

material employed. Sea and river walls in the Thames estuary are mostly laid out at an inclination of 2 to 1 on the outer face, and $1\frac{1}{2}$ to 1 on the inner face where stiff puddle clay is obtainable. Many plastic clays will not stand at anything like so steep an inclination, 5 to 1 or 7 to 1, or even flatter still, being often necessary to stability. One of the most potent agencies in conserving artificial slopes is that of systematic planting, the close network of roots of the plants creating a mat of immobility.

It frequently happens that landslides occur with great suddenness, and apparently long after predisposing causes should have ceased to operate. Such subsidence is in the main due to the underground passage of water of percolation. An area of soft silt underlying a mass of clay may remain for a long period in a condition of relative stability, owing to the incompressibility of its liquid constituent. As its moisture is gradually reinforced by percolation, it slowly develops the attributes of a semi-liquid body, and the varying pressures of the superincumbent earth cause its displacement, producing lateral and vertical stresses, until the equilibrium of the overlying strata is disturbed. The resistance of friction, due to masses of soil over such a cushion of semi-plastic silt, is ultimately overcome, and a landslide results. This action is repeated, it may be at considerable intervals, periodically, as the liquidity of the subsoil becomes such that it follows the laws of hydrostatic equilibrium. To counteract this action, ample drainage to check the tendency to the formation of subterranean pools of semi-liquid slurry is the first requirement. Rats and rabbits infesting a bank, by disturbing its superficial resistance to percolation, may set up areas of potential under-surface slip.

The infinite variation in the physical economy of the constituent materials of earth banks renders generalization difficult and formulæ precarious. Mr. W. Airy's remarks on the variability of clay resistance are of interest in this connection:¹—

“He exhibited a little rough machine he had used for testing earthwork and taking the cohesion of the ground. The block of wood might be taken to represent a block of raw clay taken out of a cutting. There was a common lever-balance, and a couple of movable cheeks were fitted into chases cut in

¹ *Proc. Inst. C. E.*, Vol. LXV, p. 188.