

GEOTECHNICAL ASPECTS OF LANDFILL DESIGN AND CONSTRUCTION

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12.4.2 Settlement of Existing Solid Waste

The following equations can be used to calculate the settlement of an existing solid waste landfill caused by vertical expansion (Chapter 14) or other additional extra loading, such as a light structure on a raft foundation.

The *primary settlement* is obtained by

$$\Delta H_c = C_c \cdot \frac{H_o}{1 + e_o} \cdot \log \frac{\sigma_o + \Delta\sigma}{\sigma_o} \quad (12.8)$$

or

$$\Delta H_c = C'_c \cdot H_o \cdot \log \frac{\sigma_o + \Delta\sigma}{\sigma_o} \quad (12.9)$$

where ΔH_c = primary settlement;

e_o = initial void ratio of the waste layer before settlement;

H_o = initial thickness of the waste layer of the existing landfill;

C_c = primary compression index;

C'_c = modified primary compression index, $C'_c = 0.17 \sim 0.36$;

σ_o = existing overburden pressure acting at the mid level of the waste layer;

$\Delta\sigma$ = increment of overburden pressure due to vertical expansion or other extra load.

The *long-term secondary settlement* is given by

$$\Delta H_\alpha = C_\alpha \cdot \frac{H_o}{1 + e_o} \cdot \log \frac{t_2}{t_1} \quad (12.10)$$

or

$$\Delta H_\alpha = C'_\alpha \cdot H_o \cdot \log \frac{t_2}{t_1} \quad (12.11)$$

where ΔH_α = secondary settlement;

e_o = initial void ratio of the waste layer before starting secondary settlement;

H_o = initial thickness of the waste layer before starting secondary settlement;

C_α = secondary compression index;

C'_α = modified secondary compression index, $C'_\alpha = 0.03 \sim 0.1$;

t_1 = starting time of the secondary settlement. It is assumed to be equal to the age of the existing landfill for vertical expansion project;

t_2 = ending time of the secondary settlement.