

Performance of Soil-Cement Mortar- N Type Mortar

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Abstract - Cement-soil mortars are commonly used for the construction of soil-cement block masonry. Many studies have been conducted to analyse mortars performance like, cement mortar, lime mortar etc. but less emphasis is given on soil-cement mortar. Therefore, paper focuses on an experimental study in understanding the various characteristics of cement soil mortars in fresh and hardened state i. e. workability and compressive strength. The two category ($w/c = 0.75$ and 0.85) specimens of 1: 6 mortar were prepared in the lab and tested. The effect of soil content on compressive strength and workability were investigate and compared with the control mortar mix. The study shows reasonable results and it will be of great use in mortar and concrete technology.

Key Words: Cement, Soil, Mortar, Workability, Compressive strength.

1. INTRODUCTION

Mortar mix is a combination of cement and sand that is used to hold together construction type blocks. When water is added, it becomes a workable paste that sets hard. It is used with materials like bricks and stones to make walkways and walls.

Mortar was originally made of mud or clay. There is evidence of the use of mortar in cultures around the world. Iranian and Babylonian structures used mortar from about 2900 BC on. The earliest Egyptian pyramids used the mud or clay combination, while later buildings used gypsum or lime.

This continued on with the ancient Greeks and Romans who perfected the use of concrete and mortar in building their elaborate city schemes. In later cultures, the water soluble ingredient lime became the primary active ingredient, which was ultimately damaging to the stability of many structures.

There are many grades of mortar mixes found at home improvement stores. It is important to recognize that each has its place in construction. Consumers should always purchase the mortar mix that is intended for their project. The most common types are N, S, M, Glass Block, and Refractory.

TYPES OF MORTAR

Different types of mortar are used different places:

Type N

Type N is of medium strength, which means it is the best choices for projects with bricks that are not load bearing. Garden walls, chimneys, and barbeques are common

applications for this mix. Type N is also preferred for soft stone masonry. This is the mortar most often used by home owners. It is easy to work with and is appropriate for most brick projects that the typical home owner would attempt.

Type S

Type S is known for its strength and is used outdoors. Patios, foundations, and retaining walls all use Type S, which is known for its ability to absorb most impacts. Type S is still an easy product to work with, but homeowners should have some experience working with brick before beginning any type of project that requires this product.

Type M

The strongest mix that you will find in a home improvement store, Type M is typically used only with stone. Type M is preferred with stone because the strength of the mortar typically mimics that of the stone being used. It is also used in situations where being able to bear heavy loads are important, such as retaining walls.

Glass Block Mortar

This specialty mortar is actually a Type S mortar that is colored for use with glass block, not brick. Rather than the traditional gray color, glass block mortar is white and can be tinted to match the material. Of course, because the color is the only significant change in this type of mortar, Type S mortar can also be used for glass block projects.

Refractory Mortar

Refractory mortar is used when heat is of a concern. This product, though more expensive than other formulas, is the best choice if you are building or repairing a barbeque or chimney that will be used regularly or exposed to high temperatures. Created with a calcium aluminates base, it will cure in wet conditions and resist melting in incredibly hot temperatures.

2. OBJECTIVE OF THE STUDY

There are several investigations on mortar, focused on the characteristics of mortar in both fresh and hardened. Majority of these studies are found commonly used mortar like cement mortar, cement lime mortar etc. there is no dedicated study on soil cement mortar. Therefore, in this research an attempt have been made to focus the characteristic & performance.

Main objectives of soil cement mortar are:-

1. To examine characteristic of fresh soil cement mortar like workability.
2. To examine characteristic of soil cement mortar like 3days, 7 days and 28 days.
3. To compare soil cement mortar with cement mortar and to find optimum mix proportion for soil cement mortar for better strength and performance.

3. EXPERIMENTAL PROGRAMME

The project focuses on characteristics of mortar like workability, bulk density, free water retentivity, compressive strength are determine for CM (CEMENT MORTAR) and CSM(CEMENT SOIL MORTAR) with various proportion. Mix proportions are based on weight are taken. Locally available red loamy soil is used in cement soil mortar.

Red Loam Soil:

Locally available red loamy soil is used in cement soil mortar. The soils have red colour, which has been attributed to the presence of hematite or anhydrous ferric oxides. These soils are essentially kaolinitic in nature, acidic in reaction, highly porous and friable. They are low in organic matter content as well as in all the essential plant nutrients.

Different test series conducted in the laboratory are tabulated in following table1.

4. RESULTS AND DISCUSSION

In this paper experimental parametric study has been undertaken to asses the performance of cement soil mortar. For better understanding of performance of soil cement mortar typical graphs have been drawn.

4.1 Effect of soil content on workability (fig. 1)

- It is observed from the workability graph for w/c 0.75 consistency value increase to certain in a maximum Value (27.5) then decrease with the increase in soil content.
- Same pattern is observed for w/c 0.85.
- For w/c 0.85 consistency value is less than that in case of w/c 0.75.

4.2 Effect of soil content on 3 days compressive strength (fig. 2)

- It is observed from the compressive strength graph for w/c 0.75 increases and than decreases with increase in soil content.
- Same pattern is observed for w/c 0.85.
- For w/c 0.85 compressive strength is less than that in case of w/c 0.75.

Table-1. Test Series under parametric study

W/C	Mortar designation	Mix proportion	Properties examined			
			workability	Bulk density	Free water content	Water retentivity
0.75	CM I	1:6	61.25	2.09	9.1	97.15
	CSM I	1:0.25:5.75	6.25	1.98	10	98.8
	CSM II	1:0.50:5.50	4.75	1.97	8.77	98.49
	CSM III	1:0.75:5.25	27.5	2.13	8.65	99.3
	CSM IV	1:1.0:5.0	3.5	2.03	8.06	98.53
0.85	CM II	1:6	9.6	2.14	7.69	97.5
	CSM I	1:0.25:5.75	6	2.24	10	98.9
	CSM II	1:0.50:5.50	14.75	2.19	9.4	98.79
	CSM III	1:0.75:5.25	14.25	2.11	8.77	98.74
	CSM IV	1:1.0:5.0	7.5	2.10	7.4	99.61

CM-I -Cement mortar mix with w/c=0.75

CSM-I Cement soil mortar with w/c=0.75

CSM-II Cement soil mortar with w/c=0.75

CSM-III Cement soil mortar with w/c=0.75

CSM-IV Cement soil mortar with w/c=0.75

CM-II Cement mortar with w/c=0.85

CSM-I Cement soil mortar with w/c=0.85

CSM-II Cement soil mortar with w/c=0.85

CSM-III Cement soil mortar with w/c=0.85

CSM-IV Cement soil mortar with w/c=0.85

4.3 Effect of soil content on 7 days compressive strength (fig. 3)

- It is observed from the workability graph for w/c 0.75 consistency value increase to certain maximum value (12.84) then decrease with the increase in soil content.
- Same pattern is observed for w/c 0.85.
- For w/c 0.85 compressive strength is less than that in case of w/c 0.75.

4.4 Effect of soil content on 28 days compressive strength

- Here, almost similar pattern is observed as in 7 days strength for w/c 0.75.
- Similar pattern is observed as in 7 days strength for w/c 0.85 also.

5. SUMMARY AND CONCLUSION:

Cement soil mortar are used for the constructions of brick Masonry. Here, workability and compressive strength are examined this research.

Major conclusion of the research is summarized below.

1. Cement soil mortar possess better workability characteristics than pure cement mortar (CM 1:6) proportion.
2. For the same w/c ratio (0.75) then compressive strength of cements soil mortar increase with

increase in soil content and the decrease. Maximum strength is achieved at mix proportion CSM-III (1:0.75:5.25).

3. For w/c 0.85 above maximum strength is achieved at mix proportion CSM-III (1:0.75:5.25).
4. On the basis of above conclusion it is recommended that for medium strength brick masonry Cement Soil Mortar - III (CSM-III with 1:0.75:5.25) is better mix proportion for better strength and performance.

REFERENCES

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Fig. 1 Effect of soil content on workability

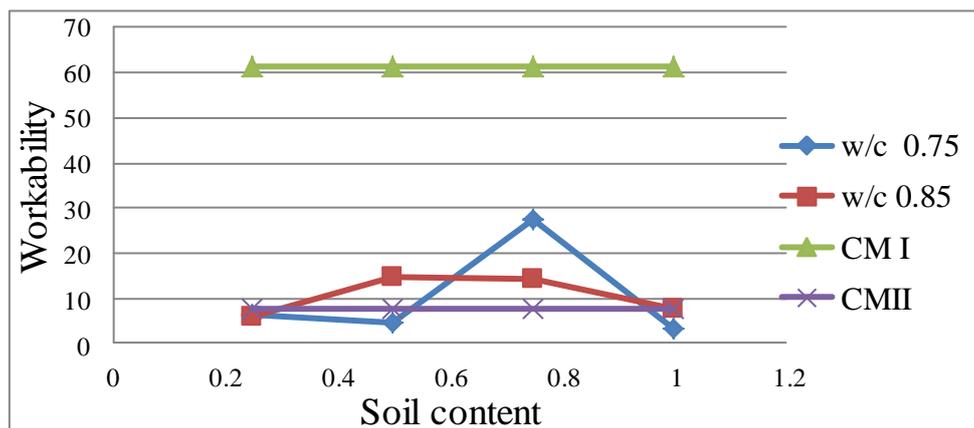


Fig. 2 Effect of soil content on 3 days compr. Strength

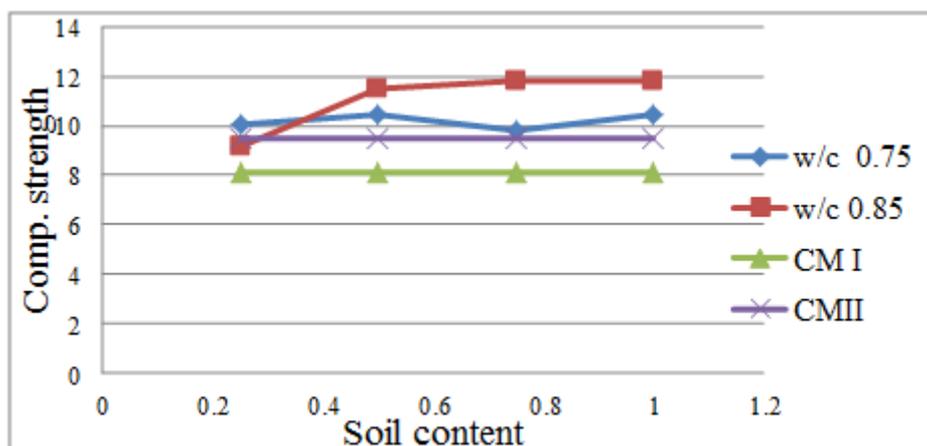
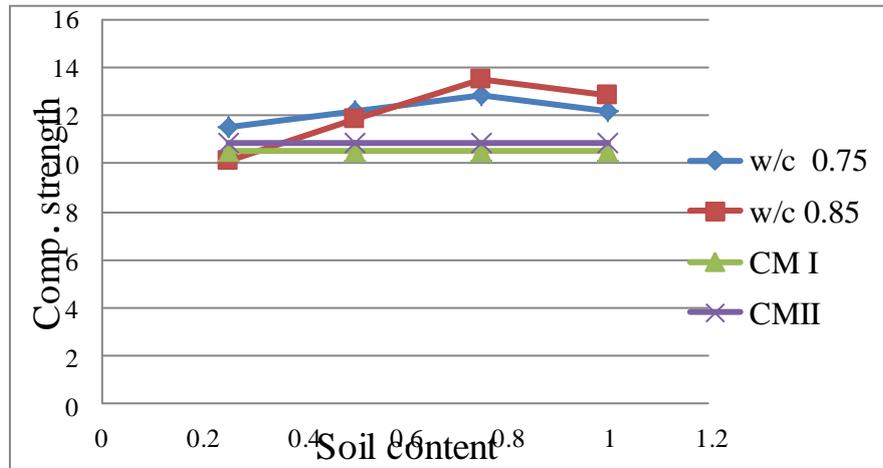


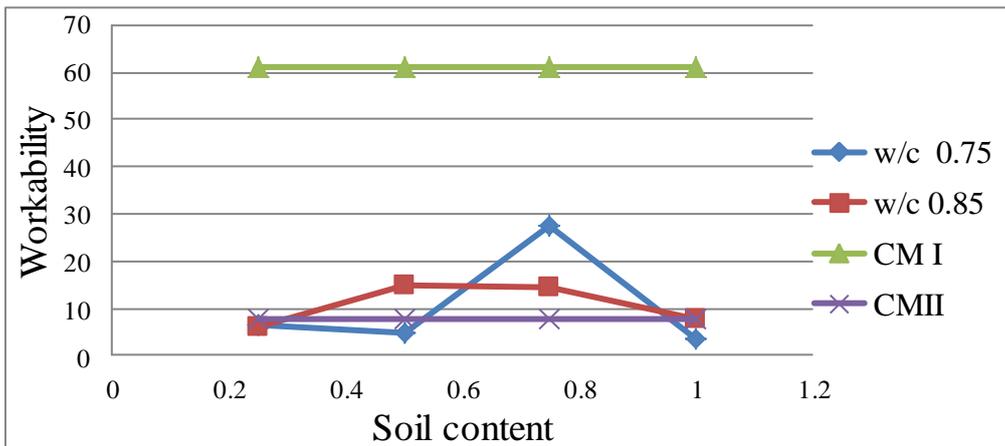
Fig. 3 Effect of soil content on 7days compr. Strength



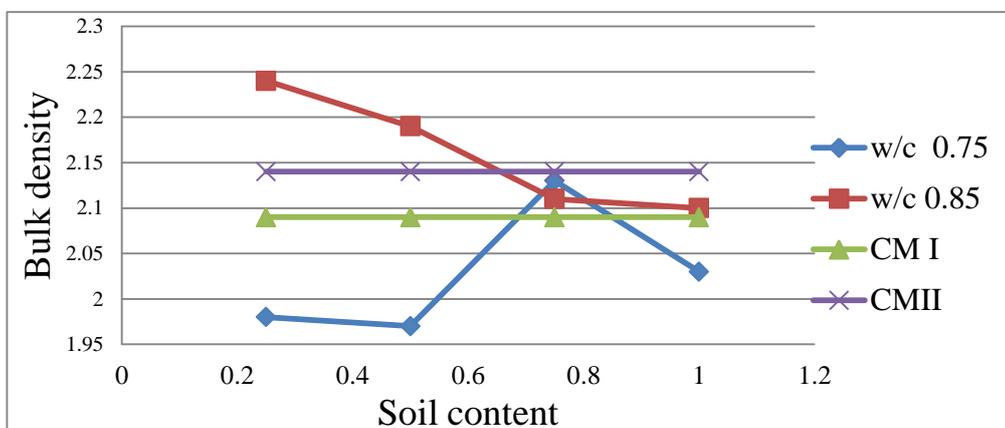
6. RESULT & DISSCUSION

6.1. Graph:

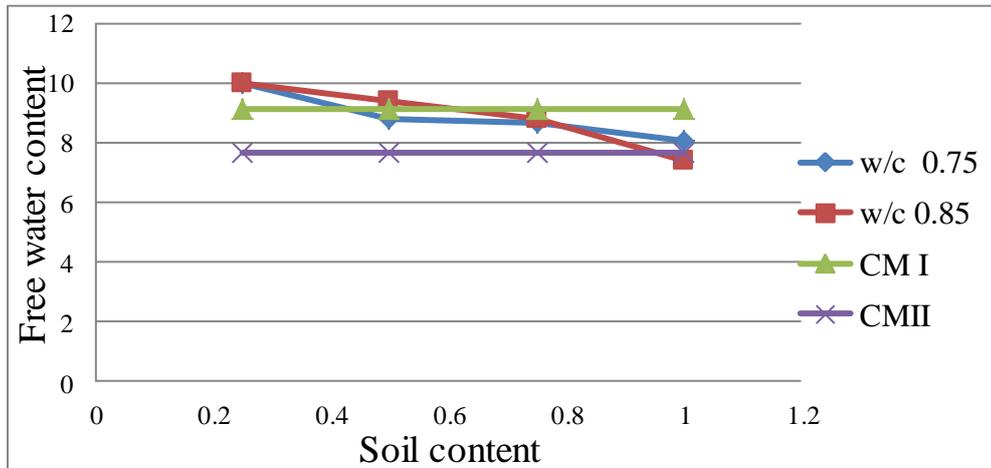
6.1.1. Graph b/w workability and soil content:



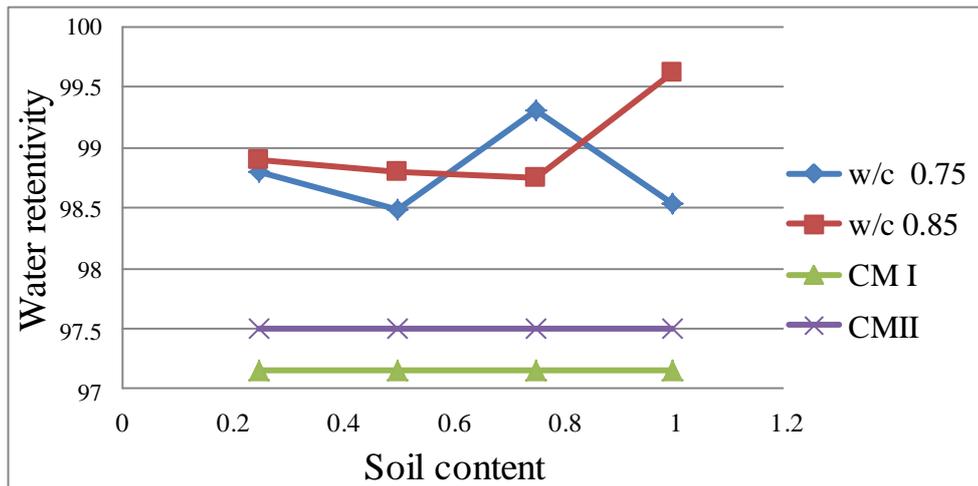
6.1.2. Graph b/w Bulk density & soil content



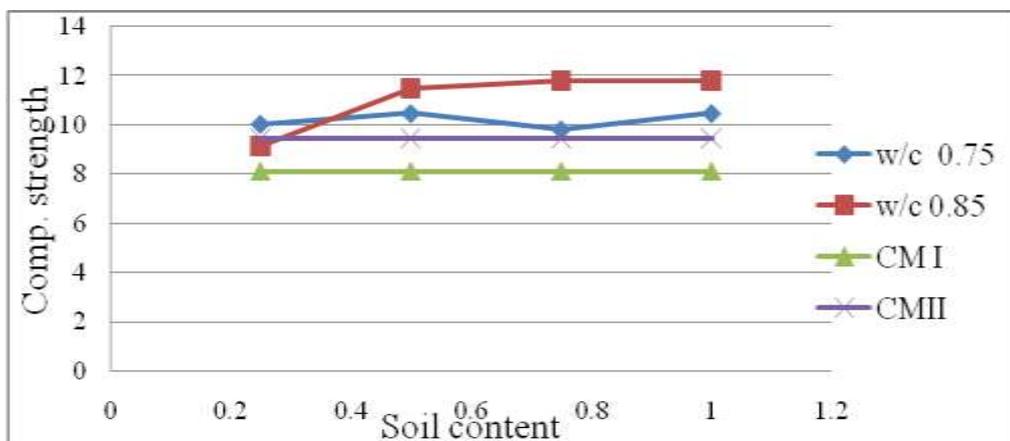
6.1.3. Graph b/w Free water content & soil content



6.1.4. Graph b/w Water retentivity & soil content



6.1.5. Graph b/w Strength (3 days) & soil content



6.1.6. Graph b/w Strength (7 days) & soil content

