

This topic is “practice ready.” Yes No

UHPC Pile Long-term Performance Monitoring

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Abstract

This project focusses on the field evaluation of a UHPC pile, which was accomplished as phase II of project “UHPC Piles Application in Integral Abutment Bridges”. The UHPC pile was installed in a abutment of three-span bridge, where there are 10 piles in each abutment. To monitor the performance, the UHPC pile and three steel piles were instrumented with strain gauges. The UHPC pile and one steel pile are in one abutment while the other two piles are in the other abutment. The pile performance monitoring started right after the bridge deck was completed, lasting more than 36 months. During this period, strain variations in piles at different depths and the ambient temperature below the bridge deck were recorded. Twelve months later, four string-potentiometers and four inclinometers were installed, so that abutment horizontal displacement and vertical rotation values could be obtained.

During the monitoring period, the daily variation in pile strain was in the 5 to 15 μ strain regardless of the pile type and gauge location. The long-term strain variation mainly occurred in the top portion of the piles due to the continuous movement of the bridge. Typical, variations were in the range of 20 to 80 μ strain with the bridge abutment movement in the range of -0.2 in to +0.1 in. The long-term strain variation was negligible for all the gauges located 18 ft below the pile head. Variation in ambient temperature correlated well with the long-term strain variation.

To compare the performance of both the UHPC and steel pile, L-Pile models were developed and

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The L-Pile models were then used to explore the impact of pre-bored holes and evaluate the expected pile performance under both design service lateral displacement and maximum allowable lateral displacement. The analyses confirmed that the UHPC pile will undergo maximum allowable displacements without experiencing visible-cracking. Suggestions regarding pile design service displacement and maximum allowable displacement for piles without pre-bored hole are also included.

Based on the field monitoring and subsequent analyses, it is concluded that UHPC pile installed in the bridge abutment performs satisfactorily that its use can be broadened in the in future projects.

Keywords: UHPC, Pile, Performance, Monitoring