

Enhancing the Resilience of Critical Lifeline Bridges in Coastal North Carolina: The Harkers Island Bridge Replacement Project

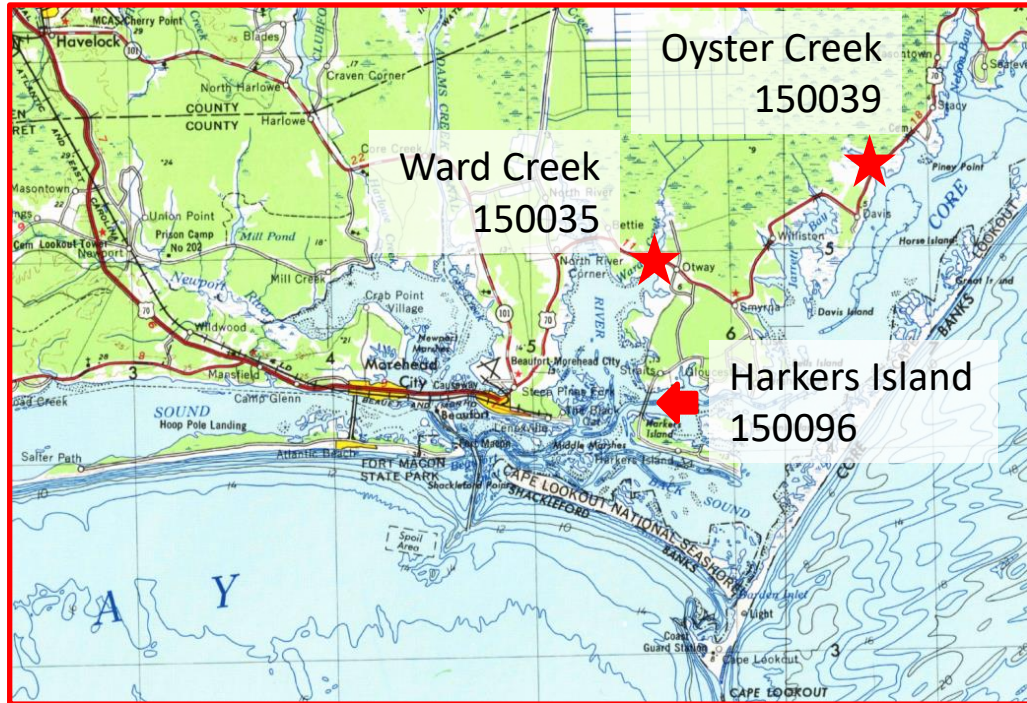
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Quantification, Damage Mitigation, and Preservation of Concrete Bridges
and Structures under Natural and Man-Made Hazards

Part 2 of 2

Bridge 150096 superstructure replaced in 2013 following 10/2012 inspection – 43 years of service



Oyster Creek Bridge – US70

8 – 45 ft spans

26 – 7/16 in. Grade 270 prestressing strands
replaced after 37 years of service





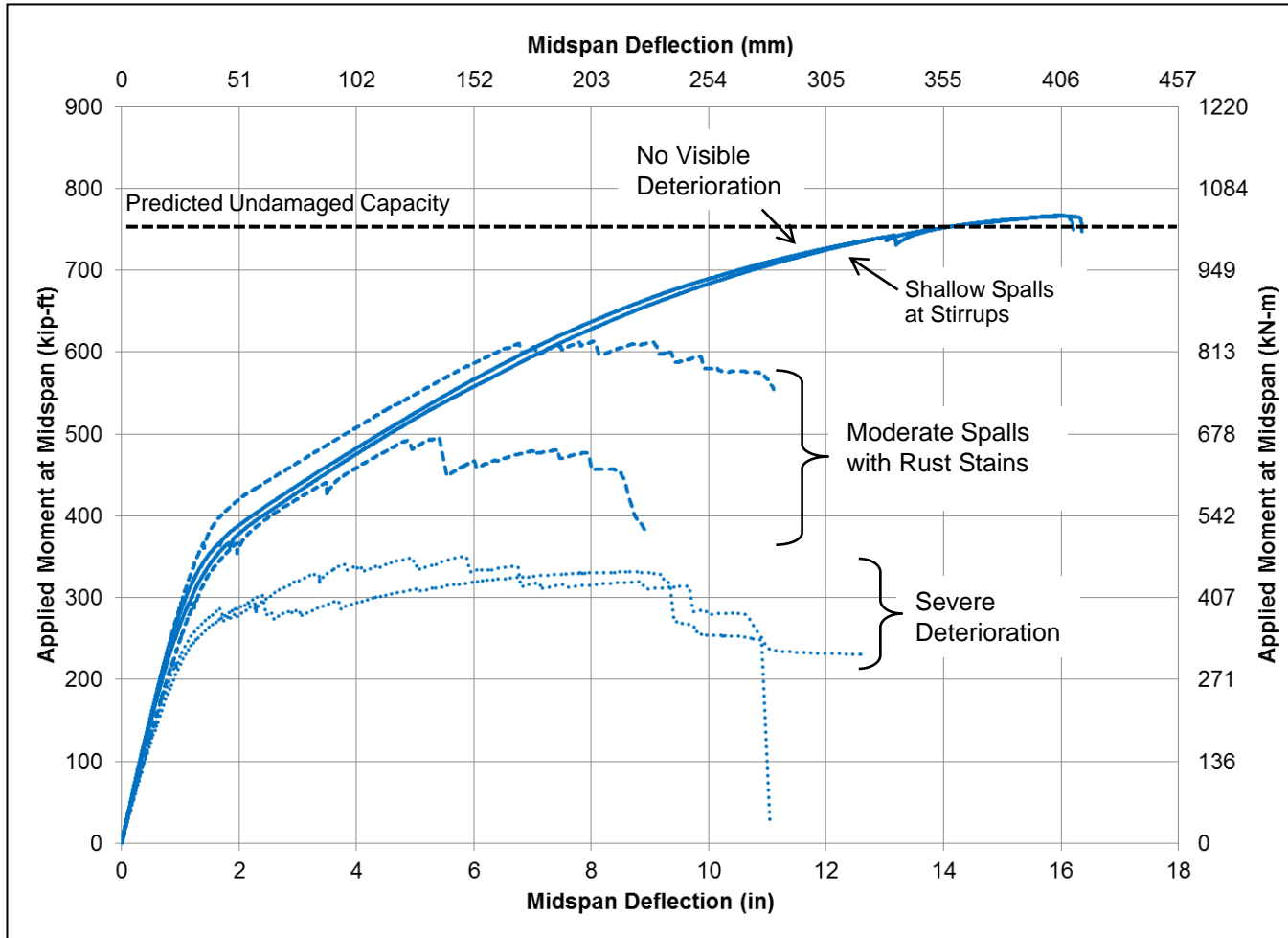








1st reference to patching in 2003 bridge inspection report – 28 years of service
Within the next 10 years: 37 of 64 end span slabs need ‘priority maintenance’
144 of 272 slabs have been patched



Steel prestressing strand



Carbon FRP strand

Fiber-Reinforced Polymer (FRP) Reinforcement

Steel reinforcing bar



Glass FRP bar

***FRP Reinforced/Prestressed Concrete...
a new technology, but no longer an emerging technology***

1988 – Sinmiya Bridge, Japan, 35 years of service

1997 – First FRP bridge in Canada, 26 years of service

2001 – First FRP bridge in the US, 22 years of service

~ 24 bridges in the US with FRP elements (girders or piles)

FL, KY, LA, ME, MI, OH, VA

~ 6 new bridges or demonstration projects in the US under design or construction

AASHTO:

LRFD Bridge Design Guide Specifications for GFRP-Reinforced Concrete

Guide Specification for the Design of Concrete Bridge Beams Prestressed with Carbon FRP Systems

ASTM D30 on Composite Materials

ACI440.11-22 Building Code Requirements for Structural Concrete Reinforced with GFRP Bars – Code and Commentary (an ACI318-14 dependent code)

Harkers Island, Carteret County, NC



Bridge No. 96

- Built 1970
- Superstructure Replacement 2013
- Functionally Obsolete



Bridge No. 73

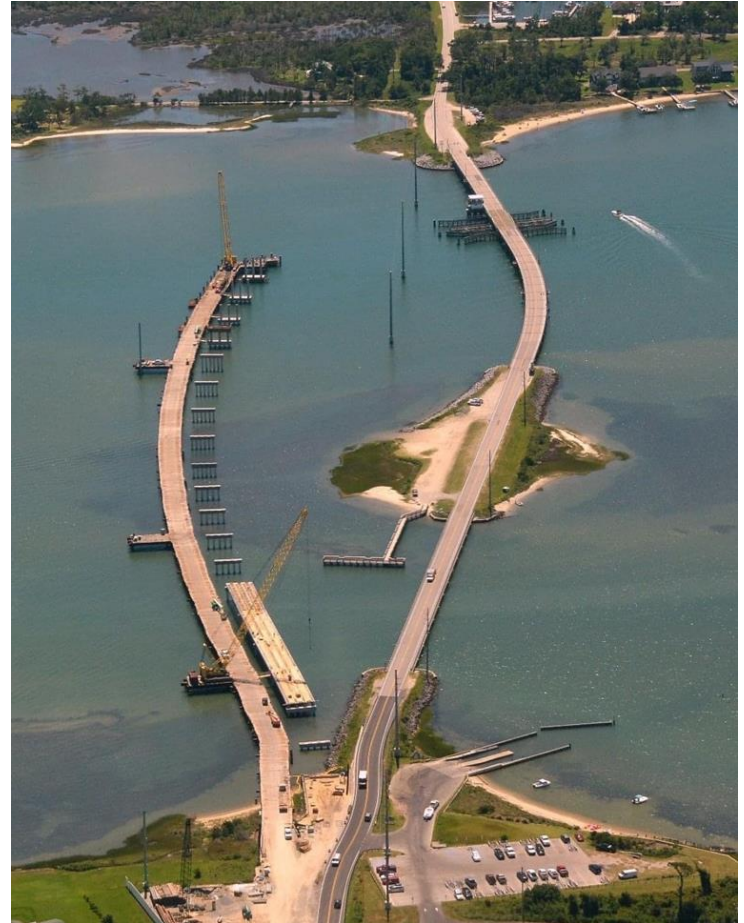
- Built 1969
- Posted SV 24, TTST 37
- Structurally Deficient

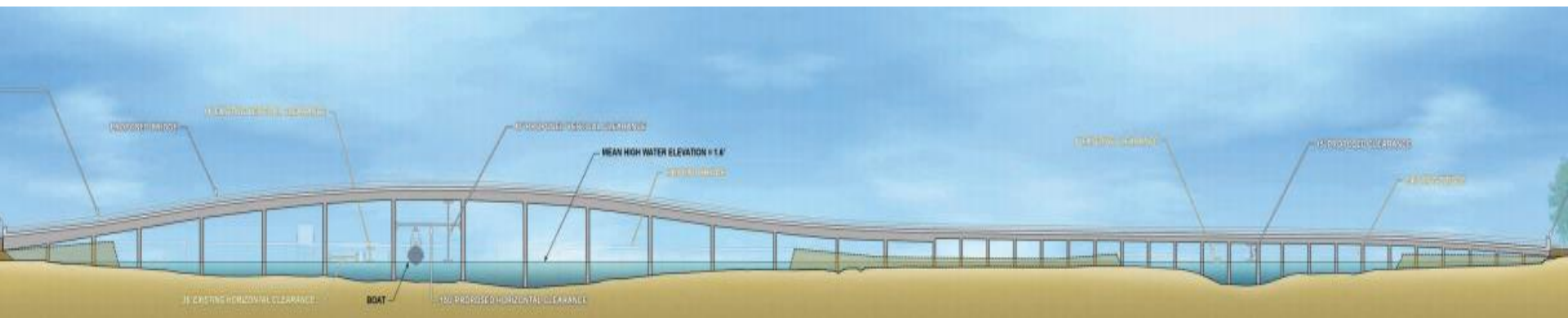




Harkers Island Bridge Project Details

- New Bridge Length: 3,200 ft. (28 Spans)
- CFRP Prestressing Strand:
 - Girders (115): 650,000 Linear Feet
 - Piles (212): 325,000 Linear Feet
- GFRP Reinforcement:
 - Superstructure: 715,000 Linear Feet
 - Substructure: 220,000 Linear Feet
- Let Date: July 2021
- Completion Date: October 2025
- Contract Amount: \$59,995,746
- Moratorium: April 1st through September 30th





24 in. Square CFRP Prestressed Precast Piles



24 in. Square CFRP Prestressed Precast Piles



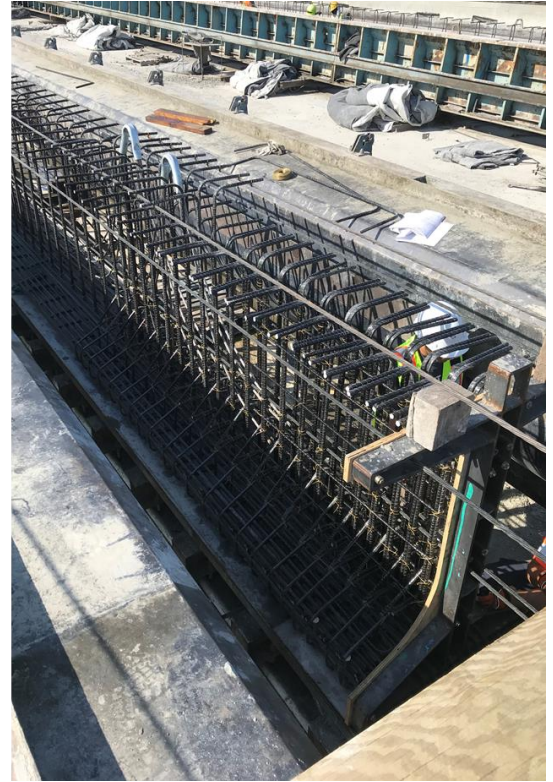
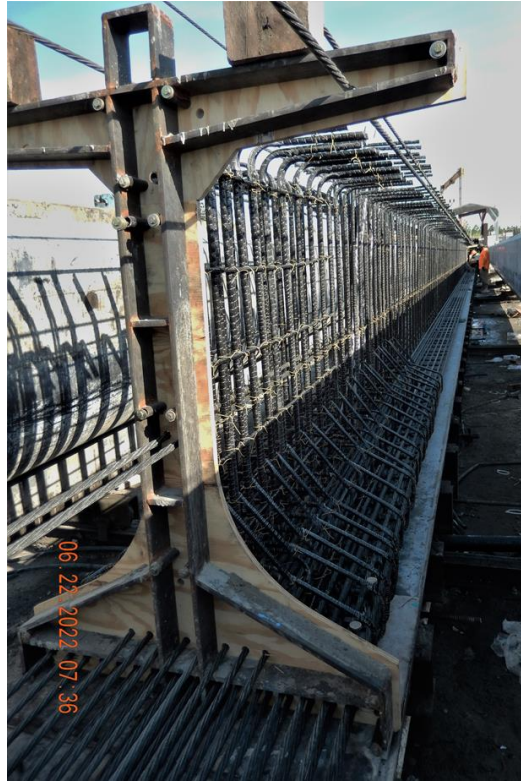
GFRP Bars for Cast-in-Place Concrete



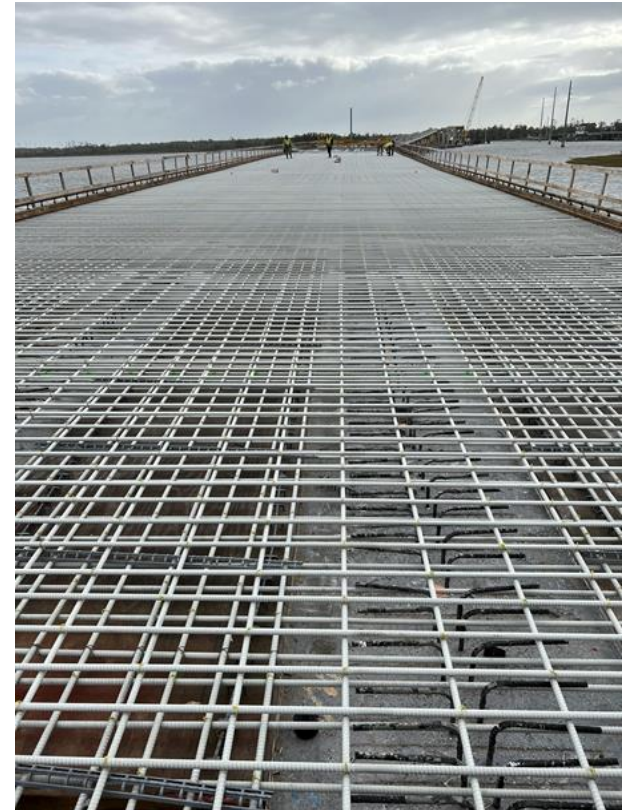
Cast-in-Place Substructure



CFRP Prestressed Precast F.I.B.

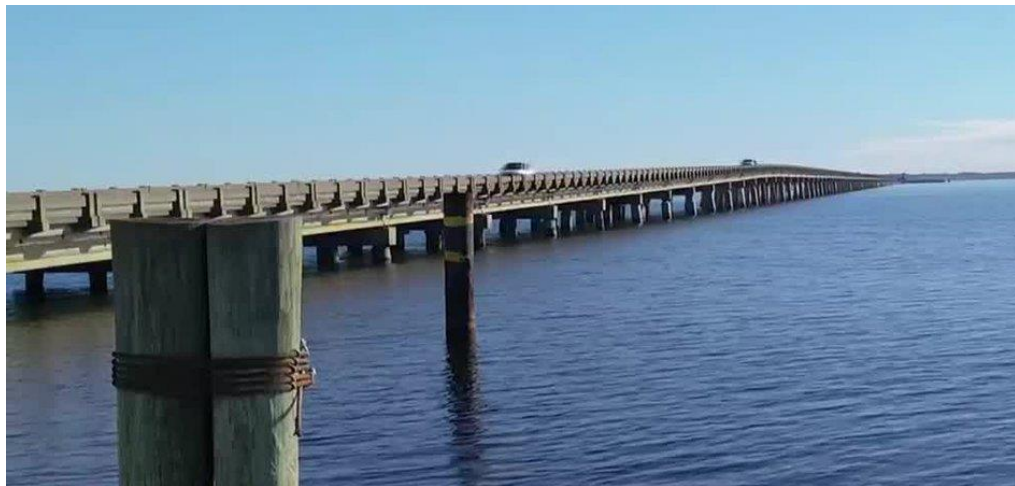
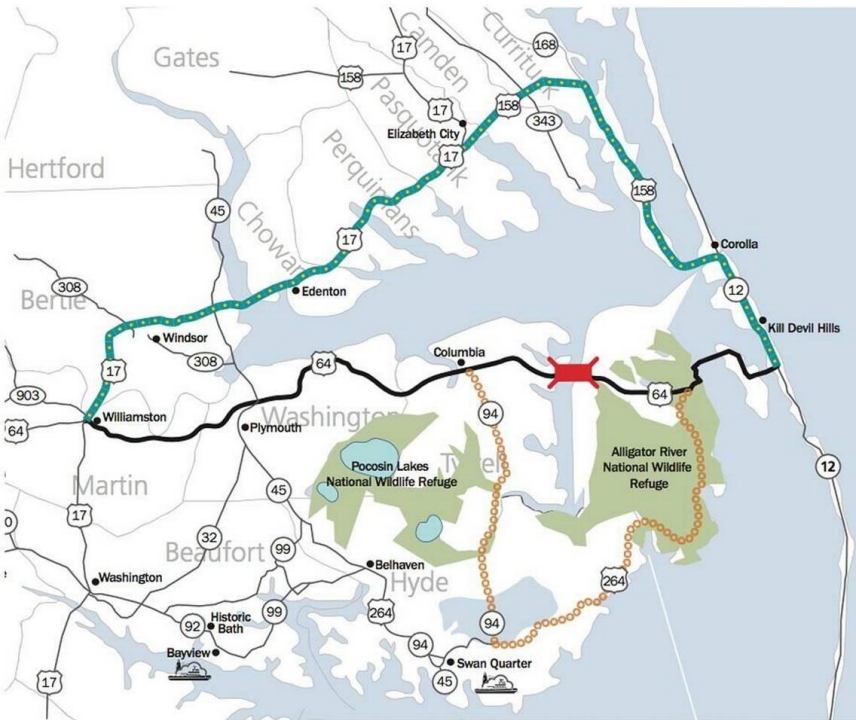


Construction Progress





What's next...



- Built in 1962
- 2.8 mi. long with mechanical swing span
- 35 mi. detour adds 45 min. driving time
- 53 mi. detour adds 58 min. driving time

Lindsay B. Warren Bridge (aka Alligator River Bridge) Replacement