NBIS Bridge Inspection

Overview

The routine bridge inspection was performed by A&O in March and April of 2006. A "hands on" visual inspection was performed of components of the bridge utilizing over-the-side bridge access equipment and hand tools. Each element of the bridge was rated numerically from 0 to 9 and the overall condition for each element and the bridge as a whole was given a rating of "Good" (7-9), "Fair" (5&6), "Poor"(3&4) or "Critical" (0-2). Elements that received a "poor" rating were the concrete deck, fishing catwalks and railing, AASHTO Girders, steel bearing assemblies, concrete caps, concrete columns, concrete pile caps, and the steel caps and piles above the water line.

The overall condition of the bridge was "**POOR"**. As a result of the inspection, "Prompt Action" notifications were included in the NBIS Report provided to NCDOT.

Findings

This section of the report describes the findings of the NBIS bridge inspection and categorizes the condition of each bridge element with a numerical value from 0 to 9 and a general condition description of "Good"(7-9), "Fair"(5&6), "Poor"(3&4), or "Critical"(0-2). The complete NBIS inspection report is referenced and is not part of this report.

Superstructure

Rail, deck and joints

ALUMINUM RAILING – (6) FAIR
The rails have minor vehicular impact damage in Span 3, with dents and splits at random throughout the length of the bridge. The rail post anchor bolts have minor rust at random locations and moderate rust at a few random locations. The rails and posts have moderate weathering throughout.

CURBS-WHEELGUARDS-PARAPETS-MEDIANS – (6) FAIR
The concrete parapets have minor vertical hairline cracks at most aluminum rail posts connections. There are a few minor spalls with exposed reinforcing steel in each face of parapets at random locations throughout. There are a few vertical hairline cracks with light efflorescence dispersed randomly throughout. The joint material has fallen out at most locations and is heavily deteriorated where it has remained in place. The curbs have minor scaling along the gutter line at random locations throughout. The safety reflectors have all been broken off. The curbs have minor spalls at the deck joint at random locations. Vertical hairline cracking is occurring at random locations throughout.

CONCRETE DECK – (3) POOR
The top surface of the concrete deck has multiple transverse hairline cracks at random throughout most spans. Crutch bent piles have been driven through holes cut in the deck near the end of many spans and the cut holes have been patched. The patches sound solid and have hairline cracks throughout and adjacent to the patches. Several of the spans have minor to moderate spalls of the top surface, in some

cases exposing the top mat of steel at random locations, with a heavier incidence south of the navigational span. There is moderate to heavy surface map cracking throughout. There are multiple transverse cracks with efflorescence in the channel spans. The undersides of the decks have significant delaminated areas throughout with some spalling, exposing the reinforcing steel. Minor section loss was observed with bar deformations still somewhat visible. There are a few locations with heavy spalls beyond the bottom mat of steel at random.

EXPANSION JOINTS - MISCELLANEOUS PREFAB DEVICES – (7) GOOD
The modular expansion joint located at Bent 143 is missing 9 anchor caps along the seal. Anchor bolts have minor rust and minor amount of debris buildup. The modular expansion joint located at Bent 146 is missing 4 anchor caps and has separation between the seal and the nosing for a length of 14'-2".

EXPANSION JOINTS - COMPRESSION SEALS – (6) FAIR
The compression joint seals have some spalling along the joint at most locations with some separation from the substrate. Most of the compression joint seals allow water passage to the girder bearings. There is minor sand debris buildup along the joint in most locations.

EXPANSION JOINTS - STANDARD JOINTS – (6) FAIR
The standard joints are located at the cored slab spans. The asphalt has broken above the joint at several locations adjacent to the curb lines in most spans with portions of the joint material missing.

DRAINAGE SYSTEMS (ON STRUCTURES) – (6) FAIR
There are approximately 2 to 3 deck drains clogged per span with cans, bottles, dead birds, and sand at random throughout.

Prestressed girders, cored slabs and bearings

LONGITUDINAL BEAMS OR GIRDERS – (3) POOR
The prestressed girders in most spans have spalls along the bottom edges at random locations. Many girders have multiple spalls, some with exposed strands that have varying degrees of rust. Many strands are broken or have been cut back in preparation for a repair. Most of the ends of girders have spalls with exposed strands on the side face of the bottom flange at the bearings. Many girders have minor spalls and delaminations in the web at the bearing locations. There are up to three or four strands exposed at any given location. Many girders have longitudinal cracking within two inches of the bottom flange at random locations with impending spalls. A few girders have minor diagonal cracking in the webs at the bearing location at random.

INTERIOR DIAPHRAGMS, CROSS-FRAMES, BRACING & CONNECTIONS – 5 (FAIR)
Many of the concrete intermediate diaphragms have spalls along the bottom with exposed reinforcing. There are also many delaminations on the side faces of the diaphragms.

END DIAPHRAGMS, CURTAIN WALLS & CONNECTIONS – (5) FAIR
There are many delaminated areas and spalls in the end diaphragms with exposed reinforcing. Many have longitudinal cracks on the bottom face.

BEARING ASSEMBLIES (INCLUDE MISALIGNMENT) – (3) POOR

Concrete Superstructure – All of the anchor bolts and nuts on the interior of Girders 1through 4 have moderate to heavy rust. The sole plates from the inside of Girder 1 to the inside of Girder 4 have moderate to heavy rust. The exterior half of sole plates for Girders 1 and 4 and the exterior bolts and nuts are in good condition. One elastomeric bearing pad is missing at Girder 2 in Span 143 and the pads at Girders 1 and 4 have moved approximately 1". A few nuts are loose at random. A Prompt Action was issued for the missing bearing.

Continuous Steel Girders and Bearings

LONGITUDINAL BEAMS OR GIRDERS – (5) FAIR
The steel Girders have moderate to heavy rust on the bottom of the top and bottom flanges.

INTERIOR DIAPHRAGMS, CROSS-FRAMES, BRACING & CONNECTIONS – 5 (FAIR)
There is severe rust on the bottom half of all cross-frames and intermediate diaphragms and connections. There is moderate rust on the upper half of the cross-frames and intermediate diaphragms.

END DIAPHRAGMS, CURTAIN WALLS & CONNECTIONS – (5) FAIR
There is moderate rust along top flange at the end diaphragms. There is severe rust on the lower half of the end diaphragms. The concrete haunch at the end diaphragms has spalls at random.

BEARING ASSEMBLIES (INCLUDE MISALIGNMENT) – (4) POOR
The steel bearing assemblies had heavy to severe rust from the inside half of exterior Girder 1 to the inside half of exterior Girder 4.

PAINT SYSTEMS – (6) FAIR
The paint system has been heavily compromised along the bottom flanges of the steel girders and on the lower half of the superstructure members. The paint is peeling, flaking, and popping off due to heavy to severe rust.

Fishing Catwalks

STEEL RAILING – (3) POOR
The railing and fence fabric along the fishing catwalks is in poor condition throughout. The top rails, bottom rails, tension wires, connection brackets, posts mounted to the bridge parapet, and fence fabric all have many broken or missing parts at random. Prompt Actions were distributed for fishing catwalks at each end of the bridge.

WALKWAYS (ON OR ATTACHED TO STRUCTURE) – (4) POOR
The pedestrian walkways (Fishing catwalks) at Spans 1-20 were closed to the public at the time of inspection. The precast double-tee beams at Spans 1-20 have many spalls at the rail post locations. The top surface has moderate weathering throughout. The fishing catwalks at Spans 185-204 have severe spalls at most rail post locations and many have exposed reinforcing. The fencing is in poor condition throughout. Prompt Actions were issued.

Substructure

Bent caps, columns and pile caps

CONCRETE BACKWALLS, WINGS, RETAINING WALLS – (5) FAIR
The wingwalls had minor hairline cracks at random.

CONCRETE ABUTMENTS & INTERIOR BENT CAPS – (4) POOR
End Bent Caps - The End Bent caps have random minor horizontal hairline cracks on the vertical face. Sand has built up around most of the cap face and in some locations around the bearing plates and bolts at the north end bent. Sand covers most of the cap at the south end bent.

Primary Caps - All caps have delaminated areas on the vertical faces and in most cases under the girders. Many caps have large delaminated areas across most of the vertical face. A few caps have delaminated areas or minor spalls on the end vertical faces. Many caps have delaminated areas that extended to the bottom face of the cap. Many caps have small delaminated areas on the top face of the caps, typically at the bridge seat step. Several primary caps have spalls with exposed reinforcing steel along the bottom edge.

Sub-caps - Many of the sub-caps have spalls with exposed reinforcing steel along the bottom edges. Most of the sub-caps have delaminated areas on the vertical faces.

Crutch Caps – Most of the crutch bent caps have spalls with exposed reinforcing steel along the bottom edges. Most of the crutch caps have large delaminated areas on the vertical faces. Top surface of crutch bent caps are generally in good condition.

Cross Girders – Several AASHTO Cross Girders have minor spalls with exposed reinforcing along top flanges at random throughout.

CONCRETE ABUTMENTS & BENT COLUMNS & BREASTWALLS – (4) POOR
The High Level Bent Columns have vertical cracks at random on all faces. There are large delaminated areas on north and south faces at random throughout. The knee brackets at the struts have cracks with random rust staining and random areas of delaminated concrete. The struts have delaminated areas and cracks with rust staining at random throughout. There are a few spalls on the struts at random. The walls between columns on top of the pile caps have large delaminated areas at several locations. Most wall locations have small delaminated areas. Most of the web walls have minor vertical hairline cracks at random.

CONCRETE ABUTMENT AND BENT FOOTINGS & SILLS – (4) POOR
The pile caps at the high level bents have spalls along the top edges with exposed reinforcing steel at random locations. Many of the caps have horizontal cracks with rust staining and efflorescence at random. Corner spalls were noted on several faces with exposed reinforcing steel. Many spalls and delaminations were noted at random throughout on the top surface. The previous grout repairs have delaminated in most locations. The previous cathodic protection cabling is non-functional.

Bent Piles (above water surface)

CONCRETE ABUTMENT & INTERIOR BENT PILES – (6) FAIR
Most of the piles have vertical hairline cracks at random and a few minor spalls at random. The pile jacket repair to Pile #6, Bent 95 are in good condition. Pile #1 at Bent 95 has a spall with exposed reinforcing in its upper area under the cap. A Prompt Action was issued.

Crutch Bents

STEEL ABUTMENT & INTERIOR BENT CAPS & RISERS – (3) POOR
The steel crutch bents at Bents 108 to 123 have heavy to severe rust and pitting on the top surfaces of the steel crutch bent cap. The steel crutch bents south of the navigational span have been superseded with a new crutch bent system and, therefore, were not considered in this report.

STEEL PILES AND BRACING AND BULKHEADS – (3) POOR
The steel crutch bents at Bents 108 to 123 have moderate to heavy rust and pitting on crutch piles. The horizontal bracing had moderate surface rust throughout.

Fender System

FENDER SYSTEMS – (4) POOR
Approximately 75 percent of the vertical timber walers are broken and/or decayed beyond repair at the water line up to the second from the top horizontal waler. The south fender system has vessel impact damage to the walers beneath the bridge. The horizontal steel walers have moderate rust along the flanges. The wire rope is loose around approximately 50 percent of the concrete filled steel pipe dolphins.

Rubber tubes have been attached to the vertical faces of the pile cap at Bent 145 and are in good condition. Impact protection has not been added to the pile cap at Bent 146.

Quantification of Deterioration by Span/Bent

During the NBIS inspection, A&O measured and noted the delaminations, spalls, and cracks located on the deck, girders, caps, columns, and pile caps by visual observation and hammer sounding. For the assessment A&O quantified the spalls/delaminations and cracks for the superstructure and substructure. The areas of the spalls/delaminations were calculated and volumes were determined by estimating a depth of repair of 3” for the superstructure elements and 6" for the substructure elements. The quantification of defects was then used in the development of costs for the recommended repairs. The detailed sketches of each bent and span is located in Appendix C – Quantification of Cracks, Spalls, and Delaminations.