NUMERICAL SIMULATION AND DYNAMIC ANALYSIS OF THE CONCRETE DIAPHRAGM WALL

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As a temporary structure, Concrete Diaphragm Wall has been widely used to counteract excavation problems in Iran not only in urban areas, but also in mountainous and coastal areas.This continuous barrier can be used in different soil types and it is able to resist lateral earth pressure, but its large deformation is a serious concern for the use of this structure in the geotechnical engineering. Dynamic behaviour of concrete diaphragm wall underlying earthquake is evaluated through fully coupled nonlinear effective stress dynamic analyses. Effects of nonlinear soil structure interaction (SSI) and a diaphragm wall can be simulated by using interface elements with *FLAC* program package. The Mohr–Coulomb model was used to simulate the nonlinear soil behaviour. The model is based on the plane strain conditions and is formulated in terms of effective stresses. The Concrete Diaphragm Wall was modelled as a linearly elastic material, by using beam element with bending stiffness of $E_c I = 1.53\times10^8 kN.\mathrm{m}^2$ (American Concrete Institute (ACI), 2008). Trenches are from 4 to 6.0 meters wide and are excavated in 3 to 6 meter lengths (Figure 1).

Each model was subjected to three ground motion events obtained by scaling the amplitude of the Bam (2003), Manjil (1995) and Kocaeli (1999) earthquakes (Figure 2).

Although recent advances in physical model experiments (Gang Zheng et al. (2014)) and computational modelling of liquefaction-induced ground deformation (Chang-Yu et al., 2013; Kung, 2009; Kung et al., (2007) and Arai et al. (2008)) are quite promising, but challenges still remain on this critical problem.

In this paper, for the precision in the assessment of the Concrete Diaphragm Wall at a site,three factors affecting the safety and cost of the design are evaluated: Trenches height, soil type and the characteristics of the earthquake. Results of the analyses are interpreted in order to improve understanding of the Concrete Diaphragm Wall response.The results revealed that Concrete Diaphragm Wall has a better performance in clay soils compared to the granular soils. Investigation of the horizontal displacement over the concrete diaphragm wall has demonstrated that the maximum displacement occurred during strong motions and it is related to earthquake characteristics. In the region of moderate to high seismicity, if the height of the Concrete Diaphragm Wall is more than 4 meters, the seismic performance of the wall should be inspected.

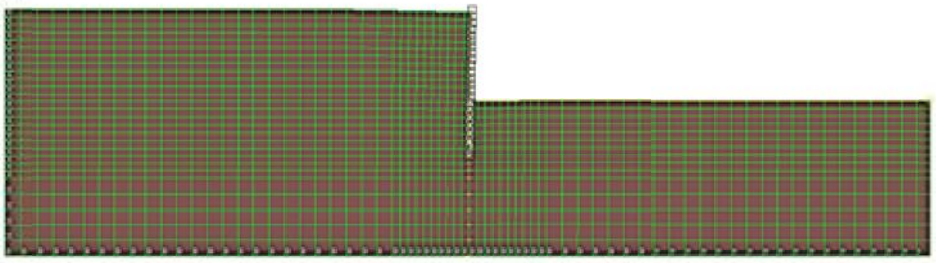

Figure 1. Schematic illustration of the concrete diaphragm wall subjected to earthquake

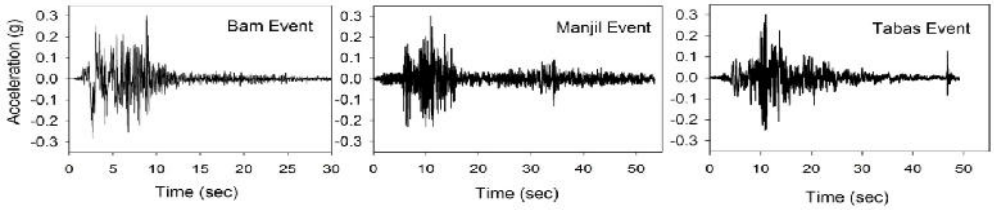

Figure 2. Horizontal acceleration history for Bam, Manjil and Tabas seismic zones, respectively

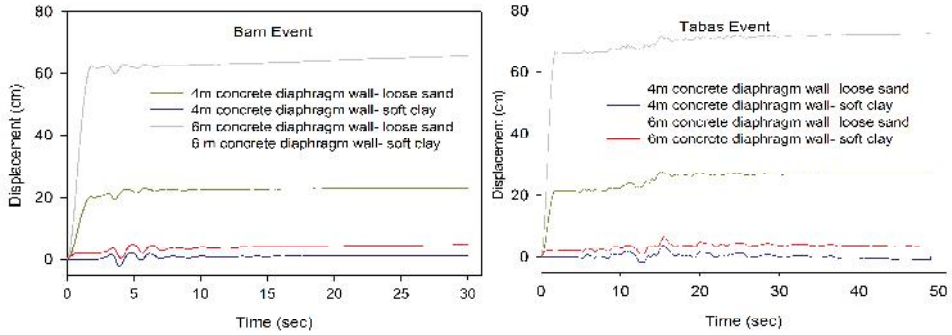

Figure 3. Time history of the lateral displacement of highest point of the concrete diaphragm wall for Bam and Tabas earthquakes

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