

# Performance of Concrete Reinforced with Human Hair

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**Abstract:** - Use of human hair in mortar and concrete is very recent now days. Human hair is used as natural fibre to enhance the strength characteristics of concrete and mortar. Many studies have been conducted to know human hair performance. Here a parametric experimental study was conducted in laboratory to know the influence of human hair on cement concrete. Concrete grade of M-25 grade were produced and reinforced with human hair content. Various specimens of concrete were casted in the laboratory and percentage of human hair content was 0, 0.5, 1.0, 1.5, 2.0 and 2.5 to the weight of cement. The specimens were tested and their effects on compressive strength and workability were investigated. The study shows reasonable results and it will be of great use in concrete technology. Result showed that the concrete cube reinforced with human hair content at 1.5 % to that of weight of cement is best suited as it gives higher compressive strength and it does not much affect the workability.

**Key Words:** Compressive strength, flexural strength human hair, concrete, mortar.

## 1. INTRODUCTION

Reuse of recycled or waste materials for the construction of civil structures is an issue of great importance in this century. Addition of waste products in Fibre-reinforced concrete is also very common now days. Fibre-reinforced concrete is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibres that are uniformly distributed and randomly oriented.

Fibres are usually used in concrete to control cracking due to plastic shrinkage and to drying shrinkage. They also reduce the permeability of concrete and thus reduce bleeding of water. Some types of fibres produce greater impact, abrasion and shatter-resistance in concrete. Some commonly used fibres are Steel, Glass, Carbon, Cellulose, Synthetic fibres like Polypropylene, Nylon and Natural fibres like Coir, Hay etc.

**Recently there has been a rapid growth in research and innovation in the natural fibre composite (NFC) area [1].**

Human hair concrete is great example of such type research and innovations. Human hair is considered as a waste material in most parts of the world and is a common constituent found in municipal waste streams which cause enormous environmental problems [8] like burning of human hair or the waste piles congaing them which is respected in many regions of the world produces foul odour and toxic gases such as ammonia carbonyl sulphides hydrogen sulphides, sulphur dioxide, phenols etc. open

dumps of hair generate hair dust which causes discomfort to nearby people and if inhaled in large quantities can result in several respiratory problems and death. Oil sweat and other organic matter getting to the hair rot over time and become a source of foul odour and breeding ground for pathogens.

Best way to reduce such problems is to use the waste material as a resource. Human hair concrete is great example of concrete produced from such resources. Used of human hair in concrete not only reduces the waste disposal problem but also, it contributes to the economic system by providing an economic construction material. Human hair has advantage that it is completely biodegradable, renewable and easily available at negligible cost.

## 2. EARLIER INVESTGATION & SCOPE OF THE STUDY

It is widely recognized that use of natural fibers when used correctly in concrete has many advantages. In similar way when human hair used in correct proportion and manner it give ideal choice of fibers in concrete. Many studies have been conducted to understand the performance characteristic of human hair concrete. Here a parametric experimental study was conducted in laboratory to know the influence of human hair on cement concrete. Concrete grade of M-25 grade were produced and reinforced with human hair content.

## 3. OBJECTIVE OF THE STUDY

- i) Strength enhancement of concrete using human hair as a natural fibre.
- ii) Testing of the specimen with and without using of human hair in various % under compression.
- iii) Analyzing the results to establish relation between compressive strength determined by varying % of human hair fibre.
- iv) Suggesting the optimum % of human hair fibre to meet the requirements like aesthetic view, workability, compressive strength etc.

## 4. EXPERIMENTAL PROGRAMME

Parametric test series were conducted in the laboratory. Concrete cube of grade M25 of size 15cm X 15cm X 15 cm made of coarse aggregate, sand, cement were prepared. Six specimens of standard proportioned mix were casted. Six specimens of each % of human hair fibre from 0.5, 1.0, 1.5, 2.0 and 2.5 were also prepared.

Different test series conducted in the laboratory are tabulated in following table1.

**Table-1. Test Series under parametric study**

S. No.	Concrete mix	Block Designation And % of human hair fibre	Property to be determined
1.	Control mix	CB-0	Compressive strength at the age of 7 days and 28 days
2.	Mix with various % of human hair	CB-I (0.5 %)	
		CB-II (1.0 %)	
		CB-III (1.5 %)	
		CB-IV (2.0 %)	
		CB-V (2.5 %)	

**MATERIALS USED:**

Ordinary Portland Cement (OPC) 53 grade conforming to IS: 8112-1989 was used. Content of human hair as natural fibre in concrete was 0, 0.5, 1.0 and 1.5 for the experimentation.

**TESTING OF HUMAN HAIR CONCRETE BLOCKS**

Compressive strength at the age of 7 days and 28 days for different material and composition are tabulated in the table 2 and table 3.

**Table -2: Compressive strength at the age of 7 days**

S. No.	Concrete mix	Block Designation And % of human hair fibre	Average compressive strength at 7 days (MPa)
1.	Control mix	CB-0	16.94
2.	Mix with various % of human hair	CB-I (0.5 %)	17.24
		CB-II (1.0 %)	17.89
		CB-III (1.5 %)	18.45
		CB-IV (2.0 %)	18.99
		CB-V (2.5 %)	18.70

**Table -3: Compressive strength at the age of 28 days.**

S. No.	Concrete mix	Block Designation And % of human hair fibre	Average compressive strength at 28 days (MPa)
1.	Control mix	CB-0	24
2.	Mix with various % of human hair	CB-I (0.5 %)	25.20
		CB-II (1.0 %)	25.60
		CB-III (1.5 %)	26.25
		CB-IV (2.0 %)	26.65
		CB-V (2.5 %)	26.33

**5. RESULTS AND DISCUSSION**

In this paper experimental parametric study has been undertaken to understand the influence of natural fibre (human hair) on the compressive strength. The parameters of the study include: Addition of human hair content as natural fibre in concrete and testing of specimen under compression. These parameters were presented in detail in Table 1. For better understanding of role of human hair on compressive strength, typical graphs have been drawn.

**5.1 Effect of human hair content on workability**

From visual observations it can be clearly said that during mixing and compaction of the concretes at initial percentage (0.5, 1.0 and 1.5) that the concretes were homogeneous; there was no segregation and bleeding; and the mixes were compactable. As the percentage of hair content increases beyond 1.5 % it was observed that practical difficulty in mixing, handling and compaction. It shows workability decreases after 1.5 % and binding properties also affected after 1.5 % hair content.

**5.2 Effect of human hair content on compressive strength**

From table 2 it can be said that compressive strength of concrete at the age of 7 days curing reinforced with human hair content increases with increase in hair content. It can be said that strength characteristics at percentage 1.5, 2.0 and 2.5 shows almost similar level of performance. But where workability and binding properties is important human hair content 1.5 and 2.0 is best suited.

Similar performance of human hair content concrete found at the age of 28 days curing. It can be said that strength characteristics at percentage 1.5, 2.0 and 2.5 shows almost similar level of performance. But where workability and binding properties is important human hair content 1.5 and 2.0 is best suited.

This observation suggests that the use of human hair content enhance the strength and other properties up to certain limit after that strength increases but other properties affected.

## 6. EFFECT ON COST

It can be clearly said that use of human hair content in concrete as a natural fibre results in increased compressive strength but it does not affect the workability of concrete. Used of human hair in concrete not only reduces the waste disposal problem but also, it contributes to the economic system by providing an economic construction material. Human hair has advantage that it is completely biodegradable, renewable and easily available at negligible cost.

## 7. SUMMARY AND CONCLUSION:

In this paper an experimental program has been conducted to study the influence of human hair as natural fibre in concrete grade of M-25. Concrete cube in various % of fibre was prepared in the laboratory. Based on results obtained from the present investigation, the following conclusions can be made on compressive strength and workability of human hair concrete.

1. Use of human hair content as natural fibre results increase in compressive strength.
2. Concrete cube with human hair content 2.0 and 2.5 % shows better performance with respect to strength but hair content 2.0 is optimum % for strength as well as workability.
3. Use of human hair content in concrete as natural fibre results in higher compressive strength as well does not affect workability much.

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