Load and Resistance Factor Design Advancements for Bridge Pile
Foundations in Iowa

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Abstract

This paper will present the recent advancements of Load and Resistance Factor Design (LRFD) for bridge pile foundations, which were made possible through establishment of PIle LOad Test (PILOT) database and full-scale testing of 10 steel H-piles. Developed as part of a project in a near completion stage, PILOT is an amalgamated, electronic source of information consisting of both historical static and dynamic data for pile load tests. Although included in PILOT, the full-scale tests, conducted in clay, sand, and mixed soil profiles, were motivated to provide dynamic restrike and verification data.

Using the quality-assured data and following the American Association of State Highway and Transportation Officials (AASHTO) framework, resistance factors for LRFD were established for driven piles in Iowa. For design purposes, an in-house design method known as the Bluebook method was chosen due to its efficiency. In consideration to the routine practices of the Iowa Department of Transportation and County Engineering Offices, Iowa DOT Modified ENR formula, Wave Equation Analysis Program (WEAP), and CAse Pile Wave Analysis Program (CAPWAP) have been chosen as the appropriate construction control methods and resistance factors for all chosen methods have been established. Compared with the AASHTO recommended LRFD Specifications, these regionally calibrated resistance factors are more efficient, improving the pile design in Iowa. Further advancements made as part of this project are: 1) refining the resistance factors established for the Bluebook method to minimize the discrepancy between designed and field verified pile resistances; and 2) incorporation of the effect of pile setup in clay profiles as part of the LRFD recommendations, thereby improving the efficiency of pile foundations in Iowa. In addition to providing these recent advancements, the improved economy of the pile design will be demonstrated through an example.
Key words: Resistance Factors—Construction Control—Pile Setup—LRFD.

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