Structural Behaviour of Concrete with Replacement of Fevicol

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Abstract

The aim of the experiments to increase the strength of the concrete and performance of the concrete. In this experiment the study on strength characteristics of M15 grade concrete using Fevicol as a replacement of cement is conducted. Mix design for fevicrete is done by calculating the specific gravity of the manufactured Fevicol and cement. Cubes, beams and cylinders were casted based on adding Fevicol with 5%, 10%, 15%, 20%. The strength parameters such as compressive strength, flexural strength and split tensile strength of the casted cubes, beams and cylinders were tested respectively.

Keywords- Fevicol, Compressive Strength, Flexural Strength, Tensile Strength

I. INTRODUCTION

A. General

Concrete is a constitute made essentially of Portland cement, fine aggregates, coarse aggregates and water. The mixture of the materials will undergo in a chemical reaction called hydration and this process will result in a change of mixture from plastic state to a solid occurs over a period of time. Fevicol branded glue is a white adhesive .It appears as a white viscous paste. As the main aim of the experiment is to increase strength and performance of the concrete.

B. Properties

- Bonding strength,
- Impact resistance,
- Time to set,
- Sagging,
- Shrinkage,
- Versatility,
- Fire resistance,
- Shock and vibration resistance,
- Non-staining,
- Corrosion resistance etc.

C. Advantages

- The strength can be increased by the usage of locally available alternative materials, instead of conventional materials though it will increase the cost it will be stable construction.
- The Fevicol has the high bonding strength, impact resistance than the ordinary cement.

D. Curing

The compression, flexural and split strengths were found after 7 and 28 days of curing.

II. PROPERTIES OF MATERIALS

A. Cement

The cement used for this project work is 53-grade Portland pozzolana cement. The various properties of cement are tabulated in Table 1.

Table 1: Properties of Cement:

S.no.	*Description*	*Value*
1	*Normal consistency*	*0.4-0.6*
2	*Initial setting time*	*30 mins*

3	*Final setting time*	*600 mins*
4	*Specific gravity*	*3.13*

B. Coarse Aggregate

Natural coarse aggregate was tested as per IS: 2386 (Part 1and 3) – 1963 and IS: 383 – 1970. The size of coarse aggregate will be 20mm.The properties of natural coarse aggregate are tabulated in Table 2.

Table 2: Properties of Aggregates:

S.No.	*Properties*	*C.A.*
1	*Specific gravity*	*2.75*
2	*Fineness modulus*	*2.33*
3	*Water absorption*	*7.5%*
4	*Crushing value*	*35%*
5	*Impact value*	*25.9%*
6	*Abrasion value*	*4%*

C. Water

Water used for mixing and curing was clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that are deleterious to concrete or steel. Potable water with pH value 7 is used for mixing and curing throughout the experiment.

III. EXPERIMENTAL INVESTIGATIONS

A. Mix Proportioning

The M15 having proportion 1:2:4 and are used by weight and w/c as 0.5. For this concrete mix, Fevicol is added for replacement of cement at 5%, 10%,15%,20%.

Table 3: Mix Proportions (for 3 cubes)

Mix	*Cement (kg)*	*Fevicol (kg)*	*F.A (kg)*	*C.A (kg)*
Standard Mix	*4.455*	*-*	*8.91*	*17.82*
Mix 1	*4.233*	*0.22*	*8.91*	*17.82*
Mix 2	*4.009*	*0.44*	*8.91*	*17.82*
Mix 3	*3.786*	*0.668*	*8.91*	*17.82*
Mix 4	*3.564*	*0.89*	*8.91*	*17.82*

B. Casting of Specimen

Fig. 1: Casting of specimen

Table 4: Properties of Specimen

S.No.	*Specimen*	*Size (mm)*	*No. of specimen*
1	*Cube*	*150x150x150*	*30*
2	*Cylinder*	*150x300*	*30*
3	*Prism*	*500x100x100*	*30*

IV. TEST PROCEDURE

A. Test on Fresh Concrete

1) Workability of Concrete by Slump Cone Test

A slump test is a method used to determine the consistency of concrete. The consistency, or stiffness, indicates how much water has been used in the mix. The stiffness of the concrete mix should be matched to the requirements for the finished product quality.

Table 4.1:

Mix proportions	*Slump value (mm)*
Standard cube	*80*
Mix 1	*70*
Mix 2	*65*
Mix 3	*63*
Mix 4	*60*

Fig. 2:

2) Workability of Concrete by Flow Table Test

The flow table test or flow test is a method to determine consistency of fresh concrete. The flow table is wetted. The cone is placed in the center of the flow table and filled with fresh concrete in two equal layers. Each layer is tamped 10 times with a tamping rod. Wait 30 seconds before lifting the cone. The cone is lifted, allowing the concrete to flow. The flow table is then lifted up 40mm and then dropped 15 times, causing the concrete to flow. After this the diameter of the concrete is measured. The flow table test or flow test is a method to determine consistency of fresh concrete.

Table 4.2:

Mix proportions	*Flow percent (%)*
Standard cube	*80*
Mix 1	*70*
Mix 2	*66*
Mix 3	*62*
Mix 4	*58*

3) Workability of Concrete by Compaction Factor Test

Compacting factor of fresh concrete is done to determine the workability of fresh concrete by compacting factor test as per IS: 1199 – 1959. The apparatus used is Compacting factor apparatus.

Fig. 3:

Table 4.3:

Mix proportions	*Compaction factor*
Standard cube	*0.89*
Mix 1	*0.85*
Mix 2	*0.8*
Mix 3	*0.79*
Mix 4	*0.75*

4) Workability of Concrete by Vee Bee Test:

To determine the workability of freshly mixed concrete by using of Vee – Bee consist meter apparatus. The time required for complete remolding in seconds is considered as a measure of workability and is expressed as the number of Vee-Bee seconds. The method is suitable for dry concrete. For concrete of slump in excess of 50mm, the remolding is so quick that the time cannot measure.

Table 4.4:

Mix proportions	*Vee bee seconds*
Standard cube	*8.22*
Mix 1	*9.7*
Mix 2	*10.5*
Mix 3	*11.4*
Mix 4	*13*

Fig. 4:

B. Test on Harden Concrete

1) Compression Test

The cube specimen was tested for compressive strength at the end of 7 days and 28 days. The specimen was tested after the surface gets dried. The load was applied on the smooth sides without shock and increased continuously till the specimen failed. The mean compressive strength is calculated and tabulated in Table 5.

Table 5: Mean Compressive of Concrete

Mix	*M15*	
	7 days (Mpa)	*28 days (Mpa)*
Control Mix	*16.04*	*18.8*
Mix 1	*17.33*	*20*
Mix 2	*18.5*	*25.7*
Mix 3	*15.5*	*17.5*
Mix 4	*11.5*	*13.9*

Fig. 5:

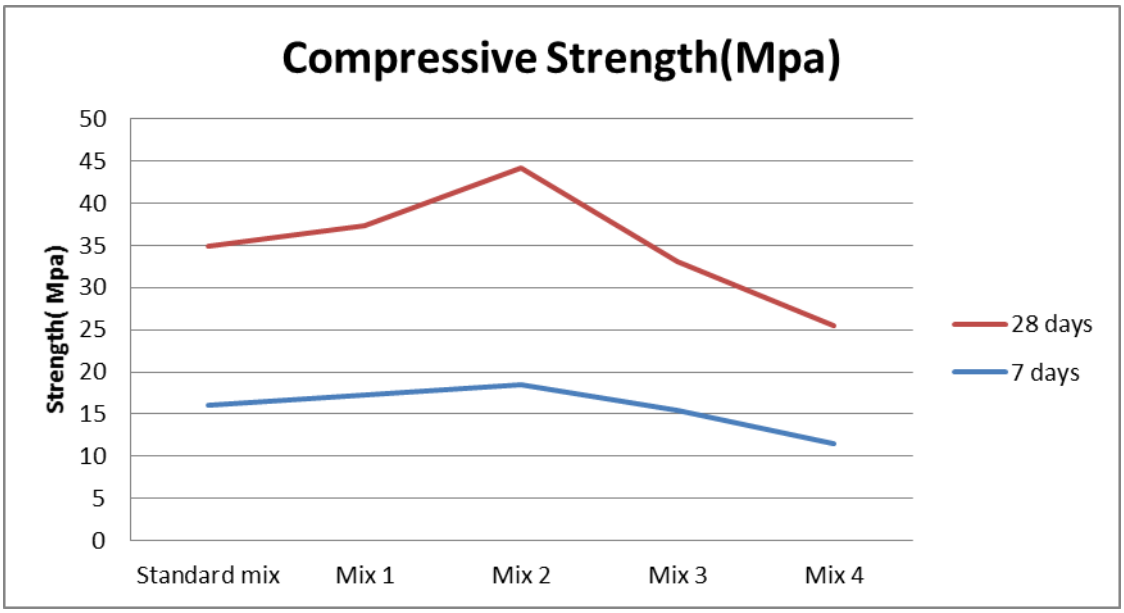

Fig. 6:

From these values we came to know that the compressive stress value increases for the mix2 for the 10% mixing of the fevicol and it will goes on decreasing for the mix 4 for 20%.

2) Split Tensile Test

Split tensile test is also referred as "Brazilian Test". Placing a cylindrical specimen horizontally between the loading surfaces of a compression-testing machine and the load is applied till the cylinder failed along the vertical diameter.

Tensile strength = 2W / (π DL)

The mean tensile strength is calculated and tabulated in Table 6.

Fig. 7:

Table 6: Spilt Tensile Strength of Concrete

Mix	*M15*	
	7 days	*28 days*
C.M	*3.7*	*3.9*
Mix 1	*5.05*	*5.52*
Mix 2	*5.55*	*5.76*
Mix 3	*4.06*	*4.88*
Mix 4	*3.24*	*3.6*

From these values there was a slight increase of tensile strength at mix 1 and mix 2,but there was not best improvement in tensile strength of the concrete after that there was a sudden drop of strength.

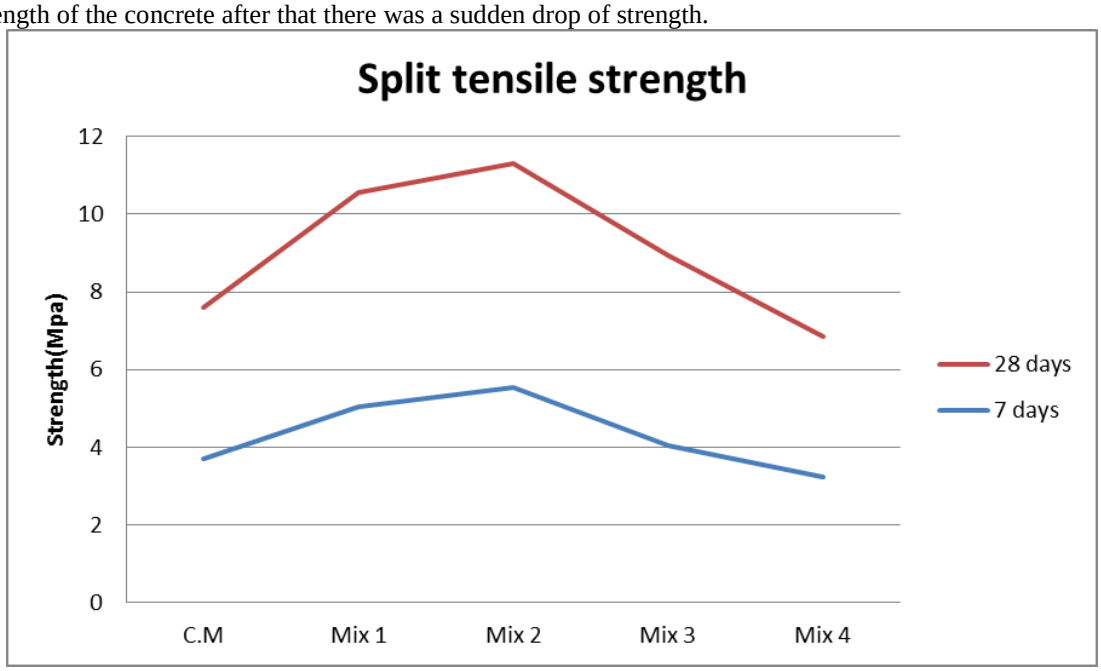

Fig. 8:

3) Flexure Test

The flexural strength of the concrete was determined by using loading frame. The loading is done using hydraulic jack on the beam and the load applied is measured using the proving ring. The span of the beam adopted is 450 mm and central concentrated load was applied.

Flexural strength = $3Wl\ a/\ bd^2$ if $110mm \leq a \leq 133mm$

Flexural strength = $WL\ a/\ bd^2$ if $a > 133mm$

The mean flexural strength is calculated and tabulated in Table 7.

Fig. 9:

Table 7: Flexural Strength of Concrete (Mpa)

Mix	*M15*	
	7 days	*28 days*
C.M	*4.61*	*4.87*
Mix 1	*4.91*	*6.2*
Mix 2	*5.02*	*7.43*
Mix 3	*4.55*	*4.73*
Mix 4	*4.23*	*4.55*

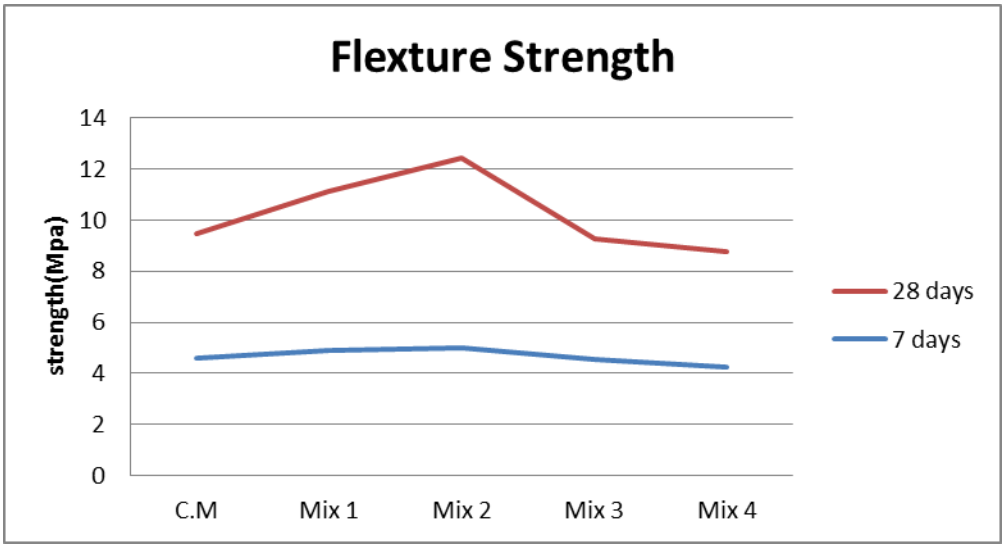

Fig. 10:

The flexural strength of the fevicrete was maximum at mix 2 after that there was a sudden decrease of the strength which indicate the good increase in the strength.

V. RESULTS AND DISCUSSIONS

- The workability of the concrete with Fevicol is low as compared to normal concrete.
- Initial setting time = 15 mins
- Final setting time =360 mins
- Though Fevicol is in semi liquid form it does not obtains good workability even at 0.5 as water cement ratio.
- By increasing the water cement ratio as 0.6 the workability in the Fevicol with concrete can be increased without affecting the strength of concrete.
- The compressive strength can be increased with Fevicol concrete as the Fevicol has the good bonding strength and impact resistance we can achieve the high strength concrete.
- The tensile strength will also increase but not the maximum strength.
- The Flexure strength is increased which indicates the concrete will not fail due to the bending.
- The mixing of Fevicol with concrete will be quietly costly.

VI. CONCLUSION

- The workability of Fevicol with concrete will be low.
- The compressive strength will be maximum at 10% of adding Fevicol which indicates the increase in compressive strength.
- Not a cost efficient.
- The flexure strength will be increased at the 10% of adding Fevicol indicates the increase in compressive strength.
- Overall the mixing of Fevicol with concrete will be efficient only when replaced with 10% Fevicol.
- The adding of Fevicol will reduce the corrosion of steel in RCC.
- When applying paint to the concrete the paint will easily stick to wall so that paint cost will be reduced.

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