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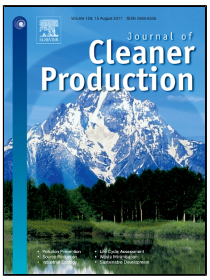

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Compared environmental and economic impact from cradle to gate of concrete with natural and recycled coarse aggregates

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Abstract

The construction sector, a representative activity in Europe, generates high Environmental Impacts: extraction of large quantities of raw materials, high energy consumption and significant production of pollutants and waste. Thereby, this study is intended to be a contribution to the research on the best concrete solutions from an environmental and economy point of view, presenting the comparison, in environmental and economic terms, of the life cycle of concrete with coarse natural and recycled concrete aggregates. A life cycle assessment of concrete (cradle to gate) was performed including all stages except application, maintenance and demolition stages. In the activities where collection of data from companies was not possible, generic databases (Ecoinvent 3 and European Life Cycle Database) were used as reference. Using CML baseline method and Cumulative Energy Demand, the Environmental Impacts of 216 concrete mixes from 24 references were analysed. The results were analysed by strength class and taking into account the influence of the cement content, superplasticizer incorporation and w/c ratio. The results show that the use of coarse aggregates recycled from concrete can significantly reduce the Environmental Impacts and costs, proving that cement is the main contributor to both impacts. The concrete mixes with best mechanical results use coarse aggregates recycled from concrete with better characteristics (low water absorption and porosity, higher density and specific mass), usually corresponding to lower Environmental Impacts and costs.

Keywords: environmental impact, life cycle assessment, life cycle costs, recycled coarse aggregates, recycled concrete, SimaPro.

1. Introduction

The construction sector is one of the most important for the economy in Europe, but also one of the most harmful for the environment due to the nature of this activity. In addition to the consumption of large amounts of natural resources and to the emission of polluting gases into the atmosphere, this sector is responsible for the production of 25%-30% in mass of wastes in Europe (JRC-IES, 2011).

Concrete plants are an example of that situation. Annually, these facilities globally consume 1,000 million of tonnes of water, 1,500 million of tonnes of cement and 10,000 million of tonnes of aggregates (Becchio *et al.*, 2009).

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