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I-26 Bridge Assessments

Newberry County, South Carolina

Bridge Assessment Report for SC202 over I-26

Prepared for:
The South Carolina Department of Transportation



November 11, 2016

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I. INTRODUCTION

OVERVIEW

This report has been prepared by STV Incorporated for the South Carolina Department of Transportation to provide a general assessment of SC202 over I-26 in Newberry County, SC in preparation for the widening of I-26. This document provides an overview of existing available information, discussion of conditions observed during a visit to the bridge site, and an overall assessment and recommendations for this structure as it relates to this project's planning efforts. Based on these factors described in this report, the recommendation is **rehabilitation**.

SCOPE OF SERVICES SUMMARY

A non-intrusive visual assessment of the SC202 Bridge over I-26 was conducted in order to identify items that will need to be addressed during the construction phase of the I-26 widening project. This report is based on the visual assessment, the most recent Bridge Inspection Report, the most recent Structure Inventory and Appraisal Report, and plans for the existing bridge. STV did not conduct an inspection similar to the biennial bridge inspection, did not generate any calculations in regard to the condition of the existing bridge, and did not generate any load rating calculations.



Figure 1 - Existing Bridge (looking north)



Figure 2 - Existing Bridge (looking west)

EXISTING BRIDGE INFORMATION

The existing bridge is a four (4) span, simply supported prestressed concrete beam structure with an overall length of 239'-0" (measured along the centerline of the roadway). The existing bridge width is 33'-6". The substructure consists of concrete caps and columns on spread footings for the interior bents and concrete cap on timber piling for the end bents.

Bridge:	SC202
Over:	Over I-26
Bridge ID:	0003640020200100
Type:	Prestressed Concrete Beams with Concrete Deck and Substructure
Year Built:	1959 (stamped on bridge parapet)
Spans:	63'-0", 63'-0", 63'-0", 50'-0" (taken from construction documents)
Width:	33'-6" (taken from construction documents)
Skew:	10°-00' (taken from construction documents)
Design Methodology:	
Code:	AASHTO 1953 with revisions through 1955 (taken from construction documents)
Live Load:	AASHTO H20-S16-44 (taken from construction documents)
Seismic:	No mention of seismic design in construction documents



Figure 3 - Existing Bridge Layout

BRIDGE TYPICAL SECTION

The existing bridge typical section consists of a 28'-0" roadway width (gutter-gutter). Currently, two 11'-0" travel lanes exist, one in each direction, with 3' shoulders on each side. There are 2'-6½" tall concrete railings with guardrail attached on both sides of the deck. The total out-to-out bridge width is 33'-6".

DECK

The existing deck thickness is approximately 6½" per the construction documents.

CONCRETE BEAMS

The superstructure is made up of five (5) prestressed concrete beams spaced at 6'-6".

EXPANSION JOINTS

There are three deck expansion joints located within the bridge. They are located at Interior Bent 2, Interior Bent 3, and Interior Bent 4.

DIAPHRAGMS

The superstructure has intermediate concrete diaphragms. The semi-integral end bent serves as the end diaphragm.

LIGHTING

The existing bridge has no overhead lighting.

DRAINAGE

Deck drains are located on each side of the existing deck. The deck drains discharge directly below to the existing shoulders.

BEARINGS

Based on original bridge plans, the existing bearings at the interior bents are rocker bearings.

END BENTS

The existing end bents consist of a concrete cap on timber piling with concrete end walls (semi-integral end bents).

INTERIOR BENTS

The interior bents consist of a concrete cap and concrete columns on concrete spread footings.

SIGNS

There is a directional exit sign attached to the existing bridge above the westbound lanes of I-26.

TRAFFIC COUNTS

ADT (2015)	2200
ADT (2035)	3212
ADTT (2015)	110 (5%)

II. BRIDGE ASSESSMENT PHYSICAL CONDITION

GENERAL

STV Incorporated performed a visual assessment on September 19, 2016. The assessment was performed in order to determine the physical condition of the existing structure and to identify items that will need to be addressed during the construction phase of the I-26 widening project. Accessible areas were visually assessed from either above or below without the aid of ladders, man lifts, etc. The roadway was not closed during the visual assessment.

SUPERSTRUCTURE CONDITION

DECK

The existing reinforced concrete deck was observed from the shoulder since the roadway wasn't closed. Overall, the bridge deck shows little deterioration. However, there are large areas that have been repaired, so there is potential deterioration that is not visible due to the repairs. The most recent Bridge Inspection Report documents that the deck was patched in 2011. The concrete end walls showed very little deterioration.

CONCRETE BEAMS

The existing prestressed concrete beams were assessed from accessible areas on the ground for deterioration and cracks. No deterioration or cracks were observed from the ground. The most recent Bridge Inspection Report does document some cracking and delamination in the ends of the beams, including some diagonal cracking and spalling.



Figure 4 - Deck



Figure 5 – Superstructure (from underneath)

DIAPHRAGMS

The intermediate and end diaphragms (semi-integral end bents) were visually assessed from accessible areas and no deterioration was observed.

BEARINGS

A small portion of the end bent bearings were visible due to the semi-integral end bent and very little deterioration was observed. The exterior bearings showed more deterioration than the interior bearings at the end bents. The interior bent bearings were not accessible from short distance, but were viewed from the ground and appeared to be in a medium state of deterioration with moderate corrosion.



Figure 6 – End Bent Bearings



Figure 7 – Interior Bent Bearing

EXPANSION JOINTS

There are three deck expansion joints located within the bridge. They are located at Interior Bent 2, Interior Bent 3, and Interior Bent 4. All three expansion joints were observed from the shoulders due to the roadway not being closed. The joint filler is starting to fall through the opening at several locations. Where the joint filler hasn't fallen through, the material is in a moderate state of deterioration.



Figure 8- Expansion Joint

BRIDGE RAILING

The bridge railing (Figures 9 and 10) is a concrete railing on a concrete curb with guardrail attached to it and showed minimal signs of deterioration.



Figure 9 – Bridge Railing (from above)



Figure 10 – Bridge Railing (Road Face)

SUBSTRUCTURE CONDITION

INTERIOR BENTS

The interior bents are showing signs of deterioration in a few locations. There is a horizontal crack in one of the caps (see Figure 11) and a spall in one of the columns (see Figure 12). The most recent Bridge Inspection Report documents these two items and some additional cracking in the columns.



Figure 11 – Horizontal Crack in Bent Cap



Figure 12 – Spall in Column

END BENTS

The end bent caps show minimal signs of deterioration. Some of the end bent wing walls have wide, full-width cracks (see Figure 13).



Figure 13 – Crack in Wing Wall

UTILITIES

The conduit running between beams for the length of the bridge shows signs of deterioration. Additionally, wires from the conduit are hanging loose and an object the wires are connected to is laying on the ground (see Figures 14 thru 16).



Figure 14 – Conduit Corrosion



Figure 15 – Hanging Wires



Figure 16 – Utility Object on Ground

CLEARANCES

HORIZONTAL CLEARANCE

The horizontal clearance between the faces of the columns underneath the bridge (Spans 2 and 3) is approximately 59.0'± for I-26 EB and approximately 61.0'± for I-26 WB per the construction documents. The exit (deceleration) lane on I-26 WB is in a taper underneath the bridge, so the horizontal clearance under the bridge for the WB lane varies. There are currently two (2) lanes of thru traffic under each of these two spans and an entrance (acceleration) lane on I-26 EB and an exit (deceleration) lane on I-26 WB. Adding a lane in each direction under the bridge will leave a total of approximately 11.0'± (I-26 EB) and approximately 13.0'± to 15.0'± (I-26 WB) for shoulders and pier protection between the column faces in each direction. The 11.0'± and 13.0'± to 15.0'± dimensions were verified during the field investigation.

VERTICAL CLEARANCE

The posted minimum vertical clearance under the existing bridge is 15'-8" (I-26 WB) which does not meet the 16'-0" minimum specified for freeway under existing overpassing bridges in the SCDOT Highway Design Manual. The posted vertical clearance under the existing bridge on I-26 EB is 16'-10".



Figure 17 - Vertical Clearance

In the reports for other bridges that are the same age, a statement is made that this age likely puts it at or near the end of its design life. Should the same statement be made here?

OTHER FACTORS

STRUCTURE INVENTORY AND APPRAISAL (SI&A) REPORT

In the most recent SI&A Report, this bridge has a sufficiency rating of 85.7 and is not classified as structurally deficient or functionally obsolete.

INSPECTION REPORT

The most recent Bridge Inspection Report documents the crack in the bent cap and the spall in the examination in various members of the bridge.

Does this include the roadway approach work? Typ. all reports.

and is 57 years old. However, as discussed below, this structure appears to be in good condition overall and its useful life can be extended by rehabilitation.

OPTIONS

The two options to consider for this bridge are replacement and rehabilitation. Rehabilitation for this existing SC 202 bridge would consist of bearing replacement, joint replacement, crack/spall repairs (both specific as referenced in this report and general), wing wall repair, utility repairs, a potential closed drainage system, and either permanently raising the bridge (and likely a portion of the roadway approaches) or undercutting I-26 to achieve the required vertical clearance. The estimated cost of rehabilitating this bridge is approximately \$410,000. The estimated cost of replacing this bridge is approximately \$2.0 million.

Does the replacement cost include the roadway approaches. Also does it include non-construction items such as design and R/W? Typ. all reports.

III. RECOMMENDATIONS

The objective of this report is to assess the bridge from a structural perspective and make a recommendation based on this assessment. With that as the basis, the recommendation for this bridge is **Rehabilitation**. This recommendation is based on the following factors:

- Sufficiency rating of 85.7
- Bridge not deemed structurally deficient or functionally obsolete in most recent SI&A Report
- Major bridge elements show small amounts of deterioration and repairing these elements is feasible
- Although designed for a truck that is not the current design truck, the traffic and truck counts are low and the bridge has held up well through the years
- Although the bridge is not designed for current seismic design requirements, the bridge could potentially be modified for seismic purposes

Structural items that need attention during rehabilitation include:

- Raise bridge permanently or undercut I-26 WB lanes to achieve required vertical clearance
- Bearing replacement
- Joint replacement
- Crack repair – interior bent
- Spall repair – column
- General crack, spall, etc. repairs throughout bridge
- Wing wall repair
- Utility repair
- Potential addition of closed drainage system
- Potential seismic modifications

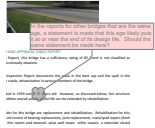
Non-structural items, listed as follows, were not considered as part of this recommendation, but could be considered on a project-wide level (compared to structural consideration only) where they may have some impact on decision-making:

- Limited width for I-26 shoulders and pier protection when I-26 is widened
- Lane and shoulder width on SC202 does not meet current requirements
- Age
- Aesthetics and the general appearance of the corridor (i.e., if the majority of bridges in this corridor are being replaced, is it effective to have one location with substandard shoulder widths, different configuration, etc.?)

Based on the age of the bridge and the fact that it has a few items that require attention, it will be important to continue the routine bridge inspections.

Markup Summary

4 Closed (3)



Subject: STRUCTURES

Author: BowersBW

Lock: Unlocked

Page Label: 14

Status:

1 Submitted set by BowersBW on 2/14/2017 at 2:37:19 PM

3 Resolved, Not Yet Implemented set by BowersBW on 3/2/2017 at 1:08:19 PM

4 Closed set by LiHongfen on 5/11/2017 at 1:33:32 PM

Date: 2/14/2017 2:15:24 PM

In the reports for other bridges that are the same age, a statement is made that this age likely puts it at or near the end of its design life. Should the same statement be made here?



Subject: Re: STRUCTURES

Author: Joe Dichak

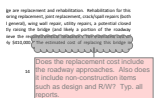
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Page Label: 14

Status:

Date: 2/28/2017 10:16:22 AM

Yes, statement can be added for this site.



Subject: STRUCTURES

Author: BowersBW

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Page Label: 14

Status:

1 Submitted set by BowersBW on 2/14/2017 at 2:37:23 PM

2 Unresolved set by BowersBW on 3/2/2017 at 1:11:56 PM

3 Resolved, Not Yet Implemented set by BowersBW on 3/15/2017 at 12:34:06 PM

4 Closed set by LiHongfen on 5/11/2017 at 1:35:15 PM

Date: 2/14/2017 2:04:07 PM

Does the replacement cost include the roadway approaches. Also does it include non-construction items such as design and R/W? Typ. all reports.



Subject: Re: STRUCTURES

Author: Joe Dichak

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Status:

Date: 2/28/2017 10:16:47 AM

The replacement cost estimate only includes bridge construction cost. Roadway construction, design, and right-of-way costs are not included in this number.



Subject: Re: Re: STRUCTURES

Author: BowersBW

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Status:

Date: 3/2/2017 1:20:09 PM

The estimated cost should include design, all necessary approach work, and right-of-way. Typ. for all reports.



Subject: Re: Re: Re: STRUCTURES

Author: Joe Dichak

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Status:

Date: 3/9/2017 1:00:47 PM

We will update all estimates to include all costs mentioned in the comments.

INSPECTION REPORT
The most recent Bridge Inspection Report documents the condition of the bridge. The report includes information on the bridge's condition, including the bridge's approach, and a list of items that need to be repaired or replaced. The report also includes a list of items that need to be repaired or replaced, and a list of items that need to be repaired or replaced.

Subject: STRUCTURES

Author: BowersBW

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2 Unresolved set by BowersBW on 3/2/2017 at 1:09:35 PM

3 Resolved, Not Yet Implemented set by BowersBW on 3/15/2017 at 12:33:51 PM

4 Closed set by LiHongfen on 5/11/2017 at 1:35:32 PM

Date: 2/14/2017 2:02:15 PM

Does this include the roadway approach work?
Typ. all reports.

Subject: Re: STRUCTURES

Author: Joe Dichak

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Status:

Date: 2/28/2017 10:16:29 AM

A small amount is included for roadway approach work. It assumes some wedging and some minor shoulder grading, not much more.

Subject: Re: Re: STRUCTURES

Author: BowersBW

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Status:

Date: 3/2/2017 1:19:59 PM

The estimated cost should include all necessary approach roadway work. Typ. for all reports.

Subject: Re: Re: Re: STRUCTURES

Author: Joe Dichak

Lock: Unlocked

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Status:

Date: 3/9/2017 1:00:13 PM

We currently assume a slight raising of the bridge as part of the rehabilitation option, which would require wedging and shoulder upgrades on the roadway approaches. We included cost for this work in the estimate, but will re-visit the cost of the roadway approach work and update the numbers, if they are different, based on our findings. Additionally, we will update the cost estimates to include design costs for any roadway work.