Development of a Material Circularity Index for Building Design in Taiwan

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Abstract:

According to statistics, as much as one third of the natural material resources of the earth were consumed by the building construction sector every year. But facing the problem of earth resource depletion, advanced countries have researched actively in recent years to introduce the concept of circular economy into the planning and design of buildings. The idea is to use as much as possible the recycled materials in building design and construction so that the consumption of natural material resources can be reduced. The Netherlands and other countries in European Union have even set a goal that by 2050 the construction of new buildings will no longer use any new natural materials (virgin materials)!

This study develops an operable method for assessing the material circularity of a building in design and construction in Taiwan. A thorough literature review as well as workshop discussions with local architects and experts are conducted to formulate the assessment method. In the method, only those building materials and products certified by the local official authorities with labels can be recognized as circular ones. A simplified version of the developed method is then tested out on five building cases in Taiwan to calculate the material circularity of each of them. The five test cases including 2 office, 2 residential and 1 school buildings. The resulted material circularity indexes range from 16.09% to 28.0%. Further comparison of the five cases and analysis are reported.

The developed assessing method can be employed in a building's design as well as construction phases to calculate its material circularity in order to meet the corresponding requirement by government regulations or by contracts. Thus, the use of circular building materials as well as products can be facilitated. The consumption of natural material resources in building construction can be reduced.

Keywords:

Building design, circular economy, circularity index, recycled material.