



Upper, Lower, and Northfield Falls Covered Bridges

Northfield BO CVBR(7)(8)(9)

Bridges No. 10 and 11 over Cox Brook
Bridge No. 15 over Dog River

Alternatives Presentation

June 23, 2026



1

Presentation Outline



- Purpose & Need
- Background
- Inspection Findings
- Rehabilitation Alternatives
- Right-of-Way, Utilities, Fire Protection
- Summary
- Cost
- Anticipated Schedule
- Questions

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

2

Purpose and Need



Purpose

- Provide safe crossings over Cox Brook & Dog River for traveling public
- Address structural deficiencies & ongoing deterioration
- Extend bridges' service life

Need

- Bridges require rehabilitation to continue to meet the needs of the community

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

3

Location Map

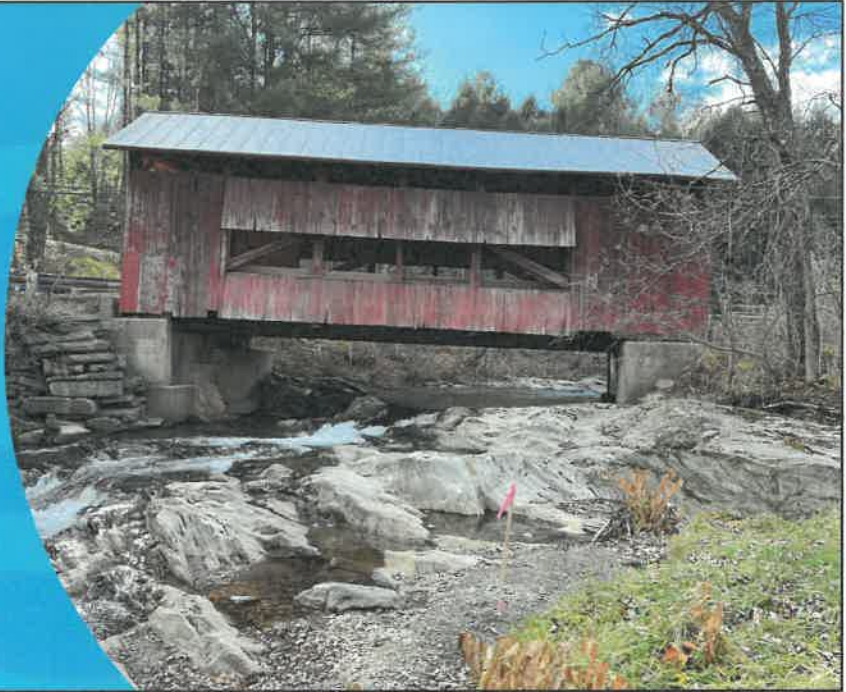


Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

4

Upper Cox Brook Covered Bridge



5

Existing Bridge Information




- Bridge Constructed in 1872, Rehabilitated in 1967 & 1979
- Listed in National Register of Historic Places in 1974
- Queen Post Trusses
 - 54'-3" Long
 - 13'-7" Horizontal Clearance
 - 12'-0" Vertical Clearance (Posted)
 - Weight Limit (6-Ton Single Axle, 8-Ton Tandem, 11-Ton Gross)
- Substructures: Reinforced Concrete Abutments

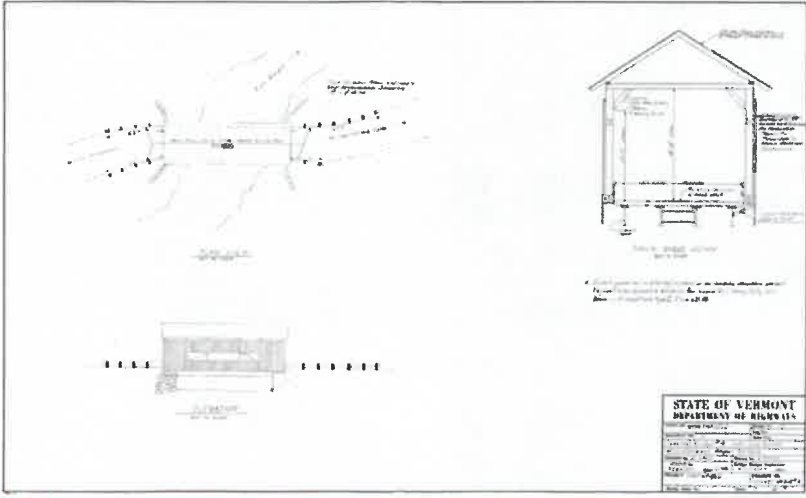
Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

6

Section and Elevation View






Northfield BO CVBR(7)(8)(9) Trusted Experts | Innovative Results

7

Inspection Findings



	Condition Rating	Description
<ul style="list-style-type: none"> • Overall Bridge Condition = 4 (Poor) • Deck Condition = 5 (Fair) • Superstructure Condition = 4 (Poor) • Substructure Condition = 6 (Satisfactory) • Channel Condition = 8 (Very Good) 	9 8 7 6 5 4 3 2 1	Excellent Condition Very Good Condition Good Condition Satisfactory Condition Fair Condition Poor Condition Serious Condition Critical Condition Imminent Failure Condition

Northfield BO CVBR(7)(8)(9) Trusted Experts | Innovative Results

8

Metal Roof



- Leaks
- Screw Attachment



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

9

Roofboards & Rafters



- Splits
- Breaks
- Rot



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

10

Upper Bracing Members



- Splits
- Breaks
- Rot
- Impact Damage



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

11

Truss Members



- Splits
- Breaks
- Rot
- Weathering
- High Moisture Content



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

12

Steel Beams



- Rust Holes
- Advanced Corrosion



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

13

Portals



- Breaks
- Impact Damage



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

14

Approach Railing



- Extensive Corrosion
- Rust Holes
- Rotted Wood Posts
- Impact Damage



Northfield BO CVBR(7)(8)(9)

Trusted Experts Innovative Results

15

Abutments



- Voids
- Spalling
- Exposed Rebar



Northfield BO CVBR(7)(8)(9)

Trusted Experts Innovative Results

16

Previous Flooding (Irene 2011)



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

17

Rehabilitation Alternatives



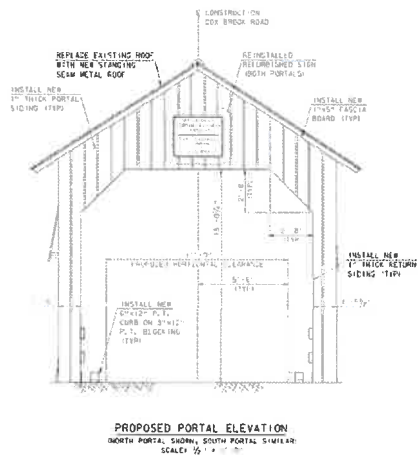
- **Bridge Rehabilitations are feasible based on:**
 - Current conditions of bridge
 - Deterioration types and levels of section losses observed
 - Expected remaining service life
- **Rehabilitation includes:**
 - Repair, strengthening, or replacement of bridge members
- **Bridge Loads**
 - Snow – 60 PSF Ground, 31 PSF Roof Applied
 - Wind – 14 PSF
 - Live Load – H15 (15-Ton), HS15 (27-Ton), H20 (20-Ton), HS20 (36-Ton)
 - Live load not carried by truss members

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

18

Recommended Work: Fascia & Portal Siding



- Existing
 - 1" Thick Boards
- Recommended Work
 - Replacement of all Existing Siding Boards, Eastern White Pine

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

19

Recommended Work: Roof Members



- Existing
 - Standing Seam Metal Roof
 - 2"x6" Rafters, Eastern Spruce
 - 1"x8" Roof Boards, Eastern Spruce
 - 3"x7" Rafter Support Beams, Eastern Spruce
- Recommended Work
 - New Standing Seam Metal Roof
 - Replacement of all Existing Roof Boards
 - 8 Rafters (14%) to be Replaced In-Kind

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

20

Recommended Work: Lat. Bracing Members

- Existing
 - 6"x6" Crossbeams, Eastern Spruce
 - 2"x8" Diagonal Braces, Eastern Spruce
 - Steel Knee Braces
- Recommended Work
 - Replacement of all Upper Bracing In-Kind
 - 2 Cross Beams (22%) to be Replaced In-Kind
 - Replace all Steel Knee Braces with Timber Knee Braces

Legend:
Red – Replace due to Strength Needs

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

21

Recommended Work: West Truss

Board Feet of Replacement:
 Verticals = 12%
 Truss Members = 4%
 Numerous Repairs

Assume additional 15% of member replacement and/or repair due to deficiencies in members that were hidden during inspection

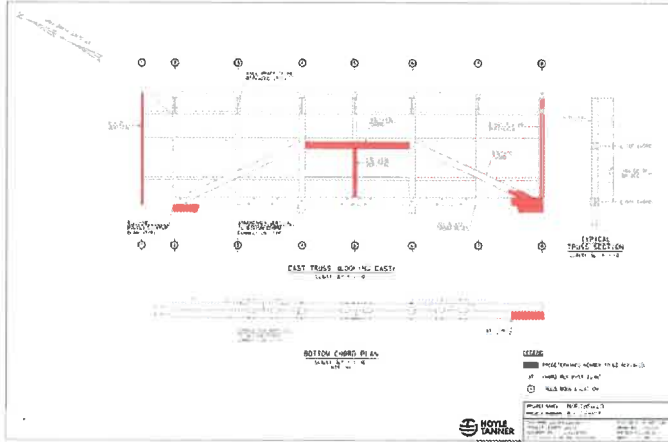
Legend:
Red – Replace due to Condition

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

22

Recommended Work: East Truss



Board Feet of Replacement:
 Verticals = 22%
 Truss Members = 29%
 Numerous Repairs

Assume additional 15% of member replacement and/or repair due to deficiencies in members that were hidden during inspection

Legend:
 Red – Replace due to Condition

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

23

Existing Conditions: Floor System



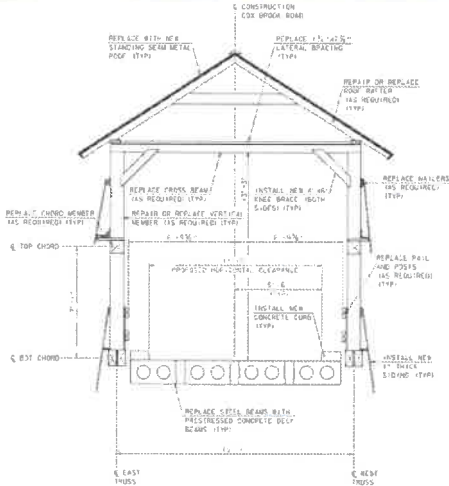
- Existing:
 - 24WF100 and 21WF62 Steel Beams
 - C15x33.9 Steel Diaphragms
 - 2"x6" Nail Laminated Deck, Southern Yellow Pine
 - 1½" Thick Runner Boards, Eastern Pine

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

24

Floor System – Concrete Deck Beam



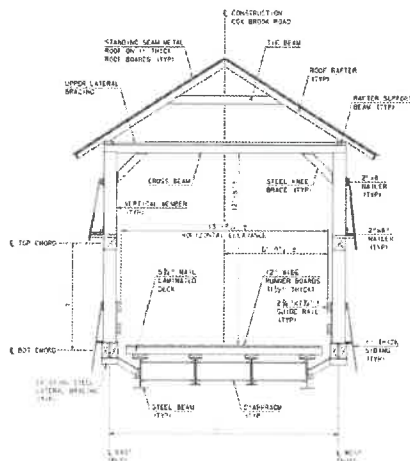
- Concrete Deck Beam
 - Replace Steel Stringers with new 18" Deep Concrete Deck Beams
 - HS20 Live Load – 36-Ton, 3 Axle
 - Exposed Concrete Deck
 - Add Concrete Curbs
- Does provide 1' freeboard during design storm event

Northfield BO CVBR(7)(8)(9)

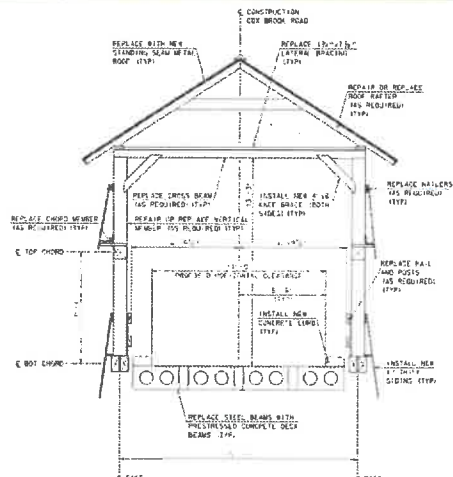
Trusted Experts Innovative Results

27

Increased Vertical Clearance



Existing Vertical Clearance
12'-8"



Proposed Vertical Clearance
13'-3"

Northfield BO CVBR(7)(8)(9)

28

Recommended Work: Substructure



- Bridge Seat Elevation Modification
- Concrete Repair / Crack Sealing
- Stain And Seal Concrete

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

29

Right-of-Way, Utilities, Fire Protection

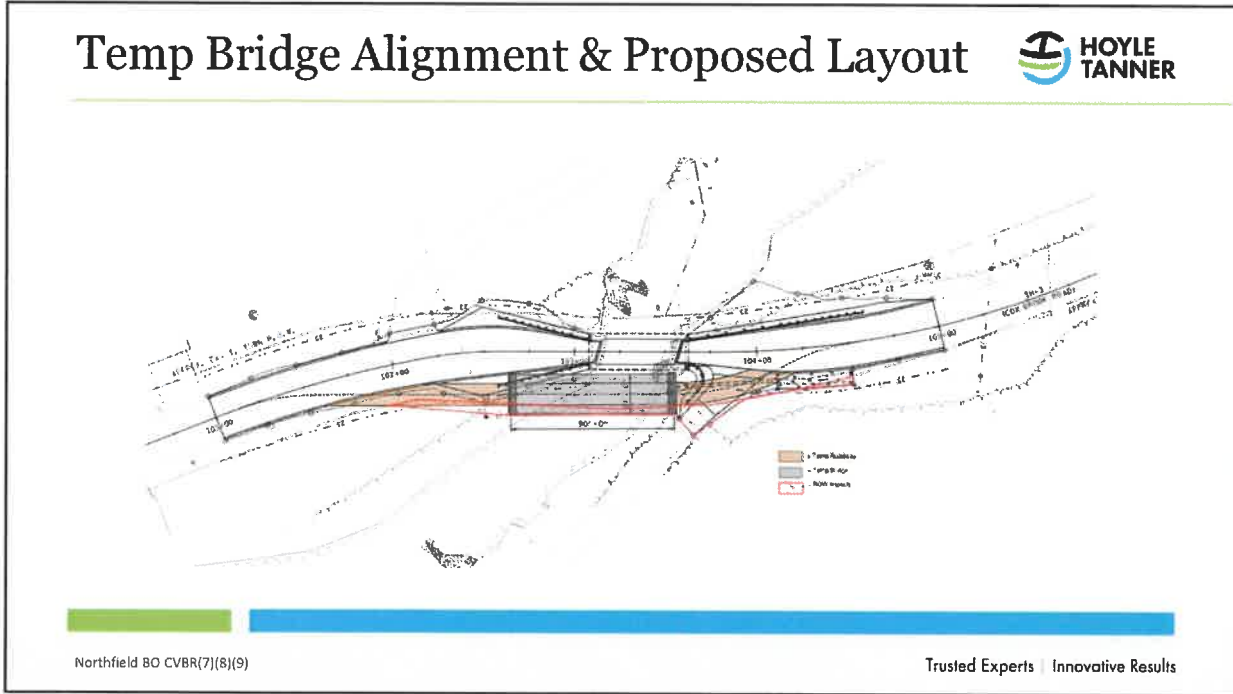


- Right-of-Way is 3-Rod
- Relocation of Utilities Will be Required
- Insecticide/Fungicide
- Fire Protection
 - Recommend NOCHAR
 - Protectowire/Sprinkler
- Lighting

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

30



31

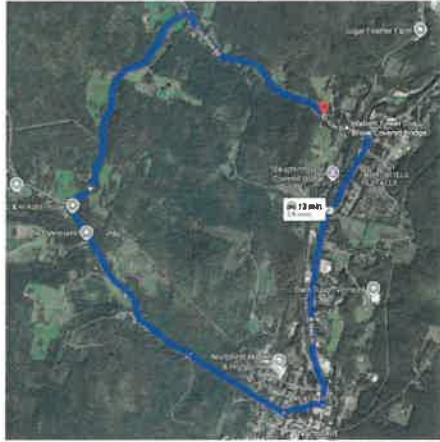
Temporary Bridge - Cost Summary

Northfield BO CVBR(7)	Do Nothing	Steel Stringers				Concrete Deck Beams
		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
		Rehabilitation for H15 (15-Ton, 2 Axle) Loading	Rehabilitation for H15 (27-Ton, 3 Axle) Loading	Rehabilitation for H20 (20-Ton, 2 Axle) Loading	Rehabilitation for H20 (36-Ton, 3 Axle) Loading	Rehabilitation for H20 (36-Ton, 3 Axle) Loading
ROADWAY	\$0	\$ 382,000	\$ 392,000	\$ 392,000	\$ 392,000	\$ 382,000
EROSION CONTROL	\$0	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000
BRIDGE	\$0	\$ 996,000	\$ 1,047,000	\$ 1,030,000	\$ 1,073,000	\$ 939,000
FULL C/E ITEMS	\$0	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000
CONSTRUCTION COSTS (SUBTOTAL)	\$0	\$ 1,468,000	\$ 1,529,000	\$ 1,512,000	\$ 1,555,000	\$ 1,411,000
CONSTRUCTION ENGINEERING AND CONTINGENCIES (CEC) (25%)	\$0	\$ 367,000	\$ 383,000	\$ 378,000	\$ 389,000	\$ 353,000
TOTAL CONSTRUCTION COST w/CEC	\$0	\$ 1,835,000	\$ 1,912,000	\$ 1,890,000	\$ 1,944,000	\$ 1,764,000
ENGINEERING (25%)	\$0	\$ 367,000	\$ 383,000	\$ 378,000	\$ 389,000	\$ 353,000
ROW	\$0	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000
TOTAL PROJECT COSTS	\$0	\$ 2,222,000	\$ 2,315,000	\$ 2,288,000	\$ 2,353,000	\$ 2,137,000
ANNUALIZED COST	\$0	\$ 55,550	\$ 57,875	\$ 57,200	\$ 58,825	\$ 53,425
TOWN SHARE	\$0	\$ 111,100	\$ 115,750	\$ 114,400	\$ 117,650	\$ 106,850
TOWN %	0%	5.0%	5.0%	5.0%	5.0%	5.0%

Northfield BO CVBR(7)(8)(9) Trusted Experts | Innovative Results

32

Off-Site Detour Alternative



- 13 Minutes / 6 Miles
- Via North Main Street, Union Brook Road, and Asetline Road
- Improvements to Asetline Road – a Class 4 Town Highway
- Decreases Town Share from 5% to 2.5%
- Shortens Construction Duration – Increasing Cost/Risk
 - Avoid detour during the winter season

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

33

Detour - Cost Summary



Northfield BO CVBR(7)	Do Nothing	Steel Stringers				Concrete Deck Beams
		Alternative 1 Rehabilitation for H15 (15-Ton, 2 Axle) Loading	Alternative 2 Rehabilitation for HS15 (27-Ton, 3 Axle) Loading	Alternative 3 Rehabilitation for H20 (20-Ton, 2 Axle) Loading	Alternative 4 Rehabilitation for HS20 (36-Ton, 3 Axle) Loading	Alternative 5 Rehabilitation for HS20 (36-Ton, 3 Axle) Loading
ROADWAY	\$0	\$ 362,000	\$ 362,000	\$ 362,000	\$ 372,000	\$ 352,000
EROSION CONTROL	\$0	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000
BRIDGE	\$0	\$ 746,000	\$ 797,000	\$ 780,000	\$ 823,000	\$ 689,000
FULL CE ITEMS	\$0	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000
CONSTRUCTION COSTS (SUBTOTAL)	\$0	\$ 1,198,000	\$ 1,249,000	\$ 1,232,000	\$ 1,285,000	\$ 1,131,000
CONSTRUCTION ENGINEERING AND CONTINGENCIES (CEC) (25%)	\$0	\$ 300,000	\$ 313,000	\$ 308,000	\$ 322,000	\$ 283,000
TOTAL CONSTRUCTION COST w/CEC	\$0	\$ 1,498,000	\$ 1,562,000	\$ 1,540,000	\$ 1,607,000	\$ 1,414,000
ENGINEERING (25%)	\$0	\$ 300,000	\$ 313,000	\$ 308,000	\$ 322,000	\$ 283,000
ROW	\$0	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000	\$ 20,000
TOTAL PROJECT COSTS	\$0	\$ 1,818,000	\$ 1,895,000	\$ 1,868,000	\$ 1,949,000	\$ 1,717,000
ANNUALIZED COST	\$0	\$ 45,450	\$ 47,375	\$ 46,700	\$ 48,725	\$ 42,925
TOWN SHARE	\$0	\$ 45,450	\$ 47,375	\$ 46,700	\$ 48,725	\$ 42,925
TOWN %	0%	2.5%	2.5%	2.5%	2.5%	2.5%

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

34

Summary



- Current Live Load Rating = 10 Tons
- Increased Vertical Clearance
- Superstructure Replacements and Repairs
- Substructure Repairs
- Approach Work
 - Approximately 200' of Roadway Reconstruction
 - Improve Drainage
 - New Signage
 - New Steel Backed Timber Guardrail

Northfield BO CVBR(7)(8)(9)

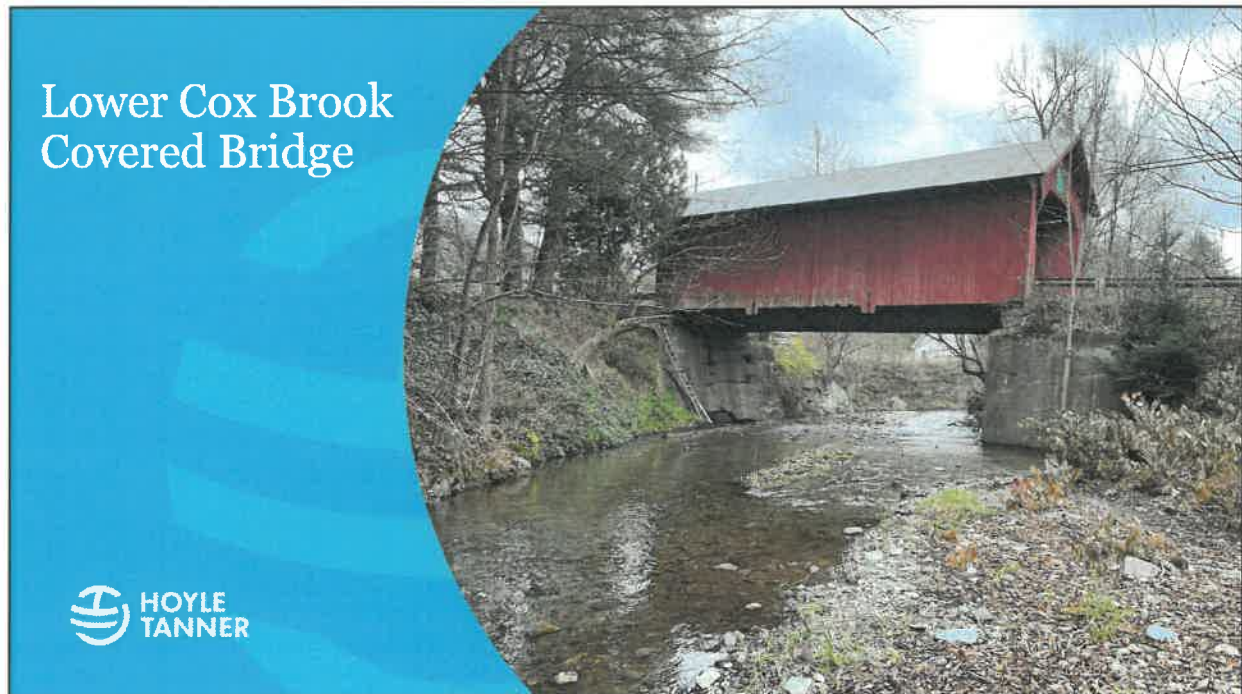
Trusted Experts | Innovative Results

35

Questions on Upper Cox Brook Alternatives?



36



Lower Cox Brook Covered Bridge



37

Existing Bridge Information




- Bridge Constructed in 1872, Rehabilitated in 1967 & 1979
- Listed in National Register of Historic Places in 1974
- Queen Post Trusses
 - 60'-3" Long
 - 15'-5" Horizontal Clearance
 - 12'-0" Vertical Clearance (Posted)
 - Weight Limit (12-Ton, Single Axle, 15-Ton Tandem, 21-Ton Gross)
- Substructures: Concrete Faced Stone Abutments

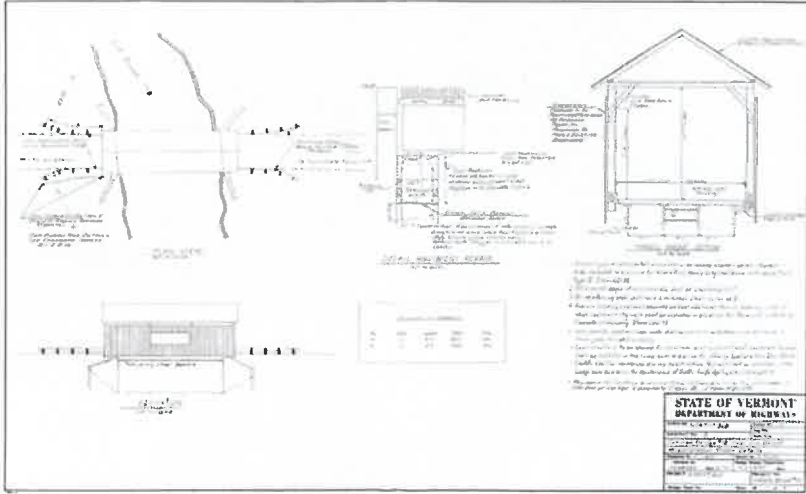
Northfield 80 CVBR(7){8}{9}

Trusted Experts | Innovative Results

38

Section and Elevation View






Northfield BO CVBR(7)(8)(9) Trusted Experts | Innovative Results

39

Inspection Findings



	Condition Rating	Description
<ul style="list-style-type: none"> • Overall Bridge Condition = 4 (Poor) • Deck Condition = 5 (Fair) • Superstructure Condition = 4 (Poor) • Substructure Condition = 5 (Fair) • Channel Condition = 7 (Good) 	<p>9</p> <p>8</p> <p>7</p> <p>6</p> <p>5</p> <p>4</p> <p>3</p> <p>2</p> <p>1</p>	<p>Excellent Condition</p> <p>Very Good Condition</p> <p>Good Condition</p> <p>Satisfactory Condition</p> <p>Fair Condition</p> <p>Poor Condition</p> <p>Serious Condition</p> <p>Critical Condition</p> <p>Imminent Failure Condition</p>

Northfield BO CVBR(7)(8)(9) Trusted Experts | Innovative Results

40

Metal Roof



- Rusting
- Leaks
- Nail Attachment



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

41

Roofboards, Rafters & Rafter Support Beam



- Splits
- Breaks
- Rot
- Insect Damage



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

42

Upper Bracing Members



- Splits
- Breaks
- Rot
- Impact Damage



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

43

Truss Members



- Splits
- Breaks
- Rot
- High Moisture Content



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

44

Steel Beams



- Rust Holes
- Advanced Corrosion



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

45

Approaches



- Drainage Issues
- Ponding



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

46

Deck



- Breaks
- Poor Attachment




Northfield BO CVBR(7)(8)(9)


Trusted Experts | Innovative Results

47

Abutments



- Voids
- Spalling
- Exposed Rebar
- CMU Truss Bearings



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

48

Rehabilitation Alternatives



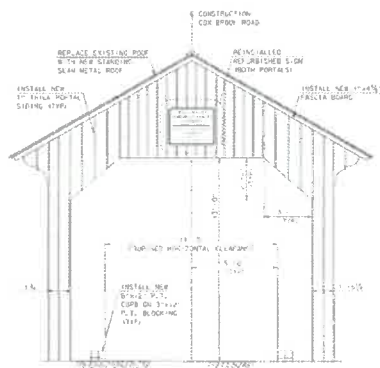
- Bridge Rehabilitations are feasible based on:
 - Current conditions of bridge
 - Deterioration types and levels of section losses observed
 - Expected remaining service life
- Rehabilitation includes:
 - Repair, strengthening, or replacement of bridge members
- Bridge Loads
 - Snow – 60 PSF Ground, 31 PSF Roof Applied
 - Wind – 14 PSF
 - Live Load – H15 (15-Ton), HS15 (27-Ton), H20 (20-Ton), HS20 (36-Ton)
 - Live load not carried by truss members

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

49

Recommended Work: Fascia & Portal Siding



PROPOSED PORTAL ELEVATION
 WEST PORTAL SIMILAR, EAST PORTAL SIMILAR
 SCALE: 3/4" = 1'-0"


- Existing
 - 1" Thick Boards
- Recommended Work
 - Replacement of all Existing Siding Boards, Eastern White Pine


Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

50

Recommended Work: Roof Members






- Existing
 - Standing Seam Metal Roof
 - 2"x6" Rafters, Eastern Spruce
 - 1"x8" Roof Boards, Eastern Spruce
 - 2"x6" Rafter Support Beam, Eastern Spruce
- Recommended Work
 - New Standing Seam Metal Roof
 - Replacement all Existing Roof Boards
 - 5 Rafters (5%) to be Replaced In-Kind
 - 1 Rafter Support Beam (8%) to be Replaced In-Kind

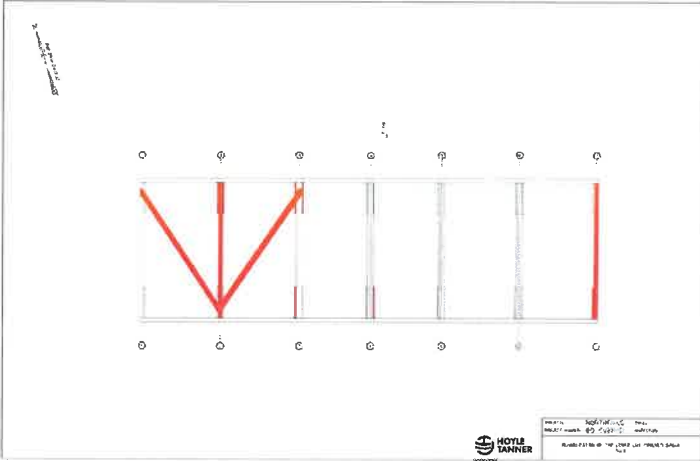
Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

51

Recommended Work: Lat. Bracing Members





- Existing
 - 6"x6" and 6"x8" Crossbeams, Eastern Spruce
 - 2"x8" Diagonal Braces, Eastern Spruce (North Portal Only)
 - 2"x6" Knee Braces, Hemlock
- Recommended Work
 - 2 Crossbeams (29%) to be Replaced In-Kind
 - Replacement of Both Diagonal Braces
 - 7 Knee Braces (29%) to be Replaced In-Kind
 - Strengthen all Knee Braces

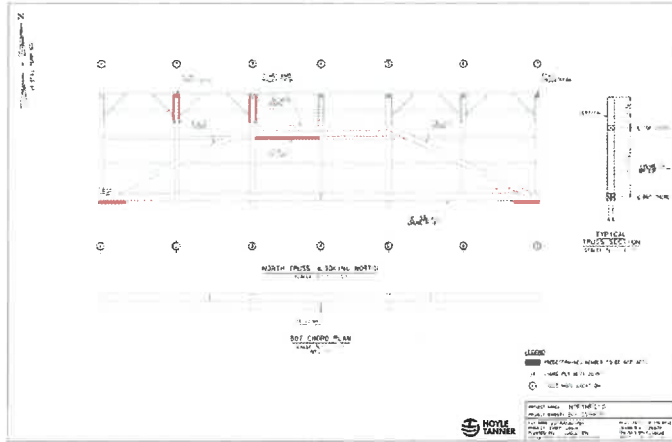
Legend:
Red - Replace due to Condition

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

52

Recommended Work: North Truss



Board Feet of Replacement:
Truss Members = None
Numerous Repairs

Assume additional 15% of member replacement and/or repair due to deficiencies in members that were hidden during inspection

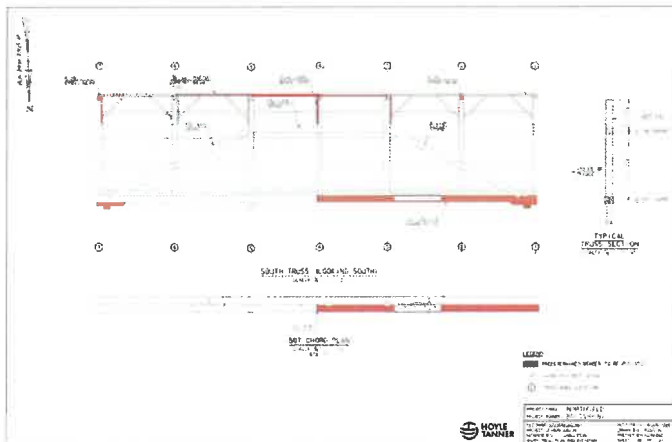
Legend:
 Red – Replace due to Condition

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

53

Recommended Work: South Truss



Board Feet of Replacement:
Truss Members = 16%
Numerous Repairs

Assume additional 15% of member replacement and/or repair due to deficiencies in members that were hidden during inspection

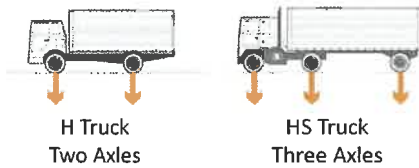
Legend:
 Red – Replace due to Condition

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

54

Floor System Alts – Glulam Beams (Cont.)



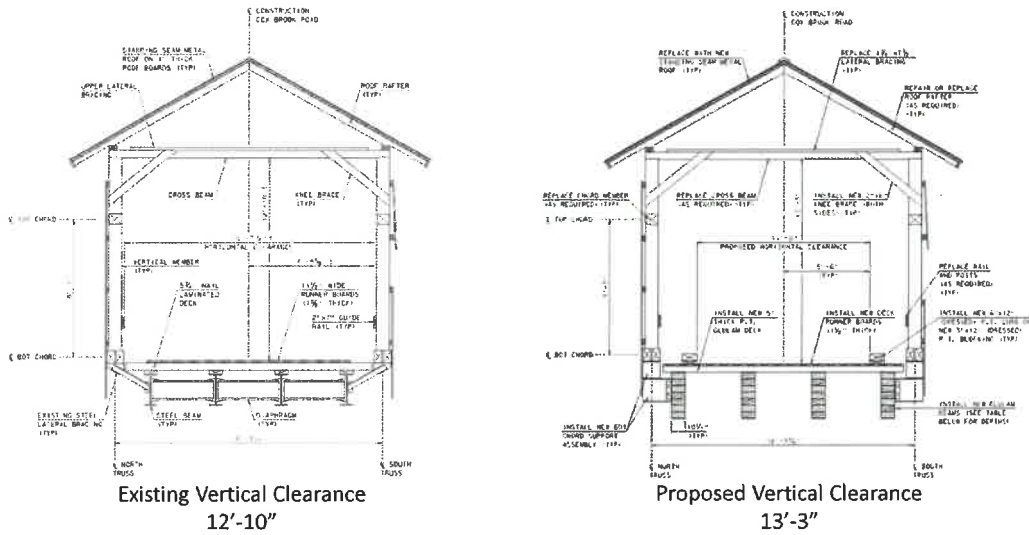
Alternative 1 - H15 (15-Ton, 2 Axle)	Alternative 2 - HS15 (27-Ton, 3 Axle)	Alternative 3 - H20 (20-Ton, 2 Axle)	Alternative 4 - HS20 (36-Ton, 3 Axle)
10½" Wide x 27½" Deep	10½" Wide x 33" Deep	10½" Wide x 30¼" Deep	10½" Wide x 35¾" Deep

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

57

Increased Vertical Clearance



Northfield BO CVBR(7)(8)(9)

58

Recommended Work : Truss Bearings



- Replace Bearing Blocks at all 4 Truss Bearing Locations

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

59

Recommended Work: Substructure



East Abutment – Replacement



- Replace with Reinforced Concrete

West Abutment – Repair



- Backwall Replacement
- Bridge Seat Elevation Modification
- Concrete Repair / Crack Sealing
- Stain and Seal Concrete
- Scour Protection with Stone Fill

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

60

Right-of-Way, Utilities, Fire Protection



- Right-of-Way is 3-Rod
- Relocation of Utilities Will be Required
- Insecticide/Fungicide
- Fire Protection
 - Recommend NOCHAR
 - Protectowire/Sprinkler
- Lighting

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

61

Summary

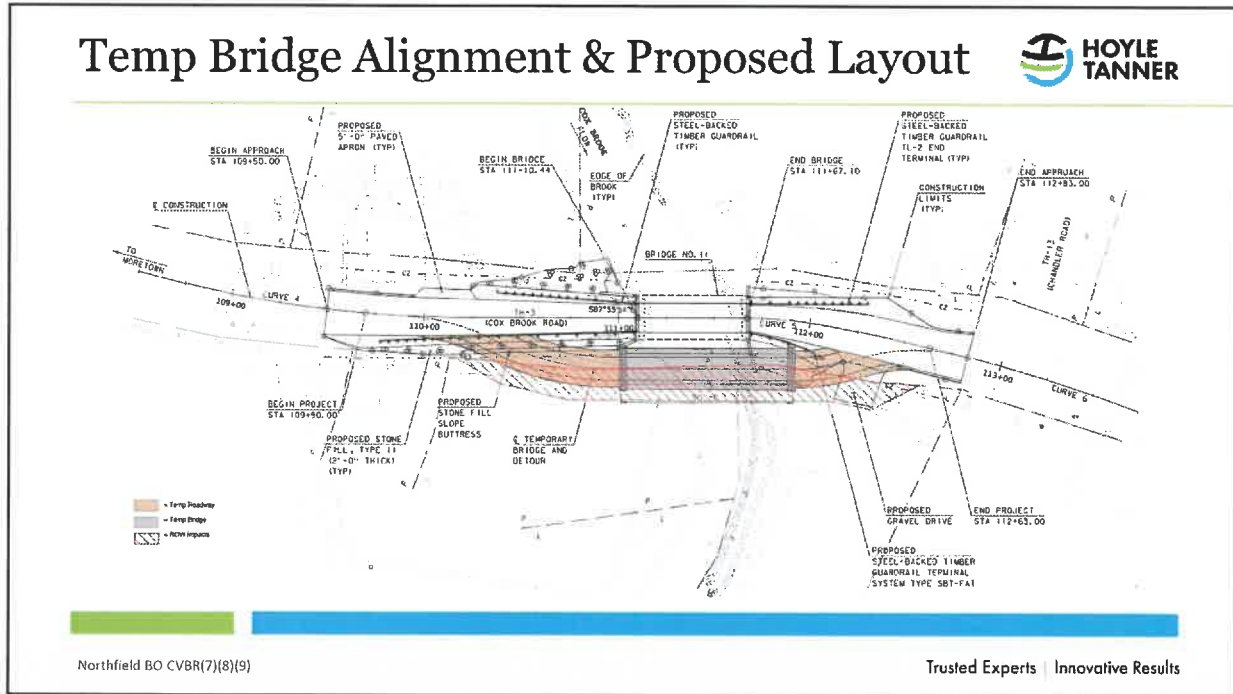


- Current Live Load Rating = 12 Tons
- Increased Vertical Clearance
- Superstructure Replacements and Repairs
- Substructure Replacement and Repairs
- Approach Work
 - Approximately 275' of Roadway Reconstruction
 - Improve Drainage
 - New Signage
 - New Steel Backed Timber Guardrail
- Temporary Bridge During Construction

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

62



63

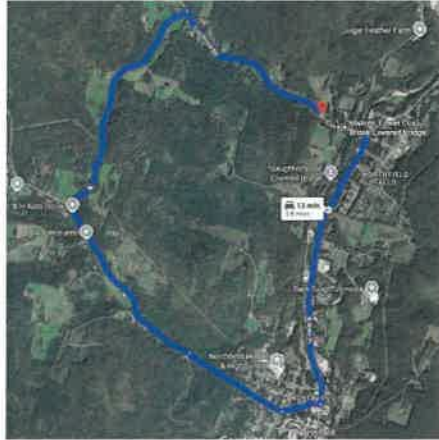
Temporary Bridge - Cost Summary

Northfield BO CVBR(8)	Do Nothing	Alternative 1 Rehabilitation for H15 (15-Ton, 2-Axle) Loading	Alternative 2 Rehabilitation for H15 (27-Ton, 3-Axle) Loading	Alternative 3 Rehabilitation for H20 (20-Ton, 2-Axle) Loading	Alternative 4 Rehabilitation for H20 (36-Ton, 3-Axle) Loading
ROADWAY	\$0	\$ 533,000	\$ 533,000	\$ 533,000	\$ 533,000
EROSION CONTROL	\$0	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000
BRIDGE	\$0	\$ 1,660,000	\$ 1,675,000	\$ 1,668,000	\$ 1,684,000
FULL CE ITEMS	\$0	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000
CONSTRUCTION COSTS (SUBTOTAL)	\$0	\$ 2,283,000	\$ 2,298,000	\$ 2,291,000	\$ 2,307,000
CONSTRUCTION ENGINEERING AND CONTINGENCIES (CEC)(25%)	\$0	\$ 571,000	\$ 575,000	\$ 573,000	\$ 577,000
TOTAL CONSTRUCTION COST w/CEC	\$0	\$ 2,854,000	\$ 2,873,000	\$ 2,864,000	\$ 2,884,000
ENGINEERING (25%)	\$0	\$ 571,000	\$ 575,000	\$ 573,000	\$ 577,000
ROW	\$0	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000
TOTAL PROJECT COSTS	\$0	\$ 3,450,000	\$ 3,473,000	\$ 3,462,000	\$ 3,486,000
ANNUALIZED COST	\$0	\$ 86,250	\$ 86,825	\$ 86,550	\$ 87,150
TOWN SHARE	\$0	\$ 172,500	\$ 173,650	\$ 173,100	\$ 174,300
TOWN %	0%	5.0%	5.0%	5.0%	5.0%

Northfield BO CVBR(7)(8)(9) Trusted Experts | Innovative Results

64

Off-Site Detour Alternative



- 13 Minutes / 6 Miles
- Via North Main Street, Union Brook Road, and Aseltnie Road
- Improvements to Aseltnie Road – a Class 4 Town Highway
- Decreases Town Share from 5% to 2.5%
- Shortens Construction Duration – Increasing Cost/Risk
 - Avoid detour during the winter season

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

65

Detour - Cost Summary



Northfield BO CVBR(8)	Do Nothing	Alternative 1 Rehabilitation for H15 (15-Ton, 2-Axle) Loading	Alternative 2 Rehabilitation for H515 (27-Ton, 3-Axle) Loading	Alternative 3 Rehabilitation for H20 (20-Ton, 2-Axle) Loading	Alternative 4 Rehabilitation for H520 (16-Ton, 3-Axle) Loading
ROADWAY	\$0	\$ 503,000	\$ 503,000	\$ 503,000	\$ 513,000
EROSION CONTROL	\$0	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000
BRIDGE	\$0	\$ 1,410,000	\$ 1,425,000	\$ 1,418,000	\$ 1,434,000
FULL CE ITEMS	\$0	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000
CONSTRUCTION COSTS (SUBTOTAL)	\$0	\$ 2,003,000	\$ 2,018,000	\$ 2,011,000	\$ 2,037,000
CONSTRUCTION ENGINEERING AND CONTINGENCIES (CEC)(25%)	\$0	\$ 501,000	\$ 505,000	\$ 503,000	\$ 510,000
TOTAL CONSTRUCTION COST w/CEC	\$0	\$ 2,504,000	\$ 2,523,000	\$ 2,514,000	\$ 2,547,000
ENGINEERING (25%)	\$0	\$ 501,000	\$ 505,000	\$ 503,000	\$ 510,000
ROW	\$0	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000
TOTAL PROJECT COSTS	\$0	\$ 3,030,000	\$ 3,053,000	\$ 3,042,000	\$ 3,082,000
ANNUALIZED COST	\$0	\$ 75,750	\$ 76,325	\$ 76,050	\$ 77,050
TOWN SHARE	\$0	\$ 75,750	\$ 76,325	\$ 76,050	\$ 77,050
TOWN %	0%	2.5%	2.5%	2.5%	2.5%

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

66

Questions on Lower Cox Brook Alternatives?



67

Northfield Falls Covered Bridge



68

Existing Bridge Information



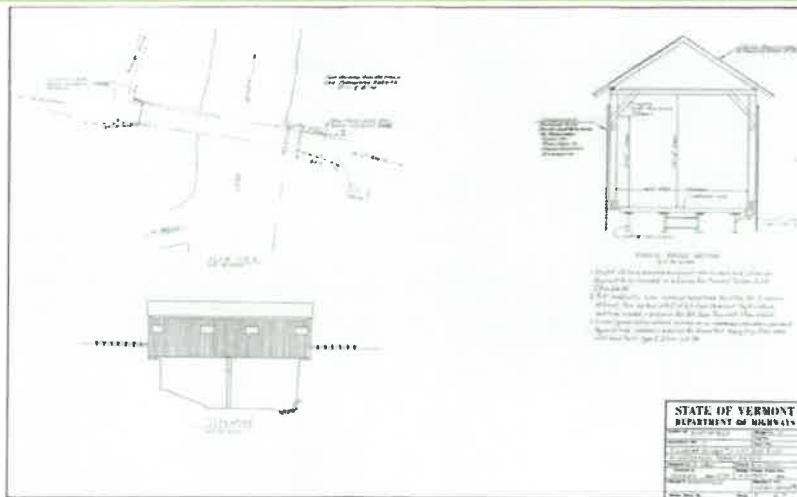
- Bridge Constructed in 1872, Rehabilitated in 1942, 1968 & 1979
- Listed in National Register of Historic Places in 1974
- Town Lattice Trusses
 - 139'-0" Long
 - 15'-5" Horizontal Clearance
 - 12'-0" Vertical Clearance (Posted)
 - Posted Weight Limit 10-Ton
- Substructures: Reinforced Concrete Pier, Stone and Concrete Abutments

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

69

Section and Elevation View



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

70

Inspection Findings



- Overall Bridge Condition = **4 (Poor)**
- Deck Condition = 5 (Fair)
- Superstructure Condition = 5 (Fair)
- Substructure Condition = 4 (Poor)
- Channel Condition = 8 (Very Good)

Condition Rating	Description
9	Excellent Condition
8	Very Good Condition
7	Good Condition
6	Satisfactory Condition
5	Fair Condition
4	Poor Condition
3	Serious Condition
2	Critical Condition
1	Imminent Failure Condition

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

71

Roofboards & Rafters



- Splits
- Breaks
- Rot
- Insect Damage



Northfield BO CVBR(7)(8)(9)

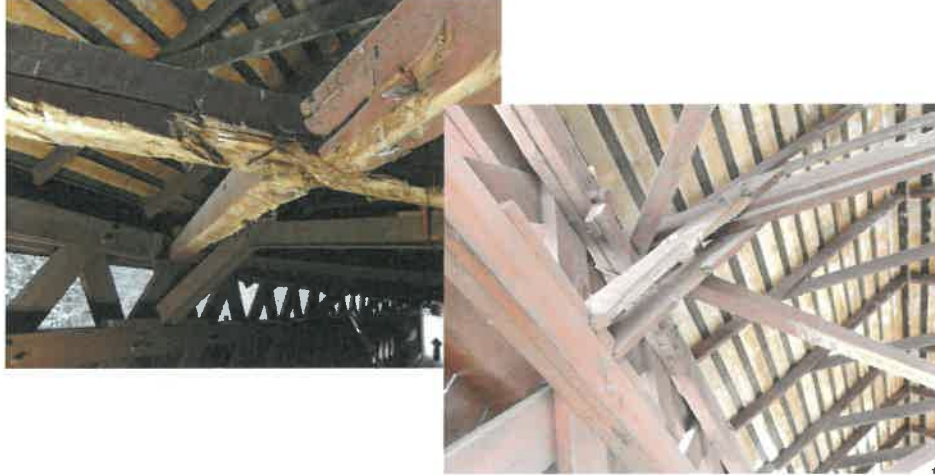
Trusted Experts | Innovative Results

72

Upper Bracing Members



- Splits
- Breaks
- Rot
- Impact Damage



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

73

Truss Members



- Splits
- Breaks
- Rot
- Misalignment
- High Moisture Content



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

74

Steel Beams



- Rusting
- Advanced Corrosion



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

75

Approaches



- Drainage Issues
- Ponding



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

76

Abutments and Pier



- Voids
- Spalling
- Exposed Rebar



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

77

Rehabilitation Alternatives



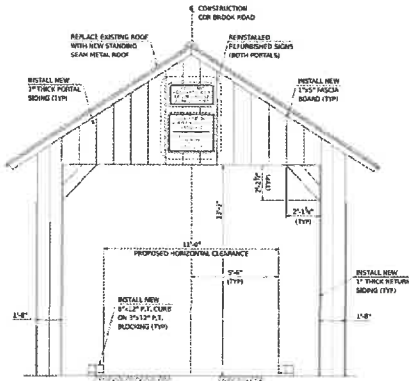
- Bridge Rehabilitations are feasible based on:
 - Current conditions of bridge
 - Deterioration types and levels of section losses observed
 - Expected remaining service life
- Rehabilitation includes:
 - Repair, strengthening, or replacement of bridge members
- Bridge Loads
 - Snow – 60 PSF Ground, 31 PSF Roof Applied
 - Wind – 15 PSF
 - Live Load – H15 (15-Ton), HS15 (27-Ton), H20 (20-Ton), HS20 (36-Ton)
 - Live load not carried by truss members

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

78

Recommended Work: Fascia & Portal Siding



PROPOSED PORTAL ELEVATION
(WEST PORTAL SHOWN, EAST PORTAL SIMILAR)
SCALE: 1/2" = 1'-0"


- Existing
 - 1" Thick Boards
- Recommended Work
 - Replacement of all Existing Siding Boards, Eastern White Pine

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

79

Recommended Work: Roof Members



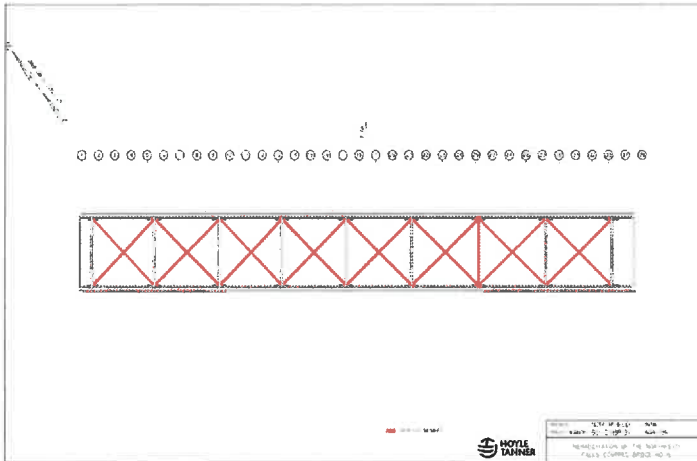
- Existing
 - Standing Seam Metal Roof
 - 2"x6" Rafters, Eastern Spruce
 - 1"x7" Roof Boards, Eastern Spruce
- Recommended Work
 - New Standing Seam Metal Roof
 - Replacement all Existing Roof Boards
 - 14 Rafters (20%) to be Replaced In-Kind

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

80

Recommended Work: Lat. Bracing Members



- Existing
 - 6"x8" Crossbeams, Eastern Spruce
 - 6"x6" Upper Diagonal Braces, Eastern Spruce
 - 2"x8" Knee Braces, Eastern Spruce
- Recommended Work
 - 1 Crossbeam (11%) to be Replaced In-Kind
 - All Diagonal Braces to be Replaced In-Kind
 - Repair knee brace connections

Legend:

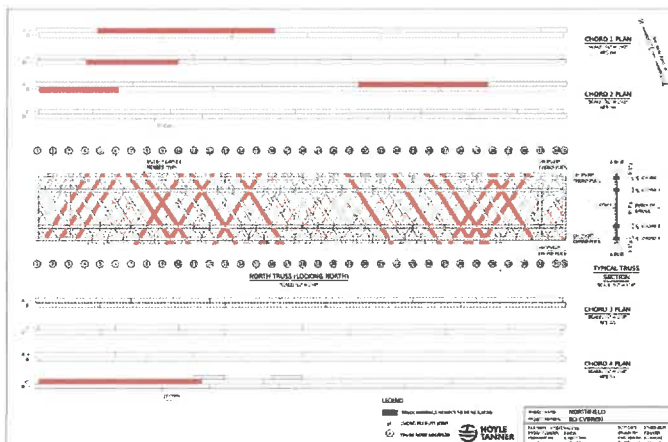
Red – Replace due to Condition

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

81

Recommended Work: North Truss



Board Feet of Replacement:
 Lattices = 22%
 Chord Members = 8%
 Numerous Repairs

Assume additional 15% of member replacement and/or repair due to deficiencies in members that were hidden during inspection

Legend:

Red – Replace due to Condition


Purple – Repair due to Condition

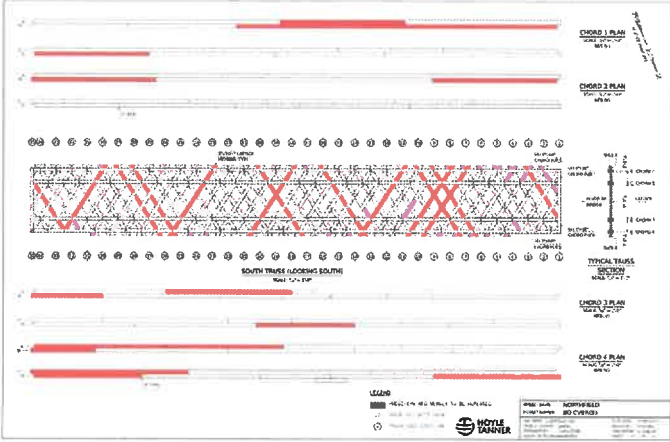
Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

82

Recommended Work: South Truss





Board Feet of Replacement:
 Lattices = 19%
 Chord Members = 20%
 Numerous Repairs

Assume additional 15% of member replacement and/or repair due to deficiencies in members that were hidden during inspection


Legend:
Red – Replace due to Condition
Purple – Repair due to Condition


Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

83

Recommended Work: Floor System






- Existing:
 - 33WF118 Steel Beams
 - C18x42.7 Steel Diaphragms
 - 2"x8" Nail Laminated Deck, Southern Yellow Pine
 - 1½" Thick Runner Boards, Eastern Hemlock

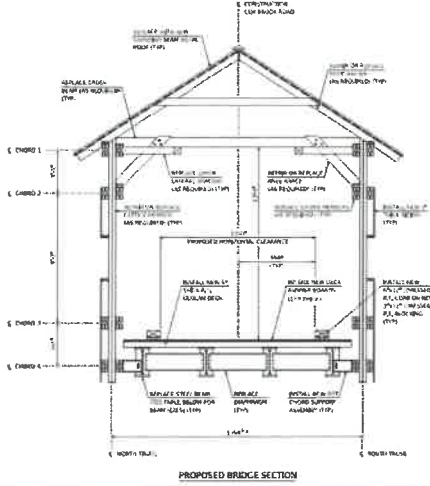
Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

84

Floor System Alts – Steel Stringers






PROPOSED BRIDGE SECTION


- Steel Stringers
 - Replace Existing Steel Stringers with New Steel Stringers
 - Replace Deck with Glulam Deck
 - Replace Runner Boards with Full Width 1 ½" Thick Runners, White Oak
 - Add Wood Curbs

Northfield BO CVBR(7)(8)(9)
Trusted Experts | Innovative Results


85

Floor System Alts – Steel Stringers (Cont.)





H Truck
Two Axles



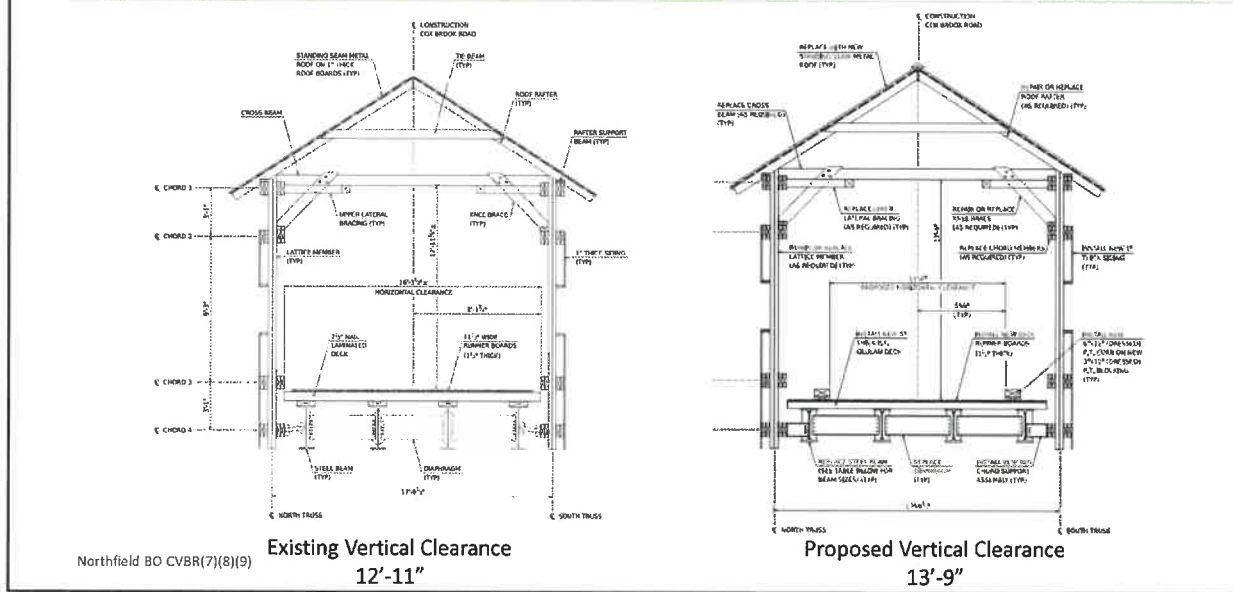
HS Truck
Three Axles

Alternative 1 - H15 (15-Ton, 2 Axle)	Alternative 2 - HS15 (27-Ton, 3 Axle)	Alternative 3 - H20 (20-Ton, 2 Axle)	Alternative 4 - HS20 (36-Ton, 3 Axle)
W21x101	W21x147	W24x117	W24x162

Northfield BO CVBR(7)(8)(9)
Trusted Experts | Innovative Results

86

Increased Vertical Clearance



87

Recommended Work: Truss Bearings



- Replace Bearing Blocks at all 6 Truss Bearing Locations

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

88

Recommended Work: Substructure



West Abutment – Repair



- Repair West Abutment
- Adjust Beam Seat Elevations for New Steel Stringers

East Abutment – Replacement



- Replace East Abutment with Reinforced Concrete

Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

89

Recommended Work: Substructure

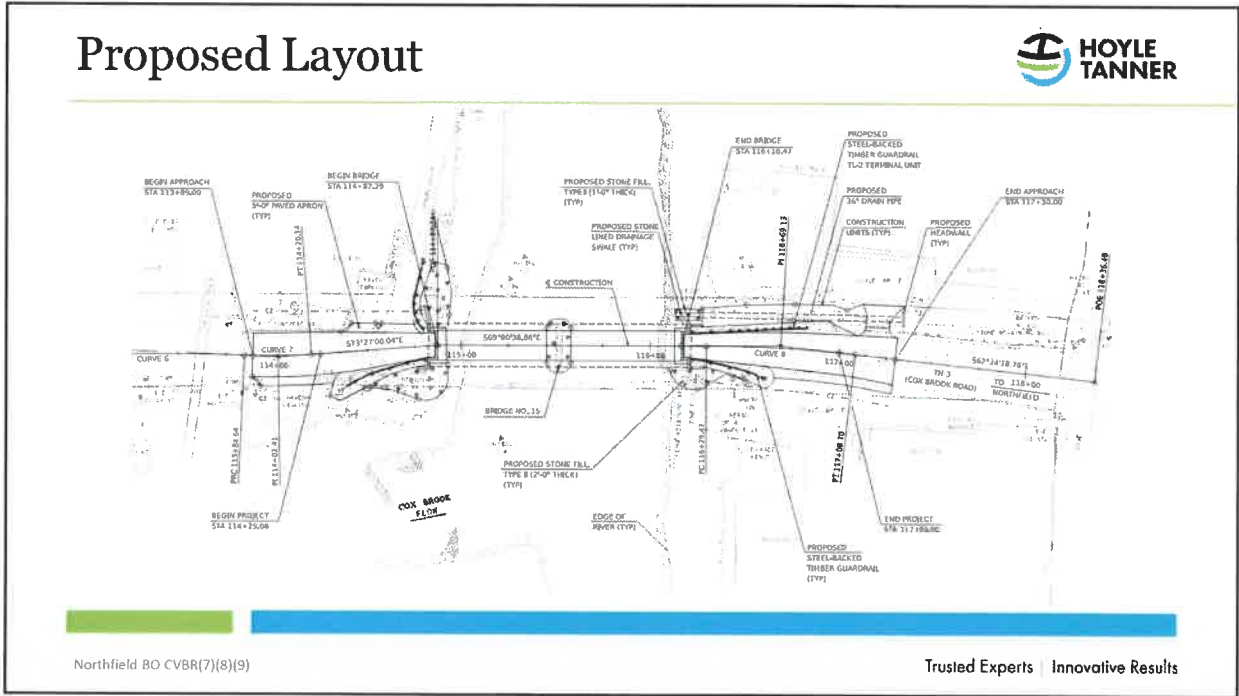


- Pier
 - Adjust Beam Seat Elevations for New Steel Stringers
 - Concrete Repair / Crack Sealing
 - Stain And Seal Concrete
 - Scour Protection with Stone Fill

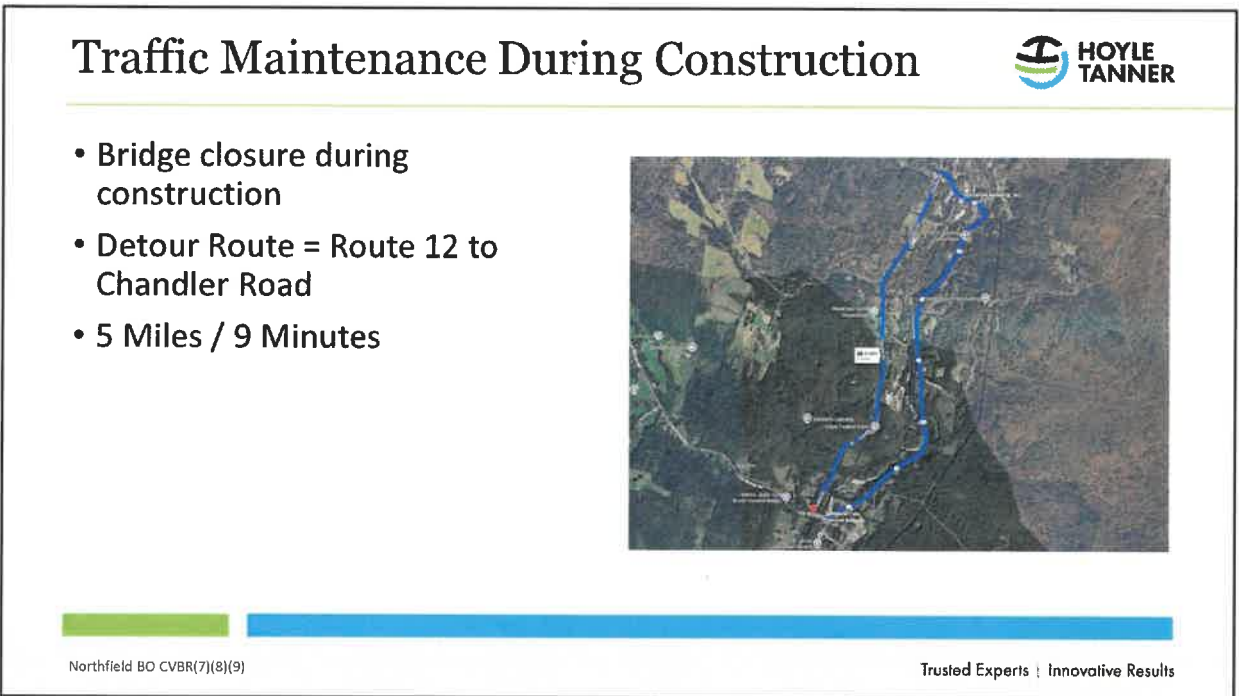
Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

90



91



92

Right-of-Way, Utilities, Fire Protection



- Right-of-Way is 3-Rod
- Relocation of Utilities Will be Required
- Insecticide/Fungicide
- Fire Protection
 - Recommend NOCHAR
 - Protectowire/Sprinkler
- Lighting



Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

93

Summary



- Current Live Load Rating = 12 Tons
- Increased Vertical Clearance
- Superstructure Replacements and Repairs
- Substructure Replacement and Repairs
- Approach Work
 - Approximately 275' of Roadway Reconstruction
 - Improve Drainage
 - New Signage
 - New Steel Backed Timber Guardrail
- Bridge Closure and Off-Site Detour During Construction




Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

94

Cost Summary



Northfield BO CVBR(9)	Do Nothing	Alternative 1 Rehabilitation for HS15 (15-Ton, 2 Axle) Loading	Alternative 2 Rehabilitation for HS15 (27-Ton, 3 Axle) Loading	Alternative 3 Rehabilitation for HS20 (20-Ton, 2 Axle) Loading	Alternative 4 Rehabilitation for HS25 (36-Ton, 3 Axle) Loading
ROADWAY	\$0	\$ 546,000	\$ 566,000	\$ 556,000	\$ 576,000
EROSION CONTROL	\$0	\$ 50,000	\$ 50,000	\$ 50,000	\$ 50,000
BRIDGE	\$0	\$ 2,969,000	\$ 3,177,000	\$ 3,041,000	\$ 3,245,000
FULL CEC ITEMS	\$0	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000
CONSTRUCTION COSTS (SUBTOTAL)	\$0	\$ 3,605,000	\$ 3,833,000	\$ 3,687,000	\$ 3,911,000
CONSTRUCTION ENGINEERING AND CONTINGENCIES (CEC)(25%)	\$0	\$ 902,000	\$ 959,000	\$ 922,000	\$ 978,000
TOTAL CONSTRUCTION COST w/CEC	\$0	\$ 4,507,000	\$ 4,792,000	\$ 4,609,000	\$ 4,889,000
ENGINEERING (25%)	\$0	\$ 902,000	\$ 959,000	\$ 922,000	\$ 978,000
ROW	\$0	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000
TOTAL PROJECT COSTS	\$0	\$ 5,434,000	\$ 5,776,000	\$ 5,556,000	\$ 5,892,000
ANNUALIZED COST	\$0	\$ 135,850	\$ 144,400	\$ 138,900	\$ 147,300
TOWN SHARE*	\$0	\$ 135,850	\$ 144,400	\$ 138,900	\$ 147,300
TOWN %*	0%	2.5%	2.5%	2.5%	2.5%

*Town share costs and Town % based on bridge closure with detour

Northfield BO CVBR(7)(8)(9) Trusted Experts | Innovative Results

95


Questions on Northfield Falls Alternatives?

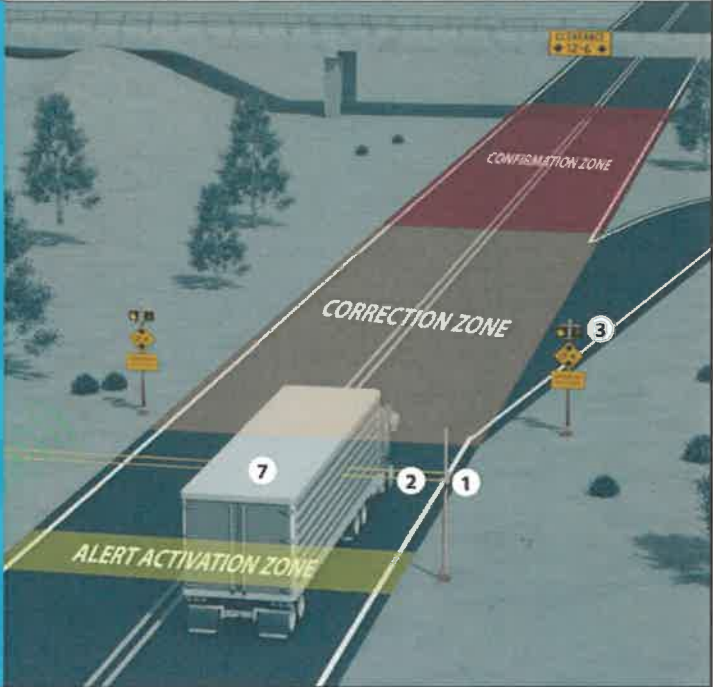


96

Overheight Vehicle Detection System


- Detects vehicles that won't clear structure ahead
- Notifies drivers of height restrictions
- Directs drivers towards safe, alternate route
- Collects data for vehicles that trigger system
- Notifies local authorities when vehicles enter confirmation zone
- Approximate cost of \$125,000 for all one system that covers all three bridges






97

Potential Layout for Upper, Lower, and Falls

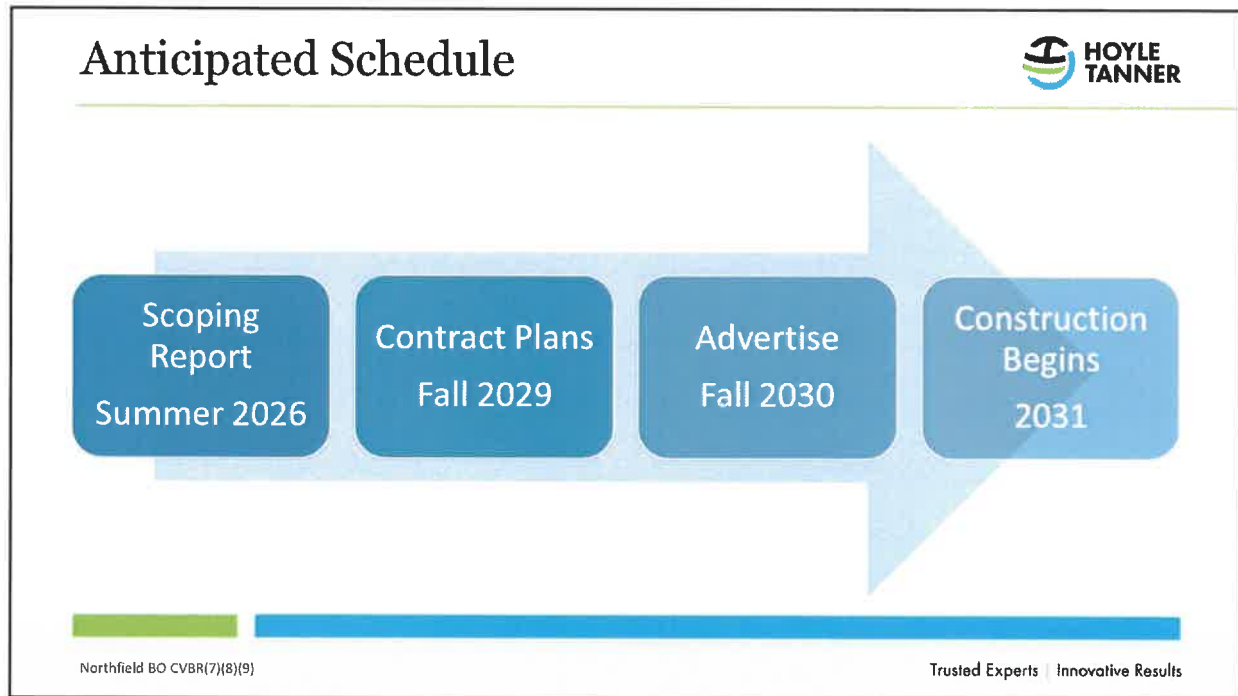




Northfield BO CVBR(7)(8)(9)

Trusted Experts | Innovative Results

98



99

Contacts

Laura Stone, PE
Laura.Stone@vermont.gov
(802) 917-4996

Josif Bicja, PE
jbicja@hoyletanner.com
(603) 460-5147

100