Optimization Strength of Masonry using Different Masonry Units

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Abstract

Masonry construction is a vast area which is one of the mostly used construction now a days. It is mainly used to divide the space inside the buildings. Now a days masonry structures has got huge scope in building high rise buildings. The term 'Masonry' refers to a construction material formed by combining masonry units such as stone and brick with a binding material called mortar. Masonry is generally a highly durable form of construction. However, the materials used, the quantity of the mortar and workmanship, and the pattern in which the units are assembled can significantly affect the durability of the overall masonry construction. This study has both experimental and analytical work. There are many different manufacturers which manufacture bricks and concrete blocks by using different materials. It is quite difficult for us to relay on one particular manufacturer having good characteristics for construction purpose. In this present work the two different manufacturer brick and concrete blocks are taken. The basic tests was conducted and walls have been casted to know the strength and crack patterns and then the reliability analysis was carried out.

Keywords: Masonry, reliability analysis

Introduction

Masonry is one of the ancient form of construction which is also most reliable one. Compressive loads can be best carried by masonry structures as they are composite in structure. Masonry structures are weak in tension and shear zone. These are built by individual units such as bricks, concrete blocks, stones, limestone, marble, granite etc. The main function of these structures is to protect the structure from nature or to partition the space inside. Now a days brick masonry and solid concrete block masonry are mostly used for the behavior of buildings. Concrete blocks are of standard rectangular in shape which can be of either completely solid or hollow. They are stronger compared to the brick masonry structures. Brick masonry and concrete block masonry are mainly used for the construction of walls which are also said as load bearing structures. Unreinforced masonry is a commonly used building material due to its economical and durable aspects. However it does not possess good seismic performance as it is brittle material with low tensile strength and exhibits little ductility when subjected to seismic actions. Hence it is unsuitable for regions of high seismicity. Masonry walls are the main seismic load resisting elements in unreinforced masonry building.

Methodology

The present investigation involves both experimental and analytical studies of bricks and Solid concrete blocks. The material properties for analysis was obtained experimentally by testing materials in laboratory. Then the compressive strength, LVDT and crack patterns of brick and solid concrete block masonry of different manufacturers was obtained. Walls of brick and solid concrete block was casted and tested. An experimental investigation was carried out by conducting basic tests on bricks and then Reliability Analysis was carried out.

Experimental Investigation

This presents experimental work carried out on wall. Basic tests on cement, fine aggregate, bricks and solid concrete blocks were carried out. Masonry walls were casted using solid concrete block of dimension 900×1050 mm and brick masonry of dimension 800×1050 were casted and tested for compression

Tests on masonry

Figure 1: Casting of Brick masonry wall

Figure 2 : Casting of Solid concrete block masonry wall

Figure 3: Masonry wall

Figure 4: Test setup of block masonry wall Type 1 before and after testing for compression strength.

Figure 5: Test setup of block masonry wall Type 2 before and after testing for compression strength.

Figure. 6: Test setup of brick masonry wall Type 1 before and after testing for compression strength.

Figure.7: Test setup of brick masonry wall Type 2 before and after testing for compression strength.

Figure 8: Measuring crack width using Travelling Microscope

Results and Discussions

Test procedure: Two different brick masonry wall of size 800*1050 mm and two different concrete block masonry wall of size 900*1050 mm.

Test results of Brick masonry Type 1 : the vertical load is applied at the first brick course of type 1 wall and it failed due to a vertical crack in top brick course which propagated through entire length of the wall. the specimen failed at a maximum load of 450KN with a corresponding deflection of 3.12mm and Standard deviation σ of 131.33.

Test results of Brick masonry Type 2 : The vertical load applied at the first course of Type 2 wall and it failed due to a vertical crack in top brick course which propagated through entire length of the wall.the specimen failed at a maximum load of 310KN with a corresponding deflection of 5.25mm and Standard deviation σ of 90.92.

Test results of Block masonry Type 1 : The vertical load applied at the first course of Type 2 wall and it failed due to a vertical crack in top brick course which propagated through entire length of the wall.the specimen failed at a maximum load of 530KN with a corresponding deflection of 5.8mm Standard deviation σ of 152.97.

Test results of Block masonry Type 2 : The vertical load applied at the first course of Type 2 wall and it failed due to a vertical crack in top brick course which propagated through entire length of the wall. The specimen failed at a maximum load of 590KN with a corresponding deflection of 4.59mm and Standard deviation σ of 171.7

Table 1: Results of Masonry wall testing

	Brick Masonry		Block Masonry	
	Type 1	Type 2	Type 1	Type 2
Max Load	450 KN	310 KN	530 KN	590 KN
Standard Deviation	131.33	90.92	152.97	171.75

Conclusions

1. This study of tests resulted in basic strength parameter of building materials like bricks and blocks.
2. The MTB (Type 2) in bricks and Manjunatha Blocks (Type 1) in blocks shows higher values compared to other two brick and block manufacturers.
3. Based on the maximum load and reliability analysis the best manufacturer is decided.

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