Recycling of load-bearing concrete elements – new method for assessment of development of cracks

Recycling of concrete elements requires documentation of the capacities. In this project, DTU Byg will develop a new digital beetle control technique to quantify formations of cracks in the load-bearing elements during selective demolition.

Resource consumption and recycling of concrete elements

Excess consumption of resources of the globe is a reality. It is necessary to break the linear consumption patterns – buying, using and throwing away. We must take better care of our resources. In fact, this is one of the main thoughts in this development towards circular economy which is an important vision in the EU. The construction sector is a large consumer of resources and therefore also plays a central part in relation to reducing the consumption of natural resources. One of the ways in which we can do this is to recycle the construction components.

Recycling of concrete elements will result in an actual reduction of extraction of sand and gravel as well as less consumption of cement. Additionally, it has been stated that recycling will save up to 95% of the CO_2 emissions compared to production of conventional concrete. Still, recycling of concrete elements is not taking place. One of the main reasons for this is missing methods for documentation of the quality.

Cracks in concrete and possibility of recycling

The load-bearing structures are relieved during selective demolition. Formation of cracks in concrete after relief is a well-known phenomenon. Primarily, it is caused by failure of the adherence between aggregates and cement. The cracks have a great impact on the longevity (i.e., chloride penetration in reinforced concrete) of the structural capacities (i.e., strength and rigidity). The knowledge of development of cracks during selective demolition is essential to be able to assess the quality in relation to the next use of the concrete elements.

New method for assessment of crack development during removal of load

Load-bearing structures are affected in different ways in relation to both environmental conditions and load, which also has an impact on the development of cracks during selective demolition. This means that the state must be determined for each individual structure element, and an on-site method for rapid scanning is necessary. A such method will be developed during this project. The method is based on digital image correlation (DIC). The non-contact technique enables ongoing measurement and monitoring of strains and cracks in the concrete surface during the relief. Image processing is a focus point in this project so that different crack parameters can be calculated. Among these are crack placement, width, length and area of the concrete surface. The formation of surface cracks is illustrated in the histograms that facilitate a quantitative analysis and the assessment of the applicability of the concrete element for recycling. The method will be

tested during demolitions, and it is the objective that the method can be put into use at the completion of the project.