



## Re-using existing prefabricated prestressed concrete girders

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### Abstract

The future of bridge and overpass design is to be fully circular. To reach that goal many innovations in construction should be made. One of the first steps is to alter the mainly existing linear construction sequence. Therefore, Royal HaskoningDHV started the innovation of re-using prefabricated concrete girders for new overpasses and bridges. The economic and technical feasibility is researched as well as the impact on climate and emissions. To prove our concept, an overpass is deconstructed, and the 40-year-old prefabricated concrete girders are disassembled and put on transport, instead of crushing them to aggregate. In a temporary storage the girders are inspected, repaired, adapted and certified. So, they are fit for their future use in a new structure. Structural assessments, environmental impact and costs calculations are made for a case study. It is concluded that re-using prefabricated girders is technical and economical feasible, with a remaining lifespan of at least 100 year. Up to 44% of CO<sub>2</sub>-eq. emissions can be saved and even 61% of abiotic depletion (in Sb-eq.). The main obstacle is the unawareness at the different stakeholders that re-using these high-quality girders is possible and these girders can function for the next century.

**Keywords:** circular economy, concrete bridges, prefabricated prestressed concrete girder, re-use.

### 1 Introduction

It is estimated [1], the Dutch construction industry consumes about half of the raw materials and 40% of the total energy of the Netherlands. Construction is responsible for up to 40% of the waste produced and almost 35% of all CO<sub>2</sub> emission released. About 97% of the construction waste is recycled and used as a foundation material for roads. However, the demand for road

foundation material is decreasing by an expected amount of 40% due to less road development. On the other hand, it is expected more construction waste is produced, as more and more structures reach their end-of-service-life. Recycled aggregate from crushed concrete can also be used in new concrete. But for recycled aggregated concrete still a lot of energy is used and emissions are released. Currently less than 3% of the construction waste is used in recycled aggregate concrete.