Evaluation for danger of falling tiles / finished exterior wall in earthquakes

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1. Foreword

In the existing earthquake damages, wet tile finished exterior walls used often for mid-to-high-rise RC buildings (hereinafter referred to as tile exterior wall) have a high occurrence rate of damage in spite of the mild level of earthquake vibrations. In particular, based on many damage involving peel-offs, falling or the like occurring to tile exterior walls in the Great East Japan Earthquake, this study proposes a convenient peel-off danger evaluation method and testing method, and specifications capable of ensuring certain earthquake prevention safety.

2. Outline of deliberations

We investigated and put damage occurring to the tile exterior walls of mid-to- high-rise RC buildings by earthquakes in order, sampled materials that seemed effective for preventing peel-off/falling and carried out performance tests of material levels. In addition to direct tensile tests to measure adhesion strength of tile finished layers (photo 1) and shearing tests (photo 2), we carried out deformation suppleness tests (photo 3) by putting loads on concrete foundations.

3. Result and conclusion

The tile exterior wall is worked on concrete structures; using plaster mortar, organic adhesive sheathing and adhesive materials (chart 1). In view of the result of deformation suppleness tests, while the plaster mortar prevents peel-off in adaptation to brandering due to its adhesive strength, organic adhesives prevented peel-off according to deformation flexibility due to its elasticity. Furthermore, while the tiles affixed by organic adhesives do not generate cracks and peel-offs when the concrete base is fractured due to elasticity, in case of direct external forces such as a tensile strength test, even though it clears the prescribed value 0.4N/mm2, it cannot be expected to have strength as high as plaster mortar (chart 2). Moreover, in reference with adhesion strength between ready-made blending mortar and blending mortar made onsite relevant to subsurface for plaster mortar, it currently has turned out that the onsite blending surpassed the ready-made blending by about 1.5 times (chart-3). For fiscal 2014, we carry out deliberations for simplified earthquake resistance test method using diagonal test bodies and verification using 1/2 wall testing bodies.

Photo 1 Direct tensile test

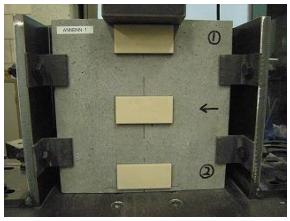

Photo 2 Direct shearing test

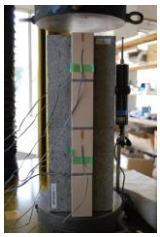

Photo 3 Deformation suppleness test

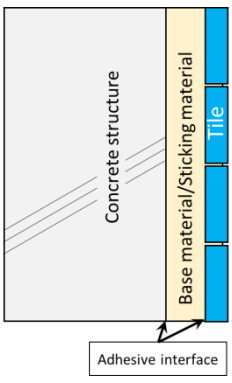

Figure1 Tile outer wall cross section

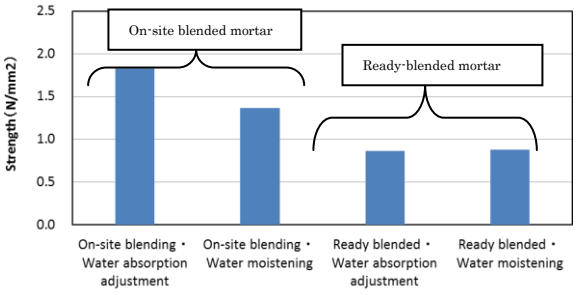

Figure2 The direct tensile test of tile direct tension

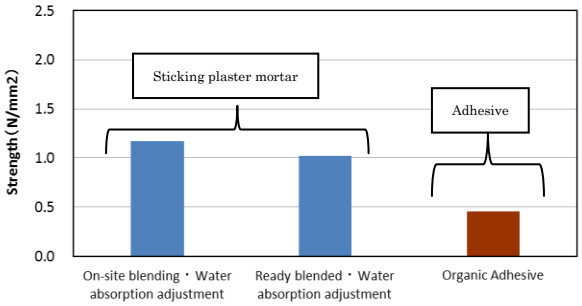

Figure3 The direct tensile test of a three-layer coating tile base for plastering mortar