Bridge Rehabilitation Requirements

1. GENERAL BRIDGE REHABILITATION REQUIREMENTS

For non-interstate route overpassing bridges that are retained, the "required bridge rehabilitations" provided herein and indicated in Table 1 are the minimum requirements. The Contractor is responsible for making an independent determination on structure needs for rehabilitation, quantifying all required rehabilitation, and submitting proposed rehabilitation to SCDOT for approval.

All bridge rehabilitation shall comply with the requirements of the Technical Provisions and Chapter 23 of the SCDOT Bridge Design Manual. The Contractor is responsible for submitting an updated load rating for all retained bridges per SCDOT's Load Rating Guidance Document and applicable Load Rating Technical Notes.

In addition to the requirements listed in Table 1, final finish requirements for all retained bridge components shall be in accordance with TP Section 700.4.1.2 and Section 702.4.11 of the SCDOT Standard Specifications.

2. BRIDGE DECK REPLACEMENT / REPAIR AND OVERLAY

~~Bridge deck repairs shall be in accordance with Section 702.4.10 of the SCDOT Standard Specifications. Cracks shall be repaired in accordance with Section 702.4.9 of the SCDOT Standard Specifications.~~

~~The Contractor is responsible for performing concrete cores to determine the chloride concentration in the existing concrete deck. 500 ppm shall be used as a threshold for determining what depth of concrete will be removed. If more than half of the deck thickness requires removal, a full-depth replacement is required.~~

~~For bridge decks requiring latex concrete deck overlay, remove the top 1½" of the existing deck concrete using mechanical and/or hydro-demolition techniques. The Contractor shall perform chloride ion testing to confirm that the chloride concentration at a depth of 1 ½" does not exceed the threshold of 500 ppm. Mechanical scarification of existing decks is limited to the top one inch, with the remainder requiring hydro-demolition. See TP Section 1000 Special Provisions for Hydro-Demolition of Existing Surface. Place latex modified concrete (LMC) overlay to restore the original deck grade and cross-slope in accordance with Section 726 of the Standard Specifications and TP Section 1000 Special Provisions. LMC is the only allowable overlay type unless a full-depth deck replacement is required.~~

~~Where sound concrete is not bonded to the top mat of reinforcing steel as determined by the RCE, perform partial-depth deck repairs by removing deck concrete to a minimum depth of ¾" below the top mat of reinforcing. Prior to removing deck concrete, the Contractor shall perform chloride ion testing to confirm that the chloride concentration at the specified depth does not exceed the threshold of 500 ppm. Use latex modified concrete for partial depth repair areas and place at the same time as placement of the LMC overlay.~~

~~Where full depth deck repairs are required by the RCE, use either LMC or Class 4000 concrete from the bottom of exiting deck to the bottom limit of hydro-demolition. Full-depth replacement is required if chloride ion testing indicates that the chloride concentration at a depth of half of the thickness of the deck exceeds the threshold of 500 ppm. Use LMC overlay for the remainder of the deck.~~

~~Blast clean all exposed reinforcing steel prior to concrete placement.~~

~~Staging of the deck repairs shall be set up such that no load (traffic loading, construction loading, barrier wall, etc.) is placed within a bay/beam space that has any portion of the deck removed.~~

Decks requiring replacement are included in Table 1. Decks being retained but repaired are also included in Table 1. Additional bridges may require deck maintenance in accordance with TP 1000, Special Provisions Section 104.

SCDOT has performed deck evaluations on Asset ID 7937 (S-40-31 (Bush River Road) over I-26), Asset ID 7272 (S-40-273 (Bush River Road) over I-20), and Asset ID 7586 (S-40-36 (St. Andrews Road) over I-26). Quantities associated with the anticipated repairs, if these bridges are not replaced as part of the Contractor's Work, on these~~is~~ bridges are included in Tables 4, 5, and 6. Evaluation reports are included in Appendices~~x~~ A, B, and C.

Mechanical scarification of existing decks is limited to the top 1" of the deck.

Staging of the deck repairs shall be set up such that no load (traffic loading, construction loading, barrier wall, etc.) is placed within a bay/beam space that has any portion of the deck removed.

Full depth deck repairs are not anticipated. The Contractor shall notify the RCE if condition of concrete may warrant a full depth repair for investigation. If the depth of a partial deck repair is greater than half of the thickness of the concrete deck, a full depth repair may be needed.

2.1 Partial Deck Repairs with Overlay

Bridge deck repairs for spalling or delaminated concrete deck shall be in accordance with Section 702.4.10 of the SCDOT Standard Specifications, except as modified herein, or with Section 726 of the SCDOT Standard Specifications and TP 1000, Special Provisions Section 726, except as modified herein. Cracks shall be repaired in accordance with Section 702.4.9 of the SCDOT Standard Specifications, except as modified herein. Repair cracks greater than 1/8" wide using an injected epoxy adhesive, meeting the requirements of ASTM C881.

For bridge decks requiring partial depth latex modified concrete (LMC) deck repair and overlay, see TP 1000, Special Provisions Section 726. Use LMC for partial depth repair areas and place at the same time as placement of the LMC overlay. The depth of a partial

deck repair shall not exceed half the depth of the existing deck and shall be determined during the execution of the Work.

Replace all reinforcing steel damaged during concrete removal. Provide uncoated reinforcing steel in accordance with the SCDOT Supplemental Specification for Reinforcing Steel. After blast cleaning and prior to concrete placement, paint the existing concrete sides of the patch with a SCDOT approved, moisture insensitive epoxy bonding compound conforming to Section 702.4.8 of the Standard Specifications and ASTM C881.

2.2 LMC Overlay Only

Place LMC overlay to restore the original deck grade and cross-slope in accordance with Section 726 of the Standard Specifications and TP 1000, Special Provisions Section 726. LMC is the only allowable overlay type. A LMC overlay shall also be placed on portions of bridge decks where no partial depth deck repair is being performed. The depth of the LMC overlay shall be a minimum of 1½".

2.3 Full Depth Deck Replacement (if necessary)

Where full depth deck repairs are required by the RCE, use either LMC or Class 4000 concrete from the bottom of exiting deck to the bottom limit of hydro-demolition. Full depth replacement is required if deteriorated concrete is discovered at a depth over half of the thickness of the deck. Use LMC overlay for the remainder of the deck.

~~2.1~~ 2.4 Bridge Deck Drainage

At any existing bridge where deck repairs are performed and deck drains are to remain in the existing location, form sloped recess at deck drain locations as shown in the drain details on existing plans. Repair or replace damaged deck drain components.

As necessary for retained drain locations at any existing bridge that is retained, modify or add closed drainage system to prevent free-falling discharge from spilling onto the new shoulders, lanes, or onto concrete barrier walls.

Any new components of the bridge drainage systems shall comply with the requirements of the TP Section 700.3.1.16.

Where existing drains are abandoned due to widening of the bridge or eliminating the drain location, remove the drainpipe and surrounding concrete as necessary and perform full depth concrete patch as described in section titled “Bridge Deck Repair” in this TP Attachment.

3. JOINT REPLACEMENT

Joint seal replacement will require complete replacement of the joint seal between exiting armor plates. Joint seal is to be sized to accommodate the existing joint opening and the movements noted on the joint sheets in the existing plans.

Full joint replacement will consist of complete replacement of all joint hardware in conjunction with the specified deck repairs. Provide a joint opening and type in accordance with the BDM to accommodate movements as required by the BDM Section entitled "Design Thermal Movement" based on the bearing arrangement in the final proposed condition of the bridge.

4. BRIDGE RAIL REPLACEMENT

Where deck replacement is required, the Contractor shall provide new bridge barrier in accordance with TP Section 700.3.1.15. The requirements of DM0119 shall apply for this project.

5. BRIDGE RAIL REPAIR

Perform crack and spall repair in accordance with standard specifications and the repair notes below. Concrete crack repairs in bridge rail are required if cracks are over 1/4" in width (regardless of crack length) or if cracks are over 0.012" in width and over 6' in length. Concrete spall repairs in bridge rail are required if the surface area of the existing spall or delaminated area is over 5 square feet or if the spall is over 1" deep and/or has exposed reinforcement (regardless of spall area). Deficiencies in the concrete bridge rail shall be assessed and measured by a Professional Engineer with hands-on access to the bridge element and confirmed by the RCE.

Standard Repair Notes:

A. Outline the defective areas and verify depth of concrete cover over reinforcing steel. Saw-cut the outlined areas to a minimum depth of 1 ½", if possible, without cutting any reinforcing steel.
B. Remove all defective and/or delaminated concrete in the outlined areas by use of jackhammers. Limit the maximum size of jackhammers to 15 pounds. Do not damage the vertical sides of the saw-cut during removal. Be careful not to damage any existing reinforcing. Replace all reinforcing steel damaged during concrete removal as part of the repair.
C. Remove concrete to a depth of no less than 1" behind the existing reinforcing steel.
D. Remove all grease, dirt, oil, or foreign material from the patch areas by blast cleaning. Immediately before placing patching material, remove all dust, sand, and blasting debris with oil-free compressed air.
E. Apply an SCDOT approved rust inhibitor to all exposed reinforcing steel. Ensure that the exposed concrete surface is clean and dry. Apply inhibitor in accordance with manufacturer's recommendations.
F. Apply an SCDOT approved epoxy mortar/concrete patch in accordance with ASTM C881. Fill all voids. The material used shall be rated for vertical and overhead use.
G. Apply an SCDOT approved epoxy surface sealer to the perimeter of the repaired area.

6. BEARING REPLACEMENT ~~/ REPAIR~~

~~Bearing repair shall include sand blasting, priming, and painting all steel bearings, as well as tightening or replacing anchor rod nuts at all bents.~~

~~Where bearing replacement is deemed necessary by the Contractor,~~ All existing bearings shall be replaced ~~existing bearings~~ with elastomeric bearings and sole plates in accordance with the BDM Section titled "Bearing Assemblies" unless otherwise directed in this section. The Contractor shall identify which types of bearings are to be installed for SCDOT approval. Pot bearings may be required to limit lateral loads on existing substructures. For a height difference between existing and proposed bearings less than 6 inches, the difference in height can be accommodated with extra thick sole plate(s) between the top of concrete beam seat and the bearing. For height differences greater than or equal to 6 inches, use plates or a steel column comprised of an HP or similar steel section and place reinforced concrete to extend the concrete beam seat up to the bottom of the elastomeric bearing. Exiting anchor bolts may be used if design allows; confirm size location and condition of existing anchor bolts prior to incorporating into the design. If new anchor bolts are required, cut off existing anchor bolts and provide new anchor bolts sized in accordance with the BDM and attached to existing concrete in accordance with the requirements for adhesively bonded anchors in the TP Section 1000 Special Provisions.

Where bridge jacking for bearing replacement is done while under traffic, size the jacks to carry the dead load of the structure plus the anticipated live load during construction. If bridge is to be raised for a duration longer than six hours, use temporary supports instead of jacks. Jack all beams simultaneously in a manner that prevents permanent deformation and/or structural damage to the existing bridge components or any appurtenances attached to the bridge. Utilize temporary asphalt as necessary to limit the vertical elevation difference while bridge is elevated on jacks.

Submit working drawings and calculations for the bridge jacking procedures (including design of bridge jacking system and evaluation of existing bridge components during the jacking process and in final condition) along with the shop drawings for the bearings and bearing assembly hardware in accordance with requirements of this Technical Provision Attachment.

Bridge end walls should be chipped as necessary to remove existing bearing assemblies including room to fully remove metal shims and the bearing plates that may be welded to the existing girder and to install new bearings. If portions of the end walls were removed, the exposed concrete shall be patched according to the following procedure.

A. Remove all grease, dirt, oil, or foreign material from the patch areas by blast cleaning. Immediately before placing patching material, remove all dust, sand, and blasting debris with oil-free compressed air.
B. Apply an SCDOT approved rust inhibitor to all exposed reinforcing steel. Ensure that the exposed concrete surface is clean and dry. Apply inhibitor in accordance with manufacturer's recommendations.
C. Apply an SCDOT approved epoxy mortar/concrete patch in accordance with ASTM C881. Fill all voids. The material used shall be rated for vertical and overhead use.
D. Apply an SCDOT approved epoxy surface sealer to the perimeter of the patch area.

Where new bearings result in loadings on the substructures that are inconsistent with the conditions considered in the original design, perform design calculations to verify the adequacy of the existing substructure and foundation.

The Contractor shall verify the geometry of the new bearing assemblies, including thermal expansion requirements. If necessary, a reinforced concrete corbel shall be installed to extend the bearing area. The corbel shall be designed in accordance with AASHTO LRFD 5.8.4.2. If necessary, vertical chipping may be required to accommodate the new bearing assembly. If needed, a high strength, fast set, non-shrink, non-metallic grout shall be used. The grout shall be factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. The grout shall contain a blend of selected Portland cements, plasticizing/water-reducing admixtures and shrinkage compensating agents. The shrinkage agents shall compensate for shrinkage in both the plastic and hardened states. The grout shall meet the following minimum material properties:

A. Compressive strength at 28 days (ASTM C942): 11,000 psi
B. Bond strength (ASTM C882): plastic grout to hardened concrete
    a) At 28 days: 2,500 psi.
    b) At 1 day: 1,800 psi.
C. Grout material must be suitable for grouting level pads.
D. Final set shall occur within 1 hour.

~~At locations where cleaning and painting of existing steel bearings is specified and the bridge is raised to achieve appropriate vertical clearance, replace the steel bearings with new bearings meeting the requirements of this section.~~

7. SUPERSTRUCTURE REPAIR

Minimum quantities of superstructure repairs are included in Table 3.

7.1 Prestressed Concrete Crack and Beam Spall Repair

Perform crack and spall repair to Prestressed Concrete Beams in accordance with the Standard Specifications and the repair notes in this section. Concrete crack repairs in prestressed concrete beams are required if cracks are over 0.009" in width (regardless of crack length) or if cracks are over 0.004” in width and over 6’ in length. Concrete spall repairs in bridge beams are required if the surface area of the existing spall or delaminated area is over 5 square feet or if the spall is over 1” deep and/or has exposed reinforcement (regardless of spall area). Deficiencies in the prestressed concrete beams shall be assessed and measured by a Professional Engineer with hands-on access to the bridge element and confirmed by the RCE.

Standard Repair Notes:

A. Remove all loose and delaminated concrete to provide a sound bond between existing concrete and repair material. Limit removal to a minimum of 1" beyond the visible deteriorated area to expose sound concrete.

B. Remove deteriorated concrete adjacent to and around the prestressing strands as required to expose sound concrete. Do not damage prestressing strands during concrete removal. Use surface preparation equipment in accordance with the concrete repair specification; however, the weight of pneumatic hammers must not exceed a nominal 15-pound class.

C. Square off deteriorated concrete to sound concrete with a saw cut or grinder. Depth of cut to be a minimum of 1/4", but not to exceed 5/8" or the depth of the reinforcement, whichever is smaller.

D. Clean all existing reinforcement bars to be retained and prestressing strands by mechanical means to near white appearance. Coat existing reinforcement bars and strands with approved bonding compound if no corrosion was present prior to cleaning. Coat existing reinforcement bars and strands with approved galvanized spray containing a minimum of 92% zinc when corrosion was present prior to cleaning.

E. Provide a sound concrete surface with exposed aggregate with a minimum surface profile of 1/8" or as required by repair material manufacturer's recommendations.

F. Drill and insert 3/8" diameter galvanized steel expansion anchor pins on 4" centers for repair areas with depths greater than 3 inches when reinforcement bars are not prevalent (spacing greater than 8"). Locate expansion anchor pins at midpoint of clear spacing between prestressing strands.

G. Apply mechanical anchorage using galvanized 4 X 4-w2.1 X w2.1 min. Welded wire fabric should be tied to existing reinforcement when deteriorated concrete is greater than 1'-0" in any direction. Provide 1" clear distance to limit of removal.

H. Area to be repaired must be clean, sound and free of contaminants prior to application of bonding agent and repair material.

I. Repair cracks in existing concrete after removing deteriorated concrete and prior to constructing concrete repair. Use epoxy injection crack repair in accordance with ASTM C 881 Type 1 Grade 1.

J. Apply an approved bonding agent, as listed in the qualified products listing that is compatible with the approved repair material, unless the manufacturer's instructions expressly state that a bonding agent is not required.

K. Apply a rapid hardening concrete patching material from a manufacturer listed in the qualified products listing under miscellaneous polymer modified and special cements, mortars and concretes, in accordance with manufacturer's instructions.

L. Apply repair material that has a compressive strength equal to or greater than that of the original concrete (if known), but not less than 4,500 psi and 5,500 psi at 7 and 28 days, respectively.

M. Cure repair material in accordance with manufacturer's recommendations for a minimum of 24 hours. Implement additional curing protections in accordance with Section 702, as required.

N. Provide repair material with minimum 200 psi bond strength to the existing concrete as tested in accordance with ASTM D4541 pull-off test.

O. Apply an approved penetrating sealer after repair material has cured in accordance with manufacturer’s recommendations.

7.2 Reinforced Concrete Diaphragm Spall Repair

Perform crack and spall repair in accordance with standard specifications and the repair notes below. Concrete crack repairs in reinforced concrete diaphragms are required if cracks are over 1/4" in width (regardless of crack length) or if cracks are over 0.012" in width and over 6' in length. Concrete spall repairs in the diaphragms are required if the surface area of the existing spall or delaminated area is over 5 square feet or if the spall is over 1" deep and/or has exposed reinforcement (regardless of spall area). Deficiencies in the reinforced concrete diaphragms shall be assessed and measured by a Professional Engineer with hands-on access to the bridge element and confirmed by the RCE.

Standard Repair Notes:

A. Outline the defective areas and verify depth of concrete cover over reinforcing steel. Saw-cut the outlined areas to a minimum depth of 1 ½", if possible, without cutting any reinforcing steel.
B. Remove all defective and/or delaminated concrete in the outlined areas by use of jackhammers. Limit the maximum size of jackhammers to 15 pounds. Do not damage the vertical sides of the saw-cut during removal. Be careful not to damage any existing reinforcing. Replace all reinforcing steel damaged during concrete removal as part of the repair.
C. Remove concrete to a depth of no less than 1" behind the existing reinforcing steel.
D. Remove all grease, dirt, oil, or foreign material from the patch areas by blast cleaning. Immediately before placing patching material, remove all dust, sand, and blasting debris with oil-free compressed air.
E. Apply an SCDOT approved rust inhibitor to all exposed reinforcing steel. Ensure that the exposed concrete surface is clean and dry. Apply inhibitor in accordance with manufacturer's recommendations.
F. Apply an SCDOT approved epoxy mortar/concrete patch in accordance with ASTM C881. Fill all voids. The material used shall be rated for vertical and overhead use.
G. Apply an SCDOT approved epoxy surface sealer to the perimeter of the repaired area.

7.3 Painting of Structural Steel

Clean and paint all steel girders, diaphragms/cross frames, and bearings (where specified) in their entirety. Comply with Section 710 of the Standard Specifications and TP Section 1000 Special Provisions. Comply with all required regulations and/or guidelines associated with the presence of lead containing paints, if present.

7.4 Inspection/Repair of Structural Steel Splices

Inspect all steel girder splices and replace all loose bolts in connections. Replace each loose bolt assembly one at a time unless directed otherwise by the IQM. Make new bolted connections with 7/8" diameter ASTM A325 bolts unless otherwise indicated. Use DTIs and place hardened washers under DTIs. Install hardened washer under the element turned for each bolt of a bolted connection. Prior to performing work,

provide a report summarizing the inspection which indicates which bolts will be replaced for SCDOT concurrence.

7.5 Heat Straightening

Damaged bridge members shall be realigned by heat straightening and may use the concurrent application of auxiliary mechanical means. All heat straightening shall be performed by an approved company and supervised by a Professional Engineer or Heat Straightening Specialist who is thoroughly familiar with and experienced in heat straightening. Provide a work history of previous successful heat straightening repair projects on structural steel of a similar nature, listing the project, owner, and contact references. All repairs shall be done in accordance with the SCDOT Standard Specifications.

A detailed heat straightening and repair procedure shall be submitted to and approved by SCDOT prior to the start of work. The heat straightening procedure shall be prepared in accordance with FHWA report no. FHWA-IF-99-004, "Heat Straightening Repair of Damaged Bridges" as modified by the NCHRP Report 604 "Heat Straightening Repair of Damaged Steel Bridge Girders: Fatigue and Fracture Performance." The procedure shall include, but is not limited to, calculations of stresses resulting from the applied external jacking loads used in the straightening operations; the approximate locations to which heat shall be applied; heat patterns and sequences proposed; general sketches of jacking system to be used; welding procedures; and MT and UT procedures.

The heat applied shall be between 700° and 1150° F, and the temperature shall be monitored by the use of contact thermometers, pyrometric sticks, or temperature indicating crayons. The maximum torch tip size shall be 1-inch diameter. Heat straightening shall be accomplished through the application of V-heat, line heat, or spot heat patterns. The base of a V-heat pattern shall not exceed 10 inches, and the angle formed at the apex shall not exceed 20 degrees. Heating shall be performed in such a manner that the only location showing a dull red color shall be directly under the torch tip. Heating shall start at the apex of the V-heat pattern and progress to the base. A heat pattern shall not be reheated until the area has cooled completely. Heat straightening operations may be assisted by the use of external pre-loading jacking devices. The forces applied through these jacking devices shall be limited such that the stresses in the member prior to heating operations do not exceed 24 ksi for A373 and A7 steels, 27 ksi for A36, 33 ksi for A94, and 37 ksi for grade 50 steels. Protect structural steel from jacking loads with hardwood blocking, bracing, etc. cut to fit, or distribution angles, plates, flat plate come-along hooks, etc.

Final straightness tolerances for plate girders shall meet the straightness requirements in the current edition of the AASHTO/AWS D1.5 Bridge Welding Code, and the final straightness tolerances for rolled beams shall meet straightness requirements in ASTM A6 "Standard Specifications for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

Appropriate sketches, notes and photos shall be prepared to describe the repair at each location in the structure. These records shall be submitted to the RCE at the completion of the project.

8. SUBSTRUCTURE REPAIR

Perform crack and spall repair in accordance with standard specifications and the repair notes below.

Concrete crack repairs in reinforced concrete substructure elements are required if cracks are over 1/4" in width (regardless of crack length) or if cracks are over 0.012" in width and over 6' in length. Concrete spall repairs in substructure elements are required if the surface area of the existing spall or delaminated area is over 5 square feet or if the spall is over 1" deep and/or has exposed reinforcement (regardless of spall area). Deficiencies in the reinforced concrete substructure elements shall be assessed and measured by a Professional Engineer with hands-on access to the bridge element and confirmed by the RCE.

Concrete crack repairs in prestressed concrete substructure elements are required if cracks are over 0.009" in width (regardless of crack length) or if cracks are over 0.004" in width and over 6' in length. Concrete spall repairs in substructure elements are required if the surface area of the existing spall or delaminated area is over 5 square feet or if the spall is over 1" deep and/or has exposed reinforcement (regardless of spall area). Deficiencies in the prestressed concrete substructure elements shall be assessed and measured by a Professional Engineer with hands-on access to the bridge element and confirmed by the RCE.

Standard Repair Notes:

A. Outline the defective areas and verify depth of concrete cover over reinforcing steel. Saw-cut the outlined areas to a minimum depth of 1 ½", if possible, without cutting any reinforcing steel.
B. Remove all defective and/or delaminated concrete in the outlined areas by use of jackhammers. Limit the maximum size of jackhammers to 15 pounds. Do not damage the vertical sides of the saw-cut during removal. Be careful not to damage any existing reinforcing. Replace all reinforcing steel damaged during concrete removal as part of the repair.
C. Remove concrete to a depth of no less than 1" behind the existing reinforcing steel.
D. Remove all grease, dirt, oil, or foreign material from the patch areas by blast cleaning. Immediately before placing patching material, remove all dust, sand, and blasting debris with oil-free compressed air.
E. Apply an SCDOT approved rust inhibitor to all exposed reinforcing steel. Ensure that the exposed concrete surface is clean and dry. Apply inhibitor in accordance with manufacturer's recommendations.
F. Apply an SCDOT approved epoxy mortar/concrete patch in accordance with ASTM C881. Fill all voids. The material used shall be rated for vertical and overhead use.
G. Apply an SCDOT approved epoxy surface sealer to the perimeter of the repaired area.

Minimum lengths of crack repairs and minimum areas of spall repairs for substructures are included in Table 2.

9. APPROACH SLAB REPAIR

Perform crack repair in accordance with Standard Specifications and the repair notes below. Conditions of approach slabs can be evaluated after they are exposed by the Contractor.

Concrete crack repairs in reinforced concrete approach slab elements are required if cracks are over 1/4" in width (regardless of crack length) or if cracks are over 0.012” in width and over 6’ in length.

Table 1: Required Bridge Rehabilitation

Bridge Information					Required Rehabilitation								
Asset ID	**Facility Carried**	**Feature Intersected**	**Year Built**	**Year Widened**	**Deck Replacement**	**Deck Spall Repairs and Overlay[1]**	**Joint Replacement**	**Bridge Railing Replacement**	**Bridge Railing Spall Repair**	**~~Rehab or~~ Replace Bearings**	**Beam Rehabilitation**	**Concrete Diaphragm Spall Repair**	**Substructure Spall Repair**
7272	S-32-273 (Bush River Rd.)	I-20	1979	N/A		x	x			x	x[2]		x
7586	S-32-36 (St. Andrews Rd.)	I-26	1979	N/A	x	x	x	x		x	x	x	x
4411	S-40-2892 (Browning Rd.)	I-20	1964	N/A	x		x	x		x	x		x
7937	S-40-31 (Bush River Rd.	I-26	1985	N/A		x	x			x	x		x
8030	I-26 WB	I-126	1986	N/A		x	x			x	x		x

1. Type of deck repair (partial-depth overlay or full-depth replacement) to~~shall~~ be provided~~determined~~ by SCDOT~~the Contractor as defined~~ in Section 2 of this TPA.
2. Includes heat straightening bottom flange and installing a second bottom flange to existing beams with collision damage.

Table 2: Minimum Substructure Repairs

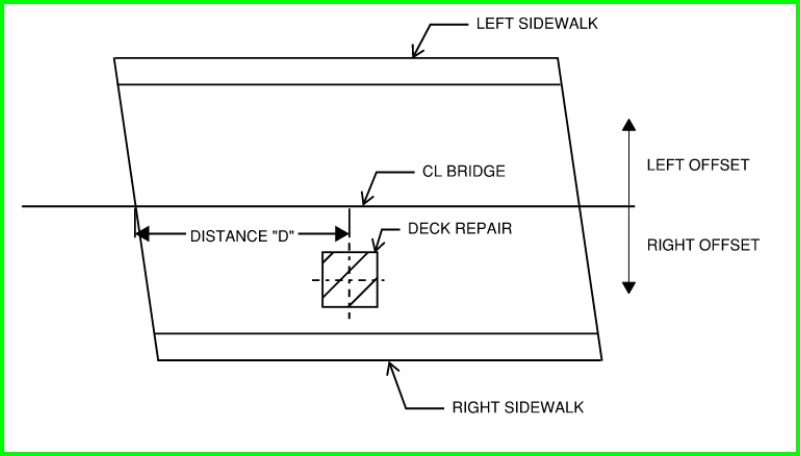
Bridge Information					Minimum Substructure Repairs	
Asset ID	**Facility Carried**	**Feature Intersected**	**Year Built**	**Year Widened**	**Reinforced Concrete Crack Repair (LF)**	**Reinforced Concrete Spall Repair (SF)[1]**
7272	S-32-273 (Bush River Rd.)	I-20	1979	N/A	10	25
7586	S-32-36 (St. Andrews Rd.)	I-26	1979	N/A	10	25
4411	S-40-2892 (Browning Rd.)	I-20	1964	N/A	10	110
7937	S-40-31 (Bush River Rd.	I-26	1985	N/A	20	25
8030	I-26 WB	I-126	1986	N/A	10	25

1. Spall repairs do not include areas of end walls adjacent to bearings that may be spalled since end walls will be chipped as part of bearing replacement.

Table 3: Minimum Superstructure Repairs

Bridge Information					Minimum Superstructure Repairs		
Asset ID	Facility Carried	Feature Intersected	Year Built	Year Widened	Painting of Structural Steel (SF)	Heat Strengthening of Steel Girder (LF)	Concrete Diaphragm Repairs (LF)
7272	S-32-273 (Bush River Rd.)	I-20	1979	N/A	2000	100	0
7586	S-32-36 (St. Andrews Rd.)	I-26	1979	N/A	12800	0	9
4411	S-40-2892 (Browning Rd.)	I-20	1964	N/A	4000	0	0
7937	S-40-31 (Bush River Rd.	I-26	1985	N/A	2200	0	0
8030	I-26 WB	I-126	1986	N/A	2000	0	0

Table 4: Top of Deck Repairs (Asset ID 7937: S-40-31 (Bush River Road) over I-26)



TOP OF DECK PLAN SCHEMATIC

Notes:

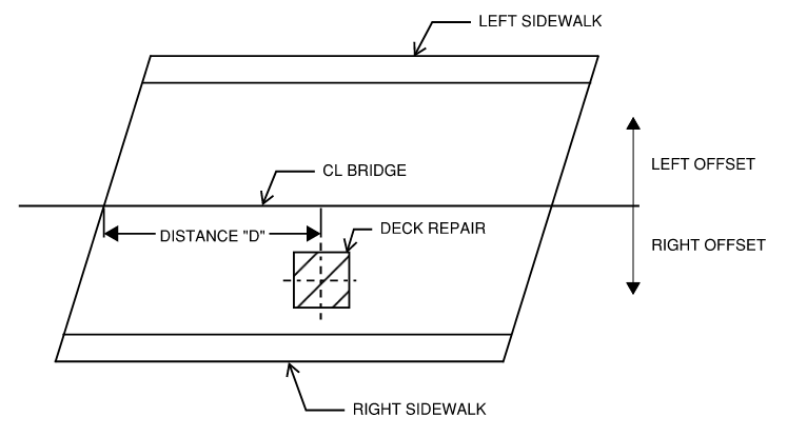
1. "D" taken from centerline of joint at the beginning of each span.
2. Direction of stationing is left to right.
3. Offset distances measured from centerline of bridge to center of repair area.
4. Quantities of concrete included in joint replacement are not presented in table.

Span Number	Repair Type	Distance "D" (FT)	Offset Direction	Offset Distance (FT)	Square Yardage (SY)	Crack Repair Length (FT)
1	Partial Depth	43.9	Left	14.8	363	-
1	Partial Depth	99.0	Right	18.9	47	-
1	Partial Depth	103.0	Right	5.4	145	-
2*	Partial Depth	0	Left	2.8	2	-
2*	Partial Depth	18.4	Right	12.1	2	-
2*	Partial Depth	33.7	Left	16.8	224	-
2	Partial Depth	97.5	Right	5.7	158	-
2*	Partial Depth	110.2	Right	24.1	481	-
3*	Partial Depth	8.7	Left	16.2	169	-
3*	Partial Depth	27.4	Right	31.6	46	-
3	Partial Depth	71.8	Right	34.6	2	-
3	Partial Depth	77.8	Right	6.1	136	-
3*	Partial Depth	89.8	Left	12.0	124	-
3*	Partial Depth	126.5	Left	20.5	2	-
3	Partial Depth	4.8	Left	13.5	2	-

3	Partial Depth	12.4	Left	20.8	2	-
3	Partial Depth	24.1	Right	24.7	417	-
3	Partial Depth	60.7	Left	16.7	110	-
3	Partial Depth	71.4	Right	6.7	132	-
3	Partial Depth	107.0	Left	11.8	39	-
3	Partial Depth	148.7	Right	22.9	4	-

* Quantity includes repairs in adjacent span (continuous deck).
Total square yardage of partial depth repair = 2,607 SY

Table 5: Top of Deck Repairs (Asset ID 7272: S-40-273 (Bush River Road) over I-20)



TOP OF DECK PLAN SCHEMATIC

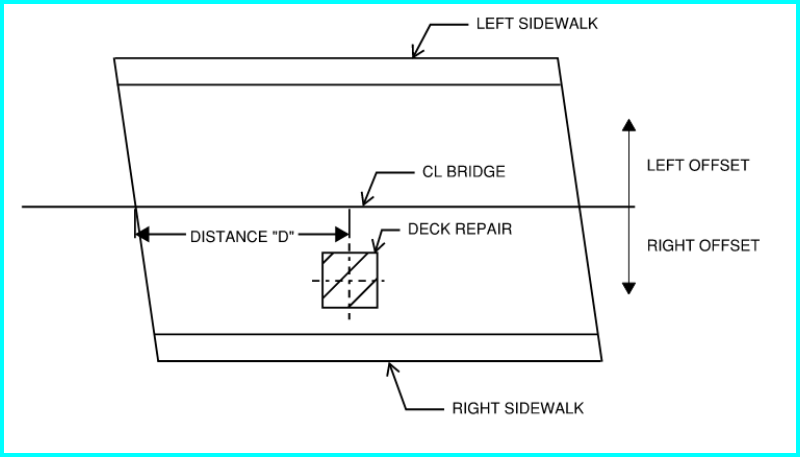
Notes:

1. "D" taken from centerline of joint at the beginning of each span.
2. Direction of stationing is left to right.
3. Offset distances measured from centerline of bridge to center of repair area.
4. Quantities of concrete included in joint replacement are not presented in table.

Span Number	Repair Type	Distance "D" (FT)	Offset Direction	Offset Distance (FT)	Square Yardage (SY)	Crack Repair Length (FT)
1	Partial Depth	20.9	Left	27.4	79	-
1	Partial Depth	12.3'	Left	4.9	13	-
1	Partial Depth	7.5'	Right	29.9	72	-
2*	Partial Depth	28	Left	28.5	96	-
2*	Partial Depth	34.2	Right	29.4	206	-
2*	Partial Depth	74.3	Right	11.6	385	-
3*	Partial Depth	25.3	Left	23.7	263	-
3	Partial Depth	26.8	Left	1	3	-
3	Partial Depth	8.6	Right	33.8	49	-
3	Partial Depth	46.5	Right	21.4	6	-
4	Partial Depth	32.4	Left	22.3	115	-
4	Partial Depth	28.9	Left	1	3	-
4*	Partial Depth	5.7	Right	32.7	143	-

*Quantity includes repairs in adjacent span (continuous deck).
Total square yardage of partial depth repair = 1,433 SY

Table 6: Top of Deck Repairs (Asset ID 7586: S-40-36 (St. Andrews Road) over I-26)



TOP OF DECK PLAN SCHEMATIC

Notes:

1. "D" taken from centerline of joint at the beginning of each span.
2. Direction of stationing is left to right.
3. Offset distances measured from centerline of bridge to center of repair area.
4. Quantities of concrete included in joint replacement are not presented in table.

Span Number	Repair Type	Distance "D" (FT)	Offset Direction	Offset Distance (FT)	Square Yardage (SY)	Crack Repair Length (FT)
2*	Partial Depth	25.8	Left	28.8	440	-
2	Partial Depth	67.7	Left	12.3	121	-
2*	Partial Depth	31.5	Right	4.0	249	-
2	Partial Depth	65.6	Right	32.6	4	-
2	Partial Depth	93.8	Right	25.2	122	-
2	Partial Depth	122.8	Right	22.4	2	-
3*	Partial Depth	17.0	Left	1.0	33	-
3	Partial Depth	37.2	Left	36.4	68	-
3	Partial Depth	53.8	Left	28.0	11	-
3	Partial Depth	63.0	Left	13.7	254	-
3	Partial Depth	32.2	Right	30.8	71	-
3	Partial Depth	34.2	Right	10.7	48	-
3*	Partial Depth	96.5	Right	21.7	352	-
4	Partial Depth	36.5	Left	12.7	54	-
4	Partial Depth	23.1	Right	16.5	4	-
4	Partial Depth	34.9	Right	6.8	2	-

4	Partial Depth	36.6	Right	33.9	49	-
4	Partial Depth	40.3	Right	23.8	13	-

*Quantity includes repairs in adjacent span (continuous deck).
Total square yardage of partial depth repair = 1,897 SY

APPENDIX A

Asset 7937 Bridge Deck Evaluation Report

WJE

I-20 / I-26 / I-126 Corridor Improvement (Carolina Crossroads)

Bridge Deck Evaluations

Asset ID 7272 - Bush River Rd over I-20
Asset ID 7586 - St. Andrews Rd over I-26
Asset ID 7937 - Bush River Rd over I-26

August 14, 2023
WJE No. 2023.1990

PREPARED FOR:
HDR Inc.
4400 Leeds Avenue, Suite 450
North Charleston, SC 29405

PREPARED BY:
Wiss, Janney, Elstner Associates, Inc.
8000 Regency Parkway, Suite 410
Cary, North Carolina 27518
984.345.0630 tel

CONTENTS

INTRODUCTION

At your request and in accordance with the agreement between HDR Inc. and Wiss, Janney, Elstner Associates, Inc. (WJE) for the I-20/I-26/I-126 Corridor (Carolina Crossroads) Improvement Project, WJE has prepared this report to document concrete evaluation services for the bridge decks of the three overpassing bridge structures listed below:

Asset ID 7272 – Bush River Rd. over I-20 - Built in 1979 - four spans, total approximate length 280 ft.

Asset ID 7586 – St. Andrews Rd. over I-26 - Built in 1981 - four spans, total approximate length 350 ft.

Asset ID 7937 – Bush River Rd. over I-26 - Built in 1985 - four spans, total approximate length 645 ft.

In general, the bridges consist of cast-in-place concrete decks supported by continuous steel plate girders that are supported by cast-in-place concrete bents.

WJE performed the following services as part of onsite investigation and materials evaluation:

- Visual and Sounding Survey
- Coring and Laboratory Examination of Extracted Concrete Core Samples
  - Compressive Strength
  - Chloride Content Evaluation
  - Petrographic Examination (pending)

ASSET 7937 - VISUAL AND SOUNDING SURVEY

WJE visited the site on July 14 and July 15, 2023 to perform visual observations of the exposed concrete bridge deck. During the visual survey, areas of apparent deck spalling, notable cracking, delaminations, and previous repairs were noted on aerial images of the bridge. Representative conditions observed were documented with field notes and digital photographs.

In addition to the visual survey, WJE performed a sounding survey to locate and identify the approximate size of existing delaminations present at the top surface of the deck. WJE performed a chain drag survey, wherein audible differences in the sound created as chains are dragged across the deck surface indicate delaminations. The extent of delaminations were determined and were squared-off to represent likely patch configurations if a patching approach is pursued. Relevant conditions and anomalies observed by WJE were documented on drawings and with photographs and are shown on the following aerial image figure 7937-1. The approximate quantity of observed spalls, delaminations, and prior repairs are reported in the following figure. Photographs of observed spalls, cracking, and previous repairs are provided in the following photograph log.

PREVIOUS REPAIRS

DELAMINATED CONCRETE

SPALLED CONCRETE

COMBINATION SPALL, REPAIRS AND/OR DELAMINATIONS

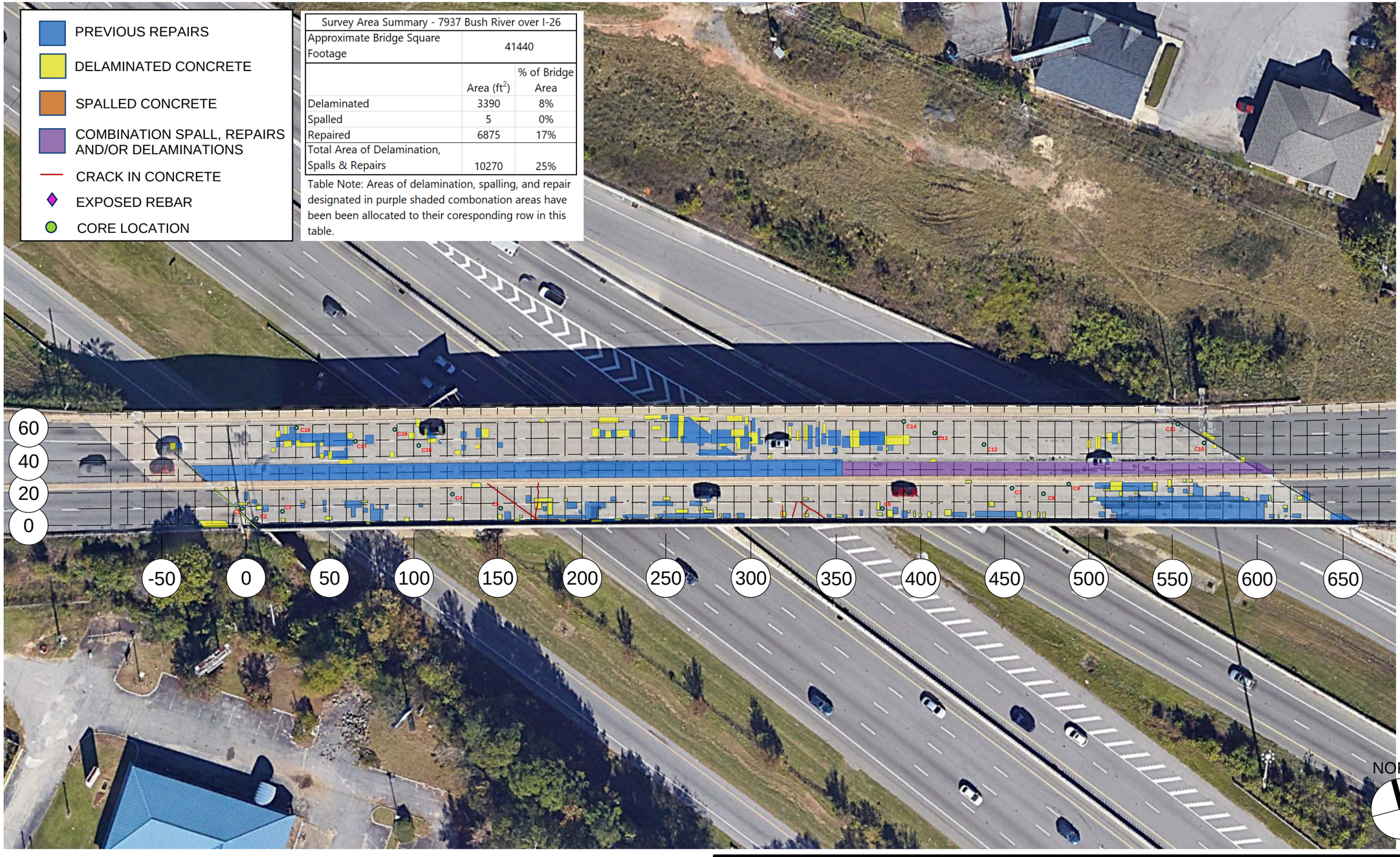
CRACK IN CONCRETE

EXPOSED REBAR

CORE LOCATION

Survey Area Summary - 7937 Bush River over I-26		
Approximate Bridge Square Footage	41440	
	Area (ft^2)	% of Bridge Area
Delaminated	3390	8%
Spalled	5	0%
Repaired	6875	17%
Total Area of Delamination, Spalls & Repairs	10270	25%

Table Note: Areas of delamination, spalling, and repair designated in purple shaded combonation areas have been been allocated to their coresponding row in this table.



LEGEND

GRID LINES

X — X-COORDINATE (FEET)

X — Y-COORDINATE (FEET)

0 1/2" 1"

THIS SHEET PLOTS FULL SIZE AT 11x17 (INCHES)

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

Wiss, Janney, Elstner Associates, Inc.
4000 Regency Parkway, Suite 410
Cary, North Carolina 27518
919.654.3037 tel
www.wje.com

Project: SCDOT - ASSET 7937 DECK SURVEY

Sheet Title: BUSH RIVER RD. OVER I-26

Proj. No. 2023.1990.0

Date 08/10/2023

Drawn JZ

Checked JL

Scale Not to scale

Sheet No. 7937-1

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7937 EB - IMG_0044

7937 EB - IMG_0045

7937 EB - IMG_0046

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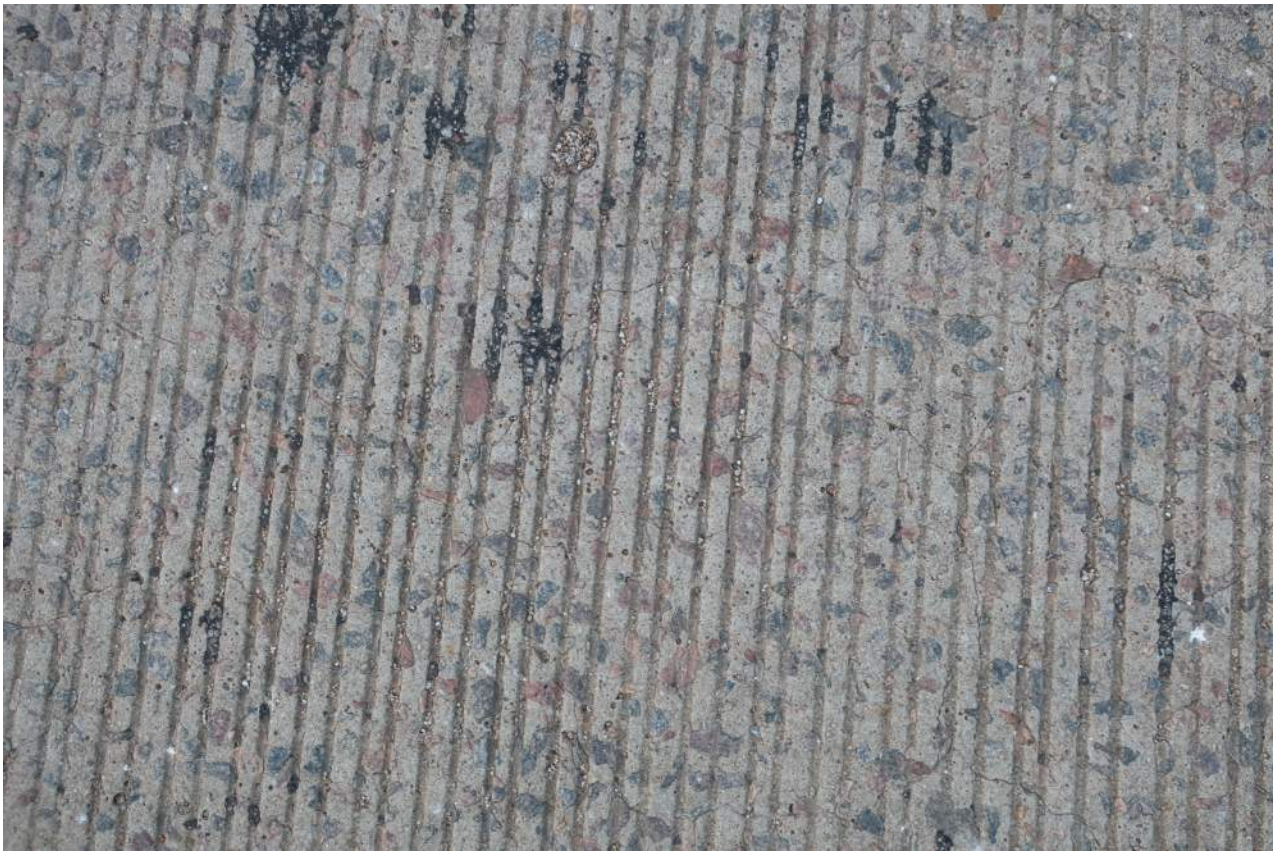

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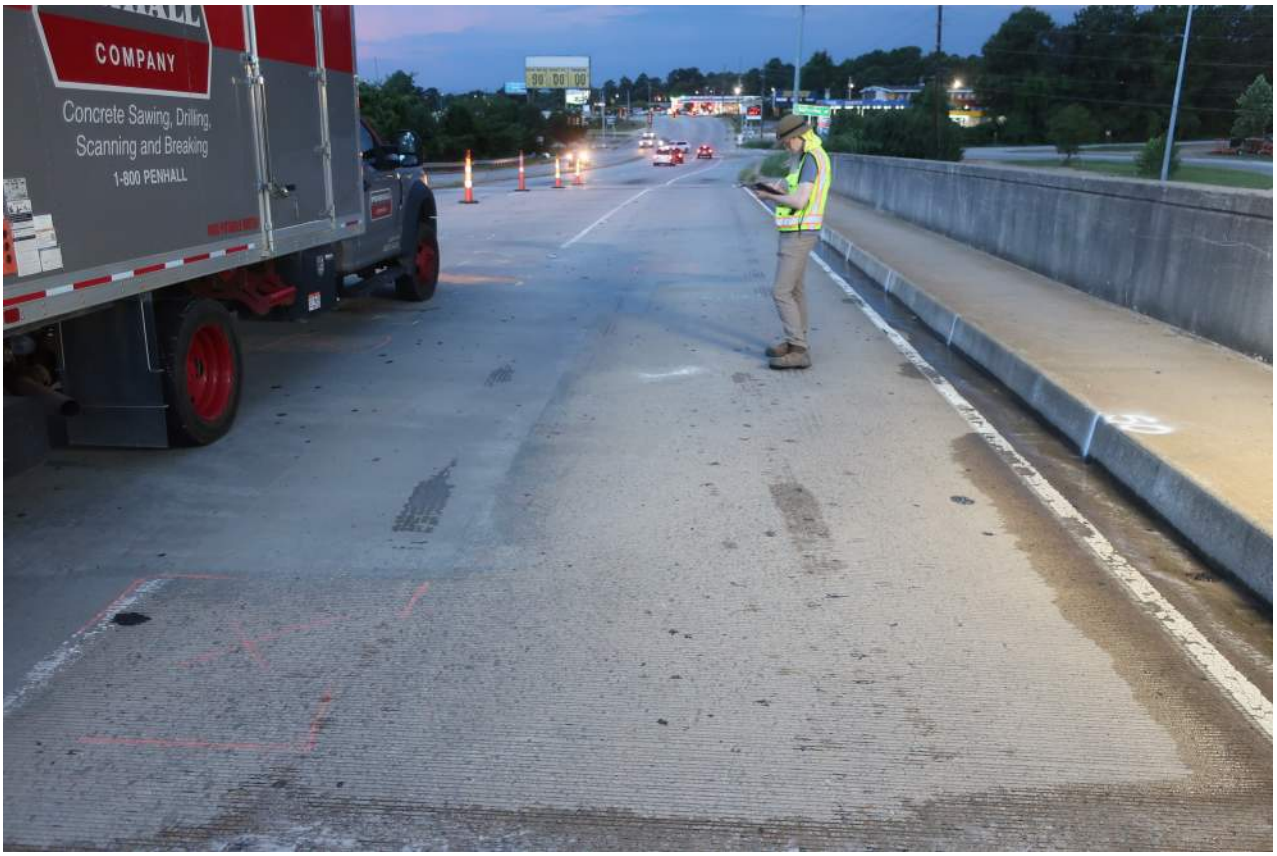

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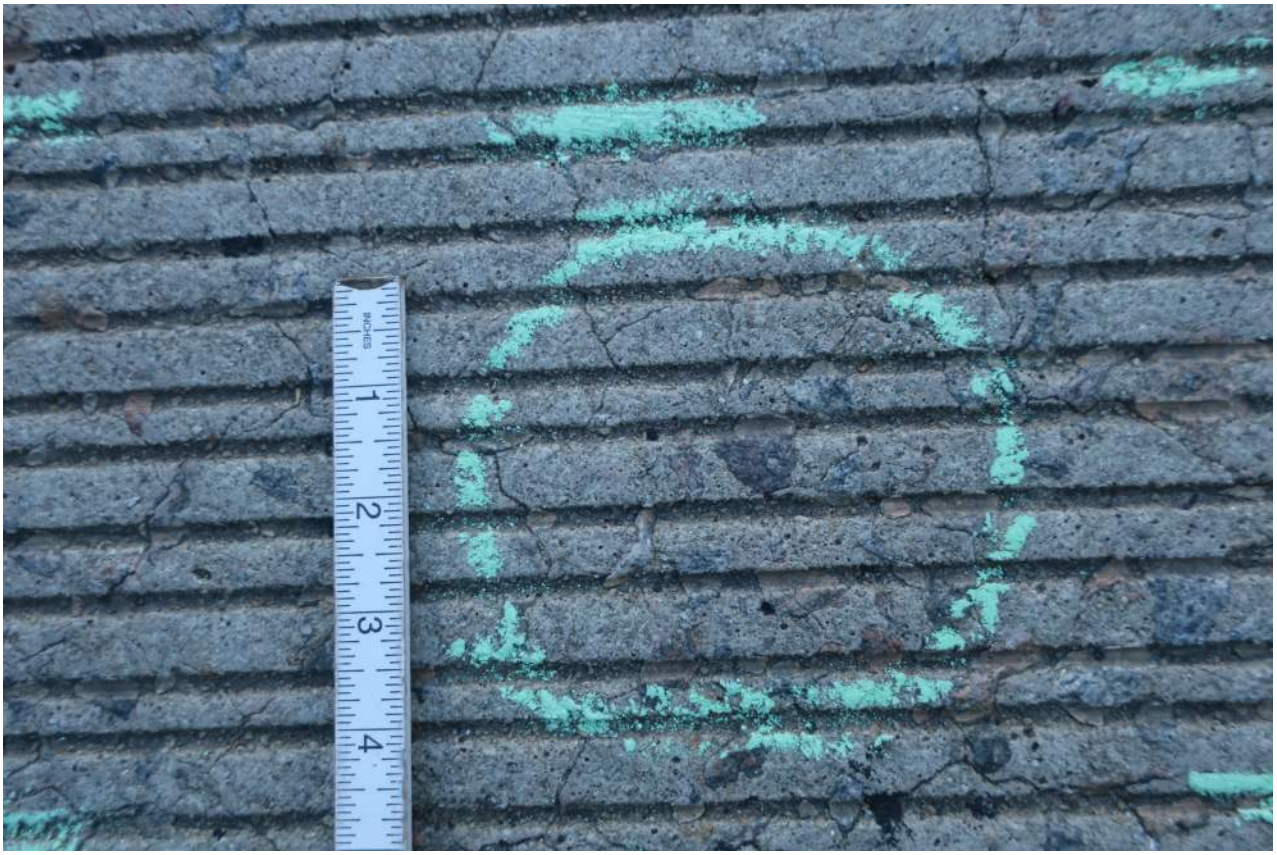

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ASSET 7937 – COMPRESSIVE STRENGTH TESTING

Compressive strength testing was performed on cores to evaluate the strength of the concrete. Cores were extracted and tested in general accordance with ASTM C42 *Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete*.

The following cores were tested for compressive strength:

- 7937 – C3
- 7937 – C4
- 7937 – C8
- 7937 – C12
- 7937 – C17

Please see the Visual and Sounding Survey Figure for core locations.

ASTM C42 COMPRESSIVE STRENGTH OF CONCRETE CORES

Project No: 2023.1990 **Project Coordinator:** S. Garrett

Operator: M. Haddad **Date:** 7/23/2023

Checked by: S. Garrett **Date:** 7/28/2023

Capping Method ☐ Sulfur ☑ Lapped ☐ Unbonded

Direction of Load ☐ Perpendicular ☐ Parallel ☑ Not Known

Capping ☑ Plane ☐ Sound ☐ Acceptable

Conditioning ☐ As Received ☐ Saturated ☑ ASTM C42 / ACI 318

Max Size of Agg ☑ 3/4" ☐ 1/2" ☐ Other

Calipers ☑ 12/060107 ☐ B65697 ☐ Other

Test Machine ☑ Test Mark SN# 11005 ☐ Satec ID: 120HLVC1240 ☐ Other

Cast Date: not known

Date and Time Cored and Sampled: 7/14/2023 and 7/15/2023

Date and Time of End Preparation: 7/18/23 6:00 PM

Sample ID	Pre-Capped Length (in.)	Capped Length (in.)	Diameter (Avg. in.)	Area (in.²)	Correction		Max Load (lbs)	Density (lb/ft³)	Compressive Strength (psi)	Corrected Compressive Strength (psi)	Fracture Type	Defects	Age of Sample (days)
					L/D	Factor							
7937 - C3	4.66	4.66	2.74	5.90	1.70	0.98	31,110	144.6	5,280	5,150	2	None	not known
7937 - C4	4.96	4.96	2.73	5.87	1.81	none	30,480	143.2	5,190	5,190	1	None	not known
7937 - C8	5.09	5.09	2.74	5.88	1.86	out of range*	36,640	144.5	6,240	--	1	None	not known
7937 - C12	4.89	4.89	2.74	5.90	1.79	none	30,830	142.3	5,230	5,230	2	None	not known
7937 - C17	4.88	4.88	2.74	5.90	1.78	none	28,600	146.5	4,850	4,850	1	None	not known

* Per ASTM C42, L/D correction factors are only applicable to low-density and normal density concretes having strengths between 2,000 and 6,000 psi.

Comments:

ASSET 7937 – CHLORIDE CONTENT TESTING

WJE performed chloride content analysis of the concrete samples. WJE measured chloride content near depths of 3/4", 1-1/4", 2-1/4", and 4" (approximately mid-depth of the slab). WJE performed testing in general accordance with AASHTO T 260 *Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials*. Material sampling was obtained via coring and cores were subdivided into layers in the laboratory for testing.

Please see the Visual and Sounding Survey Figure for core locations.

WJE

MEMORANDUM | August 14, 2023

I-20 / I-26 / I-126 Corridor Improvement (Carolina Crossroads)

AASHTO T260 Chloride Analysis - Asset 7937

WJE PROJECT NO. 2023.1990

SAMPLES

Slices taken from three or four depths in ten concrete cores were received for acid-soluble chloride analysis.

TESTING AND RESULTS

As requested, the acid-soluble chloride contents were determined at depths proposed. The acid-soluble chloride analysis was performed essentially according to Procedure A of AASHTO T 260, *Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials*. The results are listed in Table 1.

Table 1. Acid Soluble Chloride Results for Various Depths – Asset 7937

Core ID	Acid Soluble Chloride, % by mass of sample			
	$^{5}/_{8}$ – $^{7}/_{8}$ in.	$1^{1}/_{8}$-$1^{3}/_{8}$ in.	$2^{1}/_{8}$-$2^{3}/_{8}$ in.	$3^{7}/_{8}$-$4^{1}/_{8}$ in.
Core 1	0.055	0.031	0.024	0.003
Core 2	0.073	0.050	0.029	0.008
Core 5	0.026	0.013	0.007	-
Core 7	0.118	0.062	0.030	0.023
Core 9	0.098	0.055	0.028	-
Core 10	0.073	0.050	0.026	0.007
Core 13	0.123	0.051	0.023	0.004
Core 14	0.096	0.063	0.005	0.006
Core 15	0.046	0.025	0.005	<0.003
Core 18	0.080	0.045	0.023	<0.003

(As requested by HDR, measurements above 0.050 percent are shown as red text)

APPENDIX B

Asset 7272 Bridge Deck Evaluation Report

WJE

I-20 / I-26 / I-126 Corridor Improvement (Carolina Crossroads)

Bridge Deck Evaluations

Asset ID 7272 - Bush River Rd over I-20
Asset ID 7586 - St. Andrews Rd over I-26
Asset ID 7937 - Bush River Rd over I-26

August 14, 2023
WJE No. 2023.1990

PREPARED FOR:
HDR Inc.
4400 Leeds Avenue, Suite 450
North Charleston, SC 29405

PREPARED BY:
Wiss, Janney, Elstner Associates, Inc.
8000 Regency Parkway, Suite 410
Cary, North Carolina 27518
984.345.0630 tel

CONTENTS

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In general, the bridges consist of cast-in-place concrete decks supported by continuous steel plate girders that are supported by cast-in-place concrete bents.

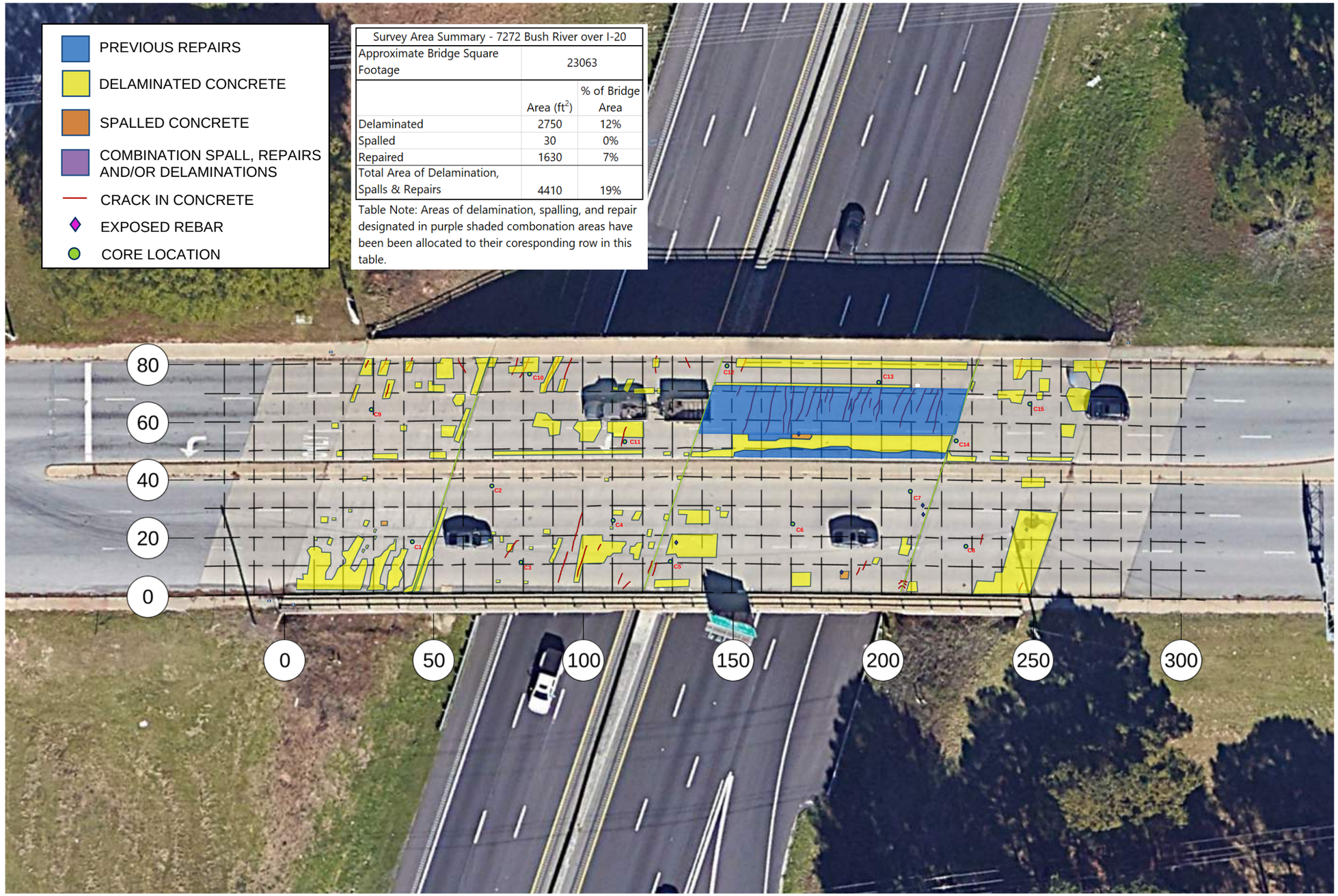
WJE performed the following services as part of onsite investigation and materials evaluation:

- Visual and Sounding Survey
- Coring and Laboratory Examination of Extracted Concrete Core Samples
  - Compressive Strength
  - Chloride Content Evaluation
  - Petrographic Examination (pending)

ASSET 7272 - VISUAL AND SOUNDING SURVEY

WJE visited the site on July 10 and July 11, 2023 to perform visual observations of the exposed concrete bridge deck. During the visual survey, areas of apparent deck spalling, notable cracking, delaminations, and previous repairs were noted on aerial images of the bridge. Representative conditions observed were documented with field notes and digital photographs.

In addition to the visual survey, WJE performed a sounding survey to locate and identify the approximate size of existing delaminations present at the top surface of the deck. WJE performed a chain drag survey, wherein audible differences in the sound created as chains are dragged across the deck surface indicate delaminations. The extent of delaminations were determined and were squared-off to represent likely patch configurations if a patching approach is pursued. Relevant conditions and anomalies observed by WJE were documented on drawings and with photographs and are shown on the following aerial image figure 7272-1. The approximate quantity of observed spalls, delaminations, and prior repairs are reported in the following figure. Photographs of observed spalls, cracking, and previous repairs are provided in the following photograph log.



Survey Area Summary - 7272 Bush River over I-20		
Approximate Bridge Square Footage	23063	
	Area (ft^2)	% of Bridge Area
Delaminated	2750	12%
Spalled	30	0%
Repaired	1630	7%
Total Area of Delamination, Spalls & Repairs	4410	19%

Table Note: Areas of delamination, spalling, and repair designated in purple shaded combonation areas have been been allocated to their coresponding row in this table.

NORTH

LEGEND

GRID LINES

X — X-COORDINATE (FEET)

X — Y-COORDINATE (FEET)

0 1/2" 1"

THIS SHEET PLOTS FULL SIZE AT 11x17 (INCHES)

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS
Wiss, Janney, Elstner Associates, Inc.
4000 Regency Parkway, Suite 410
Cary, North Carolina 27518
919.654.3037 tel
www.wje.com

Project: SCDOT - ASSET 7272 DECK SURVEY

Sheet Title: BUSH RIVER RD. OVER I-20

Proj. No. 2023.1990.0
Date 08/10/2023
Drawn JZ
Checked JL
Scale Not to scale

7272-1
Sheet No.

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ASSET 7272 – COMPRESSIVE STRENGTH TESTING

Compressive strength testing was performed on cores to evaluate the strength of the concrete. Cores were extracted and tested in general accordance with ASTM C42 *Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete*.

The following cores were tested for compressive strength:

- 7272 – C3
- 7272 - C7
- 7272 – C12
- 7272 – C14

Please see the Visual and Sounding Survey Figure for core locations.

ASTM C42 COMPRESSIVE STRENGTH OF CONCRETE CORES

Project No: 2023.1990 **Project Coordinator:** S. Garrett

Operator: M. Haddad **Date:** 7/18/2023

Checked by: S. Garrett **Date:** 7/28/2023

Capping Method ☐ Sulfur ☑ Lapped ☐ Unbonded
Direction of Load ☐ Perpendicular ☐ Parallel ☑ Not Known
Capping ☑ Plane ☐ Sound ☐ Acceptable
Conditioning ☐ As Received ☐ Saturated ☑ ASTM C42 / ACI 318
Max Size of Agg ☐ 3/4" ☐ 1/2" ☐ Other

Calipers ☑ 12/060107 ☐ B65697 ☐ Other
Test Machine ☑ Test Mark SN# 11005 ☐ Satec ID: 120HLVC1240 ☐ Other

Cast Date: not known
Date and Time Cored and Sampled: 7/10/2023 and 7/11/2023
Date and Time of End Preparation: 7/13/23 5:00 PM

Sample ID	Pre-Capped Length (in.)	Capped Length (in.)	Diameter (Avg. in.)	Area (in.²)	Correction		Max Load (lbs)	Density (lb/ft³)	Compressive Strength (psi)	Corrected Compressive Strength (psi)	Fracture Type	Defects	Age of Sample (days)
					L/D	Factor							
7272 - C12	5.44	5.44	2.73	5.84	2.00	none	19,920	142.2	3,410	3,410	1	None	not known
7272 - C14	4.06	4.06	2.73	5.83	1.49	0.96	25,060	140.8	4,300	4,120	2	None	not known
7272 - C3	3.85	3.85	2.72	5.82	1.41	0.95	24,460	139.1	4,210	3,990	2	None	not known
7272 - C7	4.37	4.37	2.73	5.84	1.60	0.97	20,760	140.0	3,560	3,440	1	None	not known

* Per ASTM C42, L/D correction factors are only applicable to low-density and normal density concretes having strengths between 2,000 and 6,000 psi.

Comments:

ASSET 7272 – CHLORIDE CONTENT TESTING

WJE performed chloride content analysis of the concrete samples. WJE measured chloride content near depths of 3/4", 1-1/4", 2-1/4", and 4" (approximately mid-depth of the slab). WJE performed testing in general accordance with AASHTO T 260 *Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials*. Material sampling was obtained via coring and cores were subdivided into layers in the laboratory for testing.

Please see the Visual and Sounding Survey Figure for core locations.

WJE

MEMORANDUM | August 14, 2023

I-20 / I-26 / I-126 Corridor Improvement (Carolina Crossroads)

AASHTO T260 Chloride Analysis - Asset 7272

WJE PROJECT NO. 2023.1990

SAMPLES

Slices taken from four depths in eight concrete cores were received for acid-soluble chloride analysis.

TESTING AND RESULTS

As requested, the acid-soluble chloride contents were determined at depths listed in Table 1. The acid-soluble chloride analysis was performed essentially according to Procedure A of AASHTO T 260, *Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials*. The results are listed in Table 1.

Table 1. Acid Soluble Chloride Results for Various Depths – Asset 7272

Core ID	Acid Soluble Chloride, % by mass of sample			
	$^5/_8$ – $^7/_8$ in.	$1^1/_8$-$1^3/_8$ in.	$2^1/_8$-$2^3/_8$ in.	$3^7/_8$-$4^1/_8$ in.
Core 1	0.104	0.062	0.023	0.004
Core 4	0.103	0.088	0.032	0.023
Core 6	0.054	0.027	0.006	<0.003
Core 8	0.081	0.028	<0.003	<0.003
Core 9	0.026	0.011	0.004	0.004
Core 10	0.027	0.006	<0.003	<0.003
Core 11	0.046	0.034	0.014	<0.003
Core 15	0.057	0.029	<0.003	<0.003

(As requested by HDR, measurements above 0.050 percent are shown as red text)

APPENDIX C

Asset 7586 Bridge Deck Evaluation Report

WJE

I-20 / I-26 / I-126 Corridor Improvement (Carolina Crossroads)

Bridge Deck Evaluations

Asset ID 7272 - Bush River Rd over I-20
Asset ID 7586 - St. Andrews Rd over I-26
Asset ID 7937 - Bush River Rd over I-26

August 14, 2023
WJE No. 2023.1990

PREPARED FOR:
HDR Inc.
4400 Leeds Avenue, Suite 450
North Charleston, SC 29405

PREPARED BY:
Wiss, Janney, Elstner Associates, Inc.
8000 Regency Parkway, Suite 410
Cary, North Carolina 27518
984.345.0630 tel

CONTENTS

INTRODUCTION

At your request and in accordance with the agreement between HDR Inc. and Wiss, Janney, Elstner Associates, Inc. (WJE) for the I-20/I-26/I-126 Corridor (Carolina Crossroads) Improvement Project, WJE has prepared this report to document concrete evaluation services for the bridge decks of the three overpassing bridge structures listed below:

Asset ID 7272 – Bush River Rd. over I-20 - Built in 1979 - four spans, total approximate length 280 ft.

Asset ID 7586 – St. Andrews Rd. over I-26 - Built in 1981 - four spans, total approximate length 350 ft.

Asset ID 7937 – Bush River Rd. over I-26 - Built in 1985 - four spans, total approximate length 645 ft.

In general, the bridges consist of cast-in-place concrete decks supported by continuous steel plate girders that are supported by cast-in-place concrete bents.

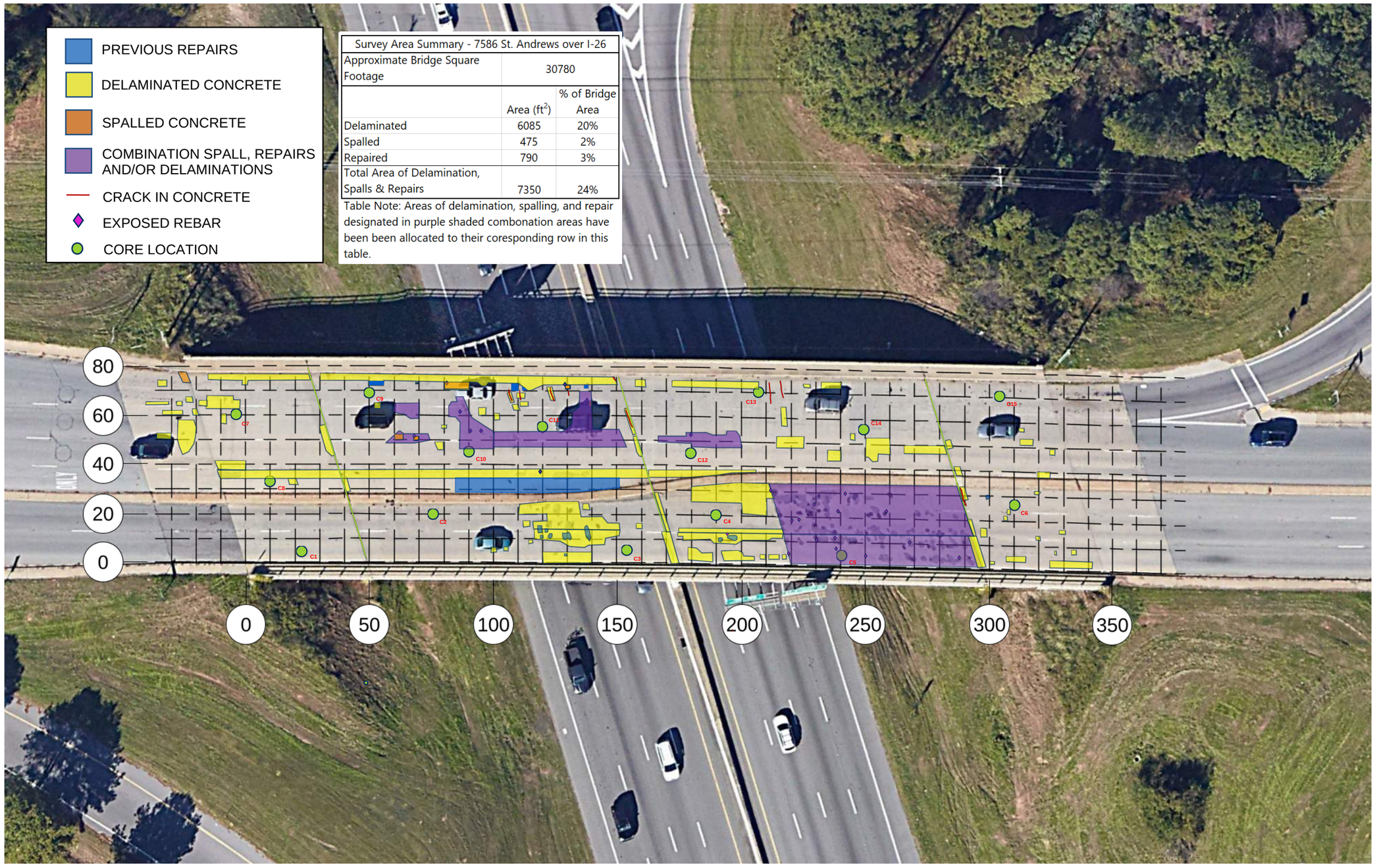
WJE performed the following services as part of onsite investigation and materials evaluation:

- Visual and Sounding Survey
- Coring and Laboratory Examination of Extracted Concrete Core Samples
  - Compressive Strength
  - Chloride Content Evaluation
  - Petrographic Examination (pending)

ASSET 7586 - VISUAL AND SOUNDING SURVEY

WJE visited the site on July 12 and July 13, 2023 to perform visual observations of the exposed concrete bridge deck. During the visual survey, areas of apparent deck spalling, notable cracking, delaminations, and previous repairs were noted on aerial images of the bridge. Representative conditions observed were documented with field notes and digital photographs.

In addition to the visual survey, WJE performed a sounding survey to locate and identify the approximate size of existing delaminations present at the top surface of the deck. WJE performed a chain drag survey, wherein audible differences in the sound created as chains are dragged across the deck surface indicate delaminations. The extent of delaminations were determined and were squared-off to represent likely patch configurations if a patching approach is pursued. Relevant conditions and anomalies observed by WJE were documented on drawings and with photographs and are shown on the following aerial image figure 7586-1. The approximate quantity of observed spalls, delaminations, and prior repairs are reported in the following figure. Photographs of observed spalls, cracking, and previous repairs are provided in the following photograph log.



Survey Area Summary - 7586 St. Andrews over I-26		
Approximate Bridge Square Footage	30780	
	Area (ft^2)	% of Bridge Area
Delaminated	6085	20%
Spalled	475	2%
Repaired	790	3%
Total Area of Delamination, Spalls & Repairs	7350	24%

Table Note: Areas of delamination, spalling, and repair designated in purple shaded combonation areas have been been allocated to their coresponding row in this table.

LEGEND

GRID LINES

X — X-COORDINATE (FEET)

X — Y-COORDINATE (FEET)

0 1/2" 1"

THIS SHEET PLOTS FULL SIZE AT 11x17 (INCHES)

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

Wiss, Janney, Elstner Associates, Inc.
4000 Regency Parkway, Suite 410
Cary, North Carolina 27518
919.654.3037 tel
www.wje.com

Project: SCDOT - ASSET 7586 DECK SURVEY

Sheet Title: ST. ANDREWS RD. OVER I-26

Proj. No.	2023.1990.0
Date	08/10/2023
Drawn	JZ
Checked	JL
Scale	Not to scale

Sheet No. 7586-1

7586 EB - IMG_0001

7586 EB - IMG_0002

7586 EB - IMG_0003

7586 EB - IMG_0004

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ASSET 7586 – COMPRESSIVE STRENGTH TESTING

Compressive strength testing was performed on cores to evaluate the strength of the concrete. Cores were extracted and tested in general accordance with ASTM C42 *Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete*.

The following cores were tested for compressive strength:

- 7586 – C1
- 7586 – C3
- 7586 – C7
- 7586 – C14

Please see the Visual and Sounding Survey Figure for core locations.

ASTM C42 COMPRESSIVE STRENGTH OF CONCRETE CORES

Project No: 2023.1990 **Project Coordinator:** S. Garrett

Operator: M. Haddad **Date:** 7/18/2023

Checked by: S. Garrett **Date:** 7/28/2023

Capping Method ☐ Sulfur ☑ Lapped ☐ Unbonded

Direction of Load ☐ Perpendicular ☐ Parallel ☑ Not Known

Capping ☑ Plane ☐ Sound ☐ Acceptable

Conditioning ☐ As Received ☐ Saturated ☑ ASTM C42 / ACI 318

Max Size of Agg ☑ 3/4" ☐ 1/2" ☐ Other

Calipers ☑ 12/060107 ☐ B65697 ☐ Other

Test Machine ☑ Test Mark SN# 11005 ☐ Satec ID: 120HLVC1240 ☐ Other

Cast Date: not known

Date and Time Cored and Sampled: 7/12/2023 and 7/13/2023

Date and Time of End Preparation: 7/14/2023 and 7/17/2023

Sample ID	Pre-Capped Length (in.)	Capped Length (in.)	Diameter (Avg. in.)	Area (in.²)	Correction		Max Load (lbs)	Density (lb/ft³)	Compressive Strength (psi)	Corrected Compressive Strength (psi)	Fracture Type	Defects	Age of Sample (days)
					L/D	Factor							
7586 - C7	4.81	4.81	2.73	5.83	1.76	none	30,700	141.7	5,260	5,260	2	None	not known
7586 - C14	4.78	4.78	2.73	5.85	1.75	out of range*	41,310	146.6	7,060	--	1	None	not known
7586 - C1	4.97	4.97	2.74	5.88	1.82	out of range*	35,520	142.7	6,040	--	1	None	not known
7586 - C3	5.06	5.06	2.74	5.88	1.85	out of range*	35,330	142.2	6,010	--	1	None	not known

* Per ASTM C42, L/D correction factors are only applicable to low-density and normal density concretes having strengths between 2,000 and 6,000 psi.

Comments:

ASSET 7586 – CHLORIDE CONTENT TESTING

WJE performed chloride content analysis of the concrete samples. WJE measured chloride content near depths of 3/4", 1-1/4", 2-1/4", and 4" (approximately mid-depth of the slab). WJE performed testing in general accordance with AASHTO T 260 *Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials*. Material sampling was obtained via coring and cores were subdivided into layers in the laboratory for testing.

Please see the Visual and Sounding Survey Figure for core locations.

WJE

MEMORANDUM | August 14, 2023

I-20 / I-26 / I-126 Corridor Improvement (Carolina Crossroads)

AASHTO T260 Chloride Analysis - Asset 7586

WJE PROJECT NO. 2023.1990

SAMPLES

Slices taken from three or four depths in eight concrete cores were received for acid-soluble chloride analysis.

TESTING AND RESULTS

As requested, the acid-soluble chloride contents were determined at depths listed in Table 1. The water-soluble chloride analysis was performed essentially according to Procedure A of AASHTO T 260, *Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials*. The results are listed in Table 1.

Table 1. Acid Soluble Chloride Results for Various Depths – Asset 7586

Core ID	Acid Soluble Chloride, % by mass of sample			
	$^{5}/_{8}$ – $^{7}/_{8}$ in.	$1^{1}/_{8}$-$1^{3}/_{8}$ in.	$2^{1}/_{8}$-$2^{3}/_{8}$ in.	$3^{7}/_{8}$-$4^{1}/_{8}$ in.
Core 2	0.024	0.006	<0.003	<0.003
Core 5	0.095	0.048	0.044	0.023
Core 6	0.097	0.057	0.027	0.004
Core 8	0.116	0.081	0.046	0.019
Core 9	0.027	0.024	0.011	0.004
Core 11	0.045	0.029	0.024	-
Core 12	0.027	0.025	0.006	0.004
Core 15	0.022	0.005	<0.003	<0.003

(As requested by HDR, measurements above 0.050 percent are shown as red text)