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Structure-Integrated Fibre-Optic Strain Wave Sensor for Pile Testing and Monitoring of Reinforced Concrete Piles

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Reinforced concrete piles are used when structures are constructed on soft ground, because it is necessary to transfer the loads into deeper strata with a sufficient bearing capacity. Usually, static and dynamic pile tests are carried out in order to determine the pile's behaviour and possible damages. The dynamic measurements can show the bearing behaviour and the structural integrity by using the theory of one-dimensional wave propagation. Commonly, the sensors are installed on the top of the pile head or embedded near the pile head. With the purpose of receiving more precise information about the pile features, now, a string of sensors is embedded at different levels of the pile.

A fibre optic strain wave sensor has already been developed by Schallert [1]. The sensor is based on the principle of the extrinsic Fabry-Perot interferometer and was already tested in laboratory and full-scale field tests with precast driven piles. It was possible to detect the introduced deformation caused by the static loading and the dilatational wave during dynamic low-strain as well as high-strain loading. Although the full-scale tests were successful, the high demands on the economy of the sensor required the optimisation of the sensor design. After laboratory tests with the optimised sensor, a cast-in-situ bored pile has been built at the BAM Test Site Technical Safety in Horstwalde, South of Berlin. In order to enable the comparison of the signals, additional fibre Bragg grating sensors, temperature sensors and resistance strain gauge sensors are embedded into the pile. In this paper, the optimised sensor and the setup of the cast-in-situ bored pile along with results of the conducted pile tests are shown together with an outlook on further field-tests in progress.

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Ключевые слова:

Содержание

Abstract
Introduction
Design of the optimised sensitive element
Large-scale model pile tests
Field tests
Conclusions and outlook
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