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SEISMIC RESPONSE OF A LANDFILL COVER: A CASE STUDY OF NAZLOU LANDFILL IN URMIA

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In this study, a geotechnical investigation consisting of static and dynamic landfill covers analyses was conducted on Nazlou landfill in West-Azerbaijan province, Iran. All the analyses were performed for the landfill cover at the end of construction. To obtain more realistic results, the physical and mechanical properties of the buried wastes were considered to be variable with depth. These properties were determined either by field investigation or from the data in the literature. A Newark-type dynamic analysis was conducted to calculate the permanent displacement of the covers. Having the properties of the buried wastes, the earthquake records whose response spectrum have a better match to the site design spectrum were selected. In the Newmark analyses, the sliding of both the critical wedge and the landfill cover was investigated. Consequently, the yield acceleration and the time history of permanent displacements were evaluated. Finally, the analyses results were used to assess the static and seismic stability of the landfill and the suitability of the design liner.

The project site is located near the village of Nazlou, at the northwest of Urmia County in West Azerbaijan province, Iran. As shown in Figure 1, the site is positioned on the heights overlooking the village of Nazlou at the end of Urmia sero Road.

Figure 1. Location of the project site (Nazlou landf ll).

Designing of MSW landfills has always been challenging for geotechnical engineering. This is because the complex behaviour and unknown aspects and factors of the geotechnical properties of MSW can create many problems in a landfill structure (Guney et al., 2014; Sadighi et al., 2019). In fact, the behaviour of the buried waste is one of the major factors that control the slope stability of engineered landfill structures. Large displacements can lead to failure or malfunctioning of the liner and affect their reparability (Landva & Clark, 1986). In the landfill design and slope stability analysis, it is imperative to consider the MSW's mechanical behaviour as well as other physical properties such as MSW, specific unit weight, water content, organic content, and permeability (Landva et al., 2000).

The wide range of reported shear strength values signifies the differences in the measurement and the definition of waste. Considering the above reports, the present study assumed the cohesion, internal friction angle and specific unit wright ranges of MSW between 0-20 kPa 20°-45° and 7-19 kN/m3 respectively (Feng et al., 2017).

The materials of the berm constructed surrounding of the waste material are obtained from borrow pits in vicinity of the landfill site. By the way, the properties of the material subgrade are based on the geotechnical and soil mechanics reports prepared in 2014 for the project site. Given that most failures observed in this study were in the liner, a failure surface was determined by trial and error to represent the most critical failure mode. This failure mode is shown in Figure 2.

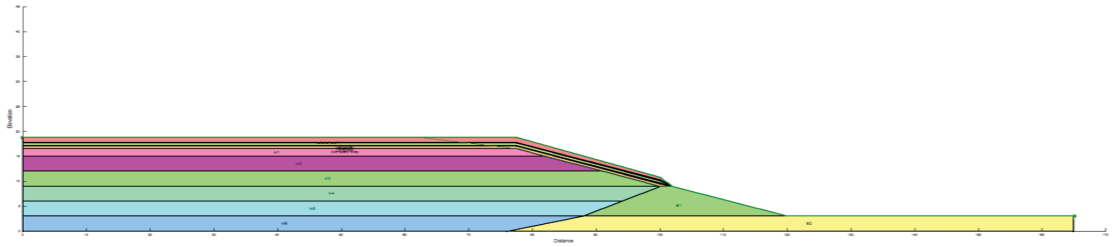

Figure 2. the most critical failure mode.

For the case studied in this paper, first, the software SeismoArtif was used to obtain an artificial earthquake recorded for the landfill site region and for the bedrock of the project site, so that it would match the standard design spectrum (Figure 3). As shown in Figure 4, the maximum displacement was found to be 4.5 centimeters.

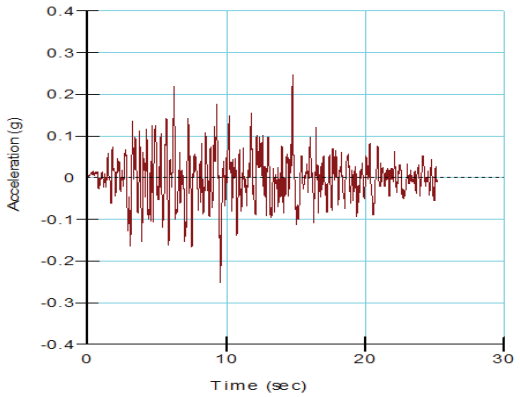

Figure 3. Variations of acceleration with time (artif cial earthquake).

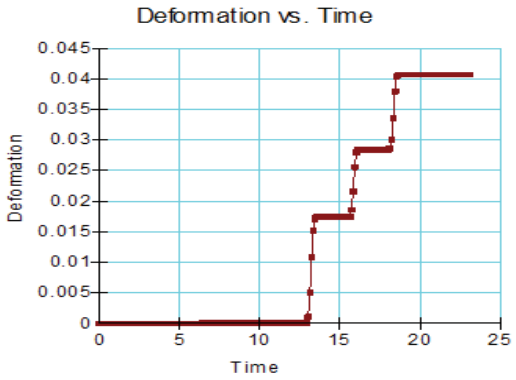

Figure 4. Variations of plastic displacement with time.

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