Effect of Normal and Flaky Aggregate on the Flexural Strength of R.C.C. Beam

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Abstract— In this thesis the comparative study of flakiness on the flexural strength of RCC beams have been studied using experiments. Total 9 beams have been cast using normal, 5% of 8 mm and10 mm size of aggregates. Non destructive test of the cast beams using Ultrasonic pulse Velocity meter and rebound hammer test have been also carried out. All the specimens (beams) were tested for flexural strength and final load were recorded. Using this flexural strength of the beam calculated and with the help of these tabulated data, relative studies have been carried out to quantify the impact of flakiness. Salient conclusions on this are drawn. All 9 samples/beams have been tested on three point loading system with the help of universal testing machine. Only one type of mixed proportion M20 grade of concrete mix is used. The concrete beam prepared on normal aggregate 95% and 5% of flaky aggregate for different size 8 mm, and 10 mm are tested to determine flexural strength of concrete with the help of destructive and non-destructive test equipments.

Key words: Flexural Strength, Rebound Hammer Test, Flaky Aggregate Ultrasonic Pulse Velocity Test, M20, Impact Load Test, Three Point Loading

I. INTRODUCTION

Concrete is broadly used construction material for the various types of construction project. There are different types of material used in concrete. Concrete is a combined material of gravel, sand, crushed rock held together by a hardened paste of cement and water. Aggregate are the important constituents in concrete. They give body to the concrete, reduce shrinkage and outcome economy. Previous, aggregates were considered as chemically inactive material but at the present it has been known that some aggregates are chemically active and exhibits a chemical bond between aggregate and paste.

An aggregate is termed flaky when its least dimension (thickness) is less than three-fifth of its mean dimension. The mean dimension of aggregate is the average of the sieve sizes through which the particles pass and are required, respectively. The particle is said to be elongated when its greatest dimension (length) is greater than nine-fifth of its mean dimension. The diagonal bending test is most frequently employed, in which a specimen has both a circular or rectangular cross-section is bent until fracture or yielding using a three point flexural test Method. The flexural strength presents the highest stress experienced within the material at its moment of rupture.

II. METHODOLOGY

The objective of this study is to investigate the effect of aggregate shape and reinforcement concrete beams using Non-destructive and destructive tests. In this study two types of aggregate normal and flaky were used in preparing beam specimens.

To investigate the comparison between aggregate shape and concrete strength using non-destructive and destructive test equipment. In this study two types of aggregate normal and flaky aggregate were used in preparing beam specimens. Types of mixed proportion are used for M20 grade of concrete. The concrete beam prepared on normal aggregate and 5% of flaky aggregate for different size 8 mm, and 10 mm.

A. Equipment

1) Standard moulds Beam 100 mm X 150 mm X 600 mm.
2) Rebound Hammer.
3) Ultra Sonic Pulse Velocity meter.
4) Universal Testing Machine.

B. RCC Beam Specimen Preparation

In the present study the RCC beam is design using M20 concrete grade and Fe-415 steel. The RCC beams have 2 bars of 10mm at compression face and 2bars of 10 mm at tension face. The stirrups used were of 6 mm diameter at 120 mm c/c five stirrups for each beam. Diameter of beam is 100 X 150 X 600 mm.

Fig. a: Used Reinforcing Steel

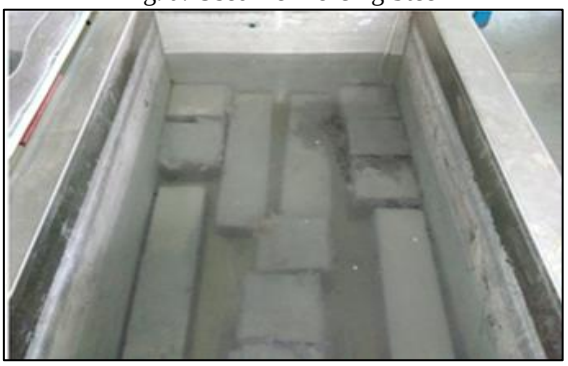


Fig. b: Beam Sample Curing

C. Test for Flexural Strength of Moulded Flexure Test Specimen

This deals with the procedure for responsible the flexural strength of moulded concrete flexure test specimens. Test specimens kept in water at a temperature of 24° to 30°C for

48 hours before testing shall be tested immediately on removal from water even as they are still in a wet state.

Fig. 4.15: Beam in Loading Condition

III. RESULTS AND DISCUSSION

A. Non-Destructive Testing Results-

Rebound hammer test results

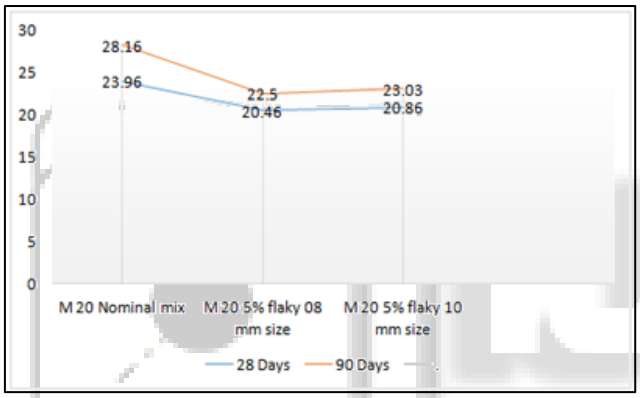
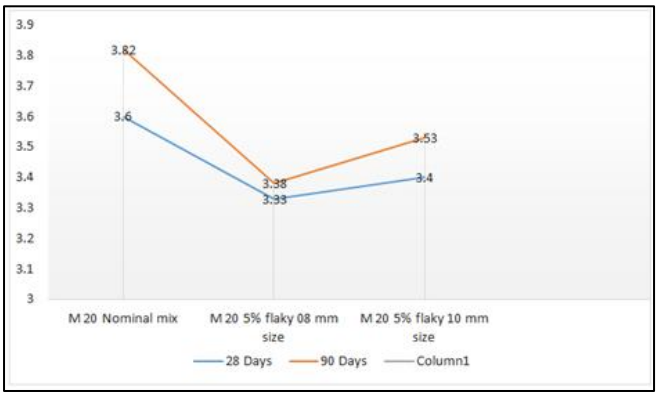


Fig. 5.10: Average Index of Rebound Hammer

1) Discussion of Results:

It can be observed that maximum of Rebound strength (MPa) is in the case of normal aggregate and minimum is in the case of 5% of flaky aggregates having 8 mm size and 95% of normal aggregates mix in concrete admixture, and similarly increasing in order to 5% of flaky aggregate with 95% of normal aggregate having 10 mm size.

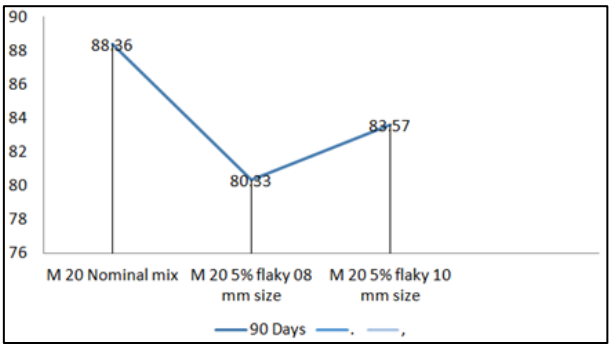
B. UPV Test Results Average



1) Discussion of Results:

It can be observed that maximum of velocity (km/sec) is in the case of normal aggregate and minimum is in the case of 5% of flaky aggregates having 8 mm size and 95% of normal aggregates mix in concrete admixture, and similarly increasing in order to 5% of flaky aggregate with 95% of normal aggregate having 10 mm size.

C. Destructive Testing Results



1) Discussion of Results

It can be observed that maximum of flexural strength is in the case of normal aggregate and minimum is in the case of 5% of flaky aggregates having 8 mm size and 95% of normal aggregates mix in concrete admixture, and similarly increasing in order to 5% of flaky aggregate with 95% of normal aggregate having 10 mm size.

IV. CONCLUSION

From the results of destructive and non-destructive tests, following salient conclusions can be drawn:

A. Rebound Hammer

1) It can be observed that RCC concrete beams show higher strength with normal aggregate concrete mix.
2) Rebound strength reduces by adding the flaky aggregates in all the cases.
3) Rebound strength in flaky aggregates concrete is found to be higher with increase in aggregate size.

B. UPV Test

1) It can be observed that RCC concrete beams show higher pulse velocity with normal aggregate concrete mix.
2) Pulse velocity reduces by adding the flaky aggregates in all the cases.
3) Pulse velocity in flaky aggregates concrete is found to be higher with increase in aggregate size.

C. Flexural Test

1) It can be observed that RCC concrete beams show higher strength with normal aggregate mix.
2) Normal aggregate mix shows the less strength with flaky aggregate due to size variation.

Flexural strength in flaky aggregates concrete is found to be higher with increase in aggregate size which is same as rebound hammer result.

V. FUTURE SCOPE OF THE WORK

The presence of flaky aggregates is considered in the thesis opens a future scope of work for the followings:

1) The present research has been carried out only for the M20 grade of concrete mix having normal aggregates

with mixture of 5% flaky aggregates in two different sizes (8 mm, 10 mm)

2) The scope of research could be further extended and research needs to be carried out on different percentages and grades also.
3) The research needs to be further extended for cubical and cylindrical specimens also.
4) This quality control system should be developed to be used in the construction of bridges, flyovers, tunnels and various concrete structures etc. using flaky aggregates.
5) Effect of flakiness may be also studies for impact and thermal loadings.

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