TIDC Transportation Infrastructure Durability Center AT THE UNIVERSITY OF MAINE

Structural testing of micropile threaded joints

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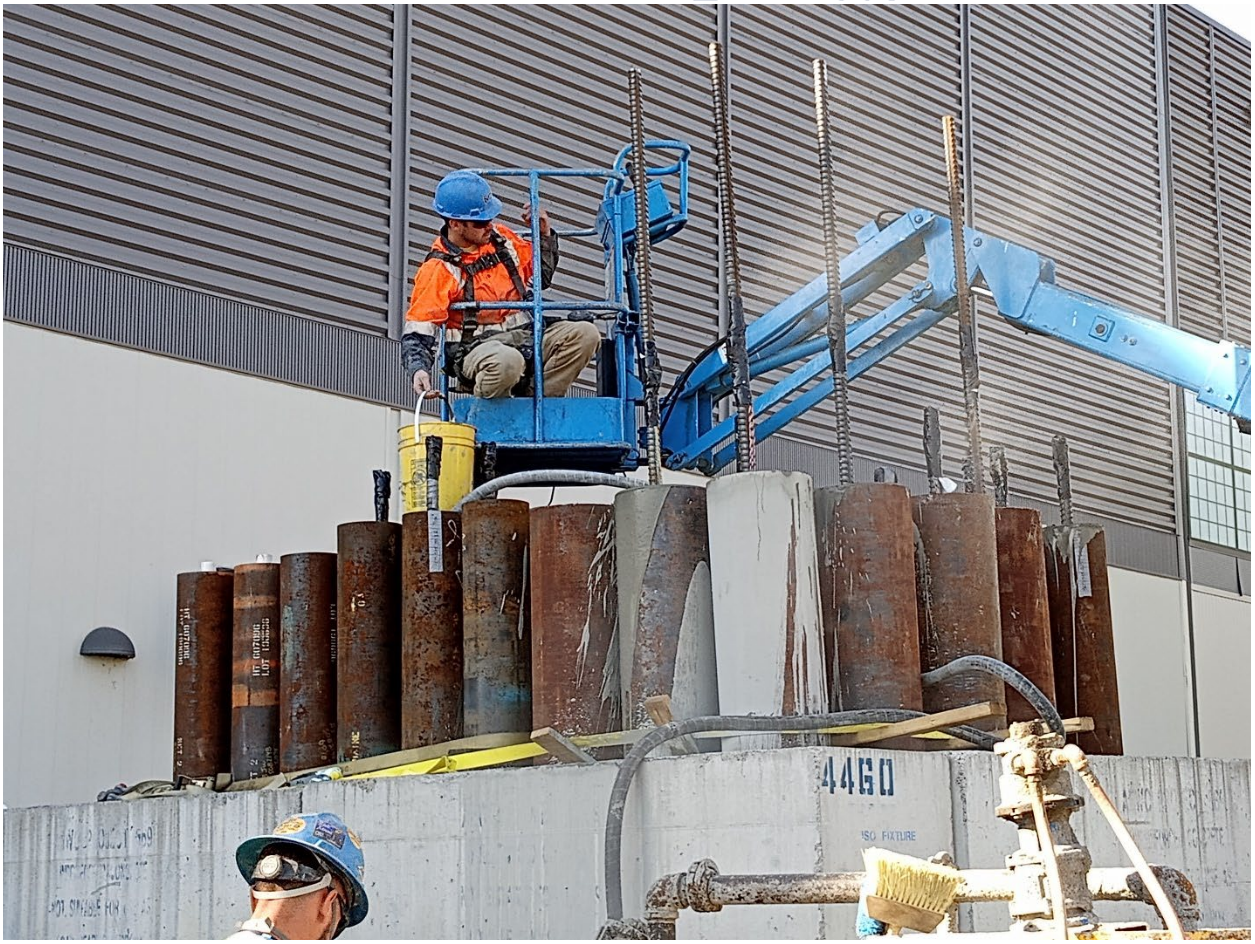
Abstract

Permanent steel casing micropiles are an advantageous foundation system that can provide high geotechnical capacities in tension and compression. However, when lateral and flexural loads are imposed, these micropiles display a limited capacity due to early bending failure of the steel casing threaded connection that couple the casing segments. The proposed research project aims to develop an analytical model capable of predicting the joint bending strength and failure mode of micropile threaded connections based on its geometric and material properties while considering the presence of center reinforcement and combined axial and bending loads. The model will combine displacement fields characteristic of the flexural failure with principles of compatibility and equilibrium to determine the cross-sectional stress distribution at the threaded joint, and thus, allowing to calculate the bending moment corresponding to failure. The project will include four-point bending tests on micropile specimens with different geometric details to characterize the longitudinal (axial) and radial displacements at the box-end of the connection that will serve as input for the analytical model. The specimens will be loaded in pure bending or bending combined with axial compression until failure of the threaded joint occurs while the displacements produced by the flexural load are monitored using digital image correlation (DIC). The collected data will be extended using finite element analysis (FEA) to characterize the features that are not observable through DIC, and later used to improve the physical consistency of the analytical model.

The outcomes of this project will allow practitioners to reliably determine the flexural strength of the connection and aid decisions regarding the details and milling of threaded connections and selection of appropriate center-bar reinforcement. Also, by providing the industry with a predictive model, financial, physical, and logistical efforts related to structural testing will be saved.



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