Long Term Performance Test of Low Span Low Cost Masonry Slab (Without Reinforcement) Under Static Load, Repeated Load and Impact

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1

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Abstract
In residential buildings, low cost is a vital demand. Slab made of brick module with or without beam is found to be practiced locally. Moreover brick masonry slab is easy to construct and durable with respect to fire proofing and corrosion if nominal or zero reinforcement is possible. Therefore a study was under taken in the Department of Civil Engineering, KUET to investigate the long-term performance of brick masonry slab of dimensions 1.52m $\times$ 3.65m, with a slab thickness of 75mm. Tests were performed subjected to static, repeated and impact loading system. Test results revealed that brick masonry slab did not failed and no crack were observed though it was loaded by a uniform pressure of 12kN/m2. Similar phenomena were observed when repeated load up to12kN/m2 was imposed on the slab. However punching shear failure was observed when an impact load was applied 9 times by a hammer of 23kg of 1m free fall. Combined failure both in joint and brick module was observed.

Index terms— masonry slab, full scale test, long term effect, static load, repeated load and impact load.ed on fourier spectrum, frequency

1 INTRODUCTION

II.

2 BACKGROUND OF RESEARCH

Reinforced brick slab are widely used in low cost rural housing. Design and code related to reinforced brick slab are well established (Dayaratnam P, 1988 andKumar S, 2005). Higher rate of corrosion in reinforcing steel and high cost of reinforcement has necessitated the study on brick slab without reinforcement for the interest of economy and durability of the slab (Siddiqi and Ashraf, 2000). Rabbani and Nahid (2006) investigated the parametric study on more than 30 brick slabs without reinforcement. Parameter included -brick line, span and filler. Figure **??** shows one of their typical laying pattern and Figure **??** shows the loading arrangement for the test of slab. size (0.91m$\times$0.61m$\times$0.075m) slab (L=787 mm) he construction of using stone, brick, block etc is termed as masonry. It may be defined as building units bonded together with mortar. The rapid progress over recent past in the understanding of the materials and considerable advances in the method of design have increased acceptance of load bearing T masonry as a variable structural material. Brick masonry is one of the oldest building materials comparatively superior to other alternatives in terms of appearance, durability and cost (Hossain M. M. et al., 1997). Roof system of a residential building is an indispensable part. There are several type of roof system which are usually constructed in rural and urban areas namely, conventional R.C.C. slab beam, wooden rafter and beam covered with tile followed by lime surki mortar finish, brick masonry roof reinforced by MS bar or other indigenous material. Sometime unreinforced brick masonry is found to be constructed from long past. Effort of lowering cost has become burning need for low income group of people. Room with comparatively short span length is used in rural adobe buildings. For cost optimization and broaden utility, its possibility needs to be verified by full scale tests.

They concluded that herring bone bond masonry slab of 75 mm thickness can resist flexural stress of about 250 psi. Therefore in this study low cost housing masonry slab of 3.65m×1.52m ×0.075m has been constructed and tested with uniform distributed load, repeated load and impact.

3 III.

4 PREPARATION OF TEST SLAB

In this study, a two panel masonry slab each of 3m×1.5m ×0.075m are cast with brick module placed flat providing 0.075m thickness for the slab. The interspaces between the modules (12.7 mm) are sealed with mortar. First of all, wooden platform was prepared and leveled before laying the bricks. Bricks are then laid in staggering pattern placed with frog mark at to side keeping 12.7mm. Layout and support position of the masonry slab has shown in Figure **??**. On the other hand, Figure **??** and 5 shows the detailing of the support size in cross-section and long section respectively. A 75mm thick slab was made keeping 12.7mm gap in between two adjacent bricks. Figure **??** shows a close view photograph of the same. Top surface of the slab was finished with 12.7 mm mortar with neat finish. After 24 hours a 75 mm height of brick border was made to store water for curing purposes. After completing 28 days of curing period the formwork was removed and the slab was prepared for test. Instrumentation and testing was performed in two phase. In first phase, only load bearing capacity of the full scale slab was tested and the test was done after 28 days of slab construction. Second phase test was done after 5 years of slab construction. This paper deals with the instrumentation and results of the second phase.

5 a) Materials Specifications

Testing of second phase involved the application of static load, repeated load and impact load.

To perform the static load test, a brick wall of height 1.2m and 125mm in thickness was constructed around the 3.65m×1.52m slab. Then water pump was used to fill the 3.65m×1.52m×1.2m chamber on the slab. Linear Voltage Displacement Transducers (LVDTs), portable data logger and computer arrangements were used for data acquisition. LVDTs were instrumented as shown in Figure **??** and connected with data logger (Figure 9). To perform the repeated load test, similar instrum entation was done. In this case, the height of water was increased again deceased gradually with respect to time and the reading changes in the data acquisition devices were observed. This was repeated 10 times.

To perform the impact load test on the masonry slab a weight of 23 kg was set to free fall on the slab from a height of 1 m as shown in Figure 11. Figure 12 shows the indigenous arrangement for the application of impact load.

6 i. Static loading on slab panel

From the test no significant change in deformation was recorded from the data acquisition devices. However the slab carried a water column height of 1.22m on the area of 3.65m×1.52m which equivalent to 12kN/m2. Hence the slab carried a uniform distributed load 4 times than traditional load of residential buildings. Moreover no crack and leakage of slab panel was observed.

ii. Repeated loading on slab panel No significant change in deformation was observed when repeated was induced on slab panel.

iii. Impact loading on slab panels In this case impact hammer was dropped to five different locations as shown in 13 on the slab. Table **??** shows the number of drop required for punching failure. From the test it was observed that the masonry brick slab though a brittle material, it did not failed catastrophically rather than just failed locally due to punching. In Panel A at 'b' point was tested first, but no significant crack was showed after punch of this point. On the other hand when 'c' point was tested it showed few cracks as shown in Figure 13. However significant cracks were observed when impact load were induced at points'd' and 'e' of Panel B (Figure **??**4 [1] [2] [3]

[3]Long Term Performance Test of Low Span Low Cost Masonry Slab (Without Reinforcement) Under Static Load, Repeated Load and Impact

12

Figure 1: Figure 1 : 2 :

Figure 2: First

34

Figure 3: Figure 3 :Figure 4 :

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Figure 4: Figure 5 :Figure 6 :

7

Figure 5: Figure 7 :

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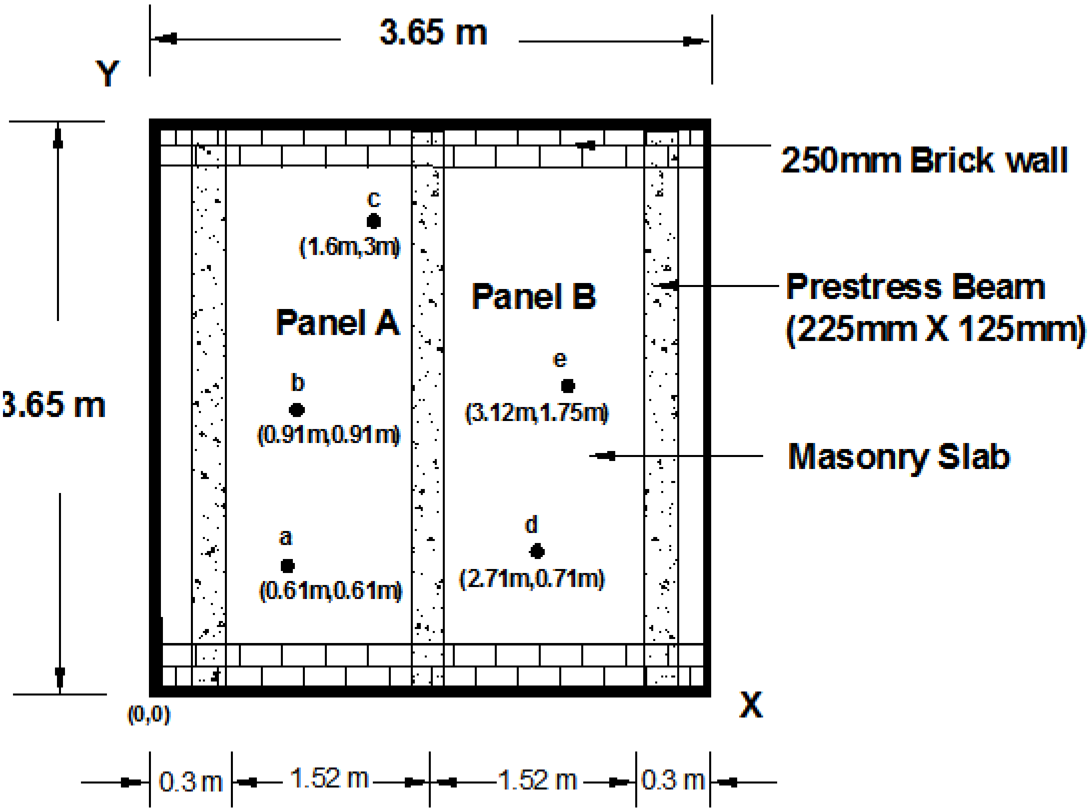
Figure 6: Figure 9 :



11

Figure 7: Figure 11 :

Figure 8:

Figure 9:

13

Figure 10: Figure 13 :

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