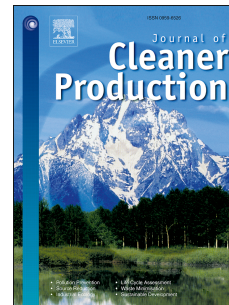


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Economic and environmental impact study of warm mix asphalt compared to hot mix asphalt

Ana Costa, Agostinho Benta



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# 1 **Economic and environmental impact study of warm mix asphalt compared to hot** 2 **mix asphalt**

3 Ana Costa<sup>a</sup>, Agostinho Benta<sup>b</sup>

4 <sup>a</sup>Civil Engineering Department, University of Aveiro, Campus Universitário de Santiago, 3810-  
5 193 Aveiro, Portugal

6 <sup>b</sup>RISCO, Civil Engineering Department, University of Aveiro, Campus Universitário de  
7 Santiago, 3810-193 Aveiro, Portugal

8 Corresponding Author: Ana Rita Almeida e Costa; tel.:+351234370049; fax:+351234370094; e-  
9 mail: ritacosta@ua.pt

## 10 **Abstract**

11 For more than two decades warm mix asphalt has been the major research challenge for the  
12 production of environmentally sustainable asphalt pavements. The primary objective of their  
13 implementation is to reduce fuel consumption and pollutant emissions in order to improve  
14 environmental quality and decrease production costs. However, because the economic and  
15 environmental benefits have not always been properly evaluated, these technologies are very far  
16 from being explored at their full potential, mainly due to the idea that the additives are  
17 expensive. Thus, in this study, in order to assess the potential economic and environmental  
18 advantages of the application of these mixtures, a warm high modulus asphalt concrete was  
19 produced with a chemical additive and a warm rough asphalt concrete was produced with an  
20 organic additive. For both cases, the maximum theoretical cost of additive was evaluated. The  
21 results of this study show that the maximum cost obtained ensures that the production of the  
22 respective warm mixture is economically advantageous. The corresponding reduction in carbon  
23 dioxide emissions was also assessed. Both studied mixtures have shown significant reduction of  
24 energy consumption and, consequently, reduction of CO<sub>2</sub> emissions. It is possible to conclude  
25 that all these environmental benefits could be achieved with economical saves and guaranteeing  
26 a good performance of the pavements.

27 **Keywords:** warm mix asphalt; additives; economic benefits; environmental benefits;  
28 sustainable pavements

## 29 **1. Introduction**

30 Approximately 700 Mt of bituminous mixtures were produced in 2012, as displayed in Fig. 1  
31 (EAPA, 2012). Although the amount of bituminous mixtures produced annually decreased over  
32 the last few years, this industry continues to contribute substantially to environmental pollution  
33 by releasing a large volume of greenhouse gases (GHG) into the atmosphere. The signature of  
34 the Kyoto Protocol, which contains a binding agreement that commits developed countries to

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