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AN EXPERIMENTAL REPORT ON NON DESTRUCTIVE EVALUATION OF DEFECTS IN CONCRETE

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Abstract:

Non destructive testing is a form of testing to be carried out on various construction elements and materials without causing any permanent damage to them. These techniques have been developed during recent years especially in the case of construction quality assessment. The main advantage of NDT tests is to avoid the concrete damage or the performance of building structural elements. NDT techniques have their own advantages as well as limitations, when compared to conventional strength estimation and damage detection tests. By using these non destructive tests has been performed to assess the compressive strength of concrete employed in the structures. In this project both Schmidt rebound hammer method and ultrasonic pulse velocity method are used to determine the compressive strength of concrete structure.

Keywords: Non-destructive, Detection tests, NDT Techniques.

1. INTRODUCTION

Non-destructive testing (NDT) as the name implies, refers to a test that does not impair the intended performance of the element, or structure under investigation. These methods or techniques are used to obtain information about the properties or internal condition of an object without damaging it. Non-destructive testing is a descriptive term used for the examination of materials and elements in such way that allows materials to be examined without changing or destroying their usefulness. NDT is a quality assurance management tool which can give impressive results when used correctly. It requires an understanding of the various methods available, their capabilities and limitations, knowledge of the relevant standards and specifications for performing the tests [2]. NDT techniques can be used to monitor the integrity of the item or structure throughout its design life. Thus, NDT methods are extremely valuable in assessing the condition of structures, such as bridges, buildings, elevated service reservoirs and highways etc., various NDT techniques are available to evaluate the condition of existing concrete structures. These NDT techniques can help to determine in situ load carrying capabilities and in turn be used to help, develop a costeffective rehabilitation solution. The rehabitation of a structure can be carried out by strengthing measures. These are now considered as a powerful technique for evaluating existing concrete structures with regard to their strength and durability apart from assessment and control of quality of hardened concrete. In certain cases, the investigation of crack depth, micro cracks and progressive deterioration are

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also studied by these techniques. Though non-destructive methods are relatively simple to perform, the analysis and interpretation of test results are cumbersome. Therefore special knowledge is required for the analysis of hardened concrete properties. In NDT methods of testing, the specimens are not loaded to failure and as such the strength inferred or estimated cannot be expected to yield absolute values of strength.

2. RELATED WORK

The collected data is grouped structural element wise by both the methods and analysed scientifically to infer their validity and reliability by these two methods. The compressive strength obtained from Schmidt rebound hammer test and ultrasonic pulse velocity test has been subjected to regression, correlation and time series analysis to determine the compressive strength of concrete of structural elements namely columns, beams and slabs of GCET campus.

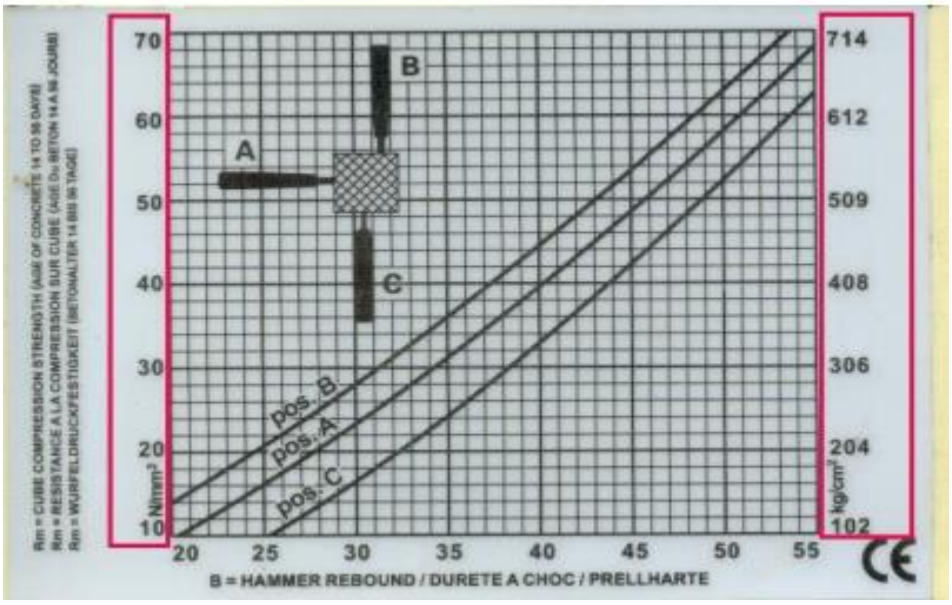

Fig.1.Comparison Test

A Schmidt hammer, also known as a Swiss hammer or a rebound hammer, is a device to measure the elastic properties or strength of concrete or rock, mainly surface hardness and penetration resistance. Ernst Schmidt, a Swiss engineer, developed the modern rebound hammer in 1948. The rebound hammer measures the surface hardness of the concrete. This is accomplished by placing the rebound hammer plunger against the concrete surface and releasing a spring loaded weight of 0.57 kg. Calcium aluminate cement is a type of cement that consisting predominantly of hydraulic calcium aluminate. Alternative names are "aluminous cement", "high-alumina cement". They are used in a number of small-scale, specialized applications. Concrete made with high alumina cement can give 100% higher compressive strength than with ordinary Portland cement.

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3. PROPOSED SYSTEM

The relationship between hardness and strength varies as a function of time. Variations in initial rate of hardening, subsequent curing and conditions of exposure also influence the relationship. Separate calibration curves are required for different curing regimes but the effect of age can generally be ignored for concrete between 3 days and 3 months old. After some years, the concrete element will deteriorate due to corrosion of the steel bars, which will reduce the steel cross-section dimension. The ultrasonic pulse velocity method is the only one of this type that shows potential for testing concrete strength in situ. It measures the time of travel of an ultrasonic pulse passing through the concrete. The fundamental design features of all commercially available units are very similar, consisting of a pulse generator and a pulse receiver. Pulses are generated by shock-exciting piezo-electric crystals, with similar crystals used in the receiver . The time taken for the pulse to pass through the concrete is measured by electronic measuring circuits. In statistical model, regression analysis is a statistical process for estimate the relationship among the two or more variables. Regression is a statistical technique to determine the multiple linear relationships between two or more variables. Regression is primarily used for prediction and causal inference. In simple correlation and regression studies, data are collected on two quantitative variables to determine whether a relationship exist between the two variables.

4. ANALYSIS

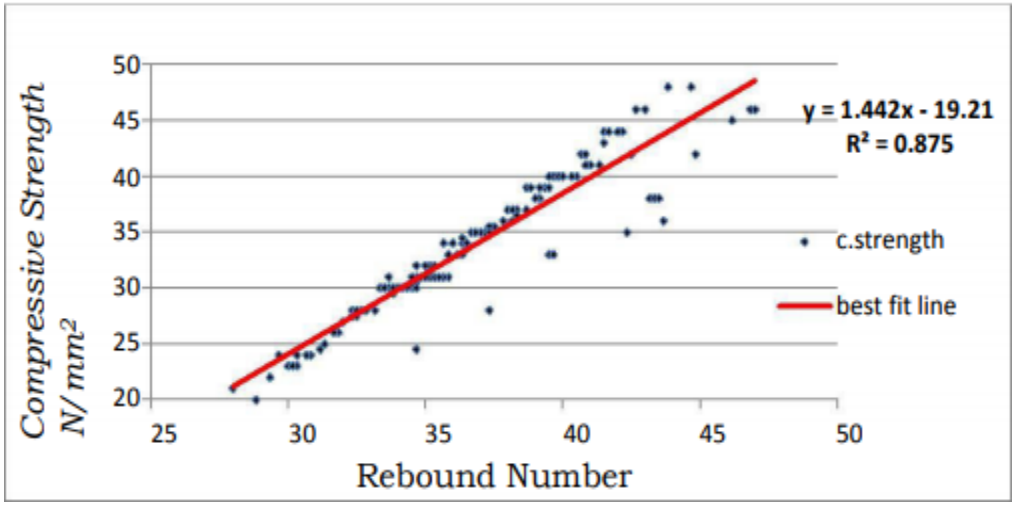

Fig.2.Analysis

The best fit line, which represents the relationship between the rebound number and compressive strength. The equation represents the Regression equation and R2 value represents the best fit of the data. If R2 value is near to +1 represents the data fitted well from observed values. Correlation analysis is applied for determining the extent to which the variables are linearly related. If such relationship exists, correlation analysis is used for providing a measure of the relative strength of the relationship. The value of correlation coefficient can vary from -1 to +1. A time series containing records of a single variable is termed as

univariate. But if records of more than one variable are considered, it is termed as multivariate. A time series can be continuous or discrete. In continuous time series observations are measured at every instance of time, whereas a discrete time series contains observations measured at discrete points of time. Usually in a discrete time series the consecutive observations are recorded at equally spaced time intervals such as hourly, daily, weekly, monthly, or yearly time separations. The variable being observed in a discrete time series is assumed to be measured as a continuous variable using the real number scale.

In time series forecasting, past observations are collected and analyzed to develop a suitable mathematical model which captures the underlying data generating process for the series. The future events are then predicted using the model. This approach is particularly useful when there is not much knowledge about the statistical pattern followed by the successive observations or when there is a lack of a satisfactory explanatory model. Time series forecasting has important applications in various fields. Often valuable strategic decisions and precautionary measures are taken based on the forecast results. Thus making a good forecast, i.e. fitting an adequate model to a time series is very important. Over the past several decades many efforts have been made by researches for the development and improvement of suitable time series forecasting models. The research work carried out by Hesham et.al., on the prices of reinforced concrete materials, based on the 'Time Series Analysis', considered the use of historical data to predict the future trend of prices of reinforced concrete materials. The objective of this paper is to apply 'Time Series Analysis' to predict the prices of reinforced concrete material compositions in Egypt. Prices of steel, cement, sand and crushed stones were collected for the period from 1997 to 2010. The analysis was conducted using 'ForecastX' and 'SPSS' software to apply the 'Time Series Analysis' to predict trend. The accurate estimation of concrete materials prices is an essential practice, especially in developing countries where high price fluctuations can have an on the project success and even viability

CONCLUSION

The cyclical variation in a time series describes the medium-term changes in the series, caused by circumstances, which repeat in cycles. The duration of a cycle extends over longer period of time, usually two or more years. Most of the economic and financial time series show some kind of cyclical variation. There is no cyclic variations occurs in the project experimental data. Hence, the cyclical variations component is not considered in this analysis. Irregular or random variations in a time series are caused by unpredictable influences, which are not regular and also do not repeat in a particular pattern.

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