Experimental Study on Brick Using Partial Replacement of Paper Industry Waste

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Abstract- *Paper creating usually produces an outsized quantity of solid waste. Paper fibers will be recycled solely a restricted variety of times before they become too short or weak to form prime quality paper. It implies that the broken, low- quality paper fibers are separated out to become waste sludge. This factory sludge consumes an outsized share of native lowland area for every and each year. Some firms burn their sludge in incinerators, contributing to our serious air pollution problems. To reduce disposal and pollution issues emanating from these industrial wastes, it is most essential to develop profitable building materials from them. Keeping this in view, investigations were undertaken to produce low cast brick by blending various ratios of cement with hypo sludge. The replacement of hypo sludge by weight with cement with permutation of 0%, 10%, 20%, 30% and 40% is done. The main aim of this study is to make economical and green bricks to maintain environmental balance, and avoid problem of sludge disposal.*

I. GENERAL

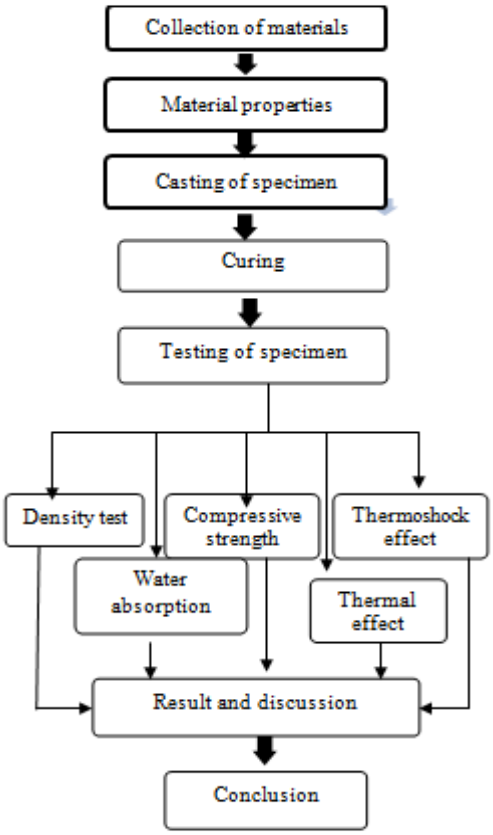
Brick plays important role within the field of engineering construction. Bricks square measure used as an alternate of stones in construction purpose. A brick may be a artifact wont to create walls, pavements and other elements in masonry construction. A brick may be composed of clay-bearing soil, sand, and lime, or concrete materials. Bricks square measure made in varied categories, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities. Two basic classes of bricks square measure dismissed and non-fired bricks. Block may be a similar term touching on an oblong building unit composed of comparable materials, but is usually larger than a brick. Bricks ought to be uniform in color, size and shape. Standard size of brick should be maintained.

They should be free from cracks and alternative flaws like air bubbles, stone nodules etc. With sharp and square edges. Bricks shouldn't absorb over 1⁄5 of their own weight of water once immersed in water for twenty-four hours (15% to twenty of dry weight).

II. HYPO SLUDGE

Hypo sludge is additionally called paper business waste. Paper creating usually produces an oversized quantity of solid waste. This mill sludge consumes an oversized proportion of native lowland area for every and each year. To reduce disposal and pollution issues emanating from these industrial wastes, it is most essential to develop profitable building materials from them. The quantity of paper waste varies from mill to mill. This hypo sludge contains low Ca and most salt and minimum quantity of silicon dioxide. Hypo sludge behaves like cement owing to silicon dioxide and Mg properties. So Hypo sludge could also be used as partly replacement of cement. So we will use Hypo sludge as a partial replacement of cement in permeable concrete

III. METHODOLOGY



Chemical analysis of hypo sludge

S. No.	Chemical compound	Percentage (%)
1	Calcium oxide (CaO)	45-55
2	Silicon Dioxide (SiO_2)	3-10
3	Magnesium Oxide (MgO)	5-15
4	Sulphur Trioxide	0.1-0.3
5	Aluminum Oxide (Al_2O_3)	0.05-0.2
6	Ferric oxide (Fe_2O_3)	0.5-1.0
7	Loss of Ignition (LOI)	35-45

Mix proportions

Generally for brick weight batching is adopted, we made weight batching of 4 differentpercentage of partial replacement of hypo sludge is made.

Mix design

For M15 grade concrete, the mix ratio is 1: 2: 4

By volume batching, the mix ratio is 0.22: 0.44: 0.89 (m^3)

By weigh batching, the mix ratio is 57.51: 126.9: 268.2 (kg)

S.No	Percentage
1	Conventional
2	10% replacement
3	20% replacement
4	30% replacement
5	40% replacement

Volume of mould:

Brick = 0.23*0.115*0.0.75= 0.00198 m^3

For 9 moulds:

Specimen	Cement (kg)	M-Sand (kg)	Fine aggregate (kg)
Brick	5.751	12.690	26.820

Casting and curing of specimen

Hypo sludge

Mixing of concrete

Brick mould

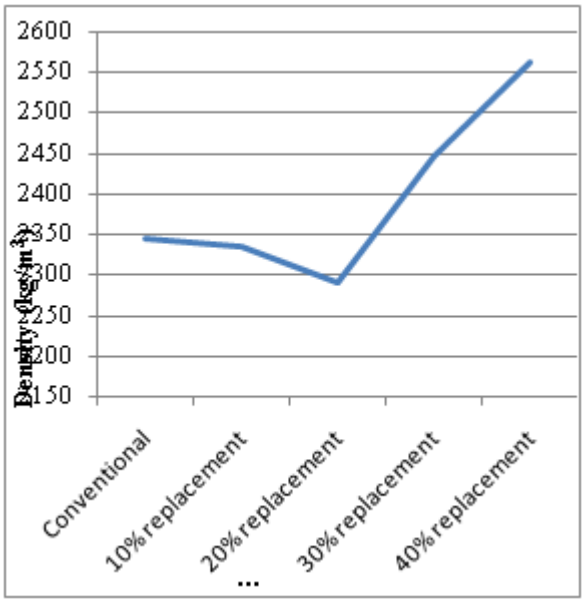
Casting

IV. RESULT AND DISCUSSION

Density test at an age of 28 days

Specimen	Density (kg/m^3)
Conventional	2344.93
10% replacement	2333.33
20% replacement	2289.46
30% replacement	2445.79
40% replacement	2561.77

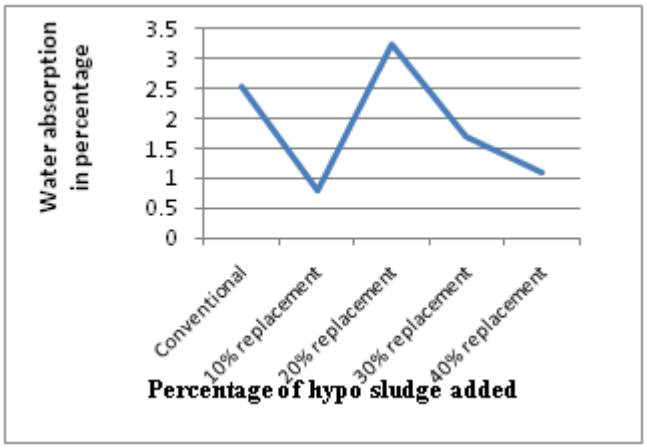
Density test at an age of 28 days



Water absorption at an age of 28 days

Specimen	Water absorption in percentage
Conventional	2.52
10% replacement	0.78
20% replacement	3.24
30% replacement	1.69
40% replacement	1.10

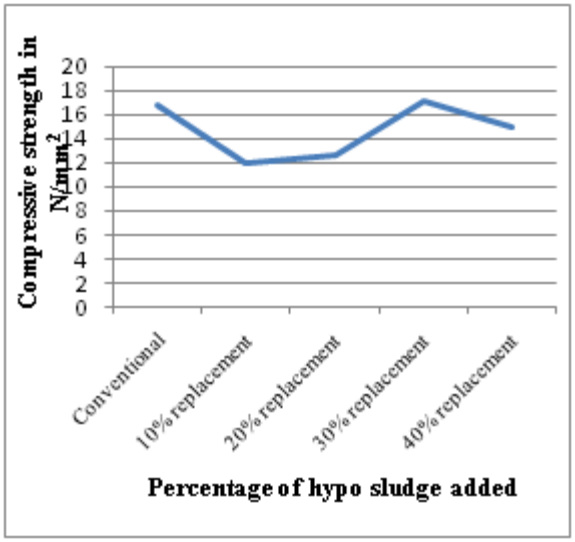
Water absorption at an age of 28 days



Compressive strength test at an age of 28 days

Specimen	Compressive strength (N/mm^2)
Conventional	16.91
10% replacement	12.02
20% replacement	12.61
30% replacement	17.16
40% replacement	14.98

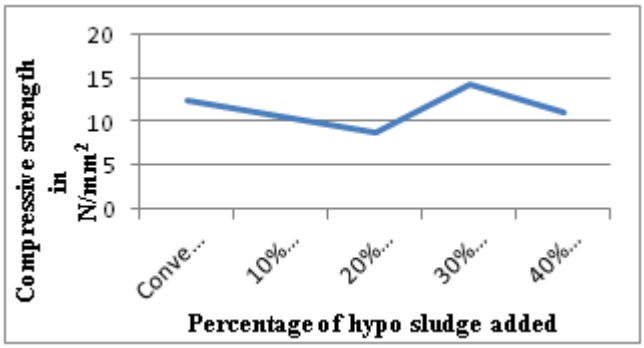
Compressive strength test at an age of 28 days



Thermal effect

Specimen	Compressive strength (N/mm^2)
Conventional	12.68
10% replacement	10.64
20% replacement	8.93
30% replacement	14.39
40% replacement	11.23

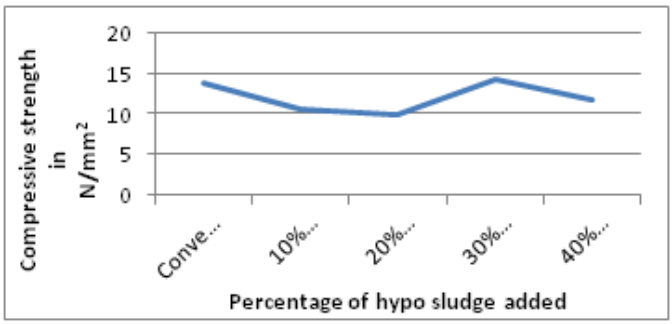
Thermal effect at an age of 28 days



Thermoshock effect at an age of 28 days

Specimen	Compressive strength (N/mm^2)
Conventional	13.81
10% replacement	10.53
20% replacement	9.94
30% replacement	14.38
40% replacement	11.92

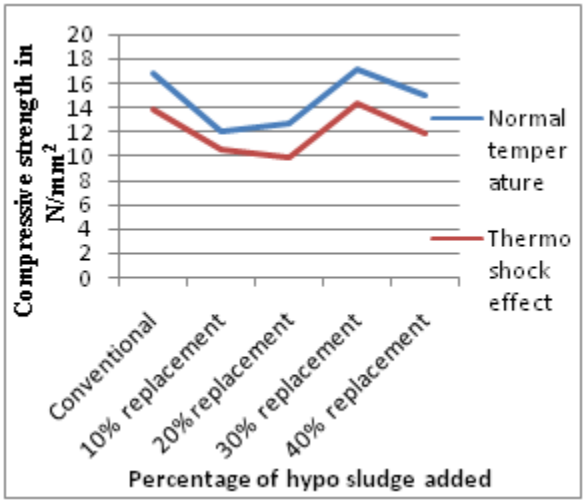
Thermoshock effect at an age of 28 days



Variation of compressive strength due to thermoshock effect

Specimen	Compressive strength (N/mm^2)	Compressive strength (N/mm^2) (thermoshock effect)	Variation of compressive strength (N/mm^2)
Conventional	16.91	13.81	3.1
10% replacement	12.02	10.53	1.49
20% replacement	12.61	9.94	2.67
30% replacement	17.16	14.38	2.78
40% replacement	14.98	11.92	3.06

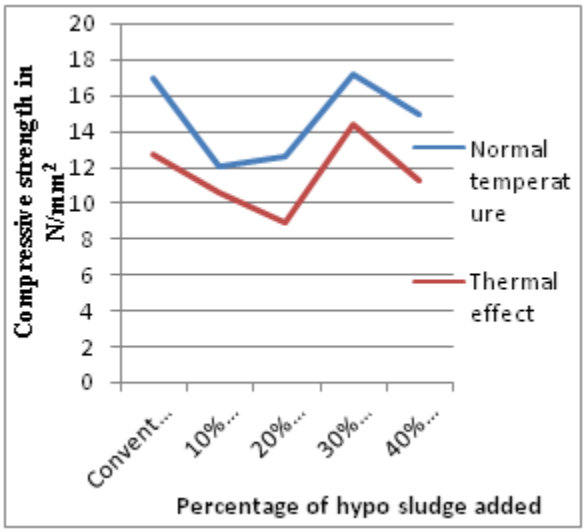
Variation of compressive strength due to thermoshock effect



Variation of compressive strength due to thermal effect

Specimen	Compressive strength (N/mm^2)	Compressive strength (N/mm^2) (Thermal effect)	Variation of compressive strength (N/mm^2)
Conventional	16.91	12.68	4.23
10% replacement	12.02	10.64	1.38
20% replacement	12.61	8.93	3.68
30% replacement	17.16	14.39	2.77
40% replacement	14.98	11.23	3.75

Variation of compressive strength due to thermal effect



V. CONCLUSION

From the test results the following conclusions are made

- Replacement of cement with hypo sludge material gave maximum compressive strength at 30% replacement.
- Maximum water absorption of hypo sludge concrete specimen is well below the allowable limit of 10%.
- Effective utilization of paper industry waste.
- Reduction of cement for cost effective construction.
- Reduces emission of CO_2 and other toxic gases.

From the above conclusion hypo sludge may be used as alternative material for cement in bricks.

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