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ICC-ES AC156 Protocol vs Real Records: Seismic Response of Freestanding Components

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Abstract. The high seismic risk related to the damage of acceleration-sensitive nonstructural components was highlighted by several post-earthquake surveys, and extensively investigated by recent experimental studies. Freestanding (or not-anchored) components are very peculiar acceleration-sensitive elements: (a) they are sensitive to both acceleration and velocity, (b) they are likely to exhibit rocking-dominated rigid motion under moderate-to-high intensity earthquake shakings, and (c) they can be extremely exposed to economical and human losses. The high vulnerability and exposure of such components, combined with high hazard locations, determines a huge seismic risk. Such risk is even more significant for equipment of critical facilities such as hospital buildings or power plants. Shake table testing is the preferred method for the seismic assessment of acceleration-sensitive nonstructural components. Generally, the seismic evaluation should follow reference testing protocols, and a standard seismic certification is often required. There are no specific protocols for seismic evaluation and certification of freestanding components, despite their potential impact on National economy and public safety. The AC156 protocol developed by the US International Code Council Evaluation Service (ICC-ES) represents the state-of-the-art for the seismic evaluation and certification of acceleration-sensitive components. The code does not explicitly forbid the application to not-anchored components, but it is conceived for attached equipment. For this and other reasons, the use of AC156 is becoming common practice for seismic assessment of freestanding components. The paper investigates the application of the AC156 protocol for the seismic assessment of small-to-medium size not-anchored components. Incremental Dynamic Analysis (IDA) of rigid blocks is performed by solving the motion equations, considering both inputs in compliance with the AC156 protocol and real strong ground motions. The seismic performance of the blocks is assessed using both dimensional and dimensionless acceleration intensity measures. The rocking and overturning fragility curves related to the AC156 inputs are compared to the ones obtained considering the real ground motions, checking whether the AC156 protocol is conservative.

Keywords: Nonstructural components, AC156 protocol, Freestanding components, Rigid block, Seismic fragility.

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