6 March 2014
Issue 364

Subscribe to free weekly News Alert

Source: Blankendaal, T., Schuur, P. & Voordijk, H. (2013). Reducing the environmental impact of concrete and asphalt: a scenario approach. *Journal of Cleaner Production* 1-10. DOI: 10.1016/j.jclepro.2013.10.012.

Contact: T.Blankendaal@bamgroep.nl

Read more about: Climate change and energy, Resource efficiency, Sustainable production

1. See http://www.lcia-recipe.net

2.LE2AP (Low Emission Asphalt Pavement) is supported by the European Commission under LIFE+. See: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=4738&docType=pdf

European Commission

Science for Environment Policy

Concrete and asphalt's green credentials could be improved through changes to production

Concrete and asphalt's environmental impact could be reduced by over a third through changes to manufacturing processes and the use of alternative raw materials, according to research. A scenario study based on life cycle analysis has indicated that using alternative types of cement in concrete and producing asphalt at lower temperatures could substantially improve the green credentials of these two common building materials.

The building industry is responsible for 40 to 50% of global greenhouse gas emissions. In addition to its potential impact on climate change, the industry's resource extraction and production facilities can also damage landscapes, disrupt ecosystems and pollute air and water, with implications for human health.

This study, conducted at a construction firm operating mainly in north-western Europe, assessed the environmental impact of two major building materials: concrete and asphalt, using the ReCiPe method[1]. This method considers three types of environmental damage: human health, ecosystem quality and resource depletion.

There are two main ways to improve the environmental impact of concrete. Firstly, the raw material Portland cement can be replaced with the industrial by-products fly-ash or blast-furnace slag. Secondly, the virgin material gravel can be replaced with crushed recycled concrete. The researchers investigated 10 scenarios of alternative concrete manufacture consisting of three standard types of cement, which contained varying concentrations of either recycled concrete or gravel and replaced proportions of Portland cement with fly-ash or blast-furnace cement.

The results revealed that the use of recovered concrete instead of gravel did not necessarily lead to a lower environmental impact in the short term. This is likely to be because, in this case, recycled concrete has to be transported and cleaned, whereas many of the sites in this study are able to access locally-sourced gravel.

The type of cement used had a much greater influence on concrete's environmental impact. For concrete that had 19% fly-ash content and 76% Portland cement, the environmental impact was reduced by up to 12% compared to the concrete which only used Portland cement. Concrete with 50% blast-furnace slag content and 46% Portland cement reduced the impact by up to 39% compared to Portland cement only.

The results also showed that using recovered material in asphalt significantly reduces asphalt's environmental impact. The use of reclaimed asphalt is standard at this company, but if its percentage is increased from 40 to 60%, the impact of asphalt can be reduced by 12%. In addition, asphalt produced at lower temperatures (100 ºC compared to 165 ºC) – a product known as warm-mix asphalt – has an environmental impact that is approximately a third lower than hot mix.

The study assesses the potential of changes in the production of concrete and asphalt to reduce environmental impact. However, further information is needed on the lifetimes of the different types of concrete and asphalt; if the more environmentally-friendly forms are less durable, this may negate some of their initial benefits. Such concerns are currently being investigated by a LIFE+ project LE2AP[2] which aims to assess the durability of asphalt mixes with minimum 80% reclaimed pavement.