Many steel truss bridges constructed before the 1930’s are classified as deficient. The objective of this research is to provide evidence that through experimental and analytical studies an accurate assessment of the global behaviors & structural conditions of these posted bridges can be determined.

Figure 1: Specimen Bridges are located in Columbus Ohio

Figure 2: The Pratt Bridge spans 152 ft with a width of 20 ft

Figure 3: The Camelback Bridge spans 250 ft with a width of 20 ft

INTRODUCTION

Nondestructive/Destructive Tests and Associated Studies On Two Aged, Decommissioned Steel Truss Bridges

Funding Agency: ODOT/FHWA

Authors:
A.E. Aktan, Director
R. Naghavi, Research Assistant
D.N. Farhey, Research Assistant
K.L. Lee, Research Associate
T. Aksel, Research Assistant
K. Hebbar, Research Assistant

TEST SPECIMENS

DREXEL UNIVERSITY INTELLIGENT INFRASTRUCTURE AND TRANSPORTATION SAFETY INSTITUTE (DI 3)
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Figure 4: Rust Pocket Truss Member
Figure 5: Rust Pocket Truss Member
Figure 6: Connections of floor beam and exterior stringer

Figure 7: Emergency retrofit was required at the girder-to truss connections to avoid premature failures in these connections due to high-magnitude concentrated loads.
Non-destructive test technique applying two loaded HS20-44 trucks weighing 40 kips each in several patterns onto the bridge to record the global displacement responses and local responses for a critical upper chord element.

NOTE: THE TEST SETUP FOR THE CAMELBACK BRIDGE WAS SIMILAR TO THAT OF THE PRATT BRIDGE.
Nondestructive/Destructive Tests and Associated Studies On Two Aged, Decommissioned Steel Truss Bridges

Instruments Used:
- Figure 13: Linear Variable Displacement Transducer (LVDT)
- Figure 14: Clip Gage Measuring Displacement and Strain
- Figure 15: Slide Wire Potentiometer (SWP)
- Figure 16: Accelerometer
- Figure 17: Actuator

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DATA ACQUISITION/POST-PROCESSING

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Figure 18: Instrumentation Box Housed Data Acquisition, Connection Slots, Power, & Current Stabilizer

Figure 19: Pratt Bridge Showing Scaffolding and Instrumentation Box

Figure 20: Real-Time Data Acquisition Display

Figure 21: Test-Control Room Equipped with Optim System and Data Acquisition Hardware

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Static test was designed with numerous loading-unloading cycles. The load pattern (the load ratio in each actuator) and the peak load in a cycle was varied to simulate various single-lane load types and therefore change the critical elements.
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Figure 24: Deck Failure of the Pratt Bridge

Figure 25: Camelback Bridge Buckling of Sway Strut at 1400 kips

Figure 26: At the Yielded Diagonal of the Pratt Bridge, localized popped-out rust pockets are apparent

Figure 27: Brittle Failure Due to Rusted Gussets at Joint of the Pratt Bridge

Figure 28: Truss member of the Pratt Bridge After Failure
CONCLUSIONS

• Actual behavior and limit states of the deteriorated test bridges could not be predicted.

• After completion of each destructive test, there were no evidence of distortion or failure at the upgraded connections.

• Although some members and connections contained rust and deterioration and the bridge may be aged does not constitute an immediate public safety hazard, as long as the bearings, abutments, and floor members are sound.

Figure 29: Load Responses For The Pratt Bridge. The Peak Load Corresponded to the equivalent of 12.8 HS20-44 trucks (AASHTO Standard 1989).

Figure 30: Load Responses For The Camelback Bridge. The Peak Load Corresponded to the equivalent of 20 HS20-44 trucks (AASHTO Standard 1989).