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TECHNICAL PAPER

Comparison of strength and durability properties between earth-cement blocks and cement–sand blocks

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Abstract
In recent years, due to the growth of the construction industry in Sri Lanka, the consumption of river sand has increased. Because of overexploitation of river sand and its various harmful environmental and social consequences, sand mining is limited by authorities, and therefore, there is a scarcity for good quality river sand at a reasonable cost. As a result, local soil is used for the production of masonry units as sand replacement material. In this study, to compare the performance of cement–sand blocks (CSBs) and earth-cement blocks (ECBs), three different cement:sand and cement:local soil mix ratios were considered for CSBs and ECBs, respectively. An experimental program was carried out to determine the physical, strength and durability characteristics of both block types. The results show that ECBs performed better in dry compressive strength and most of the durability characteristics. However, strength reduction due to wet conditions is a major issue for ECBs.

Keywords Earth-cement blocks · cement–sand blocks · River sand · Local soil · Durability

Introduction

Masonry is a major construction material and has been widely used in developing countries like Sri Lanka. There are many masonry materials, such as country fired brick (CFB), cement-sand block (CSB), hollow core fired brick, hollow cement blocks, earth-cement block (ECB) and compressed stabilized earth block (CSEB) that are used for house construction. Figure 1 shows some of the masonry materials used for house construction in Sri Lanka. Among these masonry units, CSBs are widely used in Sri Lanka due to their good strength and durability characteristics.

In general, river sand is used as fine aggregate and mixed with cement for the production of CSBs. However, due to recent economic development, Sri Lanka needs a lot of new construction and this has rapidly increased the demand for river sand. Especially in the north and east of Sri Lanka, where a large number of people who were displaced and lost their homes due to the destruction of three decades of conflict added to the destruction caused by the 2004 tsunami, need new housing units. At the same time, due to overexploitation of river sand and its various harmful environmental and social consequences, the Geological Survey and Mines Bureau (GSMB) of Sri Lanka has restricted sand mining in several places. As a result of high demand and limited supply, not only has river sand's cost increased rapidly, but also there is poor grade sand supplied to this region.

Considering this issue, in the Sri Lankan condition, many research works have been carried out to identify possible alternatives for river sand. In recent years, materials such as offshore sand [1], quarry dust [2], bottom ash [3], mud [4] and agricultural wastes [5] have been considered as a full or partial replacement for river sand. Despite these materials showing good physical and mechanical characteristics, they remain problematic because of their labor-intensive production and durability. Especially, this issue is more apparent in the northern part of Sri Lanka, with the non-availability of skilled labor and hot and humid climate.

In recent years, there has been considerable development in the use of local soil with stabilizer for construction purposes. The most popular method is ECB, which is a form of earthen construction and has been explored using the locally available soil. It is a low-cost technology using

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