PERFORMANCE EVALUATION ON LIGHT WEIGHT CONCRETE WITH WASTE TIMBER ADDING ADD MIXTURES

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Abstract

In construction, concrete is relative element. Different materials are embedded in concrete. Now as days, available waste materials are also ingress in concrete like industrials wastes, factories wastes, household wastes etc. concrete having more weight comparative other materials in construction. Now, weight reduction is main challenge for construction. Since years ago we have Light Weight Concrete (LWC), less weight it is. In present scenario huge constructions are built. In India we are having different soil conditions. Adopting of Light weight concrete is for weight reduction and temperatures conditions. And more advantages like reduction of dead load, faster building rates in construction. *In this research, we concentrated on mechanical properties of light weight concrete M30 using the light weight aggregate timber as a partial replacement to coarse aggregate and mineral admixture materials like Fly Ash and Silica Fume.*

This research was based on the performance of aerated lightweight concrete. However, sufficient water cement ratio playing a main role to produce adequate cohesion between cement and water. Insufficient water ratio can cause lack of cohesion between particles, thus effects on properties of concrete. Likewise too much water can cause segregation in high ragnge, subsequently effects on strength. Therefore, this research report is monitoring of the lightweight concrete. And concentrated on the performance of aerated concrete such as compressive strength test, Split tensile strength, and comparisons made with Normal concrete

Keywords— Light weight concrete, Timber, Fly ash, Silica Fume.

INTRODUCTION

Concrete is which made by lighter weight particles along with ingredients called Light weight concrete(LWC), which is compared with unit weight or density. LWC which is made by gravel and crushed stone. Here so many replacements were introduced in concrete. like Timber was using in concrete also a technology. The technology used both in existing timber structures and in new constructions for strength and stiffness upgrading. LWC made with lighter weight aggregate instead of normal aggregates. Compared with normal conventional aggregate concrete 1000 kg/m^3 decreased. Structural lightweight concrete has an in-place density (unit weight) on the order of 1440 to 1840 kg/m³. The range of 2240 to 2400 kg/m³ density for normal weight concrete. For usage in structural applications the concrete strength also should be greater than 17.0 MPa.

CLASSIFICATION OF LIGHT WEIGHT CONCRETE

1. It is convenient to classify the various types of lightweight concrete by their method of production. These are: By using porous lightweight aggregate of low apparent specific gravity, i.e. lower than 2.6. This type of concrete is known as ***lightweight aggregate concrete.***

2. By introducing large voids within the concrete or mortar mass; these voids should be clearly distinguished from the extremely fine voids produced by air entrainment. This types of concrete is variously knows **as *aerated, cellular, foamed*** or ***gas concrete***
3. By omitting the fine aggregate from the mix so that a large number of interstitial voids is present; normal weight coarse aggregate is generally used. This concrete as ***no-fines*** concrete.

AERATED CONCRETE

Aerated concrete having lower unit weight/density, thermal conductivity and strength. Like timber it can be sawn, screwed and nailed, but there are non-combustible. For smaller works we are using timber in concrete. This is also named as autoclave aerated concrete. Which is was made by form concrete. The precast products are usually made by the addition of about 0.2 percent aluminums powder to the mix which reacts with alkaline substances in the binder forming hydrogen bubbles. Air-cured aerated concrete is used where little strength is required e.g. roof screeds and pipe lagging. Full strength development depends upon the reaction of lime with the siliceous aggregates, and for the equal densities the strength of high pressure steam cured concrete is about twice that of air-cured concrete, and shrinkage is only one third or less. Aerated concrete is a lightweight, cellular material consisting of cement and/or lime and sand or other silicious material. It is made by either a physical or a chemical process during which either air or gas is introduced into a slurry, which generally contains no coarse material. Aerated concrete used as a structural material is usually high-pressure steam-cured. It is thus factory-made and available to the user in precast units only, for floors, walls and roofs. Blocks for laying in mortar or glue are manufactured without any reinforcement. Larger units are reinforced with steel bars to resist damage through transport, handling and superimposed loads. Autoclaved aerated concrete, which was originally developed in Sweden in 1929, is now manufactured all over the world.

HISTORY OF RECYCLE WOOD WASTE

Concrete containing wood aggregate in percentages of 0,15,20 and 25 in place of crushed stone was developed with a mix proportion of 1:1.26:2.76 and with water/cement ratio of 45. On hundred and twenty specimens were cast and tested to evaluate the strength and durability properties of concrete. The performance of wood aggregate concrete was compared with controlled concrete that contained only crushed stone aggregate. The compressive strength of control concrete was 31.40 Mpa and that of wood aggregate concrete with 15% replacement level was 32.36 Mpa which is 3.06% above the control concrete. Split tensile strength of 15% replaced wood aggregate concrete was 2.25 Mpa as against a value of 2.05 Mpa for control concrete registering an increase of 9.75%. The flexural strength of control concrete was 2.49 Mpa and that of concrete containing 15% wood aggregate was 2.51 Mpa which was 0.80% higher than the control concrete. The weight loss of wood aggregate concrete with 15% replacement level under acid attack was 30.38% greater than the control concrete. Under alkaline attack, the weight loss of wood aggregate concrete with 15% replacement level registered an increase of 9.72% over control concrete. Therefore, wood aggregate can be used in the production of concrete, and the optimum replacement was found to be 15% from all considerations.

V EXPERIMENTAL PROGRAMME

CUBE CASTING FOR M25 GRADE CONCRETE MIX & 0.45 W/C RATIO

CUBE CASTING REPLACEMENT OF 30% FLYASH & 30%WASTE WOOD	7 DAYS	14 DAYS	28 DAYS
	3	3	3

CUBE CASTING REPLACEMENT OF 30% SILICA FUME & 30%WASTE WOOD	3	3	3

FIG1: CASTING OF CUBES

Table 1: CUBE CASTING FOR M25 GRADE CONCRETE MIX & 0.5 W/C RATIO

	7 DAYS	14 DAYS	28 DAYS
CUBE CASTING REPLACEMENT OF 30% FLYASH & 30%WASTE WOOD	3	3	3
CUBE CASTING REPLACEMENT OF 30% SILICA FUME & 30%WASTE WOOD	3	3	3

TABLE 2: CYLINDER CASTING FOR M25 GRADE CONCRETE MIX & 0.5 W/C RATIO

	7 DAYS	28DAYS
CYLINDER CASTING REPLACEMENT OF 30% FLYASH & 30%WASTE WOOD	3	3
CYLINDER CASTING REPLACEMENT OF 30% SILICA FUME & 30%WASTE WOOD	3	3

VI RESULTS & DISCUSSIONS

LIGHT WEIGHT CONCRETE WITH FLY ASH

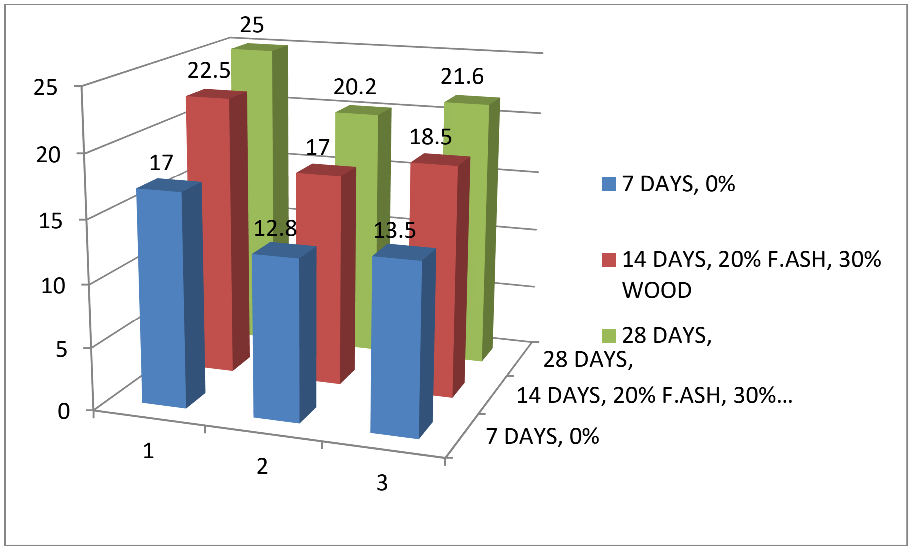
Table no 3: Percentages of optimum fly ash and waste wood(average results)

S no	Type of specimen	Replacement	w/c ratio	7 days strength	14 days strength	28 days strength
1	Cube (conventional Concrete)	No replacement	0.45	17 N/mm^2	22.5 N/mm^2	25 N/mm^2

2	Cube (Light weight concrete)	10% fly ash, 30% waste wood	0.45	11.8 N/mm^2	16.4 N/mm^2	19.4 N/mm^2
3	Cube (Light weight concrete)	20% fly ash, 30% waste wood	0.45	14.5 N/mm^2	18.1 N/mm^2	20.6 N/mm^2
3	Cube (Light weight concrete)	30% fly ash, 30% waste wood	0.45	10.5 N/mm^2	11.1 N/mm^2	13.9 N/mm^2
4	Cylinders (Light weight concrete)	20% fly ash, 30% waste wood	0.50	1.721 N/mm^2	1.92 N/mm^2	2.24 N/mm^2

Table 4: Results on using Fly ash as 20% replacement & 30% of waste wood at 0.45 & 0.50 w/c ratio(average results)

S no	Type of specimen	Replacement	w/c ratio	7 days strength	14 days strength	28 days strength
1	Cube (conventional Concrete)	No replacement	0.45	17 N/mm^2	22.5 N/mm^2	25 N/mm^2
2	Cube (Light weight concrete)	20% fly ash, 30% waste wood	0.45	12.8 N/mm^2	17 N/mm^2	20.2 N/mm^2
3	Cube (Light weight concrete)	20% fly ash, 30% waste wood	0.50	13.5 N/mm^2	18.5 N/mm^2	21.6 N/mm^2
3	Cube (Light weight concrete)	20% fly ash, 40% waste wood	0.50	9.5 N/mm^2	10.5 N/mm^2	14.6 N/mm^2
4	Cylinders (Light weight concrete)	20% fly ash, 30% waste wood	0.50	1.901 N/mm^2	2.01 N/mm^2	2.864 N/mm^2



FROM ABOVE GRAPH Y AXIS STRENGTH IN MPA

DISCUSSION

From table no 3, observed low strength performance at 0.45 water cement ratio and also leads to shrinkage cracks at early age. There is no adequate water content to control the shrinkage cracks and then we increased w/c ratio to 0.5 and casted cubes and cylinder. Results observed, shrinkage cracks are controlled due to available of required water content.

Better results are getting at 0.50 w/c ratio, and shrinkage cracks also controlled at the same time. Added fly ash like 10%, 20% and waste timber like 30%, 40%. We observed optimum results at 20% fly ash and 30% of waste wood timber. After 30% of waste wood timber getting down the properties of concrete. From above graph Y Axis we have Strength in Mpa

From the above table compressive strength performance better result at 30% of waste timber and spit tensile strength also getting same optimum results at same 30% of waste timber and 20% fly ash.

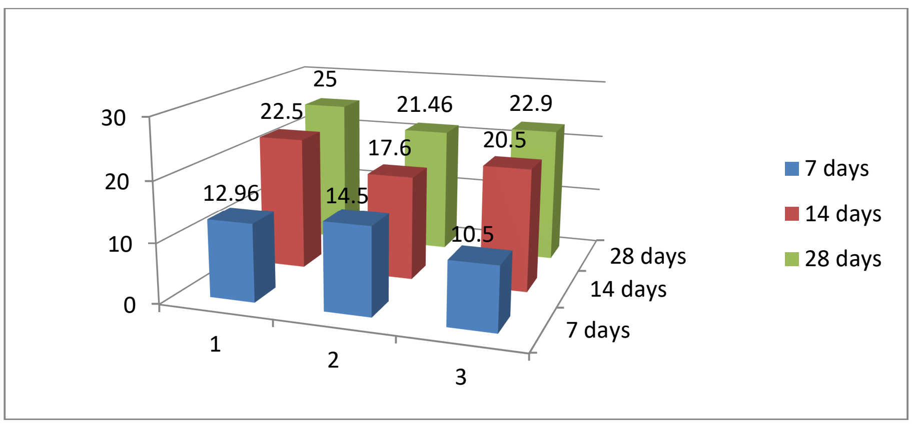
LIGHT WEIGHT CONCRETE WITH SILICA FUME

Table no 5: Percentages of optimum Silica fume and waste wood(average results)

S no	Type of specimen	Replacement	w/c ratio	7 days strength	14 days strength	28 days strength
1	Cube (conventional Concrete)	No replacement	0.45	17 N/mm^2	22.5 N/mm^2	25 N/mm^2
2	Cube (Light weight concrete)	10% silica fume, 30% waste wood	0.45	10.67 N/mm^2	14.4 N/mm^2	17.8 N/mm^2
3	Cube (Light weight concrete)	20% silica fume, 30% waste wood	0.45	15.5 N/mm^2	19.1 N/mm^2	22.6 N/mm^2
3	Cube (Light weight concrete)	30% silica fume, 30% waste wood	0.45	10.9 N/mm^2	12.8 N/mm^2	16.1 N/mm^2
4	Cylinders (Light weight concrete)	20% silica fume, 30% waste wood	0.50	1.97 N/mm^2	2.12 N/mm^2	3.01 N/mm^2

Table 6: Results on using Silica Fume as 20% replacement & 30% of waste wood at 0.45 & 0.50 w/c ratio(average results)

S no	Type of specimen	Replacement	w/c ratio	7 days strength	14 days strength	28 days strength
1	Cube (conventional Concrete)	No replacement	0.45	17 N/mm^2	22.5 N/mm^2	25 N/mm^2
2	Cube (Light weight concrete)	20% Silica Fume, 30% waste wood	0.45	12.96 N/mm^2	17.6 N/mm^2	21.46 N/mm^2
*3	Cube (Light weight concrete)	20% Silica Fume, 30% waste wood	0.50	14.5 N/mm^2	20.5 N/mm^2	22.9 N/mm^2
4	Cube (Light weight concrete)	20% Silica Fume, 40% waste wood	0.50	10.5 N/mm^2	14.5 N/mm^2	14.9 N/mm^2
*4	Cylinders (Light weight concrete)	20% Silica Fume, 30% waste wood	0.50	2.101 N/mm^2	2.31 N/mm^2	3.64 N/mm^2



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DISCUSSION

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Better results are getting at 0.50 w/c ratio, and shrinkage cracks also controlled at the same time. Added silica fume like 10%, 20% and waste timber like 30%, 40%. We observed optimum results at 20% silica fume ad 30% of waste wood timber. After 30% of waste wood timber getting down the properties of concrete.

From the above table compressive strength performance better result at 30% of waste timber and spit tensile strength also getting same optimum results at same 30% of waste timber and 20% silica fume.

APPLICATIONS OF LIGHTWEIGHT CONCRETE(WASTE WOOD)

Low density comparative conventional concrete
Dead load reduction
Sustainability at various temperatures
Used at temporary constructions
Used to low strength conditions
Constructed pedestrians at Public parks
Constructed public toilets at villages
Construction of small sewer systems at villages
Walls are easy to screw and nailing

VI CONCLUSIONS

- In this research we observed like strength parameters gradually increasing while adding fly ash and silica fume.
- Showing less strength results at low water cement ratio compared with conventional concrete
- With low water cement ratio, facing shrinkage cracks.
- In this study we recommended minimum 0.5 w/c ratio.
- The use of fly ash in portland cement concrete (PCC) has many benefits and improves concrete performance in both the fresh and hardened state. Fly ash use in concrete improves the workability of plastic concrete, and the strength and durability of hardened concrete.
- The use of silica fume in portland cement concrete (PCC) has many benefits and improves concrete performance in both the fresh and hardened state. Silica fume use in concrete improves the workability of plastic concrete, and the strength and durability of hardened concrete when compared using fly ash.
- Getting better results by using silica fume in concrete over fly ash
- In view of durability cases very less durability compared to conventional concrete.
- By using waste wood, replacement with Coarse aggregate in concrete shrinkage problems are occurred at 0.45 w/c ratio because less water content. Naturally wooden absorbs water then its not allowing to act hydration process in it.
- Then, we are increased w/c ratio to 0.50, and controls the shrinkage cracks.
- Getting optimum strength of cubes, its gradually increased by increasing the w/c ratio.

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