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Comparison of Compressive Strength of Concrete Assessed from Existing Building

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Abstract - *As the name implies Non Destructive Testing (NDT) refers to a test which does not impair the intended performance of the element, member or structure under investigation. In this paper a non-destructive test i.e. Rebound Hammer is been performed with the purpose to investigate on the mechanical properties of the pre-existing concrete columns employed in the college campus. A series of column specimens were tested in order to correlate the "in situ" concrete strengths obtained by rebound hammer method with the cubical strength obtained by destructive methods. An N-type rebound hammer was used for the testing. This method requires short time to obtain the results, it's a non-invasive method and it does not affect the resistance of structural elements. Finally the interpretation and comparison of experimental values of Rebound Hammer Test and cubical compressive strength with the help of statistical data obtained by testing of specimen as per recommended procedures by IS 13311:1992 and IS 516:1959 respectively.*

Key Words: **Compressive Strength, Non-destructive Test, Rebound Hammer, Rebound Number**

1. INTRODUCTION

Concrete, one of the most widely used construction material, has been subjected to major research and development over the past century. Once thought to provide sound structural and durable performance with little else, concrete has now evolved into a material that is capable of being suitable for environment. Service life of concrete is found to be limiting in various environmental degrading factors as it is exposed to it. This therefore has brought about the need for test method to measure the in-place properties of concrete for quality assurance and for evaluation of existing conditions. Since such test are expected as non-impairing the function of the structure and allow for re-testing at the same location to evaluate the changes in property at some other point in time, these methods should be non-destructive. The most popular non-destructive test is Rebound Hammer test, also known as Schmidt Hammer test. The principle of rebound hammer is to measures the hardness of surface.

2. TEST PROGRAM

2.1 Rebound Hammer

The Schmidt rebound hammer is principally a surface hardness tester, which works on the principle that the rebound of an elastic mass depends on the hardness of the surface against which the mass impinges. There is seemingly theoretical relationship between the strength of concrete and the rebound number of the hammer. The weight of the Schmidt rebound hammer is about 1.8 kg and is suitable for both laboratory and field purpose. The rebound distance of the hammer mass is measured on an arbitrary scale ranging from 10 to 100. The rebound distance of the hammer is recorded as a "rebound number" corresponding to the position of the rider on the scale.

2.2 Compression testing of cubes

Compression testing machine of capacity 2000 kN is used for compression testing of cube as casted of size 150 x 150 x 150 mm and capable of giving load at the rate of 140 kg/sq.cm/min. Testing of the concrete cubes is tested under CTM at the age of 10 years. The cubes had a mix proportional design of M 20. The cubes were placed in the machine between wiped and cleaned loading surfaces and load is given approximately at the rate of 140 kg/sq.cm/min. and ultimate crushing load is noted to calculate crushing strength of concrete according to IS: 516-1959. The measuring strength of specimen is calculated by dividing the maximum load applied to the specimen during the test by the cross section area.

3. RESULT AND DISCUSSION

Among the tested 77 columns with the Rebound Hammer we have selected first 10 columns as the cubes available were only 10. The selected 10 column's rebound number was compared with the compressive strength obtained by crushing the cubes in Compressive Testing Machine.

Table -1: Results obtained from Rebound Hammer Test

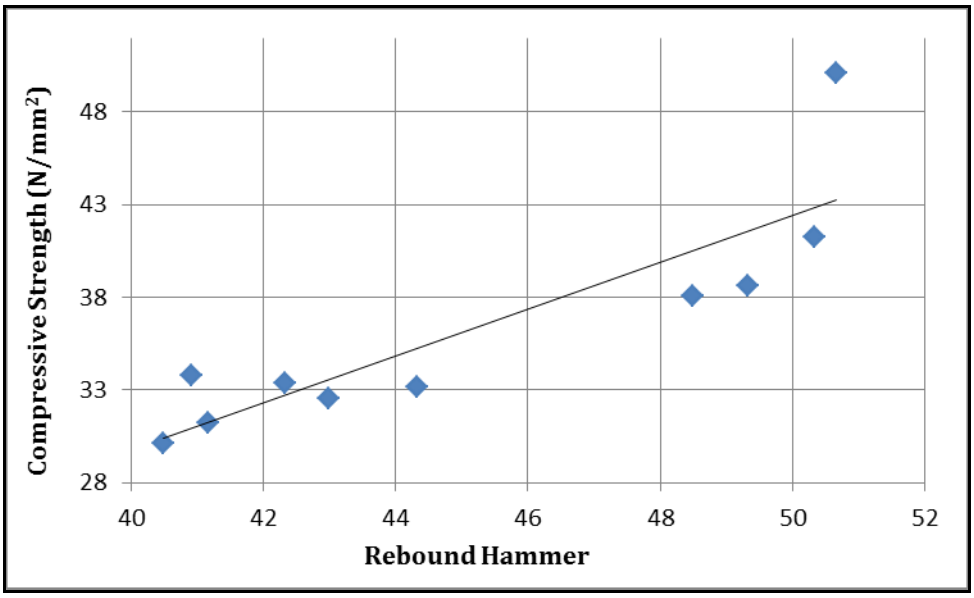
Column No	Position	Rebound Number							Average Rebound Number
		R1	R2	R3	R4	R5	R6	Ravg	
C01	Top	40	40	44	42	40	46	42	40.5
	Bottom	40	40	44	38	34	38	39	
C02	Top	40	44	44	40	42	42	42	41.165
	Bottom	38	44	42	38	40	40	40.33	
C03	Top	40	44	38	39	40	44	40.83	40.915
	Bottom	40	40	40	42	42	42	41	
C04	Top	48	48	50	60	44	46	48.66	48.495
	Bottom	50	58	40	46	46	50	48.33	
C05	Top	46	50	44	50	52	46	48	50.665
	Bottom	58	52	56	48	48	48	53.33	
C06	Top	38	40	44	32	38	40	38.66	42.33
	Bottom	38	40	60	44	42	52	46	
C07	Top	46	56	60	54	50	48	52.33	49.33
	Bottom	40	48	56	44	40	50	46.33	
C08	Top	44	52	50	52	62	50	51.67	50.335
	Bottom	46	44	40	48	56	60	49	
C09	Top	46	40	42	42	44	48	43.66	42.995
	Bottom	50	42	46	42	40	34	42.33	
C10	Top	46	44	46	46	46	46	45.66	44.33
	Bottom	40	42	48	44	42	42	43	

Table -2: Results obtained from Compressive Testing Machine

Cube	Compressive Strength (kN)	Compressive Strength (N/mm^2)
C1	679	30.16
C2	702	31.2
C3	760	33.78
C4	856	38.06
C5	1128	50.14
C6	752	33.4

C7	870	38.65
C8	929	41.29
C9	732	32.55
C10	746	33.14

By using above value graph is plotted with Rebound number on the abscissa and Cubical compressive strength on the ordinate.



Simply using the rebound values alone for strength estimation, a correlation coefficient of 0.7606 is achieved.

$$y = 1.2692x - 21.012$$

$$R^2 = 0.7606$$

4. CONCLUSION

[1] This, in turn, allows limiting the number of destructive tests needed to properly characterize concrete strength in existing buildings
[2] The cubical compressive strength after 10 years increased by almost 80 %.
[3] While conducting Rebound Hammer Test, cracks were seen which may reduce the rebound number and the accuracy of compressive strength interpretation may reduce.
[4] Simply using the rebound values alone for strength estimation, a correlation coefficient of 0.7606 is achieved.

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