Title: Comparison of CO_2 emissions of various applications of railway ballast renewal in relation to ProRail's CO_2 performance ladder

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In the Netherlands, ProRail, as the government's task organisation for maintenance and extensions of the national railway network infrastructure, has set a clear and consistent policy on how to improve the sustainability within the many tasks that suppliers including contractors have to perform. This policy resulted in a so-called "CO_2 performance ladder", that enables contractors to distinguish themselves and to get credits for sustainable and green performance foremost focused on the reduction of CO_2 emissions.

Strukton Rail, a large railway contractor in the Dutch context, approached Delft University of Technology to analyse the total carbon footprint life cycle of two different methods on ballast renewal within a case study project. The purpose of this study was to create insight on what the actual carbon footprint of various methods is and how the "CO_2 performance ladder" of ProRail would credit the sustainability behaviour of these various methods.

The case study at hand is about the ballast renewal of a four kilometre single track on the double track section connecting The Hague with Schiphol Airport, an intensively used part of the Dutch railway system. The study analysed two comprehensive work plans based on two renewal methods.

At first, the so-called traditional method is described and the results show that this method emits more CO_2 related to the transport of more personnel and a much higher number of small-size applications, like vans, trucks and shovels. Besides, in the traditional renewal method, the screening of the ballast takes place on another location, which means more transport of ballast from and to the construction site.

Secondly, the so-called mechanical renewal method has been analysed. This method uses mainly an in-situ ballast screening machine, less personnel and less time, and the CO_2 emission of this method scores lower on all steps of the life cycle. The second method is more efficient in time, less disturbance of the train service, and the costs are slightly higher.

The main conclusion of this case study is that, at one hand, the "CO_2 performance ladder" of ProRail does stimulate suppliers, including contractors, to consider more sustainable approaches and technologies in general. However, at the other hand, the "CO_2 performance ladder" does not credit the individual technologies that might have substantial lower CO_2 emission, but might be somewhat higher in bid prices. If two competing contractors quote on the same project and if their place on the "CO_2performance ladder" is comparable, the choice will still be made on economic performance, and the actual CO_2 emission of various methods is not considered in anyway.

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This paper will plea for a more constructive way of considering the CO_2 impact of railway construction activities. Both railway contractors and railway governmental organisations have to come to an explicit use of technologies that quantitatively reduce the total CO_2 impact. The only way for doing this is to prefer certain methods over others, not only based on their economic performance, but to consider their socio-ecological performance as well.