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Geotechnical Monitoring of Construction Activities by Distributed Fiber Optic Sensors Embedded in Geotextiles

Издательство DEStech Publications, Lancaster, 2010 год

Код: 10739

6 стр; формат: 23,5 x 16 см; библиографический список: 10 единиц
ISBN: 978-1-60595-024-2

The planning and design of monitoring systems for civil engineering applications typically focus on structures as they are directly subjected to live loads, are most exposed to weathering and are the most visible to the public. As such, the monitoring of structures above the ground is beginning to mature and applications in the field are emerging. An area not yet researched in depth, however, is the monitoring of foundations and earthworks. Similar to the monitoring of structures such as buildings and bridges, in-service data from foundations, retaining walls, and earthworks can be utilized to validate design assumptions, control construction operations, assist with life-cycle maintenance and management actions, and provide alert to extreme events. Particular to substructure and foundation elements is the possibility of their reuse when superstructures are replaced. In such cases, their load history and performance over time can be critical in deciding whether or not they can be reused or must be reconstructed. Also motivating the collection of data for substructures, foundations, and earthworks is the need to calibrate consistent reliability levels across each component of complex structures (e.g. the foundation, abutments, and superstructure in the case of a bridge).

Traditional measuring systems include pressure cells, piezometers, and inclinometers which produce point measurements. A new tool designed for distributed measurements is sensor-embedded reinforcing textiles. These smart textiles provide in-service data using fiber optic sensors while they perform their traditional role of soil stabilization, reinforcement, or separation. This paper highlights the state of the art in geotechnical monitoring with special emphasis on smart geotechnical textiles. Applications and case studies for these materials are provided.

Ключевые слова:

Foundation engineering, geotechnical monitoring, smart textiles, distributed fiber optic sensors, POF sensors, Brillouin sensors.

Содержание.

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