



# Effect of moisture condition on cement masonry blocks with different fine aggregates: river sand, lateritic soil and manufactured sand

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**Abstract.** With the escalating infrastructure developments in recent years, the demand for river sand has significantly increased due to its importance as a raw material in the construction industry. River sand excavation from the river bed, on the other hand, is restricted due to environmental concerns. It has caused an insufficient source of river sand to meet the present demand and thus forced the researchers to find alternative materials for river sand. Even though agricultural wastes and industrial wastes have been considered as potential alternatives in the past, researchers recommend lateritic soil and manufactured sand as they both comply with requirements for mechanical properties. Published literature shows that masonry blocks with M-sand and lateritic soil satisfy the minimum strength requirement. However, studies on the durability of these blocks, especially under extreme weather, are rare to find in the existing literature. The present study focuses on the moisture effects on cement masonry blocks cast with three types of fine aggregates; river sand, lateritic soil and manufactured sand. Moisture characteristics and the moisture effect on the mechanical performance of cement-sand blocks, cement stabilized earth blocks and cement-manufactured sand blocks were thoroughly investigated in this study. Results reveal that mechanical characteristics of cement stabilized earth block is adversely affected by moisture whereas, cement-manufactured sand blocks show better mechanical characteristics than cement-sand blocks under moisture conditions.

**Keywords.** Masonry; moisture; M-sand; river sand; lateritic soil.

## 1. Introduction

Masonry is a widely deployed construction technique in housing construction, which uses construction materials including adobe, stone, fired-brick, concrete [1] and bound together by means of cement mortar. In Sri Lanka, around 90% of the population live in brick or cement-sand block masonry structures [2]. The production of bricks has declined due to its higher energy requirement for burning and soil excavation for bricks reduces the quality of the agricultural lands [2]. On the other hand, the manufacture of cement-sand blocks requires extensive excavation of river sand from the river beds that creates several environmental issues [3]. The restrictions pertaining to the raw materials used in masonry block production has geared researches towards finding an alternative for river sand for masonry block production. Recently, considerable attempts have been made to assess the use of Manufactured sand (M-sand) [4–6] and soil from the local area (Lateritic soil)

[7–9] as a substitution for river sand to manufacture cement-sand masonry blocks. M-sand is produced by crushing stones into sand-sized particles, and washing it to remove dust. Substituting M-sand over river sand poses the following benefits; better strength enhancement in cement-based materials, reduces cement consumption and serves as eco-friendly material. Lateritic soil is a locally available raw material in tropical regions, which is inexpensive and considered as eco-friendly [8, 10].

Reviewed literature shows that cement-sand masonry blocks with M-sand and lateritic soil not only satisfy the minimum strength requirement recommended by local standards but also provide better strength than conventional cement-sand masonry blocks [4, 8, 9, 11, 12]. However, several studies show that these blocks failed to satisfy the commonly adopted requirement for absorption rate [13]. Moreover, studies on the durability of these blocks subjected to extreme weather are rare to find in published literature. Masonry blocks manufactured with cement and fine aggregates contain a large amount of voids. When saturated, these voids are filled with water and when in the dry

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