

ABSTRACT

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Title: Evolution and Performance of Box Beam Bridges in Indiana

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Adjacent box beam bridges in Indiana are not meeting their design life due to premature deterioration of shear keys and prestressing strands. Cracked shear key joints between box beams allow chloride-laden water to migrate through the superstructure and initiate corrosion. As a result, load distribution between box beams may be reduced, promoting independent beam action and differential deflections. Furthermore, loss of strands from corrosion has serious consequences on the flexural capacity of the bridge. The objective of this study is to investigate the evolution of box beam design in Indiana to understand the lack of performance and durability. The Indiana Department of Transportation (INDOT) standards and bridge design manuals were reviewed to track the historical development of box beam bridges in the State. Two timelines were produced tracking important updates to box beam design. Adjacent box beam bridges within INDOT's bridge database were also analyzed. Superstructure ratings were compared with bridge age as well as bridge characteristics to highlight possible causes for deterioration. Analyzing the INDOT inventory, data shows that the condition of adjacent box beam bridges may be affected by location, type of wearing surface, and the use of deck membranes. Six bridges were then inspected to identify common deficiencies and specific problems. Exterior beams and beams within the wheel load path tend to have higher levels of deterioration. Furthermore, leaking joints between girders lead to corrosion of reinforcement ultimately resulting in spalling, fracture of prestressing strands, and loss of structural capacity.