

**FINANCIAL AND ENVIRONMENTAL
SUSTAINABILITY OF 3D PRINTED CONCRETE
WALLS IN SRI LANKA**

**MASTER OF SCIENCE
IN
CONSTRUCTION PROJECT MANAGEMENT**

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FINANCIAL AND ENVIRONMENTAL SUSTAINABILITY OF 3D PRINTED CONCRETE WALLS IN SRI LANKA

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This report was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfilment of the requirements for the Master of Science in Construction Project Management.

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DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university to the best of my knowledge and believe it does not contain any material previously published, written or orally communicated by another person or myself except where due reference is made in the text. I also hereby give consent for my dissertation, if accepted, to be made available for photocopying and inter library loans, and for the title and summary to be available to outside organizations.

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ABSTRACT

At present, increased housing cost associated with complex human expectations, have deprived the people from affording a dwelling which is one of the basic human needs. This urges the use of sustainable solutions in housing construction. With the remarkable entrance of 3D printing technology to the construction industry, it is worthwhile to focus on sustainability aspects of this new technology in the Sri Lankan housing sector. In the view of that, this research is aimed at assessing the sustainability of 3D printed concrete walls compared to the other walling types used and which have potential to be used in the housing construction in Sri Lanka.

Since 3D printing has not been used in the Sri Lankan construction sector, ‘secondary data analysis’ was selected as the research methodology with the use of previous researches, 3D printer vendors and printer manuals. Technical aspects required for the study such as printing mechanism, printing material etc. was selected based on the knowledge gained through literature survey. Life Cycle Cost and Embodied Energy of 3D printed concrete walls were calculated in order to ascertain the economic and environmental sustainability, based on the same case studies followed by the previous researches on different walling materials and the results were compared against such previous research results.

With related to economic sustainability, the research findings identified that 3D printed concrete walls has the second lowest Life Cycle cost with low maintenance cost and energy cost which offset the high initial cost and low resale value. In terms of environmental sustainability, 3D printed concrete walls possess a middle rank as per the Embodied Energy calculation results.

In combination, 3D printed concrete walls are both economically and environmentally sustainable compared to the Brick and Cement Block walls which are the two dominant walling types in the Sri Lankan housing sector. Therefore, 3D printing proves a great potential to be used in Sri Lanka, when its sustainability performance are bundled together with other advantages such as ability to be printed in complex shapes with no additional cost enabling advanced architectural features, less labour intensiveness and less time consumption. In addition, the results of this research provides clear guidance on the level of economic and environmental sustainability achievable through 3D printed concrete walls in comparison with other potential walling types in Sri Lankan housing sector.

Thus, this research provides inputs to the contractors, investors, and developers in Sri Lanka, on the sustainability dimensions of 3D printed walls against other walling types in order to seek improvements to their construction practices and efficiencies.

Key Words: Economic Sustainability, Environmental Sustainability, Life Cycle Cost, Embodied Energy, 3D printed concrete walls

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