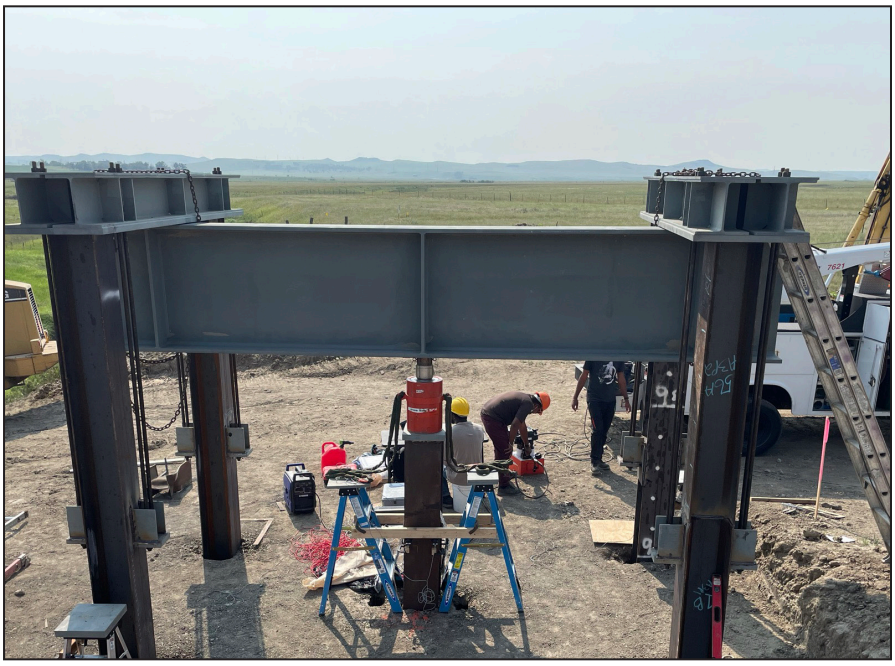
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 22-478 (project 651) | August 2022

Development of LRFD Recommendations of Driven Piles on Intermediate Geomaterials



the ISSUE

Many piles to support transportation infrastructure in the Rocky Mountain region are driven on intermediate geomaterials (IGM), a transitional geomaterial between soil and hard rock, which is not well defined for the design and construction of driven piles. There is a critical need to improve the current design construction practices for driven piles in IGMs by establishing representative engineering properties of IGM, developing new static analysis (SA) and construction control methods, and developing load resistance and factor design (LRFD) resistance factors for piles driven into IGMs. Establishment of these techniques will lead to more economical and reliable design and construction using driven piles in IGMs.

the RESEARCH

This study aims to improve the efficiency of driven piles in IGM, which will increase the system reliability of civil infrastructures, especially bridge structures. The objectives of this proposed research are the following: develop advanced SA methods for pile resistance estimation in IGMs; validate and improve the accuracy of dynamic analysis methods; develop LRFD resistance factors for piles in IGMs; and recommend changes and improvements to current pile design and construction practices. The objectives of the study are achieved by completing six key tasks: 1) pile data collection; 2) establishment of an electronic database; 3) geotechnical and pile data assessment; 4) pile resistance prediction, 5) development of LRFD resistance factors; and 6) LRFD recommendations.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

Colorado State University
North Dakota State University
South Dakota State University
University of Colorado Denver
University of Denver
University of Utah
Utah State University
University of Wyoming

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Project Title

Development of LRFD Recommendations of Driven Piles on Intermediate Geomaterials

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the FINDINGS

This study intends to establish the proper definition for IGMs so they will not be treated as soils during the driven pile design suggested by American Association of State Highway Transportation Officials. The heterogeneity of IGMs is considered through the proposed classification criteria for fine-grained-IGMs, which will help design engineers to differentiate various geomaterials in the design of driven piles. The newly developed SA methods yield more accurate pile resistance estimation than the existing SA methods; the discrepancy between measured and estimated resistance based on the existing method will be minimized. Calibrated resistance factors are developed for the proposed SA methods and construction control methods to improve the reliability of pile design and construction. Finally, economic driven pile design and construction can be achieved, which will minimize additional costs and avoid construction delays and unnecessary conflicts between contractors and owners.

the IMPACT

The recommendations developed from this research will improve the design efficiency of the driven pile foundations for bridges. Also, the outcomes will improve the construction control of driven piles during construction and reduce the events of unacceptable piles, early refusal, cost overruns due to longer pile penetration, and unpredictable variation orders. The discrepancies between design and construction can be minimized.

For more information on this project, download the main report at https://www.ugpti.org/resources/reports/details.php?id=1098

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.

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