Impact Factor Value 4.046 **e-ISSN: 2456-3463**
International Journal of Innovations in Engineering and Science, Vol. 4, No.4, 2019
www.ijies.net

A Comparative Study on Nominal Mix With Partially Replaced Cement By Paper Pulp Mix (Trial Mix)

Tina M. khandale[1], Mohan V. Nemane[2], Snehal Bijawe[3], Shah Parvez Yaqub[4], Ravina Kadekar[5], Kalyani Sutare[6]

[1]Assistant professor, [2,3.4.5,S]student
Jagadambha College of Engineering & Technology, Yavatmal, India, 445-001.

Abstract *–Environmental problems are growing due to release of CO2 in the construction process of cement, it is producing harmful effects on environment. And also shortage of conventional construction materials such as cement, gravels and sand is increasing, because of the higher growth in construction work. Hence alternates are strongly required for these materials. An ordinary Portland cement is caused to five to seven percent of total greenhouse gases emission, so alternative of cement is required for construction of concrete. At the present time researchers searched some substitute for these materials such as fly ash, blast furnace slag, silica fume, rice husk ash, etc apart from this the recent studies research has shown that the paper pulp is also useful for construction of concrete as a fine aggregate. Paper pulp contains low calcium and minimum amount of silica, because of this silica and magnesium paper pulp can be used like cement, paper pulp reduces cost of concrete and also it improves the strength of concrete. This study explains the application of paper pulp as a substitute for binding material in concrete. This paper reviews the performance properties of paper pulp in concrete. Paper pulp can be used as an effective building material.The M25 grades of concrete were used in this study. three different replacement level of cement with waste paper pulp i.e. 5,10, and 15% were used and PPC concrete of 0% cement replacement level was also made for comparison. Compressive test strength of concrete were tested at a curing age of 7 and 28 days. Overall result reveals that use of paper pulp as partial replacement of cement can improve the strength of lower grade concrete upto 20% replacement level. Use of waste paper pulp as partial replacement of cement also markedly reduces the cost of construction which otherwise been dumped making environmental hazard.*

Keywords*-compressive strength, slump value, nominal mix, trial mix.*

I- INTRODUCTION

At the recent days the development of our country is in the rising graph in various department like in civilization and in industry but when in industry production of material as well as waste material are made and hence there is need to dispose of this waste material or reuse in construction work for the minimize the cost of construction and maintained environment pollution free.

Concrete is Composite construction material composed of cement, aggregate (Course aggregate made of gravels or crush of rocks such as limestone or granite plus fine aggregate such as sand) water, admixture as per mixed design. The concrete made with OPC is relatively strong in compression but weak in tension and tends to be brittle. These two weaknesses have limited its use. Another fundamental weaknesses of concrete is that cracks start as soon as concrete is placed and before it hardened properly. These cracks are major cause of weakness in concrete particularly in large on-site applications leading to subsequent failure and effect the durability.

India is facing a serious challenge in disposing waste in many landfills throughout the country. The landfill situation is resulting in high disposal costs and potential environmental problems. If current trend continues, with waste production projected to grow by 5% each year, landfills would be at full capacity by 2025.

Paper pulp contains low calcium and maximum calcium chloride and minimum amount of silica. Paper pulp behaves like cement because of silica and

magnesium properties. This silica and magnesium improve the setting of concrete. Paper pulp consist of cellulose Fibres, calcium carbonate, china clay and residual chemicals which bound up with water. Paper pulp is beneficial to the concrete while helping to economy. The use of paper pulp in concrete can save the paper waste disposal cost and produced green concrete for construction. Paper waste has been used as building material for decades, especially in cementation matrices and since then a lot of research has been done to develop the mechanical properties of the composite like compressive, tensile and flexural strength. Most of the published works on recycling of papers are from paper mill (Ellora paper mill Nagpur, Hardoli paper mill Nagpur). The research on use of paper sludge can be further carried out in concrete manufacturing as a new recycled material. The use of paper-mill pulp in concrete formulations was investigated as an alternative to landfill disposal.

II- METHOLOGY

1. MATERIALS REQUIRED :-

1.1. Cement:-

It is one of the binding materials in this project. Cement is the important building material in today's construction 53 grade pozzolena Portland Cement (OPC) conforming to IS: 8112-1989.

1.2. Fine Aggregate:-

Concrete produced from a mixture of fine aggregate (sand), a binder (cement), and water. Fine-aggregate concrete is similar to building mortars in its composition and certain properties. It is used mainly for making thin-walled and conventional rein-forced-concrete structural components and products. Fine-aggregate concrete is used in highway and airfield construction because of the high tensile strength that Results from its fine-grained structure. The absence of coarse aggregate (crushed stone or gravel) substantially facilitates the preparation, transport, and placing of the concrete, particularly when concrete pumps are used. A disadvantage of fine-aggregate concrete is the increased consumption of binder compared to other types of concrete and the associated greater shrinkage and creep. The quantity of binder in the concrete can be reduced by pulverizing some of the sand, by the use of plasticizers, or by autoclaving of products. The sand which was locally available and passing through 4.75mm IS sieve is used.

1.3. Coarse Aggregate:-

Locally available crushed blue granite stones conforming to graded aggregate of nominal size 12.5 mm as per IS: 383 – 1970. Crushed granite aggregate passing through 4.75 mm sieve and will be used for casting all specimens. Several investigations concluded that maximum size of coarse aggregate should be restricted in strength of the composite. In addition to cement paste – aggregate ratio, aggregate type has a great influence on concrete dimensional stability

1.4. Waste paper pulp :-

Wastepaper used in this study was collected from the paper mills (hardoli paper mill Nagpur ,ellora paper mill Nagpur etc.).

2. TESTS OF MATERIALS:-

2.1. Test on cement

Table 1 Test On Cement:-

Sr. No.	Name Of Test	Reading
1	Fineness of cement	1%
2	Consistency of cement	34%
3	Initial setting time of cement	30 min
4	Final setting time of cement	9:40 min
5	Soundness of cement	3 mm

2.2. Test on fine aggregate

Table 2 Test On Fine Aggregate

Sr. No.	NAME OF TEST	READING
1	Sieve analysis of sand(fine agg.)	Zone 3
2	Specific gravity of sand	2.56
3	Bulking of sand	1%

2.3. Test On Course Aggregate :-

Table 3 Test On Course Aggregate

Sr. No.	NAME OF TEST	READING
1	Sieve analysis	20 mm
2	Specific gravity	3.01
3	Impact value	13.46%
4	Bulking of course aggregate	0.5%

2.4. Test on waste paper pulp:-

A. Fineness Of Waste paper pulp:-
The fineness of the waste paper pulp is found that in this study is 5%

B. Consistency Of Waste paper pulp:-

Table 4 Consistency Of Waste paper pulp

SR.NO.	PROPORTION	READING
1	5%	40.8
2	10%	42.5
3	15%	44.2

C. Initial setting time of waste paper pulp:-

Table 5 Initial setting time of waste paper pulp

SR.NO.	PROPORTION	READING
1	5%	30Min
2	10%	26Min
3	15%	22Min

D. Final setting time of waste paper pulp:-

Table 6.Final setting time of waste paper pulp

SR.NO.	PROPORTION	READING
1	5%	9:33Min
2	10%	9:28Min
3	15%	9:24Min

E. Specific gravity of waste paper pulp
specific gravity of the waste paper pulp is **2.11**

III- MIX PROPORTION

The process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required strength, durability, and workability as economically as possible, is termed the concrete mix design. The proportioning of ingredient of concrete is governed by the required performance of concrete in 2 stages, namely the plastic and hardened state. If the plastic concrete is not workable, it cannot be properly placed and compacted. The compressive strength of hardened concrete which is generally consider to be an index of other properties, depends up on many factors e.g. quality and quantity of cement, water and aggregate, batching and mixing, placing, compacting and curing. The concrete mix design or M25 grade was proposed by using IS: 10262-2009. The design mix proportion is shown in Table 7.

Table 7. Material required for 1 m^3

MIX	Paper pulp %	Cement (kg)	Paper pulp (kg)	FA (kg)	CA (kg)	Water (l)
M25	00%	437.7	00	661	1071	197
	05%	415.81	21.88	661	1071	197
	10%	393.93	43.77	661	1071	197
	15%	372.04	65.65	661	1071	197

IV- EXPERIMENTAL PROGRAMS

4.1. Tests on fresh concrete

The workability and consistency of all the concrete mixtures was determined through slump test utilizing a metallic slump mould. The difference in level between the height of the mould and that of highest point of the subsided concrete was measured and reported as slump. The slump tests were performed according to IS: 1199-1959.

Fig. no. 1 slump cone for workability

5.2 Tests on hardened concrete

The specimen of standard cubes of (150mm*150mm*150mm) were used to determine the compressive strength of concrete. Totally 24 cubes, were cast for the strength parameters. In this study waste paper sludge was partially replaced as 5%, 10% and 15% in place of cement in concrete for M-25 mix. Cube compressive strengths have been determined at 7 and 28 days in accordance with IS 516: 1959.

Fig.no. 2.compression testing machine

RESULT

7.1. Result on fresh concrete:-

The result on fresh concrete (i.e. workability of concrete) was obtained by using the slump cone test for various trial mixes is given in the graph no.7.1.1.

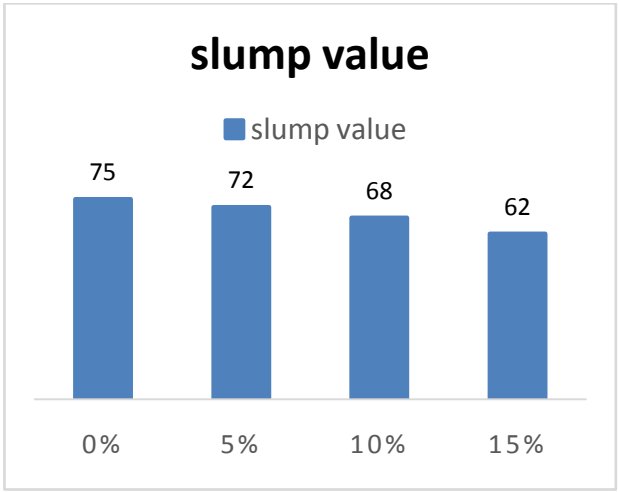

Fig. no.3.Slump value for the various trial mixes and nominal mix.

From the observation of the above graph the slump value is decrease with increase in percentage (0%, 5%, 10%, 15%) of replacement of cement by waste paper pulp (WPP).

7.2 COMPRESSIVE STRENGTH TEST RESULT IN 7 DAYS:

The result of the compressive strength of each trial mix for 7 days and 28 days curing is given in the table 7.2.1, table no. 7.2.2. and table no.7.2.3. respectively.

Table 8: Result at 0% percent replacement for

Sample name	7 days strength(N/mm)	28 days strength(N/mm)
0% replacement	20.22	32.20

compressive strength

Table 9 : Result of 7 days curing after replacement of cement on compressive strength

Replacement of Cube name	A	B	C
% of replacement level	5%	10%	15%
Curing period for 7 days	20.88 20 20.93	21.33 22 22.66	18.88 20.44 17.33

The compressive strength at the cube at 7 days of each cube in the following graph (graph no)

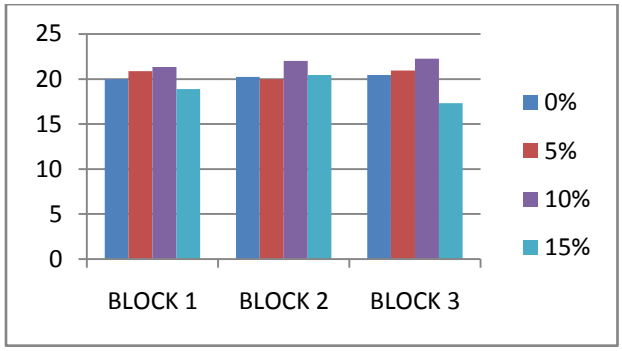

Fig. no.4.compressive strength at the cube at 7 days

The average compressive strength the cube at 7 days calculate is given and compare the value obtain for various trial mixes is given the following graph.

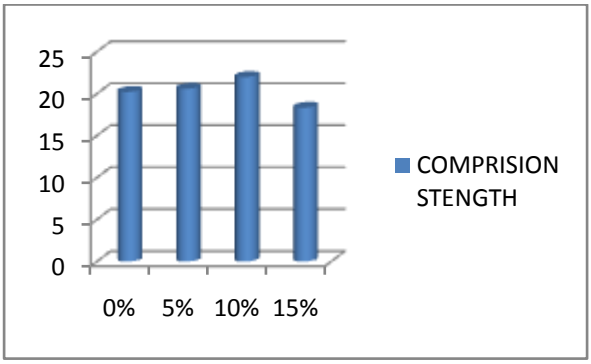

Fig no.5.average compressive strength of trial mixes after7 days curing.

7.3 COMPRESSIVE STRENGTH TEST RESULT IN 28 DAYS:

The graph here shows the compressive strength result of average cement waste paper pulp cubes when cured in water for 28 days with respective replacement .it shows the strength of maximum 10% replacement of cement by waste paper pulp respectively.

Table no 10. : Result of 28 days curing after replacement of cement

Replacement of Cube name	A	B	C
% of replacement level	5%	10%	15%
Curing period for 28 days	33.40	37.6	27.33
	32	37.51	29.64
	31.55	35.51	25.04

Compressive strength of 28 days curing:

The compressive strength at the cube at 28 days of each cube in the following graph (graph no 7.3.2.)

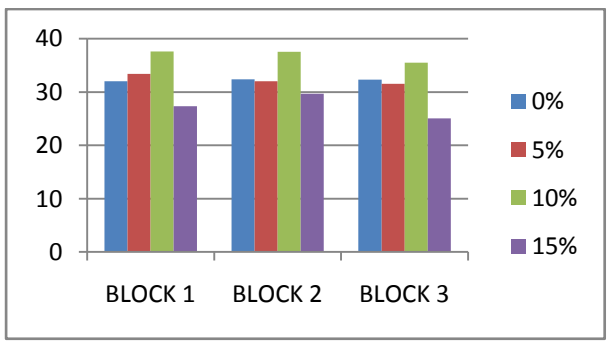

Fig no.6. Result of compressive strength of each cube after 28 days curing.

The average compressive strength the cube at 7 days calculate is given and compare the value obtain for various trial mixes is given the following graph 7.3.4.

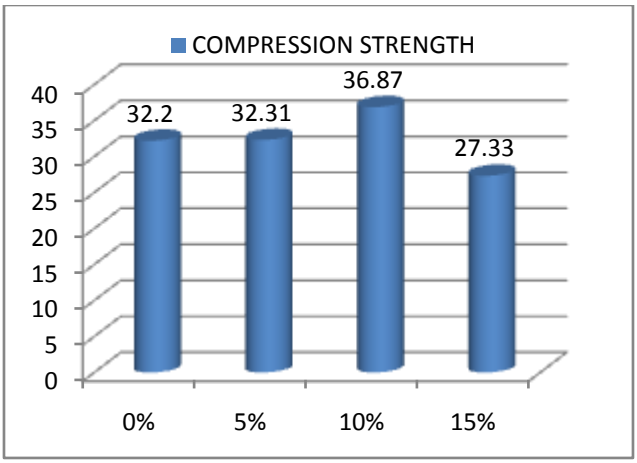

Fig no.7.The average compressive strength of trial mixes after 28 days curing.

CONCLUSION

From this study it can be inferred that waste paper sludge is a good substitute for cement in the production of concrete. In this study, considering the strength as the criteria, 5% to 10% replacement gave optimum results.

8.1. Here was an increase in compressive strength of about 7.5% at 28 days for 5% replacement of cement compared to reference mix of M25 concrete.

8.2. From the cost comparison of paper sludge concrete with conventional concrete, it was found that the former is economical for bulk works.

8.3. One of the major challenges of our present society is the protection of our environment. The use of paper sludge in concrete can save paper industry disposal costs, landfill problems and produce a greener concrete for construction.

8.4. With the addition of waste paper sludge, there was a slight reduction in the workability.

REFERENCES

[1] *Sumit A Balwaik ; S P Raut," UTILIZATION OF WASTE PAPER PULP BY PARTIAL REPLACEMENT OF CEMENT IN CONCRETE ", International Journal of Engineering Research and Applications (*

[2] *Patil," APPLICATION OF PAPER PULP IN CONCRETE", International Journal for Scientific Research & Development| Vol. 4, Issue 05, 2016 | ISSN (online): 2321-0613.*

[3] *LodhiRavindra Singh IJERA) Vol. 1, Issue 2.*

[4] *JawaharSingh Premit Kumar, AkhtarSaleem, BathamGeeta," APPLICATION OF PAPER WASTE IN CEMENT CONCRETE", . Int. Journal of Engineering Research and Applications ISSN : 2248-9622, Vol. 5, Issue 4, (Part -7) April 2015, pp.95-98.*

[5] *RitzawatybintiMohamadShukeri and A. Naser Abdul Ghani," CONCRETE MIX WITH WASTEPAPER", 2nd INTERNATIONAL CONFERENCE ON BUILT ENVIRONMENT IN DEVELOPING COUNTRIES (ICBEDC 2008)*

[6] *M.S. Shetty "Concrete technology theory and practice"*

[7] *IS 456-2000 "plain and reinforced concrete code of practice (4th revision)"*

[8] *IS 10262-2009"concrete mix proportioning-guidelines(1st revision)"*

Details of All Authors (Optional):-

Sr. no.	photograph	details
1		**T.M.khandale is working as Assistant Professor, department of civil engineering, Jagadambha College Of Engineering and Technology Yavatmal , India, 445-001**
2		**Mohan V. Nemane (final year student, civil Engg. Dept.) Jagadambha College Of Engineering and Technology Yavatmal , India, 445001**
3		**Ravina Kadekar (final year student, civil Engg. Dept.) Jagadambha College Of Engineering and Technology Yavatmal , India, 445001**
4		**Shah Parvez Yaqub (final year student, civil Engg. Dept.) Jagadambha College Of Engineering and Technology Yavatmal , India, 445001**
5		**Snehal Bijawe (final year student, civil Engg. Dept.) Jagadambha College Of Engineering and Technology Yavatmal , India, 445001**
6		**Kalyani Sutare (final year student, civil Engg. Dept.) Jagadambha College Of Engineering and Technology Yavatmal , India, 445001**