Suman Saha · Sabyasachi Biswas
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Editors
Suman Saha
Department of Civil Engineering
National Institute Technology Durgapur
Durgapur, West Bengal, India

Sabyasachi Biswas
Department of Civil Engineering
National Institute of Technology Durgapur
Durgapur, West Bengal, India

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Enhanced Monitoring of Concrete Structures Through Rebound Hammer and Ultrasonic Pulse Velocity Meter

Sk F. Ashiq, Subir Ghosh, Soumyadip Das(✉), Sanjay Sengupta, and Anupam K. Biswas

Department of Civil Engineering, Dr. B. C. Roy Engineering College Durgapur, Jemua Road, Durgapur-713206, Durgapur, West Bengal, India
soumyadip.das@bcrec.ac.in

Abstract. Monitoring the health of concrete structures is essential to ensure their safety, durability, and functionality. Non-destructive testing (NDT) methods are highly effective for assessing concrete health without causing damage. Among various NDT techniques, the rebound hammer and ultrasonic pulse velocity (UPV) meter have proven to be reliable tools for evaluating concrete quality. In this study, the authors conducted experiments using both rebound hammer and UPV tests on slabs of varying thicknesses, some of which contained intentionally embedded low-quality materials at specific locations. By combining these methods, the authors aim to provide a thorough evaluation of concrete integrity, strength, and the presence of impurities and voids. The study found a strong correlation between the UPV measurements and the strength values obtained from rebound hammer tests. Utilizing Matplotlib further enhanced result interpretation, allowing for the easy identification of weaker zones, even in monolithically cast samples, helping to predict potential issues in concrete structures. These techniques offer valuable insights for managing concrete health, ultimately contributing to the extended service life and resilience of infrastructure.

Keywords: Structural Health Monitoring · Concrete Structures · Non-destructive Testing · Rebound Hammer · Ultrasonic Pulse Velocity · Matplotlib

1 Introduction

The structural integrity of concrete structures is paramount in ensuring the safety and longevity of buildings, bridges, and other critical infrastructures. With the increasing demands on infrastructure due to urbanization and industrial growth, effective monitoring and maintenance strategies have become essential. Traditional methods of assessing concrete integrity, while valuable, often fall short in providing comprehensive insights into the material's condition. Consequently, there is a growing interest in integrating advanced non-destructive testing (NDT) techniques to enhance monitoring capabilities.

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