SUB-SECTION II b

IDENTIFICATION TESTS

THE DETERMINATION OF THE CAPILLARY RISE IN SAND BY MEANS OF PRISM PRESSURE TESTS

II b 6

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Sand, the bedding density of which is below critical density, is loosened whenever tension approaches break-point. If the sandpores are filled with water, an additional quantity of water is sucked into the sand, or, should this be prevented, tensile stress in the pore water prevents reaching of the break point. A prism formed of saturated sand, if in touch with air, therefore remains stabile until the menisci withdraw into the interior of sand and suck air into the prism, and tensile stress in the pore water is at this moment equal to that which prevails when the capillary rise is reached.

If, therefore, the friction angle of the sand and the break tension of the sand prism are known, the capillary rise may be found immediately by means of Mohr's diagram (see fig.)

With ρ as the friction angle of the sand,

σ_b the break tension of the prism, and

$p_{k\,max}$ the maximal capillary pressure, it follows that

$$\sin\rho = \frac{\sigma_b}{2 \cdot p_{k\,max} + \sigma_b} \qquad \text{and}$$

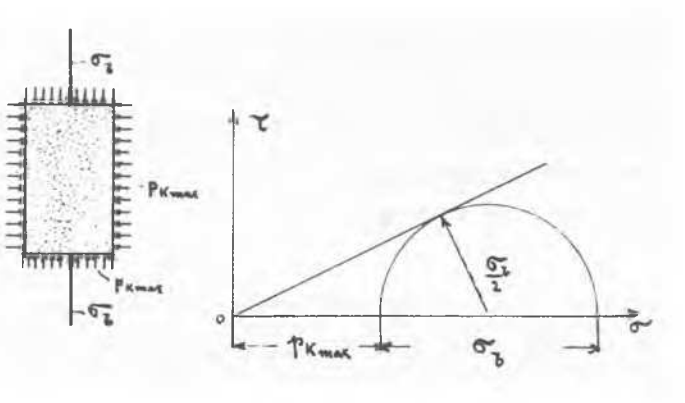
$$p_{k\,max} = \frac{\sigma_b\,(1-\sin\rho)}{2 \cdot \sin\rho}$$

Tests undertaken by the author have shown that in case of dense sand the friction angle found as the result of the prism test is 36°

Thus maximal capillary pressure amounts to

$$p_{k\,max} = 0{,}35 \cdot \sigma_b \leq \frac{\sigma_b}{3}$$

This manner of determining the capillary rise was verified by means of parallel tests carried out with Beskow's apparatus. It was found according to Beskow that e.g. sand having a granulation of 0,15 - 0,25 mm grain diameter attained a capillary rise of 40 cm. Prism pressure tests resulted in a break tension of 115 g/cm^2, from which a capillary pressure of 40,2 g/cm^2 and a capillary rise of 40,2 cm was calculated (spec.weight of water = 1).



This very simple method of determining the capillary rise makes it possible to avoid mistakes such as are caused by faulty reading of the Beskow apparatus which, besides, is very complicated to handle. Moreover, this method allows a more rapid and more precise calculation of the capillary rise than the Beskow apparatus.

REFERENCE

1) Bernatzik: Versuche über Festigkeitseigenschaften von Sand im dreiachsigen Spannungszustand. Wasserw. u. Technik 1935, H.16/17

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