A New Approach for Seismic Design of the Asymmetric Shear Wall Concrete Buildings Located Within Near-Fault Ground Motions

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ABSTRACT

Near-fault ground motions impose large demands on structures compared to far-fault ground motions. Recent studies have pointed out that the stiffness and strength of the ductile RC structural walls are dependent parameters. Based on the proposed approach, the strength distributed among the resisting elements. Minimum torsional response in one-storey and multi-storey under near-fault and far-fault ground motions are determined. A new displacement-base design method by considering criteria such as characteristics of the dynamic torsional response, the ductility of the RC walls, the system ductility and the story-drift at the softer edge of the building under the design earthquake are explained. With respect to the displacement profile, post yield displacement and curvature ductility factor of elements are defined. Therefore, confinement of concrete in boundary would be controlled.

Key words: **Design criteria**; **asymmetric building**; **near-fault**; **ductility**; **storey drift**

1. INTRODUCTION

Asymmetric buildings with centers of stiffness and strength being different from the center of floor mass, respond to earthquake excitation in coupled modes, producing both lateral and torsional motions. Such buildings as reported by many researches [1-5] are highly vulnerable due to the torsional response. The position of the stiffness and strength centers towards the floor mass center could highly affect the torsional response. The torsional provisions of codes are based on the assumption that the stiffness of the RC walls can be estimated with some degree of accuracy prior to strength allocation, and will not be affected by the subsequent strength assignment process. The effectiveness of codified torsional provisions has been the subject of extensive study over the last ten years. In all these studies the stiffness and strength of the wall elements are assumed independent. Recently, it has been pointed out that for many concrete resisting element such as bridge piers, flexural walls, ductile moment-resisting frames, the yield displacement depends only on material properties and the geometry of the element and can be considered to be independent of its strength for seismic design purpose. Paulay[4] showed that the yield displacement of shear walls depend only on the material properties, such as limiting strain, and the geometry of the components of structure elements . For design purposes generally yield displacements considered to be independent of the strength assigned to components or elements. Since in a plastic mechanism, the sequence of the onset of the components yielding, is independent of their strength, within rational limits, strengths may be assigned to components in the way that suits the designer’s intentions. With re-defined stiffness, relating freely chosen strengths to strength-independent yield displacements enables a more realistic assessment of elements or of a system to be made. Tso and Myslimaj [5], proved that the yield displacement distribution-based strength assignments between resisting elements, does not require the knowledge of stiffness distribution prior to strength assignment. They concluded that, when strength and stiffness centers are two sides of the mass center, minimum torsional response could be obtained.

Present design codes try to improve the allowance made for the dynamic torsional response of asymmetric buildings based on elastic linear response assumptions by increasing the total strength. However, the relevant rules are controversial and do not comply with the effective non-linear dynamic torsional response. This