Abstract

In order to conserve resources and reduce mineral construction waste, the construction industry should act in the sense of the circular economy in the future. The recycling of concrete waste for use in concrete production can make a significant contribution because concrete has been one of the most important building materials in the construction industry for decades. Currently, concrete waste is mainly downcycled or disposed of in landfills, accordingly, large quantities of natural raw materials have to be mined for concrete production.

To promote the circular economy, the aim of this thesis is to explain the solution space for recycling concrete waste and to present the current material and traffic flows for the city of Cologne and its surrounding area. The focus is on the recycling of construction waste into recycled aggregate for use in concrete production. Based on this, an optimization model will be developed to determine the optimal number and location of recycling plants from an economic and traffic point of view. For this purpose, a mathematical model is formulated and implemented in Python. By applying the optimization model for the city of Cologne, the recycling of concrete waste is balanced with regard to the use of natural resources, the energy consumption and the CO_2 emissions of the freight transport.

The construction of a recycling plant in a centrally located industrial area proves to be optimal for the city of Cologne. By recycling construction waste, which is slightly more energy-intensive than the downcycling currently carried out, natural resources are saved. Optimizing the location of recycling plants leads to a reduction in CO_2 emissions of the freight transport. The transport distances in particular have a significant influence on the environmental impact of construction waste recycling. Basically, the recycling of construction waste into recycled aggregate for use in concrete production promotes the circular economy of the construction industry.