Hvorslev, M. J., 1937. "Über die Festigkeitseigenschaften gestörter bindinger Böden" ("On the physical properties of disturbed cohesive soils"). *Ingeniørvidenskabelige Skrifter, A*45. 159 pp.

Kenney, T. C., 1959. *Discussion* on Paper "The influence of rate of strain on effective stresses in sensitive clay" by C. B. Crawford. *ASTM Spec. Tech. Publ. No.* 254 : 49–58.

Kenney, T. C., 1960. *Discussion* on Paper "The compressive strength of remoulded Niagara clay" by D. J. Bazett and S. W. Smotrych. *ASTM Proc. Ann. Gen. Mtg.*

Schmertmann, J. H., *and* J. O. Osterberg, 1960. "An experimental study of the development of cohesion and friction with axial strain in saturated cohesive soils." *Paper presented to Conf. on Shear Strength, Boulder, Colorado, U.S.A.*

Simons, N. E., 1960. "Comprehensive investigations of the shear strength of an undisturbed Drammen clay." *Paper presented to Conf. on Shear Strength, Boulder, Colorado, U.S.A. Norwegian Geotech. Inst. Publ. No.* 35: 23–33.

The Secretary,
The Institution of Civil Engineers.

Dear Sir,

In their Paper "A study of the consolidation characteristics of a clay" (*Géotechnique,* 10 : 2 : 62), Messrs Newland and Allely make the observation that the slope of the "secondary tail" is independent of a wide range of factors. In particular, it was concluded from tests on Whangamarino clay that this slope is independent of the total void ratio change during a given increment (and therefore of the total pressure and pressure increment).

While an *apparent* constancy in the slope of the secondary tail is occasionally observed in other clays, extensive series of consolidation tests on a wide range of soil types (Ramiah, 1959; Girault, 1960; Altschaeffl, 1960) have demonstrated that this is not generally the case. Results from a series of tests on undisturbed samples of Mexico City clay are shown in Fig. 1(a); similar data for an artificially sedimented limestone residual clay are presented in Fig. 1(b). It is evident that the slope of the secondary tail is not even approximately constant. Furthermore, there exist systematic relationships between the rate of secondary compression, the total pressure, and the pressure increment, as illustrated in Fig. 2 (R_s is the secondary compression per cycle of log time).

The coefficient of consolidation (C_v) is much more sensitive to test variables than the compression index (Leonards and Ramiah, 1959). In fact, the applicability of the Terzaghi theory can be rigorously examined only if the rate of pore-pressure dissipation is measured and the effects of side friction are either eliminated or accounted for. Investigations of this nature (including studies on the mechanism of secondary compression) are being reported elsewhere (Leonards and Girault, 1961).

Messrs Newland and Allely recommend the use of large-pressure increment ratios to accelerate consolidation testing. While this procedure has little effect on the straight-line portion of the $e - \log p$ curve, it does obscure the determination of the effective preconsolidation pressure. On the basis of laboratory tests, it has been suggested (Leonards and Ramiah, 1959) that a normally consolidated clay will not reduce in volume until a load increment of sufficient magnitude has been applied to break the bonds developed by long-term secondary compressions and thixotropic action (the effective or quasi-preconsolidation pressure). Tests on artificially sedimented clays (Altschaeffl, 1960) and field evidence (Hansbo, 1960) are corroborating this conclusion. The quasi-preconsolidation pressure can be determined from laboratory test data provided small pressure increments are used. In many cases, particularly for deep and/or highly compressible clay deposits, this factor has an important bearing on the accuracy of the settlement forecast. For Mexico City clay, where the use of net pressures only slightly in excess of the quasi-preconsolidation pressure (p_c) would result in catastrophic settlements,

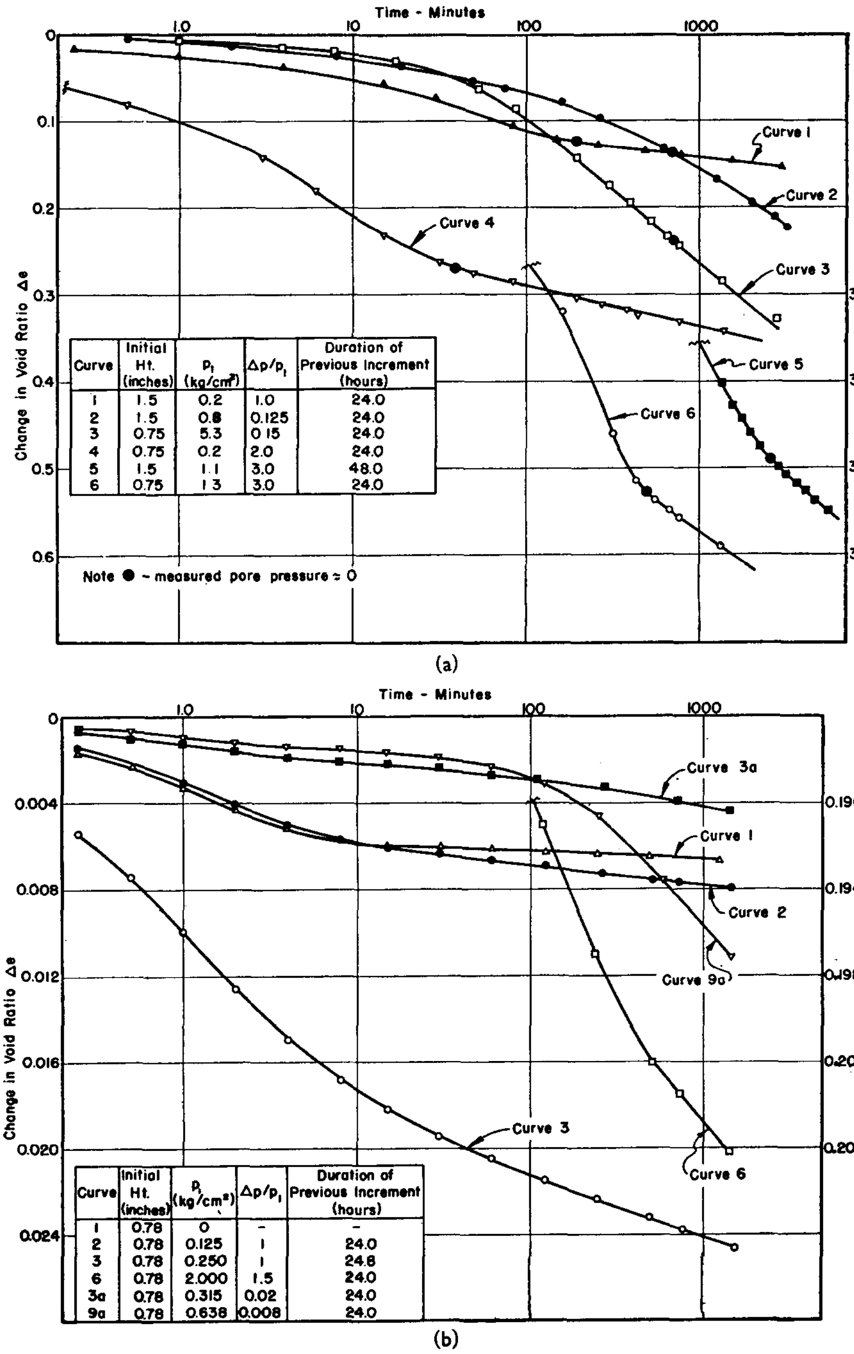

Fig. 1. (a) Undisturbed Mexico City clay after Girault (1960); (b) Artificially sedimented limestone residual clay after Altschaeffl (1960)

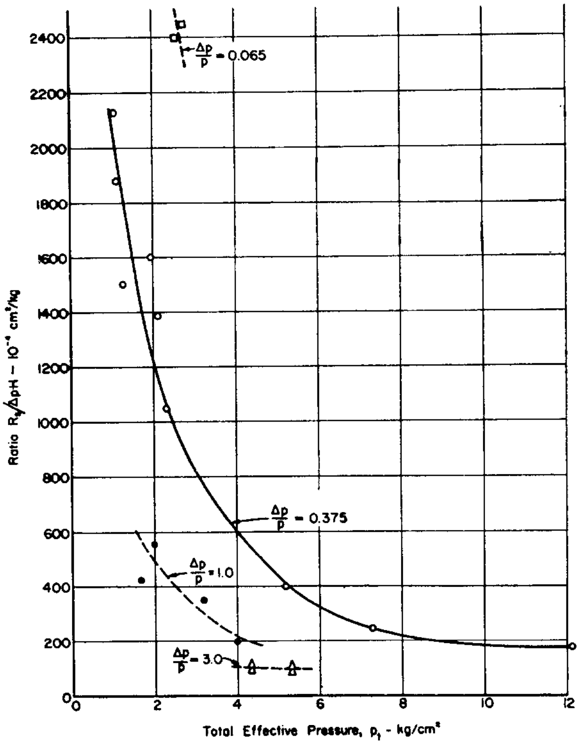

Fig. 2. Effect of total pressure on the time-rate of secondary compression. Undisturbed Mexico City clay

small pressure increments have been used for many years (Zeevaert, 1957) to obtain more reliable estimates of p_c.

Yours faithfully,
G. A. Leonards,
Professor of Soil Mechanics.

Purdue University, Indiana.
22 September, 1960.

REFERENCES

Altschaeffl, A. G., 1960. "Compressibility of artificially sedimented clays." *Ph.D. thesis, Purdue Univ.*

Girault, P., 1960. "A study of the consolidation of Mexico City clay." *Ph.D. thesis, Purdue Univ.*

Hansbo, S., 1960. "Consolidation of clay, with special reference to influence of vertical sand drains." *Proc. Swed. Geotech. Inst., No.* 18, *Stockholm.*

Leonards, G. A., *and* B. K. Ramiah, 1959. "Time effects in the consolidation of clays." *Am. Soc. Test. Mat., Spec. Techn. Publ., No.* 254, p. 116.

Leonards, G. A., *and* P. Girault, 1961. "A study of the one-dimensional consolidation test." *Contrib. to Proc. 5th Int. Conf. Soil Mech., Paris.*

Ramiah, B. K., 1959. "Time effects on the consolidation properties of clays." *Ph.D. thesis, Purdue Univ.*

Zeevaert, L., 1957. "Consolidation of Mexico City volcanic clay." *Amer. Soc. Test. Mat., Spec. Techn. Publ. No.* 232, p. 28.