

September 24, 2013



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Mr. Michael Lynch, Public Works Director  
Durham Department of Public Works  
100 Stone Quarry Drive  
Durham, NH 03824

RE: Evaluation Phase Services – Summary Letter Report  
Durham Point Road over Crommet Creek  
NHDOT Bridge No. 150/065  
Hoyle, Tanner Project Number 902705

Dear Mr. Lynch:

Hoyle, Tanner & Associates, Inc. (Hoyle, Tanner) herein submits this Summary Letter Report presenting our findings and recommendations for the Durham Point Road Bridge over Crommet Creek in accordance with our February 19, 2013 Scope of Services.

#### GENERAL SCOPE OF SERVICES

The Town of Durham (Town) requested bridge engineering services to assess potential repairs to the existing bridge and to prepare Final Plans for the agreed upon repairs. The focus of the assessment was to evaluate the following items:

- **Steel Beams.** Develop repair alternatives to the steel beams if required.
- **Bridge and Approach Rails.** Evaluate bridge and approach rail improvement alternatives.
- **Existing Scuppers.** Consider modifications to the existing scuppers to redirect water away from the exterior beams.
- **Drainage.** Consider drainage improvements to the approach roadways.

Personnel from Hoyle, Tanner visited the site on June 17, 2013 and July 16, 2013 to perform field observations and to gather measurements and information for the preparation of this Summary Letter Report. The purpose of these site visits was to assess existing conditions and prepare sketches and a cost estimate for the recommended repairs.

The evaluation included review of the following information:

- Town of Durham, N.H., Durham Point Road Bridge Repair, dated October 1992, prepared by Underwood Engineers, Inc. (2 sheets), which were obtained from the Town of Durham.
- NHDOT Bridge Inspection Report, dated January 23, 2012.

GENERAL BRIDGE INFORMATION

The Durham Point Road Bridge was constructed in 1930 and rebuilt in 1970. No plans are available for this bridge and the exact extent of work from either period is unknown. The existing bridge is a single span with a skew angle of 5 degrees and consists of steel I-beams with a concrete deck. The total bridge length along the skew is 19'-6" with a clear span of 16'. The overall width of the bridge is 22'-10½" and carries two lanes of traffic on a 21'-3" paved travelway. Bridge rail and cable guardrail are located on either side of the bridge.

The bridge superstructure is supported by stone abutments with cast-in-place concrete caps. Both stone abutments were constructed on timber cribbing. There are also stone u-back wingwalls at each quadrant.

The bridge was repaired in 1992. The available plans depict modifying the bridge rail by replacing the railing with w-beam rail on both sides of the bridge and chinking and mortaring, to the mudline, the stone abutments and wingwalls.

The existing bridge is currently listed on the NHDOT Municipal Redlist and according to the latest NHDOT Inspection Report, dated January 23, 2012; it has an AASHTO Sufficiency Rating of 8%. The bridge currently has weight limit posting signs which state "Gross Weight Limit 15 Tons or 80% of Legal Loads".

For the purpose of this Summary Letter Report, north is assumed to be the upstream direction from the bridge.



Upstream Elevation



Downstream Elevation

INSPECTION OBSERVATIONS

The current condition of the bridge superstructure was determined to be fair and the bridge substructure was determined to be poor. The following conditions and deficiencies were observed and are summarized below:

*SUPERSTRUCTURE*

- All beams exhibit light rusting with light to moderate paint loss.
- Anchor rods at the west bearing plates are not vertical. It appears that the anchor rods may have been installed in this orientation.
- Downstream and upstream exterior beams have moderate deterioration at the scupper locations.
- West bearing plates exhibit heavy rusting.
- Rust pack formation prying the beam flanges off the west bearing plates.
- The underside of the deck exhibits light concrete spalling with exposed rebar. Concrete cover is minimal and varies from approximately  $\frac{1}{4}$ " to  $\frac{3}{8}$ ".



Downstream Exterior Girder



Concrete Spall at Underside of Deck



Typical West Bearing Plate

*SUBSTRUCTURE*

- Concrete beam seat coating is failing.
- Concrete beam seat at the northwest corner is cracked and the concrete is unsound at this location.
- West concrete backwall exhibits spalling behind the upstream exterior girder.
- Void with exposed rebar in the north corner of the west abutment backwall at the wingwall interface.
- Mortar in the stone is cracked at the abutment to wingwall interface at the northwest quadrant.
- Both abutments exhibit bulging in the center, approximately  $\frac{1}{3}$  the height from the channel bottom. Bulging is estimated to be 10" at the west abutment and 8" at the east abutment.
- Within the bulging area there are cracked and loose stones.
- At the west abutment within the bulging area there is a large stone that is hanging.
- Stones are located at the upstream corners of the abutments, which direct the creek flow towards the center of the channel.



Bulging at West Abutment



Bulging at West Abutment

*EXISTING SCUPPERS*

- The underside of the concrete curb within the limits of the downstream scupper exhibits concrete spalling.



Underside of Downstream Curb



North Corner of West Abutment

*BRIDGE AND APPROACH RAILS*

- The bridge rail is substandard.
- The approach rail is damaged at the northeast and southwest quadrants and lacks terminal units.

*DRAINAGE*

- Water at the east approach flows to the downstream scupper in the brush curb.
- Water at the west approach flows to a swale located at the guardrail at the northwest quadrant of the roadway.



Damaged Approach Rail



Drainage Flow Looking East



Drainage on Bridge Looking East

ASSESSMENT AND CONCLUSIONS

*SUPERSTRUCTURE*

Hoyle, Tanner evaluated the structural capacity of the exterior beams at the deteriorated sections and determined that no repairs are required at this time to maintain the current weight limit posting. No visible cracks were observed in the stringers or bearings to suggest distress due to the anchor rods being off-vertical and deformation of the west bearing plates, therefore; no action is required. There are small localized areas of the deck underside that exhibit light concrete spalling. Due to the size and limited quantity of the spalls, patching is not required at this time.

*SUBSTRUCTURE*

The observed bulging of the abutments is believed to be due to settlement and movement of the structure. The bulging was first documented in the NHDOT Inspection report in 2010 when the condition of the substructure went from a condition rating of 5 to 4; however, Town representatives noted this bulging prior to this date. The settlement has caused cracking of the

stones within the bulging area. The loose small stones located in the bulging area appear to have been placed during the 1992 Durham Point Road Bridge Repair project.

#### *EXISTING SCUPPERS*

The existing scuppers consist of 5" high x 2' wide voids in the concrete curb on both sides of the bridge. Water draining from the scuppers leaks onto the exterior beams and has caused deterioration in the exterior beams.

#### *BRIDGE AND APPROACH RAILS*

The 1992 Durham Point Road Bridge Repair project drawings depict a concrete grade beam to be placed over each abutment and new I-Beam posts to be mounted to the grade beams. New guardrail also was installed at all four quadrants of the bridge. The existing bridge posts remain and new w-beam rail has been mounted along the full length of the rail system. Existing cable-rail remains and extends beyond the guardrail for a distance of approximately 143' on the east approach and approximately 56' on the west approach.

It appears that there has been vehicular collision damage to the approach rails, which has damaged the w-beam rail. The slopes behind the guardrail posts are steep and provide little to no shelf for the posts.

#### *DRAINAGE*

During the June 17, 2013 site visit, Hoyle, Tanner representatives were present during heavy rainfall and observed the flow of water. As mentioned under Inspection Observations, the majority of the water flowing from the east approach crosses the road and drains to the downstream scupper. A small amount of water from the east approach drains to a swale located beyond the northeast concrete grade beam. Water flowing from the west approach crosses the road and drains to a swale located beyond the west abutment on the north side of the road. Little to no water from the west approach flows onto the bridge. Ponding was observed along both edges of the bridge deck.

#### RECOMMENDATIONS

From discussions with Town representatives, it is our understanding that the Town's goal is to maintain the Durham Point Road Bridge for a period of 10 to 15 years until the bridge can be replaced. The goal of the recommendations presented in this Summary Letter is to provide the additional 10 to 15 years of service life to the bridge and improve the bridge approaches.

It is important to note that due to the condition of the substructure, a 10-15 year service life at the current live load posting may not be realistic if additional movement or settlement takes place.

The recommendations will be completed under two projects; Bridge Project and Roadway Project. The initial project will be the Bridge Project which will address concerns regarding the bridge superstructure, bridge substructure and existing scuppers. The later project will be the Roadway Project which will address concerns regarding bridge and approach rails and drainage. A "Durham Point Road South Paving" project is scheduled for 2016 and it is anticipated that the Roadway Project could be completed simultaneously with this project.

### *BRIDGE PROJECT*

Hoyle, Tanner recommends the following work items to be completed as part of the Bridge Project:

- **SUPERSTRUCTURE**
  - Paint the middle section, between the two center rail posts, on both exterior beams, with lead barrier compound (LBC) paint to arrest future deterioration. Due to the age of the structure, it is assumed that the existing paint contains lead. The LBC provides a barrier between the lead-based paint and the environment and requires minimal surface prep. An acrylic rust inhibitive primer will be required to neutralize rust on the beams.
- **SUBSTRUCTURE**
  - Long-term, annual monitoring of the abutments to supplement NHDOT inspections and ensure stability of the substructure should be completed. The stone bulging should be well documented with photographs and measurements. If any annual movement over 1/2" is detected, a qualified bridge engineer should be retained to evaluate the substructure.
  - Chink stone face of abutment and wingwalls to the mudline. Replace missing stones in breastwall.
  - Remove and reconstruct the northwest corner of the concrete abutment cap.
- **EXISTING SCUPPERS**
  - Install and grout a drainage pipe with a 90° elbow in the existing scuppers to direct water away from exterior stringers to prevent further damage.
- **MISCELLANEOUS**
  - Obtain Wetlands Permit by Notification. Painting of the beams and repairs to the substructure will require temporary impacts to the creek and the project meets the criteria in Env-Wt 303.04 (x) for "Maintenance, repair, or replacement of a nondocking structure". Once the Town Clerk has filed the completed PBN, the project may proceed after 10 calendar days, provided the Conservation Commission has signed the application. If the Conservation Commission has not signed the PBN, then the project may proceed after 25 calendar days.

The estimated probable total cost of the above Bridge Project recommendations is \$73,500. Refer to Appendix A for the estimate.

### *ROADWAY PROJECT*

Hoyle, Tanner recommends the following work items be completed as part of the Roadway Project:

- **BRIDGE AND APPROACH RAILS**
  - Double-nest the existing w-beam bridge rail and replace the cable guardrail with w-beam guardrail and terminal units. This will require slope improvements to secure the posts into the existing ground.
    - Another option would be to replace all w-beam guardrail and cable guardrail with steel-backed timber guardrail (FHWA standard). Existing bridge rail posts will be maintained and the approach posts will be replaced with wooden posts per the FHWA standard. The wooden posts are larger than the traditional steel w-beam posts, therefore; this option

would require regrading of the slopes and may prompt a Wetlands Standard Dredge & Fill Permit depending on the area of wetland impacts. The processing time for this application is 75 days from the issuance of the Notice of Acceptance.

- **DRAINAGE**

- Pave the approach and bridge roadway, at the time of the "Durham Point Road South Paving" project. The roadway will be regraded to allow water to continue to flow to the downstream scupper and to the northwest swale without ponding at the bridge deck.

- **MISCELLANEOUS**

- Obtain survey. A survey will be required to regrade the roadway and to layout the rail system.

The estimated probable total cost of the above Roadway Project recommendations is \$97,000. The cost in 2016 dollars, assuming 3% annual inflation, is \$106,000. Refer to Appendix A for the estimate.

The estimated probable total cost of both projects is \$211,048 in 2013 dollars, which includes costs for Evaluations Phase Services and Design. Refer to Appendix A for the estimate.

We trust that this letter will meet with your approval. Please feel free to contact me should you need additional information or if you have any questions during your review.

Sincerely,  
*Hoyle, Tanner & Associates, Inc.*



Sean James, P.E.  
Project Manager



Jillian Semprini, P.E.  
Project Engineer

Enclosure: Appendix A: Cost Estimates



# **Appendix A**

## **Cost Estimates**



Hoyle, Tanner & Associates, Inc.  
 150 Dow Street  
 Manchester, NH 03101 (603) 669-5555

Calc. By:	JAS	Date:	9/17/2013
Chck. By:	STJ	Date:	9/18/2013
Chck. By:		Date:	
Chck. By:		Date:	

**Durham Point Road over Crommet Creek, Durham, NHDOT Br. No. 150/065**  
**Engineers Estimate of Probable Construction Costs**  
**Preliminary Design Submittal**  
**HTA Project No. 902705**

ITEM	CONSTRUCTION (CON)	RIGHT OF WAY (ROW)	ENGINEERING	PROJECT TOTAL COST
BRIDGE PROJECT	\$63,000	\$0	\$10,500	\$73,500
ROADWAY PROJECT	\$87,000	\$0	\$10,000	\$97,000
EVALUATION PHASE SERVICES	\$0	\$0	\$28,186	\$28,186
DESIGN	\$0	\$0	\$12,362	\$12,362

PROJECT TOTAL COST (CON, ROW, PE) **\$211,048.00**

K:\902705\Design\Estimates\EstOfCost.xls]Roadway Project

This Engineers Estimate of Probable Construction Costs is based on the anticipated scope of work, as well as HTA's experience with similar projects and understanding of current industry trends. The estimate has not been based on a final design for this project, and as such, it is intended to be preliminary in nature. It should be noted that changes in material or labor costs in the construction industry could impact the project cost in either direction.



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**Durham Point Road over Crommet Creek, Durham, NHDOT Br. No. 150/065**  
**Engineers Estimate of Probable Construction Costs**  
**Preliminary Design Submittal - Bridge Project**  
**HTA Project No. 902705**

ITEM NO	ITEM DESCRIPTION	Quantity		Cost	
		Unit	Amount	Unit	Total
502	REMOVAL OF EXISTING BRIDGE STRUCTURE	U	1	\$5,000.00	\$5,000
520.12	CONCRETE CLASS A, ABOVE FOOTINGS (F)	CY	5	\$1,000.00	\$5,000
556	PAINTING EXISTING STRUCTURAL STEEL	U	1	\$10,000.00	\$10,000
571	POINTING STONE MASONRY	U	1	\$6,000.00	\$6,000
603.90021	DRAINAGE PIPE	U	1	\$1,000.00	\$1,000
618.7	FLAGGERS	HR	88	\$25.00	\$2,200
692	MOBILIZATION	U	1	\$10,000.00	\$10,000

		<b>CONSTRUCTION (CON)</b>	
CONSTRUCTION SUBTOTAL			\$40,000.00
CONTINGENCY (20%)			\$8,000.00
HOYLE , TANNER CONSTRUCTION ENGINEERING			\$15,000.00
<b>CONSTRUCTION (CON) TOTAL FOR NHDOT FY PLANNING</b>			<b>\$63,000.00</b>
		<b>RIGHT OF WAY (ROW)</b>	
EASEMENTS			\$0.00
		<b>ENGINEERING</b>	
MONITORING STONE ABUTMENTS			Town Forces
WETLAND PERMIT BY NOTIFICATION			\$5,500.00
BID			\$5,000.00
<b>PRELIMINARY ENGINEERING (PE) TOTAL</b>			<b>\$10,500.00</b>
<b>BRIDGE PROJECT TOTAL COST (CON, ROW, PE)</b>			<b>\$73,500.00</b>

K:\902705\Design\Estimates\[EstOfCost.xls]Roadway Project

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**Durham Point Road over Crommet Creek, Durham, NHDOT Br. No. 150/065**  
**Engineers Estimate of Probable Construction Costs**  
**Preliminary Design Submittal - Roadway Project**  
**HTA Project No. 902705**

ITEM NO	ITEM DESCRIPTION	Quantity		Cost	
		Unit	Amount	Unit	Total
202.71	REMOVAL OF CABLE GUARDRAIL	LF	400	\$4.00	\$1,600
203.5555	GUARDRAIL 25'EAGRT PLATFORM	U	4	\$2,500.00	\$10,000
214	FINE GRADING	U	1	\$3,000.00	\$3,000
304.31	CRUSHED GRAVEL FOR SHIMMING	CY	20	\$50.00	\$1,000
306.114	RECLAIMED STABILIZED BASE PROCESSED IN PLACE	SY	700	\$5.00	\$3,500
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	125	\$90.00	\$11,250
417	COLD PLANING BITUMINOUS SURFACES	SY	25	\$40.00	\$1,000
563.81	REHABILITATION OF BRIDGE RAIL (F)	LF	50	\$40.00	\$2,000
606.1455	BEAM GUARDRAIL (TERM. UNIT EAGRT 25 FT.)	U	4	\$2,000.00	\$8,000
606.1485	BEAM GUARDRAIL (BRIDGE APPROACH UNIT)	U	4	\$2,500.00	\$10,000
632.0104	RETROREFLECTIVE PAINT PAVE. MARKING, 4" LINE	LF	1200	\$0.25	\$300
618.7	FLAGGERS	HR	128	\$25.00	\$3,200
692	MOBILIZATION	U	1	\$5,000.00	\$5,000

	<b>CONSTRUCTION (CON)</b>	
	<b>CONSTRUCTION SUBTOTAL</b>	\$60,000.00
	<b>CONTINGENCY (20%)</b>	\$12,000.00
	<b>HOYLE , TANNER CONSTRUCTION ENGINEERING</b>	\$15,000.00
	<b>CONSTRUCTION (CON) TOTAL FOR NHDOT FY PLANNING</b>	<b>\$87,000.00</b>
	<b>RIGHT OF WAY (ROW)</b>	
	<b>EASEMENTS</b>	<b>\$0.00</b>
		<b>ENGINEERING</b>
	<b>FIELD SURVEY</b>	\$5,000.00
	<b>BID</b>	\$5,000.00
	<b>PRELIMINARY ENGINEERING (PE) TOTAL</b>	<b>\$10,000.00</b>
	<b>2013 ROADWAY PROJECT TOTAL COST (CON, ROW, PE)</b>	<b>\$97,000.00</b>
	<b>2016 ROADWAY PROJECT TOTAL COST (CON, ROW, PE)<sup>1</sup></b>	<b>\$106,000.00</b>

<sup>1</sup> It is expected that this project will be completed simultaneously with the "Druahm Point Road South Paving" project scheduled for 2016. The cost in 2016 dollars assumes 3% annual inflation.

K:\902705\Design\Estimates\[EstOfCost.xls]Roadway Project

This Engineers Estimate of Probable Construction Costs is based on the anticipated scope of work, as well as HTA's experience with similar projects and understanding of current industry trends. The estimate has not been based on a final design for this project, and as such, it is intended to be preliminary in nature. It should be noted that changes in material or labor costs in the construction industry could impact the project cost in either direction.