

An Experimental Study to Produce High Early Strength Concrete

Soni Vivek .A.

B.E. Student

Department of Civil Engineering

A D Patel Institute of Technology, New V V Nagar

Chauhan Shyamal .A.

B.E. Student

Department of Civil Engineering

A D Patel Institute of Technology, New V V Nagar

Tandel Ujjval .U.

B.E. Student

Department of Civil Engineering

A D Patel Institute of Technology, New V V Nagar

Prof. Vatsal Patel

Associate Professor

Department of Civil Engineering

A D Patel Institute of Technology, New V V Nagar

Abstract

The main aim of this study is to produce high early strength concrete and helping for boosting of construction work and to achieve economy. The main application of our research work is in the field of temporary works. In temporary WORKS if we are able to achieve earlier strength of concrete for various components of building it is possible to use that fund in further progress of construction works, as the temporary works causes 20-25% cost of total construction cost. Mechanical property has studied by performing compression test for cubes (150mm×150mm×150mm) size and beams of (500mm×100mm×100mm) size. Test performed were compression test on cube and flexural test on beams. It was observed that using plasticizer we were able to achieve high early strength.

Keywords: Concrete, Faircrete plasticizer, Compressive strength, Application of point load

I. INTRODUCTION

The total cost of temporary works for normal project costs 20-25% of total cost and sometimes-even 30-35% for complex projects so there were various problems related to economy in the construction work and time taken for the construction work. If temporary works usage time for particular component is more and if the concrete doesn't gets strength earlier so that temporary work can't be used for next component so more temporary work structures are to be purchased so fund that should be used in some other important task are blocked in that temporary work so economy is not achieved. In addition, if the concrete component does not gain strength earlier it will consume more time so as a result time consuming.

So by addition of proper artificial plasticizer if we are able to achieve the strengths earlier means if for casting of any concrete component of building if it takes 7 days for casting and if we are able to achieve high early strength at 3 days by that plasticizer so our problems will be solved and we will be benefitted.

Therefore, by addition of that artificial plasticizer it will help the same concrete mix to achieve high strength earlier and same strength as that of normal mix design at the end of 28 days. so we are able to get success in both the task of economy as well as reduction in time consumption hence it will be revolutionary work in the field of construction and will help many people related to construction activities like contractors, engineers in terms of economy, and residents or to purchaser it terms of early possession of house.

The type and improvement in early strengths is dependent upon the usage of plasticizer and the type of mix used but mainly on the plasticizer. The volume fraction used in terms of 50 kg bag of cement is 200ml of faircrete plasticizer and by reducing the water content by 10%.

In addition, it is using for various construction works such as shot Crete repair, poles, parking garages, and agricultural applications. High-early-strength concrete is used for prestressed concrete to allow for early stressing; precast concrete for rapid production of elements; high-speed cast-in-place construction; rapid form reuse; cold-weather construction; rapid repair of pavements to reduce traffic downtime; fast-track paving; and several other uses.

In fast-track paving, use of high-early-strength mixtures allows traffic to open within a few hours after concrete is placing.

II. PLASTICIZER DETAILS

For developing high early strength in concrete, we used Fair Crete plasticizer, which is manufacture in Fair Mate Company, located at Baroda. This Plasticizer is very advance plasticizer, which is very much use in construction companies, and for pavements of various highways as it provide high strength earlier, so it is very much used.

This plasticizer we used as per details given in Table 1. The main benefit is that very limited quantity is used and 10% of the water is reduce.

III. MATERIAL AND PROPERTIES

A. Cement

The cement used in this experimental effort is Ultratech 53 grade Ordinary Portland Cement. The specific gravity of this cement is 3.15. Standard consistency of cement was 31.5%. All properties of cement had tested by referring IS 12269 – 1987.

B. Fine Aggregates

Domestically available sand of Bodeli is use in this research. Sand passing from 4.75 mm sieve and of specific gravity of 2.63 and fineness modulus of 2.84 are used.

C. Coarse Aggregates

Aggregate of size 20 mm and 10 mm available from the domestic site Sevalia are used. Specific gravity of course aggregate is 2.77 and fineness modulus is 6.59.

D. Water

Fresh potable water free from acid and organic substances was use for mixing and curing concrete.

E. Artificial Plasticizer

Addition of faircrete plasticizer in concrete mix and reducing water content by 10% of same mix

Table – 1

Proportion of plasticizer

Plasticizer (ml)	cement (kg)
200	50
100	25

IV. EXPERIMENTAL WORK

A. Mix Proportion

The mix proportion shown in Table II was made for a concrete with a slump 110mm and M40 grade as per method given by IS: 10262 – 2009[7].

Table -2

Mix Proportion

Material	Weight (Kg/m ³)
Cement	463.5
Water	185.4
Fine aggregate	530.27
Coarse aggregate	1153.13
W/C ratio	0.40

B. Casting and Curing

Casting had done by as per combinations shown in Table 2

As per the details given in table 2, we first prepare the batches of sand, cement and aggregates for 6 cubes and 6 beam. We repeated process for four times for making 24 cubes (12 normal and 12 with plasticizer) and 24 beams (12 normal and 12 with plasticizer). Mixing of ingredients was done as per IS 516 (1959) by hand mixing. The concrete has first filled in layers of 5cm and compacted by table vibratos. The specimens had removed after 24 hours and submerged in water and has been leave curing. After a curing period of at 1, 3, 7 and 28 days specimens were taken out and tested.

C. Testing

Specimens with normal mix had tested to find out strength at 1, 3, 7 and 28 days.

Specimens with plasticizer had tested to find out strength at 1, 3, 7 and 28 days.

By performing following tests:

1) Compression Test

Compression test on cubes of size 150mm×150mm×150mm mm had performed on compression testing machine. Average compressive strength of three cubes had taken after 1, 3, 7 and 28 days for normal mix and mix made with plasticizer.

2) Flexural Test

Flexural test was performed by applying one point load on beams of normal mix and mix made with plasticizer and checked their strengths after 1, 3, 7 and 28 days of curing.

D. Results and Discussion

The graphs shown below as fig1 and fig3 shows the strength in Mpa for cubes and beams.

Figure 1 for cubes, strength has given for normal cubes and cubes with plasticizer for 1, 3, 7 and 28 days. In table below are shown the strengths in Mpa for both cubes (normal and with plasticizer).

Figure 3 also shows the strength in Mpa for normal beams and beams with plasticizer for 1, 3, 7 and 28 days.

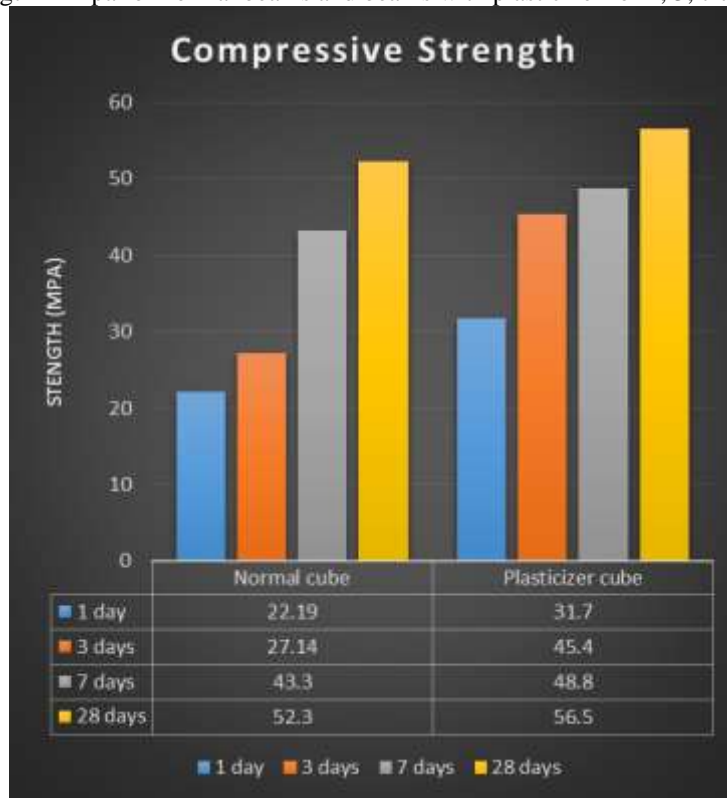


Fig. 1: Compression Strength



Fig. 2: compression test

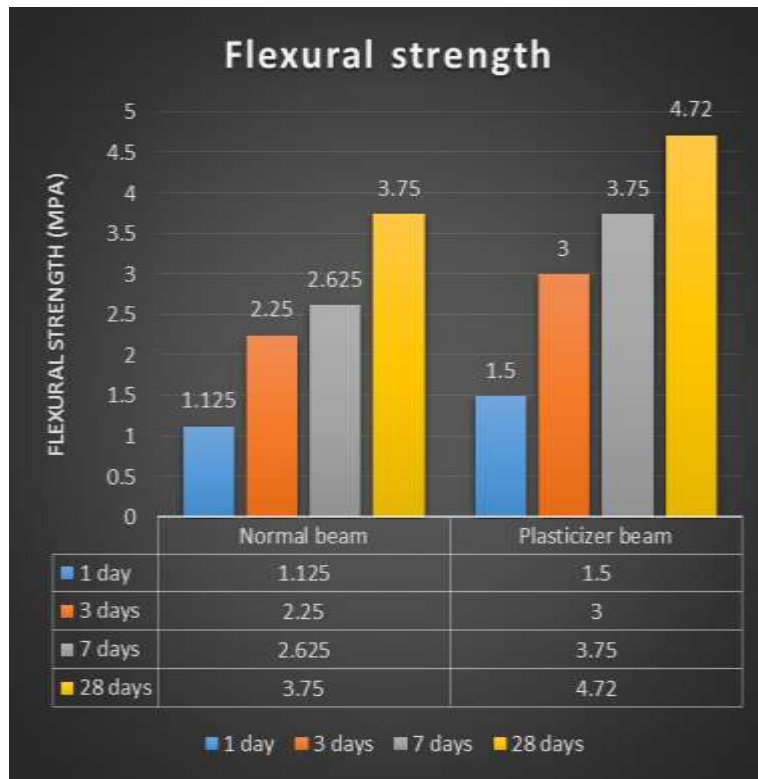


Fig. 3: Flexural strength



Fig. 4: Flexural test

V. CONCLUSION

By our experimental study, we have concluded for M40 grade of normal concrete and with plasticizers the following.

- 1) From the graph shown in figure 1 for cubes, we clearly saw that strength of cubes for 3 days with plasticizer in Mpa is greater than strength of normal cubes for 7 days. Therefore, we were able to get 40% high early strength by using our plasticizer.

- 2) From the graph of fig .3 for beam, we clearly saw that the flexural strength for beam with plasticizer was approximately 15 to 20% more than that of normal beams.
- 3) By using plasticizer as high early strength is, achieved formwork can be removed earlier and the construction works become fast.

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