ECONOMICAL & LIGHT WEIGHT CONCRETE BY PARTIAL REPLACEMENT OF FINE AGGREGATE WITH SAWDUST AND COURSE AGGREGATE WITH BRICK BALLAST

[1]Sundeep Singh, [2]Daimil Akhthar, [3]Mr. Pawan Kumar
[1]Vice Principal, [2,3]Assistant Professor
School of Polytechnic
SDGI Global University, Ghaziabad

1. INTRODUCTION

Concrete is a mixture of cement , fine aggregates , coarse aggregates and water. Normally river sand is used as fine aggregates and stones or gravels are used as coarse aggregates in the concrete . These materials are limited on the earth . The increase of demand of these materials , it causes shortage of material due to less availability and increases the cost of the materials . The availability of natural sand and stones decrease day by day for making concrete due to using excessive and unsual non-scientific mining methods from the riverbeds and drop down the water level . To overcome these types of problems researchers found an alternative or substitute material for aggregates . There are many types of waste materials available in our environment , which can be replaced with aggregates in concrete for making concrete . Many types of waste light weight material like sawdust , fly ash , rice husk ash , cow dung and over burnt bricks are easily available in our environment . If these materials are directly disposed in our environment then it causes many problems . So that these materials can be used as construction material for making concrete . The choice of these alternate or substitute materials depends upon many factors like availability , cost factor , physical and chemical composition of ingredients . If these materials are replaced with aggregates in concrete then they can considerably reduce the dumping and waste storage problems and simultaneously helps to preserve the sources of natural aggregates . Saw dust and brick ballast are the waste materials which can be replaced with fine aggregates and coarse aggregate respectively in concrete . These materials are light in weight , so that it is helpful to construct light weight structures.

From last few decades it can be seen that sawdust waste growing at a vast rate and increases year by year in our environment , households, mills and factories etc. But there are many problems and obstacles for using sawdust in concrete as compared it reduces the work ability of concrete and increases the water demand. This demand of water can be reduced by using water reducing admixtures. Sometimes sawdust concrete is also known as nailing concrete . The nailing concrete may be defined as concrete in which nails can be driven and in which they are firmly held . There are many other benefits of using sawdust concrete , if the concrete made from sawdust it controls interior humidity level,it has thermal and heat proofing properties and not subjected to fungi . The sawdust partially replaces with fine aggregates and brick ballast can be partially replaces with coarse aggregates . The major volume of ingredients in concrete is the aggregates , it attains 60-80% of the total volume of concrete . So that the cost of the whole concrete is largely depend upon the aggregates used . Normally in concrete , crushed stones or gravels are used as coarse aggregates. These are obtained naturally either from riverbed or by crushing rocks mechanically upto the required size . The concrete is the composite material, so in this research studied on how concrete behave when natural coarse aggregates partially replaced by over burnt bricks or by brick bats .

2. OBJECTIVES OF THE STUDY

This project is on the utilization of sawdust and brick ballast partially replaced with sand and gravels at different proportion in concrete mixture. The main aim of project is to achieve the lightweight and economical concrete. The work further deals with comparative study of concrete made with the use of sawdust and brick ballast at different proportion and normal aggregates concrete , in accordance to their structural member , cost , weight of structure as well as strength they provide . The specific researches in this project are :-

1) To investigate the variations in the compressive strength of concrete by replacing natural fine and coarse aggregates with sawdust and brick ballast aggregates respectively at different proportion . Compressive strength test machine is used to check the compressive strength of concrete .
2) To identify the optimum quantity of sawdust and brick ballast aggregates concrete.
3) To compare the weight reduction between nominal aggregate concrete and the concrete made with replacement of sawdust and brick ballast .
4) To compare the cost reduction between nominal mix and optimum mix after replacement.

3. EXPERIMENTAL SETUP

The experimental investigation includes the casting of cube with sawdust and brick ballast patially replaced with fine aggregates and course aggregates respectively and the tests were conducted to study the various physical properties such as slump test , compaction factor test , 28 days compressive strength . A total of 30 Nos. of Specimens were casted and tested in the laboratory to evaluate their compressive strength.

The casting of various specimens has been done under laboratory conditions using standard equipment . Each casting batch consists of in the form of at least three 150 mm cubes determining the concrete cube compressive strength . For each batch , quantities of cement , fine aggregate , coarse aggregate and water have been kept ready in the required proportions . sawdust and Brick Ballast aggregates , wherever required to be added in the concrete mix in terms of weight , have been also kept ready .

The same mix proportions have been used for the normal concrete and concrete made with different percentage proportion of sawdust and brick ballast aggregates. Initially the sand and cement have been mixed thoroughly to get a uniform mix in dry condition , indicated by the uniform colour of the mix. No concentration of the either material being visible. Then , course aggregates have been added to this dry mix. Above 60% of the total water has been added slowly to get a uniform mix . After this , the remaining water along with super plasticizer thoroughly mixed in it has been added , and the mixing was continued for about one minute.

S. No.	Designation of Specimen	% Replacement of Sand with Sawdust	% Replacement of aggregates with brick ballast
1	M0	-	-
2	M1	4	8
3	M2	4	16
4	M3	4	24
5	M4	8	8
6	M5	8	16
7	M6	8	24
8	M7	12	8
9	M8	12	16
10	M9	12	24

Table 1 : Details Of Test Specimen

4. TESTS ON PROPERTIES OF CONCRETE

1) Tests on Fresh Concrete Properties

Workability: - Workability is the fresh property of concrete. It is defined as the ease of mixing , transporting , placing and compacting . Slump test and Compaction factor test is used to check the workability of concrete during this research work . With the addition of sawdust and brick ballast , slump value is decreases and compaction factor value is also decreased

Slump Test :- The Slump test is the type of test used to determine the workability of concrete . This is the easiest procedure to check workability at Site

Sr. No.	Designation of Specimen	Slump Value (mm)
1	M0	44
2	M1	38
3	M2	34
4	M3	31
5	M4	35
6	M5	32
7	M6	28
8	M7	30
9	M8	26
10	M9	21

Table 2 : Slump Values of Different Specimens

ii) Compacting Factor Test :- Compacting factor test or compaction factor test is the type of test used to determine the workability of concrete in its plastic stage . This test is normally used if the slump is less than 25mm . This test can be performed in laboratory only.

Compacting Factor value :- It is the ratio of weight of the partially compacted concrete to the weight of fully compacted concrete.

S. no	Designation Of Specimen	Compaction Factor Value
1	M0	0.91
2	M1	0.85
3	M2	0.84
4	M3	0.82
5	M4	0.83
6	M5	0.80
7	M6	0.79
8	M7	0.77
9	M8	0.75
10	M9	0.72

Table 3 : Compaction factor values of Different Specimens

(2) Tests on Hardened Concrete

Compressive Strength of Concrete:-

Compressive strength tests have been conducted on concrete cubes of size 150 X 150 X 150 mm cast from each batch of concrete . To check the quality of concrete, these tests have been carried out in accordance with IS:516 – 1959 after 28 days . The bearing surfaces of machine have been cleaned and the test specimen has been placed in the machine such that the load is applied to the faces other than the cast faces of the specimen. The maximum compressive load has been recorded at which the specimen failed to take any further increase in the load . The average of three samples has been taken as the representative value of the compressive strength for each batch of the concrete. The compressive strength has been calculated by dividing the maximum compressive load by the cross sectional area of cube specimens.

Sr. No.	Designation of mix	Specimen Name	Compressive Strength of Specimen (After 28 days)		
			Load (KN)	Compressive Strenth (N/sq. mm)	Mean Compressive Strength (N/sq. mm)
1	M0	1	985	43.77	43.79
		2	995	44.22	
		3	970	43.11	
2	M1	1	865	38.44	38.14
		2	860	38.22	
		3	850	37.77	
3	M2	1	845	37.55	36.53
		2	801	35.60	
		3	820	36.44	
4	M3	1	792	35.20	34.13
		2	748	33.24	
		3	764	33.95	
5	M4	1	724	32.18	31.36
		2	681	30.26	
		3	690	31.66	
6	M5	1	632	28.08	28.99
		2	676	30.04	
		3	649	28.84	
7	M6	1	553	24.57	25.19
		2	578	25.68	
		3	570	25.33	
8	M7	1	554	24.62	24.57
		2	550	24.44	
		3	555	24.66	
9	M8	1	492	21.86	22.46
		2	525	23.23	
		3	502	22.31	
10	M9	1	469	20.84	19.71
		2	459	20.40	
		3	403	17.91	

Table 4 : Compressive strength of various Mix proportion at 28 days

5. CONCLUSION

The following conclusion have been found from the present work:-

1. The core objective of this research was to investigate the effects of sawdust and brick ballast aggregates on the properties of concrete. The investigation discovered decrease in workability, compressive strength, unit weight and cost per unit volume of concrete.
2. As the replacement proportion of sawdust and brick ballast increase in concrete then slump value of the mixes gradually decreases and workability is also decreases. At the optimum replacement proportion i.e. M5 (8 SD 16 BB), the slump value decreases from 44mm (For Nominal concrete) to 32mm
3. As the replacement proportion of sawdust and brick ballast increases in concrete then compacting factor value of the mixes gradually decreases and workability is also decreases. At the optimum replacement proportion i.e M5 (8 SD 16 BB) , the compacting factor value decreases from 0.91 (For Nominal Concrete) to 0.80 .
4. 28 days compressive strength of the concrete decreases gradually for the increasing replacement percentages. For the optimum mix M5 (8 SD 16 BB) , the compressive strength of M 30 grade of concrete decreases from 43.79 N/sq. mm (For Nominal Concrete) to 28.99 N/sq. mm.
5. The sawdust and brick ballast concrete can be used in the production of non load bearing precast concrete mix . Flooring and pavement concrete, hollow blocks and flooring tiles.
6. For the optimum mix the weight reduction upto 11.47%.

REFFERENCE

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