



Bridge Conditional Assessment

**Bridge No. 04770 in Scotland, CT
Brook Road #2 over Merrick Brook**



Prepared for:

Town of Scotland
Scotland, Connecticut

Issued: January 29, 2021

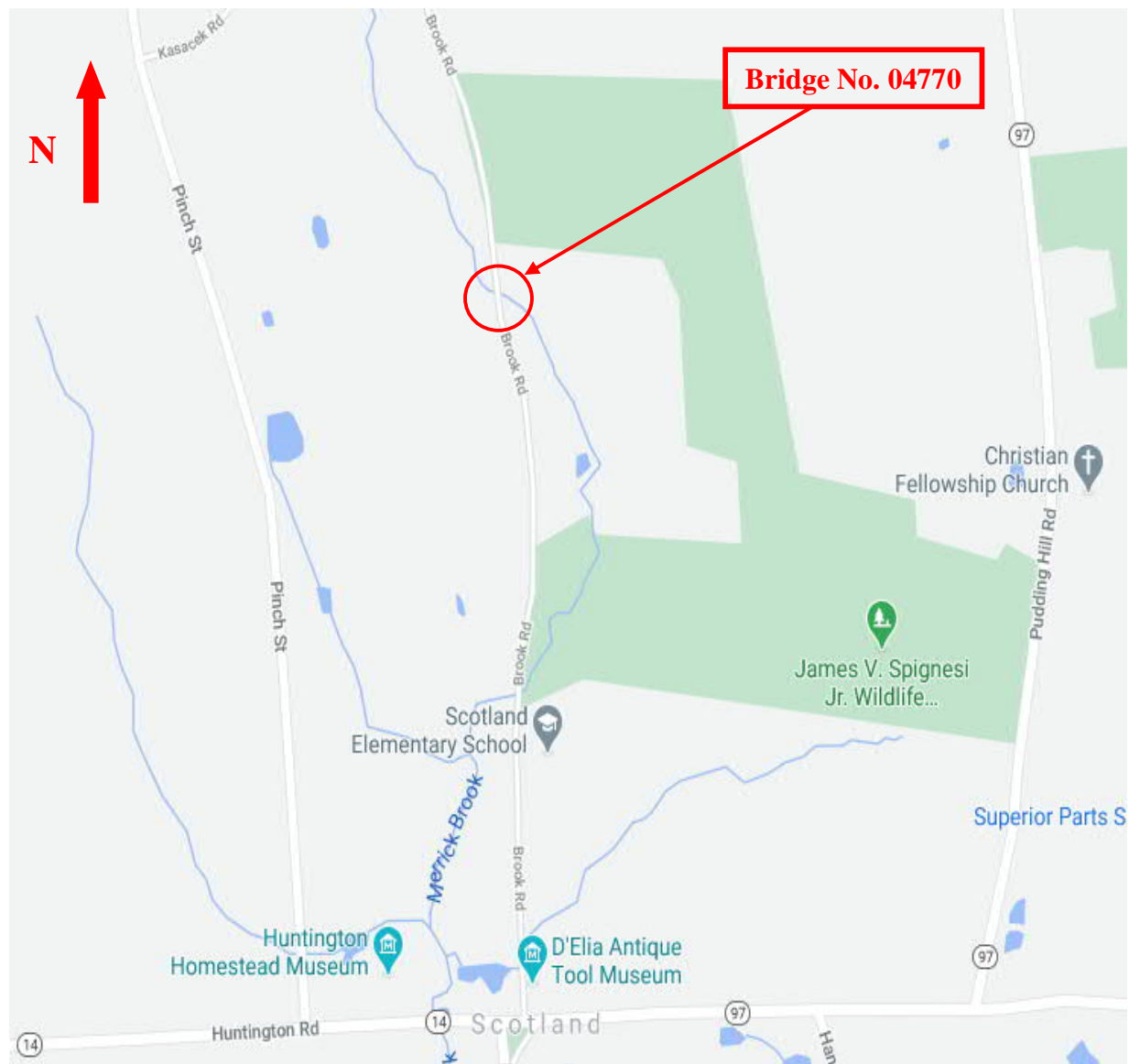
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LOCATION MAP



Location map of Bridge No. 04770, Brook Rd #2 over Merrick Brook in Scotland, CT

INTRODUCTION

CHA Companies was retained by the town of Scotland, CT to visually inspect the accessible portions of Bridge No. 04770 and to assess the current condition of the bridge. CHA conducted the field inspection on December 15, 2020. This report describes the findings of the inspection.

DESCRIPTION

General

Bridge No. 04770 carries Brook Road #2 over Merrick Brook in the Town of Scotland. The bridge is located approximately 1 mile north of the intersection of Brook Road # 2 with Route 14 and approximately $\frac{3}{4}$ mile south of the intersection of Brook Road #2 with Kasacek Road. This structure carries 2 lanes of bi-directional traffic over a 23'-7" roadway. The bridge was constructed in 1970.

The structure consists of a 22'-0" span precast reinforced concrete deck panel superstructure, with a bituminous concrete overlay and open metal bridge railing. The bridge rail consists of a lower steel "W" beam, typically used as traffic guide railing, attached to steel H posts topped by steel angles serving as a handrail. The posts are attached to the outside faces of the concrete deck on both sides of the bridge. The superstructure is supported by stone masonry abutments with concrete caps. The stone masonry continues into a portion of the wingwalls, before transitions back to reinforced concrete wingwalls. The concrete wingwall sections do not appear to be original construction suggesting the structure required rehabilitation in the past. The abutments and wingwalls stems bear on shallow spread footings. The surrounding approach embankments consist mostly of brush and vegetation.

Highway Geometrics

The immediate roadway section near the bridge is a tangent section without horizontal curvature. The bridge exists in an area near the point of intersection of a vertical sag curve. The site is lacking a formal approach traffic guide rail system. Instead, wooden posts are spaced approximately 8 feet apart on southeast, southwest, and northwest approaches. The northeast approach does not have any traffic protection. No catch basins are located within the vicinity of the bridge, indicating that surface run-off drains via overland sheetflow. The curb-to-curb roadway width of the bridge is 23'-7" at the center of the span and tapers to 22'-4" at both approaches. Based on the Federal Highway Administration (FHWA) Coding Manual, the minimum curb-to-curb roadway width for 2 lanes of 2-way traffic to avoid functional obsolescence assuming an ADT between 401 and 1000 vehicles per day is 22'. Therefore, the bridge is not considered to be functionally obsolete.

See photos 1-6 of Appendix A for general site photos.

FIELD OBSERVATIONS

The ratings indicated below are in accordance with the industry standard Federal Highway Administration (FHWA) & National Bridge Inspection Standards (NBIS) guidelines.

Deck

The deck is overall rated to be in fair condition exhibiting several areas of hairline cracking and areas with shallow concrete spalls.

Overlay - The overlay is in fair condition having areas with minor map cracking. Full length transverse cracks are visible at both ends of the deck at the interface with the roadway. Longitudinal and transverse cracks, up to 3' long each, exist and have been sealed up in the southbound lane of the deck, near mid-span. (See photo 7).

Deck – The reinforced concrete deck is rated as part of the superstructure.

Curbs –No curbs are present at this structure. The edge of the deck overlay ends approximately 10" from the fascia, leaving the concrete deck unprotected at the gutterline (see photo 8).

Railing – The railing is in fair condition. The coating system has reached the end of its useful service life and is flaking or missing coating (paint) throughout. A significant amount of exposed area has visible surface corrosion with some areas exhibiting minor section loss. Minor collision damage was observed at both the west and east railing. More advanced corrosion can be seen on backside of rails. The railing does not transition off the bridge or extend far enough clear zone, creating a hazard due to blunt end fixed condition. The railing did not exhibit the capacity to withstand a vehicle collision or prevent an errant vehicle from falling off the bridge.

Expansion Joints – There are no expansion joints.

Utilities – No utilities are present.

Superstructure

The superstructure is overall in fair condition exhibiting areas with hairline cracks with spalls near the bridge seats.

Deck – The precast concrete deck panels are in fair condition exhibiting minor deterioration consisting of random locations of hairline cracks. The deck is composed of eight 3-foot-wide precast deck units. There are no record plans available confirming whether or not the units are prestressed or posttensioned.

For the purpose of this inspection, the deck units are numbered 1 through 8, going from the west fascia to the east fascia. Transverse cracking and small areas of spalling were observed on the concrete units, near the joints in between adjacent units. The transverse cracking was observed near the midspan of all units, except for units #1, 2, 6, and 7, where cracking exists full-length of the span (see photos 11 & 12). A spall area 4" wide by 5" long was observed (up to $\frac{3}{4}$ " deep) at mid-span of deck unit #6, alongside the joint adjacent to unit #7. Joint spacing varied along the span-lengths for most units, ranging from $\frac{1}{8}$ " spacing between units to 1". Light scaling observed on both deck fasciae. It appears the shear keys have failed on these deck units allowing for rotation causing the cracking at near the abutments and allowing moisture between the deck panels. These deck panels are designed to act as a single unit and if the bond at the shear keys has failed the units will not be able to transfer (share) the loads amongst the system. This is a common issue with these types of deck systems and eventually will show signs of "piano keying". Tell tales consist of a series of parallel longitudinal reflective cracks in the wearing surface at the deck panel joints. This evidence was not present at the time of the inspection suggesting the structure is still transferring and sharing the loads between the units.

Substructure

The substructure assessment is controlled by the scour condition assessment as poor, which is further detailed below.

Abutments (Stem) – The stone masonry abutment stems are in fair condition having areas with cracked, loose, and missing mortar joints. The abutment stems exhibit cracks at the mortar joints with active moisture leakage. Over time, these cracks will grow as the moisture undergoes freeze/thaw cycles. There is no evidence of the cause for the cracking, such as settling or otherwise. This suggests that the cracking is a function of the age of the structure and the years exposed to water (see photos 13-15). Near the top of the abutment stems, signs of active leakage was observed on both the north and south abutment concrete caps. This moisture is most prevalent at the interface between the concrete deck units, suggesting the presence of voids between the deck units. The moisture appears to be coming from the roadway above through the cracks at the deck end (see photos 12 & 13).

Wingwalls (Stem) – The abutment wingwalls are in fair condition with minor cracking and scaling at the waterline. Heavy efflorescence was observed at the southwest wingwall at the construction joint between the concrete wingwall portion and the stone abutment (see photo 18). Minor scaling is present on the southeast wingwall, with heavy scaling observed at the abutment (see photo 19). The stems were sounded and found to be solid. The sloping wingwalls are lacking protective fences.

Erosion and scour – Channel erosion and scour is present primarily at the south abutments and wingwalls. A 6-foot-long portion of the south abutment footing (an 8" high vertical face) was exposed at the time of inspection (see photo 16). A 6-foot-long portion of the southwest wingwall footing was exposed at the time of inspection. The footing appears deteriorated after this 6-foot area reaches the abutment (see photo 17). No evidence of undermining was observed. The north abutment and upstream wingwall exhibits minor channel erosion/ scour estimated to be less than a foot deep.

Channel and Channel Protection

Channel Scour – The alignment of the channel near the south abutment and southwest wingwall turns which is was evident. The channel base consisted mostly of smooth stones, with areas of sediment and debris built up along the north abutment suggesting active channel erosion is occurring during significant storm events.

Approaches

The approaches leading up to the structure are in fair condition but lack important roadside safety features.

Approach pavement – The approach pavement is in fair condition have a couple locations with longitudinal and transverse cracks. The north approach pavement exhibits transverse cracking up to half of the roadway width. Minor longitudinal cracks and patchwork were observed on the south approach. Minor settling of the approach pavement exists near the transverse cracks located at both edge of decks suggesting subsidence of material below the bridge. This condition will worsen over time if left unaddressed.

Approach guiderail – It appears a timber post and cable guide railing system was originally installed along Brook Road. Currently the timer posts are the only element which remain. The posts, spaced approximately 8 feet apart, are currently located on all sides except for the northeast approach side. Most of the posts were observed to be loose or leaning away from the roadway.

Approach embankment - The approach embankment is in fair condition with areas of erosion. Approach embankments consist of vegetation and brush. Minor erosion/loss of embankment was observed behind the stems of the southeast and northwest wingwalls (see photo 20). Brush and vegetation overgrowth was noted at the ends of both the northeast and northwest wingwalls, near the channel (see photos 21 and 22).

RECOMMENDATIONS

Based on the findings from the field inspection, CHA recommends performing the following tasks in order to preserve the structural integrity of the bridge and improve the roadside safety in the short term.

Additional signage should be posted to warn motorists of the potential blunt end hazard condition of the bridge railing. Measures should also be taken to crack seal the transvers crack at the bridge limits as well as re-point the cracked stone masonry in the abutment stems. A scour countermeasure should be installed to mitigate the observed scour previously noted at the south abutment and southwest wingwall. The scour countermeasure should be designed to retain the streambed material during extreme storm events and also armor the abutments for continued service. As part of the scour countermeasure, the location of the channel centerline should be adjusted to promote flow towards the center of the bridge span. The Town should also consider updating the bridge railing and approach traffic railing at the site. Both systems are substandard and showing signs of deterioration. Potential construction estimate: \$100,000 (see Appendix B: Cost Estimate for the estimate breakdown).

APPENDICES

- Appendix A – Photographs
- Appendix B – Cost Estimate

Appendix A: Photographs

Bridge No. 04770
Location: Scotland, CT
January 29, 2021



Photo 1: West Elevation



Photo 2: East Elevation

Bridge No. 04770
Location: Scotland, CT
January 29, 2021



Photo 3: Bridge from South Approach (Looking North)



Photo 4: Bridge from North Approach (Looking South)



Photo 5: Channel looking upstream from bridge



Photo 6: Channel looking downstream from bridge



Photo 7: Typical wearing surface (Note longitudinal cracking on deck, and full width transverse cracks at deck ends)



Photo 8: Typical edge of deck overlay with missing curbs



Photo 9: Typical metal railing with H posts



Photo 10: Typical backside of metal railing and attachment to slab



Photo 11: Typical underside of concrete deck (note cracking and spalling between joints on of prestressed concrete deck units)



Photo 12: Spalling and cracking of concrete of deck units #1 and #2 (note typical leakage at southwest abutment cap)



Photo 13: North abutment (note leakage at northeast abutment cap)



Photo 14: South abutment



Photo 15: Typical mortar voids observed on both abutment stems (south abutment pictured)



Photo 16: Exposed footing at south abutment



Photo 17: Exposed footing of southwest wingwall (note deterioration on eastern end)



Photo 18: Heavy efflorescence and cracking on southwest wingwall at connection to south abutment



Photo 19 Southeast wingwall stem



Photo 20: Minor erosion behind southeast wingwall stem

Bridge No. 04770
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Photo 21: Brush overgrowth at northeast wingwall



Photo 22: Brush overgrowth at northwest wingwall

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<p align="center">TOWN OF SCOTLAND BRIDGE CONDITION ASSESSMENT PROGRAMMING COST ESTIMATE</p>			
Project Title Programming Cost Estimate		F.A.P. No.	T.B.D.
Bridge No. 04770 (Brook Rd over Merrick brook)		City/Town	Scotland
	(Short Term) Item Description	Unit	Quantity
	Fine Milling	S.Y.	250
	HMA S0.5	TON	3.5
	Waterproofing Membrane	SF	50
	Scour Countermeasure (fill, geotextile, riprap, etc.)	L.S.	1
	Traffic Approach Railing	LF	80
	Water Handling	L.S.	1
	Concrete Repairs/Crack Sealing	SF	150
		Unit Price	Amount
		\$ 20.00	\$ 5,000
		\$ 200.00	\$ 700
		\$ 60.00	\$ 3,007
		\$ 20,000.00	\$ 20,000
		\$ 75.00	\$ 6,000
		\$ 30,000.00	\$ 30,000
		\$ 50.00	\$ 7,500
		TOTAL ITEMS	\$ 72,207
CONTRACT COST SUMMARY			
		TOTAL ITEMS	\$ 72,207
	CLEARING AND GRUBBING	2.0%	\$ 1,444
	MOBILIZATION	5.0%	\$ 3,610
	CONTINGENCY	15.0%	\$ 10,831
	MINOR ITEM ALLOWANCE	15.0%	\$ 10,831
		BASE ESTIMATE	\$ 98,923
		SAY :	\$ 100,000.00
Note: ROW and Engineering costs are not included in this estimate			