Application of distributed optical fibre for shallow foundation

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Abstract. Soil deformation is one of the major interests with regard to the stability analysis of the foundations. The deformations are signified for both vertical and lateral soil deformation; which the former plays vital role in designing a good foundation. As the stability of the foundation affect the stability of the entire structure, instrumentation and monitoring play an important roles in order to monitor the performances of the geotechnical structures. Until now the design of a foundation soil system is relied on the quantification of soil bearing capacity and foundation structural capacity and then followed by conventional monitoring system to observe the settlement so that within the allowable values. Therefore, this study focuses on the newly usage of distributed optical fibre sensing application to monitor strain distribution within a soil mass due to surcharge loading. It is expected to observe the strain distribution goes proportionally to vertical stress distribution concept; where higher strain measurement right below the loading position and decreases with depth. The advantage of distributed optical fibre sensing rather than conventional strain gauge is the sensor able to collect so-called average strain along the optical fibre compare to discrete measurement of strain gauge. This paper describes the experimental work conducted with the use of a distributed sensing technology named Brillouin Optical Time-Domain Analysis (BOTDA). A small scale of 1G model of a shallow foundation which represented by a load plate under incremental surcharge loading was stimulated to assess the soil mass deformation. The optical fibre were embedded in soil mass by layering in a horizontal direction which laid perpendicular to load direction. A comparison of numerical modeling using PLAXIS 2D and experimental works as part of this study. As a results, fibre optic is a good approach for instrumentations and monitoring for geotechnical structures as fibre optics is sensitive to the movement of the soil and fibre optic with anchorage system gave better strain measurement reading compare to without anchorage system.