

Streamlining the Test Methods for Seismic Verification of Façade Anchors

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Abstract. So-called “heavy” curtain façades made of brickwork, natural stone cladding or concrete panels with a dead load of more than 100 kg/m² are usually fixed to the main load bearing sub-structure using steel anchors that transfer the loads affecting the facing panel.

In general applications, only static loads such as dead loads, wind loads and constraining forces have to be considered when calculating these façade anchors. In countries with seismic hazard, the effects of earthquakes must also be taken into account; of course, to ensure that escape routes are free in case of an earthquake and to avoid personal injury. These effects can be simulated by a static equivalent load acting in the most unfavourable horizontal direction.

“Large”-scale i.e. shake table tests were provided to compare rigid and ductile load bearing behavior of fixings for heavy façades. As these shake table tests are time consuming, alternative, rational test methods should be found.

One possibility to assess the behaviour of a single fixture and their connection to the load-bearing substructure subjected to earthquake action represented by a horizontal equivalent load is “micro”-scale testing with reference to ETAG 001, appendix E. The disadvantage of this method is that it can only confirm the load-bearing capacity of a single anchor, but not the interaction of the anchorage and the façade.

For this purpose a special “meso”-scale testing method was developed to test all components of an anchoring system instead of a single anchor. A representative façade surface - here 1 m² - is fastened with appropriate anchoring means and static equivalent loads are applied. The test program was also based on the specifications of ETAG 001, Annex E for these tests.

Thus, different fixing systems can be tested and compared completely, i.e. not only the fixing but also the connection to the load-bearing substructure and the façade, according to different criteria such as load-bearing capacity, deformations or ductility.

This paper provides an overview of the calculation methods and test methods. Test methods are introduced as an alternative to shake table tests. All of them are used to obtain necessary information about the load-bearing behaviour of the entire outer wall and to confirm theoretical assumptions with different experimental effort. The technical background is explained and the experiment results are illustrated.

Keywords: Façades; Fixing constructions; Heavy façade systems; Nonstructural elements, Testing methods