HIGHLIGHTER

PRECAST PRESTRESSED CONCRETE PAVEMENT TO ABATE SETTLEMENT PROBLEMS UNDER BRIDGE APPROACH SLABS

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PROJECT TITLE
PRECAST PRESTRESSED CONCRETE PAVEMENT TO ABATE SETTLEMENT PROBLEMS UNDER BRIDGE APPROACH SLABS

FINAL REPORT ~
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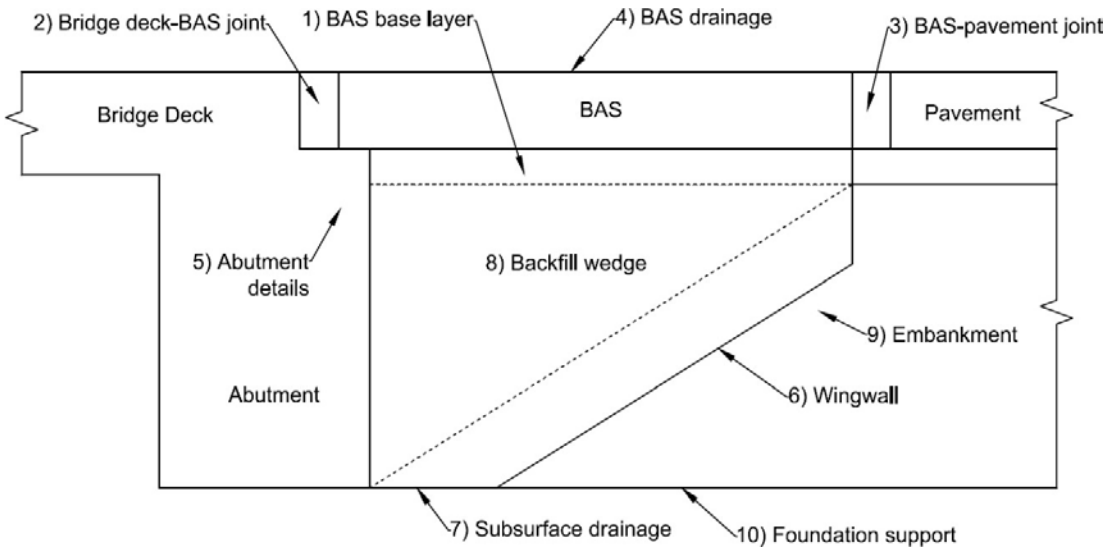
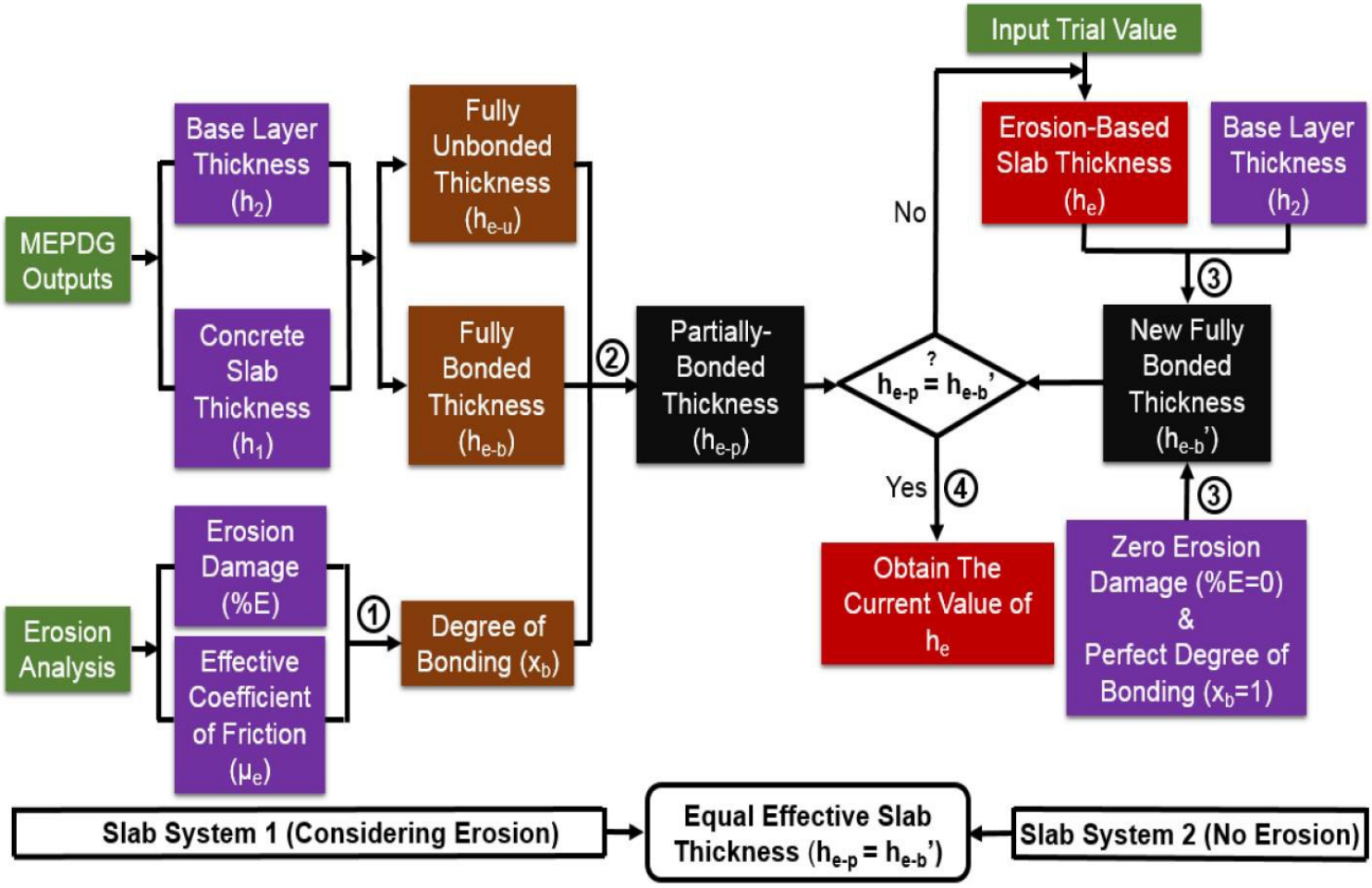
OVERVIEW The "bump-at-the-end-of-the-bridge" issue, often involving the joint between a bridge approach slab (BAS) and a bridge deck, has been a recurring issue over the years in many states. Departments of Transportation (DOTs) have reported differential settlement and cracking issues at this joint, which has significantly reduced ride quality. Previous experience indicates that any "non-removal" conventional method of repair would not work well since it was prone to erosion damage; however, removing and replacing distressed BAS with cast-in-place (CIP) concrete, due to curing requirements, is subject to higher costs of lane-closure and user delays as well as durability concerns. Therefore, a long-lasting and rapid repair method is needed to address this issue.

RESULTS This research focuses on the introduction of the precast concrete pavement slab for repairing distressed BASs and the elaboration of the design and construction procedures for precast BASs. Field investigations of four BASs in Oklahoma were conducted and involved detailed visual distress survey, falling weight deflectometer (FWD) and dynamic cone penetrometer (DCP) testing to evaluate the structural capacity and health of the BASs as well as the adjacent pavement slabs. The study found that the bump issues were mainly caused by the settlement or erosion of the underlying support due in part to moisture infiltration. A "Bridge Approach Design Guideline" was subsequently developed, which identifies key elements within a BAS system (shown in the illustration).



The Guide also provides design considerations, details, methodologies and tools for the prevention of erosion damage that may occur beneath the BASs, supplemented with procedures, such as the one demonstrated in the following flowchart used to determine the "erosion-based slab thickness".



Additionally, this research provides a "Stone Column and Embankment Design Guideline", which is a detailed design procedure for the stone column technique to address the potential for large settlement in the foundation of bridge embankments that contributes to bump issues. This technique involves replacing 10% – 35% of weak soil with coarse granular material, which is then placed and compacted into deep cylindrical holes made in the foundation soils to improve the shear strength, reduce the foundation settlement and provide a stable base for embankments or structures. Although stiffer than the surrounding soil, the stone column is essentially a soil improvement method rather than a foundation element (e.g. rigid piles); therefore, it generally does not apply for heavy loading conditions since stone columns do not behave like rigid piles which can transfer load to deeper soil strata. A procedure is presented that uses non-destructive testing methods (i.e. applying methylene blue test and percometer test) to rapidly and more economically characterize soil properties to support stone column design.

POTENTIAL BENEFITS This project provides the Oklahoma Department of Transportation (ODOT) with a long-lasting and rapid repair option and resultant design guides for addressing "bump-at-the-end-of-the-bridge" issues using precast concrete pavement slabs and stone columns to mitigate foundation settlement. The results will assist ODOT in addressing these infrastructure issues in a faster, more cost effective and less traffic-disruptive manner than other methods.