Design of New Sustainable Pavement Concrete: An Experimental Road

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Abstract : The development of concrete pavements that include recycled waste with active and predictive safety features is a possible approach to mitigate the harmful impacts of the construction industry, such as CO2 emissions and the consumption of energy and natural resources during the construction and maintenance of road infrastructure. This study establishes the basis for formulating new smart materials for concrete pavements and carrying out the in-situ implementation of an experimental road section. To this end, a comprehensive recycled pavement solution is developed that combines eco-hybrid cement made with 25% mixed recycled aggregate powder (pMRA) and biomass bottom ash powder (pBBA) and a 30% substitution of natural aggregate by MRA and BBA. This work is grouped in three lines. 1) construction materials with high rates of use of recycled material, 2) production processes with efficient consumption of natural resources and use of cleaner energies, and 3) implementation and monitoring of road section with sustainable concrete made from waste. The objective of this study is to ensure satisfactory rheology, mechanical strength, durability, and CO2 capture of pavement concrete manufactured from waste and its subsequent application in real road section as well as its monitoring to establish the optimal range of recycled material. The concrete developed during this study are aimed at the reuse of waste, promoting the circular economy. For this purpose, and after having carried out different tests in the laboratory, three mixtures were established to be applied on the experimental road.

Keywords : biomass bottom ash, construction and demolition waste, recycled concrete pavements, full-scale experimental road, monitoring
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