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BY
M. Bozozuk

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A FLUID SETTLEMENT GAUGE

M. BOZUZUK

A FLUID SETTLEMENT GAUGE¹

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The paper describes an apparatus for determining vertical settlements by measuring the hydrostatic pressures in a flexible fluid-filled hose positioned horizontally beneath an engineering structure. The pressures are measured with a torpedo containing a pressure transducer which is pulled through the hose, enabling settlements to be measured continuously along its length. As it is withdrawn after each survey, it can be used for any number of installations.

L'article décrit un appareil servant à déterminer le tassement vertical en mesurant la pression hydrostatique dans un boyau flexible rempli de liquide et positionné horizontalement sous une structure. Les pressions sont mesurées à l'aide d'une torpille comprenant un transducteur de pression qui est tiré à travers le boyau et permet de mesurer les tassements d'une façon continue sur toute sa longueur. Comme elle peut être enlevée après chaque série d'observations elle peut donc servir à plusieurs reprises.

INTRODUCTION

Remote reading settlement gauges such as the fluid overflow gauges described by Wilson (1967) and the electrical gauge (Burn 1959) have been developed to reduce interference from construction activities. Lauffer and Schober (1964) described a fluid level device consisting of a torpedo pulled through a slightly inclined, flexible, hollow tube. By measuring the hydrostatic pressure on the torpedo, settlements can be determined anywhere along the tube. Recently Bergdahl and Broms (1967) described a fluid settlement gauge in which the fluid pressure is measured on an air-filled balloon pulled through the hose. The fluid settlement gauge described in this note incorporates a pressure transducer in the sensing probe.

THE TRANSDUCER-HYDRAULIC SYSTEM

The fluid-pressure settlement gauge consists of a 1-in. (2.5-cm) diameter, semi-rigid PVC pipe filled with purified ethylene glycol and connected

¹NRCC 10803.

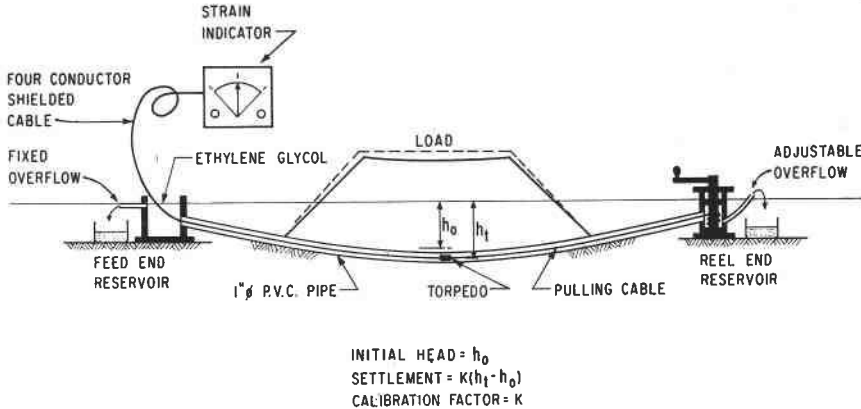


FIG. 1. The fluid settlement gauge.

at both ends to overflow reservoirs (Fig. 1). The pipe is installed with the middle portion slightly lower than the ends. A $\frac{3}{4}$ -in. (1.9-cm) diameter torpedo, $3\frac{1}{2}$ in. (8.9 cm) long, is pulled through the pipe with a fine wire cable and reel, and the difference between the fluid pressure in the reservoir and that at any point in the pipe is obtained. Any ethylene glycol displaced by the torpedo and the attached electrical leads is allowed to overflow at the reservoirs so that the elevation of the fluid surface remains constant. If the datum elevation of the fluid surface is established before the survey is made, the elevation at any point in the pipe can be determined quickly. The readings are taken outside the working area, so that settlement surveys can be made both during construction and after it has been completed. Readings can also be made in winter under freezing conditions. As the torpedo is withdrawn after each survey, it is available for use in other installations.

The torpedo shown in Fig. 2 consists of a 0-to-20 psia (0-1.4 kg/cm²) pressure transducer sealed in a stainless-steel housing and connected to 150 ft (45.7 m) of electric strain gauge cable. It is smaller in diameter than the pipe, so that the ethylene glycol flows around it when it is pulled to the desired position. Markings on the electric cable are used to locate the probe during the survey. The pulling harness, also shown in Fig. 2, helps to protect and center the torpedo in the pipe.

Two 100-ft (30.5-m) long installations under test embankments near Ottawa have been in service for about $1\frac{1}{2}$ years. Results have compared very well with measurements made with spiral foot gauges. Theoretically, it is possible to measure with an adequate reading instrument a difference in elevation of 12 ft (3.7 m) to within ± 0.001 ft (.0003 m) with the 0-to-20 psia (0-1.4 kg/cm²) transducer in the torpedo. Due to variations in temperature² in the ethylene glycol, changes in atmospheric pressure during the survey, and possibly to error in positioning the torpedo in exactly the same location, accuracy is reduced to about 0.01 ft (.003 m).

This apparatus was developed for research purposes, but it is ideally suited for monitoring vertical settlements of engineering structures founded on compressible soil. It is to be available commercially in the near future. Further information may be obtained by writing to the Division of Building Research, National Research Council of Canada, Ottawa, Canada.

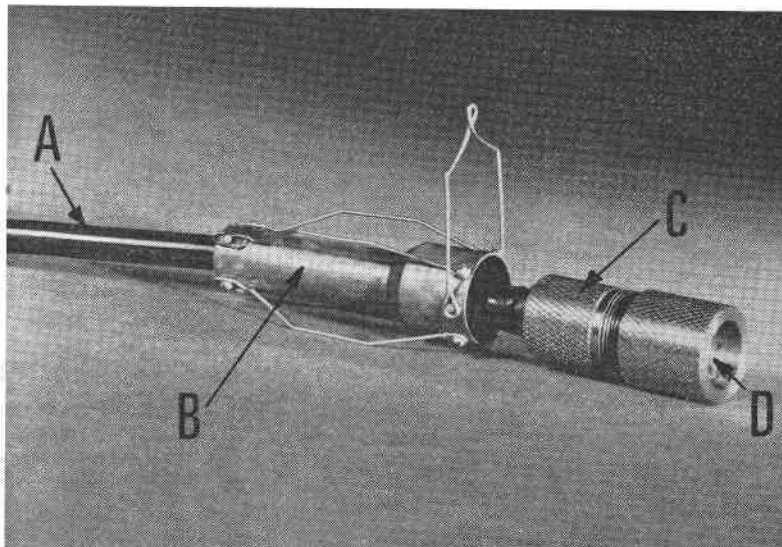


FIG. 2. The torpedo. A = Shielded electric cable; B = Centering and pulling harness; C = Housing; D = Pressure transducer.

This note is a contribution from the Division of Building Research, National Research Council of Canada, and is published with the approval of the Director of the Division.

²A change of 80 °F (44 °C) in the temperature of the ethylene glycol causes an error of 3%.

REFERENCES

- BERGDAHL, U. and BROMS, B. B. 1967. New method of measuring in-situ measurements. Proc. Amer. Soc. Civil Engrs., Soil Mech. Foundn. Div., 93, No. SM 5, pp. 51-57.
- BURN, K. N. 1959. Instrumentation for a consolidation study of a clay deposit beneath an embankment. Geotechnique, IX, (3), pp. 136-142.
- LAUFFER, H. and SCHÖBER, W. 1964. The Gepatsch rockfill dam in the Kauner Valley. Proc. 8th Cong. on Large Dams, Edinburgh, III, pp. 635-660.
- WILSON, S. D. 1967. Investigation of embankment performance. Proc. Amer. Soc. Civil Engrs., Soil Mech. Foundn. Div., 93, No. SM 4, pp. 135-156.

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