

Making sustainable decision for building maintenance

Abstract

With the development of a city to a certain stage, there is a need to maintain the ever-increasing stock of old buildings in a safe and proper status. Especially in these days, climate change and energy shortage are a frequent topic of discussion. It is convinced that sustainable building maintenance is essential for our society. In front of the overwhelming energy efficient alternative approaches and their complicated interrelationships with carbon, cost and labour, it is extremely difficult, if possible, for people to identify the most sustainable combination of alternatives by experience. Therefore, this study proposes a novel decision making methodology, setting up optimization model in Excel Solver, to identify the most sustainable solution automatically. To do so, the first step is to quantify the sustainable criteria in the form of life cycle carbon emission, life cycle cost, and life cycle employment opportunity generated. Then an optimization model set up in Excel Solver is used to demonstrate that, with different mixes of building technologies and processes, we can optimize one sustainable criterion under the constraints from the other two criteria or we can optimize one objective which normalizes the differences in measurement units of all criteria and combines them. The efficiency and applicability of the proposed approach is tested on a typical Hong Kong residential retrofitting project. After comparing optimal solutions and corresponding material choices of 8 scenarios, findings are presented. Finally, further research is suggested.