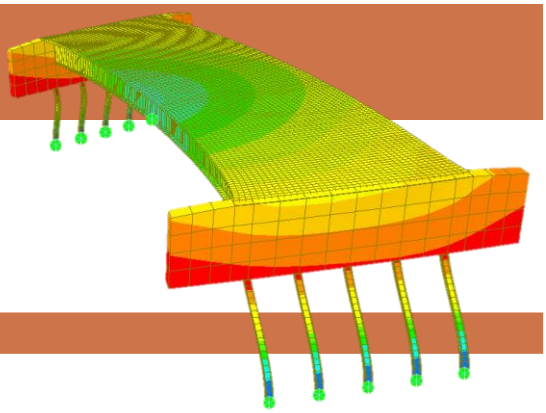
FACT SHEET

Curved Integral Abutment Bridge Design



RESEARCH PROJECT TITLE

19-1 Curved Integral Abutment Bridge Design

STUDY TIMELINE

February 12, 2020 – January 31, 2023

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MORE INFORMATION

For more information, please see the project page at:

https://www.newenglandtransportationconsortium.org/projects/netc-19-1/

The New England Transportation Consortium, a cooperative effort of the transportation agencies of the six New England States, funded this research. Through the Consortium, the states pool professional, academic and financial resources for transportation research leading to the development of improved methods for dealing with common problems associated with the administration, planning, design, construction, rehabilitation, reconstruction, operation and maintenance of the region's transportation system.

Introduction

Funding constraints suggest an urgent need to reduce New England bridge maintenance costs and extend the service life of structures. Extending integral abutment bridges to curved alignment applications offers an immediate opportunity to address this concern. The purpose of this research initiative is to investigate the effects of various bridge parameters pertaining to the behavior of curved integral structures. The results provide recommendations for a simplified design method for curved integral abutment bridges (CIAB's) to be implemented in existing design guidelines and enhance the bridge design practice throughout the region.

Methodology

A parametric study was performed to investigate the behavior of curved integral abutment bridges, with consideration for various span and radius combinations, single and two-span layout, in-line and U-wingwall orientation, strong- and weak-axis bending pile orientation, equivalent cantilever pile length, and skew of substructure from radial orientation. A total of 585 iterations were modeled to conduct this research. The bridges were modeled utilizing finite element analysis software that could analyze the complex behavior of curved integral abutment bridges, including the torsional effects in the girders. The research investigated the parametric effects on thermal movement, pile head displacements and rotations, pile forces/reactions, beam end forces, and deck stresses.

Conclusions

Wingwall and pile orientation resulted in the greatest observed effect on the responses of interest. U-wingwalls with weak-axis oriented piles show the most favorable bridge performance, and led to the following conclusions:

- A simplified design method can be utilized for CIAB's with U-wingwalls and weak-axis oriented piles across a broad range of parameters.
- A refined analysis is suggested for structures falling outside the criteria defined for the simplified method, and recommendations for a refined analysis are provided.

Other study parameters, including curve radius, skew angle, pile cantilever length, and span configuration resulted in measurable effects on performance. These effects were accounted for in the development of the resulting guidance.

Implementation

The results of this study have been used to develop the *Curved Integral Abutment Bridge Design Guidelines* to supplement the bridge design guides for New England state transportation agencies. These guidelines are intended to aid in the design of curved integral abutment bridges that would be encountered under typical conditions in New England, including cold climate thermal ranges and low seismic hazards. These guidelines should be considered supplemental to existing state design manuals and not as standalone guidance.