The Hiriya Waste Disposal Site
Control of water infiltration by the use of clay/fly ash mixtures
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Report abstract.

Capping is a known method, world-wide, for covering waste sites. Several materials have been used for it; however the cheapest cover which prohibits the penetration of moisture (water) from external sources is clay. This is especially true if suitable clay is available near the site to be capped. In Israel, the clays are mostly of the montmorillonite type and their permeability, as required usually by the international standards, should be about $1*10^{-9}$ m/sec. Most of these clays have even lower permeability- by one or two orders of magnitude. Unfortunately, when wetted, the clay swells and when dried it shrinks considerably. The many honeycombed cracks which develop make the measured permeability meaningless.

From existing literature it was found that fly ash, which is the waste material from the burning of coal and is abundant at electric companies, decreases the potential swelling and shrinkage of clays. In a previous work done in Ashdod, it was found that mixtures of highly plastic clay with fly ash, in controlled proportions of clay/ash and water contents was very effective in totally eliminating swell/shrink even in compacted conditions. After soaking mixed samples for 48 hours or more and even after an additional cycle of soaking and drying, no volume change was observed.

The tests were performed on mixtures of 0% to 100% clay and 100% to 0% fly ash, respectively. It enabled to find the optimal mixtures considering various parameters, mainly swell/shrink potential but also taking permeability into considerations. The influence of the degree of compaction with various water contents was checked as used in C.B.R cylinders at various compaction energies. It was also found that with about 35% water content (by weight), acceptable permeability results was achieved without any compaction at all.

The coefficient of permeability values varied between $5*10^{-9}$ to $1*10^{-9}$ m/sec. However, not thorough mixing caused large scattering of these values from $5*10^{-7}$ to $1*10^{-9}$ m/sec. The results of the hundreds of tests performed were presented numerically and graphically by the Technion laboratory report. The fly ash was supplied by the fly ash administration and received from the Israeli Electric Company. The water used in the tests was tap water (ordinary drinking water) in order to simulate real site conditions.

The test result can be used for other sites in Israel or elsewhere after performing several matching tests of local clays and the available fly ash to be used on specific projects.

In this research it was found that the best mixtures were between 20% to 35% fly ash (80% to 65% clay) and 35% to 40% water content, if no compaction was required and only 20% to 30% water content depending on the degree of compaction necessary to fulfill strength requirements.