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DILATOMETER TO COMPUTE FOUNDATION SETTLEMENT

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ABSTRACT

Sixteen examples demonstrate how the Marchetti dilatometer test (DMT) provides soil compressibility data for the rapid calculation of foundation settlements with an average ratio of predicted to actual settlement equal to 1.18. The examples include sands, silts, clays and organic soils, with settlement magnitudes from 3 to 2850 mm. The settlement prediction method includes the use of the basic, 1-D vertical compression modulus M, with an example calculation using both an Ordinary Method and a Special Method that includes adjusting M for the magnitude of effective stress.

1. INTRODUCTION

Geotechnical engineers have good use for an insitu test that permits a fast and usually adequately accurate calculation of ultimate foundation settlement in most problem soils. The Marchetti flat dilatometer test (DMT) has proven useful for such calculations in sands, silts, clays and even peat. Marchetti invented and developed the DMT in the mid-1970s. A brief description of the DMT follows. The reader can find more information in Jamiolkowski, <u>et. al</u>. (1985), Marchetti (1980, 1981), and Schmertmann (1981, 1983, 1984, 1985).

The basic DMT equipment consists of a stainless steel blade 96 mm wide and 15 mm thick with a sharp edge and a 60 mm diameter stainless steel membrane centered on and flush with one side of the blade. A syringe activated pressure-vacuum system permits the routine field calibration of each membrane. A single, combination gas and electrical line extends through the rods and down to the blade from a surface control and pressure readout box. The operator uses a flow control valve to increase the gas pressure behind the membrane and measures it at two points during its forced horizontal expansion into the soil. The first "A-reading" pressure occurs at membrane "lift-off" and the second "B-reading" pressure after 1.1 mm movement, with both prompted by an audio

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in 13 of these comparisons usually produces acceptable results, but occasionally the situation calls for correcting M for the effects of different effective stress levels. Note the wide range of soils (sands, silts, clays and peats) and the wide range of settlement magnitude involved (3 to 2850 mm) wherein the dilatometer gave reasonable settlement predictions. Although more research and experience will doubtless further improve the correlations, the DMT has already proven reliable for the calculation of foundation settlements.

6. SUMMARY AND CONCLUSIONS

6.1 The DMT quickly and economically provides good stratigraphic and soil property data for the computation of settlement.

6.2 The method of analysis for converting DMT data to settlement involves the application of a simple and general stress-strain equation (1) for one-dimensional compression.

6.3 Because the DMT determines M values at only the insitu effective stress, using such M in settlement analyses may require special adjustment to the different effective stress levels that apply to the problem under investigation. However, the Ordinary Method of analysis that omits this adjustment usually suffices.

6.4 As with other methods of analysis, the DMT settlement calculation method recommended herein may require correction for such effects as pseudo-elastic settlement, structural rigidity, 3-D effects, creep and aging. However, these may often be assumed to cancel each other.

6.5 The DMT appears to predict the relevant soil properties for settlement analysis with an average error of approximately 10%, and a standard deviation of approximately 30%. The ratio of calculated/measured settlement for the sixteen examples listed herein averages 1.18, with a standard deviation of 0.38. The soils involved in these cases include peats, loose to dense sands and silts, soft to hard clays, and mixtures thereof, from a wide spectrum of location and geologic origin.

6.6 A DMT sounding can usually provide the data needed for the calculation of expected settlement with an accuracy adequate for most practical purposes.