Assessing the Structural Strength of Concrete Members Using a Low-Cost, Non-Invasive Monitoring System

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With a rapidly aging infrastructure in our country, safety of the public is at stake. Since only limited public transportation funds available, there is a growing urgency to measure the level of loss in the structural strength of the deteriorating members so that repairs can be prioritized and funds utilized judiciously. To quickly estimate the section loss of rebar embedded in concrete, and thus a measure of the reduction in the load carrying capacity of the element, this research used a novel approach to measure the level of deterioration and section loss in a rebar using a feasible, minimally invasive electrical measurement approach. Split into 3 phases, phase 1 successfully demonstrated that loss of current measured through a bar is directly correlated to the section loss of a rebar cross-section. This approach provides a quick method of identifying section loss of embedded rebar in concrete and used the basics of structural engineering to calculate the load carrying capacity of a simple concrete structural member using an environmentally friendly, non-invasive system in phase 2. With the addition of an Arduino Uno in phase 3 to export data to a Google server, this knowledge can arm engineers and public transportation agencies with the ability to estimate repair budgets and set priorities, thus improving public safety. For new construction, this research provides a powerful tool to investigate the strength of structural components and to take corrective actions in time through a prompt notification tool to local law enforcement authorities should this current flow be obstructed, signifying compromise of structural integrity of the bridge.

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