developed in the US, and BE^{2}ST (Building Environmentally and Economically Sustainable Transportation–Infrastructure–Highways) [3], developed in Canada. The investigation consisted of evaluating the feasibility of increasing the amount of reclaimed asphalt (RA) in European wearing courses by carrying out a comparative analysis of eight different mixtures, containing up to 90% of RA.

2. Methodology, Results and Main Contribution

As anticipated above, the SA was performed using two SRS: GreenPave and BE^{2}ST. Both tools allow us to carry out an SA exercise by assigning a label to each compared alternative, from Gold to Bronze according to the final rating; however, GreenPave limits the assessment to the asphalt mixtures technology development phase, while BE^{2}ST allows us to also compare road pavement maintenance strategies. Even if there are some similarities, the scores are assigned with different criteria. In fact, if GreenPave groups the sustainability goals into four categories (Pavement technologies, Material and Resources, Energy and Atmosphere, Innovation and Design Process), BE^{2}ST judges the performance, evaluating the Life Cycle Assessment [4,5] for environmental aspects, the Life Cycle Cost Analysis for economic impacts [6], the traffic noise, the social costs, the social carbon costs and the recycling ratio. Furthermore, BE^{2}ST expresses the results as a percentage of the baseline: the label depends on the term of comparison.

In order to apply the former tool to the EU context, ECORCE M [7] was used instead of PALATE for calculating environmental indicators, while the Social Carbon Cost was assessed by considering the European average annual salary.

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At first, the study provides limits and benefits of the EU-adapted SRS; then, a validation of the tools was performed by carrying out a SA of three case studies. As a result, both SRSs provide similar trends of scores when compared with hot asphalt mixtures for wearing courses with no recycled materials; however, GreenPave labels all the RA technologies as Gold or Silver, unlike conventional asphalts, which never meet the requirements for sustainability (Figure 1). On the other side, with BE^{2}ST, almost all the new mixtures achieve a label (Figure 2).

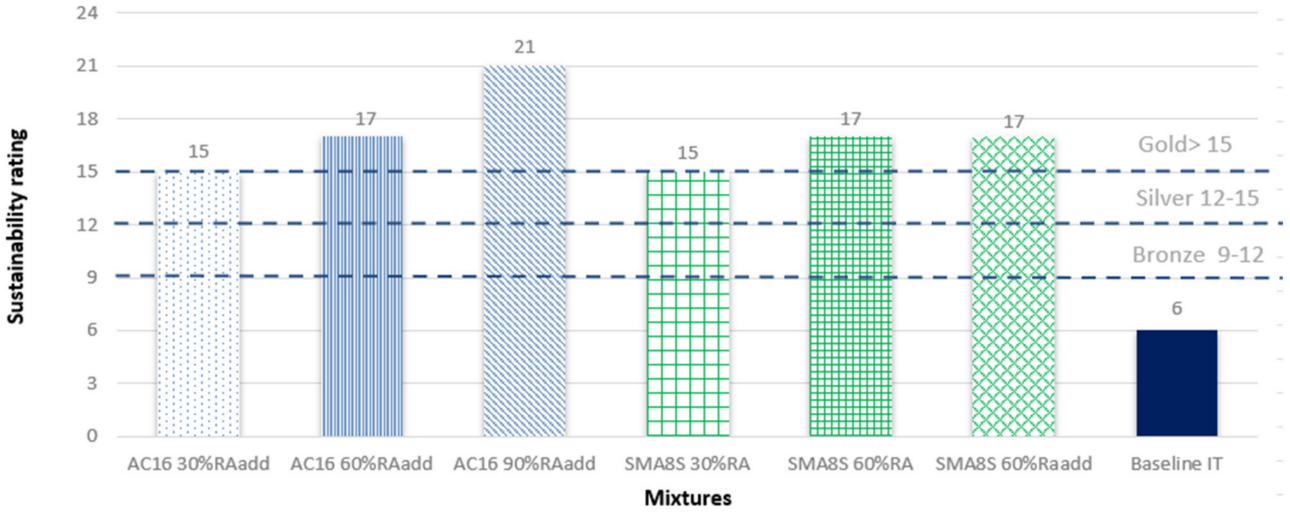

Figure 1. Results of the south EU case study calculated with EU-adapted GreenPave system.

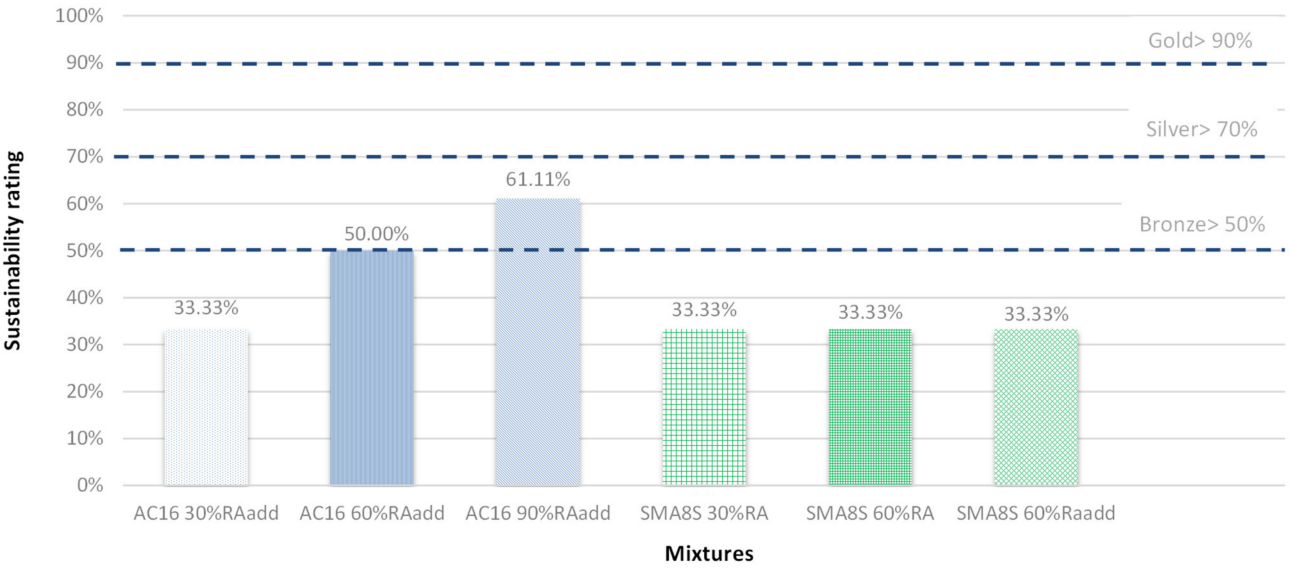

Figure 2. Results of the south EU case study calculated with EU-adapted BE^{2}ST system.

3. Conclusions and Future Works

In conclusion, it can be stated that, regardless of the SRS tools, maximizing the quantity of RA in hot mix asphalt for wearing courses, while guaranteeing the same level of durability, seems to be a more sustainable solution than not recycling at all. This is true for both a single intervention and by considering a 60-year maintenance strategy.

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