SEISMIC EVALUATION OF REINFORCED CONCRETE SHEAR WALLS CONSIDERING SOIL-STRUCTURE INTERACTION

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ABSTRACT

The use of concrete shear wall is quite common in a number of seismic countries as a result of their successful seismic behavior during past severe earthquakes. As the Iranian seismic code does not address the soil–structure interaction (SSI) explicitly, the effects of SSI on reinforced concrete shear walls are studied using the sub-structure method. Two types of slender (H/L>2) and squat (H/L<2) walls on three types of soil, with and without the soil interaction, are modelled and subjected to different earthquake records. The walls and supports are modelled using finite element method (FEM). The FEM calculations are carried out using the program ABAQUS. The results showed that soil-structure interaction has negligible effect on maximum displacement of both squat and slender walls; however, considering SSI for seismic design of the squat wall is essential.

1. INTRODUCTION

The estimation of earthquake motions at the site of a structure is the most important phase of seismic design of a structure. In classical methods used in structural analysis, it is assumed that, the motion in the foundation level of structure is equal to ground free field motion. This assumption is correct only for the structures resting on rock or very stiff soils. For the structures constructed on soft soils, foundation motion is usually different from the free field motion and a rocking component caused by the support flexibility on horizontal motion of foundation has been added (Tabatabaiefar and Massumi, 2010). However, the destruction of numerous buildings in 1985 Mexico earthquake made researchers focus on soil–structure interaction effects on the response behavior of structures. There are numerous studies which have shown correlation between damage and local geology and site condition (Ghosh and Madabhushi, 2003). Many researchers studied seismic analysis of soil-structure interaction for different types of structures (Dogangun et al., 2007; Mwafy et al., 2008).

The use of concrete-shear-wall buildings is quite common in some earthquake-prone countries such as Iran; their seismic behavior has been successful during past severe earthquakes, both, from a serviceability as well as a safety standpoint (Wood, 1991). Therefore, their use has been recommended in earthquake-resistant design as long as its true behavior is included in building modeling (Sozen, 1989).