

“EXPERIMENTAL STUDY ON HIGH STRENGTH FIBRE REINFORCED CONCRETE BY USING HORSE MANURE”

Prof. Vinay Kumar Singh Chandrakar

****Department of Civil Engineering, School of engineering Bhopal****

PRAVIN KUMAR SINGH

M. Tech. Scholar, Madhyanchal Professional University, (School of engineering) Bhopal, M.P., India.

ABSTRACT

Use of fibres is not new to the construction industry. But the way they are being used and its ever-growing varieties have always made it a burning topic for the researchers. The principal reason to incorporate fibres into a cement matrix is to increase the compressive strength and to improve the soundness characteristics of the resultant composite. Previous studies related to the use of natural organic fibres in concrete have shown strength variation with respect to the various types of fibres and fibres content.

In the present investigation, an attempt has been made to design a high strength Fibre Reinforced Concrete by proportioning the mix with moisture free pulverized natural organic fibres obtained from horse manure/dung. 6 mixes were prepared separately to determine the characteristics and properties of freshly laid concrete. 18 cubes were casted for the determination of compressive strength and 18 beams were casted for the determination of flexural strength of concrete. Later study was carried out on this designed concrete mix by considering different parameters such as fibre content, proportioning of fine aggregates, time (days) and types of tests (Destructive and Non Destructive test).

Results of the study have shown that the performance of designed concrete mix with different mix proportions and different percentage of fibres as additive and replacement of fine aggregates are far more efficient and superior to the conventional mix. As the proportion of percentage of fibers is increased, the performance and strength of freshly mixed as well as of hardened concrete cubes gets improved. After increment in percentage of fibers in mixes, a stage comes where the quantity of fibers is well enough to affect the performance as well as strength of concrete cube. This research

summarized the use of horse manure/dung, a natural organic fibre by some percentage in the concrete mix to get favorable workability, compressive and flexural strength.

Key words: - High Strength Concrete, Natural Organic Fibre Reinforced Concrete, Horse Manure/dung, Designed Mix, Workability, Flexural Strength, Compressive strength.

INTRODUCTION

Concrete is the mixture of cement, sand, aggregate and water this is most commonly used construction material in the field of construction engineering. But increasing the technology these material modify day by day using some equivalent quality material such as fiber reinforced concrete.

Fiber Reinforced Concrete

Random oriented fiber reinforced concrete is one of the most promising composites used in the construction. Usually, for the structural applications steel fibers should be used in a role supplementary to the reinforcing bars. Steel fibers relatively inhibit cracking and improve resistance to material deterioration as a result of fatigue, impact and shrinkage.

Effects of Fiber on Concrete

The quantity of the fibers added to a cement concrete mixture is measured as a % of the total volume of the composite (concrete and fibers) termed volume fraction (V_f). V_f typically ranges from 0.1 to 3%. Aspect ratio (l/d) is calculated by dividing fiber length (l) by its diameter (d).

Horse Manure/Dung

In this research, natural organic fiber from waste (horse manure) is used as admixture in concrete. The physical composition of horse manure consists of straw, straw pellets, straw flax, flax, wood pellets, saw dust. The chemical composition of the excreta is 24.63% crude fiber, 32.84% dry matter, 81.83% volatile organic matter, 18.17% ash and 2.95% ether extract. The fibrous amount in the manure would be higher of such horses whose diet content having green grasses, plant hay (rice, wheat). The horses does anaerobic digestion so their compost, after receiving moisture free

doesn't smell bad as compare to other animals excrete. It is eco- friendly, as it doesn't have any bad environmental effect

OBJECTIVE OF THE STUDY:

- ✓ To compare the effect of using horse manure as a Fine aggregate in concrete by partial replacement of sand also compare the effect of using horse manure as an additive in concrete by partially adding it as the weight of cement
- ✓ To make the comparative study of properties of concrete with the parameter like fiber content.

LITERATURE REVIEW

Experimental study on concrete reinforced with human and horse hair fibers “Zakaria Hameed Awadallah Ibrahim” (2020)

Was examine to improve the tensile properties of concrete, short fibers are used. Human and horse hairs consider a bio material and have a good strong in tension; hence it can be used as a fiber reinforcement material. Hair Fiber (HF) an alternate non-degradable matter is available in abundance and at a very cheap cost. It also creates environmental problem for its decompositions. The aim of this research work is to find out the properties (mechanical) of hair fiber reinforced concrete. Experiments were conducted on concrete cylinders, cubes and prisms with various percentages of human and horse hairs fibers i.e. 0%, 1%, 1.5%, and 2.5 % by weight of cement. Two grades of reference plain concrete were used, 20 and 40 MPa. The results showed that there is an increment in the various mechanical properties and strength of concrete by addition of human and horse hairs to concrete.

Study of Horse Manure with Fly Ash Ingredients in Brick Fabrication “Neelesh Kumar Deshmukh, Dr. Raviraj Singh Gabbi” (2022)

Directed on manufacturing of the bricks from natural waste however the current pattern of reusing organic waste has extraordinary effect on building material industry. A few research works have done to discover the substitution of bond in concrete. This examination work is on an

arrangement to utilize one such natural waste i.e. horse manure into the bricks fabricating. Fly-ash bricks have officially demonstrated their significance as the ordinary bricks gives hardness to the ground water. This gives a rule that the horse manure can likewise be utilized as a part of bricks fabricating if its quality is satisfactory with in the farthest point. Five diverse weight rates of Fly ash and horse manure with (70%, 60% half, 40% and 30%) and (10%, 15%, 20%, 25% and 30%) were taken individually. These syntheses were mixed completely by hand mixing, to get a homogenous mix. Distinctive pieces of Fly ash remains alongside horse manure were kept in three diverse little size containers.

MATERIALS AND METHODS

The materials those were used in our thesis work are as follows:-

- ❖ Binding material i.e. Cement
- ❖ Fine aggregate (Sand)
- ❖ Coarse aggregate
- ❖ Horse Dung as fibre
- ❖ Potable water

MIX PROPORTION AND DESIGN

Mix design can be defined as the procedure of selecting appropriate ingredients of concrete and determining their virtual proportions with the objective of producing concrete of certain minimum strength and durability as economically as possible. The purpose of designing as can be seen from the above definition is twofold. The primary objective is to achieve the stipulated target strength and durability. The subsequent objective is to make the concrete most economical. Cost wise all concretes depend primarily on two factors; namely cost of material and labor cost, by way of formworks, batching, mixing, transporting and curing is nearly same for high-quality concrete and low quality concrete. In this study we take M25 grade of concrete.

Table 1 Mix Proportion M25 Grade Concrete

S.No.	Materials	Proportions
1	Water (L.)	160
2	Cement (kg.)	350
3	Sand (kg.)	717
4	Aggregate (kg.)	1170
5	Calculated Proportions (C:S:A)	1 : 2.05 : 3.34

Fiber add in this study 2%,4%,6%,8% and 10% with cement and same % replacing with sand.

RESULTS AND DISCUSSION

The Results (or Findings) section follows the Methods and precedes the Discussion section. The Discussion section follows the Results and precedes the Conclusions and Recommendations.

Slump Cone Tests Results

The results of slump tests determines that due to increase in the fiber content, there is a indication of very low water cement ratio and hence value of slump decreases with increase in fibrous contents. This is due to reason that manure is highly porous and somehow viscous material. Thus when the fiber is used as a additive in mix proportions, the value of slump starts decreasing randomly. Also when the fiber is used as a replacement of sand in mix proportions, the value of slump also decreases, but doesn't collapse aimlessly.

Table 2 - Tests results of Slump Cone Test

Fibre (%)	Slump (mm)
0%	68
2%	65
4%	63
6%	60
8%	57
10%	54

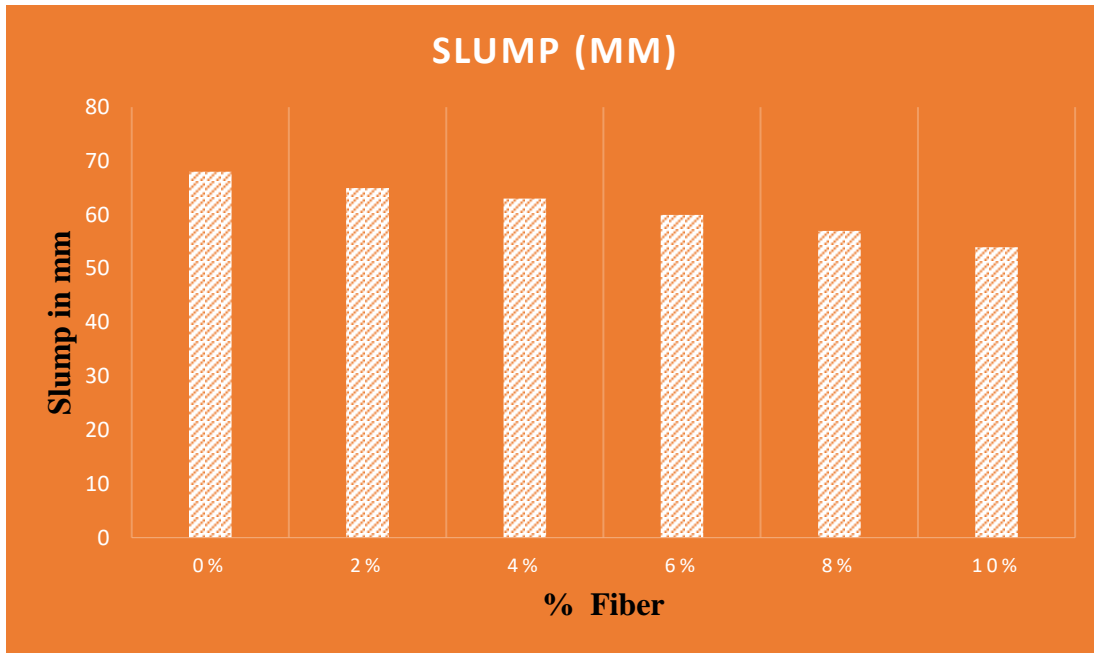


Figure -1 Slump Cone Test

Rebound Hammer Tests Results

The Characteristics Compressive Strength of concrete at 3,7 and 28 days was found in N/mm^2 . It was observed that when fibre is used as additive in concrete mix, with increases in fiber content the early age growth of concrete decreases. The reason behind that is due to moisture in concrete due to fiber.. This is due to reason that the greater bonding of fibre amongst them. However, the best results at 28 days when (6%) fibre is used as additive.

Table .3 Tests results of Rebound Hammer Test

Fibre (%)	Rebound Value N/mm^2		
	3 Days	7 Days	28 Days
0%	12.95	18.4	30.6
2%	12.51	18.5	31.1
4%	13.23	18.1	31.0
6%	14.54	19.0	32.5
8%	13.61	18.7	32.3
10%	12.36	17.8	31.2

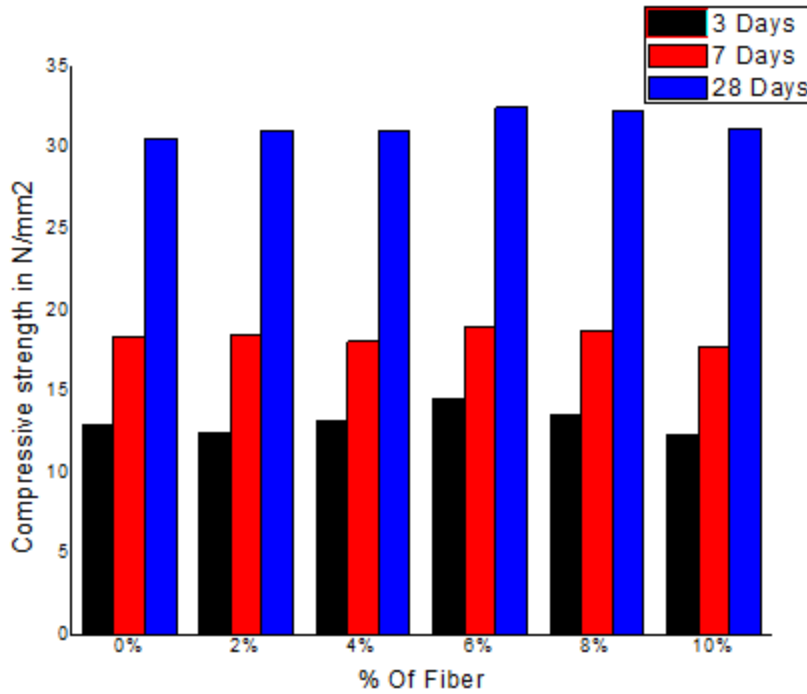


Figure -2 Compressive Strength With Rebound Hammer

Flexural Strength Test Results

The Flexural strength of concrete was found in N/mm^2 at 7 and 28 days. It is tested on 6 different mixes. The mix design was selected from such previous concrete mix whose compressive strength was good in compression test in this project. The best results after 28 days was found in (6%) as a additive fibre by weight of cement and replacement of sand, similar to the case of compressive strength.

Table 4 Tests Results of Flexural Strength Test.

Fibre (%)	Flexural Strength (N/mm^2)	
	7 Days	28 Days
0%	1.80	3.65
2%	1.88	3.70
4%	2.45	3.71
6%	3.05	3.89

8%	2.75	3.45
10%	2.42	3.42

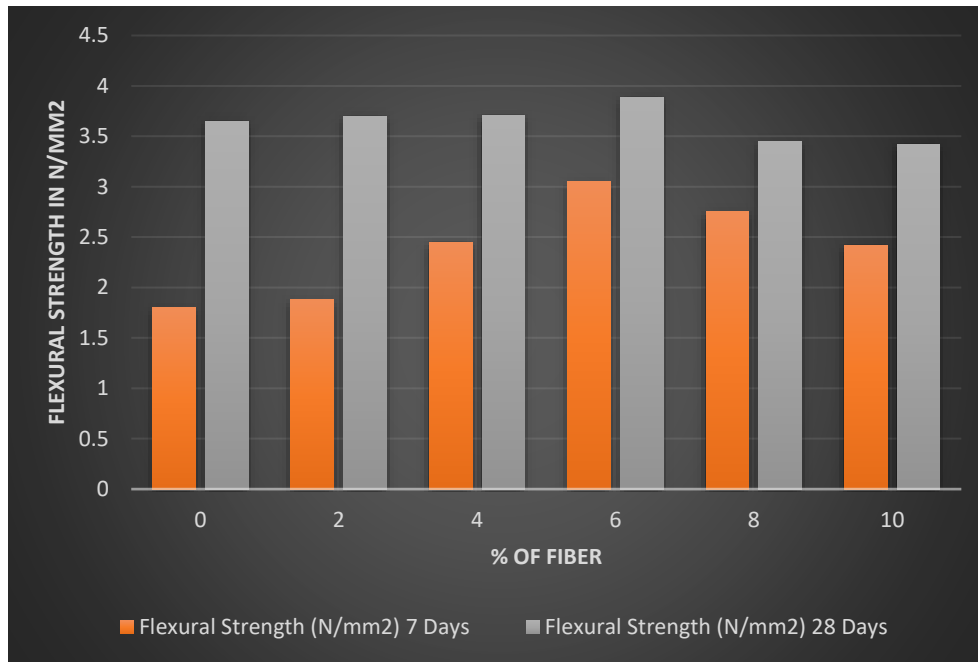


Figure 4 Flexural Strength Test

Conclusion

From the experimental examination this exploration work can be conclude as following:-

- ❖ A slump test results indicates with increase in fiber content, workability of mix decreases.
- ❖ It has been found that fiber improves bond strength. Improvements in concrete properties of fresh concrete by the addition of fiber were observed.
- ❖ Compressive and flexural strength increases with the increase in the percentage of fiber up to addition of 6% by weight of cement and 6% by replacement of sand.

- ❖ The positive effects of the fibers become more significant after 28 days, but still it was capable to give concrete with better strength in early stages as compared to the plain concrete.
- ❖ The use of fiber resulted in better elasticity of hardened concrete than conventional concrete without affecting the performance of concrete

REFERENCES

- [1] N. Krishna Raju, "Prestressed Concrete", published by Tata McGraw-Hill Education, 2012.
- [2] N. Subramanian, "Design of Reinforced Concrete Structures" published by Oxford University Press, 16 Jan 2014.
- [3] O. Y. Ojedokun, A. A. Adeniran, S. B. Raheem and S. J. Aderinto, "Cow Dung Ash (CDA) as Partial Replacement of Cementing Material in the Production of Concrete", British Journal of Applied Science & Technology 4(24): 3445-3454, 2014.
- [4] Pavithra.V, "an experimental investigation on concrete by using soil and cow dungcash as a partial replacement of fine aggregate and cement" International Conference on current Research in Engineering Science and Technology (ICCREST-2016).
- [5] Pravin V Domke, "Improvement in Strength of Concrete by using Industrial and Agriculture Waste", IOSR Journal of Engineering, Vol. 2 (4), April 2012, pp 755-759.
- [6] Ravindra K. Dhir, Trevor G. Jappy, "Exploiting Waste in Concrete", Proceedings of International Seminar, University of Dundee, Scotland, UK in 1999.
- [7] Siddique Rafat, "Characteristics of Concrete Reinforced with San fibers", Research gate, Article: January, 1996.
- [8] S.K. Duggal, "Building Materials", fourth edition, published by New Age International (P) Limited, 2016.
- [9] Zakaria Hameed Awadallah Ibrahim "Experimental study on concrete reinforced with human and horse hair fibers" Volume 15, Issue 56, July 2020, Page 753-762 10.21608/aej.2020.103351.
- [10] Neelesh Kumar Deshmukh, Dr. Raviraj Singh Gabbi "Study of Horse Manure with Fly Ash Ingredients in Brick Fabrication" nternational Journal of Scientific Research & Engineering Trends Volume 7, Issue 1, Jan-Feb-2022, ISSN (Online): 2395-566X.