

Seismic pounding mitigation of a modern heritage R/C bell tower

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Abstract

Pounding is one of the greatest sources of seismic vulnerability of pre-normative R/C structures, as they have often been built at poor distance from adjacent buildings. The effects of pounding can be particularly severe in slender modern R/C heritage structures, including civic or bell towers. An emblematic case study falling in this class of structures, i.e. a monumental R/C bell tower constructed in the early 1960s to replace the former 19th century tower of the Chiesa del Sacro Cuore in Florence, is analyzed in this paper. In order to assess the effects of pounding, a non-linear dynamic finite element enquiry was carried out by simulating collisions with a multi-link viscoelastic contact model originally implemented in this study. The survey results show that pounding affects the seismic response of the bell tower and the church as early as an input seismic action scaled at the amplitude of the normative basic design earthquake level. A retrofit hypothesis to prevent pounding is then proposed, which consists in linking the two structures by means of a pair of fluid-viscous dampers. The technical implementation of this rehabilitation strategy and the benefits induced in the response of the bell tower are discussed in detail in the paper.