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Non-destructive testing — Acoustic emission testing — Test method for damage qualification of reinforced concrete beams

Essais non destructifs — Contrôle par émission acoustique — Méthode d'essai pour la qualification des dommages des faisceaux de béton armé



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Foreword

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This document was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 9, *Acoustic emission testing*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Acoustic emission (AE) techniques are extensively developed in concrete engineering. Concrete structures have long been referred to as maintenance-free. Recently, however, it is realized that the concrete structures can deteriorate due to many factors. In particular, heavy traffic loads result in fatigue of the concrete structures.

In order to assess the fatigue of reinforced concrete beams, one criterion to qualify the damage levels is proposed on the basis of two ratios associated with the Kaiser effect.

New AE parameters of load ratio and calm ratio are defined for qualification of the damage. It is found that the damage qualified by the two ratios are in good agreement with actual damage of the beams. This suggests that the damage of the reinforced concrete structures in service as bridges, docks and buildings be quantitatively assessed, by simply applying cyclic loading and monitoring AE activity.

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Non-destructive testing — Acoustic emission testing — Test method for damage qualification of reinforced concrete beams

1 Scope

This document specifies a test for damage qualification of reinforced concrete beams in services as bridges, docks and buildings.

2 Normative reference

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12716, *Non-destructive testing — Acoustic emission inspection — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12716 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
AE activity
occurrence of AE hits or counts under stressed conditions in concrete

3.2
Kaiser effect
little *AE activity* (3.1) observed until the maximum load of the previous stage is surpassed when stresses are applied, removed and then reapplied to a material or a structure

3.3
Felicity ratio
ratio of the load at which emissions start to the previous maximum load when stresses are applied, removed and then reapplied to a material or a structure

Note 1 to entry: This shows the ratio of the degree of conformity of the *Kaiser effect* (3.2).

4 Requirement for the measuring system

For detection of AE signals, AE sensors shall be sensitive enough to detect AE signals generated in a concrete member, taking acoustic coupling into consideration. AE sensor shall be also robust enough against temperature change, moisture condition and mechanical vibrations in the environments. AE sensor shall be attached at proper locations to cover the target area.

In advance of the test, attenuation properties of the target structure shall be estimated, by employing the standard source. Based on this information, sensor location shall be determined in consideration with the attenuation properties.

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