VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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PROJECT REPORT

On

"Studies on Engineering Properties of Thin Jointed Masonry with Cement-Lime-Soil Paste as Mortar"

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In

INFRASTRUCTURE CONSTRUCTION AND MANAGEMENT

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ABSTRACT

Masonry Construction is the most basic forms of construction. Masonry is an assemblage of masonry units one above the other with mortar layer in between the masonry units which binds the units firmly. Mortar most widely used in the cement sand mortar, generally in the proportion 1:6. Over the past few decades, extensive construction activity has resulted in severe exploitation of Sand and Cement. River Sand is obtained from the process of dredging or Sand Mining. The ill effects of sand mining or dredging are numerous. Cement and Burnt Clay bricks are also very good contributors of greenhouse gases that destroy the ozone layer. Considering all these problems associated with river sand and other conventional materials, it is our responsibility to adapt to alternative material that can be used as a replacement over conventional materials like natural river sand to strike a balance between construction and environmental conservation.

In the present study, an attempt is made to eliminate the use of river sand in masonry construction using alternative materials so that construction activity has minimal impacts on the environment. Hence Cement-Lime-Soil Paste (CLSP) in two different proportions has been used as mortar as complete replacement over natural river sand in mortar. A certain level of stabilization with binders, soil can be used effectively as an alternative building material. Hence the conventionally used burnt clay brick in masonry has been replaced with Stabilized Mud Blocks (SMB) as masonry unit with a view to achieve a sustainable or eco-friendly construction without any compromise in strength parameters.

The strength of parameters of both masonry unit and masonry mortar has been evaluated in the study. The thickness of the mortar joints has been limited to 5mm; hence it is referred to as ***thin jointed masonry***. This reduction in thickness is with a view to achieve higher strength; to achieve better modulus as Masonry unit and Mortar has been prepared using the same soil. The block wet compressive strength at 30 days and 60 days was 8.50 MPa and 11.30 MPa respectively. Flexural strength of block was 2.04 MPa and 3.02 MPa at 30 days and 60 days respectively. To have a perfect understanding of the mortar, it is essential to analyse the mortar in two state namely Workability of Mortar in its fresh state and Compressive strength in Hardened state. Workability is the ease with which mortar can be spread uniformly over the masonry units without setting. CLSP showed very good workability as Lime based Mortars have low Hydration rate. There was plenty of time to

spread the paste uniformly and also take care of any dimensional irregularities in the masonry unit. Mortar cubes of 1:1:2 CLSP and 1:1:1.5 CLSP were cast and evaluated for its cube compressive strength at 28 days and 56 days respectively. One set of mortar cubes were cast with 1:6 Cement Sand mortar for comparative analysis. The compressive strength of 1:1:2 CLSP, 1:1:1.5 CLSP and 1:6 Cement Sand mortar was found to be 11.29 MPa, 14.28 MPa and 6.85 MPa respectively at 28 days; 13.7 MPa, 18 MPa and 10.5 MPa for 56 days respectively. Stack bonded Prism were cast with two different proportions of CLSP as mortar (1:1:2 and 1:1:1.5) and also with conventional cement river sand mortar (1:6) for comparison. Prism with 1:1:2 CLSP had a compressive strength of 4.17 MPa and 4.63 MPa at 30 days and 60 days respectively. 1:1:1.5 CLSP had a compressive strength of 4.48 MPa and 5.60 MPa at 30 days and 60 days respectively. The compressive strength of 1:6 Cement - Mortar Prism was found to be 4.84 MPa and 5.68 MPa at 30 days and 60 days. Flexural strength was evaluated at 60 days. The flexural strength of Prism cast using 1:1:2, 1:1:1.5 CLSP and 1:6 Cement - Sand Mortar were found to be 0.09 MPa, 0.11MPa and 0.12MPa respectively.

From the present study, we can conclude that CLSP can be used effectively as masonry mortar with complete replacement of sand. With thin jointed masonry, there is around 50% reduction in volume of materials that is consumed in conventional construction with 12-15mm thick joints. The embodied energy associated with the masonry using CLSP is around $1/4^{th}$ as compared with conventional construction with 1:6 CM. The use of SMB as unit eliminates the need for plastering which further leads to savings in volume of materials being consumed and in turn proves to be economical. There is also a lot of saving in time as plastering is eliminated. Plastering is usually done with a rich mortar which makes the plastered wall a good contributor of Green House gases. In the present case, there is no plastering and the structure has very good thermal efficiency and is eco-friendly. Thus over all one can conclude that masonry with CLSP as mortar and SMB as unit can prove to be ***Effective, Economical and Energy Efficient Structure***.