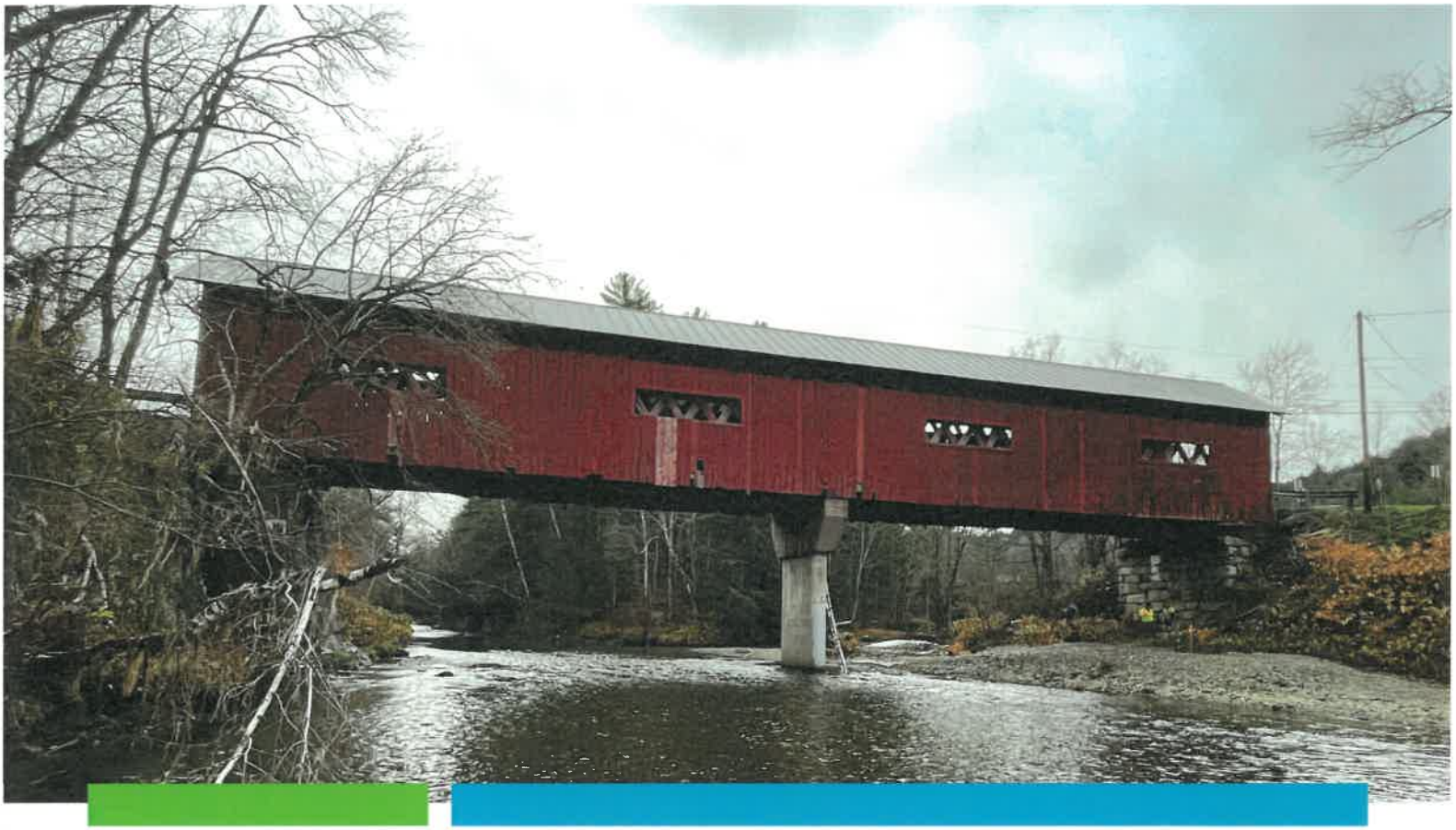

Draft Scoping Report
Northfield Falls Covered Bridge
Town Highway 3
Bridge 15 over Dog River

Northfield BO CVBR(9)

January 24, 2026

Prepared for:
Vermont Agency of Transportation

HOYLE TANNER

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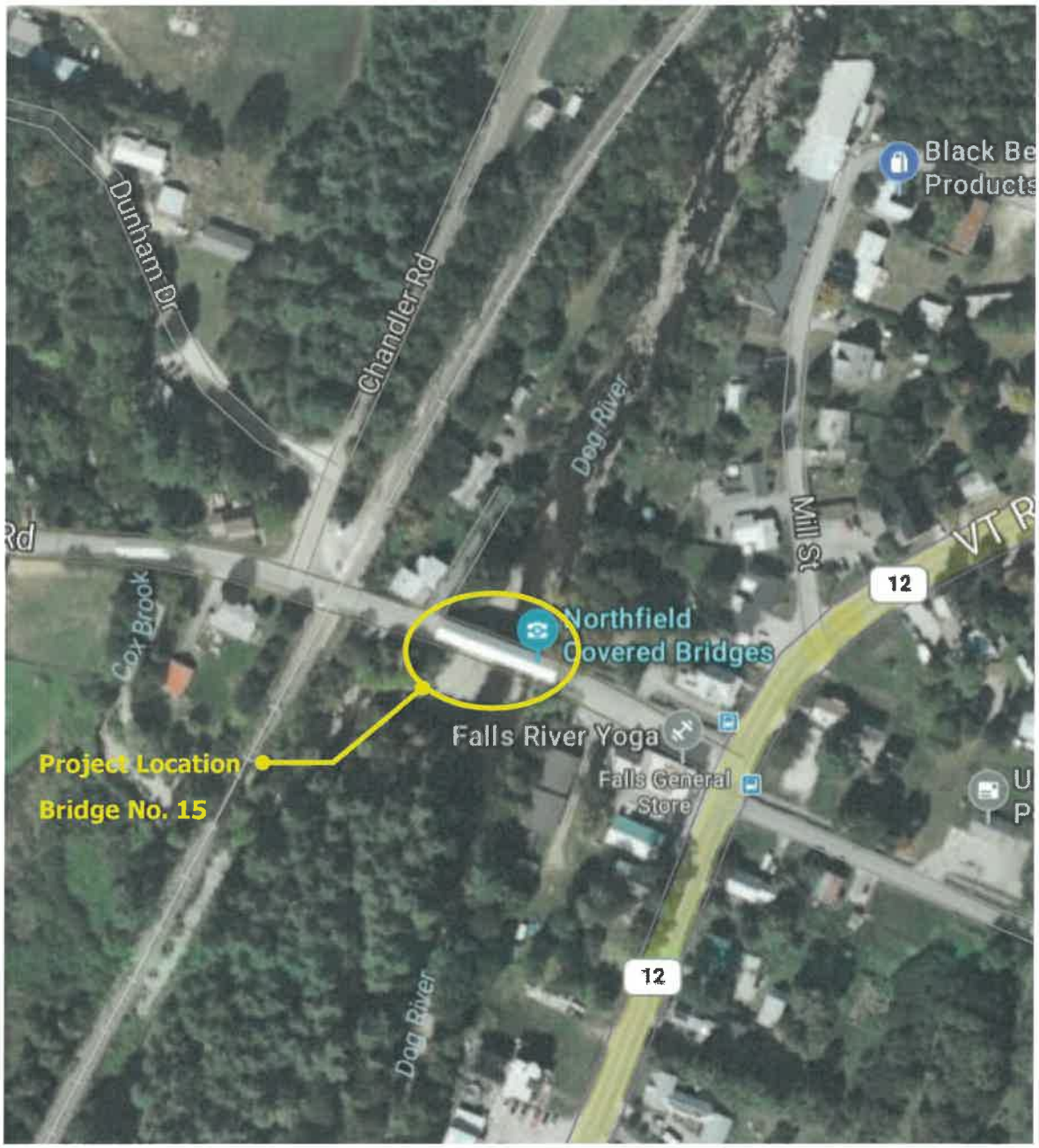
Location Map



1. SITE INFORMATION

The Northfield Falls Covered Bridge (Bridge No. 15) is a Town-owned bridge located on Town Highway 3 (TH-3), Cox Brook Road, just west of the intersection with VT Route 12. The bridge is a 131-0" long two-span continuous Town Lattice truss which carries one lane alternating traffic over the Dog River near the center of the Village of Northfield Falls. Northfield Falls is an unincorporated village in the Town of Northfield, VT. The bridge is one of five covered bridges in the Town of Northfield, the second highest concentration by town of such bridges in Vermont. The sign on the west portal states that the bridge was built in 1872.

Due to its historic and national significance the bridge is currently listed on the National Register of Historic Places, a federal program that is administered by the National Park Service.

This scoping report was compiled after the review of multiple sources of data including topographic ground survey, lidar scanning, previous rehabilitation plans, VTrans Structure Inspection, Inventory and Appraisal Sheet, field measurements, and photographs taken during site visits by Hoyle Tanner personnel. The intent of this report is to evaluate structural deficiencies and to recommend a solution which best addresses the project's need. For purposes of this report, the substructure units are numbered sequentially from west to east and all members are wood unless noted otherwise.

Downstream Elevation Looking South

Roadway Classification:	Local Road, Class 2 Town Highway
Bridge Type:	Two Span Town Lattice Truss Covered Bridge
Bridge Length:	131'-0" feet
Bridge Skew:	No Skew
Year Built:	1872, Rehabilitated in 1942, 1968, and 1979
Ownership:	Town of Northfield

The bridge has undergone numerous changes or additions throughout its history with various degrees of documentation. Three major and documented rehabilitations were completed in 1942, 1967, and 1979.

The 1942 rehabilitation plans noted the work shown below. Record drawings of this rehabilitation are not available, and it is not known if all this work was completed at that time.

- Replacing parts of the floor system, including new 2"x8" nail laminated deck and 12"x12" floor beams, new 10"x12" stringers, and new 10"x10"x8' sleepers.
- Replacing parts of upper lateral bracing system, including new 2"x8" knee braces and new 6"x8" cross beams.
- Replacing concrete bridge seat and pedestals.

The 1967 rehabilitation plans noted the work shown below. Record drawings of this rehabilitation are not available, and it is not known if all this work was completed at that time.

- Straightening and plumbing of the trusses.
- Installing new 6"x18"x10' shear beams below bottom chord.
- Replacing parts of the floor system, including new 2"x8" nail laminated deck and 4"x14" nailing strips, new 33WF118 steel stringers, lateral bracing, intermediate and end diaphragms.
- Installing new bearings for all stringers.
- Applying wood preservative to flooring, blocking, and nailing strips replacement timbers.
- Removing and replacing concrete backwall and bridge seat.
- Installing new concrete pier at midspan of the bridge.
- Removing and reinstalling or replacing the existing siding as required to complete the work noted above.

The 1979 rehabilitation plans noted the work shown below. Record drawings of this rehabilitation are not available, and it is not known if all this work was completed at that time.

- Clean and paint support brackets.
- Clean and paint steel stringers.
- Install new approach guardrail.
- Reinstall or replace loose or damaged siding.

West Portal Looking East

There is load restriction posted for the bridge of 10-tons. The bridge provides a horizontal clearance of 15'-5" between the trusses and 12'-6" maximum vertical clearance, with vertical clearance at the edges of the travel lane of approximately 10'-4". The vertical clearance signs on each approach to the bridge indicate a height restriction of 12'-0".

Cox Brook Road (TH-3) is oriented in a west to east direction within the project limits. Chandler Road is located to the west of the bridge and VT Route 12 is located to the east. Chandler Road (TH-13) and VT Route 12 are oriented north to south. The Northfield Falls Covered Bridge is located 230 feet northwest of the intersection of Cox Brook Road and VT Route 12.

Tangent weathering steel w-beam guardrail is used at all four approaches to the bridge. There are no crashworthy end units on the guardrail. Side slopes are generally level off the roadway except in the vicinity of the bridge. The west approach to the bridge intersects with Chandler Road approximately 300' west of the bridge. There are gravel drives directly southeast, northwest, and southwest of the bridge. There is a railroad grade crossing approximately 250' west of the bridge. There is no curbing on any of the approaches to the bridge. The approach grades to the bridge are mostly flat and stormwater generally sheet flows off the roadway.

a. Need

The Northfield Falls Covered Bridge was last inspected by VTrans personnel on August 20, 2024. Hoyle Tanner personnel also inspected the bridge and performed in-depth field measurements and gathered field data for this Scoping Study on November 8, 9, and 10, 2023. The bridge (superstructure, deck, substructure) is considered to be in poor condition, and several deficiencies have been noted. The following is a list of deficiencies of Bridge No. 15 and TH-3 at this location:

Roof and Siding Members:

- Metal roof is in fair condition. Replacement of the roof will be required for access for repairs to the truss members.
- The roof boards and rafters exhibit through splits, breaks, insect damage, and rot.
- The siding boards are in good condition; however, removal and replacement will likely be required to provide access for the extensive truss member replacements.

Commercial Drive at South Approach

Upper Lateral Bracing Members:

- The upper lateral bracing members exhibit splits, breaks, rot, and impact damage.
- The crossbeams have been hit by vehicles, causing impact damage and breaking the connection between the crossbeams and knee braces.
- The knee braces have been damaged from oversized vehicles, and some are not connected to the crossbeams or truss members.

Truss Members:

- Chord members exhibit splits, breaks, rot, misalignment, and high moisture content at lower sections.
- Chord trunnels exhibit rot, breakage, and walking.
- The lattice members exhibit splits, section loss, bark wane, and section loss.
- The moisture content of the truss members was as high as 50% in some members.
- Some minor amounts of debris and dirt have accumulated near the bearings between the truss and the siding.
- Refer to Appendix E for deteriorated Truss members that were identified in need of replacement due to condition.

Floor System Members:

- The steel beams exhibit advanced corrosion of the lower flange and paint failure of the webs.
- There are several locations where the section loss was 100% on the lateral bracing to the truss.
- The runner boards exhibit areas of minor wear and debris built up.
- The pavement on the approaches is flush with the runner boards.
- The deck is comprised of 2"x6" nail laminated timber and is in fair condition; however, removal and replacement will likely be required to provide access for the steel beam replacement.

Truss Bearing Blocks:

- The wooden bearing blocks have heavy rot and decay at each end of the bridge.

Substructure:

- The West abutment concrete exhibits heavy spalling, pulverized concrete, exposed rebar, efflorescence, deep voids in the masonry, and a cracked stone.
- The pier exhibits heavy spalling and exposed rebar, and the bearing of the steel beams is partially unsupported due to spalling.
- The East abutment exhibits heavy spalling, delamination, and exposed rebar.

General:

- The bridge lacks fire protection.
- The vertical clearance is substandard and there is evidence of vehicular damage at each portal.

b. Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2029 and 2049.

Traffic Data	2029	2049
AADT	886	957
DHV	130	130
ADTT	64	82
%T	6.1%	7.2%
%D	50%	50%

c. Design Criteria

The design standards for this bridge project are the Vermont State Design Standards, dated October 22, 1997. Minimum standards are based on an ADT of 957, a DHV of 130, and a design speed of 35 mph for a Local Road.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSDS Table 6.3	9'/0' (20')	9'/2' (22')	Substandard
Bridge Lane and Shoulder Widths	VSDS Table 6.3	15'-5" Between Trusses/0' (15.33')	9'/2' (22')	Substandard
Clear Zone Distance	VSDS Table 6.5	No Issues Noted	12' Fill / 10' Cut	
Banking	VSDS Section 6.12	NC	Low Speed Road – No Super Elevation Required	
Speed	VSDS Section 6.2	25 mph (Signed)	35 mph (Design)	Substandard
Horizontal Alignment	AASHTO Green Book, Table 3.10	R = ∞ over bridge	At e_{max} = 8%: super = 8%, R_{min} = 314' NC, R_{min} = 614'	

Vertical Grade	VSDS Table 6.6	-0.54% over bridge	7% (Max) for Level Terrain	
K Values for Vertical Curves	VSDS Table 6.1	No Vertical Curve over Bridge Approach K = 7 Min	40 Crest / 50 Sag	Substandard
Vertical Clearance	VSDS Section 6.7	12'-10" Vertical Clearance Provided	14'-3"	Substandard
Stopping Sight Distance	VSDS Table 6.1	200'	225'	Substandard
Bicycle/Pedestrian Criteria	VSDS Table 6.7	No Shoulders	1' Paved Shoulder	Substandard
Hydraulics	VTrans Hydraulics Manual, Table 6.1	Passes 4% AEP (Q_{25}) storm event with X' of freeboard Clear Span: 115'	Pass 4% AEP (Q_{25}) Storm Event with 1' of Freeboard Bank Full: X'	Surpasses Hydraulic Standards
Structural Capacity	Structures Design Manual, Ch. 3.4.1	Posted: 10 Tons	Design Live Load: HL-93	Substandard

d. VTrans Inspection Report Summary

The ratings provided below are from the most recent inspection performed by VTrans in August 2024. The bridge is on a 24-month inspection frequency.

Deck Rating:	6 Satisfactory
Superstructure Rating:	6 Satisfactory
Substructure Rating:	5 Fair
Channel Rating:	8 Very Good

From the Structure Inspection, Inventory and Appraisal Sheet:

Erosion of the upstream embankment along the abutment 1 approach has caused the erosion of the asphalt in the shoulder area. Preventive repairs are needed so erosion doesn't extend further into the roadway. The structure should be considered for a paint project with extensive cleaning of the beams. Abutment 1 and the pier cap are in need of concrete repairs due to cracked and spalled out areas that extend up to and have undermined small portions of the neighboring bearings; see maintenance reports.

e. Hoyle Tanner Field Observations

On November 8, 9, and 11, 2023 a four-person inspection team from Hoyle Tanner visited the covered bridge to perform in-depth field measurements and gather field data for this Scoping Report. The roof framing members, upper lateral bracing, truss members above the deck, interior of the siding, and deck were inspected using extension and folding ladders. The underside of the deck, truss members below the bridge deck, and steel stringers were inspected using rope access. Field observations were used as a basis for this report and expanded as appropriate. Lumber dimensions are nominal unless otherwise noted.

Several small wood samples were removed from the bridge for the purpose of species identification (see Appendix D).

Bridge Orientation Conventions

The truss top chord is denoted as chord 1 and other chords are sequentially numbered down with the lower most chord designated as chord 4. Each chord consists of four plies, which are denoted as plies "A" through "D". Ply "A" is the most exterior ply while ply "D" is the most interior ply. The node points are numbered from west to east with the western most node point designated as 1. Each consecutive node number is numbered in ascending order at each trunnel connecting the lattice tails of the chord 1.

i. Roof Framing and Siding

The roof framing consists of a standing seam metal roof on 1" thick x 7" wide roofboards which are supported by roof rafters. The roof rafters are 2" wide x 6" deep and are spaced at 4' on center and supported on a rafter support beam that is 2" deep x 6" wide supported on chord 1 ply A and B. The siding is ¾" thick and is attached to the truss members.

The siding boards were not tested but assumed to be Eastern Spruce. The roofboard wood and rafter support beam species were also not tested but assumed to be Common Premium. The roof boards are less than 2" thick and are therefore not graded by NDS. A grade of construction was used for the roof boards to account for the lack of grading. The roof rafters were identified to be Eastern Spruce and assigned a grade of Select Structural. The grades were selected for structural analysis based on a visual examination of knots, checks, slope of grain of the wood and the growth rate characteristics of the wood.

Split in Rafter

Split in Roofboard and Spliced Rafters

The roof framing is generally considered to be in fair to satisfactory condition with the following deficiencies noted:

- The metal roof is in fair condition.
- The rafters exhibit spits, breakage, and dry rot throughout. Some split and broken members have been sistered to new members.
- The rafter support beam exhibits rotting in few locations.
- The roofboards are overall in satisfactory condition with some splits.
- The siding boards exhibit areas of faded paint. The siding is in good condition; however, removal and replacement will likely be required to provide access for the extensive truss member replacements.

ii. Upper Lateral Bracing

The upper bracing consists of 6"x8" crossbeams spaced every four nodes. Two diagonal bracing members are located between the cross beams with one continuous and the other cut at midspan connected to the continuous member. Each cross beam has two timber knee braces on each side (4 total) connecting to chord 2 of the truss.

The upper bracing wood species were identified to be Eastern Spruce and assigned a grade of Select Structural based on a visual examination of knots, checks, slope of grain of the wood and the growth rate characteristics of the wood. The knee brace wood species were identified to be Eastern Spruce.

Impact Damage in Diagonal Bracing

Broken Connection at Crossbeam and Knee Brace

The upper lateral bracing members are generally considered to be in fair to satisfactory condition with the following deficiencies noted:

- The cross beams exhibit significant impact damage from vehicles and dislodged and twisting in one location.
- Diagonal bracing members exhibit significant impact damage from vehicles, breakage, twisting and multiple are missing.
- Crossbeams have been previously damaged from oversized vehicles and are not well connected to the vertical truss members.
- The knee braces exhibit significant impact damage from vehicles and breakage.

iii. Trusses

The Town Lattice Truss was patented in 1820 by Ithiel Town and included lattice members and two (four-piece) chords (a single upper and single lower chord). The original design was sufficient for light loads and smaller spans but was subject to out of plane bending. A second patent was granted in 1835 that included four (four-piece) chords and two layers (planes) of lattice. The 1835 patent truss type was used primarily for railroad bridges, and the use of four chords was adopted for vehicular bridges. The Northfield Falls Covered Bridge has two each (four-piece) top and lower chords.

North Truss Looking East

The trusses are approximately 131'-0" long and support a roof length of approximately 136'-0". The clear span from face of south abutment to pier is approximately 61'-0" long and pier to face of north abutment is approximately 61'-0" long. Truss chord members consist of 4 plies of 3"x12" built-up double upper and lower chords. Truss lattice members consist of 3"x11" timber planks. Chords are connected to lattice members through 2" diameter wood trunnels. Three wood trunnels are present at each lattice and chord intersection and two are present at lattice intersections.

The truss chord and lattice members' wood species were identified as Eastern Hemlock, and the trunnels were identified as Red Oak. All truss members have been assigned a grade of Select Structural for the structural analysis based on a visual examination of knots, checks, slope of grain of the wood and the growth rate characteristics of the wood.

The truss members are generally considered to be in poor condition with the following deficiencies noted:

Truss Chord Members:

- The upper chord members of the South truss exhibit plies split up to 4' long at various locations and one location of surface dry rot up to 1½" deep.
- The upper chord members of the North truss exhibit breakage, splitting up to 4' long, waning, buckling and gaps at joints.
- The lower chord members of the South truss exhibit multiple locations of splitting and rotting.
- The lower chord members of the North truss exhibit plies split up to 2' long at various locations, holes up to 5" in diameter, rotting, lifting, waning, and gaps at joints. Multiple locations on chord 4 of the North truss have supplemental boards spliced to ply D.
- At the time of inspection, the lower chord members had a moisture content up to 50 percent.

Lattice Members:

- Many lattice members exhibit splitting, checking, full width section loss, cracks around trunnels, impact damage, insect infestation, and rot.
- Multiple top lattice tails are split with varying lengths. Multiple tail splits extend past the trunnel connections in chord 1.
- Multiple lattice bottom tails are split and extend past the trunnel connections in chord 4.
- The lattice lower tails are cut at the pier and abutments for the sleeper beam and bearing.

Gap in Chord 3 at Trunnels

Trunnels:

- Trunnels exhibit walking out of connection, breakage, and rotting.
- In one location on the South Truss the trunnel missed the lattice on chord 4.

Refer to Appendix E for deteriorated lattice members that were identified in need of replacement due to condition.

iv. Floor System

The floor framing consists of four 33WF118 longitudinal steel stringers spaced at 4'-6" on center that end at the pier, transverse 2"x8" nail laminated deck boards placed edgewise, and longitudinal 1½" (actual)

thick runner planks across the entire deck. There are C18x42.7 steel diaphragms spaced at 21' along the stringers. There are no diaphragms at the beam ends or over the pier. The exterior beams are connected to chord 4 of the truss for lower lateral bracing of the truss.

The nail laminated deck wood species was identified to be Southern Pine. The runner planks are not shown in the 1979 plans and are assumed to be Eastern Spruce. The nail laminated deck board members have been assigned a grade of No. 1 for the structural analysis based on a visual examination of knots, checks, slope of grain of the wood, and the growth rate characteristics of the wood.

Exterior Stringer

The floor system members are generally considered to be in poor condition with the following deficiencies noted:

- The runner boards exhibit areas of minor wear with sand debris build up at roadway shoulders.
- The beams exhibit significant corrosion along the bottom flange and paint failure of the webs.
- The truss lower lateral bracing connection to chord 4 exhibits moderate corrosion.
- The exterior stringers had section loss that reduced flange thickness to $^{7}/_{16}$" in isolated areas. The top flange also had areas of section loss with a flange thickness of $^{7}/_{16}$" throughout. The webs were in fair condition with areas of paint failure and rust. By inspection, it appears the web had approximately $^{1}/_{16}$" section loss on both sides of the web (⅛" total).

Concrete Spalling at Stringers Bearings

- Access was limited for the interior stringers. By inspection from the exterior stringers, it appeared the interior stringers had the same amount of section losses exhibited in the exterior stringers.

f. Truss Bearing Blocks

The trusses sit on sleepers consisting of two 6"x18" timbers approximately 9' long at each bearing location. The sleepers sit on timber blocks consisting of 2"x10" hardwood blocks with varying length that sit on the concrete beam seats.

The truss bearing blocks are considered to be in satisfactory condition.

g. Substructure

East Abutment Elevation

West Abutment Elevation

The bridge substructure consists of a concrete abutment on the east side, dry laid masonry abutment with a concrete cap on the west side, and a concrete pier at the center of the bridge. It is not clear if the original east abutment was constructed with stone masonry and encased with concrete during previous undocumented rehabilitations. Both abutments have exposed ledge in front and below them, so it is likely the abutments bear on ledge. The channel bed consists of ledge and large cobbles.

The abutments are considered to be in poor condition with the following deficiencies noted:

- The east abutment exhibits significant concrete spalling, efflorescence staining, delamination, and vertical, horizontal, and map cracking. The southeast beam seat corner has a large spall, and the concrete is coming loose from the structure. The concrete appears to be of poor quality with large round aggregates used.
- The west abutment masonry exhibits voids up to 5' deep. The concrete beam seat cap concrete has significantly deteriorated.
- The southwest wingwall is comprised of dry laid stacked stones which have failed, and the wall is no longer vertical.

West Abutment Beam Seat

- At the spalled areas, the concrete was observed to contain round river stones with no fractured faces, which significantly reduces the concrete strength and durability.
- The east abutment is in poor condition and needs to be replaced. The west abutment beam seat and backwall is in poor condition and needs to be replaced.

h. Wood Species Identification

Ten small wood samples were removed from the bridge for the purpose of species identification. The samples were taken from deteriorated members that will most likely be replaced during the course of potential bridge rehabilitation or from non-critical sections of the members. To identify the wood species,

the samples were sent to Doug Gardner, Ph.D., a Professor of Forest Operations, Bioproducts, and Bioenergy, at the University of Maine at Orono. A summary of the species identification can be found in Appendix D.

i. Hydraulics

Downstream Elevation

The bridge crosses over the Dog River which flows primarily north to south at the bridge site. A hydraulic study at this location was completed on January X, 2026 by Hoyle Tanner. The preliminary findings indicate that under the current conditions, there is XX.X' and XX.X' of freeboard during the 4% (Q_{25} flood event) and 1% (Q_{100} flood event) storm event, respectively. The Q_{100} storm event is defined as a flood having a one percent (1%) chance of being met or exceeded in any given year (base flood designation Q_{100}). The Q_{25} storm event is defined as a flood having a four percent (4%) chance of being met or exceeded in any given year (base flood designation Q_{25}). The existing bridge opening has sufficient hydraulic capacity to pass the 1% storm event flow with adequate freeboard.

The primary purpose of the hydraulics section is to determine if the rehabilitated covered bridge is at an elevation high enough to provide adequate free board during the 100-year flood event. The existing bridge opening has sufficient hydraulic capacity to pass the 1% storm event flow with adequate freeboard.

j. Utilities

The VTrans Utilities and Permits unit will investigate the existing utility within the project limits during the next phase of project development. The existing utilities identified based on the site visit are as follows:

Aerial Utilities

- Main service line crosses Cox Brook Road from the north to the south on the east approach of the bridge
- Main service line crosses the Dog River south of the bridge
- Utility pole carrying the main line located southeast of the bridge
- Service utility lines crosses Cox Brook Road to the home located northwest of the bridge
- A service pole and guy wires are located northwest of the bridge
- A guy wire is attached to the lower northwest corner of the bridge

Guy Wire Attached to NW Corner of Bridge

An aerial utility relocation will be needed. Utility relocation plans will be determined once design plans are available.

Underground Utilities

There appears to be a septic leach field vent on the southeast corner of the bridge. No underground utilities have been investigated.

k. Right-of-Way

The existing Right-Of-Way (ROW) is shown on the Layout sheet in Appendix E. It is not anticipated that permanent ROW will be required, however temporary construction easements will be required for the construction of the project.

l. Resources

The biological, historic, archaeological, hazardous material and stormwater resources present at this project are shown on the Resource Site Plan Sheet in Appendix E and are based on information provided by VTrans. See Appendix E for Resource Site Plan Sheet and Appendix I for Natural Resource ID memo.

i. Biological

Wetlands/Watercourses

Northfield Falls Covered Bridge crosses over the Dog River, a watercourse regulated by the US Army Corps of Engineers.

There are no wetlands within the review area.

Wildlife Habitat

This area has three habitat blocks adjacent to the project area and ranks high for surface water riparian community connectivity and has a high priority connectivity block adjacent to it. Aquatic Organism Passage (AOP) will be prioritized by the design team.

Rare, Threatened and Endangered Species

The only listed species within the review area is the wood turtle (Glyptemys insculpta), which has an occurrence recorded under Bridge 15. A wood turtle survey should be conducted.

Also listed within the review area is the federally endangered northern long-eared bat, however it was determined that this location may effect, not likely to adversely effect the northern long-eared bat, and no critical habitat was located near the bridge location.

Agricultural

The review area noted prime statewide and prime agricultural soils were mapped in the vicinity and around the project location.

ii. Historic

One Historic resource was identified within the immediate project area. The historic resource is considered a Section 4(f) property and is as follows:

Bridge No. 15 (Northfield Falls Covered Bridge) which is individually listed in the National Register of Historic Places (NRHP) and it remains significant under Criterion C.

The Northfield Falls Covered Bridge was listed on the National Register of Historic Places on August 13, 1974 (National Register of Historic Place Inventory Nomination Form). The project was initially presented at the Historic Covered Bridge Preservation Committee (HCBPC) meeting on September 4th and 12th, 2024. The committee reviewed the proposed project based on the Historic Covered Bridge Preservation Plan

and Section 106 review process set forth by the National Historic Preservation Act of 1966, as amended, and the Advisory Council on Historic Preservation's Procedures for the Protection of Historic Properties (36 CFR 800) and recommended replacing the existing beams with steel beams. They did not recommend an alternative based on live loading.

iii. Archaeological

The VTrans archaeological unit will investigate the project limits during the next phase of project development to determine any archaeologically sensitive areas.

iv. Hazardous Materials

According to the Vermont Agency of Natural Resources (VANR) Vermont Hazardous Sites List, there are no hazardous waste sites or hazardous waste generators related in the vicinity of the project location. See the figure below for a map of Hazardous Sites. The project area also does not show in the VT Hazardous Waste Urban Soils Map.

v. Stormwater

There are no stormwater concerns at this site. The project area is relatively flat with no roadway curbing and stormwater runoff involves overland flow into Cox Brook.

2. SAFETY

There have been no reported crashes along Cox Brook Road in Northfield within the last 5-year period.

There are no High Crash Location segments located within the project area.

3. COMMUNITY NEEDS AND CONSIDERATIONS

A community questionnaire was sent to the Town to fill out. The town noted seasonal visitors to the bridges in the summer months, including bus tours, but the slow season is considered winter and spring. For a long-term closure, emergency services and school buses would take a 4-mile Class 4 town road detour. Cox Brook Road connects Northfield to Berlin and Moretown, so users would need to take the same detour as emergency services, which is a gravel road and not designed for significant traffic. The town noted significant numbers of bicycle and pedestrian users on the bridge, which should be accommodated during construction. There were no known instances of flood waters impacting the bridge.

The Local and Regional Input Questionnaire can be found in Appendix J.

Public involvement for this project included a Local Concerns Meeting and Alternatives Presentation Meeting held in-person and as summarized below.

a. Local Concerns Meeting

A Local Concerns Meeting was held on March 26, 2024, at the Brown Public Library. Attendees included the Northfield Selectboard, VTrans and Hoyle Tanner personnel, and members of the public. The Local Concerns Meeting was regarding three different covered bridges that were inspected by Hoyle Tanner. Many of the discussion topics were applicable to all three bridges. The following were discussed:

- *Oversized Vehicles:* The bridge has substandard vertical clearance. Despite warning signs, oversized vehicles have repeatedly crossed the bridge, hitting and damaging the upper lateral bracing and cross beams. Many residents expressed concern about this and asked about mitigation measures that could be taken to deter oversized vehicles from using the bridge, including an over-height bar, cameras, alerts in map apps, and increasing the vertical clearance in the bridge. Over-height bars can be a safety concern if they are rigid, but a swinging bar could be an option. There are many mapping apps and it is difficult to get alerts in all apps that the traveling public use.
- *Enforcement:* The Town is responsible for enforcing load restrictions on any Town structure currently posted.
- *Guardrail and Signage:* It was noted that the approach guardrail is in poor condition, and the approach signing is covered by foliage. The Town is responsible for maintaining approach guardrail and clearing vegetation.
- *Bridge Closure During Construction:* There was a question about how long the bridge would be closed during construction. The bridge would be closed for an entire construction season. The shortest route around is Cox Brook Road, to VT Route 12, Water Street, Union Street, Union Brook Road, and Aseltine Road, and back to Cox Brook Road which has an end-to-end distance of 6.1 miles. Several concerns were bought up at the meeting about the detour route. Participants expressed concern that Aseltine Road is not well maintained. It was noted that in the past, Pearson Hill was connected to Dunham Drive as a temporary detour. These will be investigated during the scoping process. Because this is a Town owned structure, the Town would ultimately be responsible for choosing and signing the detour route according to the Manual on Uniform Traffic Control Devices (MUTCD). VTrans often encourages Towns to reach out to our district offices for questions regarding what signs are required and where they should be placed. The Town would also be responsible to obtain permits from VTrans Operations Bureau for any signs

that would be placed within the State Right-of-Way. The requirements for the detour will be detailed in the Finance and Maintenance Agreement.

- *Temporary Bridge:* A resident expressed interest in a temporary bridge option. A temporary bridge could be installed for access during construction, but the site conditions would make turning movements difficult to meet design standards.

b. Alternatives Presentation Meeting

An Alternatives Presentation Meeting was held on March DAY, 2026 at the Brown Public Library. Attendees included the Northfield Selectboard, VTrans and Hoyle Tanner personnel and members of the public. The following were discussed:

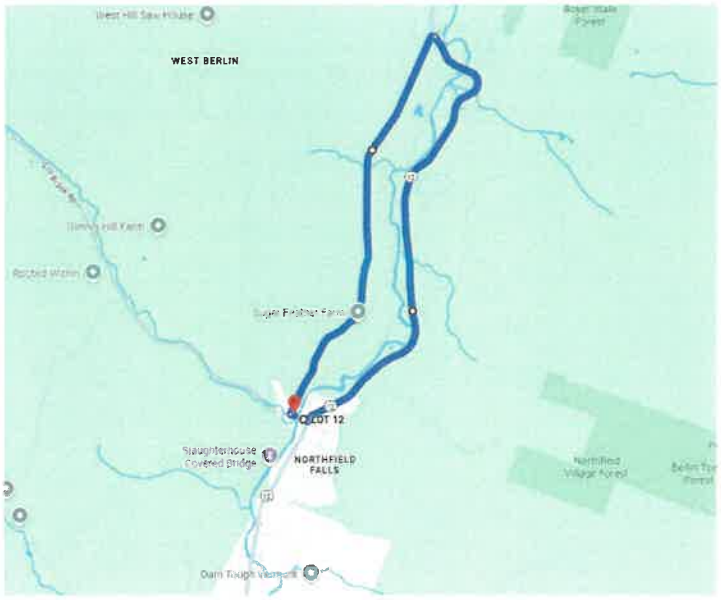
- Discussion Topics

4. MAINTENANCE OF TRAFFIC

In accordance with Vermont Agency of Transportation guidance this project was reviewed to determine suitability for the Accelerated Bridge Program which focuses on faster delivery of construction plans, permitting, and Right-of-Way, as well as faster construction of projects in the field. One practice that will help in this endeavor is closing bridges for portions of the construction period, rather than maintaining traffic on a portion of the existing bridge during construction or providing temporary bridges. In addition to saving money, the intention is to minimize the closure period with faster construction techniques and incentives to allow contractors to complete projects sooner. The Agency will consider the closure option on most projects where rapid reconstruction or rehabilitation is feasible.

a. Off-site Detour

This option would close the bridge and reroute traffic onto an offsite detour. Since the bridge is located on a Class 2 Town Highway, it would be the responsibility of the Town of Northfield to choose the preferred detour route and to sign it according to the MUTCD manual. If the preferred detour route goes through an adjacent Town, it will be the responsibility of the Town of Northfield to coordinate with that Town.



The most likely detour route has an end-to-end distance of 5.0 miles and adds 5.0 miles to the through route. This route is as follows:

- Cox Brook Road, to Chandler Road, VT Route 12, and back to Cox Brook Road (5.0 mi end-to-end)

Advantages: This option would eliminate the need for a temporary bridge to maintain traffic during construction, which would significantly decrease cost and time of construction. This option would have

the least impact to adjacent properties and environmental resources. This option reduces the time and cost of the project both at the development stage and construction. Additionally, this is the safest traffic control option since the traveling public is removed from the construction site.

Disadvantages: Traffic flow would not be maintained through the project site during construction. Additionally, the detour route contains portions of roads that are Class 3 Town Highways that are gravel and would require additional maintenance during construction.

Due to the advantages of an off-site detour and short detour route, it is recommended that this option for maintenance of traffic be utilized for this project.

b. Temporary Bridge

From a constructability standpoint, a temporary bridge could be placed on the upstream (south) side of Northfield Falls Covered Bridge. A temporary bridge on the north side would have fewer impacts to aerial utilities but would still require some relocation. The downstream temporary bridge would require tree clearing.

If a temporary bridge is utilized, borings should be drilled at the temporary abutment locations.

Based on the daily traffic volumes and length of the bridge, a one-way alternating temporary bridge would be recommended.

Advantages: A temporary bridge will maintain traffic flow through the project corridor during construction.

Disadvantages: This traffic control option would be costly and time-consuming, as construction activities will likely require an additional construction season in order to construct the temporary bridge and approaches. There would be decreased safety (in relation to road closure) for workers and vehicular traffic due to cars driving near the construction site and construction vehicles entering and exiting the site. A temporary bridge would be considered safer during construction than phased construction.

Despite the disadvantages, utilizing a temporary bridge during construction is certainly feasible for this project. However, the off-site detour is recommended for maintaining traffic during construction. The Cost Matrix, shown in Section 6 below, does not include the temporary bridge cost in the Bridge category subtotal or overall project costs. By using a temporary bridge instead of an off-site detour, the Town's share of the construction costs would increase from 2.5% to 5%.

c. Phased Construction

Another method of maintaining traffic along a corridor during construction is to build a new structure one lane at a time, or in phases.

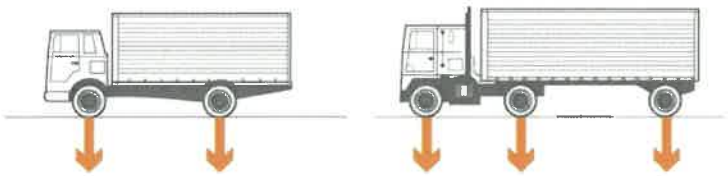
Advantages: This would maintain traffic along the existing corridor during construction.

Disadvantages: Typically, the time required to construct a phased construction project is longer than a project constructed without phasing, because some of the construction tasks must be performed multiple times and cannot be performed concurrently. The costs of construction also increase over un-phased work because of this increase in the length of time, the additional inconvenience of working around traffic, and the effort involved in coordinating the joints between the phases.

The existing bridge is a one-lane structure with a 15'-5" minimum width face of truss to face of truss typical. This does not provide enough width to phase construction and the type of construction required for covered bridges does not allow phasing of work. As such, phased construction will not be considered further.

5. ALTERNATIVES DISCUSSION

a. Structural Analysis



H Truck on the left, HS Truck on the Right

A structural analysis and load rating was performed of all primary live load carrying members of the bridge superstructure. Superstructure roof framing members were also checked for the applied wind, snow, and dead loads. The Service Load (Allowable Stress) Rating method was used for all members in accordance with the provisions of the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges, 17th Edition, AASHTO Manual for Bridge Evaluation Third Edition with 2019 Interim Revisions (MBE), and the 2010 VTrans Structures Design Manual. The bridge was rated to determine the allowable rating vehicle in terms of H Truck, which is a truck with two axles spaced at 14 feet with 20% of the load on the front axle and 80% on the rear axle. Per the scope of services, the bridge was rated for four AASHTO live loads; H20 (20 tons), HS20 (36 tons), H15 (15 tons), HS15 (27 tons). All structural members were rated for single lane loading configurations. The controlling live load force effect for each AASHTO live load was taken as the maximum of the design truck or the lane load. Excel spreadsheets, MIDAS bridge design software, MathCAD computer program, STAAD, and hand calculations were utilized to calculate the as-inspected section properties, capacities, and load rating values.

Since the timber stringers were previously replaced with steel beams, the timber components of the bridge only carry their own self-weight, wind loads, and snow loads. The steel beams support their own self-weight and the vehicular live loads. To differentiate these two different types of loadings in the ratings below, live-load carrying members are reported in terms of Load Factors, while non-live-load carrying members are reported in terms Performance Factors.

For the floor system (steel beams and decking) the inventory rating was determined by combining the maximum design load effects of the dead and live load compared to the allowable inventory stress levels, while the operating rating was determined by combining the maximum effects of the live load, dead load, and snow load (as applicable) as compared to the higher operating stress levels.

Allowable stress values for wood members were obtained from the 2018 National Design Specification for Wood Construction and Supplement (NDS). The wood species used in the superstructure was identified through testing. The grade assigned to each member was based on a visual examination of knots, checks, slope of grain of the wood, and growth rate characteristics of the wood. All superstructure members are wood unless noted otherwise. The substructure was not analyzed as part of the load rating since it was not expected to control the load rating of the bridge.

The steel beams were analyzed using the Load Factor Method (LFR) per the MBE. The inventory rating was determined by combining the maximum effects of the dead and live load effects compared to the allowable inventory stress levels, while the operating rating was determined by combining the maximum effects of the dead and live load (as applicable) as compared to the higher operating stress levels.

Our initial recommendations for repair or replacement of each member are detailed in the following sections. These were reviewed by the Historic Covered Bridge Preservation Committee (HCBPC) so the structural and historical issues could be weighed to determine a rehabilitation live load that met the project goals, while preserving as much of the original fabric of the covered bridge as possible. We have

also identified the priority treatment number (PTN) from the Historic Covered Bridge Preservation Plan to aid in review of the recommendations.

It should be noted that not all members to be replaced can be identified based on our inspection due to inaccessible areas (i.e. top-face rafters, etc.). The estimate of cost in this study includes an additional amount of conditional replacement based on Hoyle Tanner's experience with similar structures to determine an appropriate budget for the project.

Roof Framing

Analysis

The roof rafters and roof boards were analyzed for dead load, wind load (9.4 pounds per square foot (psf) upward on the windward roof and 15.0 psf uplift on the leeward roof) and a ground snow load of 60.0 psf (30.6 psf roof applied) per the 2015 Vermont Fire and Building Safety Code snow load and the 2022 ASCE 7 Minimum Design Loads for Buildings and Other Structures. Our structural analyses showed that roof boards and rafters are adequate for the applied dead, wind, and snow loads (9% utilized for the roof boards and 53% utilized for the roof rafters).

Recommendations

The existing standing-seam metal roof is in fair condition though the ridge cap is attached with nails and screws which allow water to seep into the bridge over time. During rehabilitation, the existing metal roof would most likely be damaged by the removal of certain truss and roof members and will need to be replaced. We recommend that the entire metal roof, all roof boards, and 14 roof rafters (20%) be replaced in-kind (Priority Treatment No. 2) (PTN 2) due to condition. Roof boards are 1" thick Eastern Spruce and rafters are 2"x6" Eastern Spruce. These roof framing recommendations apply to Alternatives 1 through 4.

Upper Lateral Bracing

Analysis

The existing upper lateral bracing, which consists of timber diagonal braces, cross beams, and knee braces, was analyzed for wind loading in conformance with ASCE 7-22. A grade of No. 1 was assigned to all upper lateral bracing wood members based on a visual examination of the wood. A portion of the lateral wind load based on the tributary area is applied to the existing upper later cross beams. Our analysis showed the diagonal bracing system is adequate to keep the bridge square and plumb and to resist code required wind loads.

Recommendations

Long span Lattice Trusses such as those of Northfield Falls Covered Bridge are notorious for bowing and racking during their life span. The following recommendations are expected to improve and strengthen the lateral bracing:

- Replace all diagonal braces in-kind (PTN 2)
- Replace 1 crossbeams (11%) in-kind (PTN 2)
- Repair knee brace connections (PTN 1)

These upper lateral bracing recommendations apply to Alternatives 1 through 4.

Trusses

Analysis

The Town Lattice Truss members were assigned a grade of Select Structural based on a visual examination of the wood.

The trusses were analyzed to determine their current and proposed dead load capacity. A 2-Dimensional bridge computer model of the Town Lattice Trusses was utilized for the structural analysis.

To determine the current capacity of all truss members, full dead and snow loads were applied and compared to allowable stress levels. No truss members are required to be replaced due to strength requirements.

Recommendations

Since the truss members are not carrying any live load and all rate over 1.0, the removal and replacement of the truss members is due to condition and the same for all alternatives (PTN 2). Epoxy injection into the large splits of a few members and rotted areas is also recommended to lessen further splitting and deterioration to these members (PTN 1). See Appendix E for members that are required to be replaced and repaired.

To prevent the spread of the splits in the tails we recommend that wood epoxy be applied to the splits and through bolts be added to prevent further splitting for all alternatives (PTN 1).

Recommendations for member replacements is detailed below. All replacement wood is to be Douglas Fir Select Structural grade unless noted otherwise.

North Truss member replacements and repairs:

- Epoxy repair deteriorated members (PTN 1)
- Replace several plies of chord 1, 2 and 4 in-kind between (PTN 2)

South Truss member replacements and repairs:

- Epoxy repair deteriorated members (PTN 1)
- Replace several plies of chord 1, 2 3, and 4 in-kind between (PTN 2)

Floor System

Analysis

The existing decking and stringers were analyzed to determine the live load capacity. The load rating summary for the deck is shown in Table 1. The tire contact area used for the deck load rating varies based on the applied load. As such, the deck rating for each design truck varies and the Rating Factor for each design truck is reported below. The load rating summary (in "H tons") for the stringers is shown in Table 3. The rear axle of the design truck controlled the load rating of all floor system members. The deck has been assigned a grade of No. 1 for the structural analysis based on a visual examination of knots, checks, slope of grain of the wood and the growth rate characteristics of the wood.

Table 1 - Existing Deck Load Rating Summary

Live Load Alternative	Inventory Rating Factor[2]	Operating Rating Factor[1]
Alternative 1 – H15	2.35	3.13
Alternative 2 – HS15	2.35	3.13
Alternative 3 – H20	1.76	2.35
Alternative 4 – HS20	1.76	2.35

1. Rating factors greater than 1.0 indicate that the member has sufficient capacity to safely carry the design live load.

Table 2 – Existing Interior (33WF118) Stringer Load Rating Summary

Live Load Alternative	Inventory Rating Factor[3]	Operating Rating Factor[2]
Alternative 1 – H15	0.68	1.13
Alternative 2 – HS15	0.38	0.63
Alternative 3 – H20	0.51	0.85
Alternative 4 – HS20	0.28	0.47

2. Rating factors greater than 1.0 indicate that the member has sufficient capacity to safely carry the design live load.

Table 3 - Existing Exterior (33WF118) Stringer Load Rating Summary

Live Load Alternative	Inventory Rating Factor[4]	Operating Rating Factor[4]
Alternative 1 – H15	0.78	1.30
Alternative 2 – HS15	0.43	0.72
Alternative 3 – H20	0.59	0.98
Alternative 4 – HS20	0.33	0.54

3. Rating factors greater than 1.0 indicate that the member has sufficient capacity to safely carry the design live load.

Recommendations

It is recommended that all stringers be replaced due to strength, age, and condition for Alternatives 1, 2, 3, and 4 (H15, HS15, H20, and HS20). The existing stringers have deteriorated beyond meaningful cleaning and repair work, and given their age, are due for replacement. The existing nail laminated deck is adequate for alternatives H15, H20, HS20; however, the deck will need to be removed to facilitate stringer replacement. This work will likely damage the deck as removal of a nail laminated deck is difficult, requiring a replacement deck to be installed. For all alternatives, it is recommended that the existing runner boards be replaced with full-width runner boards. This helps to provide a smoother and wider traffic surface and could help prevent vehicles from losing control if a tire runs off the runner boards.

In addition, it is recommended that a new wood curb be added to the bridge to help keep vehicles from impacting the trusses. This curb has previously been used by VTrans on the Hutchins, Comstock, and Longley Covered Bridges in Montgomery and many other covered bridges rehabilitations throughout the State.

b. Substructure

The existing abutments have not been analyzed for overturning and sliding per the VTrans structures manual since they appear stable with no signs of distress and there is exposed bedrock at the bridge location.

Overall, the existing abutments and pier appear sound and globally stable with no apparent sign of movement, settlement, or tipping. Some isolated voids, cracks, and spalls were found on various surfaces of the existing substructure elements. The scope of work does not include the stability analysis of the existing substructure.

Recommendations

The following recommendations are made for the east abutment bridge substructure:

- Replace the east abutment with a reinforced concrete abutment (PTN 2).
- Replace truss bearing blocks (PTN 2).
- Remove all vegetation and small trees (PTN 1).

The following recommendations are made for the west abutment bridge substructure:

- Replace the concrete backwall and bridge seat, including modifying bridge seat elevation to accommodate replacement stringers (PTN 2).
- Conduct minor repairs to all existing west substructure elements (PTN 1).
- Replace truss bearing blocks (PTN 2).
- Remove all vegetation and small trees (PTN 1).

The following recommendations are made for the pier:

- Modify bridge seat elevation to accommodate replacement stringers (PTN 1).
- Conduct minor partial depth concrete repairs to all existing pier substructure elements (PTN 1).
- Grout and seal the concrete cracks greater than ⅛" in width (PTN 1).
- Stain and seal all exposed concrete surfaces with a water-based sealant in order to provide long-term protection of the concrete (PTN 1).

c. No Action

This alternative would leave the bridge as it currently exists. A general guideline for evaluating a "No Action" alternative is determining whether the structure can remain in service for at least the next 10 years without requiring any work. The existing bridge superstructure is in poor condition, with multiple components—including truss members, bearing blocks, and upper lateral bracing—with numerous deficiencies. For safety reasons, maintaining the bridge in its present state is not recommended. No cost estimate is provided for this alternative, as it does not involve any immediate expenditures.

d. Alternative 1: Rehabilitation for H15 (15-Ton) Loading

This alternative consists of work necessary to extend the useful life of the bridge and to upgrade the bridge live load carrying capacity to carry a 15-ton design vehicle. Refer to Appendix E for replacement members that are required to be replaced for this alternative. This work includes:

- Stringers
    - Replacement of all steel stringers with galvanized W21x101 steel stringers (PTN 2)

e. Alternative 2: Rehabilitation for HS15 (27-Ton) Loading

This alternative consists of work necessary to extend the useful life of the bridge and to upgrade the bridge live load carrying capacity to carry a 27-ton design vehicle. Refer to Appendix E for replacement members that are required to be replaced for this alternative. This work includes:

- Stringers
    - Replacement of all steel stringers with galvanized W21x147 steel stringers (PTN 2)

f. Alternative 3: Rehabilitation for H20 (20-Ton) Loading

This alternative consists of work necessary to extend the useful life of the bridge and to upgrade the bridge live load carrying capacity to carry a 20-ton design vehicle. Refer to Appendix E for replacement members that are required to be replaced for this alternative. This work includes:

- Stringers
    - Replacement of all steel stringers with galvanized W24x117 steel stringers (PTN 2)

g. Alternative 4: Rehabilitation for HS20 (36-Ton) Loading

This alternative consists of work necessary to extend the useful life of the bridge and to upgrade the bridge live load carrying capacity to carry a 36-ton design vehicle. Refer to Appendix E for replacement members that are required to be replaced for this alternative. This work includes:

- Stringers
    - Replacement of all steel stringers with galvanized W24x162 steel stringers (PTN 2)

h. Proposed Roadway Improvements

Along the southern approach, the roadway will mimic existing conditions and transition approximately 50' before the bridge to a 15'-4" paved roadway at the bridge. The proposed roadway typical paved section south of the bridge will consist of removal of existing pavement and enough subbase material to provide suitable drainage roadway fill beneath the pavement. Final pavement design will be provided by VTrans.

The approach roadway width will mimic the existing conditions measuring 15'-5" at the bridge and gradually widening to match the existing width at the end of the project limits. The proposed roadway typical section between the bridge and project limits will match the proposed paved typical section.

Stormwater flow patterns will mimic existing conditions with sheet flow of the roadway to vegetated side slopes. Stop drains or lowering the grade at one end of the bridge will be considered in final design to improve drainage conditions. New steel backed timber guardrail is proposed on both approaches and will closely match existing guardrail lengths.

It is recommended that tree removal and trimming take place on both sides of the bridge as many of the nearby tree branches have potential to grow over the bridge and could fall and damage the bridge and are also promoting insect infestation of the bridge.

i. Fire Protection

As part of this Scoping Report, the bridge was assessed for improvements against the potential for loss or damage from fire. There are no known fire detection or protection systems at the covered bridge site. Three fire detection/protection systems are generally used for covered bridges, each of which was evaluated for this project.

Intumescent or Fire-Retardant Coatings (Nochar/Polaseal)

These coatings are water-based, water repellent treatments that are specifically designed to protect exterior and interior wood surfaces. They penetrate the wood and then cure by reaction with air to lock into the pore structure of the wood. These coatings work by raising the flashpoint of the wood making it difficult to start a fire. The fire-retardant coatings contain a proven fire retardant *to reduce* flame spread in the event of a fire and a blend of special preservatives to fight against the causes of decay. The coatings are available in colored and clear versions that are applied to the wood by brush or spray. The coatings do not affect the strength of the wood. It is also recommended the application of a fungicide to the bridge members to defend against fungal growth. Infestation by fungi causes the wood to rot, lowering the capacity of affected members.

The application of fire-retardant coatings is recommended for all alternatives considered.

Fire Detection System (Protectowire)

If a fire is started, it is advantageous to notify the local fire department as soon as possible. The "Protectowire" is a proprietary alert system that works by running a small wire through key locations in the bridge. The sensor cable is comprised of steel conductors individually insulated with a heat sensitive polymer. The insulated conductors are twisted together to impose a spring pressure between them and wrapped with a protective tape. If a rapid rise in temperature is detected or if a wire is cut, the system alerts the local mutual aid or fire department. This advanced warning can greatly reduce fire damage to a bridge and hopefully prevent the fire from making the bridge a total loss.

It should be noted that there is an annual maintenance cost associated with this system. The system requires power and a phone line (land or cell) to contact mutual aid. In addition, the control box contains batteries that have small electric strip heaters on them to prevent damage from freezing during cold weather. The control box is typically hidden at the end of the bridge in the siding and can be well insulated to reduce electrical costs.

The fire detection system will be discussed with the Town at the alternatives presentation meeting.

Dry Deluge Sprinkler System

The purpose of a deluge sprinkler system is to prevent the spread of fire by wetting down the entire fire area. The sprinkler system typically used includes dry pipes with a fire department connection away from the ends of the bridge. During a fire, the fire department feeds the system which directs water to the source of the fire. The majority of the piping and heads are in the roof; however, coverage is also provided under the bridge at the abutments. These systems are typically used in long or multi-span bridges where the fire department cannot effectively fight the fire near the center of the bridge.

The sprinkler system will be discussed with the Town at the alternatives presentation meeting.

j. Lighting

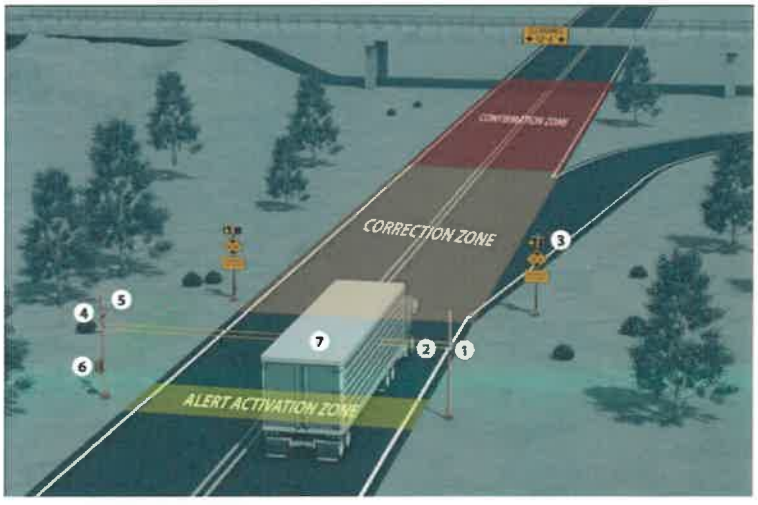
There is currently no lighting on the bridge or immediate approaches to it. Lighting can be an effective means to deter vandalism and improve visibility. The decision to add lighting to the bridge should be made by the Town. Interior lighting in the form of high-pressure sodium lights controlled by photocells may be added if desired. This type of lighting provides a light brown color and is the type preferred by state historic resource agencies. The fixtures proposed in this study have a good long-term performance record, are unobtrusive as they are installed in between the upper lateral bracing, and are reasonably vandal proof. The photocell is specified to help ensure that the lights are only on when needed.

The lighting system will be discussed with the Town at the alternatives presentation meeting.

k. Vertical Clearance

The existing vertical clearance on the bridge is approximately 12'-6", which is substandard and causing impact damage to the portals, cross braces, upper lateral bracing, and knee braces due to oversized vehicles. The same is true of the other two covered bridges on Cox Brook Road. It is proposed to increase the vertical clearance of all three bridges to a uniform 13'-0". At the Northfield Falls Covered Bridge, this would be done by replacing the existing steel lateral bracing with a new bottom chord assembly and blocking that would raise the truss members enough to achieve the desired vertical clearance. The siding will extend down enough to cover this assembly unit, so it is not visible on the exterior. Curbing and deck widening on the inside would cover the assembly unit from view on the inside of the truss.

This option was presented to the HCBPC and was approved as an acceptable modification to the existing structure.



Additionally, early detection and vehicle warning systems can be incorporated into the project. These systems use sensors within an "activation zone" to identify vehicles that exceed the clearance height of an upcoming structure and alert drivers to the restriction. Drivers are then guided toward a safe alternate route within the "correction zone". The system also collects data, such as license plate information, for vehicles that trigger the warning and notifies local authorities when a vehicle enters the "confirmation zone". A potential layout of this system for the three covered bridges along Cox Brook Road is shown below. The associated cost, estimated at approximately $125,000, is not included in the Cost Matrix in Section 6, as the system is proposed as an optional enhancement.

1. Construction Schedule

Northfield Falls Covered Bridge is one of three bridges on Cox Brook Road scheduled for rehabilitation. The rehabilitation of this bridge is expected to take approximately two construction season (about eight months). Upper Cox Covered Bridge, located 0.3 miles to the north, and Lower Cox Covered Bridge, located 0.2 miles to the south, will likely require one construction season each.

Because these projects are in close proximity, there may be opportunities for cost and schedule savings by bundling two or all three bridges into a single contract. Temporary bridge alternatives for Bridges 10 and 11 share the same span length and width requirements, allowing the same temporary structure to be reused at both sites. Bridge 15 has a short local detour available for traffic maintenance.

Covered bridge rehabilitation is a highly specialized type of construction, and contractors often have limited crews with the required expertise. For this reason, the Town may consider bundling Bridges 10 and 11 into a single contract. Under this approach, one contractor could complete both projects over two construction seasons, using the same specialized crew and the same temporary bridge at each site. Bridge 15 could then be bid separately and constructed over the same two seasons, allowing all three bridges to be completed within a two-year period.

Alternatively, all three bridges could be bid together as one project and completed over four years, or they could be bid individually, giving contractors the flexibility to pursue one, two, or all three projects.

6. COST MATRIX

Northfield BO CVBR(9)		Do Nothing	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
COST[1]	Roadway	$0	$535,870.00	$555,870.00	$545,870.00	$565,870.00
	Erosion Control	$0	$50,000.00	$50,000.00	$50,000.00	$50,000.00
	Bridge	$0	$2,890,555.00	$3,098,805.00	$2,962,805.00	$3,166,805.00
	Full CE Items	$0	$40,000.00	$40,000.00	$40,000.00	$40,000.00
	Construction Costs	$0	$3,517,000.00	$3,745,000.00	$3,599,000.00	$3,823,000.00
	Construction Engineering & Contingencies (CEC)	$0	$880,000.00	$937,000.00	$900,000.00	$956,000.00
	Accelerated Premium	$0	$0	$0	$0	$0
	Total Construction Costs with CEC	$0	$4,397,000.00	$4,682,000.00	$4,499,000.00	$4,779,000.00
	Preliminary Engineering	$0	$880,000.00	$937,000.00	$900,000.00	$956,000.00
	Right of Way	$0	$25,000.00	$25,000.00	$25,000.00	$25,000.00
	Total Project Costs	$0	$5,302,000.00	$5,644,000.00	$5,424,000.00	$5,760,000.00
	Annualized Costs	$0	$132,550.00	$141,100.00	$135,600.00	$144,000.00
	TOWN SHARE	$0	$132,550.00	$141,100.00	$135,600.00	$144,000.00
	TOWN %	0%	2.50%	2.50%	2.50%	2.50%
SCHEDULING	Project Development Duration	N/A	3 years	3 years	3 years	3 years
	Construction Duration	N/A	16 months	16 months	16 months	16 months
	Closure Duration (If Applicable)	N/A	16 months	16 months	16 months	16 months
ENGINEERING	Typical Section - Roadway (feet)	23'	23'	23'	23'	23'
	Typical Section - Bridge (feet)	15'-5"	11'	11'	11'	11'
	Geometric Design Criteria	Substandard Width	Substandard Width	Substandard Width	Substandard Width	Substandard Width
	Traffic Safety	No Change	Improved	Improved	Improved	Improved
	Alignment Change	No Change	No Change	No Change	No Change	No Change
	Bicycle Access	Substandard	Substandard	Substandard	Substandard	Substandard
	Pedestrian Access	Substandard	Substandard	Substandard	Substandard	Substandard
	Hydraulics	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard	Meets Minimum Standard
	Utilities	No Change	No Change	No Change	No Change	No Change
OTHER	ROW Acquisition	No	Yes	Yes	Yes	Yes
	Road Closure	No	Yes	Yes	Yes	Yes
	Design Life (years)[2]	<10	40	40	40	40

[1] Costs are estimates only, used for comparison purposes.

[2] A design life of 40 years will be assumed for the deck and superstructure rehabilitation options. Substructure rehabilitation is assumed to have a design life of 50 years.

7. CONCLUSION

The Northfield Falls Covered Bridge (Bridge No. 15), built in 1872, is a Town-owned bridge located on Town Highway 3 (Cox Brook Road) just west of the intersection with VT Route 12. It is a 131'-0" long two-span Town Lattice truss which carries one lane alternating traffic over the Dog River near Northfield Falls, an unincorporated village in the Town of Northfield. The bridge has undergone numerous changes and additions throughout its history with various degrees of documentation.

A detailed inspection and load rating of the bridge was completed to determine if the bridge can meet the project purpose and need. The roof framing was determined to be adequate for code required dead, wind, and snow loads, however modifications are recommended to repair some select members due to their deteriorated condition. The bridge lateral bracing system was determined to not be adequate for code required wind loads, however modifications are recommended to repair some select members due to their deteriorated condition. The truss members were determined to be adequate for code required dead, wind, and snow loads, however modifications are recommended to repair some select members due to their deteriorated condition. The floor system was determined to not be adequate for H15 (15-ton) loading at inventory or operating level. The substructure was visually reviewed and appears to be adequate with minor repairs recommended.

Based upon our inspection and analysis of the Northfield Falls Covered Bridge, it appears feasible to rehabilitate the bridge for vehicular loading to meet the project's purpose and need. Several alternatives were considered and studied as described above in Section 5.

The Town Selectboard and public at the March DATE, 2026 meeting approved Alternative X – Rehabilitation for HXX (XX-ton) loading. Alternative X promotes a safe transportation system, increases the load carrying capacity of the crossing for the emergency responses vehicles, promotes economic development and growth of the Town of Northfield, and maintains the historic character of the covered bridge.

The total estimated construction cost of all recommended work items for Alternative X, in 2026 dollars, is $X,XXX,XXX.

This Scoping Report has been completed utilizing information available as of March 2026. This information may include the Design Criteria listed above, permitting requirements, field data obtained by Hoyle Tanner, and reports or survey information prepared by others, which are subject to change. The condition of an existing bridge can change rapidly, or the bridge be damaged through manmade or natural events that could alter the conclusions reached herein. Therefore, the conceptual design, estimate of probable construction costs, and conclusions reached in this Scoping Report should not be relied upon for an extended period.

APPENDIX A

VTrans Bridge Inspection Report

VERMONT
AGENCY OF TRANSPORTATION

Route C2003 /
Structure #00015 / (Routine)
C2003 over DOG RIVER
Team Lead: Justin White, **Inspection Date:** 08/20/2024

Town: 155 - NORTHFIELD

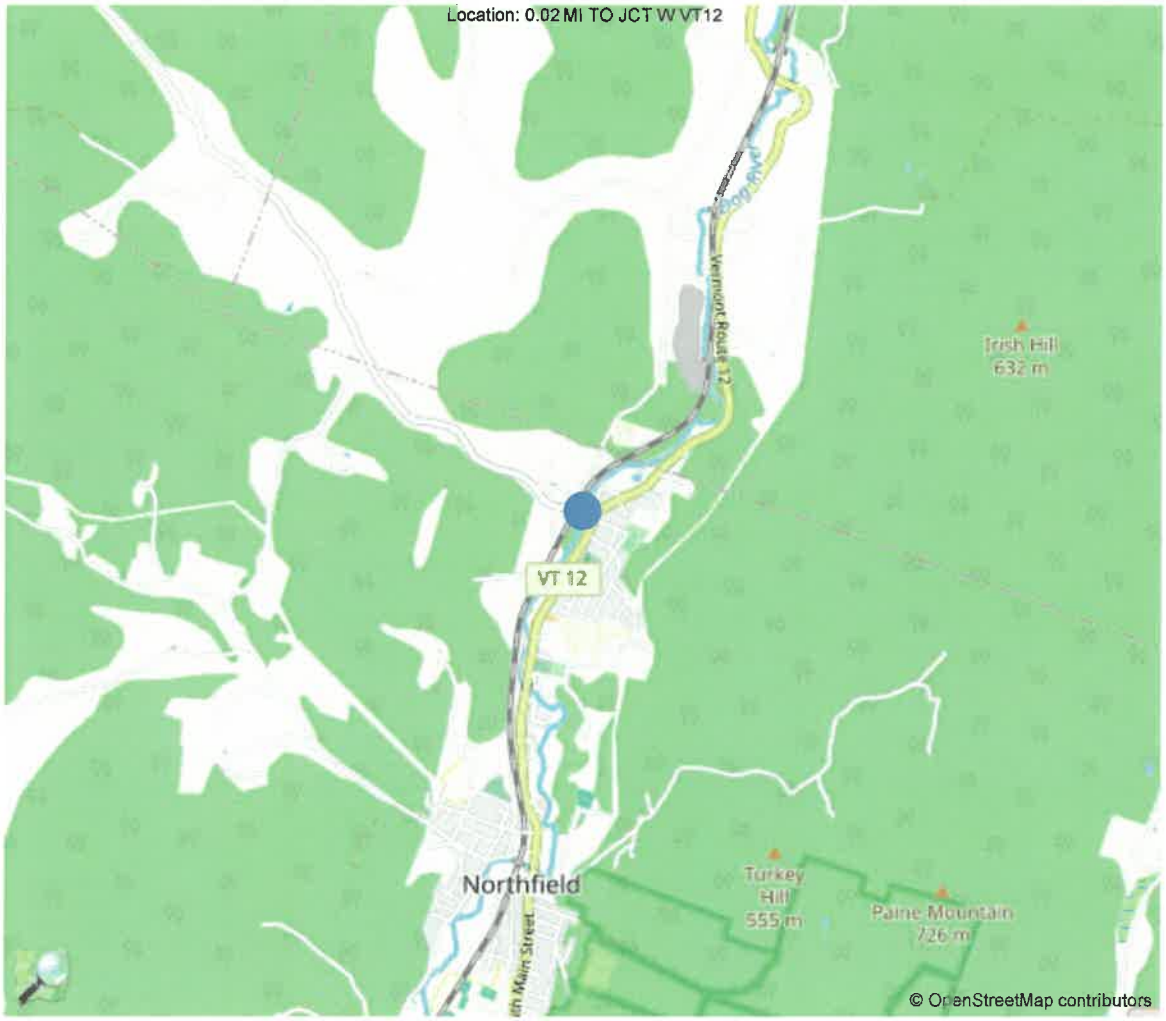
District 6, 23 - WASHINGTON County

Owner: 3 - Town or Township Highway Agency

Maintenance Responsibility: 3 - Town or Township Highway Agency

VERMONT
AGENCY OF TRANSPORTATION

Route C2003 /
Structure #00015 / (Routine)
C2003 over DOG RIVER
Team Lead: Justin White, **Inspection Date:** 08/20/2024



44.17244, -72.65151

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Structure #00015 / (Routine)
C2003 over DOG RIVER

Team Lead: Justin White, **Inspection Date:** 08/20/2024

IDENTIFICATION	
(1) State Names	50 - Vermont
(8) Structure Number	101213001512131
(5) Inventory Route	1
(2) Highway Agency District	6 - District 6
(3) County Code	23 - WASHINGTON
(4) Place Code	50275
(6) Features Intersected	DOG RIVER
(7) Facility Carried	C2003
(9) Location	0.02 MI TO JCT W VT12
(11) Mile Point	0 mi
(12) Base Highway Network	No
(13) LRS Inventory Rte & Subrte	
(16) Latitude	44.1724444444444
(17) Longitude	-72.6515083333333
(98) Border Bridge State Code	
(99) Border Bridge Structure No.	
STRUCTURE TYPE AND MATERIAL	
(43) Main Structure Type	32
Material	3 - Steel
Type	2 - Stringer/Multi-beam or girder
(44) Approach Structure Type	00
Material	0 - Other
Type	0 - Other
(45) No. of Spans in Main Unit	2
(46) No. of Approach Spans	0
(107) Deck Structure Type	8 - Wood or Timber
(108) Wearing Surface/Protective System	
Type of Wearing Surface	7 - Wood or Timber
Type of Membrane	0 - None
Type of Deck Protection	7 - Internally Sealed
AGE AND SERVICE	
(27) Year Built	1872
(106) Year Reconstructed	1969
(42) Type of Service	15
On	1 - Highway
Under	5 - Waterway
(28) Lane	
On	1
Under	0
(29) Average Daily Traffic	1500
(30) Year of ADT	2019
(109) Truck ADT	3 %
(19) Bypass, Detour Length	3 mi
GEOMETRIC DATA	
(48) Length of Maximum Span	64 ft
(49) Structure Length	139 ft
(50) Curb or Sidewalk Width	
Left	0 ft
Right	0 ft
(51) Bridge Roadway Width Curb to Curb	15.6 ft
(52) Deck Width Out to Out	15.7 ft
(32) Approach Roadway Width (W/Shoulders)	20 ft
(33) Bridge Median	0 - No median
(34) Skew	0 Deg
(35) Structure Flared	0 - No flare
(10) Inventory Route Min Vert Clear	12.17 ft
(47) Inventory Route Total Horiz Clear	15.6 ft
(53) Min Vert Clear Over Bridge Rdwy	11.92 ft
(54) Min Vert Underclear	0 ft
Ref:	
(55) Min Lat Underclear RT	0 ft
Ref:	
(56) Min Lat Underclear LT	0 ft
NAVIGATION DATA	
(38) Navigation Control	0 - No navigation control on w
(111) Pier Protection	
(39) Navigation Vertical Clearance	0 ft
(116) Vert-Lift Bridge Nav Min Vert Clear	0 ft
(40) Navigation Horizontal Clearance	0 ft

CLASSIFICATION	
(112) NBIS Bridge Length	Y
(104) Highway System	0
(26) Functional Class	8 - Rural Minor Collector
(100) Defense Highway	0 - The inventory route is not
(101) Parallel Structure	N - No parallel structure exis
(102) Direction of Traffic	3 - One lane bridge for 2 - way traffic
(103) Temporary Structure	
(105) Federal Lands Highways	0 - N/A
(110) Designated National Network	0 - The inventory route is not
(20) Toll	3 - On free road. The structu
(21) Maintain	3 - Town or Township Highway A
(22) Owner	3 - Town or Township Highway A
(37) Historical Significance	1 - Bridge is on the National
CONDITION	
(58) Deck	6
(59) Superstructure	6
(60) Substructure	5
(61) Channel & Channel Protection	8
(62) Culverts	N
LOAD RATING AND POSTING	
(31) Design Load	4 - M 18 / H 20
(63) Operating Rating Method	2
(64) Operating Rating	
Type	2 - Allowable Stress(AS)
Rating	49
(65) Inventory Rating Method	2 - Allowable Stress(AS)
(66) Inventory Rating	
Type	
Rating	34
(70) Bridge Posting	5 - Equal to or above legal loads
(41) Structure Open/Posted/Closed	A - Open, no restriction
APPRAISAL	
(67) Structural Evaluation	5
(68) Deck Geometry	2
(69) Clearances, Vertical/Horizontal	N
(71) Waterway Adequacy	7
(72) Approach Roadway Alignment	8
(36A) Bridge Railings	0 - Inspected feature does not meet
(36B) Transitions	0 - Inspected feature does not meet
(36C) Approach Guardrail	1 - Inspected feature meets current
(36D) Approach Guardrail Ends	1 - Inspected feature meets current
(113) Scour Critical Bridges	8 - Bridge foundations determined t
PROPOSED IMPROVEMENTS	
(75) Type of Work	35 - Bridge rehabilitation bec
(76) Length of Structure Improvement	139 ft
(94) Bridge Improvement Cost (Multiply value by 1000)	$ 764
(95) Roadway Improvement Cost (Multiply value by 1000)	$ 50
(96) Total Project Cost (Multiply value by 1000)	$ 814
(97) Year of Improvement Cost Estimate	2020
(114) Future ADT	1575
(115) Year of Future ADT	2029

INSPECTIONS *

(90) Inspection Date			08/20/2024
(91) Frequency			24
(92) Critical Feature Inspection	Done	Freq. (Mon)	Date
A: Fracture Critical Detail	No		
B: Underwater Inspection	No		
C: Other Special Inspection			

* The inspection date and frequency information in this box contains the current NBI date and frequency information. Please refer to the report header for the date this inspection was conducted.

VERMONT
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Route C2003 /
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C2003 over DOG RIVER
Team Lead: Justin White, **Inspection Date:** 08/20/2024

Maintenance Needs

Date Reported: 08/18/2022

Priority:	4 - Maintenance Finding - Next Inspection Cycle	**Status:**	Open
Type of Work:	4 - Approach - Approach settlement/erosion repair	**Component:**	Approach

Deficiency Description

A small area in the upstream shoulder of the abutment 1 approach is undermined and roadway asphalt has been eroded.

Remarks

A means of retaining the approach roadway should be considered with added roadway fill.

Upstream abutment 1 shoulder area

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Maintenance Needs

Date Reported: 08/18/2022

Priority:

Status: Open

Type of Work: 27 - Superstructure - Clean and paint superstructure

Component: Superstructure

Deficiency Description

Heavy rust scale along the flanges and lower areas of the webs with minor to moderate section loss.

Remarks

A paint project with extensive cleaning of the beams should be considered.

Superstructure

Superstructure

VERMONT
AGENCY OF TRANSPORTATION

Route C2003 /
Structure #00015 / (Routine)
C2003 over DOG RIVER
Team Lead: Justin White, **Inspection Date:** 08/20/2024

Maintenance Needs

Date Reported: 08/18/2022

Priority:

Status: Open

Type of Work: 33 - Substructure - Pier repair

Component: Substructure

Deficiency Description

The area beneath beam 2 span 2 side has spalled out undermining the bearing 3"+/-.

Remarks

Patching repairs are needed.

Pier cap

Deck

ELEMENTS	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4
31	Timber Deck	SF	2182	1882	300	0	0
1140	Decay/Section Loss	SF	300	0	300	0	0
510	Wearing Surfaces	SF	2182	1586	596	0	0
1180	Abrasion/Wear (Timber)	SF	556	0	556	0	0
7000	Damage	SF	40	0	40	0	0

58 - Deck (6 - SATISFACTORY CONDITION - structural elements show some minor deterioration.)
Areas of minor fuzzy mold growth and mildew staining with minor saturation throughout the soffit

200 - Existing Wearing Surface Depth (1.5")

A21 - Deck Wearing Surface Condition (Satisfactory)
Minor tire wear throughout with some split/broken ends ends at each portal.

A39 - Deck Fascia Condition (Very Good)

B.C.05 Bridge Railing Condition Rating (NOT APPLICABLE - Component does not exist.)

B.C.08 Bridge Joints Condition Rating (NOT APPLICABLE - Bridge does not have deck joints.)

APPROACH

72 - Approach Roadway Alignment (8 - Equal to present desirable criteria)

A13 - Approach Rail Condition (Good)
Scattered scape marks with areas of minor rust staining.

A16 - Approach Post Condition (Good)
Minor bending and twisting in the ends of some posts.

A18 - Approach Erosion/Settlement (Minor)
A small area in the upstream shoulder of the abutment 1 approach is undermined and asphalt has been eroded.

B.C.06 Bridge Railing Transitions Condition Rating (GOOD - Some minor defects.)

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Superstructure

ELEMENTS	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4
107	Steel Open Girder/Beam	LF	556	0	0	556	0
1000	Corrosion	LF	556	0	0	556	0
515	Steel Protective Coating	SF	4110	0	0	0	4110
3440	Effectiveness (Steel Protective Coatings)	LF	4110	0	0	0	4110
311	Movable Bearing	EA	8	0	0	8	0
1000	Corrosion	EA	8	0	0	8	0
313	Fixed Bearing	EA	8	0	0	8	0
1000	Corrosion	EA	7	0	0	7	0
2240	Loss of Bearing Area	EA	1	0	0	1	0

59 - Superstructure (6 - SATISFACTORY CONDITION - structural elements show some minor deterioration.)
Heavy rust scale along the flanges and lower areas of the webs with deep pitting and moderate section loss.

A50 - Super Verticals/Diagonals Condition (Good)

A51 - Top Chords Condition (Good)

A52 - Bot. Chords Condition (Satisfactory)
Minor splits and checks scattered throughout. The upper interior portion of the bottom chord has separation gaps at some of the splice joints with splintered/broke ends, leaving some of the timber pegs ends exposed.

A55 - Lateral Bracing Condition (Satisfactory)
Paint peel and areas of rust scale with minor pitting/section loss.

A65 - Roof/Siding Condition (Satisfactory)
The roof is in good condition. The siding has broken out and splintered with weathering along the lower ends.

B.C.07 Bridge Bearings Condition Rating (SATISFACTORY - Widespread minor or isolated moderate defects.)
Rust scale throughout with deep pitting and moderate section loss. The abutment 2 bearings are covered in debris and are not visible.

B.C.14 NSTM Inspection Condition (NOT APPLICABLE - Component does not exist.)

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Substructure

ELEMENTS	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4
210	Reinforced Concrete Pier Wall	LF	12	12	0	0	0
217	Masonry Abutment	LF	24	10	4	10	0
1640	Masonry Displacement	LF	14	0	4	10	0
218	Other Abutment	LF	24	0	0	24	0
1010	Cracking	LF	12	0	0	12	0
1080	Delamination/Spall/Patched Area	LF	12	0	0	12	0
234	Reinforced Concrete Pier Cap	LF	24	8	4	12	0
1130	Cracking (RC and Other)	LF	16	0	4	12	0

60 - Substructure (5 - FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.)
Abutment 1 Lineal cracking along the pour joints and scattered vertical shrinkage cracks with minor separation throughout. The ends have map cracking with minor efflorescence staining and minor to moderate spalling in the base. The upstream end has a segmented corner section that has failed revealing laid up granite block behind it.

Abutment 2 laid up granite block wall has scattered small voids along the joints throughout. The concrete cap has voided spalling in each end end with scaling and surrounding delams.

A71 - Abutment End Walls Condition (Satisfactory)
Areas of minor spalling in the ends with surrounding delams and small areas of exposed reinforcing.

A81 - Pier Seat/Cap Condition (Satisfactory)
Scattered small delayed areas with rust staining along the top and bottom edges. The area beneath beam 2 span 2 side has spalled out under Ming the bearing approximately 3-4"

A83 - Pier Shaft Condition (Very Good)

A86 - Pier Footings Condition (Very Good)

CHANNEL

61 - Channel Condition (8 - Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.)
Debris up against the pier has caused localized scour hole exposing the footing.

B.C.10 Channel Protection Condition Rating (VERY GOOD - Some inherent defects.)

B.C.11 Scour Condition Rating (Some minor scour.)

GENERAL OBSERVATION

Erosion of the upstream embankment along the abutment 1 approach has caused the erosion of the asphalt in the shoulder area. Preventive repairs are needed so erosion doesn't extend further into the roadway. The structure should be considered for a paint project with extensive cleaning of the beams. Abutment 1 and the pier cap are in need of concrete repairs due to cracked and spalled out areas that extend up to and have undermined small portions of the neighboring bearings; see maintenance reports.

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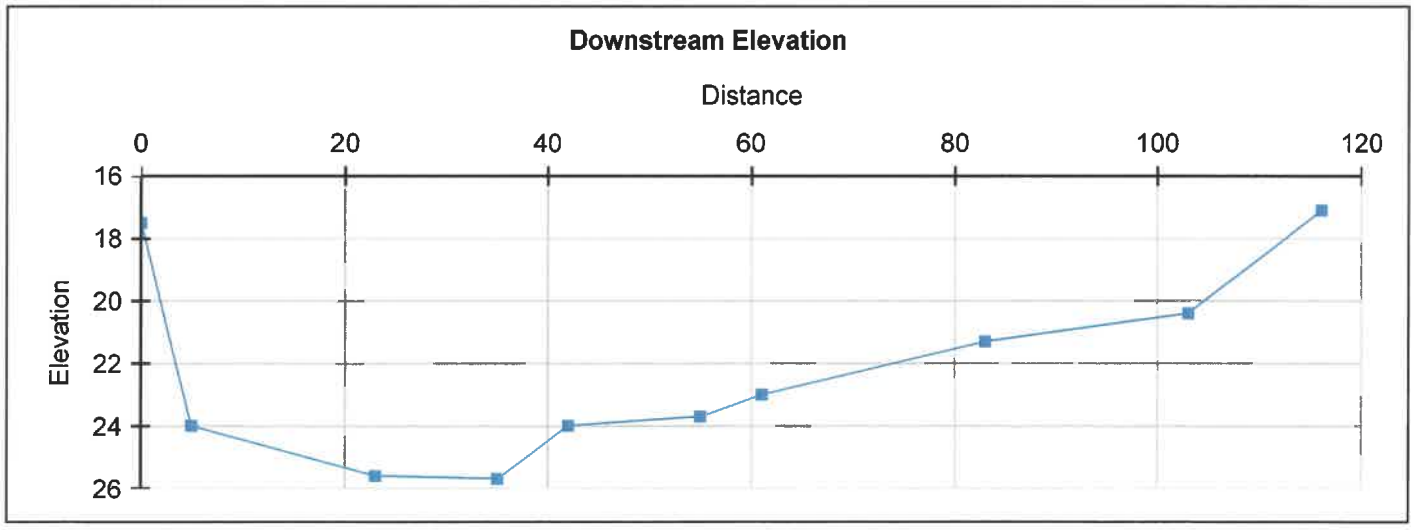
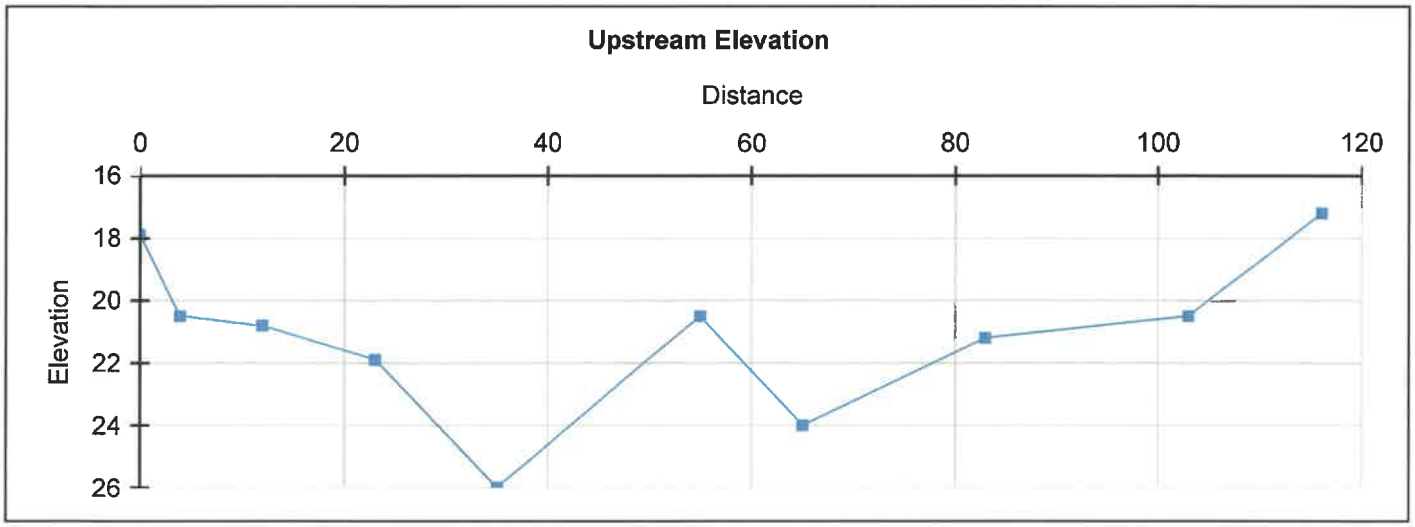
Channel Profile

Waterway Flow:	Left to right	Top of Water:	
Origin:	Bottom of deck fascia	Bottom of Beam:	

Station	Distance	Downstream	Upstream
Abutment 1	0	17.5	17.9
EOW	4		20.5
EOW	5	24	
EOW	12		20.8
	23	25.6	21.9
	35	25.7	26
EOW	42	24	
Pier side 1	55	23.7	20.5
EOW	61	23	
EOW	65		24
	83	21.3	21.2
	103	20.4	20.5
Abutment 2	116	17.1	17.2





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Abutment 2 approach

Abutment 1 approach

Upstream abutment 1 shoulder area

Wearing surface

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Wearing surface

Downstream elevation

Upstream elevation

Lateral cross bracing

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Span 1

Span 2

Superstructure

Abutment 1 beam ends

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Abutment 1

Abutment 1

Pier span 1

Pier span 2

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Pier cap

Abutment 2

Downstream

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Upstream