



Seismic stability of landfill slope in Dushanbe, Tajikistan

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The present paper is a progress report on the cooperative project NISMIST (Management of environmental risks associated with landfills in seismically active regions in the New Independent States of Central Asia) within the 6th Framework Program of the European Commission. The project objective is, among others, to analyze the dynamic behavior of municipal solid waste landfills in the seismically active regions of the New Independent States (NIS) of Central Asia.

Tajikistan is bordered on the south by Afghanistan, on the east by China and on the west and north by Uzbekistan and Kyrgyzstan. Dushanbe – the capital of Tajikistan is located on a southern slope of Hissar Mountains in a picturesque fertile valley at height of 750-840 meters above the level of Baltic Sea. The project area is located 12 km south-east in the outskirt of Dushanbe city. This area is characterized by complex ground conditions and high seismicity. The landfill is close to the river bank. An out rush of the waste would have fatal consequence for the environment. Taking seismic event as a triggering potential, the scenario of the landfill and surrounding hills under severe seismic event are analyzed using the numerical codes FLAC3D and QUAKE/W (2D). The mechanical parameters of waste were estimated based on the site investigation carried out within our project. The site investigation consists of boreholes, geotechnical laboratory tests and geophysical tests in field. Two boreholes

were drilled to a depth of 18m. Both disturbed and undisturbed soil samples are taken to the laboratory and various soil properties are determined. Shear tests and triaxial consolidation tests are also conducted.

The results of dynamic analysis using QUAKE/W and FLAC3D are quite similar except the displacements, which show significant variations. This may be attributed by the fact that there is a difference in the basic numerical method used by the two codes. QUAKE/W uses the finite element and FLAC3D uses finite difference schemes. Moreover, QUAKE/W uses equivalent linear material behaviour whereas FLAC3D handles the problem using the non-linear material behaviour. The slight differences in the other results could be as a result of the 2D and 3D analysis. Therefore, the displacements obtained from FLAC3D analysis are considered to be more realistic. The basic findings from the numerical analysis of Dushanbe landfill are:

There is considerable plastic displacement of the waste material (FLAC3D).

Amplification and attenuation characteristics of the different soil layers are paramount important in dealing with earthquake response analysis.

The results showed that the input acceleration is significantly attenuated by the soil layer immediate to the input level and the attenuated response was amplified by the fill material.

Both analyses showed instability after about 12 seconds of the input ground motion.