

# A Study on Compressive Strength of Concrete Brick Masonry for Different Mortar Proportions

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**Abstract**— Experimental study for the check of compressive strength was carried out by the author on brick prisms of concrete bricks and cement mortar. Concrete brick masonry prisms were tested for mortar proportions of 1:4, 1:3, 1:2, 1:1.5 and 1:1 cement to sand, 3 specimens for each proportion were tested. After testing it was concluded that the proportion of cement to sand in mortar do not play any significant role on the ultimate compressive strength of concrete brick masonry.

**Key words:** Scaled Concrete, Particle Size Reduction, Compressive Strength, Brick Masonry Prism

## I. INTRODUCTION

Masonry is the word used for construction with mortar as a binding material with individual units of bricks, stones, marbles, granites, concrete blocks, tiles etc. Mortar is a mixture of binding material with sand. Binding materials can be cement, lime, soil or any other. The durability and strength of masonry wall construction depends on the type and quality of material used and workmanship. A concrete block is primarily used as a building material in the construction of walls. It is sometimes called a concrete masonry unit (CMU). A concrete block is one of several precast concrete products used in construction. The concrete commonly used to make concrete blocks is a mixture of powdered Portland cement, water, sand, and gravel. This produces a light grey block with a fine surface texture and a high compressive strength. However due to low compressive strength requirement, very less cement content required and raw constitutes can be approached by locally available material Which makes cement concrete block cost effective too.

## II. SCALING OF CONSTITUENTS

Here author was intended to make a reduced scaled a concrete brick masonry house model for study purpose. The scale used for modelling was 1:5. For reduced scaling purpose all constituents were approximately reduced to one fifth of their original dimensions. The size of coarse aggregate used in prototype concrete mix was approx. 19 mm (0.75 inch). The size of grit used in prototype concrete mix was approx. 12.7 mm (0.5 inch). Coarse aggregate and grit were used in ratio of 1:1 to form total portion of aggregate. The sand particles passing through the sieve of 4.75 mm were used in prototype concrete mix. OPC of grade 53 was used as cement for prototype concrete mix. Sand particles were sieved to get particles for reduced scaled concrete mix. The sand particles passing through the sieve of 4.75 mm and retained on the sieve of 1.18 mm were used as coarse aggregate in model concrete mix. The sand particles passing through the sieve of 1.18 mm and retained on the sieve of 600  $\mu\text{m}$  were used as grit in model concrete mix. The same ratio of 1:1 was used to form total aggregate

from coarse aggregate and grit. The sand particles passing through the sieve of 600  $\mu\text{m}$  were used as sand in model concrete mix. As cement is very finer material, its scaling would be insignificant hence same cement was used for model concrete mix which was used for prototype concrete mix. However, cement used for model concrete mix was sieved through 150  $\mu\text{m}$  to avoid any lumps present in cement. Sand used for cement mortar was sieved through 600  $\mu\text{m}$ .

## III. EXPERIMENT

Concrete brick prism assembly was prepared from reduced scaled bricks for different mortar proportions like 1:4, 1:3, 1:2, 1: 1.5 and 1:1. Dimensions of reduced scale brick used in prism assembly were 8 cm in length, 4 cm in width and 3 cm in height compared to 40 cm in length, 20 cm in width and 15 cm in height of prototype brick. Dimensions of concrete brick prism assembly is shown in figure:1.

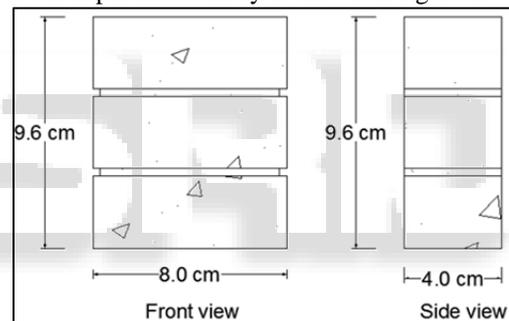


Fig. 1: Brick Prism Assembly

As per dimensions total 15 model concrete brick prisms were prepared, three for each proportion as shown in figure.2



Fig. 2: Prepared model concrete Brick prism



Fig. 3: Failure of concrete brick masonry prism

Testing of concrete brick prism was done according to IS 1905:1987 by universal testing machine. Failure of brick assembly prism shown in figure.3.

#### IV. RESULTS

Average Compressive strength of model concrete brick prism for each proportion is tabulated in successive tables below.

Size (mm)	Weight (gm)	Density (gm/cm <sup>3</sup> )	Strength (N/mm <sup>2</sup> )	Average strength (N/mm <sup>2</sup> )
80×40×110	680	1.93	5.8	6.0
80×40×105	680	2.02	6.1	
80×40×100	704	2.20	6.3	

Table 1: Test results for Brick prism with mortar proportion 1:1

Size (mm)	Weight (gm)	Density (gm/cm <sup>3</sup> )	Strength (N/mm <sup>2</sup> )	Average strength (N/mm <sup>2</sup> )
80×40×110	675	1.92	5.0	5.8
80×40×102	676	2.07	6.9	
80×40×106	709	2.09	5.5	

Table 2: Test results for Brick prism with mortar proportion 1:1.5

Size (mm)	Weight (gm)	Density (gm/cm <sup>3</sup> )	Strength (N/mm <sup>2</sup> )	Average strength (N/mm <sup>2</sup> )
80×40×110	699	1.99	5.2	4.7
80×40×106	678	2.00	6.6	
80×40×103	666	2.02	2.3	

Table 3: Test results for Brick prism with mortar proportion 1:2

Size (mm)	Weight (gm)	Density (gm/cm <sup>3</sup> )	Strength (N/mm <sup>2</sup> )	Average strength (N/mm <sup>2</sup> )
80×40×110	679	1.93	5.5	5.9
80×40×107	700	2.04	6.3	
80×40×106	658	1.94	6.1	

Table 4: Test results for Brick prism with mortar proportion 1:3

Size (mm)	Weight (gm)	Density (gm/cm <sup>3</sup> )	Strength (N/mm <sup>2</sup> )	Average strength (N/mm <sup>2</sup> )
80×40×110	711	2.02	4.8	4.6
80×40×110	730	2.07	5.0	
80×40×110	680	1.93	3.9	

Table 5: Test results for Brick prism with mortar proportion 1:4

#### V. CONCLUSION

From test results it can be clearly seen that for different proportions of mortar average ultimate compressive strength is not much effected. Increase in cement proportion in mortar do not affect the ultimate strength of masonry assembly. Hence standard proportion of 1:4 or 1:5 should be used for mortar. Proportions with higher cement proportion like 1:1, 1:1.5, etc. are not recommended for use.

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