

Experimental Investigations On Water Transport Phenomenon Between Laterite Blocks And Mortar In Laterite Block Masonry

Ganesha Mogaveera¹, Umesh S S²

^{1, 2} Department of Civil Engineering

^{1, 2} Mangalore Institute of Technology and Engineering, Moodabidri, Karnataka, India

Abstract- The moisture transport in mortar and laterite block masonry is an important study to decide the strength of mortar joints and masonry. Water transport phenomenon can be studied for laterite block masonry and other similar blocks used in constructions. Water transport between the laterite block selected from the quarry which satisfies all the requirements and also three different types of cement mortars have been investigated in detail. Rate of moisture absorption of laterite blocks for different duration of time also has been studied to satisfy the Indian standard requirements

Keywords- Masonry, mortar, water transport, Rate of moisture absorption.

I. INTRODUCTION

Masonry units are generally porous and have the tendency of absorbing the water from the mortar due to capillary suction. The rate at which it absorbs water varies with time. Initially it absorbs the water at a very high rate and after sometime the rate of suction slows down. This property of masonry units affects the behaviour of masonry adversely. The mortar in the masonry becomes deficient in water as all the water in the mortar gets transported to the masonry units. This will be very high especially when the masonry units are dry. The water deficiency in the mortar will lead to incomplete hydration. Any incomplete hydration will lead to reduction of strength of masonry. These water transport studies have elaborately made by G.Sarangapani (1998) for bricks. He has considered cement mortars, soil cement mortars and cement lime mortars for his study. He has made it very clear that the water in the masonry units has to be carefully adjusted so that there will not be any water deficiency in mortar. This can be done by using partially saturated blocks. Partial saturation can be done by soaking of masonry units in water before construction. In this investigation the water transport studies have been made for laterite blocks with three types of cement mortars

II. EXPERIMENTAL INVESTIGATION

Transport of moisture from mortar to laterite block in masonry

This study has been made by considering one type of laterite blocks with three types of cement mortars. Cement mortars considered for the study are 1:3 cement mortar, 1:4 cement mortar and 1:6 cement mortar and The simple experiment suggested by Groot (1993) to study the water transport phenomena has been adopted. The steps of the experiment are listed below.

- a) The oven-dry blocks used in the experiment are soaked in water for varying duration like 0min, 5min, 10 min, 15min, 20min, 25min, 30 min etc.
- b) The partially saturated laterite block is covered with fresh mortar to a thickness of 10mm on top and another similarly saturated laterite block is kept on the mortar.
- c) The top laterite block is removed after one hour and the mortar is scooped out and placed in the container to note down the dry weight. This indeed has been used to calculate the moisture content of mortar.

Rate of moisture absorption of laterite blocks

The rate of moisture absorption of laterite blocks of type III was determined by soaking in water for different duration of time (0 min, 5min, 10min, 15min, 20min, 30min, 40min, 50min, 60min, 2hour, 3hour and 24hour). Five specimens were used for each case. The test is carried out as per the procedure given in IS: 1124-1974.

III. RESULTS AND DISCUSSION

Transport of moisture from mortar to laterite block in masonry

The variation of water-cement ratio of mortar with moisture content of laterite blocks have been plotted in the

figures 1 to 3 for the cement mortars i.e. 1:3 cement mortar, 1:4 cement mortar and 1:6 cement. The water-cement ratios of mortar after one hour of contact with the pre-wetted blocks have been considered for the study. From the figures it is clear that if the laterite blocks are dry, most of the moisture in the mortar finds its way into the block within one hour. The value of water cement ratio in the mortar depends on the water retentivity capacity of the mortar. In case of rich mortars (i.e. 1:3 and 1:4) the water cement ratio reduces to a value less than 0.5. However for other mortars i.e. 1:6 cement mortar the final water cement ratio is around 0.6. If the water cement ratio of the mortar is less than 0.5, setting of mortar will be unsatisfactory and complete hydration will not take place in mortar leading to lower strengths. To improve the hydration conditions of mortars so as to produce good masonry the only way is to have sufficient moisture content (i.e. around 6%) in the laterite blocks. To achieve 6% moisture content the laterite blocks have to be soaked in water for about 20 to 25 minutes. Masonry in 1:3 cement mortar, 1:4 cement mortar soaking period of around 20 to 25 minutes is required.

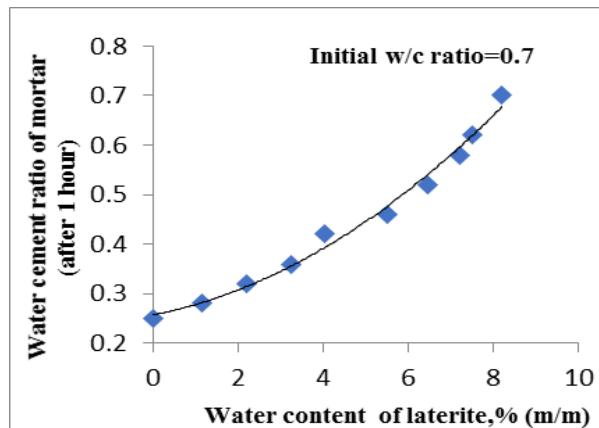


Figure 1. Variation of water cement ratio of 1:3 cement mortar with water content of laterite block

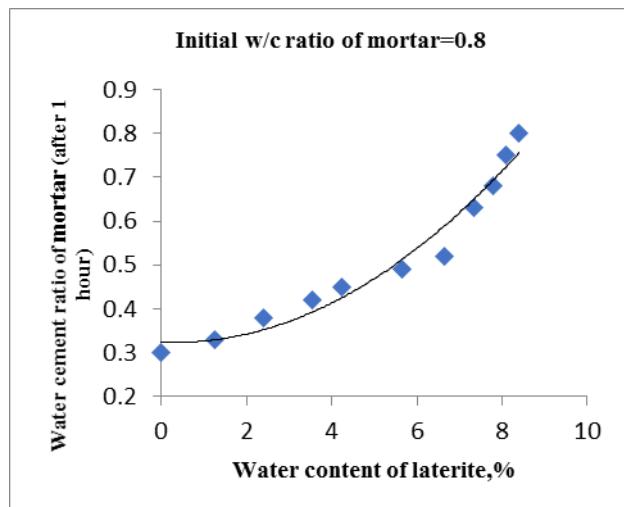


Figure 2. Variation of water cement ratio of 1:4 cement mortar with water content of laterite block

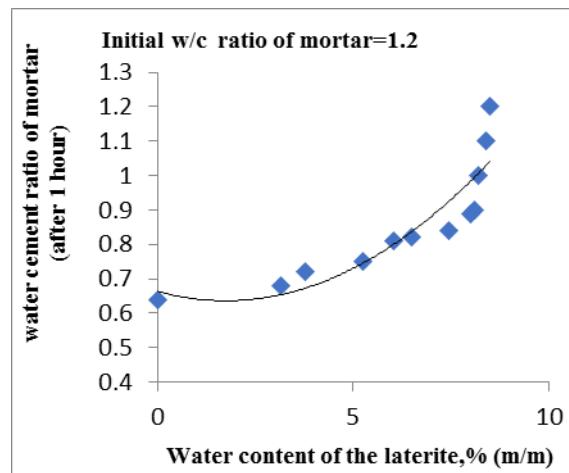


Figure 3. Variation of water cement ratio of 1:6 cement mortar with water content of laterite block

Rate of moisture absorption of laterite blocks

Figure 4 shows the variation in water content of laterite blocks which are soaked in water for varying durations of time. The curve represents the mean of 5 specimens. The graph indicates that as the soaking period increases the rate of water absorption also increases. In the initial stages laterite blocks suck water at high rate. The rate of suction slows down after the moisture content in the laterite block is 88% of its saturation value. To achieve this situation the laterite blocks need to be immersed in water for 20 to 25 minutes. Similar types of results have been obtained by G.Sarapapani (2008) for clay bricks and cement mortar.

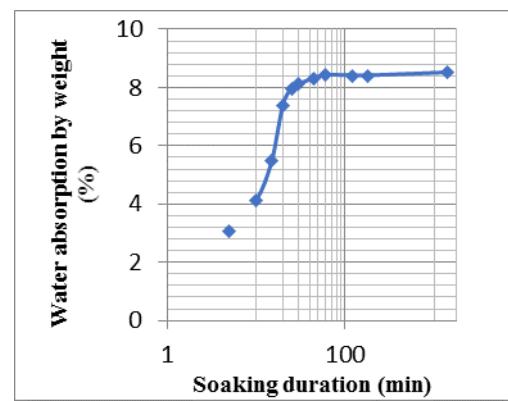


Figure 4. Water content of laterite blocks v/s duration of soaking in water

IV. CONCLUSIONS

- If the water cement ratio of the mortar is less than 0.5, setting of mortar will be unsatisfactory and complete

hydration will not takes place in mortar leading to lower strengths.

- 2) Laterite blocks shall be soaked in water during the construction of laterite block masonry arches. Soaking period shall be around 20-25 minutes to achieve a moisture content of 6 to 10%
- 3) The laterite blocks with high iron content and less silica content is preferable for the construction of masonry as they have high strength. Higher the iron content, lesser the silica content, greater is the strength of laterite blocks.
- 4) Wet strength of laterite blocks shall be considered for the design of masonry as the wet strength is around 33 to 74% of dry strength,
- 5) Mortars with good workability (Flow value between 80-100%)shall be chosen for the construction of laterite block masonry arches.

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REFERENCES

- [1] ASTM C 97 (2002), Standard test methods for water absorption and bulk specific gravity of dimension stone, ASTM, Philadelphia, USA.
- [2] ArunkumarBhat, Study of geotechnical and strength parameters of laterite blocks in and around karkalla taluk'.B.E. Project report,NMAM Institute of Technology,NIItte,Karkala.
- [3] H.J.P Brocken, Moisture transport properties of mortar and mortar joint: a NMR study
- [4] Casper groot,the influence of water flow on bond strength development in young masonry
- [5] Ottawa, Loss of moisture from mortars upon contact with bricks of various suctions, National research council of Canada division of building research