

Bossong developing Seismic C2 resin for standard threaded rods

The need for high performance chemical anchors has become dramatically evident during recent high intensity earthquakes in Europe. This has pushed European institutions to adopt new tighter rules regarding the use of anchors in seismic areas [Annex E to ETAG 001].

Introduction

Post-installed anchors (chemical and mechanical) for use in concrete are currently regulated in Europe by the EOTA (European Organisation for Technical Approvals) guideline ETAG-001: Metal anchors for use in concrete. This document includes a general part, five specific parts depending on the type of anchor, and three Annexes.

Now, after some years of work, the ETAG 001 includes a new Annex concerning the qualification of anchor in seismic zone: Annex E: Assessment of metal anchors under seismic action.

Considering that most European territories are classified as seismic areas, Annex E fills a significant regulatory omission.

History of Annex E

In 2007, the European Commission gave EOTA the mandate to integrate the ETAG 001 guideline with a test protocol aimed at the seismic certification of post-installed anchors. After five years of work, the European guideline for seismic approval of anchors has been developed and has reached its final format in terms of the technical content.

The standardisation work leading to the preparation of this document has been long and intense, and involved contributions, alongside those from multinational corporations and European experts in seismic activities and Eurocodes, from small and medium European companies such as Bossong. This was possible due to ECAP (the European Consortium of Anchor Producer) and the scientific cooperation of the Politecnico of Milan.

The first draft on the seismic qualification of the post-installed anchors was exclusively inspired by the United States standard ACI 355-2 (on which some of the current anchor certifications for seismic activities are based).

The regulatory work highlighted significant incompatibility between the United States standards and the European ones regarding the precise seismic qualification of the anchors. As a result, the 2007 draft could not be validated, and was significantly reformulated until reaching its current version (amended October 2012).



Annex E test protocol C1 and C2

Annex E provides that only anchors suitable for cracked concrete (Option 1 according to ETAG 001) can be qualified with the tests provided in the test protocol. The only exception refers to areas with very low seismic activity ($a_g S \leq 0.05g$)* for which no additional prerequisite is required; in other words the current qualifications according to ETAG 001 will be sufficient.

Specifically, two test protocols are identified:

- C1: Only for non-structural uses and for levels of low seismicity.
- C2: For structural uses and non-structural uses and for levels of significant seismicity.





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It must be pointed out that the C1 test protocol includes everything that is recommended already in the existing United States regulatory document ACI 355-2. This test protocol required a minimum number of 10 tests to be performed for every diameter of the anchor that one wants to certify.

Test protocol C2 is very different and certainly stricter. This protocol requires a minimum of 30 tests per diameter and tests in which the anchors are qualified in cracks up to 0.8mm in width, by simulating the inversion of the moment through the active compression of the concrete around the anchor.

Bossong BCR EPOXY 21

Specifically, in the field of chemical anchors, Bossong believes that for these applications epoxy products with the use of metal bars, could represent one of the best answers in terms of resistance and flexibility for the end user.

To satisfy the current and future requirements in this field, Bossong S.p.A. is collaborating with the equipment laboratory of the Politecnico of Milan (department of structural engineering) to evaluate the behaviour during earthquakes of the chemical epoxy anchor BCR EPOXY 21 (European Technical Approval ETA - 11/0344).

According to Annex E protocol C2 - for structural uses and non-structural uses and for levels of significant seismicity - Bossong has finished the phase of tests and is working to obtain the final ETA.

BCR EPOXY 21 has been tested in combination with standard threaded rods. Bossong believes that this qualification will confirm BCR EPOXY 21 as one of the most advanced pure epoxy resins in the market. It also sees the possibility of using BCR EPOXY 21 to achieve C2 approved fixings using standard threaded rods available in the market will make safe installations in seismic risk zones easier.

The product has already two ETAs for fixing with threaded rods (Option 1 for cracked concrete and Option 7 for non cracked concrete) and for rebar connections, plus a certification to guarantee electrically isolated fixings. It is available in the sizes 900ml, 400ml, 265ml, and in the brand new 470ml cartridge.



** $a_g = \gamma_1 \cdot a_{gR}$ Design ground acceleration on type A ground (Ground types as defined in EN 1998-1, Table 3.1);
 γ_1 = importance factor (see EN 1998-1, 4.2.5);
 a_{gR} = reference peak ground acceleration on type A ground (see EN 1998-1, 3.2.1);
 S = Soil factor (see e.g. EN 1998-1, 3.2.2).*