3.7 EARTH PRESSURES FOR SMALL WALL DEFLECTIONS

For certain wall types, such as propped cantilevers and anchored diaphragm walls, only small wall movements occur and elastic conditions apply.

Where no lateral movement takes place from the insitu condition, the 'at-rest' earth pressure applies. For the case of a vertical wall and a horizontal ground surface, it has been shown empirically by Jaky (1944) that the coefficient of 'at-rest' earth pressure, K_o, for normally consolidated materials may be taken as :

$$K_o = 1 - \sin \phi' \qquad .....(6)$$

where ϕ' is the angle of shearing resistance of the soil in terms of effective stress.

Because of the lack of data on the values of K_o for Hong Kong soils, values adopted for design should not be less than 0.5 even for soils with high friction angles. It should be noted that, in some situations, values much higher than $K_o = 0.5$ may be found.

For a sloping ground surface, K_o varies from that given by equation (6). The Danish Code (Danish Geotechnical Institute, 1978) suggests for a vertical wall and ground sloping at an angle, ω, that the 'at-rest' earth pressure coefficient is $K_o (1 + \sin \omega)$. For other wall angles and backfill slopes, it may assumed that the at-rest pressure coefficient varies proportionally to the 'active' earth pressure coefficient, K_a. 'At-rest' earth pressures, except for over-consolidated soils, may be assumed to increase linearly with depth from zero at the ground surface. The total at-rest earth pressure force is given by $P_o = \frac{1}{2} K_o \gamma H^2$. This acts at H/3 from the base of the wall or from the bottom of the key for walls with keys.

In cohesionless soils, full 'at-rest' earth pressures occur only with the most rigidly supported walls (see Section 3.10). In highly plastic clays, pressures approaching at-rest may develop unless wall movement can continue with time.