Abstract

Investigating tools for sustainability assessment of road pavements in Europe

Gabriella Buttitta [1], Gaspare Giancontieri [1], Silvia Milazzo [1], Chiara Mignini [1], Patricia Hennig Osmari[1], Usman Ghani[1] and Davide Lo Presti [1]*

[1] University of Palermo
* Correspondence: davide.lopresti@unipa.it

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1. Overview and motivation

Sustainability Assessment (SA) is a method to support decision-making process through the evaluation of the 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 which are determined to contribute to the overall sustainability of the project. However, only few of these systems can be applied specifically to compare road pavements technologies and/or maintenance and rehabilitation strategies. This study focuses on adapting two of these tools: GreenPave [2**Errore. L'origine riferimento non è stata trovata.**], developed in US, and BE²ST (Building Environmentally and Economically Sustainable Transportation-Infrastructure-Highways) [3], developed in Canada. The investigation consisted in 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 BE²ST. Both tools allow to carry out a 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 BE²ST allows to compare also 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 & Resources, Energy & Atmosphere, Innovation & Design Process), BE²ST 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, BE²ST expresses the results as 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 indicator; while the Social Carbon Cost was assessed by considering the European average annual salary.

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 SRS provides 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 the conventional asphalts which never meet the requirements for sustainability. On the other side, with BE²ST almost all the new mixtures achieve a label.
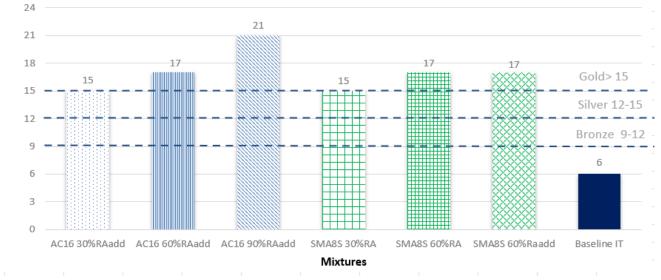
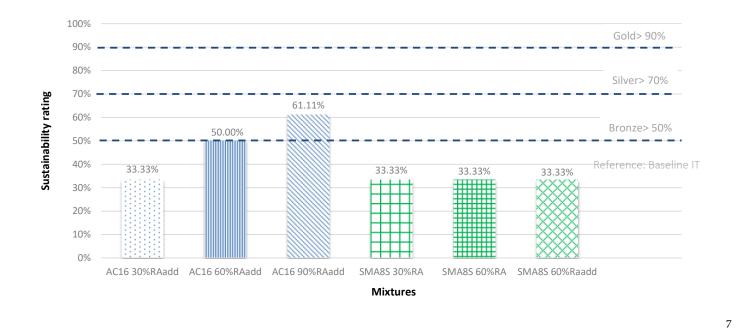Figure 1 - Results of the South-EU case study calculated with EU-adapted GreenPave system

Figure 2 - Results of the South-EU case study calculated with EU-adapted BE²ST system

3. Conclusion 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 years maintenance strategy.