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Optimal Placement of Mega-Brace Dampers for Integrated Seismic Design of Super Tall Building Structures

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Abstract

Super tall buildings are commonly controlled by earthquake in high seismicity area. Viscous dampers have been widely applied in seismic design of tall buildings to mitigate the seismic responses of super tall buildings. The energy dissipation capacity of viscous damper system is highly related to the damper configuration. Mega-brace damper system is one of the deformation amplification configurations, which can amplify the story deformation under earthquake. The mega braces can be flexibly arranged according to the building brace configuration. The installation of mega-brace dampers will cause the stiffness loss of primitive stiff mega braces. The optimal placement of mega-brace dampers will comprehensively consider the maximizing of energy dissipation capacity and the minimizing of stiffness reduction. This paper proposes an optimal placement method of mega-brace dampers which can satisfy both requirements. A real super tall building project will be employed to illustrate the applicability and effectiveness of the proposed optimal placement method for the mega-brace dampers.

Keywords: optimal placement; mega-brace damper; integrated seismic design; tall buildings.

1 Introduction

Super tall buildings are commonly controlled by earthquake in high seismicity area. There have been various damping measures since then. Bo [1] proposed a variety of seismic resistance measures, one of which is the energy dissipation devices - viscous dampers. Viscous dampers have been widely applied in seismic design of tall buildings to mitigate the seismic responses of super tall buildings. They can absorb and dissipate large amounts of energy under earthquake actions and improve mechanical performance and seismic characteristics Constantinou and Symans [2] noted that viscous dampers are widely used because of the relatively simple design. The energy dissipation capacity of viscous damper system is highly related to the damper configuration. Soon after, Taylor and Tonawanda [3] proposed the toggle-brace dampers with a displacement amplification effect. Then, Hanson and Soong [4] introduced kinds of motion amplification devices.

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