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SEISMIC SITE RESPONSE INDUCED BY A SEDIMENTARY BASIN: 1D AND 2D NUMERICAL ANALYSIS

Hamid ALIELAHI
Assistant Professor, Department of Civil Engineering, Zanjan Branch, Islamic Azad University, Zanjan, Iran
h.alielahi@iazu.ac.ir

Maryam RAHIMI
Ph.D. Student, Department of Civil Engineering, University of Zanjan, Zanjan, Iran
rahimmashaie.maryam@yahoo.com

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Nowadays, the influence of the site and geological conditions, especially in the sedimentary basins, is quite obvious on the characteristics of the input motion and the distribution of their damage. The existence of various effective factors in calculating the seismic response of sedimentary basins such as topography features and the characteristics of sedimentary layers and the combination of these factors together will create uncertainties in this subject, which can be explained only by an accurate evaluation of specific site study (Singh et al., 1981). These effects are mostly evaluated using one-dimensional analysis. However, one-dimensional analysis is not able to predict the site responses and their wave amplification. In this paper, the seismic behavior of the Persian Gulf Bridge's basin as case study has been evaluated, using FLAC 2D program based on the finite difference method. In this regard, a 1D modeling for soil profile at each pier position of bridge and a 2D modeling for all piers located on sedimentary basin are performed. In order to verify the results of the numerical modeling, the 1D responses obtained from the FLAC 2D and DEEPSOIL 1D software have been compared using the Viscoelastic soil behavior. In this study, the 2D modeling process includes introducing soil layers characteristics and determining the lateral free-field boundaries and quiet boundary as the bottom boundary, are subjected to the 18 earthquake excitations. In the following, as shown in Figure 1, a two-dimensional model of the sedimentary basin is constructed using the FLAC 2D program, that its net length of 2500 meters in the sea, with an overall length of 3000 meters and a depth of 120 meters.

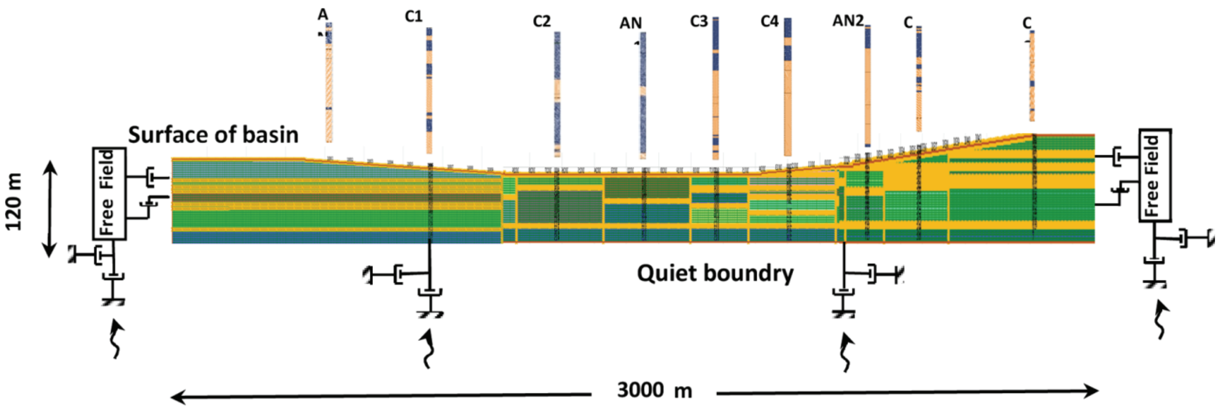

Figure 1. Two-Dimensional Modeling of Persian Gulf Bridge Sedimentary Basin using FLAC 2D.

The two-dimensional model is similar to the one-dimensional models subjected to 18 earthquake excitations and the acceleration response spectral is obtained at the soil profile of each bridge pier location and then, the median of the acceleration response spectra for all the earthquake excitations is calculated. Thereafter, as shown in Figure 2, the results of one-dimensional and two-dimensional models are compared with each other in the soil profile of each bridge pier position.

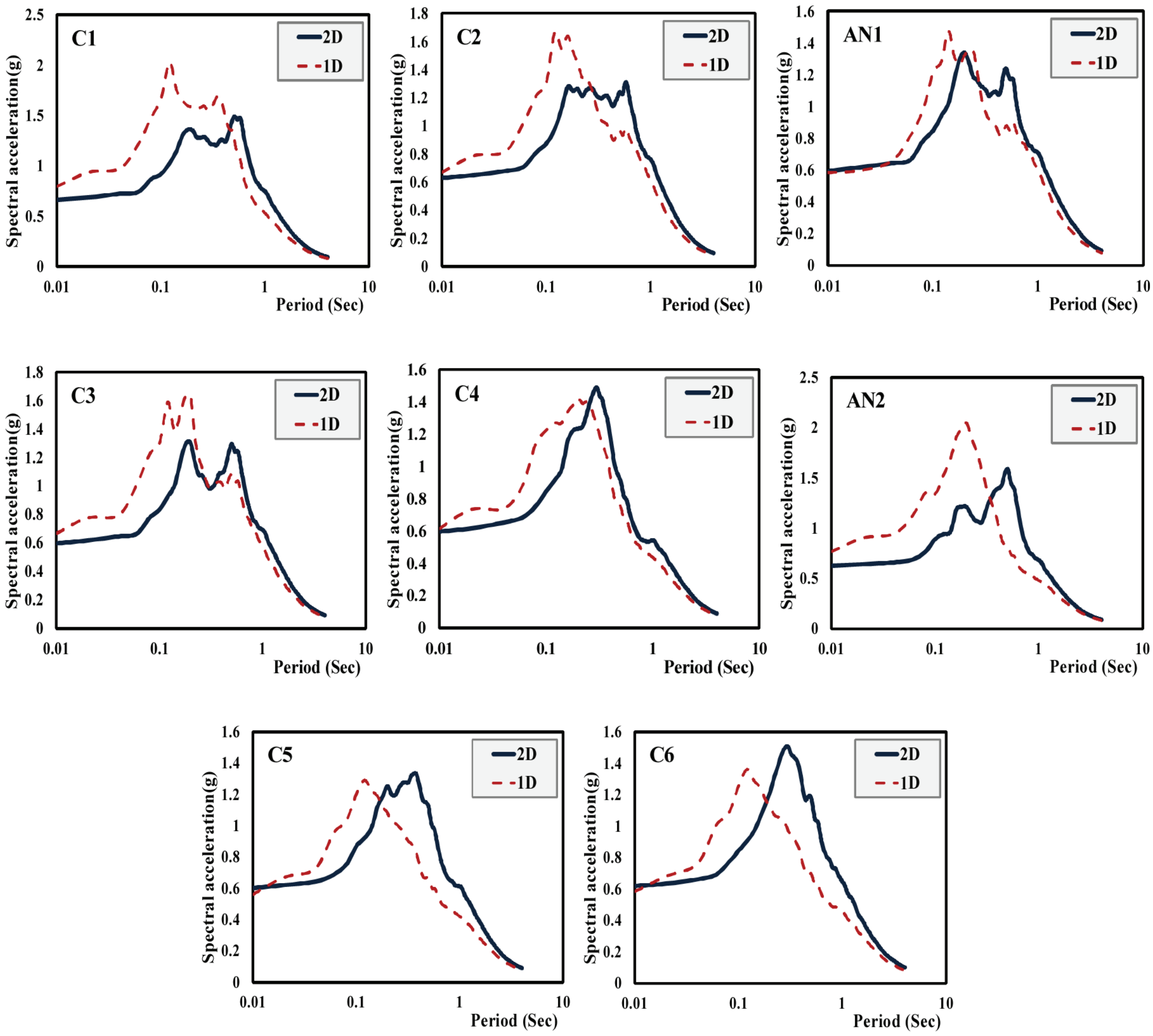

Figure 2. Comparison of the Median Response Spectra between One-Dimensional and Two-dimensional Modeling in FLAC 2D.

Finding responses in the location of the bridge piers represent the important role of the Sedimentary basin and its 2D geometry on the seismic ground motion responses. This issue is very important for the foundation of structures such as bridges due to excess displacements, settlements and the consequences of its destructive effects on the bridge's deck. The obtained results indicated that the seismic responses of the 2D and 1D analysis such as the seismic amplification, predominant period and the PGA in the basin site are different. Moreover, the 2D amplification effects of the basin is more prominent than the results of the 1D model in the periodic range of 0.5 to 1 second in a specified profile. Finally, the response spectra obtained on the basin surface at each pier position are compared with the standard design spectrum of AASHTO.

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