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DEVELOPING A NEW PARADIGM ENERGY ASSESSMENT TECHNIQUES IN FIBER REINFORCED CONCRETE FOR AN EFFECTIVE ADOPTION IN CONSTRUCTION INDUSTRY

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ABSTRACT

The aim of the project is to implement the energy assessment techniques in construction industry by the use of natural fiber. This paper presents non-destructive methodology for investigating selected geometrical and material imperfections in harden concrete structures. The imperfections include: larger air voids, improper thickness of concrete, delimitation. The methodologies preceded by a survey of the literature on the subject. The non-destructive testing analysis are made between the conventional reinforced concrete and natural fiber reinforced concrete.

Key words: Non-destructive testing, Geometrical, Imperfection and reinforced concrete.

INTRODUCTION

Non-destructive testing systems have a role in the evaluation and testing of civil engineering structures but often they are used to provide discrete information on specific problems rather than as an integral part of the overall survey programme. Many of the methods that are widely used in the NDT of civil engineering structures particularly in the site investigation process for civil engineering construction projects. The tests available for testing concrete range from the completely non-destructive, where there is no damage to the concrete, through those where the concrete surface is slightly damaged, to partially destructive tests, such as core tests and pullout and pull off tests, where the surface has to be repaired after the test. The range of properties that can be assessed using non-destructive tests and partially destructive tests is quite large and includes such fundamental parameters as density, elastic modulus and strength as well as surface hardness and reinforcement location, size and distance from the surface.

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EXPERIMENTAL

Literature review

F. Sarasini et al., presents the non-destructive testing of natural fibre composites. This chapter discusses the use of mechanical behaviour monitoring and characterization of natural fibre mixtures. The chapter begins by providing a detailed overview of non-destructive techniques and the principles of the (AE) meth[1]. K. Schabowlcz presents Modern acoustic techniques for testing concrete structures accessible from one side only. This paper presents NDT methodology for investigating selected geometrical and material imperfections in unilaterally accessible concrete structures. The available knowledge also contributed by the present author, has been collected and systematized as well as added with two new methodologies for determining the depth of cracks[2].

Objective

The purpose of this research is based on the investigation of the use of natural fiber in structural concrete to enhance the mechanical characteristics of concrete. To find and compare the difference in properties of concrete without fiber and special concrete with fiber as well as the geometry of natural fiber in concrete. The acoustic characterization of the natural fiber has been determined, using different techniques.

Project methodology

The methodology are formed based on the collection of literature review. The design mix and the compressive strength are calculated, and the non destructive tests are carried out.

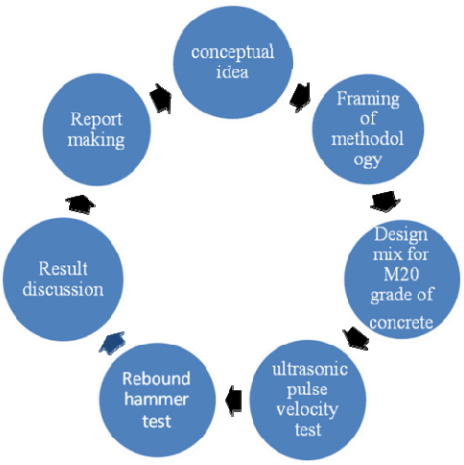

Fig. 1: Methodology chart

Collection of materials

The materials are collected as per the design requirements and the standard codes and the necessary sieving's are carried to find the quality of materials for testing.

Cement: Cement conforming to IS 1489 (part-1): 1991, chettinad cement of 53 grade of cement is considered for the concrete mix.

Fine aggregate: The fine aggregate used for the entire case was natural river sand conforming to Zone-II Grading and complying with the requirements of IS 383:1970, sand size used is 2.36 mm.

Coarse aggregate: Coarse aggregate are used with the requirements of IS 383:1970 varying between 10 and 20 mm aggregate was used for making the concrete cubes.

Water: Potable water was used for concrete and for the curing of cast specimens.

Superplasticizer: Auramix 400: Auramix 400 combines the properties of water reduction and workability retention. It permits the production of high performance concrete and or concrete with high workability.

Compression test results for M20 grade of concrete

Compression result are carried out at diffrent age of concrete by the compression testing machine at the laboratory.

Table 1: Compressive test result for M20 grade of conventional concrete

Date	Average compressive strength (N/mm^2)
3^{rd} day	19.46
7^{th} day	23.6
28^{th} day	27.8

Table 2: Compressive test result for M20 special fiber (1.5%) grade of concrete

Date	Average compressive strength (N/mm^2)
3^{rd} day	22.18
7^{th} day	27.14
28^{th} day	32.52

Ultrasonic pulse velocity test

Ultrasonic pulse velocity test are carried out in the laboratory to determine the strength of concrete as per IS 13311 (part-1)-1992.

Objective of test

- The UPV method could be used to establish the homogeneity of the concrete.
- The pressure of the cracks voids and other imperfections
- The quality of concrete in relation to standard requirement

Observation of result

To determine the ultrasonic pulse velocity test 150 x 150 mm concrete cube are casted.

Table 4: Velocity criteria for concrete quality for M20 conventational grade of concrete

Date	Specimen No.	Pulse velocity by cross probing (km/s)	Average pulse velocity by cross probing (km/s)	Concrete quality grading
28th day	1	4.12	4.16	GOOD
	2	4.14		
	3	4.23		

Table 5: Velocity criteria for concrete quality for M20 special fiber (1.5%) mixed concrete

Date	Specimen No.	Pulse velocity by cross probing (km/s)	Average pulse velocity by cross probing (km/s)	Concrete quality grading
28th day	1	4.54	4.60	Excellent
	2	4.59		
	3	4.68		

Rebound hammer test

Rebound hammer test are carried out to find the compressive strength and surface hardness of the concrete by non-destructive testing method, as per IS 13311 (Part 2) 1992.

Objective of test

The rebound hammer method could be used for, assessing the likely compressive strength for concrete with the help of suitable corelations between rebound index and compressive strength, and for assessing the uniformity of concrete.

Observation of result

To determine the rebound hammer test 150 x 150 mm concrete cube are casted.

Table 6: Test result for M20 conventational grade of concrete

S. No.	Date	Compressive strength of concrete for rebound hammer test N/mm^2	Actual compressive strength of concrete N/mm^2
1	28th day	35.67	27.80

Table 7: Test result for M20 grade of (1.5%) fiber concrete

S. No.	Date	Compressive strength of concrete for rebound hammer test N/mm^2	Actual compressive strength of concrete N/mm^2
1	28th day	39.28	32.52

CONCLUSION

The mix design for M20 grade of concrete is calculated as per the standard code condition. The comparession between Compressive strength of concrete cubes with the rebound hammer test and actual compressive test are determined. Concrete Quality Grading for both the conventational and nominal mix are analysed with the Ultrasonic pulse velocity test.

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