Trestle Bridge Presentation – October 11, 2022

Franklin
NEW HAMPSHIRE
The Three Rivers City

McFarland Johnson

Introduction

- Seth Creighton, AICP – Planning & Zoning Director
  City Project Manager
- Brian Colburn, PE – MJ Project Manager
- Ron Joy, PE – MJ Structural Engineer
- Chris Gagne – MJ Structural Engineer

Agenda

- Project Description
- Summary of Inspection Findings
- Review of Conceptual Alternatives
- Cost Estimates
- Public Feedback / Questions
- Discussion on Next Steps

Project Description

- Construct a Pedestrian Connection Between Winnipesaukee River Trail and Mill City Park
- Awarded a Grant from NHDOT in 2019
  - NHDOT Funding $512,000
  - City Funding $128,000
  - Total Funding $640,000
  - (Assumed Replacing Railroad Ties with Solid Timber Deck)
  - Project Must Follow Prescribed Design Process

Design Process

- Engineering Study
  - Bridge Inspection
  - Develop Alternatives
  - Public Input
  - Select Locally Preferred Alternative
- Preliminary Design
- Final Design
- Construction

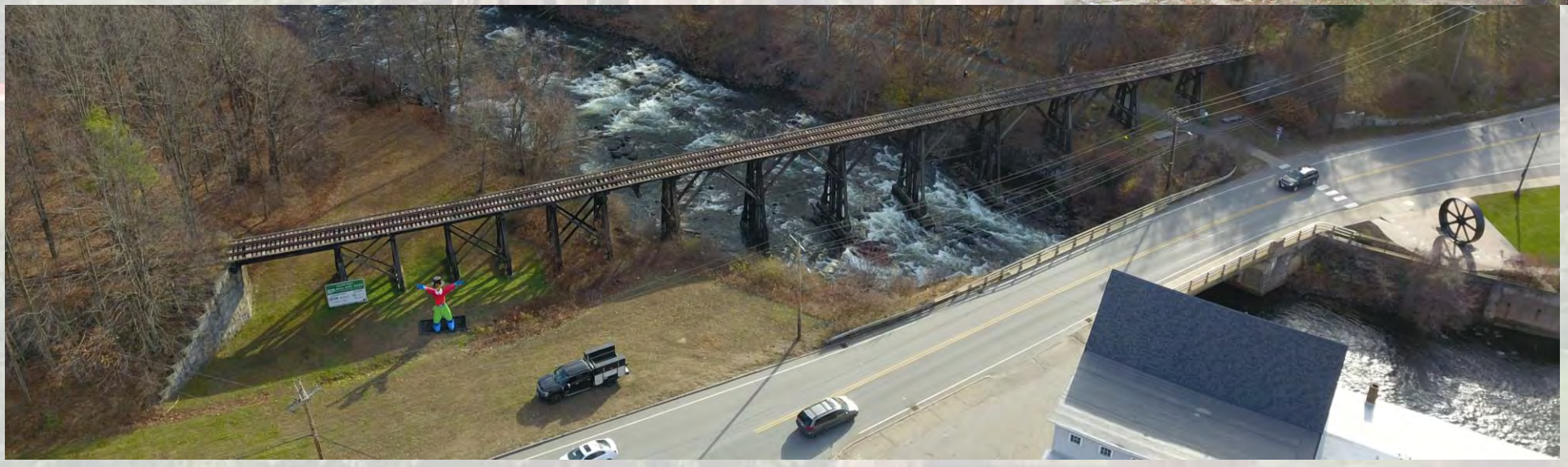
September 1967

History of Franklin Tilton Railroad

- 5-mile Franklin-Tilton RR Spur Between Winnipesaukee Rail Division and B&M Northern Line
- 1889 Franklin-Tilton RR Charter
- 1891 First Sulphite RR Bridge
- 1895 B&M RR Leases Railroad Line
- 1896 Present Sulphite RR Bridge
- Trestle Bridge Built
- 1890s International Paper Buys Mill
- 1920s Paper Mill Closes
- 1936 Rail Service Stopped
- 1940 Request to ICC to Abandon
- 1973 Line Decommissioned

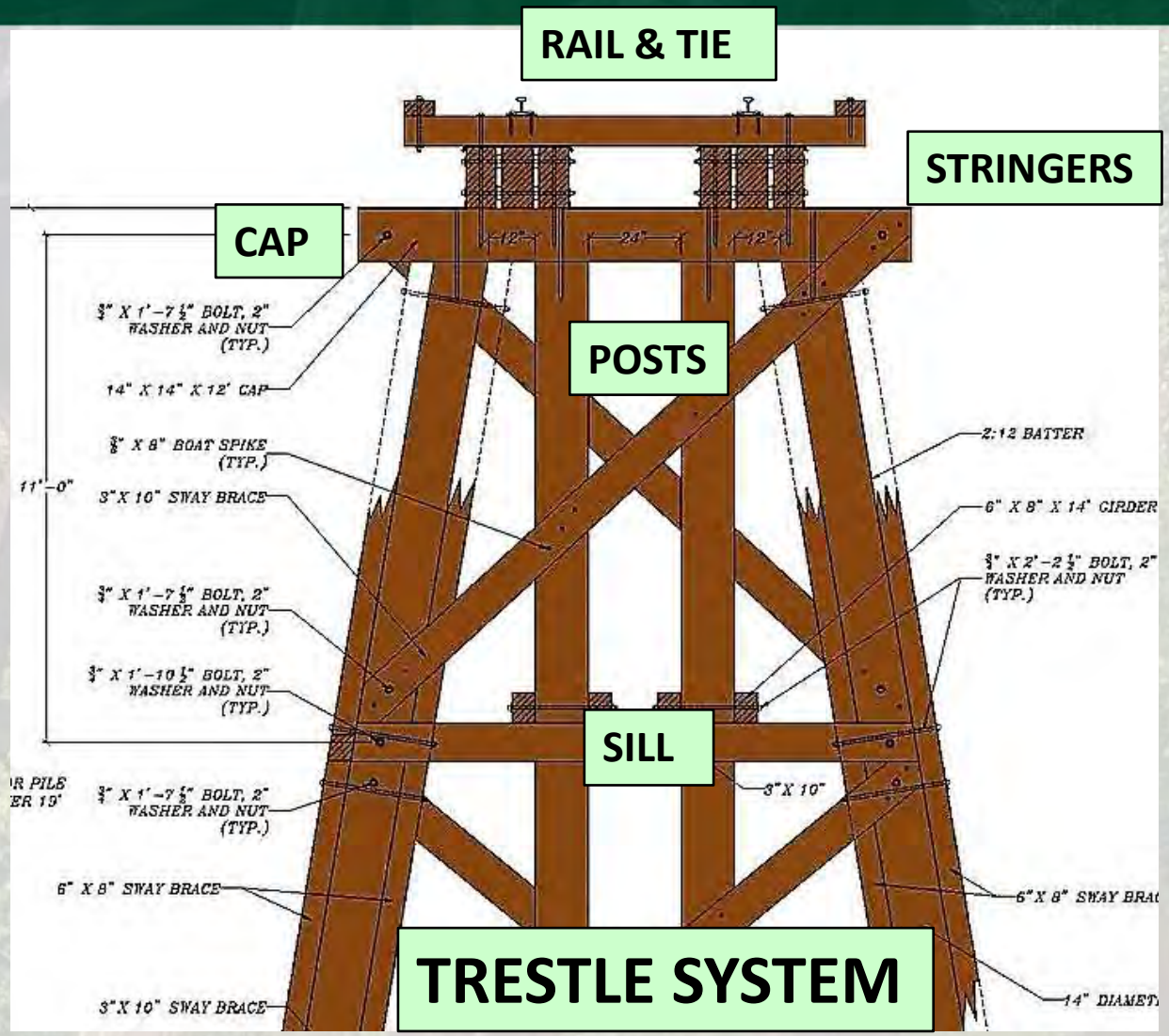
Description of Bridge

- 15-Spans, 356’ long, 12’ wide, 20’ above ground
- 3 types of trestle spans
  1. Standard (Spans 1-6 & 15)
  2. A-Frame (Spans 8-13)
  3. Inverted King Post (Spans 7 & 14)



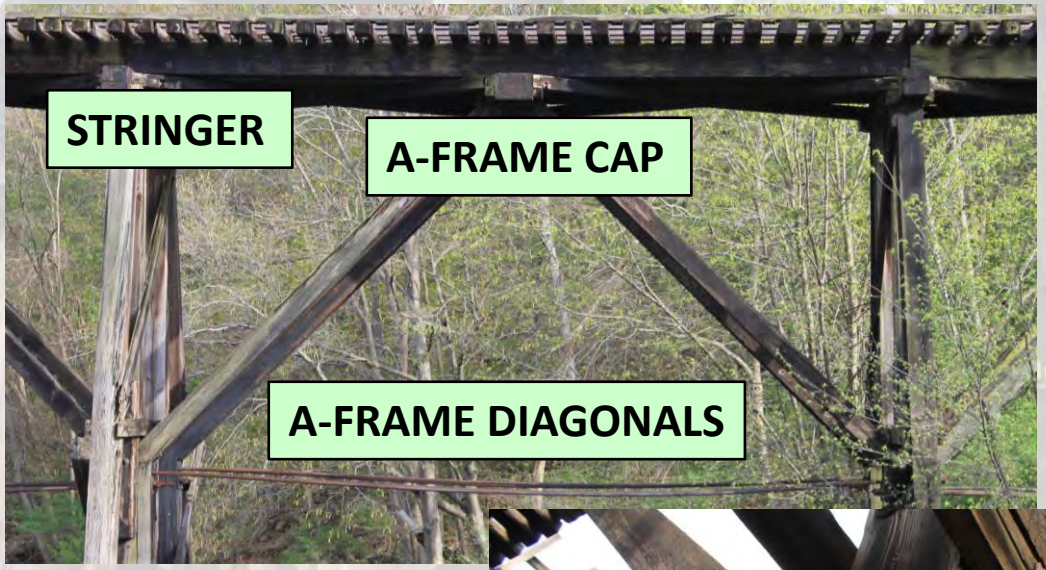
1. Standard Span

- Standard for Branch Lines
  - Height under 12 feet
  - Height between 12-19 feet
  - Height over 19 feet
- Maximum 14 foot span
- Consists of series of nearly identical vertical supports holding up a succession of short spans.
- Direct load path from top of rail to foundation



2. A-Frame Span

- For span lengths greater than standard trestle span, A-frames effectively provide additional stringer support.
- Additional longitudinal bracing of adjacent spans are required to aid the bridge in resisting horizontal forces acting through the frame members.



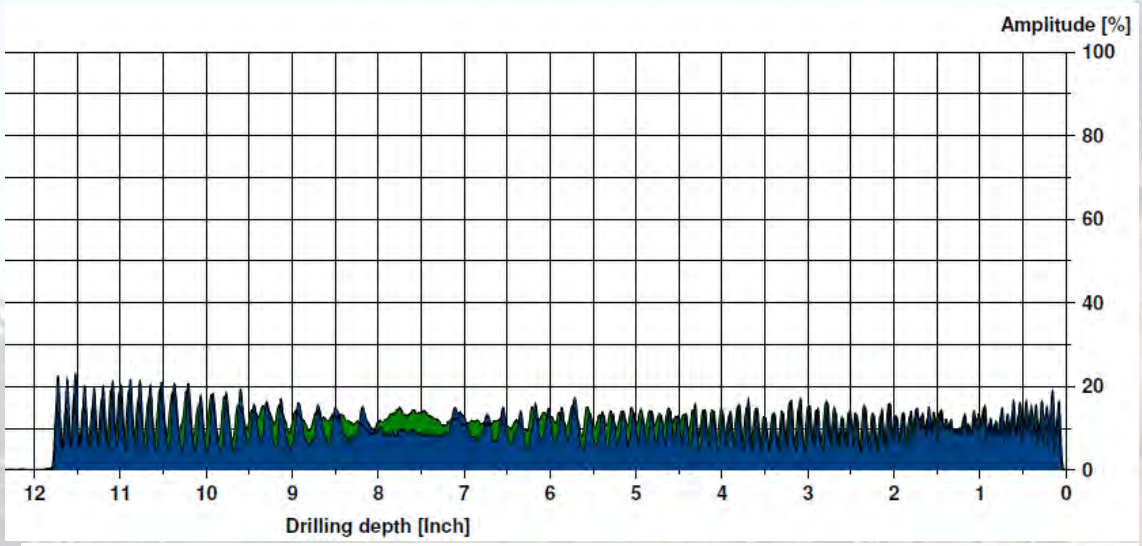
3. Inverted King Post Span

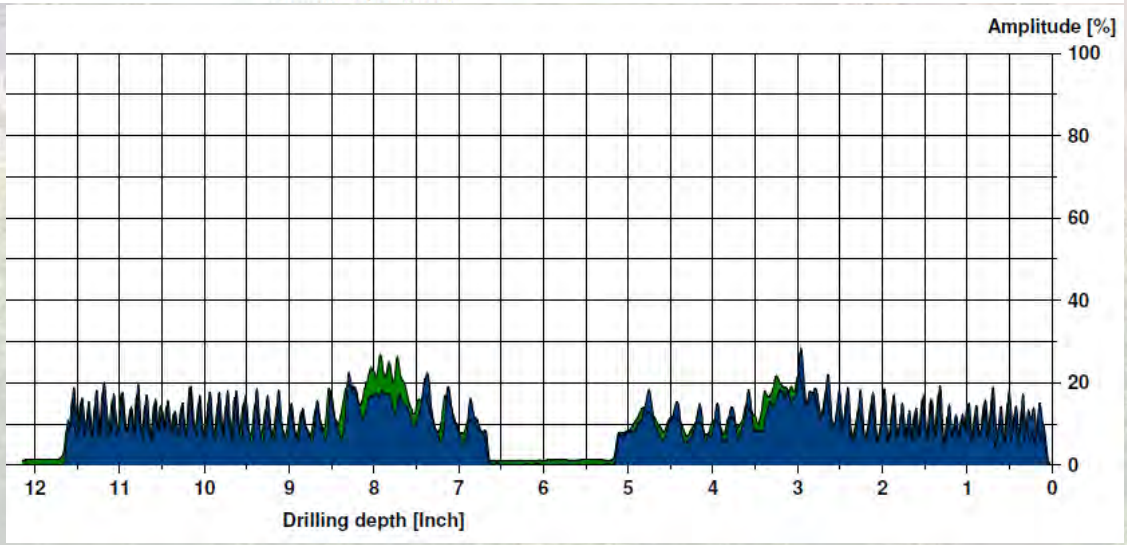
- Inverted King Post provides additional stringer support.
- Incorporate a short section of a standard timber bent (with a cap and sill).
- Stringers function as truss members with combined axial compression (truss action) and flexural (floor system bending) stresses.
- Most distinguishable element on the bridge.

Resistance Microdrilling for Timber Inspection

- Highly calibrated drill used to identify timber condition
- Measures forward pressure and torsional resistance needed to advance a 1/16” diameter drill bit into material
- Plots Resistances vs. Depth in real time on built in display
- DOES NOT measure strength of wood – only verifies condition relative to resistances throughout cross-section

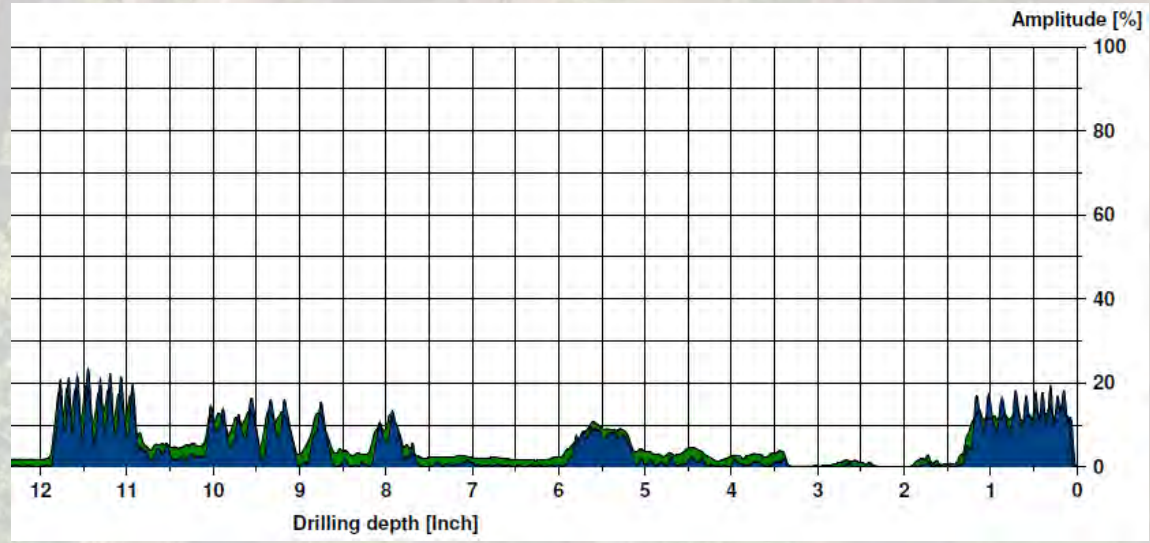
Resistance Microdrilling for Timber Inspection





SAMPLE DRILL RESULTS

- Note the drilled dimension is 11.75” in all members
- Top Left – Quality wood, no obvious signs of defects
- Bottom Left – Majority is OK, but middle 1.5” is rotted
- Bottom Right – The exterior 1” on each side is ok, but rest of section is deteriorated



Track View

2008

2020

2022

Condition Summary Table - Bents

	Cap	Post 1	Post 2	Post 3	Post 4	Comments
Bent 1		DB, SD	DB, DM	DM	RE, SD, DB (6')	
Bent 2	RE	RE, DB	RE, DM	DM	RE, DB	All columns have discrete rot, but generally okay.
Bent 3	RE, HO	RE, DM, HO	RE, DT, HO	RE, DT, HO	RE, DB	Top half of C4 may be able to be salvaged.
Bent 4	CR	RE		RE, DB	RE, DB	
Bent 5	RE, ST	DB	RE, DT	DB	RE, ST	
Bent 6		RE	RE, DB, DT			
Bent 7	R	RE, DT, DB	RE, DT, SD	RE, DB, DM	ST, SD, DB, DT	Pipe rolled onto/resting on C4.
River Bent 8	R, CR	RE, DB (6')	RE, R, SD	DB	RE, DB (5')	
River Bent 9	CR	DT, DM	R, SD	DB, SD	DB, SD	Could not access bottom. Visual rot at base of all 4 colmuns - severity unknown.
River Bent 10	ST	DM, HO	DB	RE, DM	DM, SD	Could not access bottom. Cap showing signs of shear distress.
River Bent 11	ST, SD	RE, ST	DB (3'), DT	RE, DB, HO, SD	RE	Cap rotting at ends, solid under bearing area.
River Bent 12	RE	RE, ST, DB (3')	RE, DB, DM, HO, SD	RE, DM, SD	RE, SD	Visual inspection only at bent cap (top).
Bent 13	CR	RE, HO, DT (6')	RE, HO, DT (6')	RE, HO, DT (6')	RE, HO, DT (3')	Bolsters are crushed.
Bent 14	CR	RE, DB	RE, DB	RE, DB, SD	RE, DB	Bolsters are crushed. C2 and C3 are doubled/twin columns (each).

Timber Defects	
CR	Crushed
ST	Split
DB(feet)	Deteriorated Bottom (feet)
DM (feet)	Deteriorated Mid-Height (feet)
DT(feet)	Deteriorated Top (feet)
HO	Hollow
R	Rot
RE	Repaired (Previously)
SD	Surface Deterioration
	Retain Member
	Replace Member
	Repair Member Option

Condition Summary Table - Stringers

	Stringer 1	Stringer 2	Stringer 3	Stringer 4	Stringer 5	Stringer 6
Span 1	DT					HO
Span 2	HO	HO, R		ST		
Span 3	DT, ST			DT, R		
Span 4	HO, R	R		DT		DT
Span 5		DT	DT	DT	DT	DT
Span 6	R	DT, R	DT, R	DT, R	DT, R	DT, R
Span 7	R @ B7		R @ B7			
Span 8	R @ B7	R @ B7	R @ B7	R @ B7	R @ B7	R @ B7
Span 9		R			DT, HO, R	DT, HO, R
Span 10					R	
Span 11					R	
Span 12		R			DT, R	R
Span 13			R	R	R	
Span 14		R			R	
Span 15						

Timber Defects	
CR	Crushed
ST	Split
DB(feet)	Deteriorated Bottom (feet)
DT(feet)	Deteriorated Top (feet)
R	Rot
HO	Hollow
RE	Repaired (Previously)
SD	Surface Deterioration
FL	Full Length
	Retain Member
	Replace Member
	Repair Member

*Note that surface deterioration is typical for tops of all stringers in all spans

**Note that this table is based on hands on inspection from under the structure. Top side inspection was partially visual due to restricted access.

Condition Summary Table – A-Frames & Truss

	A-Frame Cap	A-Frame Diagonals				King Post
		U. Stream, B. Bent	D. Stream, B. Bent	U. Stream, F. Bent	D. Stream, F. Bent	
Span 1	N/A	N/A	N/A	N/A	N/A	N/A
Span 2	N/A	N/A	N/A	N/A	N/A	N/A
Span 3	N/A	N/A	N/A	N/A	N/A	N/A
Span 4	N/A	N/A	N/A	N/A	N/A	N/A
Span 5	N/A	N/A	N/A	N/A	N/A	N/A
Span 6	N/A	N/A	N/A	N/A	N/A	N/A
Span 7	N/A	N/A	N/A	N/A	N/A	HO, R
Span 8	R		R	ST	R	N/A
Span 9						N/A
Span 10						N/A
Span 11			R			N/A
Span 12	R	R	R			N/A
Span 13	ST	R		HO, ST		N/A
Span 14	N/A	N/A	N/A	N/A	N/A	CR
Span 15	N/A	N/A	N/A	N/A	N/A	N/A

Timber Defects	
CR	Crushed
ST	Split
DB(feet)	Deteriorated Bottom (feet)
DT(feet)	Deteriorated Top (feet)
R	Rot
HO	Hollow
RE	Repaired (Previously)
SD	Surface Deterioration
FL	Full Length
	Retain Member
	Replace Member
	Repair Member

Condition Summary Table

Element	Total	Green (Retain)	%	Red (Replace)	%	Yellow (Repair)	%
Bents	70	27	39%	20	29%	23	33%
Stringers	90	10	11%	38	42%	42	47%
A-Frames	30	12	40%	8	27%	10	33%
	190	49	26%	66	35%	75	39%

Bent Condition

BENT 1

BENT 1

BENT 3

Bent Condition

BENT 3

BENT 3

BENT 4

Bent Condition

BENT 7

BENT 7

BENT 7

Bent Condition

BENT 10

BENT 11

BENT 13

Bent Condition

BENT 13

BENT 13

SPAN 13

River Piers Condition

River Piers Condition

River Piers Condition

River Piers Condition

Structural Inspection Findings

- Portions of the Truss are in Poor Condition
- Truss is Continuing to Deteriorate
- 2019 Inspection Led to Path Relocation

Current Alternatives

- Rehabilitate Existing Railroad Trestle
  - Remove Rail, Ties, & Stringer and Put on New Deck & Historic Style Railing
  - Rehabilitate and Replace Trestle Members
- New Railroad Trestle
  - Replicate Existing Design
  - All New Timber Members
- New Pedestrian Bridge Upstream
  - [illegible]ing Trestle

Alternative Cost Estimates

	ALTERNATIVE COST ESTIMATES			
	FULL HISTORIC RESTORATION ALTERNATIVES FOR PEDESTRIAN LOADING		NEW PEDESTRIAN BRIDGE & STABILIZE TRESTLE	NO-BUILD & STABILIZE TRESTLE
	REHABILITATE TRESTLE	REPLACE TRESTLE IN-KIND		
TIMBER TRESTLE WORK	$ 2,200,000	$ 1,925,000	$ 1,000,000	$ 1,000,000
NEW CONCRETE RIVER PIERS (TBD)	$ 550,000	$ 550,000	$ -	$ -
PEDESTRIAN DECK & WROUGHT IRON HISTORIC STYLE RAILING	$ 625,000	$ 625,000	$ -	$ -
CONTINGENCY	$ 350,000	$ 300,000	$ 225,000	$ 225,000
MOBILIZATION	$ 350,000	$ 300,000	$ 225,000	$ 225,000
NEW PEDESTRIAN BRIDGE & FOUNDATIONS	$ -	$ -	$ 1,495,000	$ -
APPROACH WORK	$ 75,000	$ 75,000	$ 60,000	$ -
TOTAL CONSTRUCTION ESTIMATE	**$ 4,150,000**	**$ 3,775,000**	**$ 3,005,000**	**$ 1,450,000**
DESIGN ENGINEERING, GEOTECHNICAL, & PERMITTING	$ 375,000	$ 350,000	$ 240,000	$ 150,000
CONSTRUCTION ENGINEERING (7% CONSTRUCTION)	$ 290,000	$ 260,000	$ 210,000	$ 100,000
TOTAL PROJECT ESTIMATE	**$ 4,815,000**	**$ 4,385,000**	**$ 3,455,000**	**$ 1,700,000**
CITY SHARE	20%	20%	20%	100%
CITY COST	**$ 963,000**	**$ 877,000**	**$ 691,000**	**$ 1,700,000**

$550,000 Already Funded ($440,000 DOT - $110,000 City)

New Railroad Trestle Alternatives

- Modern Materials Could Be Used to Build a More Efficient Trestle
  - Fewer Bents
  - Longer Spans
  - Would Change the Look of the Trestle
  - Would Lower Construction Costs
  - Require Additional Coordination with Resource Agencies
  - Wide Range of Options

Questions

Next Steps

- Select Locally Preferred Alternative
- Review with NHDOT
- Identify Additional Funding Sources
- Continue with Design Development

Contact Information

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