

Assessment of corroded reinforced concrete beams : cyclic load test and acoustic emission techniques

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ABSTRACT

An acoustic emission (AE) technique has been used to monitor different initial conditions of corroded reinforced concrete beams under a cyclic load test (CLT) in accordance with ACI 437. Limited studies have assessed the validity of this test method for corroded reinforced concrete structural members, especially in a full-scale specimen. This study aimed to explore damage evaluation techniques based on CLT acceptance criteria and AE damage quantification techniques under different initial conditions of corroded reinforced concrete beam specimens. The beam specimens were subjected to three different corrosion durations (15, 30 and 45 days), to reflect the different extents of corrosion, which was accelerated using the impressed current method with 3.5% NaCl solution. This study also discussed the results obtained by both methods. Deviation from linearity (DFL) failed after loadset 3 based on the CLT acceptance criteria corresponding to the first visible crack in all of the specimens. The AE data analysis revealed that the cumulative signal strength (CSS) ratio was useful for identifying minor damage, whereas the felicity and calm ratios were suitable for determining moderate to heavy damage. Relaxation ratio analysis could be effectively performed to identify damage that corresponded to the first visible crack. Analysis on both methods showed that the DFL and relaxation ratio could be effectively used for damage identification because both methods corresponded to the first visible crack. Nonetheless, the AE method offered more advantages including damage detection and progression. Therefore, this method is promising for non-destructive evaluation in structural health monitoring.

KEYWORDS

Acoustic emission; Reinforced concrete; Corrosion; Cyclic load test; Structural health monitoring

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