



Helical Pile Foundation Implementation for Bridge Structures

tech transfer summary

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RESEARCH PROJECT TITLE

Helical Pile Foundation Implementation for Bridge Structures

SPONSORS

Iowa Highway Research Board
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Accelerated Bridge Construction
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The Bridge Engineering Center (BEC) is part of the Institute for Transportation (InTrans) at Iowa State University. The mission of the BEC is to conduct research on bridge technologies to help bridge designers/owners design, build, and maintain long-lasting bridges.

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Guidance on the use of helical pile foundations for bridge structures can help bridge engineers and owners take advantage of this increasingly popular deep foundation technology.

Goal

The primary goal of this project was to develop a guide that provides bridge engineers and designers with information and direction for the use of helical piles in bridge substructures.

Background

Helical piles are a manufactured steel product consisting of lead sections fabricated with a single helix or multiple helices coupled to extension sections, with piles varying in size, shape, and cross-section depending on load demand requirements. Installation involves rotating pile sections into the ground until the required depth and design bearing strength are achieved.

Helical piles can be installed using relatively small and maneuverable equipment, allowing them to be placed in areas that pose challenges for other deep foundation technologies. Additionally, installation is relatively simple and quick, which can accelerate construction.

In recent decades, the use of helical pile foundation systems has gained popularity across several industries as efforts have focused on standardizing design procedures and developing design tools and construction methods that can satisfy strength and serviceability requirements. As a result of these efforts, helical piles have been adopted into the International Building Code as a deep foundation option.



Helical pile installation equipment



Helical pile lead sections



Helical pile extension sections

Problem Statement

As helical pile technology has advanced and governing codes have been developed, little attention has been given to the use of helical piles in bridge substructures. However, the bridge design community can benefit from the recent advances in helical pile technology given that the deep foundation methodology has largely been proven.

Development of the Guide

The material in the guide was researched and organized with the aim of providing guidance for bridge owners and engineers on the design and installation of helical piles for bridge substructures, particularly for bridges on low-volume roads.

Numerous resources developed for other industries on the design and installation of helical piles were consulted in development of the guide. Also consulted were key studies and publications on topics such as the structural requirements of bridges, geotechnical considerations, and the potential applications and limitations of helical piles.

Key Features of the Guide

- Chapters cover the history and applications of helical piles; materials, equipment, and installation; the design process; construction; example specifications; and preparation of construction documents.
- The guide includes useful design specification examples and reference tables, construction and installation documentation tools, and sample forms in table format.
- Numerous resources are provided for more detailed or supplementary information.

Implementation Readiness and Benefits

The guidance and specifications developed in this project are currently available in a document designed to help bridge engineers and designers take advantage of the benefits of helical pile technology.

The use of helical piles has become an attractive option to bridge engineers and owners because helical piles can support loads and be installed in areas that pose challenges for other foundation technologies. Helical piles are particularly advantageous for low-volume roads, where budgetary considerations tend to be a priority.

Moreover, the simplicity and speed of helical pile installation, along with the ability of helical piles to be installed in areas where access is limited, can accelerate the construction of bridge structure foundations.