RANKING OF WALLING MATERIALS USING ECO-EFFICIENCY FOR TROPICAL CLIMATIC CONDITIONS: A SURVEY-BASED APPROACH

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Construction is an important sector that consumes a significant amount of resources worldwide and produces a lot of waste. Buildings as a whole share nearly a quarter of total electricity generation in tropical countries, which has adverse effects on the natural environment and their national economies. Improving the energy efficiency of the building is based on the choice of materials and technologies that complement the local climatic conditions. Compressed stabilized earth blocks are considered an innovative and proven building envelope upgrade that improves building efficiency both economically and ecologically given their cradle-to-grave phase. However, the cradle-to-grave life cycle impacts of compressed stabilized earth blocks compared to conventional walling materials still need to be assessed under tropical climatic conditions over the long run. Hence, the objective of this study is to compare compressed stabilized earth blocks with conventional walling materials such as burnt clay bricks and cement sand blocks. The life cycle thinking approach has been integrated into the eco-efficiency analysis to compare and evaluate the materials mentioned above taking into account their total lifespan, from cradle to grave.

A case study approach has been followed in order to compare the walling materials. The cost component has been computed in every stage of building life cycle and the net present value has been computed through a cash flow. The life cycle assessment has been considered in the form of emissions as both embodied as well as operational emissions. Hence, the eco-efficiency index has been quantified. The result of the case study indicated that when the eco-efficiency index of burnt clay bricks is taken to be 1, cement sand blocks showed 0.959 (decrease of 4%) and compressed stabilized earth block showed 1.013 (increase of 13%) showing the highest eco efficiency. Further when plaster was not applied, the index increased to 1.054 showing 4% increment than the plastering situation.

As a result, compressed stabilized earth block was selected as the most efficient material with environmental benefits. In addition, since it can be used as a walling material even without the application of plaster, costs and environmental impacts could be further reduced when used without plaster. The results of this research will encourage building developers, contractors, and practitioners to choose the most desirable material for their projects taking into account the costs and environmental impacts of the life cycle of materials.

Keywords: life cycle cost; life cycle assessment; building thermal comfort; material energy assessment

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