SEISMIC BEHAVIOUR OF TRIANGULAR ALLUVIAL VALLEYS SUBJECTED TO VERTICALLY PROPAGATING INCIDENT SV WAVES

Jafar NAJAFIZADEH
PhD Candidate of Geotechnical Engineering Research Center, IIEES, Tehran, Iran
j.najafizadeh@iiees.ac.ir

Peyman AMINPOUR
Graduate Student of Geotechnical Engineering Research Center, IIEES, Tehran, Iran
p.aminpour@iiees.ac.ir

Mohsen KAMALIAN
Associate Professor of Geotechnical Engineering Research Center, IIEES, Tehran, Iran
kamalian@iiees.ac.ir

Mohammad Kazem JAFARI
Professor of Geotechnical Engineering Research Center, IIEES, Tehran, Iran
jafari@iiees.ac.ir

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ABSTRACT

This paper is concerned with the problem of soil amplification and seismic site effects due to the local topographical and geotechnical characteristics. It focuses on 2D triangular alluvial valleys subjected to vertically propagating incident SV waves. The medium is assumed to have a linear elastic constitutive behaviour. All calculations are executed in time-domain using the spectral finite element method. Clear perspectives of the amplification patterns of the valley are presented by investigation of the frequency-domain responses. It is shown that the amplification pattern of the valley and its frequency characteristics depend strongly on its shape ratio. The maximum amplification ratio along the ground surface occurs at the center of the valley. A simple formula has been proposed for making initial estimation of the natural period of the valley in site effect microzonation studies. The natural frequency of the triangular alluvial valley decreases as the shape ratio of the valley decreases.

INTRODUCTION

It has long been recognized that site effects can significantly affect the nature of ground motion during earthquakes. Local conditions can generate large amplifications and important spatial variations of ground shaking. These effects are relevant in assessing seismic risk, in planning, in the seismic design of important facilities and in calculating the response of long structures. There is a close relation between earthquake damage and topographic and geological irregularities. There have been numerous cases of recorded motion and observed earthquake damage pointing towards topographic amplification as an important effect. Very high accelerations recorded at the Pacoima Dam (1.25 g) during the 1971 San Fernando Earthquake (Trifunac & Hudson, 1971; Boore, 1973) and at Tarzana Hill (1.78 g) during the 1994 Northridge Earthquake (Spudich et al., 1996) can be partly attributed to topographic effects. Thorough geophysical and geotechnical surveys, in combination with the utilization of small seismographic arrays and various analytical or numerical simulations, have suggested that the aforementioned discrepancy may be attributed to