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Trench Barriers to Protection of Structures under Dynamic Loadings-1

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Abstract

This study presents in detail numerical modeling nonlinear response of soil in model that has been conducted to investigate the protective performance of both open trench and in-filled trench as well as to examine the influences of wall geometry and location from the vibratory source and structure on the isolation efficiency. Also the results of the numerical investigations are analyzed and interpreted to provide recommendations for implementation in design. It is seen from results that in the range distance of 5 to50m after structure, in open trenches curves of reduction displacements ratio have inclined as expected, but for in-filled barriers these curves have declined.

Keywords: Vibration Reduction, Wave Barrier, Soil Response, Wave Propagation.

1. Introduction

One of the most effective methods that have been sued for protection of structure from surface wave is known as wave barrier. In three past decades an extensive research have been carried out by many researchers also the Russian scientists to investigation the efficiency of screening barriers of surface waves energy in soil [1-4].

In this study a 2D finite difference element model is developed by software package FLAC in order to simulate the efficiency of open and in-filled trench barriers against surface waves with presence of structures and with assuming strain-hardening constitutive model for soil. In the finite difference element analysis of geotechnical problems, the choice of an appropriate constitutive model may have a significant influence on the numerical results. The constitutive model should be able to capture the main features of the mechanical behavior of barriers under complex states of stress. In this contribution for numerical and analytical methods, based on standard some available tests, general parameters have been developed for determination of strain-hardening constitutive parameters.

2. State of research

In this research an extensive parametric study has been carried out to study the influence of various parameters such as geometric dimension of barrier-trench (depth-D), the barrier (wall and in-filled material), the distance from the barrier to the source of disturbance - X with assuming that the distance from the barrier to construction-L is constant. The results of the parametric study will be presented in the form of averaged amplitude reduction ratio. Measurements were taken for every selected point between trench and structure in five stages (without trench, with trench open and with in-filled trench) at the three loading positions. Three loading events with different location of trench and structure were utilized in this analysis. The loading were located at distances 3.0, 8.0 and 16.0m in right-hand of trench.

The soil was modeled in a half-space. The structure is approximated to an equivalent rectangular shape which is determinate by 10m width, 15m height was located on the right side of barrier on the ground surface, and the foundation of building was assumed mat one that located at the 1.0m depth under the ground surface. In this paper be assumed that the vertical impulse dynamic load in triangular shape induced on surface of soil with one meter diameter on the left hand of barrier(duration=0.1second). The maximum amount of dynamic loads was P=1.0 MN at peak point.