



Bridge Conditional Assessment

**Bridge No. 04772 in Scotland, CT
Bass Rd over Merrick Brook**



Prepared for:

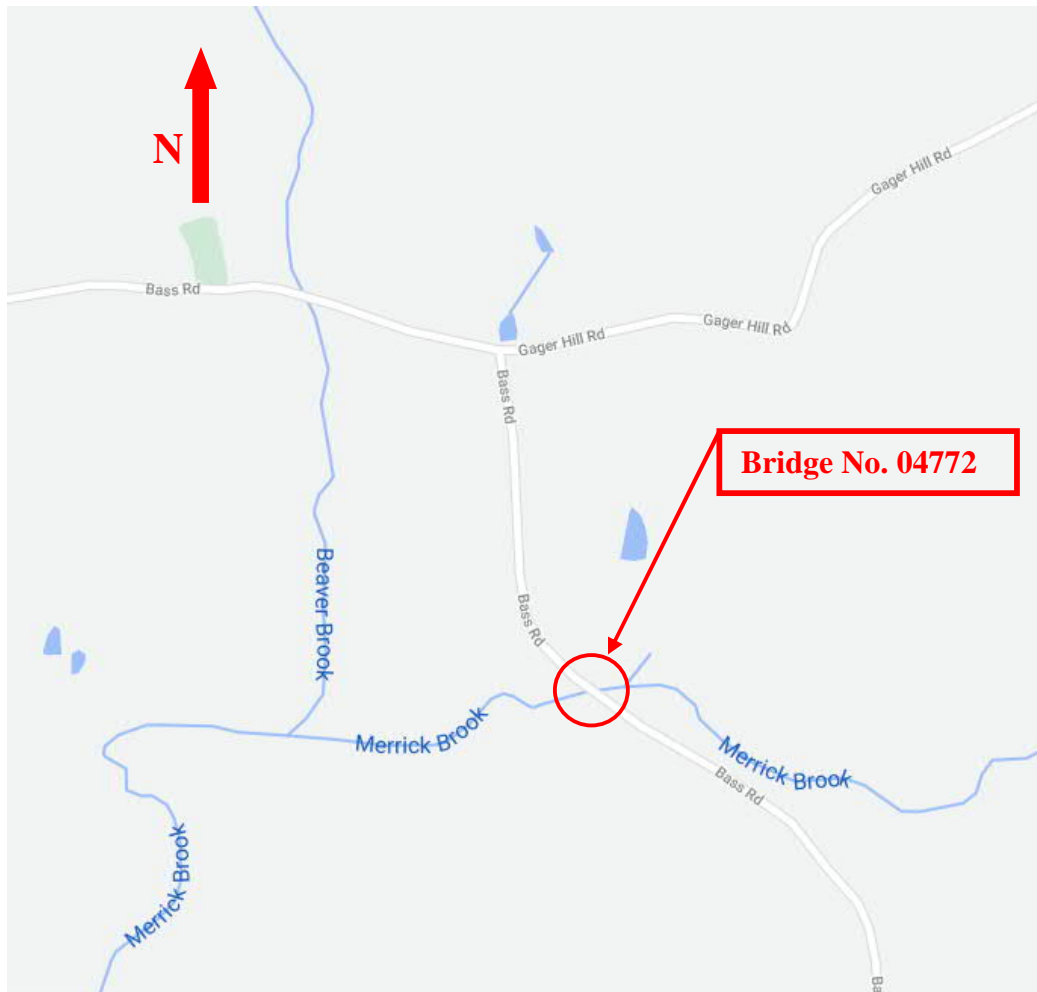
Town of Scotland
Scotland, Connecticut

Issued: January 29, 2021

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LOCATION MAP



Location map of Bridge No. 04772 Bass Road over Merrick Brook in Scotland, CT

INTRODUCTION

CHA Companies was retained by the town of Scotland, CT to visually inspect Bridge No. 04772 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 as well as provides recommendations for addressing the areas of deteriorations observed at the time of the inspection as well as conceptual level costs for planning purposes.

DESCRIPTION

General

Bridge No. 04722 carries Bass Road over Merrick Brook in the Town of Scotland. The current in-service structure consists of an ACROW 45'x12' temporary bridge which over spans the original structure which still remains. The original structure consists of a reinforced concrete superstructure with reinforced concrete abutments and wingwalls. The ACROW bridge appears to have been installed as a temporary condition to keep Bass Road open due to the concerns of the existing structure's severe scour and undermined footings suggesting instability. The ACROW bridge is much narrower than the original bridge and approach roadway width creating a significant bottleneck for motorists. The ACROW superstructure consists of (4) 27" main beams, (8) support stringers, two separate steel roadway deck plates with an anti-skid overlay, and thru bolted steel posts supporting the TL-2 guardrail system. The ACROW superstructure is supported on shallow reinforced stub abutments.

Highway Geometrics

The roadway approaching the bridge has a gradual horizontal curve. The roadway profile is a subtle vertical crest curve at the bridge to allow for the ACROW bridge installation above the existing structure. No catch basins are located within the vicinity of the bridge, indicating that surface run-off drains via overland sheetflow. The roadway width of the bridge is 12'-0" with a curb-to-curb roadway width of 21'-0" at both approaches.

Based on the Federal Highway Administration (FHWA) Coding Manual, the minimum curb-to-curb roadway width for 2 lane 2-way traffic to avoid functional obsolescence assuming an ADT between 401 and 1000 vehicles per day is 22'. Therefore, the bridge is 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. The inspection at this site is unique as these two structures appear to be working in unison. The ACROW bridge supports all of the live loads and transfers these loads to the shallow stub abutments. The stub abutments transfer the load to the surrounding soil which is retained and protected by the Merrick Brook by the original bridge abutments. Finally, the original bridge deck is serving as a strut preventing the undermined abutments from overturning into Merrick Brook. The superstructure portion of this inspection concentrates on the ACROW bridge, whereas the substructure section investigates the current condition of the original structure abutments.

Deck

Overlay – The anti skid epoxy aggregate on the ACROW steel deck appears to be in good condition. There are no signs of deterioration or cracking of the anti skid overlay.

Deck – The ACROW steel plates act as the deck for this structure and are in good condition. The underside was inspected and there was no notable deterioration at the time of inspection. The top of the plates are covered by the anti skid overlay.

Railing – The galvanized ‘H’ beam posts attached to the ACROW fascia beams with metal beam rail appears to be in good condition. There are no signs of impact damage or corrosion.

Expansion Joints – There are 1” open joints on both ends between the bridge superstructure and substructure. (See photo 22)

Utilities – No utilities are present.

Superstructure

The ACROW superstructure consists of (4) main beams with diaphragms and (8) support stringers that appear to be in good condition with no deterioration.

No alarming deterioration was present for the original superstructure that’s not currently in use.

Substructure

The ACROW bridge substructure is supported by reinforced concrete stub abutments and a spread footing which is in good condition. The abutments were installed perpendicular to Bass Road and 8ft to 15ft behind the original structure (which is skewed 19 degrees).

The original bridge substructure remains in poor condition. The following observations correspond only to the original bridge substructure.

Abutments (Stem) – The abutments are in fair condition due to minor deterioration. Light to medium scaling is evident, along with minor vertical and diagonal cracking up to 1/8”.

Wingwalls (Stem) – The wingwalls are in fair condition with moderate scaling.

Erosion and scour – Erosion and scour of the original structure remains in poor to serious condition. The overall substructure rating of the original structure is driven by the severe erosion and undermining that is evident. The north abutment and wingwalls, along with the southwest wingwall and the south abutment, experience moderate to severe scour and undermining. The west side of the north abutment and the northwest wingwall have completely exposed footings with up to 12” of undermining measured at the time of field inspection. The northeast wingwall and east side of the north abutment also appear to be exposed and severely undermined which was also noted in the underwater inspection report dated 2/27/2020. Our observations match those of the recent underwater inspection suggesting that the conditions are serious but not rapidly progressing. The footings exhibit full height exposure and undermining up to 2.7ft high and 5ft penetration, up to 3ft behind the footing. The south abutment is exposed full length but is not currently undermined. See photos and ‘Appendix B-Notes’.

Channel and Channel Protection

Channel Scour – The channel enters the structure at a sharp angle with flow heading west and directed towards the Northeast wingwall and the north abutment. The misalignment of the flow has contributed to the erosion and scour issues previously noted.

Approaches

Approach pavement – The new approach pavement is in good condition leading up to the bridge.

Approach guiderail – Metal beam attached to timber post at each corner (see photo 9). Guiderail system appears to be in good condition. Note: the speed limit over this bridge is posted for 10mph, and stop signs are evident on both approaches.

Approach embankment - The channel centerline makes an abrupt turn as it approaches the structure with flow directed towards the Northeast wingwall and the north abutment. This change to Merrick Brook's angle of the attack has led to embankment erosion and scouring of streambed material surrounding the nearby tree root wads. The approach embankments consist mostly of brush and vegetation.

RECOMMENDATIONS FOR REPAIR

Based on the findings from the field inspection, the following are recommendations to address the immediate concerns. The Town has also expressed the desire to maintain the current temporary ACROW bridge as a permanent structure at this location. As such, CHA also provides preliminary cost effective recommendations to meet that objective as well.

Short term Recommendation: To address the immediate scour and undermining of the original bridge substructure, the Town should re-establish the existing channel section immediately upstream and at the bridge. Subsequently, a scour countermeasure should be installed and specifically designed to remain in-place during major storm events. These activities will stabilize and armor the existing abutments for continued service. To address the reduced travelway width at the bridge, object marker signs should be added at all four corners to bring attention to motorists as they approach the bridge. Potential construction cost estimate: \$300,000 (see Appendix C: Cost Estimate for the estimate breakdown).

Long Term Recommendations (Option 1): As previously noted, the Town prefers to maintain the current ACROW bridge as a permanent structure and is seeking recommendations for a long term solution. To keep this structure stable during significant storm events, it is recommended that the existing shallow temporary stub abutments be replaced with deep foundations. Design parameters and soil conditions for a permanent foundation will need to be obtained in order to design the deep foundation consisting of driven or drilled piles. In efforts of reduce construction costs, the lower portions of the original bridge substructure could be salvaged and armored to provide a low flow channel during the seasonal dry periods. Additionally, signage should be posted to warn motorists of the roadway width reduction, blunt end bridge railings, and 1- way traffic over the ACROW bridge. Action should also be taken to prevent further scour to the existing abutments. The scour countermeasure should be designed to re-align the channel towards the center of the bridge span.

It must be noted that the curb-to-curb width of this ACROW bridge create a severe bottleneck for Bass Road. This may be acceptable to the Town and local residents but from an engineering standpoint this condition changes the road functionality, poses safety concerns and is therefore not recommended. Potential construction cost estimate: \$700,000 (see Appendix C: Cost Estimate for the estimate breakdown).

Long Term Recommendation (Option 2): Another potential approach involves pursuing a grant through either the CTDOT Local Bridge Program or LOTCIP programs to remove and replace the existing bridges with a new structure following current bridge design standards and roadside safety features. This bridge would maintain the minimum curb to curb width based on the average daily traffic counts. The structure would also be designed below the calculated scour depths for the design storm event and also improve the hydraulic conveyance preventing future maintenance caused by erosion and scouring as well as improving the aquatic habitat in the immediate area. Potential construction cost estimate: \$1,500,000 (see Appendix C: Cost Estimate for the estimate)

Appendix A: Photographs

Bridge No. 04772
Location: Scotland, CT
January 29, 2021



Photo 1: East Elevation



Photo 2: West Elevation

Bridge No. 04772
Location: Scotland, CT
January 29, 2021



Photo 3: Bridge from South Approach (Looking North)



Photo 4: Bridge from North Approach (Looking South)

Bridge No. 04772
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Photo 5: Channel looking upstream (East) from bridge



Photo 6: Channel looking downstream (West) from bridge



Photo 7: Typical steel deck with anti skid coating (Note two separate steel plates with longitudinal joint)



Photo 8: North bridge railing connected to wooden approach post. (Typical all corners)



Photo 9: Typical approach and bridge railing. 10 mph area and stop signs on both approaches



Photo 10: End of Northeast wingwall, rip rap, erosion exposing and undermining tree roots, inlet side



Photo 11: Erosion exposing and undermining tree roots, inlet side



Photo 12: End of Northwest wingwall erosion, outlet side



Photo 13: Southwest corner erosion, exposed and undermined tree roots, outlet side



Photo 14: Southeast corner, rip rap at inlet side



Photo 15: North expansion bearing,



Photo 16: South fixed bearing and typical stub abutment /footing



Photo 17: Typical stub abutment and footing cast against the existing roadway



Photo 18: Typical underside and framing.



Photo 19: Typical abutment beam seat and backwall. Footing not shown



Photo 20: Existing reinforced concrete deck elevation



Photo 21: South approach, looking north. Compounding vertical curve changes due to the need to feather into existing grade.



Photo 22: Typical joint between steel deck and backwall. Longitudinal joint also visible.

Appendix C: Cost Estimate

CHA Project No. : <u>67404</u>		Date : <u>01/29/21</u>	
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TOWN OF SCOTLAND BRIDGE CONDITION ASSESSMENT PROGRAMMING COST ESTIMATE			
Project Title <u>Programming Cost Estimate</u>		F.A.P. No. <u>T.B.D.</u>	
<u>Bridge No. 04772 (Brooklyn Turnpike over Merrick Brook)</u>		City/Town <u>Scotland</u>	

(Short Term) Item Description	Unit	Quantity	Unit Price	Amount
Scour Countermeasure (fill, geotextile, riprap, etc.)	LS	1	\$ 100,000.00	\$ 100,000
Channel Excavation and re-grading	LS	1	\$ 75,000.00	\$ 75,000
Water Handling	LS	1	\$ 100,000.00	\$ 100,000
Signage	LS	1	\$ 2,000.00	\$ 2,000
TOTAL ITEMS				\$ 277,000

PRELIMINARY COST SUMMARY	
TOTAL ITEMS \$ 277,000	
BASE ESTIMATE \$ 277,000	
SAY : \$ 300,000.00	
<i>Note: ROW and Engineering costs are not included in this estimate</i>	

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Project Title <u>Programming Cost Estimate</u>		F.A.P. No. <u>T.B.D.</u>	
<u>Bridge No. 04772 (Brooklyn Turnpike over Merrick Brook)</u>		City/Town <u>Scotland</u>	

(Long Term Option 1: Maintain ACROW BR) Item Description	Unit	Quantity	Unit Price	Amount
Micropiles	EA	32	\$ 10,000.00	\$ 320,000
Substructure Concrete (Pile Cap)	CY	50	\$ 1,000.00	\$ 50,000
Relocate, protect and reset existing bridge superstructure	LS	1	\$ 40,000.00	\$ 40,000
Signage	LS	1	\$ 2,000.00	\$ 2,000
Scour Countermeasure & re align (fill, geotextile, riprap, etc.)	LS	1	\$ 100,000.00	\$ 100,000
Excavation of existing reinforced concrete stub abutment	LS	1	\$ 15,000.00	\$ 15,000
TOTAL ITEMS				\$ 527,000

PRELIMINARY COST SUMMARY				
			TOTAL ITEMS	\$ 527,000
MINOR ITEM ALLOWANCE			30.0%	\$ 158,100
			BASE ESTIMATE	\$ 685,100
SAY : \$			700,000.00	
<i>Note: ROW and Engineering costs are not included in this estimate</i>				

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PROGRAMMING COST ESTIMATE					
Project Title <u>Programming Cost Estimate</u>		F.A.P. No. <u>T.B.D.</u>			
<u>Bridge No. 04772 (Brooklyn Turnpike over Merrick Brook)</u>		City/Town <u>Scotland</u>			

(Long Term Option 2: Bridge Replacement) Item Description	Unit	Quantity	Unit Price	Amount
Superstructure	LS	1	\$ 500,000.00	\$ 500,000
Substructure - Abutments & Wingwalls	LS	1	\$ 400,000.00	\$ 400,000
Removal of ACROW bridge	LS	1	\$ 25,000.00	\$ 25,000
Demolition of existing bridge	LS	1	\$ 50,000.00	\$ 50,000
Approach Roadway work	LS	1	\$ 50,000.00	\$ 50,000
Scour Countermeasure & re align (fill, geotextile, riprap, etc.)	LS	1	\$ 100,000.00	\$ 100,000
TOTAL ITEMS				\$ 1,125,000

PRELIMINARY COST SUMMARY				
			TOTAL ITEMS	\$ 1,125,000
MINOR ITEM ALLOWANCE			30.0%	\$ 337,500
			BASE ESTIMATE	\$ 1,462,500
SAY :			\$	1,500,000.00
<i>Note: ROW and Engineering costs are not included in this estimate</i>				