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Vertical Expanding of Landfill with Considering Its Component

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ABSTRACT

Shear strength of landfill municipal solid waste (MSW) is a very important topic in the landfill stability investigation. Impressibility of this material from the temperature and humidity regarding to its early component causes this material suffering from much change in its shape. This variation with filling condition such as prime compression and soil increasing for daily and monthly cover change structure of MSW; so the fresh samples or primary component have not enough indication to define the problem. In this paper, large-scale direct shear tests were performed on the real samples with different age and different percent of soil obtained from Alborz landfill in Qom city to investigate the shear strength of materials in existing landfill and to expand the landfill. Other parameters such as overconsolidation and plastic content have been analyzed. The results show that shear strength have been decreased with increasing in waste age and plastic content. In addition, with changing in soil amount to optimum percent the shear resistance increase and then decreased. Overconsolidation without changing in compaction effort has mutated the mobilization of the shear strength.

KEYWORDS

Shear Strength, Waste age, Landfill, Soil Content, Plastic Content.

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1- INTRODUCTION

By considering daily increase in population on earth and growth of production and consumption all over the world, waste production and its issues have become one of the serious subjects that governments are facing today. As the result, waste management or upper, materials cycle management has become one of the most main and important elements of sustainable development.

There have been lots of efforts made such as reducing waste production (Revising the consumption pattern), reusing some materials (Reusing the glass) or utilization by recycling (departing and reusing paper as cartoon) in order to reduce buried waste or even after this process, reducing the volume of waste to a very tiny amount by burning or composting, there will be need to bury the burned waste or the compost leftover.

According to the above statements, the necessity of secure and hygienic burying of waste is and going to be one of the priorities for the human communities. As a result, we should extend the available sanitary or provide new landfills.

Due to the fact that finding suitable location of landfill site is extremely a subtle issue, there are some important points that have to be considered, for instance, some necessities such as living environment, mental impacts on the people living in the vicinity of landfills (if it be close to city) and financial effects in the intervals of transportation and transfer of waste with increase of distance must be considered for choosing the location of new landfill center. All these points have persuaded the city authorities and governments to develop the existing landfills.

This type of development may take place in two forms: 1) horizontal and 2) vertical development.

Since the vertical development of landfills will be feasible to the highest border allowed by site and design, the investors and policy makers of the waste burial mostly insist on the vertical development. It has resulted in the fact that some of these landfills are built with approximately 100 meters height.

Although the development of vertical landfills, which hygienic burial has been performed there previously, looks appropriate in the first view to the environment, but an immediate implementation of this task while neglecting the complicated properties of waste, can danger the stability (slopes) of landfills.

Thanks to the mentioned reasons, a secure design contains inevitable needs for the prevention of financial life and environmental losses which are going to occur if the rupture takes place.

What is presently defined as Waste Mechanics requires an extensive completion. Assessment of geometric specifications and thereafter waste behavior is a disputable issue due to changes in the materials present therein. The best method is testing on the real and intact sample. The intact sample cannot be provided; therefore the remolded materials must be placed in the test apparatus by reconsolidation. One of the existing problems is that waste structure will be destroyed by this method and meanwhile, the obvious difference in the waste compositions may cause the fact that the sample cannot represent the behavior of the whole waste and also systematic change in ingredients will be problematic to clarify the impact of each of them.

Further to all above mentioned, the future changes (age) and their impact on the waste compositions as well as choosing a device with suitable size for sampling and testing are among the important points which should be considered in this research.

2- TESTING PROCEDURE.

Tests were performed in accordance with ASTM Method for Direct Shear Tests of Soil under Consolidated Drained conditions. The tests were strain controlled and readings were taken at particular strain interval. However, the samples in many of studies did not undergo shear failure even at large strains. In our tests, we limited the relative displacement to 6 cm, or about 20% strain, in an attempt to remain within the relative operating range of the apparatus.

3- RESULTS AND DISCUSSION

Shear stresses were plotted against the corresponding applied horizontal displacement (Figure 1&2).

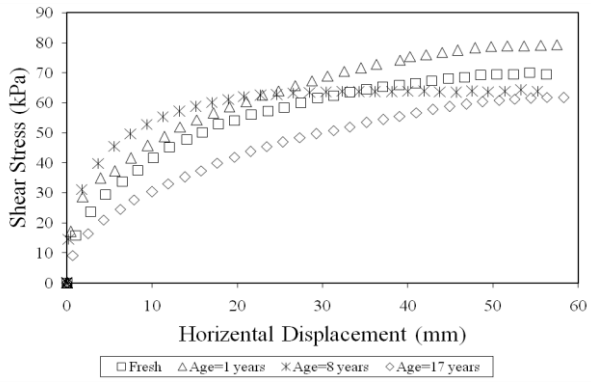

FIG.1 EXAMPLE RESULTS OF LARGE SCALE DIRECT SHEAR TESTS ON DIFFERENT YEAR OLD MSW (EFFECT OF OLD).

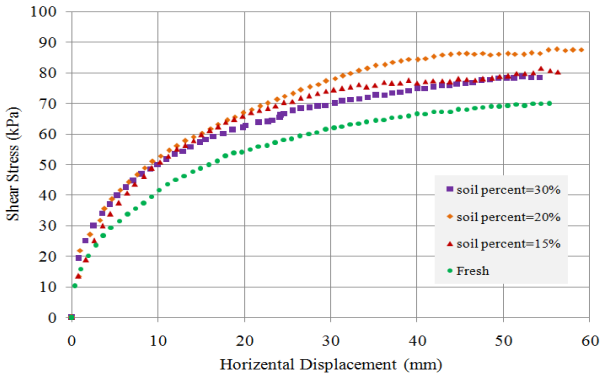

FIG.1 EXAMPLE RESULTS OF LARGE SCALE DIRECT SHEAR TESTS ON FRESH MSW SAMPLES (EFFECT OF SOIL CONTECT).

The results indicated an increase in shear strength with the displacement which is compatible with the findings of

Karimpour-Fard (2009).

As it is observed, with increasing the normal stress, the level of shear strength increases which indicates the frictional nature of these geo-materials. This result is compatible with the findings of Zekkos (2005) and Karimpour-Fard (2009). As the result of the method for sample preparation that the materials are compacted in horizontal layers, fibers and plastic parts may locate parallel to forced shear plane. As another considerable factor, waste response is probably more dilative at lower normal stresses rather than the case for reinforced earth materials (Figure 1). Thanks to Figure 2, it can be stated that we have optimum soil to add to MSW. This increasing in strength is completely obvious in normal stresses more than 50 kPa.

4- CONCLUSION

Shear strength parameter is one of the most important subjects in landfill design. Because of this usage, all parameters that can affect the shear strength must be considered. Considering that age has the most potential to affect shear strength, in this research, we tried to represent this significance by utilizing a large scale direct shear apparatus and testing on samples with different age and soil content which were obtained from Iranian landfills. The results indicated that the shear strength of MSW is considerably relative to the changes of composition with time (aging) and soil percent and it is very important to consider it to expand the landfills.

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