

ON THE DISTRIBUTION OF MOTION IN MULTISTOREY BUILDINGS AS INPUT TO SECONDARY SYSTEM COMPONENTS

Stylianos I. Pardalopoulos¹ and George D. Manolis²

¹ Post-doctoral Fellow

² Professor

Department of Civil Engineering

Laboratory for Experimental Mechanics

Aristotle University of Thessaloniki (AUTH)

Thessaloniki, GR-54124, Greece

e-mail: stylpard@civil.auth.gr; gdm@civil.auth.gr

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Abstract. Secondary systems are nonstructural building components that serve important functional and aesthetic purposes, yet are not part of the main structural system. These may be different types of architectural, mechanical, electrical and plumbing components as well as the building content. The main issue in the installation process of secondary building components in regions with high seismicity is the preservation of the components' integrity and functionality during earthquake excitations, since mechanical failure of those systems can have dramatic consequences in terms of property damage and life safety for the occupants of the building. The paper focuses on the determination of the seismic response of acceleration-sensitive secondary building components with total mass lower than 1% of the total mass of the building on which they are installed, whose seismic excitation derives exclusively from the dynamic response of the supporting building and they are incapable of influencing the building's seismic response. A new methodology for the seismic design of such systems installed on multistory buildings with established diaphragm action at their floor levels is presented, which quantifies the seismic demand from information based on the deflected shape of the supporting building at the instant of its peak seismic response. The methodology can be performed utilizing different alternative approaches, depending on the required accuracy of the results and the allowable computational cost, yielding dependable results as compared to those deriving from detailed time-history dynamic analysis. The introduced methodology is a significant departure from the current state of design of acceleration-sensitive secondary building components, which do not account for the seismic response of the vibrating supporting structure. The accuracy of the introduced methodology is evaluated through application examples to different types of building and – component systems.

1 INTRODUCTION

Secondary building components are nonstructural systems that serve important functional and aesthetic purposes, yet are not part of the main structural system of the building (Figure 1). Architectural building components include a wide variety of systems that improve the living conditions of the occupants of a building, such as claddings of different materials and shapes, used in building facades as a means for providing thermal and sound insulation and protection against exposure to weather conditions. The category of architectural building components also include parapets and gables at roof level of buildings, used for aesthetic purposes and partition walls used for dividing the floor area of buildings and facilitating the practical needs of the occupants. Natural gas pipeline networks, elevator systems, plumbing and fire extinguishing networks, air-conditioning units and ducts are only few examples of mechanical building components. Antennas of different types, electrical networks, solar panels, electrical appliances (refrigerators, washing machines, televisions, etc) fall under the category of electrical building components, whereas, building contents (furniture, store merchandise, domestic equipment, etc) are also secondary building components.