

# **An Experimental Study on Non Destructive Testing by Using Steel Fiber Concrete**

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**ABSTRACT:** The estimation of properties of concrete can be carried out by several methods such as destructive and non-destructive. In this context, the crushing of the samples is the usual destructive test to determine the concrete strength. The rebound hammer test and the ultrasonic Pulse velocity are used in the field of non-destructive tests to determine the compression strength of concrete. In this work various grade compositions from M15 to M35 were used to prepare cube specimens by varying Steel Fiber ratio such as 0.5% and 1 % . An experimental study was conducted to non-destructive UPV test and Rebound Hammer test at different . The results showed that the relationship between the comparison of UPV and Rebound Hammer values. All values are within the acceptable limit as per Indian Standards.

**KEYWORDS:** Ultrasonic Pulse Velocity, Rebound Hammer, Steel Fiber.

## **I. INTRODUCTION**

Non-destructive testing of concrete can be defined as the test method used to examine the properties of concrete used in the actual structure. These test methods can also be said as in-situ tests or in-place tests. Traditionally these tests are said to be as the non-destructive test although some minor damage to the structure may be involved. An important feature of non-destructive test is that the place where test is done can be used for re-testing. The use of non-destructive tests has increased the safety level of construction and also helps in improving the scheduling of construction. All this increases the speed of construction besides keeping the economy of construction in considerable limits.

These tests can be categorized in two parts:

1. Tests used to determine the strength of concrete
2. Tests used to determine the other characteristics of concrete like voids, cracks etc.

## **II. RELATED WORK**

**Behubari.H et al (2016)**, the paper analyses the effects of high temperatures on the concrete residual strength using ultrasonic velocity (UPV). An experimental investigation was conducted to study the relationship between UPV residual data and compressive strength of concrete with different mixture proportions, cubic specimens with water-cement ratio of 0.35. They were heated in an electric furnace at temperatures ranging from 200°C to 600°C. In this experiment a comparison was made between the four groups which include two types of fibers (steel 0.13%, 0.19 % and 0.38%, polypropylene: 0.05%, 0.11% 0.22% and mixing of fibers (polypropylene and steel) 0.18 % and 0.30% by meter cube. Cube specimens were tested in order to determine ultrasonic velocity. The compressive strength was tested too. According to the results, relations were established between ultrasonic velocity in the specimens and the

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compressive strength at different temperature and the range of the velocity of the waves were also determined for this kind of concrete. The result of the test showed that UPV test can be successfully used in order to verify the consistency of structures damaged by fire.

**Helal.Jet al (2015)**,this paper reviews the most common non-destructive testing (NDT) methods of concrete structures as utilized by the structural engineering industry. The fundamentals of NDT methods are explored in regards to their potential, limitations, inspection techniques and interpretations. The factors that influence the success of NDT methods are discussed and ways to mediate their influence are recommended. Reference is made to standard guidelines for the application and interpretation of the discussed NDT methods. NDT of concrete was found to be gaining increasing acceptance as a means of evaluating the strength, uniformity, durability and other properties of existing concrete structures. Perceptions of NDT inadequacy were attributable to lack of understanding construction materials and NDT methods themselves. The intent of this paper is to address these concerns by identifying and describing the most common successful methods of NDT as applied to concrete structures.

### III. METHODOLOGY

#### ULTRASONIC PULSE VELOCITY

Measurement of pulse velocities at points on a regular grid on the surface of a concrete structure provides a reliable method of assessing the homogeneity of the concrete. The size of the grid chosen will depend on the size of the structure and the amount of variability encountered.

Table 3.1 Concrete Quality based on Ultrasonic Pulse Velocity Test

PULSE VELOCITY	CONCRETE QUALITY
>4.0 km/s	Very good to excellent
3.5 – 4.0 km/s	Good to very good, slight porosity may exist
3.0 – 3.5 km/s	Satisfactory but loss of integrity is suspected
<3.0 km/s	Poor and loss of integrity exist.

#### REBOUND HAMMER

Rebound hammer test is done to find out the compressive strength of concrete by using rebound hammer as per IS: 13311 (Part 2) – 1992. The rebound of an elastic mass depends on the hardness of the surface against which its mass strikes. When the plunger of the rebound hammer is pressed against the surface of the concrete, the spring-controlled mass rebounds and the extent of such a rebound depends upon the surface hardness of the concrete. The surface hardness and therefore the rebound is taken to be related to the compressive strength of the concrete. The rebound value is read from a graduated scale and is designated as the rebound number or rebound index. The compressive strength can be read directly from the graph provided on the body of the hammer.

Table 3.2 Concrete quality

Average Rebound Number	Quality of Concrete
> 40	Very Good
30 -40	Good
20-30	Fair
< 20	Poor and/or Delaminated
0	Very Poor and/or Delaminated

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## IV. EXPERIMENTAL RESULTS

The following Figures are shows the comparative values of UPV and Rebound Hammer.

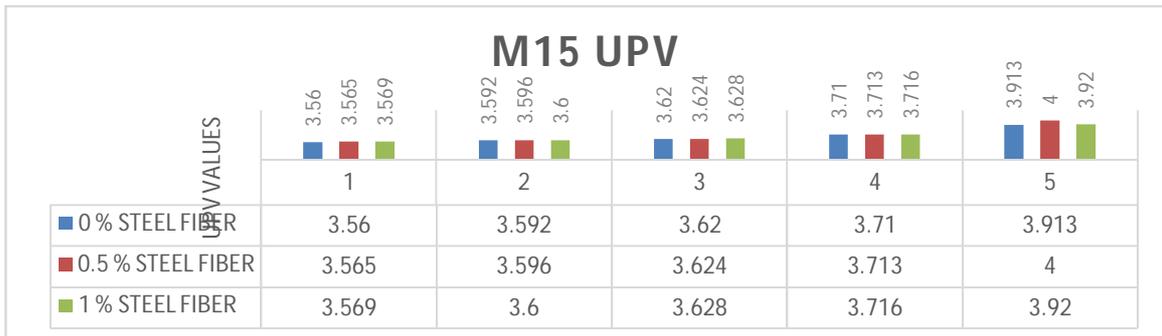


Fig 1: Comparison of M15 Concrete UPV Values in Km/S

The M15 Grade UPV test results shows us some porosity may exist in Concrete and that strength are in the middle of good to very good stage.

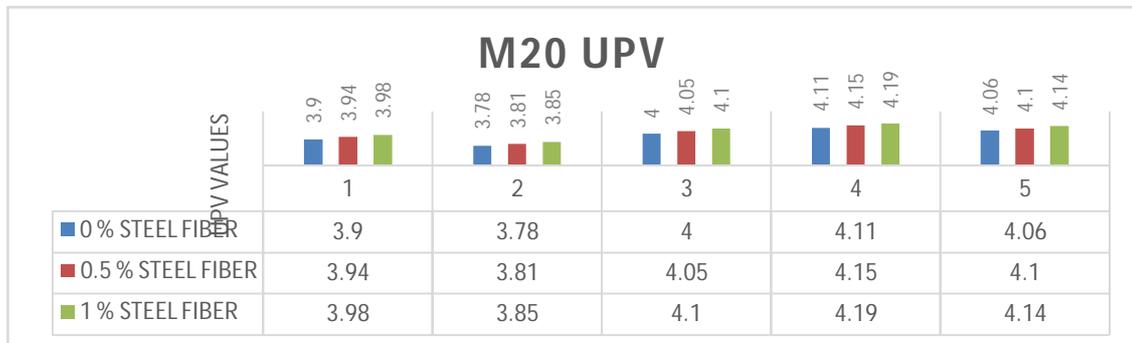


Fig 2: Comparison of M20 Concrete UPV Values in Km/S

The M20 Grade UPV test results shows that strength are in the middle of very good to excellent stage

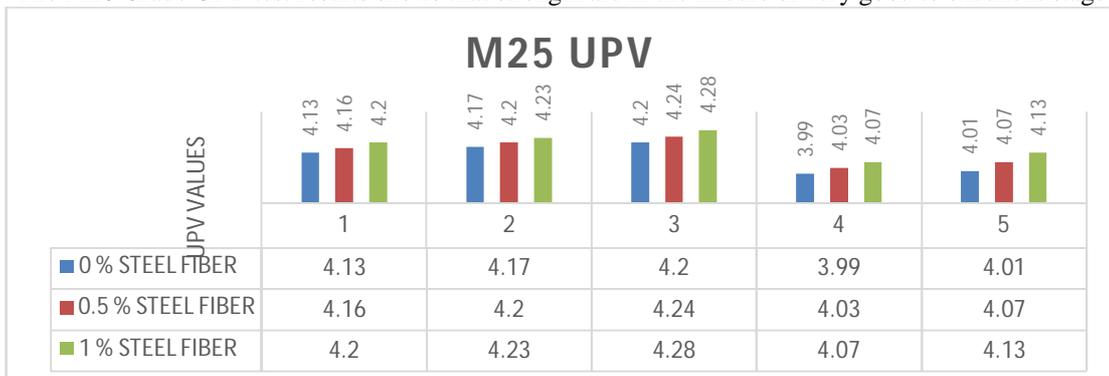


Fig 3: Comparison of M25 Concrete UPV Values in Km/S

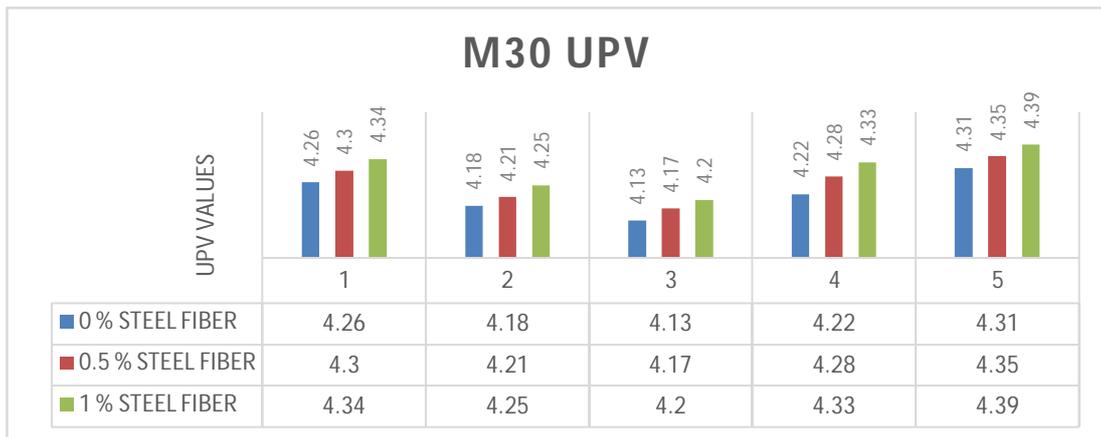
The M25 Grade UPV test results shows that strength are in the middle of very good to excellent stage

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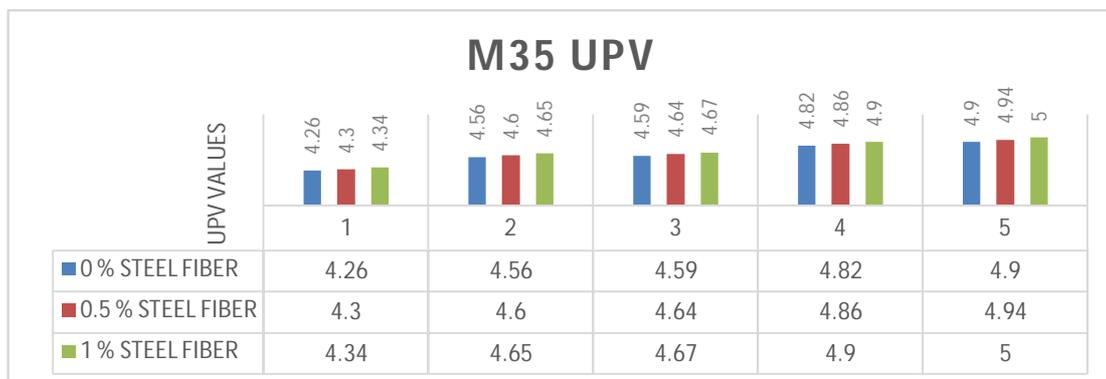
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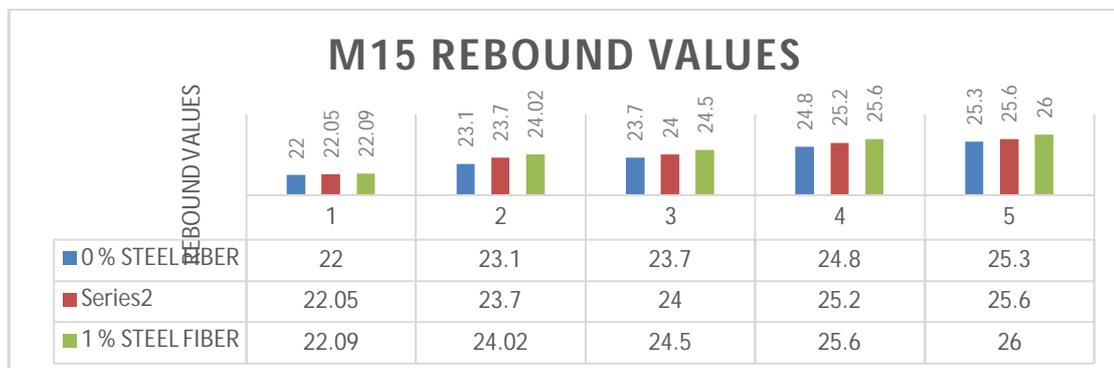
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**Fig 4: Comparison of M30 Concrete UPV Values in Km/S**  
The M30 Grade UPV test results shows that strength are in the middle of very good to excellent stage.



**Fig 5: Comparison of M35 Concrete UPV Values in Km/S**  
The M35 Grade UPV test results shows that strength are in the middle of very good to excellent stage.



**Fig 6: Comparison of M15 Concrete Rebound Values**  
The M15 Grade Rebound test results shows that strength are Fair stage.

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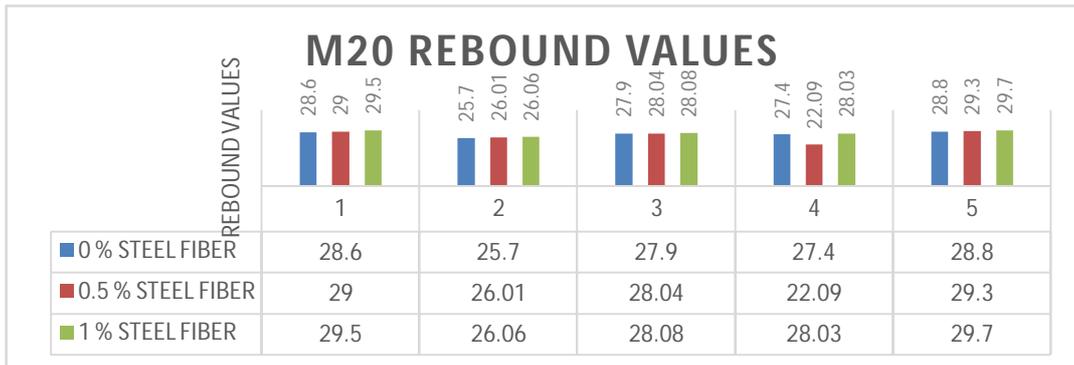


Fig 7: Comparison of M20 Concrete Rebound Values  
The M20 Grade Rebound test results shows that strength are Fair stage.

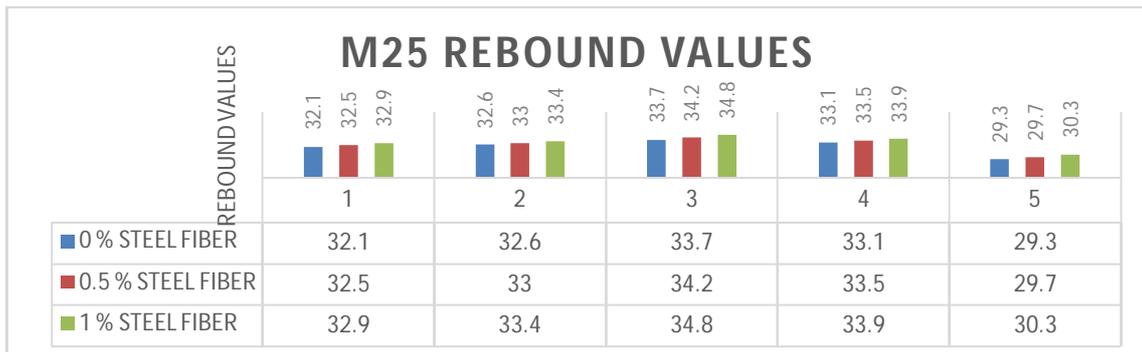


Fig 8: Comparison of M25 Concrete Rebound Values  
The M25 Grade Rebound test results shows that strength are Good stage

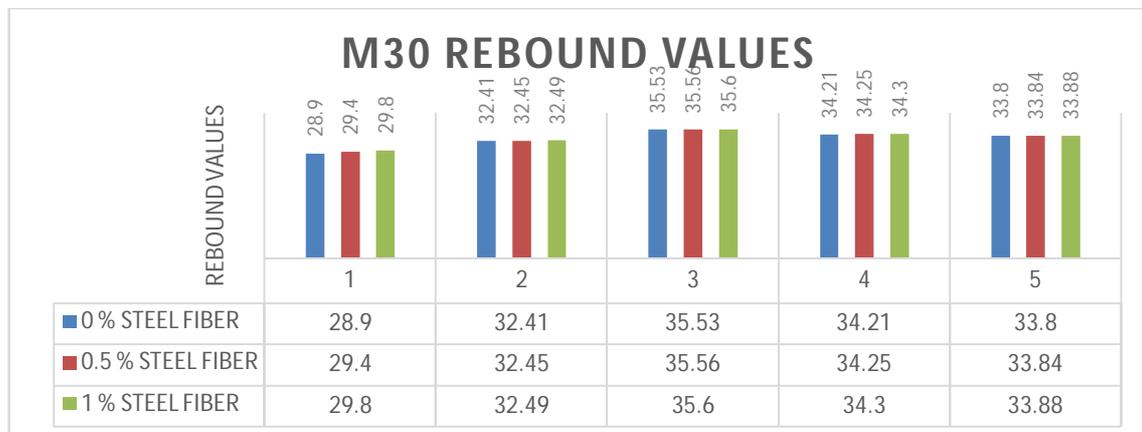


Fig 9: Comparison of M30 Concrete Rebound Values

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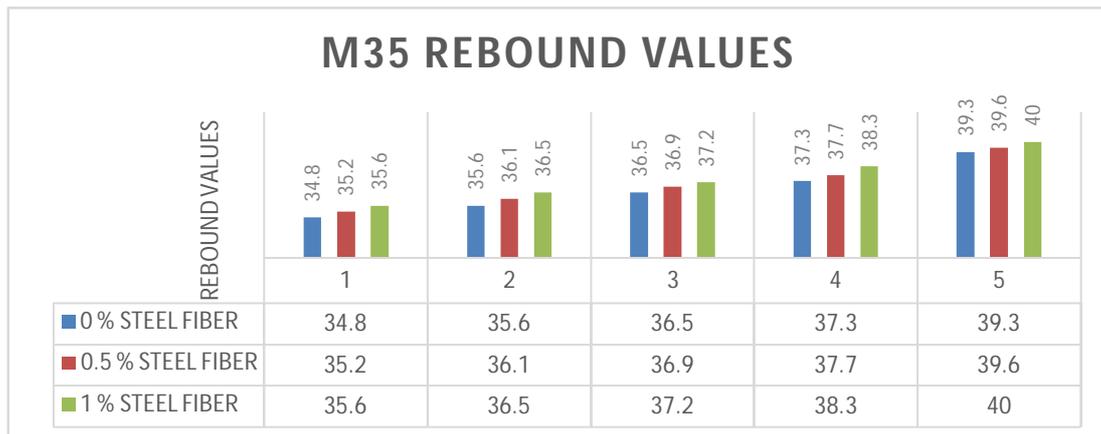


Fig 10: Comparison of M35 Concrete Rebound Values  
The M35 Grade Rebound test results shows that strength are Good stage

## V. CONCLUSION

We have investigated the Steel Fiber used concrete with various complex proportions (Grade is M15, M20, M25, M30, M35 and Steel fiber added ratio is 0.5% , 1 % ) and find out some of the following points.

1. Ultrasonic Pulse Velocity results shows the ordinary concrete, 0.5 % added Steel Fiber concrete and 1 % added Steel Fiber Concrete are from satisfactory to excellent range.
2. Rebound Hammer results shows the ordinary concrete, 0.5 % added Steel Fiber concrete and 1 % added Steel Fiber Concrete are from Fair to Very Good conditions.

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