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The Secretary,
The Institution of Civil Engineers,

DEAR SIR,

Bishop and Morgenstein define the factor of safety, on p. 132 of their Paper on "Stability Coefficients for Earth Slopes (*Géotechnique*, 10:4:129–150), as the ratio of shear strength to shear stress. Their equation (3) may be rearranged as follows:

$$F = \frac{C' + \bar{\sigma} \tan d'}{\tau}$$

where $\bar{\sigma}$ is the effective stress on a potential failure surface. This expression contains an implied assumption that the stress point A on the enclosed sketch may approach strength point B on a straight line vector curve. This can occur in a completely drained direct shear

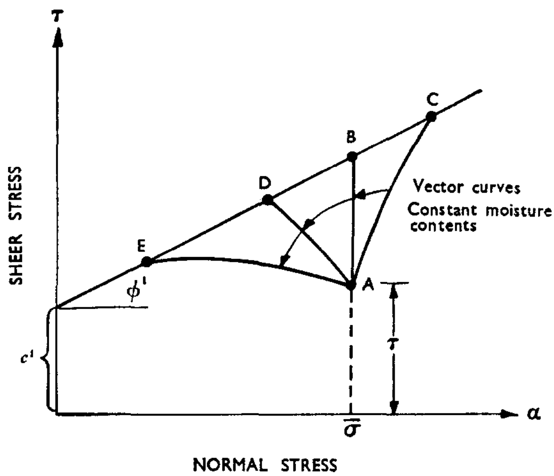

Fig. 1

test and appears reasonable for stability studies for steady seepage cases where the soil can adjust its moisture content to changed stress conditions.

For cases where a soil cannot change its moisture content the above definition may not apply. A soil which tends to dilate under shear will have a failure strength indicated by point C which is greater than that at point B and the safety factor as defined by equation (3) is conservative provided a problem of progressive failure does not exist. A soil which tends to consolidate during shear will have a strength indicated by point D and the safety factor defined by equation (3) will not be conservative. In fact, if the soil has a sensitive structure such as indicated by point E, the safety factor as defined by equation (3) may be highly dangerous.

Yours faithfully,

REGINALD A. BARRON

Office, Chief of Engineers,
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19 August, 1964

The Secretary,
The Institution of Civil Engineers,
DEAR SIR,

In his valuable paper entitled "Some experiments on the influence of strain conditions on the strength of sand" (*Géotechnique*, 14:2:143–168) Dr Cornforth records a series of peak Coulomb ϕ'_d max values in Figs 12 and 14, and a series of instantaneous dilatancy rates at or close to the peak in Fig. 20. The information from these diagrams has been used to insert into the stress-dilatancy equation, Rowe (1962) and Rowe, Barden and Lee (1964).

$$\frac{\sigma'_1}{\sigma'_3\left(1+\frac{\delta\left(\frac{\Delta v}{v_c}\right)}{\delta\epsilon}\right)} = \tan^2(45+\phi_{f/2}) \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

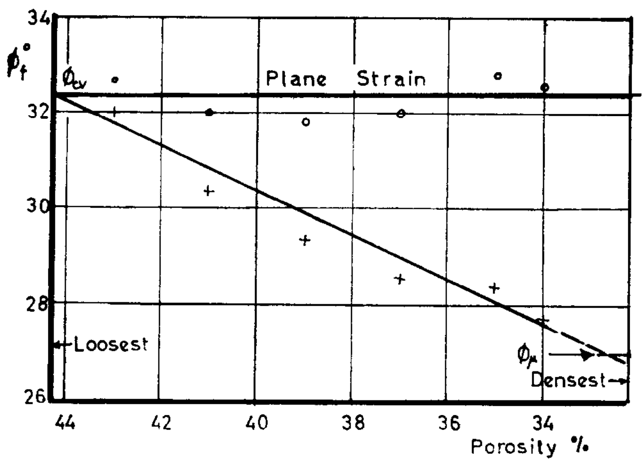

Fig. 1. Observations at the peak

The values of ϕ_f which satisfy the observations are shown in Fig. 1. The grading of the Brasted sand can be used to deduce that over half the number of grains were smaller than 0·2 mm and using Fig. 3, Rowe (1962), the Writer estimates that the average true intergranular angle of friction ϕ_μ was in the region of 27°. Fig. 1 illustrates the following:

1. The measurements by Cornforth on normally consolidated sand using the triaxial cell test give values of ϕ_f which lie between ϕ_μ at the densest state and ϕ_{cv} at the loosest state. This is in good experimental agreement with Fig. 22, Rowe (1962).
2. In the plane strain test at failure the value of $\phi_f = \phi_{cv}$ independent of porosity.