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Compaction properties for municipal solid waste at open dumping sites located in Sri Lanka

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Due to rapid urbanization, generation of municipal solid waste is increasing in developing countries. However, most of the waste disposal site in developing countries is an unsanitary open dumping causing serious social and environmental problems such as subsidence and collapse of waste slopes at disposal sites. Sri Lanka is one of countries facing the waste disposal problems (Sato, et al,. 2012), and most of collected waste is dumped at the disposal sites without any engineering consideration such as ground settlement and slope stability. Several studies have been done to investigate geotechnical properties for municipal solid waste samples (e.g., Chen et al., 2009; Reddy et al., 2009), however effects of climate condition and age of waste on geotechnical properties are not well understood.

In this study, to investigate effects of climatic conditions and age of waste fill on compaction properties of buried municipal solid waste. Boring core and box samples of buried municipal solid waste and its subgrade taken from two open dumping sites under different climatic conditions in Sri Lanka: Udapalatha (Average temperature is 17.5 ? 25.0 degree, annual rainfall is greater than 2,500 mm) abandoned open dumping site in the wet zone and Hambantota (Average temperature is 26.3 ? 28.1 degree, annual rainfall is less than 800 mm) open dumping site under operation in the dry zone. The age of collected ranged less than 3 years after dumping for new dumped zones and between 4 and 11 years for old dumped zones. Furthermore, intact boring core and box samples of subgrade were taken from a point at which no waste dumping. Basic physicals and chemical properties such as moisture content, specific gravity (Gs), Atterberg limits, particle size distribution, waste composition, pH and EC, ignition loss were measured in the laboratory. Standard proctor tests were carried out to determine the maximum dry bulk densities and optimum water contents for waste and subgrade samples.

Results show that Gs values for waste samples in both wet and dry zones were less than intact soil, in addition less than 2.50 for waste samples in the wet zone. Based on the waste compositions for two sites in wet and dry zone, for every waste samples, residue content below 4.75mm were rich, and the residue content for dry zone exceed 60%, the waste samples in the wet zone had more various kinds of wastes. The maximum dry densities (ρ_{dmax}) for dry zone were around 1.5 times higher than those of wet zone. *In-situ* dry bulk densities ($\rho_{in-situ}$) were around 80 % compared to ρ_{dmax} for both samples in wet and dry zones. Both ρ_{dmax} and $\rho_{in-situ}$ gave good linear relations to residue content below 2.00mm and loss on ignition. Therefore, the residue content and loss on ignitions seem to be good indices to identify the compaction properties for dumped waste materials.

Keywords: Muncipal solid waste, Maximum dry bulk density