2D SITE EFFECTS STUDY IN THE SEISMIC RESPONSE OF THE EXCAVATIONS AND ADJACENT BUILDINGS

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One of the most important seismic geotechnical concepts is to evaluate the effect of site conditions on strong ground movements. Many aspects of seismic site effect still need to be studied in more detail and they can be incorporated in the seismic norms after quantification. Looking at the past earthquakes, it is possible to attribute the reason for many damages to the effects of the site, with this in mind, the movement created on the surface of the earth, in addition to the condition of the seismic spring and the direction of the waves, is also highly dependent on the local conditions.

Therefore, considering different two-dimensional conditions and various parameters, it improves seismic codes to reduce damages in known conditions. The present research is carried out in this direction in order to find out more about the two-dimensional effects of the site. The purpose of this paper is to contribute to establishment of a simple method to include complex site effects in a building code.

Site effects are divided into two general categories: the effects of local sediments and the effects of topographic irregularities. The parametric studies are achieved by means of HYBRID program combining finite elements in the near field and boundary elements in the far field (FEM/BEM)(Gatmiri et al., 2008). This software allows solving the problem of propagation of waves in a dry two-dimensional environment or elastic saturation in time, using the combination of methods of boundary element and finite element.

In this study, in order to evaluate the two-dimensional effects of the site in the seismic response and estimate the magnitude of the amplification, the effect of excavations is considered to be the same as the effect of a rectangular topography with a 90 degree angle to the horizon line, and the seismic response of the buildings built on the excavation and also buildings adjacent to the excavation up to a certain distance that can be affected by site effects and subjected to invasive SV waves of vertical incidence are calculated.

This paper focuses on the modeling of rectangular excavation with different shape ratios, for this purpose excavations are modeled with 0.5 (H=20, L=40), 1 (H=20, L=20), 1.5 (H=30, L=20) shape ratio (H/L) (Gatmiri et al., 2009) (Figure 1). Horizontal ground movements, acceleration rate and amplification at critical points, the configuration has been analyzed by Hybrid.

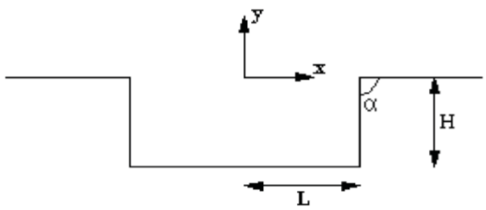

Figure 1. Rectangular Excavation.

We considered some critical points in the center and wall of the excavation also the ground level up to a distance of 3L and 9300 (m) from the center of the excavation and analyzed the parameters mentioned above. Dots up to a distance of 3L in the finite element method and points up to a distance of 9300 (m) from the center of the excavation in the boundary element method have been investigated.

We assume that the dominant frequency and impedance ratio between sediments and bedrock is constant. Also the aggregates are modeled as dry and homogeneous and their behavior is linearly elastic.

The soil and bedrock characteristics are listed in the Table 1.

Table 1. Mechanical parameters for the materials.

Soil Type	E (Mpa)	ρ (Kg/m³)	C (m/s)	K	K_0	ν	β
Hard	3447	1630	902	2872	0.5	0.3	0.6
Bedrock	6860	2450	1000	11433	0.5	0.4	1

After analyzing the information, the results are as follows:

The results indicate that in a homogeneous soil layer and surface of the bedrock, by increasing the shape ratio in the constant depth, *and* reduction of the crater (H=20m=cons, L=40→L=20) the amount of horizontal displacement (Ux) and amplification increases on the bottom of the excavations. By increasing the shape ratio in the constant width, and increase depth (L=20m=cons, H=20m→H=30m) the amount of horizontal displacement (Ux) and amplification decreases in the center of the excavations.

Also in all ratios of shapes the maximum of horizontal displacement and amplification happens on the excavation edge (Gatmiri et al., 2011). As far as the distance from the center of the excavation to 300 m the amount of horizontal displacement (Ux) and amplification decreases. The results are shown in the form of pseudo acceleration response spectra.

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