RESEARCH
PROJECT CAPSULE [13-3GT]
April 2016
TECHNOLOGY TRANSFER PROGRAM

Finite Element Analysis of the Lateral Load Test on Battered Pile Group at I-10 Twin Span Bridge

JUST THE FACTS:

Start Date:
March 1, 2016

Duration:
30 months

End Date:
August 1, 2018

Funding:
TT-Fed/TT-Reg

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Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

PROBLEM

Full-scale load tests on laterally loaded piles are desirable for providing the experimental data needed to verify and/or develop new theoretical and empirical pile design methods. However, a literature review reveals very few reported full-scale lateral load tests on piles, even fewer are reported on battered pile group foundations, due to high cost and technical difficulty.

Two approaches can be used to numerically analyze the lateral behavior of piles: simplified p-y methods and continuum-based finite element (FE) methods. However, the p-y methods are not adequate for describing the three dimensional nature of the pile group (e.g., geometry, spacing). The continuum-based FE analysis is desirable for better simulation and understanding of the soil-structure interaction.

Recently, a unique full-scale lateral load test was conducted on a fully instrumented battered pile group foundation at an eastbound pier (M19) of the new I-10 Twin Span Bridge over Lake Pontchartrain to assess the methodology used in the design and analysis of the battered pile group foundation and to evaluate its performance under lateral loading. The test report includes complete subsurface soil information and a large amount of measured data from the lateral load test (e.g., lateral deflections, moment distributions).

The report information can be used to verify and calibrate a three-dimensional FE model for comprehensive analyses and parametric studies on the performance of battered pile group foundations and to develop the soil p-y curves needed for design.

OBJECTIVE

The objectives of this research study are to develop a three-dimensional FE model for simulating the behavior of a battered pile group foundation subjected to lateral loading, and to verify the model using results from a unique static lateral load test that was conducted at the M19 eastbound pier of the I-10 Twin Span Bridge.

METHODOLOGY

A three-dimensional FE model (Figure 1) will be developed to simulate the behavior of a battered pile group foundation subjected to lateral loading. The finite element model will be first verified and calibrated using the results of

full-scale load tests at the M19 eastbound pier. Once calibrated, the model will be used to conduct a comprehensive finite element parametric study to evaluate the effect of different variables and parameters on the lateral performance of the battered pile group. The results from the parametric study will be used to develop p-y curve models that represent different soil types and conditions in Louisiana, and to evaluate p-multipliers for potential implementation in software (e.g., FB-MultiPier, Midas) for future analysis and design of battered pile group foundations.

IMPLEMENTATION POTENTIAL

This research will provide a better understanding of the lateral behavior of transportation infrastructure subjected to both static and dynamic loads. The research results will be implemented in the design of pile group foundations for bridges and other transportation infrastructure built every year in Louisiana, resulting in a better, safer, and more cost-effective design methodology for bridge pile foundations subjected to lateral loading.

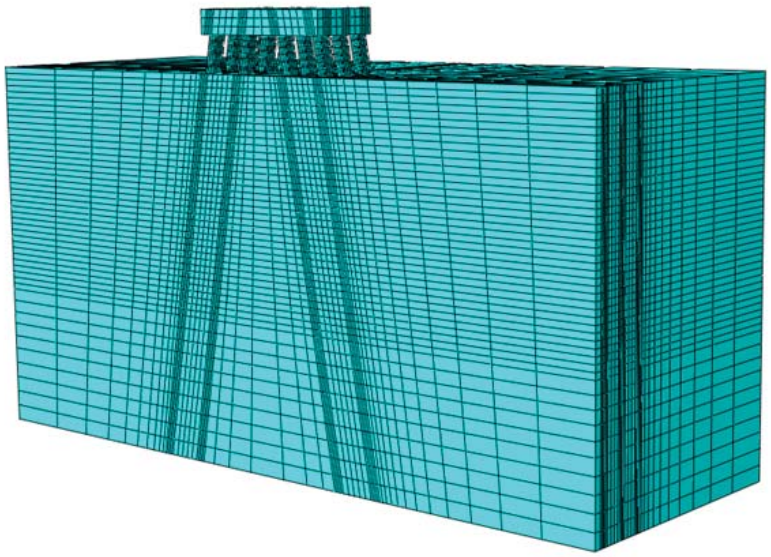

Figure 1
FE model for the battered pile group foundation