# Analysis of the structural behavior of reinforced concrete components with acoustic emission analysis

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The use of non-destructive testing methods can provide insights into processes within the interiors of structures. Acoustic emission testing is one of the non-destructive testing methods that allows the detection of material damage during its occurrence. When structures, such as concrete components, fail under load, elastic waves are generated, propagating within the component. These signals can be detected by acoustic emission sensors placed on the surface of the component, enabling the tracking of the material's condition and the location of failure. This paper summarizes recent applications of acoustic emission measurements on large-scale laboratory specimens made of reinforced concrete. The first example describes measurements during a tensile fatigue test on a large-scale reinforced concrete specimen to investigate the fatigue behaviour of an embedded concrete dowel. The second example involves measurements during a dynamic three-point bending test to examine the fatigue behaviour of a prestressed concrete railway sleeper. The third example describes a full-scale test conducted on a flat slab concrete test specimen with dimensions of 2.8 m × 2.8 m. The objective of these investigations is the development and optimization of new components to enhance punching shear resistance and provide an economical solution. To detect microcracking during loading acoustic emission measurement has been carried out using broadband sensors with a measurement frequency of up to 200 kHz which were especially developed for the detection of microcracks in concrete. For the three-dimensional location of the acoustic emission events, 16 of these acoustic emission sensors were attached to the surface of the specimens. Most of the events were in the centre of the sample in the punching area. These events form a circular structure with a diameter of approximately 1m. A visual inspection of the sample after the experiment shows that macroscopic cracks have formed in this area, which extend up to the surface of the sample.