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I-26 Bridge Assessments

Richland County, South Carolina

Bridge Assessment Report for Mt. Vernon Church Road (S-40-234) over I-26

**Prepared for:
The South Carolina Department of Transportation**



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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 Mt. Vernon Church Road over I-26 in Richland 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 **replacement**.

SCOPE OF SERVICES SUMMARY

A non-intrusive visual assessment of the Mt. Vernon Church Road 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 south)



Figure 2 - Existing Bridge (looking west)

EXISTING BRIDGE INFORMATION

The existing bridge is a four (4) span, simply supported reinforced concrete beam structure with an overall length of 215'-0" (measured along the centerline of the roadway). The existing bridge width is 31'-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:	Mt.Vernon Church Road (S-40-234)
Over:	Over I-26
Bridge ID:	0004070023400100
Type:	Reinforced Concrete Beams with Concrete Deck and Substructure
Year Built:	1959 (stamped on bridge parapet)
Spans:	50'-0", 55'-0", 55'-0", 55'-0" (taken from construction documents)
Width:	31'-6" (taken from construction documents)
Skew:	2°-02' (taken from construction documents)
Design Methodology:	
Code:	AASHTO 1953 with revisions through 1955 (taken from construction documents)
Live Load:	AASHTO H15-S12-44 (taken from construction documents)
Seismic:	No mention of seismic design in construction documents

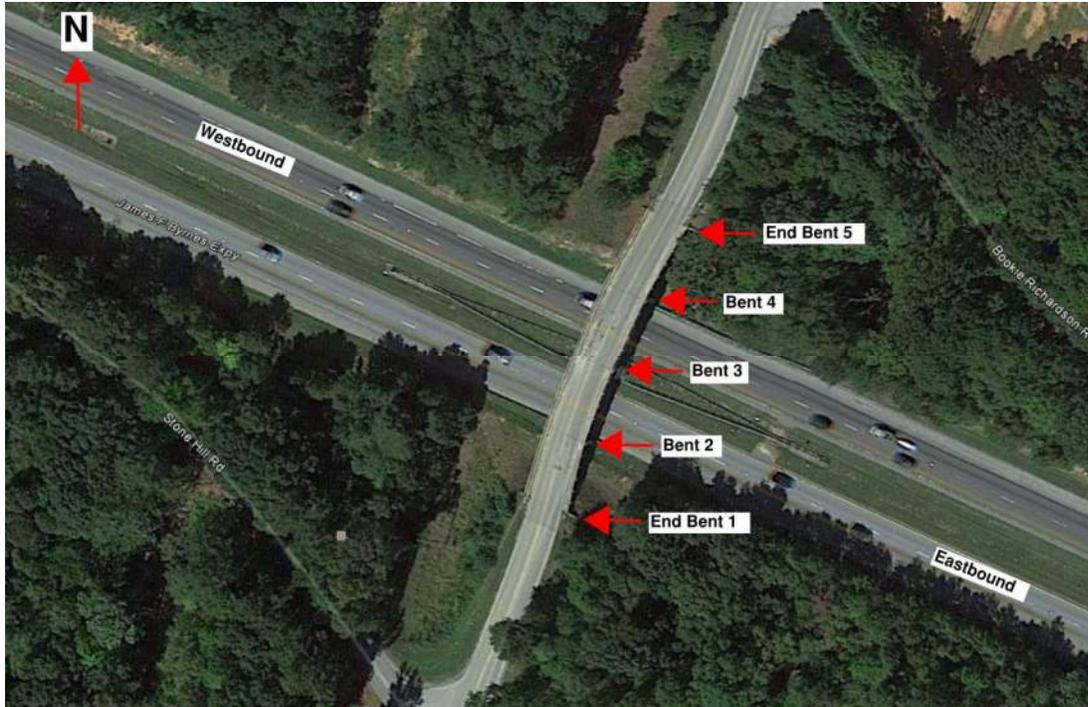


Figure 3 - Existing Bridge Layout

BRIDGE TYPICAL SECTION

The existing bridge typical section consists of a 26'-0" roadway width (gutter-gutter). Currently, two 10'-0" travel lanes exist, one in each direction, with 3' shoulders on each side. There are 2'-6½" tall concrete railings on both sides of the deck. The total out-to-out bridge width is 31'-6".

DECK

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

CONCRETE BEAMS

The superstructure is made up of four (4) reinforced concrete beams spaced at 7'-10".

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 bearing pads at the interior bents are 1" thick neoprene pads.

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 are no signs located on the existing bridge. There is an electronic "Weigh Station" sign with an accompanying electrical box underneath the existing bridge, but neither are attached to the bridge.

TRAFFIC COUNTS

ADT (2015)	2800
ADT (2035)	4928
ADTT (2015)	168 (6%)

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 (see Figure 4). There are several areas on the deck where concrete has spalled off and the reinforcing steel is exposed and corroded (see Figure 5). Additionally, there are patched areas of the bridge deck that potentially conceal corroded rebar. The most recent Bridge Inspection Report documents that 56% of the deck is delaminated and has minor spalls. The concrete end walls showed very little deterioration.

CONCRETE BEAMS

The existing reinforced 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 documents some flexural cracking at mid-span of most beams, additional cracking, some diagonal, near the bearings, and collision damage in one of the beams.



Figure 4 – General View of Deck



Figure 5 – Exposed Rebar in Concrete Deck



Figure 6 – Superstructure (from underneath)

DIAPHRAGMS

The intermediate and end diaphragms (semi-integral end bents) were visually assessed from accessible areas and no deterioration was observed. The most recent Bridge Inspection Report documents minor hairline cracks in the diaphragms.

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.

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. Each has been covered with asphalt and there are cracks in the asphalt at the joints. 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.

BRIDGE RAILING

The bridge railing (Figure 7) is a concrete railing on a concrete curb and showed minimal signs of deterioration.



Figure 7 – Bridge Railing

SUBSTRUCTURE CONDITION

INTERIOR BENTS

The interior bents are showing minor signs of deterioration. A repaired area has some web cracking (see Figure 8). The most recent Bridge Inspection Report documents additional cracking and repairs in the caps and columns.



Figure 8 – Repaired Area in Cap

END BENTS

The end bent caps show minimal signs of deterioration. The most recent Bridge Inspection Report documents minor spalls in wing walls and headwalls that have been patched.

UTILITIES

No utilities were observed on/attached to the bridge, but there is what appears to be an electrical box and a "Weigh Station" sign in close proximity to Interior Bent 3 (median bent) (see Figure 9).



Figure 9 – Electrical Box near Interior Bent 3

CLEARANCES

HORIZONTAL CLEARANCE

The horizontal clearance between the faces of the columns underneath the bridge (Spans 2 and 3) is approximately 51.9'± per the construction documents. There are currently two (2) lanes of thru traffic under each of these two spans. Adding a lane in each direction under the bridge will leave a total of approximately 15.9'± for shoulders and pier protection between the column faces in each direction. The 15.9'± dimension was verified during the field investigation.

VERTICAL CLEARANCE

The posted minimum vertical clearance under the existing bridge is 15'-5" (I-26 EB) 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 WB is 16'-0".



Figure 10 - Vertical Clearance (I-26 EB)

OTHER FACTORS

STRUCTURE INVENTORY AND APPRAISAL (SI&A) REPORT

In the most recent SI&A Report, this bridge has a sufficiency rating of 71.2 and is not classified as structurally deficient, but is classified as functionally obsolete.

INSPECTION REPORT

The most recent Bridge Inspection Report documents general cracking, spalling, and delamination in various members of the bridge.

AGE

This bridge was constructed in 1959 and is 57 years old. This age likely puts it at or near the end of its design life.

OPTIONS

The two options to consider for this bridge are replacement and rehabilitation. Rehabilitation for this existing Mt. Vernon Church Road Bridge would consist of deck replacement, bearing replacement, joint replacement, crack/spall repairs, a potential closed drainage system, and permanently raising the bridge (and likely a portion of the roadway approaches) to achieve the required vertical clearance. Also, since the beams are monolithic with the deck, the beams would likely be replaced as part of a bridge rehabilitation. The estimated cost of rehabilitating this bridge is approximately \$890,000. The estimated cost of replacing this bridge is approximately \$3.2 million. Both estimated costs (rehabilitation and replacement) include design and construction costs for the bridge and roadway approaches.

Note: In regard to the deck replacement, in order to meet current requirements, the minimum deck thickness would need to be 8" which is 1½" thicker than what is shown on the existing plans. It is unknown if the existing beams and substructure could support an additional 1½" of deck thickness. The \$890,000 rehabilitation cost mentioned above allots for a 6½" deck thickness for the deck replacement.

If meeting the current 8" minimum thickness is required, analysis of existing beams and substructure, which is not included in the rehabilitation cost mentioned above, would be needed.

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 **Replacement**. This recommendation is based on the following factors:

- Sufficiency rating of 71.2
- Bridge deemed functionally obsolete in most recent SI&A Report
- Collision damage has occurred in one of the exterior beams
- 56% of the deck is delaminated and has spalls. Some locations have exposed rebar. Deck replacement is necessary and would be costly, especially if new deck needs to meet current thickness requirements and beams and substructure would need to be analyzed to see if they can support the extra deck thickness.
- Since beams are monolithic with deck, beams would likely be replaced
- Beams have both flexural and shear cracks in multiple locations
- Joints, bearings, vertical clearance would all be improved to meet current requirements
- New bridge can be designed for current live load requirements
- New bridge can be designed for current seismic requirements

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 enhance the replacement option:

- Limited width for I-26 shoulders and pier protection when I-26 is widened would not be an issue with a bridge replacement
- Lane and shoulder width on Mt. Vernon Church Road would be updated to meet current requirements with a bridge replacement
- The age of the bridge would not be a factor with a bridge replacement
- Aesthetics and the general appearance of the corridor would be improved with a bridge replacement