



Bridge Conditional Assessment

**Bridge No. 123003 in Scotland, CT
Kemp Road over Kimball Pond Brook**



Prepared for:

Town of Scotland
Scotland, Connecticut

Issued: January 29, 2021

Table of Contents

Location Map2

Introduction.....3

Description.....3

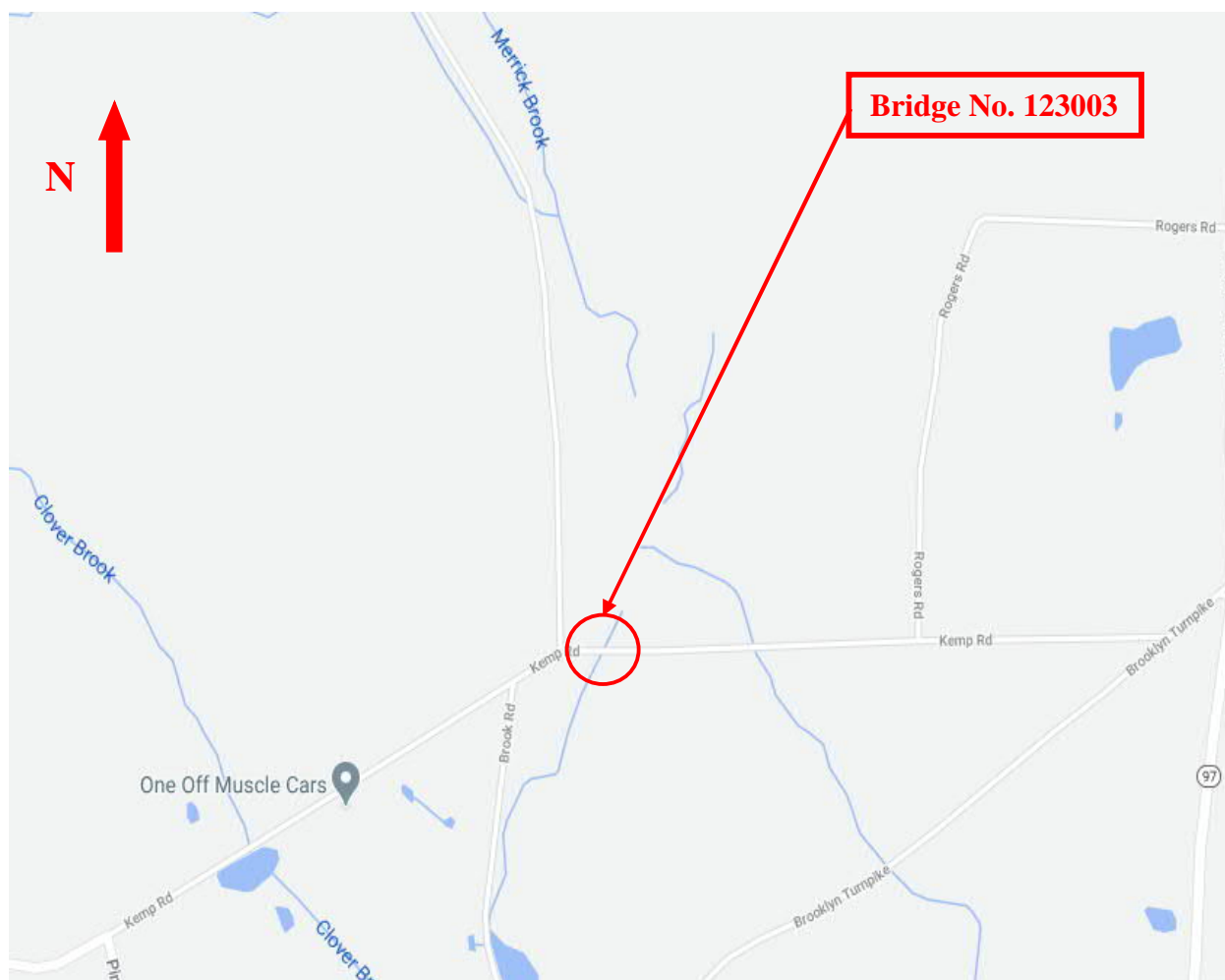
Field Observations3

Recommendations.....6

Appendices7

Appendix A: Photographs

LOCATION MAP



Location map of Bridge No. 123003, Kemp Road over Kimball Pond Brook in Scotland, CT

INTRODUCTION

CHA Companies was retained by the town of Scotland, CT to visually inspect Bridge No. 123003 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, damage, or potential hazards observed at the time of the inspection.

DESCRIPTION

General

Bridge No. 123003 carries Kemp Road over Kimball Pond Brook in the Town of Scotland. The bridge is located approximately 300 feet east of the intersection of Brook Road with Kemp Road and approximately 0.4 miles west of the intersection of Rogers Road with Kemp Road. This structure carries 2 lanes of bidirectional traffic over a 20'-3" roadway. The bridge was constructed in 1960.

The structure consists of a 21'-6" span concrete slab superstructure, with an approximate 3" asphalt overlay, supported by stone masonry abutments and flared sloping wingwalls. The abutments and wingwalls sit on shallow spread footings. The bridge rail consists of steel posts capped by steel angles. The railing posts are attached to the concrete curbs and connect to wooden approach posts via two steel cables. The 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. 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 20'-3" at the center of the span and 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 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 poor condition due to advanced deterioration and spalling.

Overlay - The overlay is in poor condition due to the amount of cracking and spalling. Transverse cracking for the full width of the roadway on eastern end of the deck span. There are numerous areas of spalling and patched potholes, especially at center of mid-span. Patched potholes 3'-2" long by 2'-0" wide were observed near the southwest corner of deck. (See photo 7). The potholes suggest a lack of a membrane on top of the deck allowing deleterious de-icing salts to seep into the deck leading to deck cracking and holding water which is cause spalling to the bituminous concrete during the cold weather months.

Deck - The concrete deck is rated as part of the concrete slab superstructure.

Curbs - The curbs are in poor condition due to advanced deterioration. Cracked and crumbling of concrete is visible along both fasciae (see photo 10). This condition appears to be signs of freeze/ thaw damage to the concrete. The edge of the deck asphalt overlay ends approximately 10" from the curbing (see photo 8). Heavy sediment accumulation was present along the southern gutterline, and vegetation was present on both northern and southern curbs (see photo 10).

Railing - The railing is in poor condition due to the weak connections between the posts and bridge deck curbs. Visually there is minor surface rust on many of the posts and caps (see photo 9). Concrete around posts appeared loose with heavy crumbling around several posts noted. The railing does not properly transition off the bridge beyond the 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

Deck - The concrete slab is in poor condition due to advanced deterioration. Significant cracking with heavy efflorescence and shallow spalls exists for the full length of both outside faces of the fasciae (see photos 11 & 12). At the north fascia, the efflorescence is most prominent at both the east and west edge of deck. Efflorescence noted on northern portion of deck underside (see photo 13). Severe cracking with heavy efflorescence, throughout the span is prevalent on the southern portion of the underside of deck (about 25% of the deck surface area) (see photo 14).

Substructure

The substructure is overall in fair condition due to cracking of stone masonry.

Abutments (Stem) - The abutments are in fair condition with minor deterioration. Minor cracking at mortar joints observed on west abutment (see photo 17). Minor cracking at mortar joints observed at northern portion of east abutment, near waterline (see photo 18). The abutment stems appear plumb, with no signs of leaning apparent at the time of the inspection.

Wingwalls (Stem) - The wingwalls are in poor condition due to advanced cracking at mortar joints. Vertical cracking, up to 2 feet in length, was observed at mortar joints on the northwest wingwall at the base of the stem. A crack along mortar joints that starts horizontal and turns diagonal was noted at an area located at mid-height of the stem (see photo 19). This crack measured approximately 2 feet long by 10" high in total. The width of this crack opening stayed generally consistent throughout. The northeast wingwall exhibited signs of leakage at the time of inspection, and stones were missing from the stem at the waterline (see photo 18). At the waterline of the southeast wingwall, a crumbling mortar joint, approximately 16" long, has led to a loose stone (see photo 22).

Vertical and horizontal cracking at mortar joints was also observed at the top of the southeast wingwall (see photo 23). No protective fences are present at any of the wingwalls.

Erosion and scour - The depth of Kimball Pond Brook limited access for a detailed inspection. Channel probing was performed from above. Both abutments exhibit moderate scour. The scour appeared worse at the west abutment near the downstream corner. While undermining could not be verified at the time of the inspection, based on the depths and flows, both footings are shallow and prone to undermining. Further inspection is necessary to accurately determine the extents of the scour and presence of undermining.

The areas at and above the wingwall ends are steep and eroding. It appears the Town has added stone at the end of the northeast wingwall to stabilize the embankment, which appears to be working.

Channel and Channel Protection

Channel Scour - The channel alignment runs in a northeast to southwest direction as it flows under Kemp Road. The channel alignment is tangent from the inlet to the outlet favoring the west side. Immediately downstream of the bridge, the channel takes an abrupt turn towards the east immediately beyond the structure. There is angular riprap immediately upstream of the northeast wingwall suggesting there is reoccurring erosion at the structure. The channel at the time of the inspection was deep (greater than 5ft) limiting inspection access.

Approaches

The approaches are overall in fair condition due to advanced deterioration and structural elements not being sound.

Approach pavement - The approach pavement is in poor condition due to advanced deterioration. There are several locations having deep longitudinal cracking along both approaches. Longitudinal cracks up to $\frac{3}{4}$ " wide were observed the full length of the west approach, leading up to the western edge of the bridge deck. On the east approach, transverse cracking up to 1" wide leads to a longitudinal crack up to 1-1/4" wide. This crack ends approximately 1 foot away from the eastern edge of deck. The eastbound lane of the east approach exhibits heavy map cracking with spalling and patchwork over potholes.

Approach guiderail - One timber post exists on each corner of the bridge deck and are connected to the bridge railing via multi-strand steel cables. This cable then terminates into the ground immediately beyond the bridge. This end termination connection was not visible during the inspection. The steel cables appeared loose from the bridge railing to the wooden posts. The approach guide railing does not meet current standards, as it does not extend far enough beyond the drop off hazard, nor does the cable appear to provide adequate capacity to withstand a vehicle collision or prevent an errant vehicle from falling off the bridge.

Approach embankment - The approach embankment is in satisfactory condition with a few areas having minor erosion. Approach embankments are fairly steep leading from the roadway to the wingwalls, and consist of vegetation and brush. Minor erosion/loss of embankment was observed behind the stem of the southwest wingwall (see photo 22). Larger riprap exists at the waterline of the northwest and southeast wingwalls.

RECOMMENDATIONS FOR REPAIR

Based on the findings from the field inspection, CHA is offering recommendations to preserve the structural integrity of the bridge as well as improve roadside safety at the site in the short term.

It is recommended to replace the existing pavement on the bridge and at the approaches. A waterproofing membrane should be added to the top of the bare concrete bridge deck before repaving to limit the amount of de-icing salts that can penetrate the concrete. Additional signage should be posted to warn motorists of the potential blunt end hazard condition at the bridge ends.

Measures should also be taken to seal the cracked stone masonry abutments and wingwalls. If left unaddressed these cracks will grow and cause stone and portions of the walls to become unstable.

Action should also be taken to prevent further scour to the east abutment. The scour countermeasure should be designed specifically to retain the streambed material in front of and below the substructure during extreme storm events. The channel centerline should also be shifted towards the center of the bridge span. Potential construction cost estimate: \$125,000 (see Appendix B: Cost Estimate for the estimate breakdown).

While the recommendations above will help to preserve the bridge within the short term, the Town should plan and budget to replace this structure within the next 10 years due to the level of deterioration, substandard bridge railings, lack of approach traffic guide railing, and amount of scour to the substructures. Potential construction cost estimate: \$1,500,000 (see Appendix B: Cost Estimate for the estimate breakdown).

APPENDICES

- Appendix A – Photographs
- Appendix B – Cost Estimate

Appendix A: Photographs

Bridge No. 123003
Location: Scotland, CT
January 29, 2021



Photo 1: North Elevation



Photo 2: South Elevation

Bridge No. 123003
Location: Scotland, CT
January 29, 2021



Photo 3: Bridge from East Approach (Looking West)



Photo 4: Bridge from West Approach (Looking East)

Bridge No. 123003
Location: Scotland, CT
January 29, 2021



Photo 5: Channel looking upstream from bridge



Photo 6: Channel looking downstream from bridge



Photo 7: Typical wearing surface (Note full width transverse cracking on east edge of deck, and spalling with patchwork near midspan)



Photo 8: Southern bridge railing connected to wooden approach post (note space between edge of overlay and curb)



Photo 9: Northern metal railing (note surface rusting)



Photo 10: Typical crumbling and spalling of concrete curbs (note vegetation along northern curb)



Photo 11: Heavy efflorescence and spalling on northern fascia of concrete deck



Photo 12: Heavy efflorescence and spalling on southern fascia of concrete deck



Photo 13: Underside of deck from north fascia (note efflorescence on underside)



Photo 14: Underside of deck from southern fascia (note heavy efflorescence full span length on underside)

Bridge No. 123003
Location: Scotland, CT
January 29, 2021



Photo 15: West abutment



Photo 16: East abutment

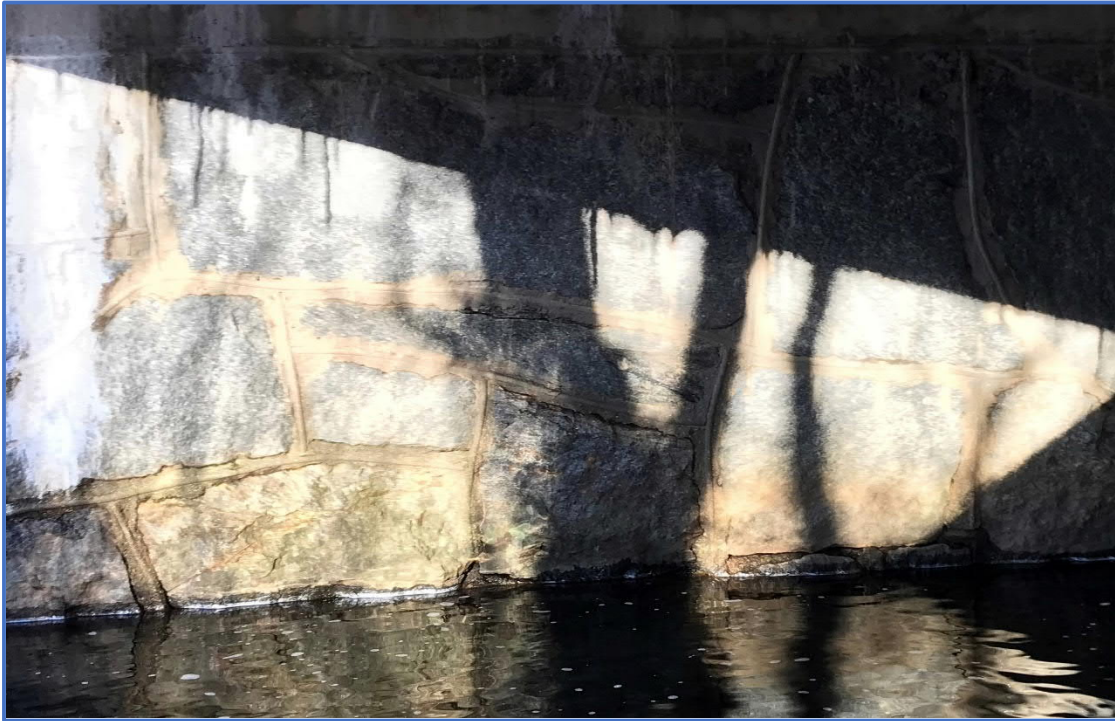


Photo 17: Typical cracking at mortar joints at west abutment



Photo 18: Typical cracking at mortar joints at east abutment



Photo 19: Northwest wingwall (note horizontal to diagonal cracking along mortar joints at mid-height of stem)



Photo 20: Northeast wingwall (note signs of leakage and missing stones at tip of wingwall near waterline)



Photo 21: Southwest wingwall



Photo 22: Southeast wingwall (note loss of mortar near tip of wingwall at waterline)



Photo 23: Vertical and horizontal cracking at top of southeast wingwall



Photo 24: Minor erosion at southwest wingwall

CHA Project No. : 67404		Date : 01/29/21	
		Page: 1 OF 1	
<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. 123003 (Kemp Road over Kimball Pond Brook)		City/Town	Scotland
	(Short Term) Item Description	Unit	Quantity
	Fine Milling	S.Y.	250
	HMA S0.5	TON	4.0
	Waterproofing Membrane	SF	50
	Scour Countermeasure (fill, geotextile, riprap, etc.)	L.S.	1
	Water Handling	L.S.	1
	Concrete Repairs/Crack Sealing	SF	150
		Unit Price	Amount
		\$ 20.00	\$ 5,000
		\$ 300.00	\$ 1,200
		\$ 60.00	\$ 3,007
		\$ 30,000.00	\$ 30,000
		\$ 30,000.00	\$ 30,000
		\$ 100.00	\$ 15,000
		TOTAL ITEMS	\$ 84,207
CONTRACT COST SUMMARY			
		TOTAL ITEMS	\$ 84,207
CLEARING AND GRUBBING		2.0%	\$ 1,684
MOBILIZATION		5.0%	\$ 4,210
CONTINGENCY		15.0%	\$ 12,631
MINOR ITEM ALLOWANCE		15.0%	\$ 12,631
		BASE ESTIMATE	\$ 115,363
		SAY : \$	125,000.00
<p align="center"><i>Note: ROW and Engineering costs are not included in this estimate</i></p>			

CHA Project No. : <u>67404</u>		Date : <u>01/29/21</u>	
		Page: <u>1 OF 1</u>	
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. 123003 (Kemp Road over Kimball Pond Brook)</u>		City/Town <u>Scotland</u>	

(Long Term 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
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
Water Handling	LS	1	\$ 50,000.00	\$ 50,000
TOTAL ITEMS				\$ 1,150,000

PRELIMINARY COST SUMMARY				
			TOTAL ITEMS	\$ 1,150,000
MINOR ITEM ALLOWANCE			30.0%	\$ 345,000
			BASE ESTIMATE	\$ 1,495,000
SAY : \$			<u>1,500,000.00</u>	
<i>Note: ROW and Engineering costs are not included in this estimate</i>				