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I-26 Bridge Assessments

Lexington County, South Carolina

Bridge Assessment Report for Peak Street (S-32-49) 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 Peak Street over I-26 in Lexington 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 Peak Street 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 structural steel wide flange beam structure with an overall length of 284'-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:	Peak Street (S-32-49)
Over:	Over I-26
Bridge ID:	0003270004900200
Type:	Structural Steel Wide Flange Beams with Concrete Deck and Substructure
Year Built:	1959 (stamped on bridge parapet)
Spans:	60'-0", 82'-0", 82'-0", 60'-0" (taken from construction documents)
Width:	31'-6" (taken from construction documents)
Skew:	45°-00' (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 with guardrail attached 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.

STEEL BEAMS

The superstructure is made up of four (4) structural steel wide flange beams spaced at 8'-0".

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 steel 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 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 are no signs located on the existing bridge.

TRAFFIC COUNTS

ADT (2015)	1400
ADT (2035)	2464
ADTT (2015)	84 (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 80% of the deck is delaminated and the deck has significant cracking, spalls, and scaling, some of which has been repaired. The concrete end walls showed very little deterioration.

STEEL BEAMS

The existing steel beams were assessed from accessible areas on the ground for deterioration. Minor deterioration was observed from the ground. The most recent Bridge Inspection Report documents that the steel beams were re-painted but metal loss and minor corrosion still exists.



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 minor deterioration was observed. The most recent Bridge Inspection Report documents moderate/heavy corrosion on the intermediate steel diaphragms.

BEARINGS

A portion of the end bent bearings were visible due to the semi-integral end bent and moderate/severe corrosion was observed (see Figure 7). 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 moderate/severe state of deterioration with heavy corrosion (see Figure 8). The most recent Bridge Inspection Report documents moderate/heavy rust on bearings and some missing anchor bolt nuts.



Figure 7 – End Bent Bearing



Figure 8 – 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 material is in a moderate state of deterioration.

BRIDGE RAILING

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



Figure 9 – Bridge Railing

SUBSTRUCTURE CONDITION

INTERIOR BENTS

The interior bents are showing minor signs of deterioration. Figure 10 shows a crack in one of the interior bent caps. The most recent Bridge Inspection Report documents hairline cracks and minor spalls in caps and hairline cracks and minor spalls in columns, some of which have been patched.



Figure 10 – Crack in Interior Bent Cap

END BENTS

The end bent caps show minimal signs of deterioration. One of the wing walls had a large chunk missing (see Figure 11). The most recent Bridge Inspection Report documents minor spalls with rebar exposed at End Bent 1.



Figure 11 – End Bent Wing Wall

UTILITIES

Two conduits are located in an exterior bay and run the entire length of the bridge (see Figure 12). At the end of the conduit, the wires go underground near the end bent (see Figure 13). The wooden slats that help support the conduits were all in place, but there is probably a more stable support system that could be used (see Figures 14 and 15).



Figure 12 – Conduit under Bridge



Figure 13 – Utilities going underground near End Bent



Figure 14 – Wooden Slats supporting Conduit



Figure 15 – Wooden Slat has fallen off the Beam

CLEARANCES

HORIZONTAL CLEARANCE

The horizontal clearance between the faces of the columns underneath the bridge (Spans 2 and 3) is approximately $54.2' \pm$ 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 $18.2' \pm$ for shoulders and pier protection between the column faces in each direction. The $18.2' \pm$ dimension was verified during the field investigation.

VERTICAL CLEARANCE

The posted minimum vertical clearances under the existing bridge are 15'-5" (I-26 WB) and 15'-10" (I-26 EB), neither of which meets the 16'-0" minimum specified for freeway under existing overpassing bridges in the SCDOT Highway Design Manual.



Figure 16 - Vertical Clearance (I-26 WB)

OTHER FACTORS

STRUCTURE INVENTORY AND APPRAISAL (SI&A) REPORT

In the most recent SI&A Report, this bridge has a sufficiency rating of 56.8 and is not classified as structurally deficient or functionally obsolete.

INSPECTION REPORT

The most recent Bridge Inspection Report documents general cracking, spalling, delamination, and moderate/heavy corrosion 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 Peak St. bridge would consist of deck replacement, bearing replacement, joint replacement, crack/spall repairs, 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 \$1.06 million. The estimated cost of replacing this bridge is approximately \$3.7 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 \$1.06 million 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 56.8
- 80% of the deck is delaminated and there are numerous locations on the deck where the concrete has spalled off and rebar is exposed. 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.
- 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 Peak Street 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