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STUDY OF CONCRETE MASONRY UNIT CONSTRUCTION IN ITHIKKARA BLOCK PANCHAYATH

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Abstract- *Concrete masonry units are one of the most versatile products in the construction industry. The local manufacturing units are not following any guidelines for proportioning, casting & curing of masonry units in the sites. Absence of study of raw materials, inspection, quality control were found at these sites. This paper aims at investigating the locally made concrete block in Ithikkara Block Panchayat*h, *which were chosen based on their production capacity. The main objectives of this paper is to study the mixing ratio of local masonry units and the parameters affecting the variation in strength of the blocks. Test performed is compressive strength.*

Key Words: **Concrete Block, Local manufacturing unit, Strength*, Raw materials,* Parameters.**

1. INTRODUCTION

Concrete blocks are important and common building construction in India. Concrete blocks have used in making various buildings, retaining wall and others. Concrete masonry units are manufactured from very dry, stiff concrete mixtures. The no-slump or low-slump material is placed into molds, vibrated and compacted, and demoulded. The demoulded units are kept for curing to get the required strength. However, the materials used, the quality of the mortar and workmanship, and the pattern in which the units are assembled can affect the durability of the overall masonry construction. Brick and concrete block are the most common types of masonry in use in industrialized nations and may be either weight-bearing. Concrete Masonry Units are one of the most versatile products in the construction industry. Increasing urbanization and related economic growth has led to the over-exploitation of natural resources. This study focuses on the works and procedures followed on four local sites on Ithikkara Block Panchayath, which were chosen on their production capacity. The raw materials were collected from the various sites, the mix proportions were quantified, the pattern and duration of curing were studied.

2. EXPERIMENTAL STUDY

The experimental study aims at investigating the quality of locally made concrete blocks in accordance with IS for strength requirements. The products of the local manufacturers, i.e. concrete masonry units are extensively used for constructions and they are not undergoing any quality inspections. Moreover there is no common mix proportion or material study for the local manufactures which is definitely a factor for the strength for any materials. This deficiency of lack of proper material study and varying proportions led to the idea of an experimental investigation over a small area in Ithikkara Block Panchayath in Kollam District, Kerala, India. On direct field visits we observed that there are 20 local concrete making units within our study area. Out of which 4 units are having a daily production capacity greater than 500 numbers. So we have taken those 4 sites namely Plavinmoodu, Bhajanamadam, Meenambalam, & Chirakkara. The raw materials were collected from these sites, the mix proportions were quantified, the pattern and duration of curing were studied and those products were tested for compressive strength.

3. DATA COLLECTION & TEST RESULTS

The various materials selected for our work are briefly mentioned below,

3.1 CEMENT

OPC (Ordinary Portland Cement) of 53 grade conforming to IS 12269:1987 is used in the entire work. More over in all the four sites the same grade and type of cement under the same brand name was used. The study of various properties of cement are as follows;

Table-1: Testing properties of cement

Cement grade	OPC 53
Initial setting time	45 min
Final setting time	600 min
Fineness	08%

3.2 COARSE AGGREGATE

The coarse aggregates most employed in concrete block production are those that pass through 10 mm sieve and are retained by a number 6.3 mm sieve. The study of various properties of cement are as follows;

Table-2: Specific gravity of coarse aggregate

Site	Specific Gravity
Plavinmoodu	2.67
Bhajanamadam	2.68
Meenambalam	2.7
Chirakkara	2.76

3.3 FINE AGGREGATE

To ensure adequate cohesion of the mix, the fine aggregate (or mixture of fine aggregates) must have a fineness modulus of 2.20 to 2.80 and the percentage of fine aggregate that passes through a number 50 (0.3 mm) sieve must be between 25% and 35%.

Table-3: Specific gravity of Fine aggregate

Site	Specific Gravity
Plavinmoodu	2.52
Bhajanamadam	2.64
Meenambalam	2.63
Chirakkara	2.47

3.4 WATER

The water that is used should be free of chlorides, sulphates, acid, oil, industrial waste, sugar, organic materials, clay and silt. The portable water is used in making concrete as well as curing the blocks.

4. METHODOLOGY

4.1 SITE SELECTION

On direct field visits we observed that there are 10 local concrete making units within our study area. Out of which 4 units are having a daily production capacity greater than 500 numbers. Four different sites–Plavinmoodu, Bhajanamadam, Meenambalam, Chirakkara, were identified based on their production capacity.

4.2 OBSERVATION

4.2.1 Mix proportion, W/C ratio

The four local sites were visited and collected data's regarding the procedures followed there. Following were mixing ratios and W/C ratio carried over these sites;

Table-4: Mixing ratio and W/C ratio

Site	Ratio	W/C Ratio
Plavinmoodu	1:6.48:11.49	1.697
Bhajanamadam	1:6.19:14.08	1.937
Meenambalam	1:8.31:14.97	1.531
Chirakkara	1:7.01:15.02	1.514

4.2.2 Specimen size

Size of the specimens collected from the for sites were 8×6×12 inches. From each sites 6 specimens were collected.

4.2.3 Curing in days

Types of curing followed in these sites were water spraying and jute cover. The information about the number of days for curing were obtained from the manufacturing units.

Table-5: Curing of Blocks

Site	Curing (in days)
Plavinmoodu	6
Bhajanamadam	6
Meenambalam	8
Chirakkara	10

4.3 RESULTS OF COMPRESSIVE STRENGTH

Compressive strength test was conducted on the 6 sample from each sites after 7 days and 28 days. Analysis and conclusions were made on the basis of these tests conducted.

4.3.1 7 Days Compressive Strength

Table-6: Compressive Strength for 7 days

Place	Compressive Strength (in n/mm^2, for 7 days)
Plavinmoodu	1.78
Bhajanamadam	1.93
Meenambalm	2.64
Chirakkara	3.44

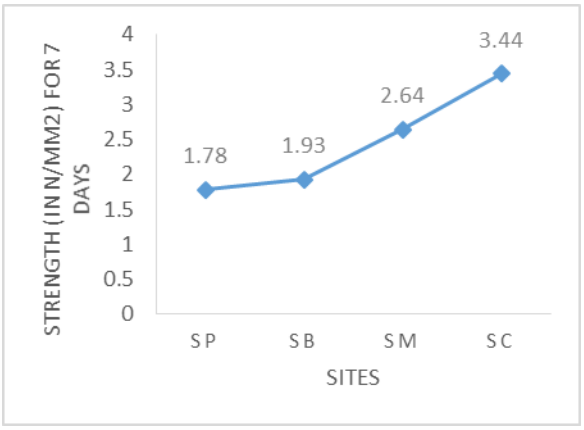

Chart-1: Graph between Strength (7 days) and Sites

4.3.2 28 Days Compressive Strength

Table-7: Compressive Strength for 28days

Place	Compreesive Strength (in n/mm², for 28 days)
Plavinmoodu	4.18
Bhajanamadam	4.47
Meenambalam	5.05
Chirakkara	5.59

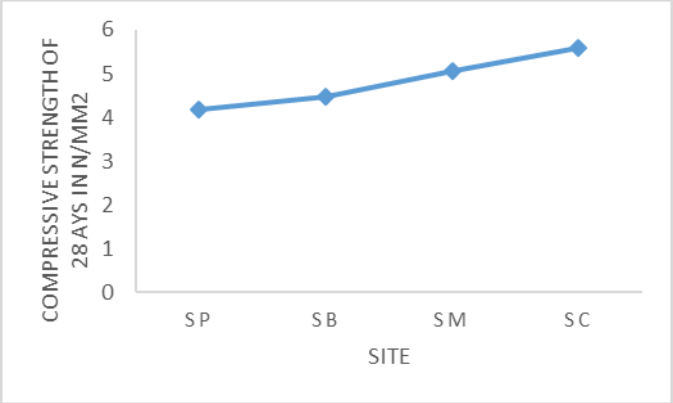

Chart-2: Graph between Strength (28 days) and Sites

4.4 RESULTS OF PARAMETER INVESTIGATION

4.4.1 EFFECT OF SPECIFIC GRAVITY

Materials having higher specific gravity is generally considered as having higher strength. From the tests conducted, it is found that the specific gravity of coarse aggregate is having a direct relation with strength of the blocks whereas, the specific gravity of fine aggregate doesn't effect the strength.

Table-8: Variations of strength and Specific gravity

Name	Strength in N/mm2 for 28 days	Specific gravity of C. aggregate	Specific gravity of fine aggregate
Plavinmoodu	4.18	2.67	2.52
Bhajanamadam	4.47	2.68	2.64
Meenambalam	5.50	2.7	2.63
Chirakkara	5.59	2.76	2.47

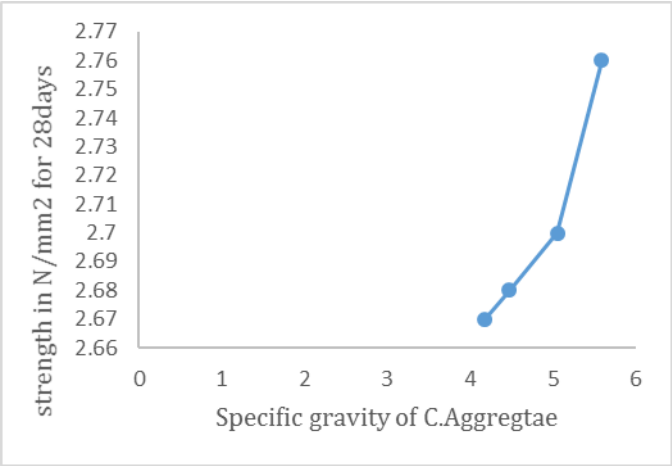

Chart-3: Graph between strength and specific gravity

4.4.2 EFFECT OF WATER-CEMENT RATIO

A lower water-cement ratio leads to higher strength and durability.

Table-9: Variations of Strength and W/C ratio

Site	Strength in N/mm² for 28 days	W/C ratio
Plavinmoodu	4.18	1.697
Bhajanamadam	4.47	1.937
Meenambalam	5.05	1.531
Chirakkara	5.59	1.514

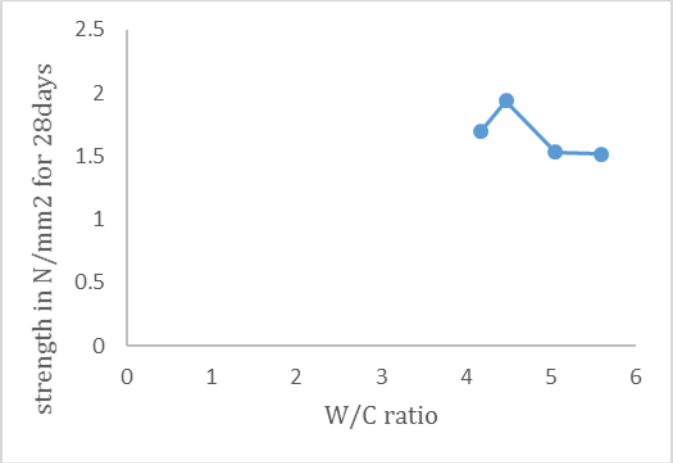

Chart-4: Graph between strength and W/C ratio

4.4.3 EFFECT OF WATER-AGGREAGATE RATIO

For a lower water-aggregate ratio strength is found to be increasing.

Table-10: Variations of strength and W/A ratio

Site	Strength in N/mm² for 28 days	W/A ratio
Plavinmoodu	4.18	0.094
Bhajanamadam	4.47	0.097
Meenambalam	5.05	0.065
Chirakkara	5.59	0.068

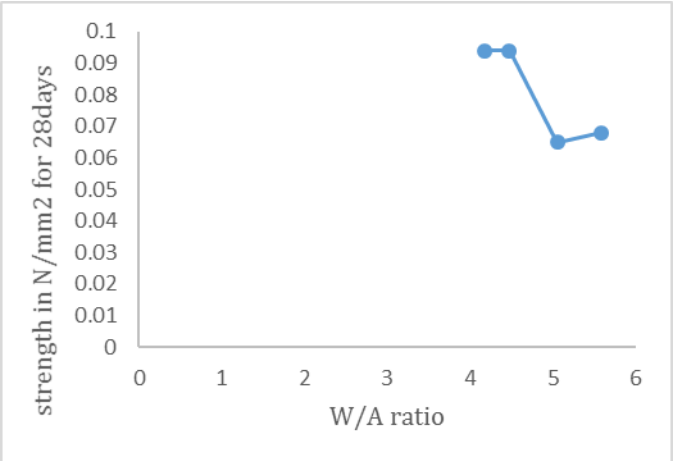

Chart-5: Graph between strength and W/A ratio

4.4.4 EFFECT OF CEMENT-AGGREGATE RATIO

Cement-aggregate ratio is not primary factor in strength development of concrete. But it is found that for a particular water-cement ratio, higher strength is produced by a leaner mix.

Table-11: Variation of Strength and C/A ratio

Site	Strength in N/mm2 for 28 days	C/A ratio
Plavinmoodu	4.18	0.055
Bhajanamadam	4.47	0.049
Meenambalam	5.05	0.043
Chirakkara	5.59	0.045

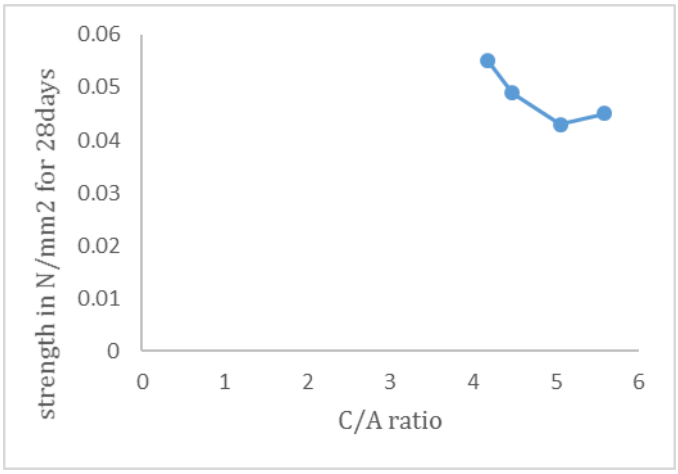

Chart-6: Graph between strength and C/A ratio

4.4.5 EFFECT OF WATER-SOLID RATIO

Results from the testing showed that the water-solid ratio did affect the concrete blocks to some degree.

Table-12: Variations of Strength and W/S ratio

Site	Strength in N/mm2 for 28 days	W/S ratio
Plavinmoodu	4.18	0.089
Bhajanamadam	4.47	0.092
Meenambalam	5.05	0.063
Chirakkara	5.59	0.065

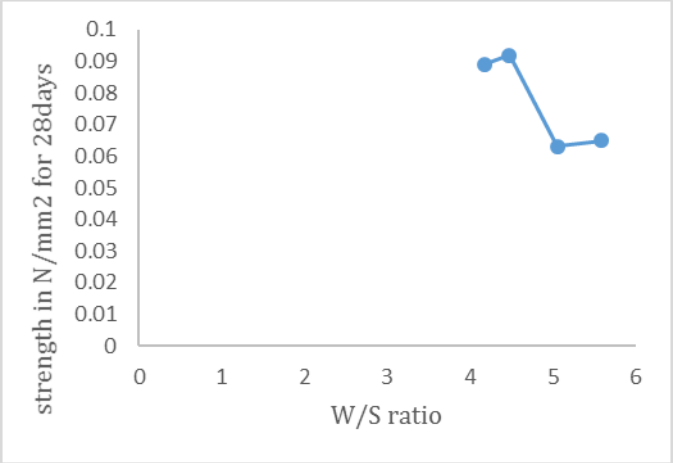

Chart-7: Graph between strength and W/S ratio

4.4.6 EFFECT OF WORKABILITY

Results of the test conducted gave an indirect relation between workability and strength.

Table-13: Variation of Strength and Workability

Site	Strength in N/mm2 for 28 days	Workability in mm(slump test)
Plavinmoodu	4.18	65
Bhajanamadam	4.47	90
Meenambalam	5.05	48
Chirakkara	5.59	33

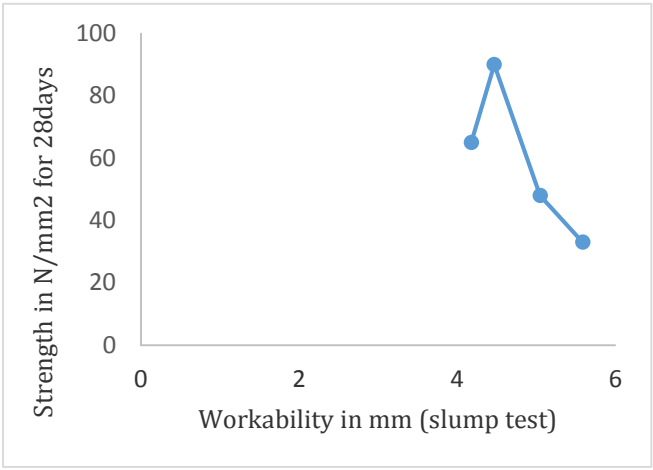

Chart-8: Graph between Strength and Workability

5. EXPERIMENTAL INVESTIGATION

From the analysis of the tests results good strength was obtained for the samples of Meenambalam and Chirakkara units. For a better strength, it is decided cast blocks with a ratio of 1:7.5:15 and water-solid ratio as 0.064 which is an average of both ratios of Meenambalam and Chirakkkara. Water- cement ratio was found to be in the range of 1.5 in those sites. Samples casted with these proportions were undergone compressive strength test and the value being an average of six samples was 5.12 N/mm^2.

6 .RESULTS AND DISCUSSION

- Absence of quality control & study of properties of raw materials.
- Manufacturing of concrete blocks in these local sites are not following any standards.
- Local sites are not following any guidelines for proportioning, casting & curing of masonry units.
- Results shows that workability, specific gravity, water content & curing effects the strength of masonry blocks considerable.
- Curing of specimen seems to be a factor which seem to be the most ignored at local sites and result obtained proves its aftereffects also.
- Strength of block depends not only on w/c ratio but also on specific gravity, w/a ratio, c/a ratio, w/s ratio, workability and curing.

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