INTERNATIONAL CONGRESS ON
CIVIL ENGINEERING, ARCHITECTURE &
RECREATION OF METROPOLISES
TUM CONGRESS
GERMANY - MÜNCHEN
MUNICH - GERMANY
SEPTEMBER 17-18, 2019

Evaluating the effect of geometry and stiffness contrast on seismic response of landfills_ a numerical study

Keyvan Ebneali Heydari[1], Amin Azhari[2], Hajar Share Isfahani[3]

1. Bachelor Student, Department of Mining Engineering, Isfahan University of Technology; Isfahan, 8415683111, Iran, k1.ebh95@gmail.com
2. Assistant Prof., Department of Mining Engineering, Isfahan University of Technology; Isfahan, 8415683111, Iran, aazhari@cc.iut.ac.ir
3. Assistant Prof., Department of Civil Engineering, Isfahan University of Technology; Isfahan, 8415683111, Iran, hajar.share@cv.iut.ac.ir

Abstract

The stability of municipal solid waste (MSW) landfills has been a great concern to geotechnicians, due to the environmental disaster that the waste may cause through their failure. Therefore, the seismic response of these landfills has to be evaluated in high seismicity regions. The effect of geometry and stiffness contrast as the two main site factors play a significant role in the dynamic stability of slopes. In this study, the individual and coupled effect of these site factors are investigated via numerical analyses considering amplification factor (AF) for six mostly common MSW landfill types namely, canyon type, hill type, sidehill types 1 and 2, and stepped base types 1 and 2. The results show that landfill types have significantly different behaviors due to their geometry and waste material properties. Generally, among the investigated geometries, AF for hill type landfills reached to 2.33, which is the maximum value for the stiffness contrast close to one. However, in other stiffness contrasts, the behavior of softer waste material could be different by the effect of damping due to the volume of the waste material. Mostly, the AF parameter increases by stiffness contrast growth; however, for very soft waste material, the behavior changes due to the significance of the damping effect in the high volume of soft waste material. According to the obtained results, AF will be 0.46 for the lowest waste material stiffness for the canyon type, that makes them more stable under seismic conditions; it makes other landfill types susceptive to failure. As a result, the most suitable landfill type can be recommended according to the stiffness contrasts between the natural ground and waste material, base on the seismic amplification factor analysis.

Keywords: MSW landfills, seismic analyses, site effects, stiffness contrast, topographical effect, numerical analysis.

1. Introduction

Nowadays, environmental pollution for different waste materials is one of the significant hazard concerns for human lives[1–3]. Municipal solid waste (MSW) as one of the large and important types of waste materials is yearly produced more than 2.1 billion tons around the world [4]. MSW is usually disposed of in geo-structures named landfills, which their environmental concerns, including soil, air and, water pollution have to be considered in sustainable development decision