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Scoping Report

Clarendon BO 1443(55)
Kinglsey Covered Bridge
Town Highway 39
Bridge 28 over Mill River

Prepared for:
Vermont Agency of Transportation

Hoyle, Tanner & Associates, Inc.
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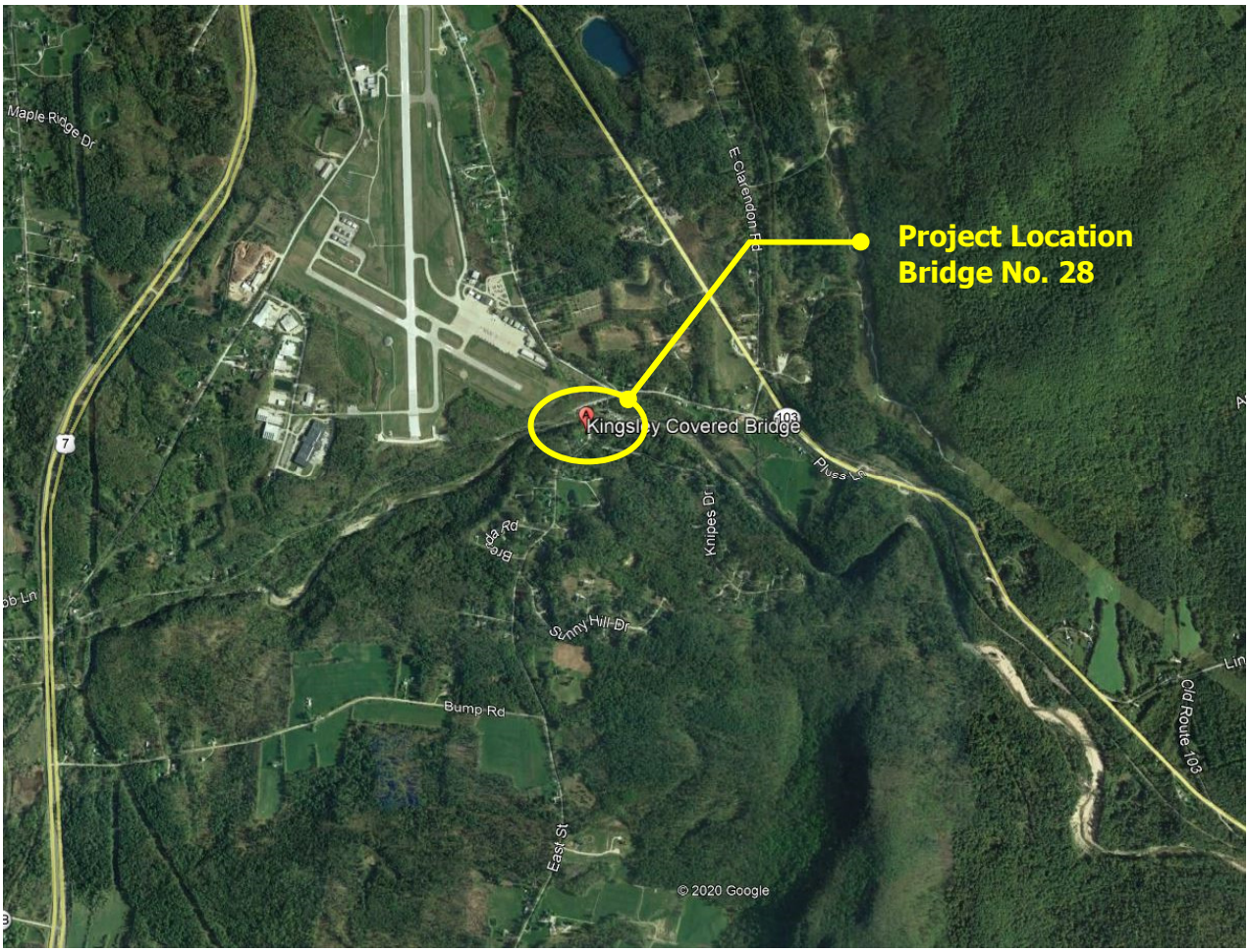

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I. SITE INFORMATION

The Kingsley Covered Bridge (Bridge No. 28) is a Town-owned bridge located on Town Highway 39 (East Street) just south of the intersection with Gorge Road. The bridge is a 121'-0" long single span town lattice truss which carries one-way alternating traffic over the Mill River near the eastern boundary of the Town of Clarendon with the Town of Shrewsbury. The bridge is the only remaining covered bridge in the Town of Clarendon. The sign on the north portal states that the bridge was built in 1836, however, the National Register of Historic Places Inventory Nomination Form claims a construction date of about 1870. The VTrans Structure Inspection, Inventory and Appraisal Sheet indicates that the bridge was built in 1836. The bridge was built by local carpenter Timothy K. Horton, a well-known and respected builder which also built other bridges, houses and barns in the Clarendon area. The Kingsley Covered Bridge is named for a family that operated a nearby mill.

Upstream and North Portal Elevation
Looking South

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 numerous 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 need. For purposes of this report the substructure units are numbered sequentially from south to north and all members are wood unless noted otherwise.

Roadway Classification:	Local Road, Class 3 Town Highway Bridge
Type:	Single Span Town Lattice Covered Bridge
Bridge Length:	121 feet
Bridge Skew:	No Skew
Year Built:	1836, Rehabilitated in 1949 and 1987
Ownership:	Town of Clarendon

The bridge has undergone numerous changes or additions throughout its history with various degrees of documentation. The two major and documented rehabilitations were completed in 1949 and 1987.

The 1949 rehabilitation plans noted the work shown below. Record drawings of this rehabilitation are not available, and it is not known if all of this work was completed at that time.

- Straighten and plumb the trusses.
- Replace end sections of the lower chords and install new end posts.
- Install bearing blocks for the ends of trusses and new stringers below the floor beams.
- Jack the entire bridge approximately 3 feet to allow for drilling dowel holes and boring for split ring connectors.
- Install split ring connectors at connections of the new lower chord members with the existing members.
- Replace all broken and deteriorated members in-kind.
- Replace the floor system in its entirety with new floor system which included new 8”x16” floor beams spaced at 4’-0” on center, new 8”x16” stringers below the floor beams and new 2”x8” nail laminated deck.
- Install new 1” diameter tie rod lower chord bracing with turnbuckles.
- Apply wood preservative to bearing blocks under the truss ends and stringers and all truss members from the ends to three feet beyond the abutment faces and to a height of five feet above the floor.
- Remove and reinstall the existing siding as required to complete the work noted above. Portions of any damaged siding were specified to be replaced with new siding boards.
- Construct new concrete truss seats and backwall extensions.
- Install new anchorages set in ledge and above high water for the existing guy rods which are broken or out of condition.

The record drawings of the 1987 rehabilitation are available and noted of the following work:

- The trusses were straightened and plumbed, and attempt was made to create a positive (upward) camber.
- The floor system was replaced in its entirety with new floor system which included new 8”x14” floor beams spaced at 2’-0” on center, new 2”x6” nail laminated deck and new 4’ wide x 3” thick hardwood runner boards at each wheel line.
- The existing lower chords were replaced in their entirety with 3”x12” members bolted to lattice members.
- The majority of the lower portions of the lattice members were replaced with new 3”x11½” members spliced with through bolts to remaining portions of the existing lattice.
- Replaced all broken and deteriorated members in-kind.
- Installed new 18”x18”x4’-0” long hardwood bearing blocks at each end of the trusses.
- All structural timber except for the bearing blocks and runner planks were specified as Eastern Spruce or Southern Pine select structural or No.1 grade. It is not clear from the plans as to which grade and wood species was used.
- The bearing blocks and runner planks were specified as untreated red or white oak, or white ash or yellow birch.
- New nail laminated deck, new floor beams, new lattice and chord members were specified to be pressure treated.
- The existing roof was removed and replaced with new standing seam aluminum, baked enamel 28-gauge thickness roof.
- The existing guy rod wind anchors along the sides of the bridge were repaired.

- Removed and reinstalled the existing siding as required to complete the work noted above. Portions of any damaged siding were specified to be replaced with new siding boards.
- New concrete backwalls and wingwalls were constructed.
- Each approach to the bridge was constructed sloping away from the bridge.
- Standard steel beam guardrail with wood posts was installed at each approach to the bridge.

North Portal Signage
Looking South

The bridge is posted for no trucks, a weight limit of 3 tons and one car at a time crossing the bridge. It provides an approximate 14' width between the trusses and 12' maximum vertical clearance. The vertical clearance at the edges of the travel lane is approximately 9', however, the vertical clearance signs on each approach to the bridge indicate a height restriction of 11'-0".

East Street (Town Highway 39) is oriented in a south to north direction while Gorge Road (Town Highway 25) and Knipes Drive (Town Highway 37) are oriented west to east. Gorge Road is located to the north of the bridge and Knipes Drive is located to the south. The Kingsley Covered Bridge is located just south of the East Street/Gorge Road intersection.

South Approach Ponding

The southern approach of East Street creates a low point approximately just south of the bridge and also intersects with Knipes Drive approximately 200' south of the bridge. This approach is paved from just north of the intersection with Knipes Drive to the bridge. South of Knipes Drive, East Street is a gravel road. Stormwater generally sheet flows off the roadway. Along the western side of the roadway there is a shallow stone-lined drainage swale, which collects the roadway stormwater and conveys it beneath a field access driveway via a 15" drain pipe and towards the river. Along the eastern edge of pavement, and at the low point, stormwater is collected and ponds as there is no ditch line along this side of the road.

Galvanized w-beam guardrail begins at the bridge and continues south, flaring away from the roadway. 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 north approach to the bridge intersects with Gorge Road approximately 120' north of the bridge. The approach is paved with a slight low point at the bridge abutment. Granite curb runs along the western edge of pavement. Stormwater generally sheet flows from the roadway, toward the curb where it is collected and conveyed along the curb line toward the bridge.

Stone-Lined Drainage Swale at Intersection

Along the eastern side of the roadway there is a shallow stone swale that conveys roadway stormwater from the intersection with Gorge Road toward a catch basin and drain pipe that outlets beneath a nearby driveway and toward the river.

Galvanized w-beam guardrail runs along the pavement edges from the bridge and toward the north. There are no crash worthy end units at the guardrail terminus.

A. Need

The Kingsley Covered Bridge was last inspected by VTrans personnel in October 2020. Hoyle, Tanner personnel also inspected the bridge and performed in-depth field measurements and gather field data for this Scoping Study on June 11 and 12, 2020. The existing superstructure is in fair condition; however, several deficiencies have been noted. The following is a list of deficiencies of Bridge No. 28 and Town Highway 39 at this location:

Roof and Siding Members:

- The majority of the existing metal roof exhibits areas of rust staining, paint blistering and fading.
- The metal roof ridge cap is attached to the roof boards with nails and screws over rubber gaskets and it is not mechanically field-seamed or watertight.
- The roof boards and rafters exhibit through splits, breaks, rot and insect damage. It is estimated that 20% of the roof boards and 19% of the roof rafters will require replacement due to condition.
- The siding boards at each end of the bridge exhibit areas of rot due to poor air circulation and moisture retention from the overgrown trees and vegetation. The rest of the siding is in good condition; however, removal and replacement will likely be required due to provide access for the extensive truss member replacements.

Upper Lateral Bracing Members:

- Added knew braces have large overcuts at the upper bolted connection, which are weakening their capacity.

- Three cross beams and three upper lateral braces exhibit twisting, rot and splits. Several other cross beams are not bearing on the upper chord members and a large gap of up to 1 ½" exist at some locations.
- Seven knee braces have been previously damaged from oversized vehicles and are not well connected to the cross beams or truss members.
- Guy rods are not well anchored and most of them are connected to trees.
- The majority of the upper lateral braces are loose and do not have wedges or means of tightening them.

Truss Lattice Members:

- The majority of the lower lattice members were cut-off and spliced with remaining portions of the old lattice with fish plates and 1" diameter through bolts during the 1987 rehabilitation. Many of the tension lattice have splice gaps up to 1¼" and through bolts are deformed, indicating overstressing of such connections.
- Many lattice members are broken, rotted and exhibit through splits and insect damage. Refer to Appendix E sheets 8 and 9 for deteriorated lattice members that were identified in need of replacement due to condition.
- There is evidence of powderpost beetle activity at lattice members at the southern end of the bridge. Trees at the southern end of the bridge have overgrown and are directly over the bridge roof, promoting insect infestation of the bridge.
- The ends of the lattice members (or tails) extend 2½" to 3" beyond the upper and lower chords of the truss. Many of the tails have splits at the ends. The splits do not affect the capacity of the lattice members unless they extend along the member and through the trunnel connection at the chord.

Truss Chord Members:

- The upper chords exhibit extensive rot and insect damage. Carpenter ants were observed on the upper chord members. Refer to Appendix E sheets 8 and 9 for deteriorated chord members that were identified in need of replacement due to condition. Chord 4, Ply A near midspan is not deteriorated in these drawings, however, its replacement is required with stronger wood species and grade to meet the specified loading.
- The south end of the west (downstream) truss is out of plumb due to extensive rot of the bearing blocks over the south abutment. The upper chord was measured to be out of plane by ¾" over its height of 12".
- The butt joints on the lower chord have gaps up to ⅜" wide, indicate some crushing of the wood at the existing through bolts.
- The lower chord galvanized through bolts installed during the 1987 rehabilitation exhibit various levels of rusting and minor section losses on the steel washers.
- There is evidence of powderpost beetle activity at top chord members at the southern end of the bridge. Trees at the southern end of the bridge have overgrown and are directly over the bridge roof, promoting insect infestation of the bridge.

Floor System Members:

- The runner boards exhibit areas of moderate to heavy wear, rutting and splits. The runner boards are only located at wheel lines and pose a potential safety hazard because vertical differences between surfaces can affect vehicle stability and reduce a driver's ability to handle the vehicle.
- The runner boards also collect significant sand and debris due to uneven deck surfaces between the runners and the nail laminated deck.
- The runner boards are tapered down at each end of the bridge in order to match the concrete backwall elevation and create a "bump" for on-coming traffic.

Truss Bearing Blocks:

- The wooden bearing blocks are decaying at each end of the bridge.
- At the southwest end of the bridge the bearing blocks exhibit extensive rot which has caused the truss bearing to settle approximately 2½".
- The bearing blocks are not strategically positioned to reduce the truss clear span and do not fully support the truss lower chord over the entire concrete beam seat.

Substructure:

- Both abutments exhibit some areas of concrete spalling, delamination, efflorescence staining, vertical, horizontal and map cracking.
- 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 footing of Wingwall No. 1 (southwest) has started to undermine due to erosion from stormwater drainage at that quadrant.

General:

- There is substandard vertical clearance, and the approach signage indicates higher vertical clearance than currently exists.
- The bridge provides a 14' wide one-way alternating traffic and it does not mee the minimum standard width for a one-way bridge.
- There is limited live load carrying capacity and the bridge is posted for 3 tons weight limit.

B. Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2024 and 2044.

Traffic Data	2024	2044
AADT	720	780
DHV	110	120
ADTT	60	80
%T	8.1	10.4
%D	62	62

C. Design Criteria

The design standards for this bridge project are the Vermont State Standards, dated October 22, 1997. Minimum standards are based on an ADT of 780, a DHV of 120, and a design speed of 35 mph for a Local Road.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 6.3	9'/0' (18')	9'/2' (22')	Substandard
Bridge Lane and Shoulder Widths	VSS Table 6.3	14' between trusses/0' (14')	9'/2' (22')	Substandard
Clear Zone Distance	VSS Table 6.5	No Issues Noted	12' fill / 10' cut	
Banking	VSS Section 6.12	NC	Low speed road – no super elevation required	
Speed	VSS Section 6.2	35 mph (Signed)	35 mph (Design)	
Horizontal Alignment	AASHTO Green Book, Table 3.10b	R = ∞ over bridge	R = 314' @ e=8%	
Vertical Grade	VSS Table 6.6	-0.6% over bridge	7% (max) for level terrain	Drainage Issues at South Approach
K Values for Vertical Curves	VSS Table 6.1	No Vertical Curve over Bridge Approach K = 15 Min	40 crest / 50 sag	Substandard
Vertical Clearance	VSS Section 6.7	9' vertical clearance provided	14'-3"	Substandard
Stopping Sight Distance	VSS Table 6.1	255'	225'	
Bicycle/Pedestrian Criteria	VSS Table 6.7	No shoulders	2' Shoulder	Substandard
Hydraulics	VTrans Hydraulics Manual, Table 6.1	Passes 4% AEP (Q_{25}) storm event with 27.4' of freeboard Clear Span: 97'	Pass 4% AEP (Q_{25}) storm event with 1' of freeboard Bank Full: 95'	Surpasses Hydraulic Standards
Structural Capacity	Structures Design Manual, Ch. 3.4.1	Posted for 3 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 October 2020. The bridge is on a 24-month inspection frequency.

Deck Rating:	7 Good
Superstructure Rating:	5 Fair
Substructure Rating:	7 Good
Channel Rating:	8 Very Good

From the Structure Inspection, Inventory and Appraisal Sheet:

10/23/2018 – Bridge is in need of a major rehabilitation with significant replacement of many components along the upstream truss. The upstream truss has significant rotten areas and insect damage along the upper chords and multiple splice connections for the lattice, have weakened the truss considerably. The eighth tie beam is rotten away along its downstream end. The timber bearing blocks are rotting and need replacement. The southwest bearings are crushing and the lower chord is distorting and rolling outward as a result. See past inspection comments regarding noted deterioration. ~ MJ/MK

10/07/2016 – Bearings have not been changed and continue to rot and crush. Staging done in September found the ends of the lattice had some minor cracking at the ends. The deck has some saturation in spots but is still sound. Truss lattice splices haven't moved since they were marked number of years ago. 10/7/2016 full inspection done. Found beetles are still causing damage to the top cords and the bridge needs to be sprayed before they weaken the superstructure so reduced load or closer is necessary. ~JAS/SMP

11/06/2014 – Inspection done in month of November to adjust frequency in Town wide sequential order. Bridge has areas of damage/decay that needs attention; unfortunately, most of which is quite extensive to repair. The 8th tie beam is rotted off along the downstream side. Most of this original member can be saved and a tasteful pinned scarf joint employed along its west end. Multiple areas of rot and insect damage are present along the top portion of the upstream truss. Timber bearing blocks are also rotting and crushing. Bearings need to be replaced preferably with long bolster beams and bearing blocks before the truss settles more. The roof improvement some years ago has prevented additional rot, but damage by insects is progressing. The bridge needs to be sprayed with insecticide. Addressing the deteriorated truss problems are substantially more involved, which require jacking with supplemental support systems and extensive disassembly. ~ MJ/JS/SP

E. Hoyle, Tanner Field Observations

On June 11 and 12, 2020 a two-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, deck, and accessible areas of the abutments were inspected using extension and folding ladders. The underside of the deck, floor beams and truss members below the bridge deck were inspected using a small,

unmanned aircraft system (sUAS) (i.e. drone). The sUAS was also used to visually observe the condition of the metal roof, exterior of the siding, and areas of the abutments not accessible by ladders. Field observations were used as a basis for this report and expanded as appropriate.

Bridge Orientation Conventions

The upper most truss top chord is referred as chord 1 while the lower most top chord is referred to as chord 2. The upper most truss bottom chord is referred to as chord 3 while the lower most bottom chord is referred to as chord 4. Each truss chord consists of four plies, which are denoted as plies "A", "B", "C" and "D". Ply "A" is the most exterior ply while ply "D" is the most interior ply at any given chord member. Plies "B" and "C" are between plies "A" and "D" from the exterior to interior of the covered bridge. The node points are numbered from south to north with the southern most node point designated as 1 at the intersection of end post members to chord 1. Each consecutive node number is numbered in ascending order at each intersection of lattice members to chord 1.

Typical Broken Roof Rafter

1. *Roof Framing and Siding*

The roof framing consists of a standing seam metal roof on 1" thick roof boards with variable width (5" to 16") which are supported by roof rafters. The principal roof rafters at cross beam locations are 4" wide x 5" deep while the rest of the roof rafters are 3" wide x 5" deep are spaced at 4'-0" on center, and toe nailed at plies A and B of chord 1 members. The siding is ¾" thick and is nailed to nailers attached to truss members.

Nailed Ridge Cap
Metal Roof Paint Failure – Left Side

The siding boards were identified as Eastern White Pine. The roof board wood species were identified to be Eastern Hemlock and assigned a grade of No.1. The roof rafters were identified to be Eastern Spruce and assigned a grade of Select Structural. The grades were selected 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 roof framing is generally considered to be in fair to satisfactory condition with the following deficiencies noted:

- The majority of the existing metal roof exhibits areas of rust staining, paint blistering and fading.
- The metal roof ridge cap is attached to the roof boards with nails and screws over rubber gaskets and it is not mechanically field-seamed or watertight.
- The roof boards and rafters exhibit through splits, breaks, rot and insect damage. It is estimated that 20% of the roof boards and 19% of the roof rafters will require replacement due to condition.
- The siding boards at each end of the bridge exhibit areas of rot due to poor air circulation and moisture retention from the overgrown trees and vegetation. The rest of the siding is in good condition; however, removal and replacement will likely be required due to provide access for the extensive truss member replacements.

Typical Broken Roof Rafter

2. *Upper Lateral Bracing*

The upper bracing consists of 8”x9” cross beams spaced at 12’-0” on center, 4”x5” diagonal “X” bracing between cross beams, and 4”x4” original knee braces. Additional 4”x5” knee braces extend from the top of cross beams. The guy rod anchors consist of ¾” to 1” diameter steel rods connected at each end of the bridge.

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.

Heavy Rot at Cross Beam
Node 10/11 West End

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

- Three cross beams and three upper lateral braces exhibit twisting, rot and splits. Several other cross beams are not bearing on chord 1 members and a large gap of up to 1 ½” exist at some locations.
- Added knew braces have large overcuts at the upper bolted connection, which are weakening their capacity.
- Seven knee braces have been previously damaged from oversized vehicles and are not well connected to the cross beams or truss members.

- Guy rods are not well anchored and most of them are connected to trees.
- The majority of the upper lateral braces are loose and do not have wedges or means of tightening them.

Typical Guy Rod Tied to a Tree

3. *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 adopted for vehicular bridges. The Kingsley Covered Bridge has two each (four-piece) top and lower chords.

The trusses are 120'-0" long and support a roof length of 121'-0". The clear span from face of south abutment to face of north abutment is approximately 97' long. Truss chord members consist of 4 plies, varying in size from 2¾"x11¼" to 3"x12", built-up double upper and lower chords. Truss lattice members consist of varying 2¾"x11" to 3"x11" timber planks.

West Truss
Looking West

The truss chord members' wood species were identified to be Eastern Spruce. Members that have been replaced were identified to be Eastern Hemlock. The truss lattice members' wood species were identified to be Eastern Spruce. 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 Lattice Members:

Typical Gap at Spliced Lattice Members

Split Lattice Member

- The majority of the lower lattice members were cut-off and spliced with remaining portions of the old lattice with fish plates and 1" diameter through bolts during the 1987 rehabilitation. Many of the tension lattice have splice gaps up to 1¼" and through bolts are deformed, indicating overstressing of such connections.
- Many lattice members are broken, rotted and exhibit through splits and insect damage. Refer to Appendix E sheets 8 and 9 for deteriorated lattice members that were identified in need of replacement due to condition.

Out of Plumb Chord 1
South End of West Truss

- There is evidence of powderpost beetle activity at lattice members at the southern end of the bridge. Trees at the southern end of the bridge have overgrown and are directly over the bridge roof, promoting insect infestation of the bridge.
- The ends of the lattice members (or tails) extend 2½" to 3" beyond the upper and lower chords of the truss. Many of the tails have splits at the ends. The splits do not affect the capacity of the lattice members unless they extend along the member and through the trunnel connection at the chord.

Truss Chord Members:

- The upper chords exhibit extensive rot and insect damage. Carpenter ants were observed on the upper chord members. Refer to Appendix E sheets 8 and 9 for deteriorated chord members that were identified in need of replacement due to condition. Chord 4, Ply A near midspan is not deteriorated in these drawings,

however, its replacement is required with stronger wood species and grade to meet the specified loading.

- The south end of the west (downstream) truss is out of plumb due to extensive rot of the bearing blocks over the south abutment. The upper chord was measured to be out of plane by ¾" over its height of 12".
- The butt joints on the lower chord have gaps up to ⅜" wide, indicate some crushing of the wood at the existing through bolts.
- The lower chord galvanized through bolts installed during the 1987 rehabilitation exhibit various levels of rusting and minor section losses on the steel washers.
- There is evidence of powderpost beetle activity at top chord members at the southern end of the bridge. Trees at the southern end of the bridge have overgrown and are directly over the bridge roof, promoting insect infestation of the bridge.

Typical Rot at Top Chord

4. *Floor System*

The floor framing consists of transverse 8"x14" floor beams spaced at 2'-0" on center, 2"x6" nail laminated deck boards placed edgewise, and 3" thick by 4'-0" wide runner planks at the wheel lines. There is no lower lateral bracing on this covered bridge.

Tapper Runner Boards at Abutments

The floor beam and nail laminated deck board wood species were identified to be Southern Pine. The runner planks are hardwood as described in the 1987 plans. All floor framing 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 floor system members are generally considered to be in good condition with the following deficiencies noted:

- The runner boards exhibit areas of moderate to heavy wear, rutting and splits. The runner boards are only located at wheel lines and pose a potential safety hazard

because vertical differences between surfaces can affect vehicle stability and reduce a driver's ability to handle the vehicle.

- The runner boards also collect significant sand and debris due to uneven deck surfaces between the runners and the nail laminated deck.
- The runner boards are tapered down at each end of the bridge in order to match the concrete backwall elevation and create a "bump" for on-coming traffic.

F. Truss Bearing Blocks

The truss bearing blocks consist of 18"x18"x4'-0" long hardwood blocks at each end of the bridge as described in 1987 plans and as measured in the field.

The truss bearing blocks are considered to be in poor to serious condition with the following deficiencies noted:

- The wooden bearing blocks are decaying at each end of the bridge.
- At the southwest end of the bridge the bearing blocks exhibit extensive rot which has caused the truss bearing to settle approximately 2½".
- The bearing blocks are not strategically positioned to reduce the truss clear span and do not fully support the truss lower chord over the entire concrete beam seat.

Bearing Block Rot
South End West Truss

Floor Beam to Chord 4 2½" Gap Due to Bearing Block Extensive Rot – South End West Truss

G. Substructure

The bridge substructure consists of two concrete abutments. It is not clear if original abutments were constructed with stone masonry and encased with concrete during previous undocumented rehabilitations. Both bridge abutments have areas of exposed ledge in front of 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 good condition with the following deficiencies noted:

- Both abutments exhibit some areas of concrete spalling, delamination, efflorescence staining, vertical, horizontal and map cracking.
- 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 footing of Wingwall No. 1 (southwest) has started to undermine due to erosion from stormwater drainage at that quadrant.

Abutment No.2 (North) Footing Spalling and Efflorescence Staining

Wingwall No.1 (Southwest) Undermining

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

The bridge crosses over the Mill River which flows primarily east to west at the bridge site. A hydraulic study at this location was completed on July 13, 2020 by the VTrans Structures and Hydraulics Section. The preliminary findings indicate that under the current conditions, there is 27.4' and 25.7' 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.

The preliminary hydraulic memo states that a preliminary scour analysis and countermeasure design was not performed due to the visible bedrock in the main channel, and the abutments bearing on bedrock.

J. Utilities

The VTrans Utilities and Permits unit investigated the existing utility within the project limits. The existing utilities identified are as follows:

Aerial Utilities – (Green Mountain Power (single phase), Consolidated Communications, and Comcast)

- Communications – There is a main utility line that crosses over the river to the east of the bridge. The line contains single phase power as well as 3 communication lines.
- There is also a utility service crossing over East St to the north of the bridge.

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

K. Right-of-Way

The existing Right-Of-Way (ROW) is shown on the Layout sheet in Appendix E. The existing 15" drain pipe at the north approach and stone swale are located just outside the existing ROW. As such, it is anticipated that additional ROW will be required for the construction of the project.

L. Resources

The resources present at this project are shown on the Resource Site Plan Sheet and are based on information provided by VTrans, and are as follows:

1. *Biological*

Wetlands/Watercourses
Kinglsey Covered Bridge crosses over the Mill River, a watercourse regulated by the US Army Corps of Engineers.

There are no wetlands within the review area.

Wildlife Habitat
This area has limited adjacent wildlife habitat. There is a likelihood that terrestrial wildlife uses the riparian area of the river. Vegetation should be maintained or re-established to the best extent practicable if impacts occur.

Rare, Threatened and Endangered Species
The only listed species within the review area is the federally threatened northern long-eared bat. The bridge has a large amount of potential habitat features under the roof of the bridge. An acoustic survey or time of year restrictions will likely be required for work on the bridge.

Agricultural
The northern half of the review area is mapped as statewide significant agricultural soils.

2. *Historic*

Two Historic resources were identified within the immediate project area. These historic resources are considered Section 4(f) properties and are as follows:

- Bridge No. 28 (Kingsley Covered Bridge) which is individually listed in the National Register of Historic Places (NRHP) and as a contributing resource to the NRHP-listed Kingsley Grist Mill Historic District.
- Kingsley Grist Mill/Kingsley Grist Mill Historic District which is also listed in the NRHP.

From the Historic Resource memo:

> *Being listed on the National Register carries with it limitations regarding what actions are possible when considering rehabilitating Bridge No. 28. There are certain preferred means and methods to rehabilitating historic covered bridges that aim to retain the highest degree of historic integrity possible, described generally in the "Secretary of Interior's Standards for Historic Preservation," as well as more specifically in FHWA's "Covered Bridge Manual" and VTrans' Priority of Treatments for covered bridges.*

The Kingsley Covered Bridge was listed on the National Register of Historic Places on February 12, 1974 (National Register of Historic Place Inventory Nomination Form 1974). The project was initially presented at the Historic Covered Bridge Preservation Committee (HCBPC) meeting on October 14, 2020. 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 Alternative No.2 – Rehabilitation for H12 (12-ton) live loading.

The Kingsley Grist Mill Historic District is located in close proximity to the project area. It was listed on the National Register of Historic Places on November 8, 2007.

3. *Archaeological*

There are no archaeologically sensitive areas within the project limits.

4. *Hazardous Materials*

According to the Vermont Agency of Natural Resources (VANR) Vermont Hazardous Sites List, there are there are several hazardous waste sites and hazardous waste generators related to the Rutland Southern Vermont Regional Airport. See the figure to the right for a map of Hazardous Sites.

5. *Stormwater*

There are no stormwater concerns at this site.

II. SAFETY

There have been 2 reported crashes along East Road in Clarendon within the last 5-year period. None of these crashes are located within anticipated project limits.

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

III. COMMUNITY NEEDS AND CONSIDERATIONS

A community questionnaire was sent to the Town and Regional Planning Commission to fill out. VTrans is awaiting responses to the questionnaire.

Public involvement for this project included a Local Concerns Meeting held virtually and as summarized below.

A. <u>Local Concerns Meeting</u>

A Local Concerns Meeting was held on August 10, 2020 virtually through Zoom. Attendees included the Clarendon Selectboard, VTrans and Hoyle, Tanner personnel and members of the public. The following was discussed:

- *Load Rating:* Currently the bridge is posted for 3 Tons. Hoyle, Tanner, & Associates, Inc. will be evaluating alternatives for the 3T, 12T, 15T, and 20T options. Many residents spoke in favor of designing for a higher load but keeping the bridge posted at 3T. This reserve capacity will help the bridge from sustaining damage due to overweight loads. It seemed like many residents were in favor of having the bridge able to carry an ambulance (approximately 6 Tons).

- *Enforcement:* A resident made a comment that flatbeds and other overweight vehicles are using the bridge. The town is responsible for enforcing load restrictions on any town structure currently posted.

- *Ramps/Runners:* There was some discussion about the runners and ramps along the deck the bridge. A resident was concerned that removing the ramps/runners may encourage speeding through the project area. Another resident felt that the runners should be removed as cars pull over off the runners when moving out of the way for pedestrians on the bridge. This causes damage to the bridge when they cannot get back on the runners. There was also concern expressed about damage to the bridge when cars hit the ramps too hard which causes the bridge to bounce.

- *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 East Street, to Gorge Road, VT Route 7B, and Bump Road, back to East Street which has an end-to-end distance of 3.8 miles. Several concerns were bought up at the meeting about the detour route. Participants expressed concern that Bump Road is not well maintained. Additionally, it was suggested that US Route 7 would more likely be used versus Route 7B, in which case there would be a dangerous crossing across US Route 7. This 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.

- *Ownership:* There was a question about the ownership of the bridge. The bridge is owned and maintained by the Town of Clarendon. The bridge has been programmed as part of the Town Highway Bridge Program, which provides federal and state funds along with Town funds for the rehabilitation and replacements of Town Highway Bridges greater than 20-feet in length. The program is an extremely competitive program with many needs across State, and only a handful of Town Highway structures are selected each year for the program. The typical funding split for projects in the program is 80% federal, 10% state, 10% local funds, with the opportunity for reduced local share as described in the next bullet.

- *Town Share/Act 153:* Per Act 153 from the 2012 legislative session, by closing the road to traffic during construction, the local share would be reduced by 50%. Additionally, by rehabilitating the existing bridge, the local share would be reduced an additional 50%. Prior to 2012, the local share was 10% for all Town Highway Bridge projects. The intent of Act 153 is to reduce environmental and Right-of-Way impacts and reduce overall project costs. As mentioned, the Town share for bridges in the historic program may be reduced to 0% per Act 153. There are stipulations regarding future maintenance attached to this further reduction in share. The share for the Town will be laid out for each alternative in the scoping report and can further be discussed at the Alternatives Presentation Meeting.

- *Off-Alignment Option:* A resident expressed interest in an Off-alignment option with a new conventional steel beam bridge constructed adjacent to the existing covered bridge. The construction of a new bridge would likely not be funded as part of this project. Additionally, depending on placement, this may hinder efforts to obtain the necessary 106 and 4(f) permits. An off-alignment option would require additional Right-of-Way easements, and potentially have negative impacts to archaeological and historic resources. At this time, VTrans does not recommend an off-alignment structure.

B. Alternatives Presentation Meeting

An Alternatives Presentation Meeting will be held in the near future.

IV. 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 contractors to complete projects sooner. The Agency will consider the closure option on most projects where rapid reconstruction or rehabilitation is feasible. The use of prefabricated elements in new bridges will also expedite construction schedules. This can apply to decks, superstructures and substructures. Accelerated Construction provides enhanced safety for the workers and the traveling public while maintaining project quality.

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 3 Town Highway, it would be the responsibility of the Town of Clarendon 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 Clarendon to coordinate with that town.

The most likely detour route that the Town of Clarendon may want to choose has an end-to-end distance of 3.9 miles and adds 2.2 miles to the through route. This route is as follows:

1. East Street, to Gorge Road, VT Route 7, and Bump Road, back to East Street (3.9 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; however, the detour route is short.

B. Temporary Bridge

From a constructability standpoint, a temporary bridge could be placed on either the upstream or downstream side of Kingsley Covered Bridge. A temporary bridge on the east side would have greater impacts to aerial utilities and would require the relocation of aerial utilities. Both an upstream and downstream temporary bridge would require significant 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 a second construction season in order to construct the temporary bridge and approaches. There would be decreased safety for workers and vehicular traffic because of cars driving near the construction site and construction vehicles entering and exiting the construction site.

C. Phased Construction

Another method of typically maintaining traffic along a corridor during construction is to build a new structure one lane at a time, or in phases. The existing bridge is a one-lane structure with a 14-foot 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.

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 have to 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. Due to type of construction associated with this covered bridge phasing is not feasible or constructible.

V. ALTERNATIVES DISCUSSION

A. Structural Analysis

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, and the 2010 VTrans Structures Design Manual. Per the scope of services, the bridge was rated for four AASHTO live loads; H20 (20 tons), H15 (15 tons), H12 (12 tons), H3 (3 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, MathCAD computer program, and hand calculations were utilized to calculate the as-inspected section properties, capacities, and load rating values. STAAD.Pro computer program was used to perform the structural analysis of the Town Lattice and to determine the truss and member forces.

For the truss and floor system (floor beams and decking) the inventory rating was determined by combining the maximum effects of live load with the dead load effects 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.

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 that the structural and historical issues could be weighed in order 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 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 of rafters, wide face of chord plies A to B, C to B, 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 (9.0 pounds per square foot (psf) upward on the windward roof and and 17.7 psf uplift on the leeward roof) and a ground snow load of 50 psf (27.0 psf roof applied) per the 2015 Vermont Fire and Building Safety Code snow load

and the 2010 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 (85% utilized for the roof boards and 70% utilized for the roof rafters).

Recommendations

The existing standing-seam metal roof is in fair condition and exhibits areas of rust staining, paint blistering and fading throughout. Additionally, the ridge cap is attached with nails and screws which allow water to seep into the bridge overtime. During rehabilitation, the existing metal roof would most likely be damaged by the removal of certain truss and roof members and we recommend that it be replaced with a new standing-seam metal roof. A replacement of 12 roof rafters and 20% of the existing roof boards is included for this study based upon our field inspections. (Priority Treatment No.2 for the roof boards and the roof rafters). A total of five roof rafters are also in need of repair with wood epoxy (Priority Treatment No.1).

Upper Lateral Bracing

Analysis

The existing upper lateral bracing, which consists of "X" braces, cross beams, added A-frame knee braces and original knee braces (between chord 2 and the cross beam), was analyzed for wind loading in conformance with ASCE 7-10. There are also guy rod anchors tied to trees that brace each end of the bridge. 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 "X" bracing. Our analysis showed without the guy rod anchors the bracing system is not adequate to keep the bridge square and plumb and to resist code required wind loads.

Recommendations

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

- Install new 5"x5" upper lateral bracing below the cross beams to brace chord 1 at the mid-point between each cross beam (Priority Treatment No. 3). The new braces will not require modifications to existing truss members or cross beams, other than attachment to these members. These modifications do not alter the historic character of the bridge and are reversible. During the design phase of the project we will perform more detailed analysis to determine if the above change will be sufficient to warrant removal of the guy rod bracing system, otherwise the guy rod system would be to be better connected to the truss members and anchored in the ground.
- Strengthen cross beam to chord 1 connection (Priority Treatment No.3).
- Replace three "X" braces in-kind (Priority Treatment No.2).
- Replace five 4" x 5" knee braces and two 4"x4" knee braces in-kind (Priority Treatment No.2).
- Replace three cross beams in-kind (Priority Treatment No.2).

- Epoxy repair several deteriorated upper lateral bracing members (Priority Treatment No.1).

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 live load capacity. A 2-Dimensional bridge computer model of the Town Lattice Trusses was utilized for the structural analysis.

To determine the current live load capacity of all truss members, full dead and live loads were applied and compared to allowable inventory stress levels, while full dead, live, *and* snow loads were applied and compared to the higher operating stress levels. Inventory stress levels are used for loadings the bridge is expected to normally see, while the higher operating stress levels are used for less frequent or less likely to occur loadings such as a full live load at the same time as a full snow load. See Table 1 below for a summary of all members rated.

Table 1 – Town Lattice Truss Members Rating Summary

Member	Size	Inventory Load Rating	Operating Load Rating
Chord 1	4- 3”x12”	H11.8	H14.8
Chord 2	4- 3”x12”	H28.4	H37.1
Chord 3	4- 3”x12”	H8.2	H9.8
Chord 4	4- 3”x12”	H1.9	H2.1
Tension Lattice Members[1]	3”x11”	H3.8	H5.8
Compression Lattice Members over Abutments	3”x11”	H12.2	H15.2
Compression Lattice Members Away From Abutments	3”x11”	H17.4	H21.7

1. The controlling tension lattice rating is located at the splice location.

Recommendations

The removal and replacement of the truss members due to condition is recommended for Alternatives 1, 2, 3, and 4, see Appendix E for members that are required to be replaced for each alternative. Epoxy injection into the large splits of a few members and rotted areas is also recommended for all alternatives to lessen further splitting and deteriorating to these members (Priority Treatment No.1).

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 (Priority Treatment No.1). This repair was recently completed for the Longley Covered Bridge in Montgomery, VT.

The addition of a sleeper beam at all four truss bearings is recommended for all alternatives. Sleeper beams help reduce the effective span length of the Town Lattice Truss thereby reducing member forces and providing a more durable structure. In order to maximize the effectiveness of the sleeper beam, a flitch beam comprised of a steel plate bolted between two timber beams is recommended.

Alternative specific recommendations for member replacements or strengthening is detailed below. All replacement wood is to be Douglas Fir Select Structural grade unless noted otherwise.

Floor System

Analysis

The existing floor beams and decking were analyzed to determine their live load capacity. The load rating summary for the deck is shown in Table 2. 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. Conservatively, the lowest rating (in "H tons") is reported below. The load rating summary (in "H tons") for the floor beams is shown in Table 3. The rear axle of the design truck controlled the load rating of all floor system mebers. All floor framing 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.

Table 2 – Existing Deck Load Rating Summary

Live Load Alternative	Inventory Rating Factor[1]	Operating Rating Factor[1]
Alternative 1 - H3	5.8	7.7
Alternative 2 - H12	2.9	3.9
Alternative 3 - H15	2.7	3.6
Alternative 4 - H20	2.5	3.3

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

Table 3 – Existing Floor Beam Load Rating Summary

Member	Size and Spacing	Inventory Load Rating	Operating Load Rating
Floor Beams	8" x 14", 2'-0" on center	H15.1	H20.5

The existing deck was analyzed for this study for wind loading in conformance with ASCE 7-10. It was found that the existing deck acts as a diaphragm and has ample strength to meet the code lateral wind loading.

Recommendations

There are no floor beams identified to be replaced due to condition. The existing floor beams are adequate for Alternatives 1, 2, and 3 (H3, H12, H15). All floor beams would need to be replaced for

Alternative No. 4. The existing nail laminated deck is adequate for all alternatives, however, for Alternative 4 (H20), the deck will need to be removed to facilitate floor beam replacement. This work will likely damage the deck as removal of a nail laminated deck is difficult. For all alternatives, we recommend that the existing runner boards are 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.

The existing nail laminated deck has been in service for 34 years; however, it is in good condition as the runner boards have protected it from wear and tear. For the last 34 years the runner boards have served as sacrificial wearing surface. It is likely that some deficiencies may be encountered on the nail laminated deck when the runner boards are removed for replacement. If any deficiencies are discovered when the top surface of the nail laminated deck is exposed and debris removed, decisions would need to me made in the field as to whether repair with wood epoxy would be sufficient or partial replacement be warranted.

In addition, we recommend 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 we have designed the 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.

Overall, the existing abutments appear sound and globally stable with no apparent sign of movement, settlement, or tipping. Some isolated 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 bridge substructure:

- Conduct minor partial depth concrete repairs to all existing substructure elements (Substructure Priority Treatment No.1).
- Route and seal the concrete cracks greater than ⅛” in width (Substructure Priority Treatment No.1).
- Stain and seal all of exposed concrete surfaces with a water-based sealant in order to provide long-term protection of the concrete (Substructure Priority Treatment No.1).
- Remove all vegetation and small trees at both abutments (Substructure Priority Treatment No.1).
- Reconstruct the tops of the backwalls such that they are flush with the top of the proposed runner boards.

C. No Action

This alternative would involve leaving the bridge in its current condition. A good rule of thumb for the "No Action" alternative is whether the bridge can stay in place without any work being performed on the bridge in the next 10 years. The existing bridge superstructure is considered to be in fair condition with many areas of the truss, bearing blocks and upper lateral bracing in serious to poor condition. In the interest of safety to the traveling public, the No Action alternative is not recommended. A cost estimate has not been provided for this alternative since there are no immediate costs.

D. Alternative 1: Rehabilitation for H3 (3-ton) Loading

This alternative consists of work necessary to extend the useful life of the bridge and to carry a 3-ton design vehicle. All truss elements except for chord 4 are adequate to support an H3 live load. Select ply of chord 4 is recommended to be replaced with 3"x12" members (Priority Treatment No. 2). Refer to sheets 8 and 9 shown in Appendix E for truss members that are required to be replaced for this alternative.

E. Alternative 2: Rehabilitation for H12 (12-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 12-ton design vehicle. Refer to sheets 10 and 11 shown in Appendix E for truss members that are required to be replaced for this alternative. This work includes:

- Replacement of tension lattice members with in-kind dimensions. (Priority Treatment No. 2)
- Replacement of first tension lattice members off the abutment with larger 4½"x11" members to increase capacity (Priority Treatment No. 5).
- Strengthening of existing lattice connections by adding additional bolts (Priority Treatment No. 1).
- Replacement of select chord 3 and 4 plies with in-kind dimensions (Priority Treatment No. 2).

F. Alternative 3: 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 sheets 12 and 13 shown in Appendix E for truss members that are required to be replaced for this alternative. This work includes:

- Installation of additional upper lateral bracing to reduce the unbraced length of Chord 1 (Priority Treatment No. 3).
- Replacement of additional tension lattice members beyond what is required for H12 with in-kind dimensions (Priority Treatment No. 2).
- Replacement of first tension lattice members off the abutment with larger 4½"x11" members to increase capacity (Priority Treatment No. 5).
- Replacement of compression lattice members with in-kind dimensions (Priority Treatment No. 2).
- Replacement of additional chord 3 plies beyond what is required for H12 with in-kind

dimensions (Priority Treatment No. 2).
- Replacement of select chord 4 plies with 3”x15” members (Priority Treatment No. 5).

G. Alternative 4: 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 sheets 14 and 15 shown in Appendix E for truss members that are required to be replaced for this alternative. This work includes:

- Installation of additional upper lateral bracing to reduce the unbraced length of Chord 1 (Priority Treatment No. 3).
- Replacement of additional tension lattice members beyond what is required for H15 with in-kind dimensions (Priority Treatment No. 2).
- Replacement 14 tension lattice members with larger 4½”x11” members to increase capacity (Priority Treatment No. 5).
- Replacement of compression lattice members with in-kind dimensions (Priority Treatment No. 2).
- Replacement of additional chord 3 plies beyond what is required for H15 with in-kind dimensions (Priority Treatment No. 2).
- Replacement of the entire chord 4 plies with 3”x15” members (Priority Treatment No. 5).

H. Proposed Roadway Improvements

Along the southern approach, the roadway will transition from a gravel surface to a paved roadway approximately 140 feet south of the bridge and just north of the intersection with Knipes Drive mimicking existing conditions. The roadway width will also mimic existing widths south of Knipes Drive and transition to a 24’ paved roadway just north of the intersection. The 24’ width will continue for approximately 50’ before it transitions to 12’ 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 allow for placement of 3” of subbase of crushed gravel, coarse graded and 5” of pavement. For the gravel section the 5” of proposed pavement in the typical section will be replaced with 4” of aggregate surface course.

The northern approach roadway width will mimic existing conditions, measuring 12’ at the bridge and gradually widening to match the existing intersection radii and width at Gorge Road. The proposed roadway typical section between the bridge and Gorge Road will match the proposed paved typical section south of the bridge.

North of the bridge the granite curbing on the west side of the roadway will be removed and reset at the new edge of pavement. Stormwater flow patterns will mimic existing conditions. Along the eastern side of the roadway, the existing stone-lined drainage swale will be reconstructed to provide increased capacity for stormwater flows from Gorge Road and East Street. The reconstructed swale will convey the stormwater to the existing catch basin and outlet pipe. New steel backed timber guardrail is proposed and will closely match existing guardrail lengths. A yield sign is proposed for southbound traffic approaching the one-lane bridge.

South of the bridge, existing stormwater flow patterns will be mimicked with the exception of the introduction of a new swale along the eastern side of the roadway from the low point toward the river to reduce the ponding that currently occurs there. The stone-lined drainage swale and drive pipe on the western side of the roadway will be reconstructed to provide more capacity in the swale to more efficiently convey the stormwater to the river. The drive pipe will be lowered and the swale between the drive pipe and river will be stone-lined to reduce erosion potential.

Like the north approach, new steel backed timber guardrail is proposed to replace the w-beam guardrail matching existing lengths. A stop condition is proposed for the northbound traffic and will include a stop bar on the paved roadway, and a stop sign on the gravel shoulder.

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

South Approach to the Bridge

Existing W-Beam Guardrail and Drain Pipe

I. Fire Protection

As part of this Scoping Report, the bridge was assessed for improvements against the potential for arson. There are no known fire detection or protection systems at the covered bridge site. Based on our conversations with local abutters there have been previous arson attempts. 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. We also recommend 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.

Protectowire Cabinet
(Slate Covered Bridge)

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 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.

Typical Sprinkler Head
(Slate Covered Bridge)

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

Proposed Light Fixture
(Slate Covered Bridge)

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, however, it is strongly recommended due to the length of the bridge. 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.

VI. COST MATRIX[1]

Clarendon BO 1443(55)		Do Nothing	Alternative 1 Rehabilitation for H3 (3-ton) Loading	Alternative 2 Rehabilitation for H12 (12-ton) Loading	Alternative 3 Rehabilitation for H15 (15-ton) Loading	Alternative 4 Rehabilitation for H20 (20-ton) Loading
COST	Roadway	$0	259,539	269,539	278,539	303,539
	Erosion Control	$0	24,711	25,901	26,461	27,301
	Bridge	$0	1,024,223	1,116,273	1,171,223	1,436,473
	Full CE Items	$0	22,200	28,600	35,000	47,800
	Construction Costs	$0	1,330,673	1,440,313	1,511,223	1,815,113
	Construction Engineering & Contingencies	$0	399,202	432,094	453,367	544,534
	Accelerated Premium	$0	0	0	0	0
	Total Construction Costs w CEC	$0	1,729,875	1,872,407	1,964,590	2,359,647
	Preliminary Engineering	$0	332,668	360,078	377,806	453,778
	Right of Way	$0	5,000	5,000	5,000	5,000
	Total Project Costs	$0	2,067,543	2,237,485	2,347,396	2,818,425
	Annualized Costs	$0	51,689	55,937	58,685	70,461
TOWN SHARE		$0	51,689	55,937	58,685	70,461
TOWN %		0%	2.5%	2.5%	2.5%	2.5%
SCHEDULING	Project Development Duration	N/A	2 years	2 years	2 years	2 years
	Construction Duration	N/A	6 months	8 months	10 months	14 months
	Closure Duration (If Applicable)	N/A	6 months	8 months	10 months	14 months
ENGINEERING	Typical Section - Roadway (feet)	20'	18'	18'	18'	18'
	Typical Section - Bridge (feet)	14’	11’-6”	11’-6”	11’-6”	11’-6”
	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 based on the existing substructure rating of “Good” condition.

VII. CONCLUSION

This section will be written after the alternatives are presented to the Town.

APPENDIX A

VTrans Bridge Inspection Report

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

Vermont Agency of Transportation ~ Structures Section ~ Bridge Management and Inspection Unit

Inspection Report for : CLARENDON **Bridge No.:** 00028 **District:** 3
Located on: C3039 **over** MILL RIVER **approximately** 0.05 MI TO JCT W C3 TH25 **Owner:** TOWN-OWNED

CONDITION

Deck Rating: 7 GOOD
Superstructure Rating: 5 FAIR
Substructure Rating: 7 GOOD
Channel Rating: 8 VERY GOOD
Culvert Rating: N NOT APPLICABLE
Federal Str. Number: 101105002811051
Federal Sufficiency Rating: 20.1
Deficiency Status of Structure: SD

AGE and SERVICE

Year Built: 1836 **Year Reconstructed:** 1987
Service On: 1 HIGHWAY
Service Under: 5 WATERWAY
Lanes On the Structure: 01
Lanes Under the Structure: 00
Bypass, Detour Length (miles): 04
ADT: 000500 **% Truck ADT:** 02
Year of ADT: 2019

GEOMETRIC DATA

Length of Maximum Span (ft): 0111
Structure Length (ft): 000119
Lt Curb/Sidewalk Width (ft): 0
Rt Curb/Sidewalk Width (ft): 0
Bridge Rdwy Width Curb-to-Curb (ft): 13.3
Deck Width Out-to-Out (ft): 13
Appr. Roadway Width (ft): 018
Skew: 00
Bridge Median: 0 NO MEDIAN
Min Vertical Clr Over (ft): 09 FT 02 IN
Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD
Min Vertical Underclr (ft): 00 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: TOWN LATTICE COV BR
Number of Approach Spans: 0000 **Number of Main Spans:** 001
Kind of Material and/or Design: 7 TIMBER
Deck Structure Type: 8 TIMBER
Type of Wearing Surface: 7 WOOD OR TIMBER
Type of Membrane: 0 NONE
Deck Protection: 7 CCA.CREOSOTED WOOD

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 0 DOES NOT MEET CURRENT STANDARD
Transitions: 0 DOES NOT MEET CURRENT STANDARD
Approach Guardrail: 1 MEETS CURRENT STANDARD
Approach Guardrail Ends: 1 MEETS CURRENT STANDARD
Structural Evaluation: 2 INTOLERABLE REPLACEMENT NEEDED
Deck Geometry: 2 INTOLERABLE REPLACEMENT NEEDED
Underclearances Vertical and Horizontal: N NOT APPLICABLE

Waterway Adequacy: 8 SLIGHT CHANCE OF OVERTOPPING ROADWAY

Approach Roadway Alignment: 4 MEETS MINIMUM TOLERABLE CRITERIA

Scour Critical Bridges: 8 STABLE FOR SCOUR

DESIGN VEHICLE, RATING and POSTING

Load Rating Method (Inv): 0 NO RATING ANALYSIS PERFORMED
Posting Status: P POSTED FOR LOAD
Bridge Posting: 5 NO POSTING REQUIRED
Load Posting: 02 BRIDGE IS LEGALLY LOAD POSTED AT BOTH ENDS
Posted Vehicle: 6 GROSS LOAD ONLY
Posted Weight (tons): 03
Design Load: 2 H 15

INSPECTION

Insp. Date: 102020 **Insp. Freq. (months):** 24 **X-Ref. Route:** **X-Ref. BrNum:**

INSPECTION SUMMARY and NEEDS

Click to view the Glossary

10/23/2018 - Bridge is in need of a major rehabilitation with significant replacement of many components along the upstream truss. The upstream truss has significant rotten areas and insect damage along the upper chords and multiple splice connections for the lattice, have weakened the truss considerably. The eighth tie beam is rotten away along its downstream end. The timber bearing blocks are rotting and need replacement. The southwest bearings are crushing and the lower chord is distorting and rolling outward as a result. See past inspection comments regarding noted deterioration. ~ MJ/MK

10/07/2016- Bearings have not been changed and continue to rot and crush. Staging done in September found the ends of the lattice had some minor cracking at the ends. the deck has some saturation in spots but is still sound. Truss lattice splices haven't moved since they were marked number of years ago. 10/7/2016 full inspection done. found beetles are still causing damage to the top cords and the bridge needs to be sprayed before they weaken the superstructure so reduced load or closer is necessary JAS/SMP

11/06/2014 - Inspection done in month of November to adjust frequency in Town wide sequential order. Bridge has areas of damage/decay that needs attention; unfortunately most of which is quite extensive to repair. The 8th tie beam is rotted off along the downstream side. Most of this original member can be saved and a tasteful pinned scarf joint employed along its west end. Multiple areas of rot and insect damage are present along the top portion of the upstream truss. Timber bearing blocks are also rotting and crushing. Bearings need to be replaced preferably with long bolster beams and bearing blocks before the truss settles more. The roof improvement some years ago has prevented additional rot, but damage by insects is progressing. The bridge needs to be sprayed with insecticide. Addressing the deteriorated truss problems are substantially more involved, which require jacking with supplemental support systems and extensive disassembly. ~ MJ/JS/SP

10/31/2012 - The downstream end of tie beam #8, counting from north to south, is rotten off and needs repair. Most of the beam could be salvaged utilizing a traditional scarf joint repair. Corresponding principle rafter foot is rotten as are a few others along areas of prior leakage thru the roof which has since been arrested with the standing seam addition. Rafter #3 from the northwest corner is also fractured and needs replacement or sistering. The upper chords have random spots of heavy decay and at some point will need repair, though at present the 3 Ton posting is adequate coupled with the supplemental upper chord presence, both compensating for the structural (chord) damage. Bearing blocks are also developing some rot where they contact the concrete bridge seats and from back splash. In the future when the blocks are replaced, preferably larger and longer bolsters could be added; as well as sistering of the lattice members at each truss corner to strengthen against shear. ~ MJ/DK

10/06/10 Staging done and some minor decay was found in 2nd set of chords from the bottom & floorbeams were found in relatively good shape with typical check cracks. ~ MJK/FRE

APPENDIX B

Preliminary Hydraulic Report

State of Vermont
Structures and Hydraulics Section
One National Life Drive
Montpelier, Vermont 05633-5001
vtrans.vermont.gov

Agency of Transportation

[phone] 802-371-7326
[fax] 802-828-3566
[ttd] 800-253-0191

TO: Laura Stone, Structures, Scoping Engineer

CC: Nick Wark, Hydraulics Engineer

FROM: Jeff DeGraff, Hydraulics Project Engineer

DATE: July 13, 2020

SUBJECT: Clarendon BO 1443(55) pin #19j228
Clarendon, TH-39 Br28, over Mill River
Site location: 1.5 miles east of VT-7B
Coordinates: 43.523791, -72.941039

We have completed our hydraulic study for the above referenced site, and offer the following for your use:

A site visit to measure bankfull width was not conducted for this project. An estimated bankfull width was determined using available aerial photography, geomorphic assessments, and regression equations. A bankfull width of 95-ft was estimated.

The project is located on a Local Road. Design Storm Flow is 4% AEP (Q25).

The following was analyzed:

Existing Conditions: 90.3-ft clear span by 35.9-ft rise Single Span Town Lattice Covered Bridge

- Provides approximately 27.4-ft and 25.7-ft of freeboard during the 4% (Q25) and 1% (Q100) storm event, respectively.

This project is most likely a rehabilitation project and meets and/or surpasses the current hydraulic standards. If a replacement option is considered for this project, a bankfull width should be confirmed with ANR before advancing to far into the design.

The existing abutments are bearing directly on bedrock. Bedrock is visible in the main channel both upstream and downstream of the existing bridge. For these reasons, a preliminary scour analysis and countermeasure design was not performed. If subsurface investigations are performed and indicate that existing bedrock is erodible or erosive soils are encountered, an updated/detailed scour analysis will be performed during the final hydraulics phase.

Other similar sized structures could be considered for this site. If another alternative is considered, coordinate with the Hydraulics Unit to perform additionally analyses.

Please contact us with any questions, or to check substructure configuration scenarios.

APPENDIX C

Engineer's Estimate of Probable Construction Costs

Estimate 19J228

Estimated Cost:$1,330,673.00

Contingency: 0.00%

Estimated Total: $1,330,673.00

WORK INCLUDES THE REHABILITATION OF THE KINGSLEY COVERED BRIDGE (FOR H3 LIVE LOADING) (BRIDGE NO. 28) ON TH 39 SPANNING THE MILL RIVER

Base Date: 01/08/21

Spec Year:

Unit System: E

Work Type: COVERED BRIDGE REHABILITATION

Highway Type: LOCAL

Urban/Rural Type: RURAL

Season: CONSTRUCTION (APRIL 15th - OCTOBER 15th)

County: CLARENDON

Latitude of Midpoint: 433125

Longitude of Midpoint: 725627

District: SW

Federal Project Number: Clarendon BO 1443(55)

State Project Number:

Prepared by Hoyle, Tanner & Associates, Inc. on 01/08/21

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
Group 1011: ROADWAY					
0005	201.10 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	1.00	LS	$22,000.00	$22,000.00
0010	203.15 COMMON EXCAVATION	530.00	CY	$20.00	$10,600.00
0015	203.30 EARTH BORROW	8.00	CY	$15.00	$120.00
0020	204.20 TRENCH EXCAVATION OF EARTH	60.00	CY	$50.00	$3,000.00
0025	204.30 GRANULAR BACKFILL FOR STRUCTURES	55.00	CY	$70.00	$3,850.00
0030	301.25 SUBBASE OF CRUSHED GRAVEL, COARSE GRADED	250.00	CY	$40.00	$10,000.00
0035	401.10 AGGREGATE SURFACE COURSE	10.00	CY	$40.00	$400.00
0040	402.12 AGGREGATE SHOULDERS	24.00	TON	$60.00	$1,440.00
0045	404.65 EMULSIFIED ASPHALT	6.00	CWT	$140.00	$840.00
0050	406.35 SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	160.00	TON	$150.00	$24,000.00
0055	406.50 PRICE ADJUSTMENT, ASPHALT CEMENT (N.A.B.I.)	1.00	LU	$1.00	$1.00
0060	601.0910 15" CPEP	62.00	LF	$80.00	$4,960.00
0065	601.7010 15" CPEPES	3.00	EACH	$300.00	$900.00
0070	609.10 DUST CONTROL WITH WATER	1.00	MGAL	$50.00	$50.00
0075	613.10 STONE FILL, TYPE I	165.00	CY	$70.00	$11,550.00
0080	617.10 REMOVE AND RESET MAILBOX, SINGLE SUPPORT	2.00	EACH	$250.00	$500.00
0085	621.18 STEEL BACKED TIMBER GUARDRAIL	158.00	LF	$150.00	$23,700.00
0090	621.80 REMOVAL AND DISPOSAL OF GUARDRAIL	173.00	LF	$6.00	$1,038.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0095	621.90 TEMPORARY TRAFFIC BARRIER	40.00	LF	$40.00	$1,600.00
0100	630.15 FLAGGERS	80.00	HR	$25.00	$2,000.00
0105	635.11 MOBILIZATION/DEMOBILIZATION	1.00	LS	$121,000.00	$121,000.00
0110	641.10 TRAFFIC CONTROL	1.00	LS	$10,000.00	$10,000.00
0115	646.482 DURABLE 24 INCH STOP BAR, THERMOPLASTIC	12.00	LF	$100.00	$1,200.00
0120	649.31 GEOTEXTILE UNDER STONE FILL	240.00	SY	$5.00	$1,200.00
0125	675.20 TRAFFIC SIGN, TYPE A	56.00	SF	$25.00	$1,400.00
0130	675.341 SQUARE TUBE SIGN POST AND ANCHOR	83.00	LF	$20.00	$1,660.00
0135	675.50 REMOVING SIGNS	11.00	EACH	$30.00	$330.00
0140	675.60 RESETTING SIGNS	5.00	EACH	$40.00	$200.00

Total for Group 1011:$259,539.00

Group 1051: EROSION CONTROL

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0145	608.25 ALL PURPOSE EXCAVATOR RENTAL, TYPE I	20.00	HR	$100.00	$2,000.00
0150	651.15 SEED	4.00	LB	$15.00	$60.00
0155	651.18 FERTILIZER	17.00	LB	$15.00	$255.00
0160	651.20 AGRICULTURAL LIMESTONE	1.00	TON	$600.00	$600.00
0165	651.35 TOPSOIL	18.00	CY	$90.00	$1,620.00
0170	651.40 GRUBBING MATERIAL	85.00	SY	$20.00	$1,700.00
0175	653.01	1.00	LS	$5,300.00	$5,300.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	EPSC PLAN				
0180	653.02 MONITORING EPSC PLAN	55.00	HR	$70.00	$3,850.00
0185	653.03 MAINTENANCE OF EPSC PLAN (N.A.B.I.)	1.00	LU	$4,600.00	$4,600.00
0190	653.10 HAY MULCH	0.10	TON	$860.00	$86.00
0195	653.475 SILT FENCE, TYPE I	260.00	LF	$5.00	$1,300.00
0200	653.55 PROJECT DEMARCATION FENCE	630.00	LF	$3.00	$1,890.00
0205	653.60 EROSION LOG	145.00	LF	$10.00	$1,450.00

Total for Group 1051:$24,711.00

Group 1211: BRIDGE

0210	204.30 GRANULAR BACKFILL FOR STRUCTURES	10.00	CY	$90.00	$900.00
0215	204.25 STRUCTURE EXCAVATION	15.00	CY	$80.00	$1,200.00
0220	502.10 SHORING SUPERSTRUCTURE	1.00	LS	$409,000.00	$409,000.00
0225	506.75 STRUCTURAL STEEL	1.00	LS	$20,000.00	$20,000.00
0230	507.11 REINFORCING STEEL, LEVEL I	750.00	LB	$5.00	$3,750.00
0235	507.16 DRILLING AND GROUTING DOWELS	53.00	LF	$45.00	$2,385.00
0240	522.20 STRUCTURAL LUMBER AND TIMBER, UNTREATED	10.00	MFBM	$17,000.00	$170,000.00
0245	522.25 STRUCTURAL LUMBER AND TIMBER, TREATED	2.40	MFBM	$13,000.00	$31,200.00
0250	522.30 NONSTRUCTURAL LUMBER, UNTREATED	5.20	MFBM	$8,000.00	$41,600.00
0255	524.21 JOINT SEALER, POLYURETHANE	85.00	LF	$20.00	$1,700.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0260	529.20 PARTIAL REMOVAL OF STRUCTURE	1.00	EACH	$75,000.00	$75,000.00
0265	529.25 REMOVAL OF CONCRETE OR MASONRY	2.00	CY	$1,200.00	$2,400.00
0270	541.22 CONCRETE, CLASS A	6.00	CY	$1,200.00	$7,200.00
0275	580.14 REPAIR OF CONCRETE SUBSTRUCTURE SURFACE, CLASS II	5.00	SY	$2,000.00	$10,000.00
0280	613.13 STONE FILL, TYPE IV	110.00	CY	$100.00	$11,000.00
0285	900.620 SPECIAL PROVISION *(WOOD EPOXY REPAIRS)*	108.00	EACH	$250.00	$27,000.00
0290	900.625 SPECIAL PROVISION *(CONCRETE STAINING AND SEALING)*	10.00	GAL	$200.00	$2,000.00
0295	900.645 SPECIAL PROVISION *(FIRE DETECTION SYSTEM)*	1.00	LS	$35,000.00	$35,000.00
0300	900.645 SPECIAL PROVISION *(LIGHTING FOR COVERED BRIDGE)*	1.00	LS	$30,000.00	$30,000.00
0305	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$75,000.00	$75,000.00
0310	900.645 SPECIAL PROVISION *(TIMBER COATING, ENVIRONMENTAL PROTECTION)*	1.00	LS	$14,000.00	$14,000.00
0315	900.645 SPECIAL PROVISION *(TIMBER COATING, FIRE RETARDANT)*	1.00	LS	$17,000.00	$17,000.00
0320	900.645 SPECIAL PROVISION *(TIMBER COATING, TERMITICIDE/INSECTICIDE/FUNGICIDE)*	1.00	LS	$12,000.00	$12,000.00
0325	900.670 SPECIAL PROVISION *(METAL ROOFING)*	2,928.00	SF	$8.50	$24,888.00

Total for Group 1211:$1,024,223.00

Group 1999: FULL C.E. ITEMS

Line #	Item Number / Description	Quantity	Units	Unit Price	Extension
0330	631.10 FIELD OFFICE, ENGINEERS	1.00	LS	$19,200.00	$19,200.00
0335	631.26 FIELD OFFICE COMMUNICATIONS (N.A.B.I.)	3,000.00	DL	$1.00	$3,000.00

Total for Group 1999:$22,200.00

Estimate 19J228

Estimated Cost:$1,440,313.00

Contingency: 0.00%

Estimated Total: $1,440,313.00

WORK INCLUDES THE REHABILITATION OF THE KINGSLEY COVERED BRIDGE (FOR H12 LIVE LOADING) (BRIDGE NO. 28) ON TH 39 SPANNING THE MILL RIVER

Base Date: 01/08/21

Spec Year:

Unit System: E

Work Type: COVERED BRIDGE REHABILITATION

Highway Type: LOCAL

Urban/Rural Type: RURAL

Season: CONSTRUCTION (APRIL 15th - OCTOBER 15th)

County: CLARENDON

Latitude of Midpoint: 433125

Longitude of Midpoint: 725627

District: SW

Federal Project Number: Clarendon BO 1443(55)

State Project Number:

Prepared by Hoyle, Tanner & Associates, Inc. on 01/08/21

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
Group 1011: ROADWAY					
0005	201.10 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	1.00	LS	$22,000.00	$22,000.00
0010	203.15 COMMON EXCAVATION	530.00	CY	$20.00	$10,600.00
0015	203.30 EARTH BORROW	8.00	CY	$15.00	$120.00
0020	204.20 TRENCH EXCAVATION OF EARTH	60.00	CY	$50.00	$3,000.00
0025	204.30 GRANULAR BACKFILL FOR STRUCTURES	55.00	CY	$70.00	$3,850.00
0030	301.25 SUBBASE OF CRUSHED GRAVEL, COARSE GRADED	250.00	CY	$40.00	$10,000.00
0035	401.10 AGGREGATE SURFACE COURSE	10.00	CY	$40.00	$400.00
0040	402.12 AGGREGATE SHOULDERS	24.00	TON	$60.00	$1,440.00
0045	404.65 EMULSIFIED ASPHALT	6.00	CWT	$140.00	$840.00
0050	406.35 SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	160.00	TON	$150.00	$24,000.00
0055	406.50 PRICE ADJUSTMENT, ASPHALT CEMENT (N.A.B.I.)	1.00	LU	$1.00	$1.00
0060	601.0910 15" CPEP	62.00	LF	$80.00	$4,960.00
0065	601.7010 15" CPEPES	3.00	EACH	$300.00	$900.00
0070	609.10 DUST CONTROL WITH WATER	1.00	MGAL	$50.00	$50.00
0075	613.10 STONE FILL, TYPE I	165.00	CY	$70.00	$11,550.00
0080	617.10 REMOVE AND RESET MAILBOX, SINGLE SUPPORT	2.00	EACH	$250.00	$500.00
0085	621.18 STEEL BACKED TIMBER GUARDRAIL	158.00	LF	$150.00	$23,700.00
0090	621.80 REMOVAL AND DISPOSAL OF GUARDRAIL	173.00	LF	$6.00	$1,038.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0095	621.90 TEMPORARY TRAFFIC BARRIER	40.00	LF	$40.00	$1,600.00
0100	630.15 FLAGGERS	80.00	HR	$25.00	$2,000.00
0105	635.11 MOBILIZATION/DEMOBILIZATION	1.00	LS	$131,000.00	$131,000.00
0110	641.10 TRAFFIC CONTROL	1.00	LS	$10,000.00	$10,000.00
0115	646.482 DURABLE 24 INCH STOP BAR, THERMOPLASTIC	12.00	LF	$100.00	$1,200.00
0120	649.31 GEOTEXTILE UNDER STONE FILL	240.00	SY	$5.00	$1,200.00
0125	675.20 TRAFFIC SIGN, TYPE A	56.00	SF	$25.00	$1,400.00
0130	675.341 SQUARE TUBE SIGN POST AND ANCHOR	83.00	LF	$20.00	$1,660.00
0135	675.50 REMOVING SIGNS	11.00	EACH	$30.00	$330.00
0140	675.60 RESETTING SIGNS	5.00	EACH	$40.00	$200.00

Total for Group 1011:$269,539.00

Group 1051: EROSION CONTROL

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0145	608.25 ALL PURPOSE EXCAVATOR RENTAL, TYPE I	20.00	HR	$100.00	$2,000.00
0150	651.15 SEED	4.00	LB	$15.00	$60.00
0155	651.18 FERTILIZER	17.00	LB	$15.00	$255.00
0160	651.20 AGRICULTURAL LIMESTONE	1.00	TON	$600.00	$600.00
0165	651.35 TOPSOIL	18.00	CY	$90.00	$1,620.00
0170	651.40 GRUBBING MATERIAL	85.00	SY	$20.00	$1,700.00
0175	653.01	1.00	LS	$5,300.00	$5,300.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	EPSC PLAN				
0180	653.02 MONITORING EPSC PLAN	72.00	HR	$70.00	$5,040.00
0185	653.03 MAINTENANCE OF EPSC PLAN (N.A.B.I.)	1.00	LU	$4,600.00	$4,600.00
0190	653.10 HAY MULCH	0.10	TON	$860.00	$86.00
0195	653.475 SILT FENCE, TYPE I	260.00	LF	$5.00	$1,300.00
0200	653.55 PROJECT DEMARCATION FENCE	630.00	LF	$3.00	$1,890.00
0205	653.60 EROSION LOG	145.00	LF	$10.00	$1,450.00

Total for Group 1051:$25,901.00

Group 1211: BRIDGE

0210	204.30 GRANULAR BACKFILL FOR STRUCTURES	10.00	CY	$90.00	$900.00
0215	204.25 STRUCTURE EXCAVATION	15.00	CY	$80.00	$1,200.00
0220	502.10 SHORING SUPERSTRUCTURE	1.00	LS	$416,000.00	$416,000.00
0225	506.75 STRUCTURAL STEEL	1.00	LS	$20,000.00	$20,000.00
0230	507.11 REINFORCING STEEL, LEVEL I	750.00	LB	$5.00	$3,750.00
0235	507.16 DRILLING AND GROUTING DOWELS	53.00	LF	$45.00	$2,385.00
0240	522.20 STRUCTURAL LUMBER AND TIMBER, UNTREATED	12.70	MFBM	$19,000.00	$241,300.00
0245	522.25 STRUCTURAL LUMBER AND TIMBER, TREATED	2.40	MFBM	$13,000.00	$31,200.00
0250	522.30 NONSTRUCTURAL LUMBER, UNTREATED	5.20	MFBM	$8,000.00	$41,600.00
0255	524.21 JOINT SEALER, POLYURETHANE	85.00	LF	$20.00	$1,700.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0260	529.20 PARTIAL REMOVAL OF STRUCTURE	1.00	EACH	$95,000.00	$95,000.00
0265	529.25 REMOVAL OF CONCRETE OR MASONRY	2.00	CY	$1,200.00	$2,400.00
0270	541.22 CONCRETE, CLASS A	6.00	CY	$1,200.00	$7,200.00
0275	580.14 REPAIR OF CONCRETE SUBSTRUCTURE SURFACE, CLASS II	5.00	SY	$2,000.00	$10,000.00
0280	613.13 STONE FILL, TYPE IV	110.00	CY	$100.00	$11,000.00
0285	900.620 SPECIAL PROVISION *(WOOD EPOXY REPAIRS)*	115.00	EACH	$250.00	$28,750.00
0290	900.625 SPECIAL PROVISION *(CONCRETE STAINING AND SEALING)*	10.00	GAL	$200.00	$2,000.00
0295	900.645 SPECIAL PROVISION *(FIRE DETECTION SYSTEM)*	1.00	LS	$35,000.00	$35,000.00
0300	900.645 SPECIAL PROVISION *(LIGHTING FOR COVERED BRIDGE)*	1.00	LS	$30,000.00	$30,000.00
0305	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$67,000.00	$67,000.00
0310	900.645 SPECIAL PROVISION *(TIMBER COATING, ENVIRONMENTAL PROTECTION)*	1.00	LS	$14,000.00	$14,000.00
0315	900.645 SPECIAL PROVISION *(TIMBER COATING, FIRE RETARDANT)*	1.00	LS	$17,000.00	$17,000.00
0320	900.645 SPECIAL PROVISION *(TIMBER COATING, TERMITICIDE/INSECTICIDE/FUNGICIDE)*	1.00	LS	$12,000.00	$12,000.00
0325	900.670 SPECIAL PROVISION *(METAL ROOFING)*	2,928.00	SF	$8.50	$24,888.00

Total for Group 1211:$1,116,273.00

Group 1999: FULL C.E. ITEMS

0330	631.10 FIELD OFFICE, ENGINEERS	1.00	LS	$25,600.00	$25,600.00
0335	631.26 FIELD OFFICE COMMUNICATIONS (N.A.B.I.)	3,000.00	DL	$1.00	$3,000.00

Total for Group 1999:$28,600.00

Estimate 19J228

Estimated Cost:$1,511,223.00

Contingency: 0.00%

Estimated Total: $1,511,223.00

WORK INCLUDES THE REHABILITATION OF THE KINGSLEY COVERED BRIDGE (FOR H15 LIVE LOADING) (BRIDGE NO. 28) ON TH 39 SPANNING THE MILL RIVER

Base Date: 01/08/21

Spec Year:

Unit System: E

Work Type: COVERED BRIDGE REHABILITATION

Highway Type: LOCAL

Urban/Rural Type: RURAL

Season: CONSTRUCTION (APRIL 15th - OCTOBER 15th)

County: CLARENDON

Latitude of Midpoint: 433125

Longitude of Midpoint: 725627

District: SW

Federal Project Number: Clarendon BO 1443(55)

State Project Number:

Prepared by Hoyle, Tanner & Associates, Inc. on 01/08/21

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
Group 1011: ROADWAY					
0005	201.10 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	1.00	LS	$22,000.00	$22,000.00
0010	203.15 COMMON EXCAVATION	530.00	CY	$20.00	$10,600.00
0015	203.30 EARTH BORROW	8.00	CY	$15.00	$120.00
0020	204.20 TRENCH EXCAVATION OF EARTH	60.00	CY	$50.00	$3,000.00
0025	204.30 GRANULAR BACKFILL FOR STRUCTURES	55.00	CY	$70.00	$3,850.00
0030	301.25 SUBBASE OF CRUSHED GRAVEL, COARSE GRADED	250.00	CY	$40.00	$10,000.00
0035	401.10 AGGREGATE SURFACE COURSE	10.00	CY	$40.00	$400.00
0040	402.12 AGGREGATE SHOULDERS	24.00	TON	$60.00	$1,440.00
0045	404.65 EMULSIFIED ASPHALT	6.00	CWT	$140.00	$840.00
0050	406.35 SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	160.00	TON	$150.00	$24,000.00
0055	406.50 PRICE ADJUSTMENT, ASPHALT CEMENT (N.A.B.I.)	1.00	LU	$1.00	$1.00
0060	601.0910 15" CPEP	62.00	LF	$80.00	$4,960.00
0065	601.7010 15" CPEPES	3.00	EACH	$300.00	$900.00
0070	609.10 DUST CONTROL WITH WATER	1.00	MGAL	$50.00	$50.00
0075	613.10 STONE FILL, TYPE I	165.00	CY	$70.00	$11,550.00
0080	617.10 REMOVE AND RESET MAILBOX, SINGLE SUPPORT	2.00	EACH	$250.00	$500.00
0085	621.18 STEEL BACKED TIMBER GUARDRAIL	158.00	LF	$150.00	$23,700.00
0090	621.80 REMOVAL AND DISPOSAL OF GUARDRAIL	173.00	LF	$6.00	$1,038.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0095	621.90 TEMPORARY TRAFFIC BARRIER	40.00	LF	$40.00	$1,600.00
0100	630.15 FLAGGERS	80.00	HR	$25.00	$2,000.00
0105	635.11 MOBILIZATION/DEMOBILIZATION	1.00	LS	$140,000.00	$140,000.00
0110	641.10 TRAFFIC CONTROL	1.00	LS	$10,000.00	$10,000.00
0115	646.482 DURABLE 24 INCH STOP BAR, THERMOPLASTIC	12.00	LF	$100.00	$1,200.00
0120	649.31 GEOTEXTILE UNDER STONE FILL	240.00	SY	$5.00	$1,200.00
0125	675.20 TRAFFIC SIGN, TYPE A	56.00	SF	$25.00	$1,400.00
0130	675.341 SQUARE TUBE SIGN POST AND ANCHOR	83.00	LF	$20.00	$1,660.00
0135	675.50 REMOVING SIGNS	11.00	EACH	$30.00	$330.00
0140	675.60 RESETTING SIGNS	5.00	EACH	$40.00	$200.00

Total for Group 1011:$278,539.00

Group 1051: EROSION CONTROL

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0145	608.25 ALL PURPOSE EXCAVATOR RENTAL, TYPE I	20.00	HR	$100.00	$2,000.00
0150	651.15 SEED	4.00	LB	$15.00	$60.00
0155	651.18 FERTILIZER	17.00	LB	$15.00	$255.00
0160	651.20 AGRICULTURAL LIMESTONE	1.00	TON	$600.00	$600.00
0165	651.35 TOPSOIL	18.00	CY	$90.00	$1,620.00
0170	651.40 GRUBBING MATERIAL	85.00	SY	$20.00	$1,700.00
0175	653.01	1.00	LS	$5,300.00	$5,300.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	EPSC PLAN				
0180	653.02 MONITORING EPSC PLAN	80.00	HR	$70.00	$5,600.00
0185	653.03 MAINTENANCE OF EPSC PLAN (N.A.B.I.)	1.00	LU	$4,600.00	$4,600.00
0190	653.10 HAY MULCH	0.10	TON	$860.00	$86.00
0195	653.475 SILT FENCE, TYPE I	260.00	LF	$5.00	$1,300.00
0200	653.55 PROJECT DEMARCATION FENCE	630.00	LF	$3.00	$1,890.00
0205	653.60 EROSION LOG	145.00	LF	$10.00	$1,450.00

Total for Group 1051:$26,461.00

Group 1211: BRIDGE

0210	204.30 GRANULAR BACKFILL FOR STRUCTURES	10.00	CY	$90.00	$900.00
0215	204.25 STRUCTURE EXCAVATION	15.00	CY	$80.00	$1,200.00
0220	502.10 SHORING SUPERSTRUCTURE	1.00	LS	$423,000.00	$423,000.00
0225	506.75 STRUCTURAL STEEL	1.00	LS	$20,000.00	$20,000.00
0230	507.11 REINFORCING STEEL, LEVEL I	750.00	LB	$5.00	$3,750.00
0235	507.16 DRILLING AND GROUTING DOWELS	53.00	LF	$45.00	$2,385.00
0240	522.20 STRUCTURAL LUMBER AND TIMBER, UNTREATED	15.50	MFBM	$19,000.00	$294,500.00
0245	522.25 STRUCTURAL LUMBER AND TIMBER, TREATED	2.40	MFBM	$13,000.00	$31,200.00
0250	522.30 NONSTRUCTURAL LUMBER, UNTREATED	5.20	MFBM	$8,000.00	$41,600.00
0255	524.21 JOINT SEALER, POLYURETHANE	85.00	LF	$20.00	$1,700.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0260	529.20 PARTIAL REMOVAL OF STRUCTURE	1.00	EACH	$105,000.00	$105,000.00
0265	529.25 REMOVAL OF CONCRETE OR MASONRY	2.00	CY	$1,200.00	$2,400.00
0270	541.22 CONCRETE, CLASS A	6.00	CY	$1,200.00	$7,200.00
0275	580.14 REPAIR OF CONCRETE SUBSTRUCTURE SURFACE, CLASS II	5.00	SY	$2,000.00	$10,000.00
0280	613.13 STONE FILL, TYPE IV	110.00	CY	$100.00	$11,000.00
0285	900.620 SPECIAL PROVISION *(WOOD EPOXY REPAIRS)*	88.00	EACH	$250.00	$22,000.00
0290	900.625 SPECIAL PROVISION *(CONCRETE STAINING AND SEALING)*	10.00	GAL	$200.00	$2,000.00
0295	900.645 SPECIAL PROVISION *(FIRE DETECTION SYSTEM)*	1.00	LS	$35,000.00	$35,000.00
0300	900.645 SPECIAL PROVISION *(LIGHTING FOR COVERED BRIDGE)*	1.00	LS	$30,000.00	$30,000.00
0305	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$58,500.00	$58,500.00
0310	900.645 SPECIAL PROVISION *(TIMBER COATING, ENVIRONMENTAL PROTECTION)*	1.00	LS	$14,000.00	$14,000.00
0315	900.645 SPECIAL PROVISION *(TIMBER COATING, FIRE RETARDANT)*	1.00	LS	$17,000.00	$17,000.00
0320	900.645 SPECIAL PROVISION *(TIMBER COATING, TERMITICIDE/INSECTICIDE/FUNGICIDE)*	1.00	LS	$12,000.00	$12,000.00
0325	900.670 SPECIAL PROVISION *(METAL ROOFING)*	2,928.00	SF	$8.50	$24,888.00

Total for Group 1211:$1,171,223.00

Group 1999: FULL C.E. ITEMS

Line #	Item Number / Description	Quantity	Units	Unit Price	Extension
0330	631.10 FIELD OFFICE, ENGINEERS	1.00	LS	$32,000.00	$32,000.00
0335	631.26 FIELD OFFICE COMMUNICATIONS (N.A.B.I.)	3,000.00	DL	$1.00	$3,000.00

Total for Group 1999:$35,000.00

Estimate 19J228

Estimated Cost:$1,815,113.00

Contingency: 0.00%

Estimated Total: $1,815,113.00

WORK INCLUDES THE REHABILITATION OF THE KINGSLEY COVERED BRIDGE (FOR H20 LIVE LOADING) (BRIDGE NO. 28) ON TH 39 SPANNING THE MILL RIVER

Base Date: 01/08/21

Spec Year:

Unit System: E

Work Type: COVERED BRIDGE REHABILITATION

Highway Type: LOCAL

Urban/Rural Type: RURAL

Season: CONSTRUCTION (APRIL 15th - OCTOBER 15th)

County: CLARENDON

Latitude of Midpoint: 433125

Longitude of Midpoint: 725627

District: SW

Federal Project Number: Clarendon BO 1443(55)

State Project Number:

Prepared by Hoyle, Tanner & Associates, Inc. on 01/08/21

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
Group 1011: ROADWAY					
0005	201.10 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	1.00	LS	$22,000.00	$22,000.00
0010	203.15 COMMON EXCAVATION	530.00	CY	$20.00	$10,600.00
0015	203.30 EARTH BORROW	8.00	CY	$15.00	$120.00
0020	204.20 TRENCH EXCAVATION OF EARTH	60.00	CY	$50.00	$3,000.00
0025	204.30 GRANULAR BACKFILL FOR STRUCTURES	55.00	CY	$70.00	$3,850.00
0030	301.25 SUBBASE OF CRUSHED GRAVEL, COARSE GRADED	250.00	CY	$40.00	$10,000.00
0035	401.10 AGGREGATE SURFACE COURSE	10.00	CY	$40.00	$400.00
0040	402.12 AGGREGATE SHOULDERS	24.00	TON	$60.00	$1,440.00
0045	404.65 EMULSIFIED ASPHALT	6.00	CWT	$140.00	$840.00
0050	406.35 SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	160.00	TON	$150.00	$24,000.00
0055	406.50 PRICE ADJUSTMENT, ASPHALT CEMENT (N.A.B.I.)	1.00	LU	$1.00	$1.00
0060	601.0910 15" CPEP	62.00	LF	$80.00	$4,960.00
0065	601.7010 15" CPEPES	3.00	EACH	$300.00	$900.00
0070	609.10 DUST CONTROL WITH WATER	1.00	MGAL	$50.00	$50.00
0075	613.10 STONE FILL, TYPE I	165.00	CY	$70.00	$11,550.00
0080	617.10 REMOVE AND RESET MAILBOX, SINGLE SUPPORT	2.00	EACH	$250.00	$500.00
0085	621.18 STEEL BACKED TIMBER GUARDRAIL	158.00	LF	$150.00	$23,700.00
0090	621.80 REMOVAL AND DISPOSAL OF GUARDRAIL	173.00	LF	$6.00	$1,038.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0095	621.90 TEMPORARY TRAFFIC BARRIER	40.00	LF	$40.00	$1,600.00
0100	630.15 FLAGGERS	80.00	HR	$25.00	$2,000.00
0105	635.11 MOBILIZATION/DEMOBILIZATION	1.00	LS	$165,000.00	$165,000.00
0110	641.10 TRAFFIC CONTROL	1.00	LS	$10,000.00	$10,000.00
0115	646.482 DURABLE 24 INCH STOP BAR, THERMOPLASTIC	12.00	LF	$100.00	$1,200.00
0120	649.31 GEOTEXTILE UNDER STONE FILL	240.00	SY	$5.00	$1,200.00
0125	675.20 TRAFFIC SIGN, TYPE A	56.00	SF	$25.00	$1,400.00
0130	675.341 SQUARE TUBE SIGN POST AND ANCHOR	83.00	LF	$20.00	$1,660.00
0135	675.50 REMOVING SIGNS	11.00	EACH	$30.00	$330.00
0140	675.60 RESETTING SIGNS	5.00	EACH	$40.00	$200.00

Total for Group 1011:$303,539.00

Group 1051: EROSION CONTROL

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0145	608.25 ALL PURPOSE EXCAVATOR RENTAL, TYPE I	20.00	HR	$100.00	$2,000.00
0150	651.15 SEED	4.00	LB	$15.00	$60.00
0155	651.18 FERTILIZER	17.00	LB	$15.00	$255.00
0160	651.20 AGRICULTURAL LIMESTONE	1.00	TON	$600.00	$600.00
0165	651.35 TOPSOIL	18.00	CY	$90.00	$1,620.00
0170	651.40 GRUBBING MATERIAL	85.00	SY	$20.00	$1,700.00
0175	653.01	1.00	LS	$5,300.00	$5,300.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	EPSC PLAN				
0180	653.02 MONITORING EPSC PLAN	92.00	HR	$70.00	$6,440.00
0185	653.03 MAINTENANCE OF EPSC PLAN (N.A.B.I.)	1.00	LU	$4,600.00	$4,600.00
0190	653.10 HAY MULCH	0.10	TON	$860.00	$86.00
0195	653.475 SILT FENCE, TYPE I	260.00	LF	$5.00	$1,300.00
0200	653.55 PROJECT DEMARCATION FENCE	630.00	LF	$3.00	$1,890.00
0205	653.60 EROSION LOG	145.00	LF	$10.00	$1,450.00

Total for Group 1051:$27,301.00

Group 1211: BRIDGE

0210	204.30 GRANULAR BACKFILL FOR STRUCTURES	10.00	CY	$90.00	$900.00
0215	204.25 STRUCTURE EXCAVATION	15.00	CY	$80.00	$1,200.00
0220	502.10 SHORING SUPERSTRUCTURE	1.00	LS	$436,000.00	$436,000.00
0225	506.75 STRUCTURAL STEEL	1.00	LS	$20,000.00	$20,000.00
0230	507.11 REINFORCING STEEL, LEVEL I	750.00	LB	$5.00	$3,750.00
0235	507.16 DRILLING AND GROUTING DOWELS	53.00	LF	$45.00	$2,385.00
0240	522.20 STRUCTURAL LUMBER AND TIMBER, UNTREATED	19.40	MFBM	$20,000.00	$388,000.00
0245	522.25 STRUCTURAL LUMBER AND TIMBER, TREATED	2.40	MFBM	$13,000.00	$31,200.00
0250	522.30 NONSTRUCTURAL LUMBER, UNTREATED	5.20	MFBM	$8,000.00	$41,600.00
0255	522.40 STRUCTURAL GLUED LAMINATED TIMBER	1.00	LS	$102,500.00	$102,500.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0260	524.21 JOINT SEALER, POLYURETHANE	85.00	LF	$20.00	$1,700.00
0265	529.20 PARTIAL REMOVAL OF STRUCTURE	1.00	EACH	$170,000.00	$170,000.00
0270	529.25 REMOVAL OF CONCRETE OR MASONRY	2.00	CY	$1,200.00	$2,400.00
0275	541.22 CONCRETE, CLASS A	6.00	CY	$1,200.00	$7,200.00
0280	580.14 REPAIR OF CONCRETE SUBSTRUCTURE SURFACE, CLASS II	5.00	SY	$2,000.00	$10,000.00
0285	613.13 STONE FILL, TYPE IV	110.00	CY	$100.00	$11,000.00
0290	900.620 SPECIAL PROVISION *(WOOD EPOXY REPAIRS)*	87.00	EACH	$250.00	$21,750.00
0295	900.625 SPECIAL PROVISION *(CONCRETE STAINING AND SEALING)*	10.00	GAL	$200.00	$2,000.00
0300	900.645 SPECIAL PROVISION *(FIRE DETECTION SYSTEM)*	1.00	LS	$35,000.00	$35,000.00
0305	900.645 SPECIAL PROVISION *(LIGHTING FOR COVERED BRIDGE)*	1.00	LS	$30,000.00	$30,000.00
0310	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$50,000.00	$50,000.00
0315	900.645 SPECIAL PROVISION *(TIMBER COATING, ENVIRONMENTAL PROTECTION)*	1.00	LS	$14,000.00	$14,000.00
0320	900.645 SPECIAL PROVISION *(TIMBER COATING, FIRE RETARDANT)*	1.00	LS	$17,000.00	$17,000.00
0325	900.645 SPECIAL PROVISION *(TIMBER COATING, TERMITICIDE/INSECTICIDE/FUNGICIDE)*	1.00	LS	$12,000.00	$12,000.00
0330	900.670 SPECIAL PROVISION *(METAL ROOFING)*	2,928.00	SF	$8.50	$24,888.00

Total for Group 1211:$1,436,473.00

Group 1999: FULL C.E. ITEMS

0335	631.10 FIELD OFFICE, ENGINEERS	1.00	LS	$44,800.00	$44,800.00
0340	631.26 FIELD OFFICE COMMUNICATIONS (N.A.B.I.)	3,000.00	DL	$1.00	$3,000.00

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Total for Group 1999:$47,800.00

APPENDIX D

Wood Species Identification Report

Memorandum

Date: June 29, 2020

To: Josif Bicja, P.E.
Project Engineer
Hoyle, Tanner & Associates
150 Dow Street
Manchester, NH 03101

From: Doug Gardner
Professor of Forest Operations, Bioproducts & Bioenergy
Advanced Structures and Composites Center

Subject: Identification of 10 timber bridge wood samples from the Kingsley Covered Bridge Clarendon, VT.

Following are my findings relative to the identification of the timber bridge wood species samples you sent to me on June 15, 2020. I relied on my background in wood identification, and the Key to Gross Identification found in the Textbook of Wood Technology, 4th Edition by Panshin and De Zeeuw (ISBN 0-07-048441-4) in making my evaluations. Identification of the wood samples was made using a 12x Hand Lens.

Samples Identified
A summary of the wood species identified are listed in Table 1 along with comments related to the nature of the samples. The original wood species used (1870) consisted of common eastern softwoods (Spruce and Hemlock) and hardwood (red oak) for the trunnel. The repairs in 1987 included southern pine for structural support (floor beam) and hemlock for the replaced chord and white pine for siding. More details about each sample are described below.

Table 1. Summary of wood species identified comprising wooden bridge members.

Sample Label	Wood Species	Comments
#1 – Rafter Node 29 to 30, West Truss	Eastern Spruce	
#2 – Original Lattice Node 22 to 23, East Truss	Eastern Spruce	
#3 –Original Lattice Node 9, West Truss	Eastern Spruce	
#4 –Cross Beam Node 10 to 11, West Truss	Eastern Spruce	Obvious decay and insect attack
#5 –Original Chord 2, Ply B, Node 22 to 23, East Truss	Eastern Spruce	
#6 –Siding, North Portal	Eastern White Pine	Pine odor
#7 – Floor Beam, Node 3, Over south Abutment	Southern Pine	Preservative Treated? Green Color
#8 –Replaced Chord 3, Ply C, Node 5, West Truss	Eastern Hemlock	
#9 – Roof Board, Node 19, East Truss	Eastern Hemlock	
#10 – Trunnel, Node 8, East Truss	Red Oak	

1. Sample 1 Eastern Spruce (*Picea* spp.): straight grained and exhibited a gradual transition from earlywood to latewood in the growth increments.

2. Sample 2 Eastern Spruce (*Picea* spp.): straight grained and exhibited a gradual transition from earlywood to latewood in the growth increments.

3. Sample 3 Eastern Spruce (*Picea* spp.): straight grained and exhibited a gradual transition from earlywood to latewood in the growth increments.

4. Sample 4 Eastern Spruce (*Picea* spp.): straight grained and exhibited a gradual transition from earlywood to latewood in the growth increments.

5. Sample 5 Eastern Spruce (*Picea* spp.): straight grained and exhibited a gradual transition from earlywood to latewood in the growth increments.

6. Sample 6 Eastern White Pine (*Pinus strobus*): light wood, gradual transition from earlywood to latewood, resin canals readily apparent and characteristic pine odor

7. Sample 7 Southern Pine (*Pinus* spp.) dense wood with abrupt transition from earlywood to latewood, resin canal apparent to naked eye.

8. Sample 8. Eastern Hemlock (*Tsuga canadensis*): wood tended to be brittle and exhibited an abrupt transition from early wood to latewood in the growth increments.

9. Sample 9. Eastern Hemlock (*Tsuga canadensis*): wood tended to be brittle and exhibited an abrupt transition from early wood to latewood in the growth increments.

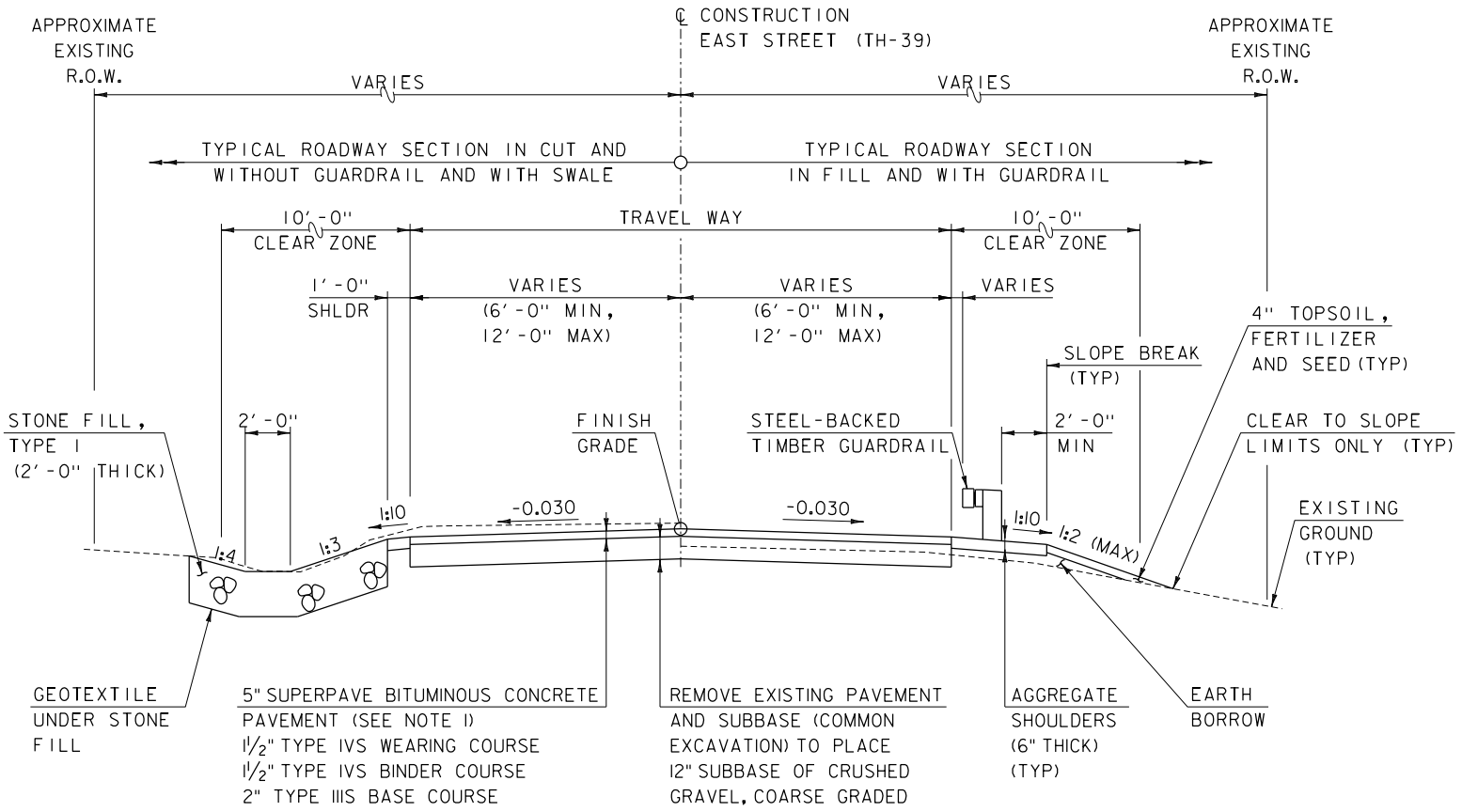
10. Sample 10. Red Oak (*Quercus rubra*): ring porous hardwood, no tyloses in the pores.

My consulting fee is $60 per sample, so the cost for this wood sample identification is $600.00. Payment can be made to

Douglas J. Gardner
PO Box 219
Eddington, ME 04428

APPENDIX E

Plans of Proposed Improvements



NOTE

1. REPLACE 4" PAVEMENT WITH 4" AGGREGATE SURFACE COURSE STA 11+75.00 - STA 12+00.00.

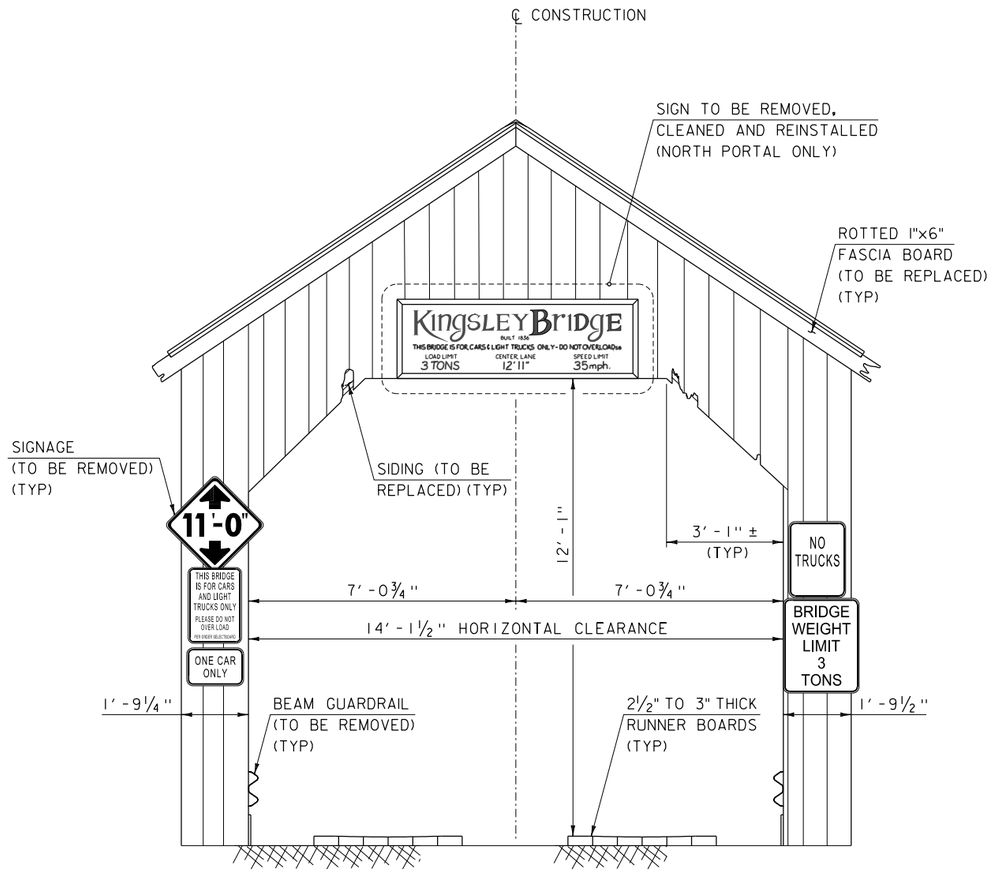
TYPICAL ROADWAY SECTION

STA 12+00.00 - STA 13+39.38
STA 14+61.76 - STA 15+85.00
NOT TO SCALE

Hoyle, Tanner & Associates, Inc.

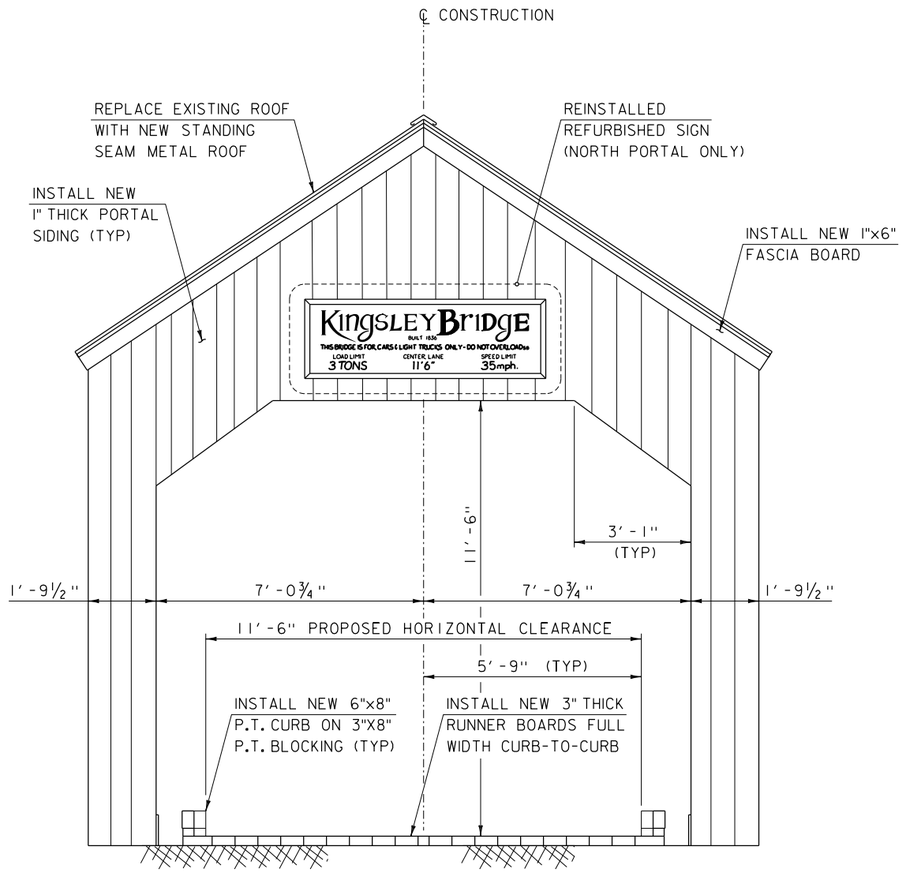
PROJECT NAME:	CLARENDON
PROJECT NUMBER:	BO 1443(55)

FILE NAME: z19j228typ.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: P.DUSTIN	CHECKED BY: A.BEAULAC
ROADWAY TYPICAL SECTION	SHEET 1 OF 15



EXISTING PORTAL ELEVATION

(SOUTH PORTAL SHOWN, NORTH PORTAL SIMILAR)
SCALE: ½" = 1'-0"

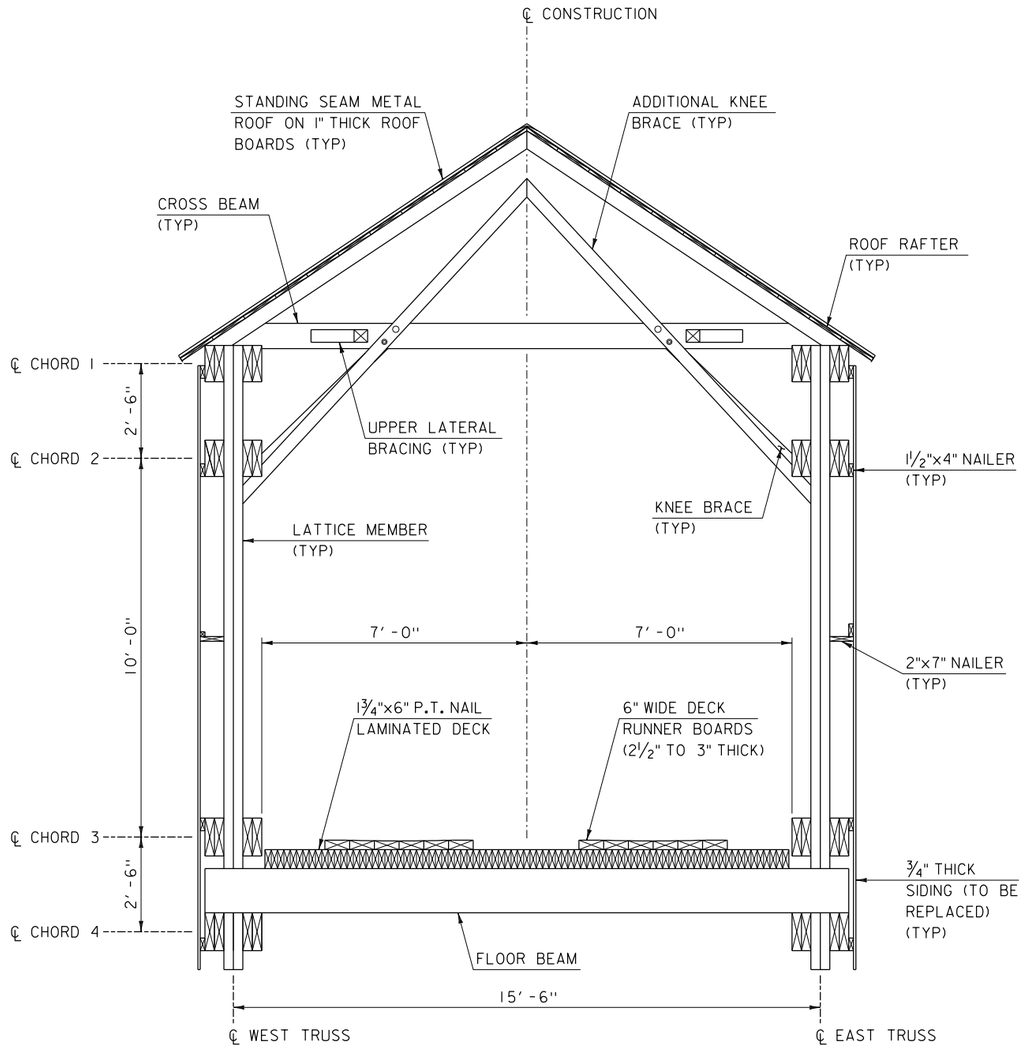


PROPOSED PORTAL ELEVATION

(SOUTH PORTAL SHOWN, NORTH PORTAL SIMILAR)
SCALE: ½" = 1'-0"

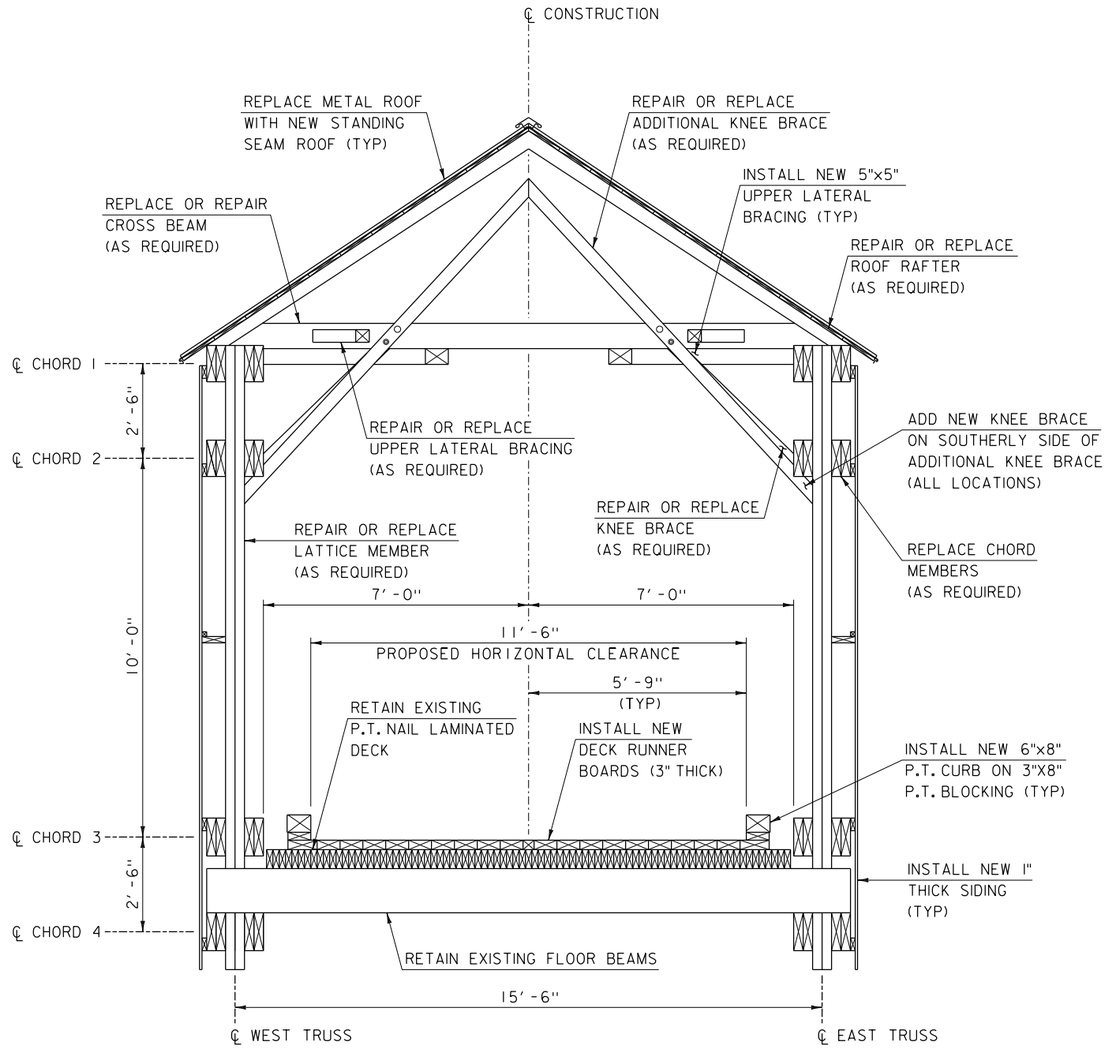
Hoyle, Tanner & Associates, Inc.

PROJECT NAME:	CLARENDON
PROJECT NUMBER:	BO 1443(55)
FILE NAME: z19j228supl.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: J.RIPLEY	CHECKED BY: J.BICJA
TYPICAL PORTAL ELEVATIONS	SHEET 2 OF 15



EXISTING BRIDGE SECTION

SCALE: ½" = 1'-0"



PROPOSED BRIDGE SECTION

SCALE: ½" = 1'-0"

PROJECT NAME:	CLARENDON
PROJECT NUMBER:	BO 1443(55)

Hoyle, Tanner & Associates, Inc.

FILE NAME: z19j228sup2.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: J.RIPLEY	CHECKED BY: J.BICJA
TYPICAL BRIDGE SECTIONS	SHEET 3 OF 15

EAST STREET (TH-39) CURVE NO. 1 DATA	EAST STREET (TH-39) CURVE NO. 2 DATA	EAST STREET (TH-39) CURVE NO. 3 DATA
Δ = 45°35′21.63″	Δ = 27°39′06.68″	Δ = 12°40′48.56″
D = 38°11′49.87″	D = 45°50′11.84″	D = 11°27′32.96″
R = 150.00′	R = 125.00′	R = 500.00′
T = 63.04′	T = 30.76′	T = 55.55′
L = 119.35′	L = 60.33′	L = 110.66′
E = 12.71′	E = 3.73′	E = 3.08′

VT STATE PLANE GRID

N

BEGIN APPROACH
STA 11+75.00

BEGIN PROJECT
STA 12+00.00

PROPOSED
STONE-LINED
DRAINAGE
SWALE (TYP)

PROPOSED
DRIVE
CULVERT

PT
STA 11+96.04

PC
STA 12+54.85

PT
STA 13+15.18

MILL RIVER
FLOW

EXISTING STEEL
SUPPORT CABLE
(SEE BRIDGE
PLANS) (TYP)

BEGIN BRIDGE
STA 13+39.38

END BRIDGE
STA 14+61.76

PROPOSED
STONE FILL,
TYPE IV

PROPOSED
STEEL-BACKED
TIMBER GUARDRAIL
(TYP)

CLEAR TO
SLOPE LIMITS
ONLY (TYP)

PI
STA 15+16.01

PROPOSED
GRANITE CURB
(TYP)

PROPOSED
YIELD SIGN

END APPROACH
END PROJECT
STA 15+85.37

TO
US ROUTE 7

BENCHMARK
RAILROAD SPIKE
IN TREE
ELEV. = 724.69

℄ CONSTRUCTION

PI
STA 11+39.13

TH-39
(EAST STREET)

TH-37
(KNIPES DRIVE)

APPROX. EXISTING TOWN R.O.W.

CURVE NO. 1

11+00

10+16

TO
US ROUTE 7

N 49°55′30.73″ E

PC
STA 10+76.69

IRON PIPE
¾″ REBAR 8″ AGS

BENCHMARK
RAILROAD SPIKE
IN POLE
ELEV. = 724.03

MAINTAIN
STOP SIGN

RELOCATE
MAILBOX

12′-0″
(TYP)

5′-0″ PAVED
APRON (TYP)

REMOVE
MAILBOX

PROPOSED
STOP SIGN

PROPOSED
24″ STOP BAR

MAINTAIN
FENCE

PI
STA 12+85.62

PROPOSED
STONE FILL,
TYPE I (TYP)

PROPOSED
STONE-LINED
DRAINAGE
SWALE

EDGE OF
RIVER (TYP)

BRIDGE NO. 28

PC
STA 14+60.45

PROPOSED
DRIVE
CULVERT

PROPOSED
CATCH
BASIN

REMOVE
AND
RESET
MAILBOX

PT
STA 15+71.11

APPROX. EXISTING TOWN R.O.W.

TH-25
(GORGE RD)

TO
VT ROUTE 103

APPROX. EXISTING TOWN R.O.W.

PROPOSED
STONE-LINED
DRAINAGE
SWALE

N 04°20′09.10″ E

N 23°18′57.58″ W

N 10°38′09.02″ W

CURVE NO. 2

CURVE NO. 3

12′-0″

13+00

14+00

15+00

15+97

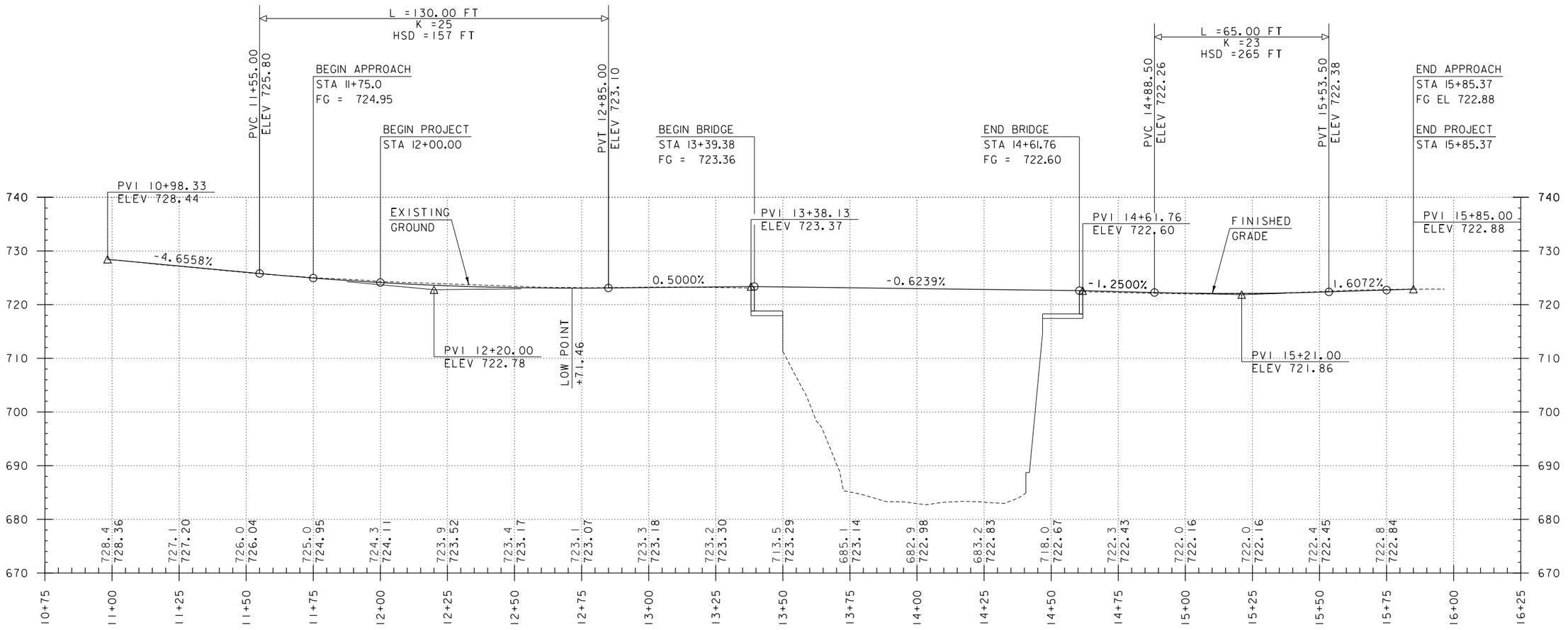
SAVE

EXISTING BRIDGE INFORMATION
TOWN LATTICE COVERED BRIDGE
BUILT 1836, RECONSTRUCTED 1987
SINGLE SPAN, 121′ LENGTH
13′-3″ ROADWAY WIDTH
WOODEN DECK WITH RUNNER BOARDS
9′-2″ MIN VERTICAL CLEAR
CONCRETE ABUTMENTS

0 20 40
SCALE IN FEET

Hoyle, Tanner & Associates, Inc.

PROJECT NAME:	CLARENDON
PROJECT NUMBER:	BO 1443(55)
FILE NAME: z19j228bdr_lay.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: P.DUSTIN	CHECKED BY: A.BEAULAC
LAYOUT SHEET	SHEET 4 OF 15



TH-39 PROFILE

SCALE: HORIZONTAL 1" = 20'
VERTICAL 1" = 10'

GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND

GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE

Hoyle, Tanner & Associates, Inc.

PROJECT NAME:	CLARENDON
PROJECT NUMBER:	BO 1443(55)
FILE NAME: z19j228pro.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: P.DUSTIN	CHECKED BY: A.BEAULAC
PROFILE SHEET	SHEET 5 OF 15

PC STA 12+54.85

PROPOSED STONE-LINED DRAINAGE SWALE (TYP)

BEGIN BRIDGE STA 13+39.38

PT STA 13+15.18

WINGWALL NO. 1

PROPOSED STONE FILL, TYPE IV

MILL RIVER FLOW

APPROXIMATE EXISTING TOWN R.O.W.

END BRIDGE STA 14+61.76

STEEL BACKED TIMBER GUARDRAIL (TYP)

VT STATE PLANE GRID

N

TO US ROUTE 7

PROPOSED DRIVE CULVERT

WINGWALL NO. 3

ECT

13+00

N 23°18'57.58" W

14+00

15+00

TH-39 (EAST STREET)

TO VT ROUTE 103

℄ CONSTRUCTION

BRIDGE NO. 28

WINGWALL NO. 4

APPROXIMATE EXISTING TOWN R.O.W.

PC STA 14+60.45

WINGWALL NO. 2

EDGE OF RIVER (TYP)

PROPOSED STONE FILL, TYPE I (TYP)

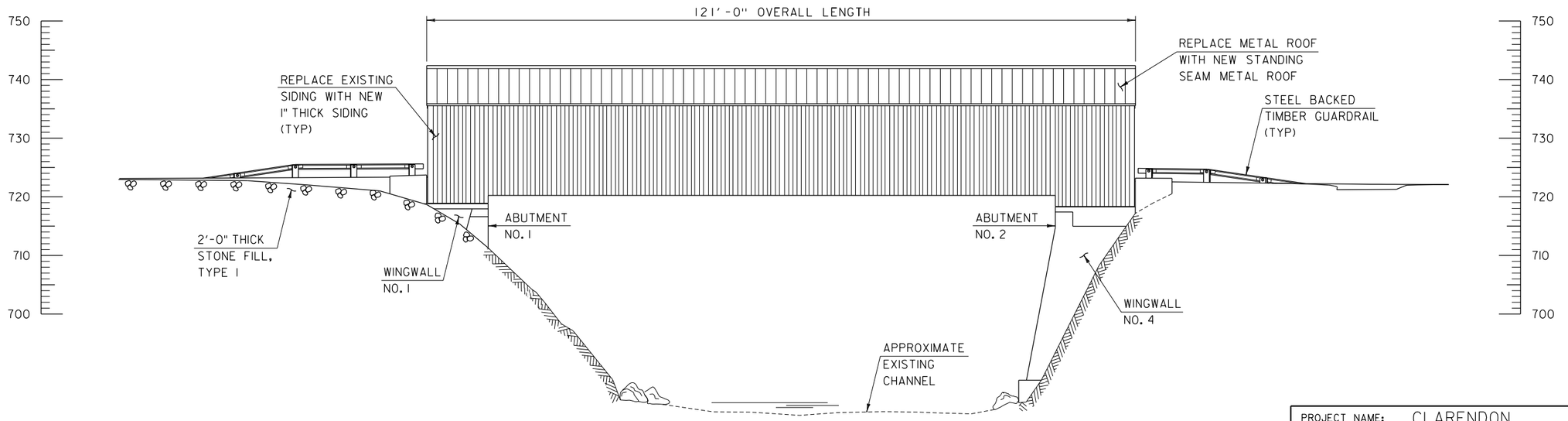
PROPOSED DRIVE CULVERT

PROPOSED CATCH BASIN

PROPOSED STONE FILL, TYPE I (TYP)

PLAN

SCALE: 1" = 10'



ELEVATION

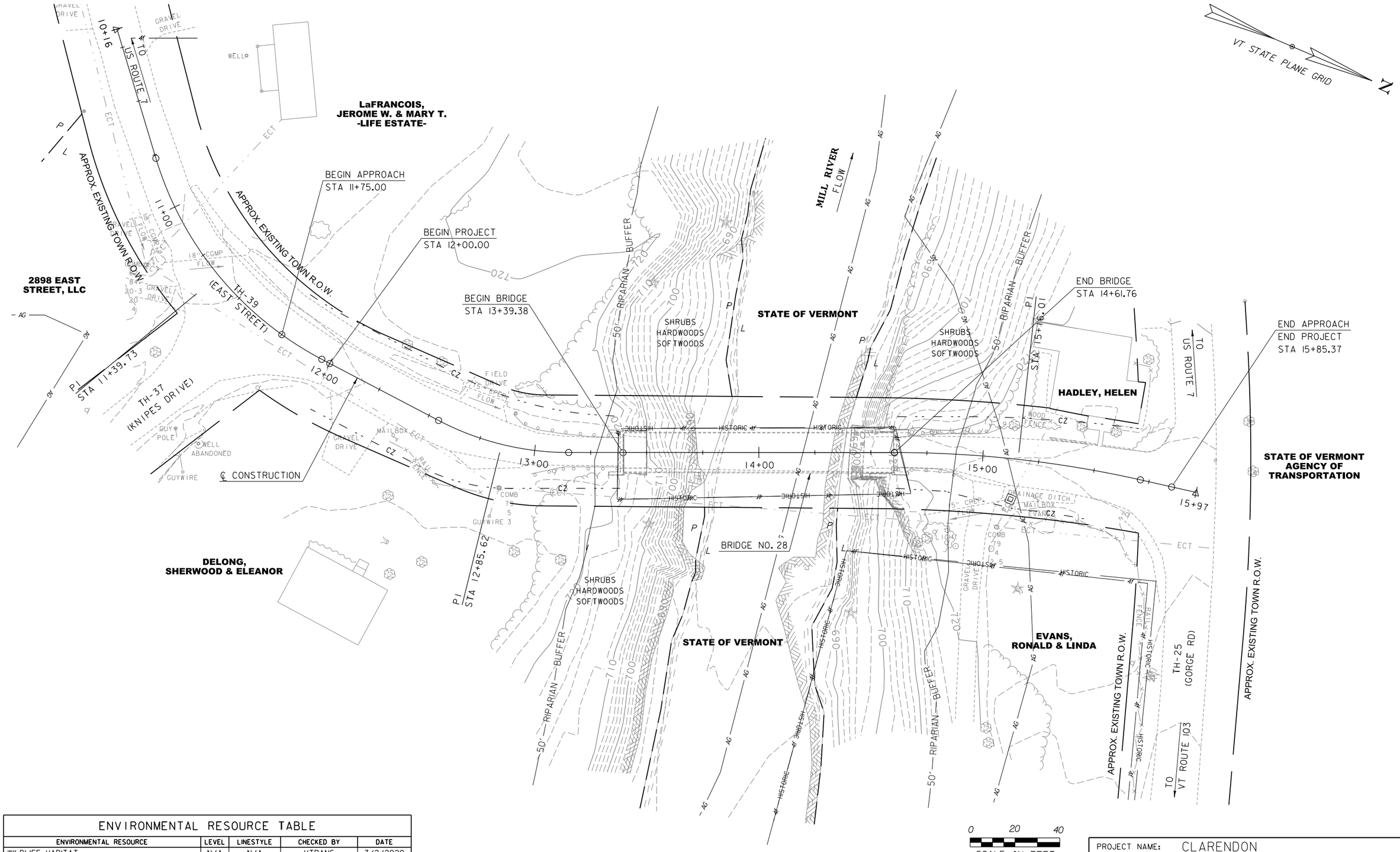
SCALE: 1" = 10'

Hoyle, Tanner & Associates, Inc.

PROJECT NAME: CLARENDON
PROJECT NUMBER: BO 1443(55)

FILE NAME: z19j228pe.dgn
PROJECT LEADER: L.STONE
DESIGNED BY: J.RIPLEY
GENERAL PLAN AND ELEVATION

PLOT DATE: 1/14/2021
DRAWN BY: P.DUSTIN
CHECKED BY: J.BICJA
SHEET 6 OF 15



ENVIRONMENTAL RESOURCE TABLE

ENVIRONMENTAL RESOURCE	LEVEL	LINESTYLE	CHECKED BY	DATE
WILDLIFE HABITAT	N/A	N/A	VTRANS	3/2/2020
RARE, THREATENED AND ENDANGERED SPECIES	N/A	N/A	VTRANS	3/2/2020
AGRICULTURAL	LAAS	—— AG ——	HOYLE, TANNER	10/5/2020
HISTORIC	MHBC	— HISTORIC —	VTRANS	3/2/2020
4F PROPERTY	LAAS	—— 4F ——	VTRANS	3/2/2020

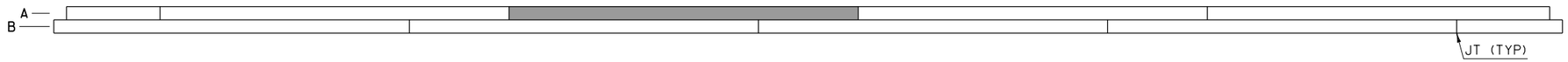
0 20 40
SCALE IN FEET

Hoyle, Tanner & Associates, Inc.

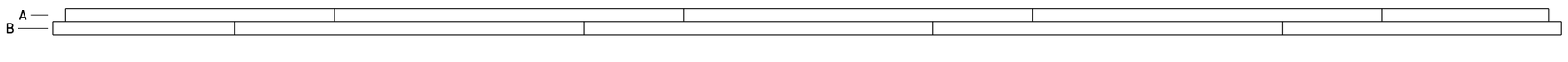
PROJECT NAME: CLARENDON
PROJECT NUMBER: BO 1443(55)

FILE NAME: z19j228res.dgn
PROJECT LEADER: L.STONE
DESIGNED BY: P.DUSTIN
RESOURCE SITE PLAN

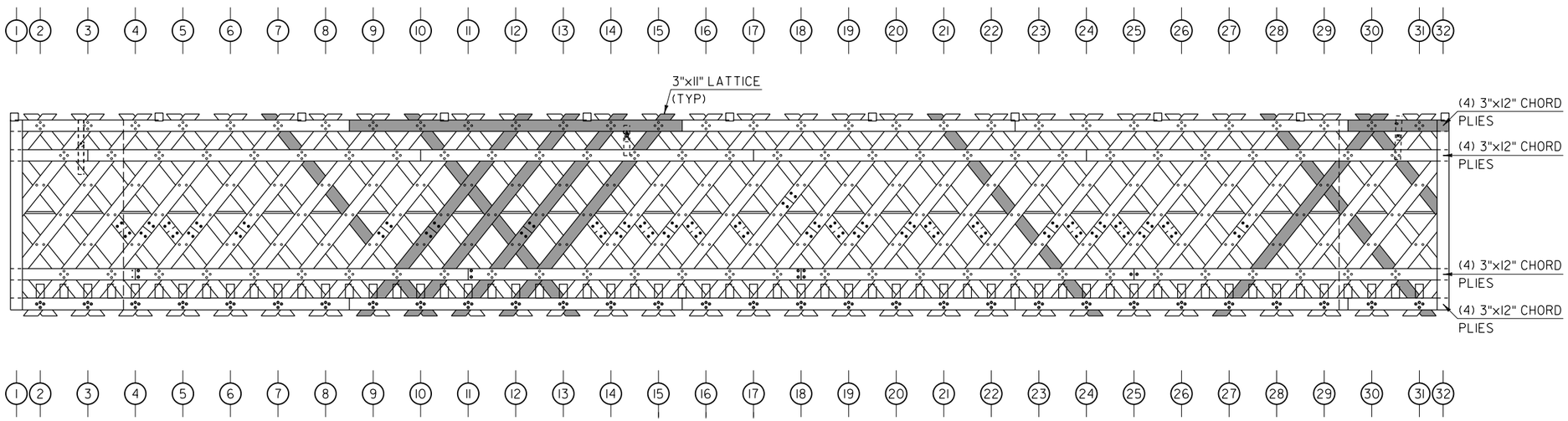
PLOT DATE: 1/14/2021
DRAWN BY: P.DUSTIN
CHECKED BY: J.BICJA
SHEET 7 OF 15



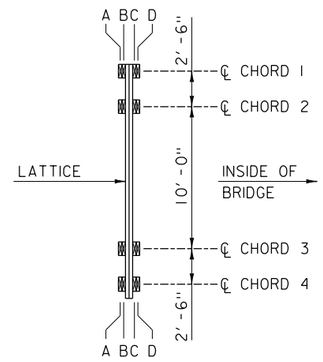
CHORD 1 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



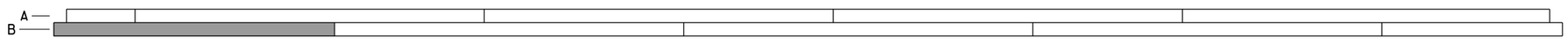
CHORD 2 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



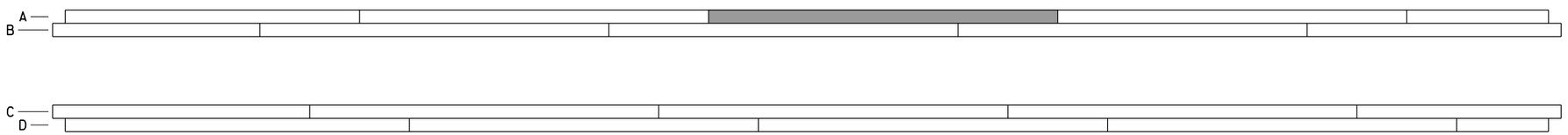
WEST TRUSS (LOOKING WEST)
SCALE: 3/16" = 1'-0"



TYPICAL TRUSS SECTION
SCALE: 3/16" = 1'-0"



CHORD 3 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



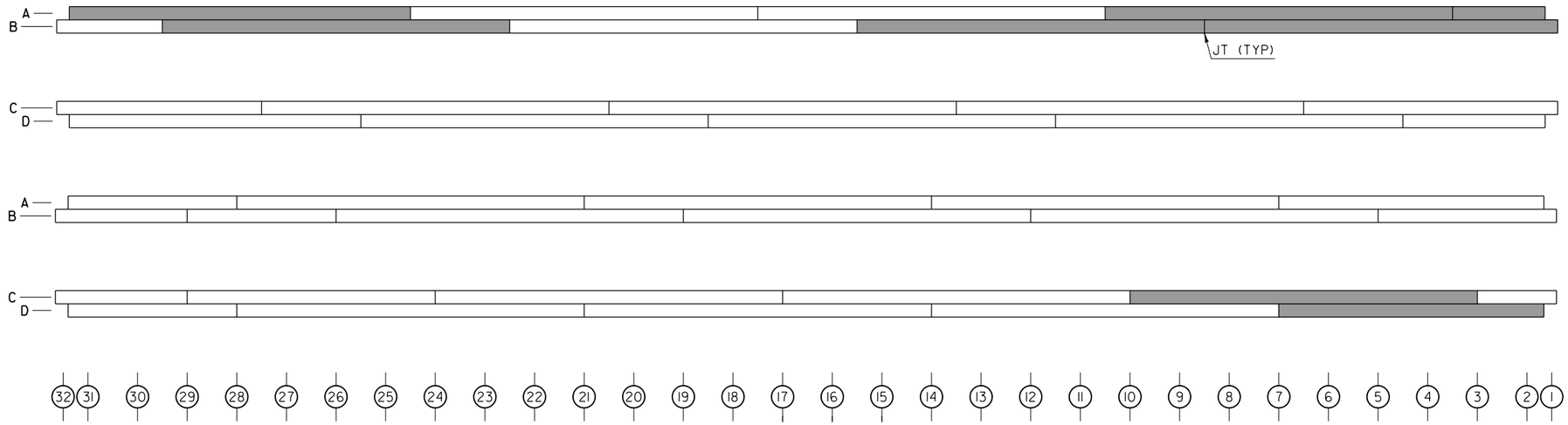
CHORD 4 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

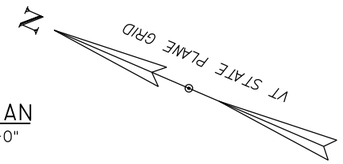
LEGEND

	PREDETERMINED MEMBER TO BE REPLACED
JT	CHORD PLY BUTT JOINT
(XX)	TRUSS NODE LOCATION

Hoyle, Tanner & Associates, Inc.

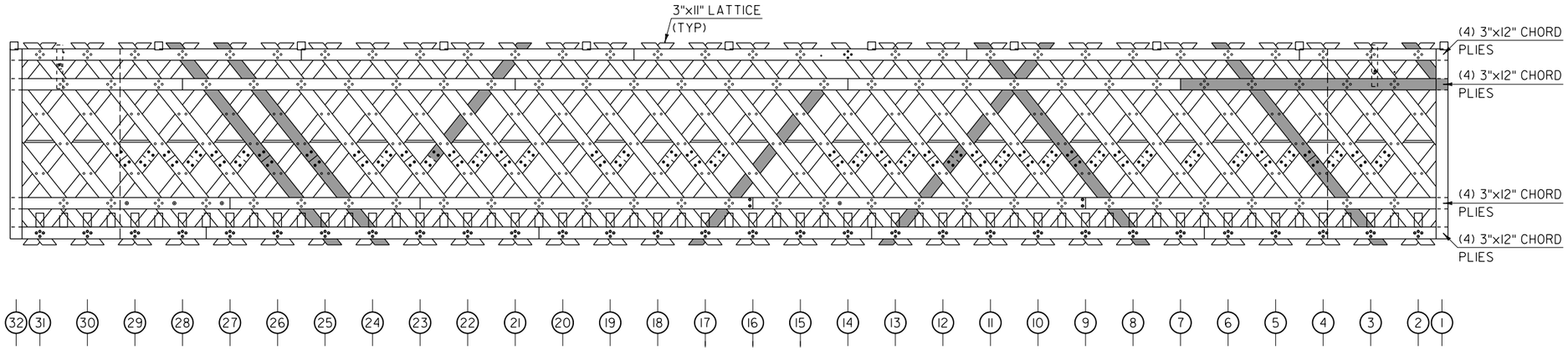
PROJECT NAME:	CLARENDON
PROJECT NUMBER:	BO 1443(55)
FILE NAME: z19j228sup3.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: J.RIPLEY	CHECKED BY: J.BICJA
WEST TRUSS H3 LIVE LOADING	SHEET 8 OF 15



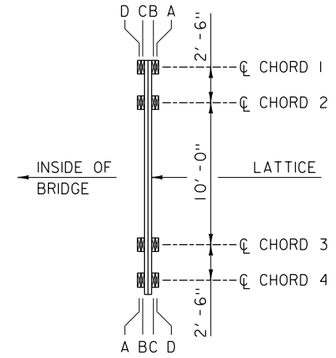


CHORD 1 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

CHORD 2 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



EAST TRUSS (LOOKING EAST)
SCALE: 3/16" = 1'-0"



TYPICAL TRUSS SECTION
SCALE: 3/16" = 1'-0"

CHORD 3 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

CHORD 4 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

LEGEND

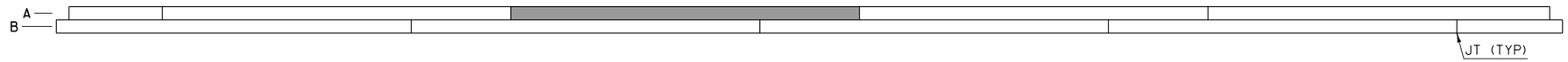
	PREDETERMINED MEMBER TO BE REPLACED
JT	CHORD PLY BUTT JOINT
(XX)	TRUSS NODE LOCATION

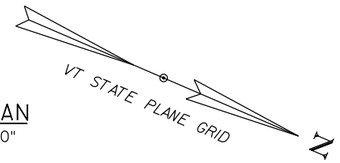
Hoyle, Tanner & Associates, Inc.

PROJECT NAME: CLARENDON
PROJECT NUMBER: BO 1443(55)

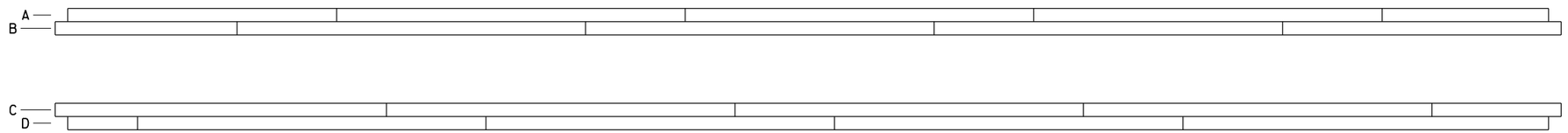
FILE NAME: z19j228sup3.dgn
PROJECT LEADER: L.STONE
DESIGNED BY: J.RIPLEY
EAST TRUSS H3 LIVE LOADING

PLOT DATE: 1/14/2021
DRAWN BY: P.DUSTIN
CHECKED BY: J.BICJA
SHEET 9 OF 15

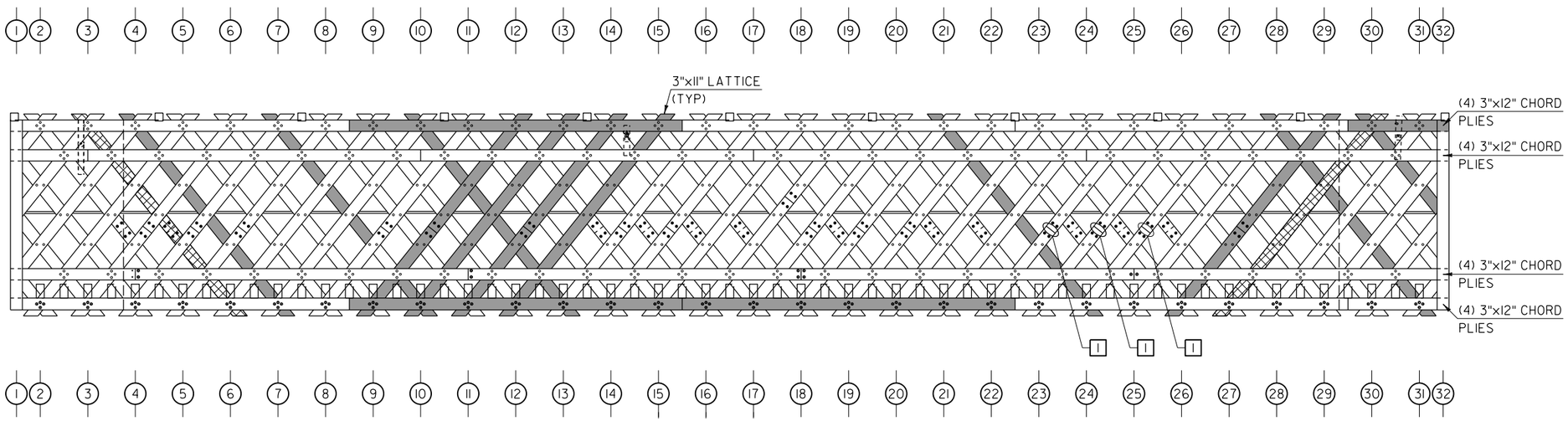




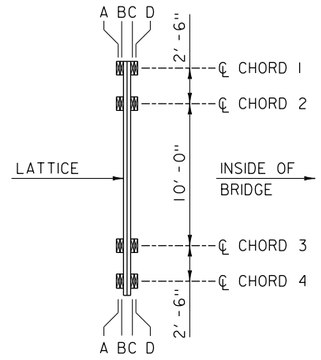
CHORD 1 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



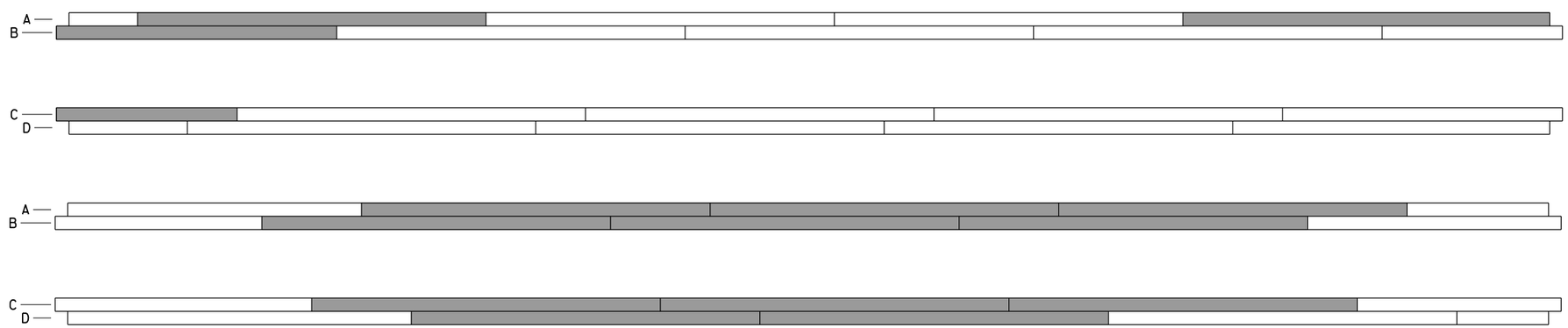
CHORD 2 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



WEST TRUSS (LOOKING WEST)
SCALE: 3/16" = 1'-0"



TYPICAL TRUSS SECTION
SCALE: 3/16" = 1'-0"



CHORD 3 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

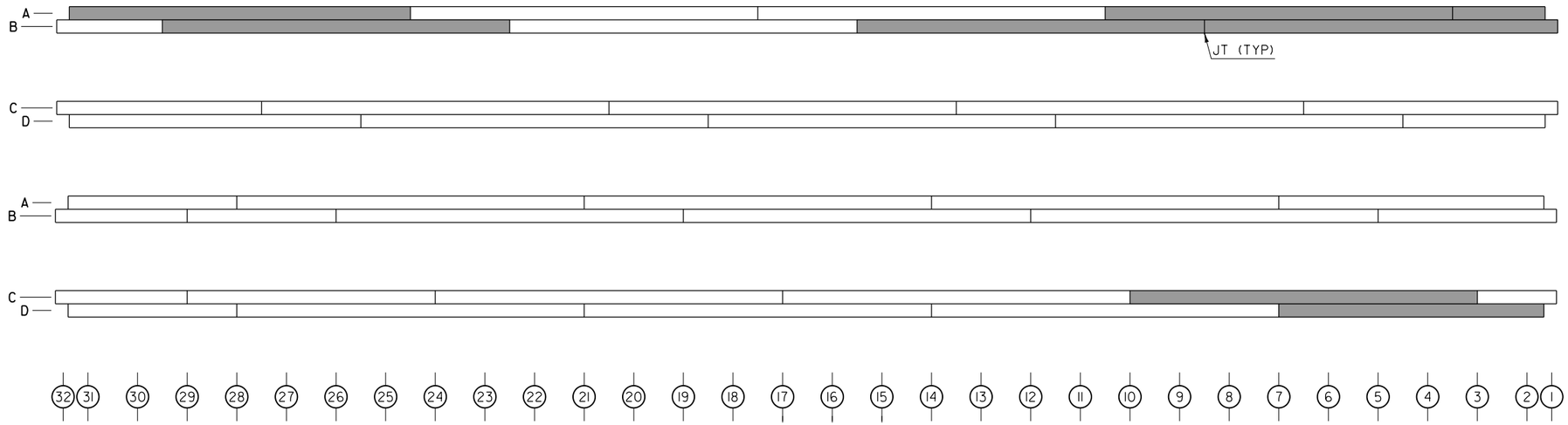
CHORD 4 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

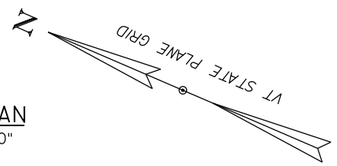
LEGEND

- PREDETERMINED MEMBER TO BE REPLACED
- MEMBER TO BE REPLACED WITH 4½"x11" TIMBER
- [1] ADD 2 ADDITIONAL 1" DIA BOLTS
- JT CHORD PLY BUTT JOINT
- (XX) TRUSS NODE LOCATION

Hoyle, Tanner & Associates, Inc.

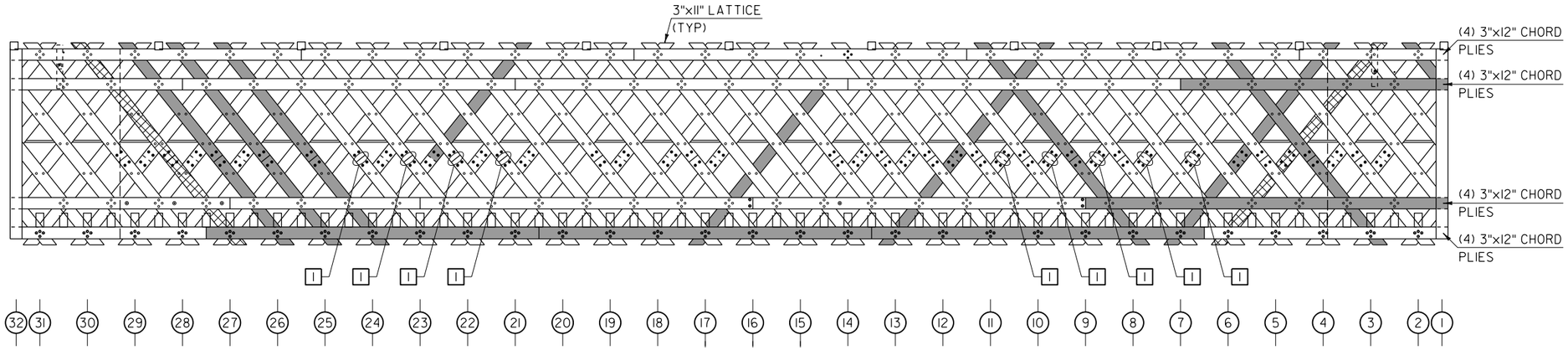
PROJECT NAME: CLARENDON	
PROJECT NUMBER: BO 1443(55)	
FILE NAME: z19j228sup3.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: J.RIPLEY	CHECKED BY: J.BICJA
WEST TRUSS HI2 LIVE LOADING	SHEET 10 OF 15



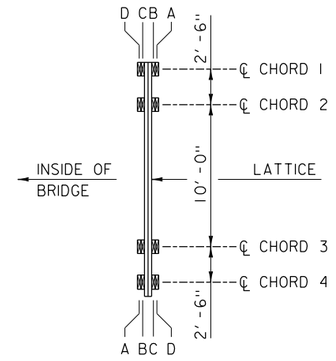


CHORD 1 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

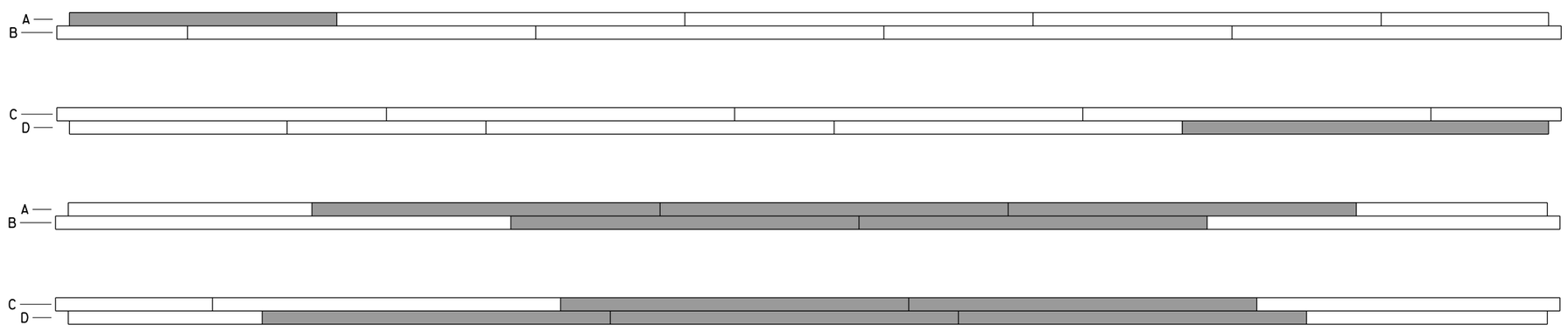
CHORD 2 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



EAST TRUSS (LOOKING EAST)
SCALE: 3/16" = 1'-0"



TYPICAL TRUSS SECTION
SCALE: 3/16" = 1'-0"



CHORD 3 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

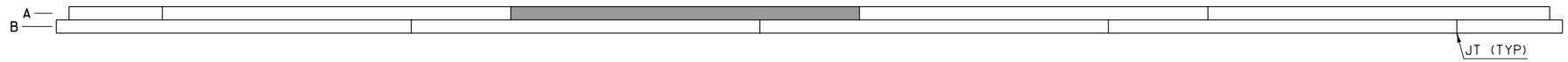
CHORD 4 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

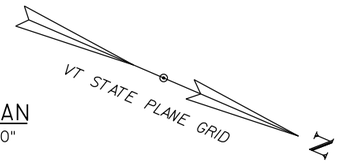
LEGEND

- PREDETERMINED MEMBER TO BE REPLACED
- MEMBER TO BE REPLACED WITH 4½"x11" TIMBER
- [1] ADD 2 ADDITIONAL 1" DIA BOLTS
- JT CHORD PLY BUTT JOINT
- (XX) TRUSS NODE LOCATION

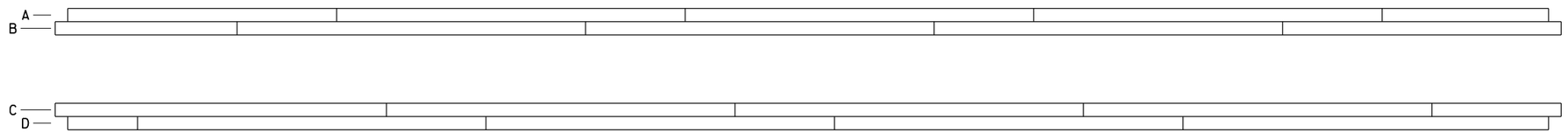
Hoyle, Tanner & Associates, Inc.

PROJECT NAME: CLARENDON	
PROJECT NUMBER: BO 1443(55)	
FILE NAME: z19j228sup3.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: J.RIPLEY	CHECKED BY: J.BICJA
EAST TRUSS H12 LIVE LOADING	SHEET 11 OF 15





CHORD 1 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



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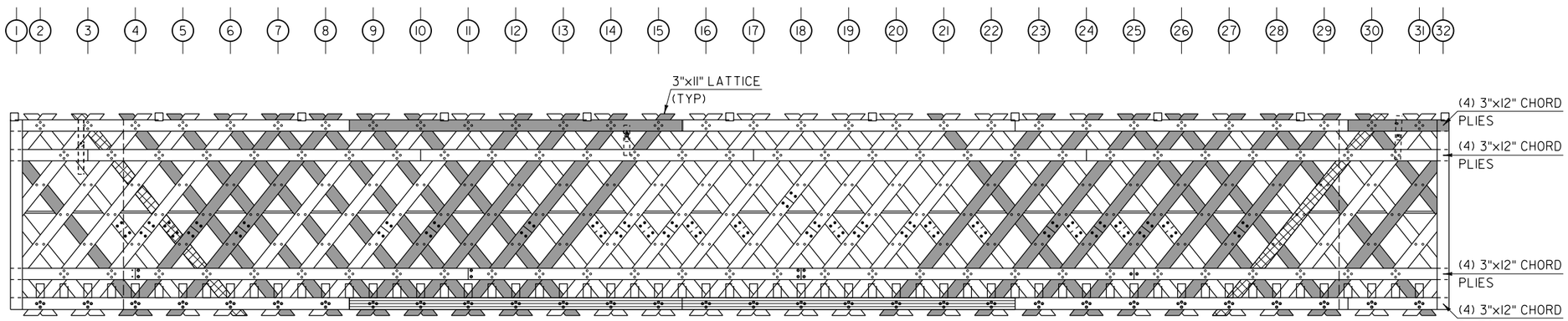
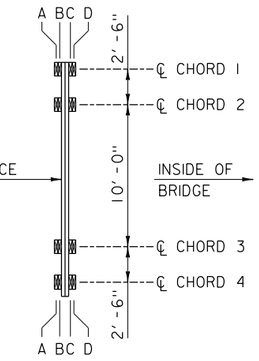
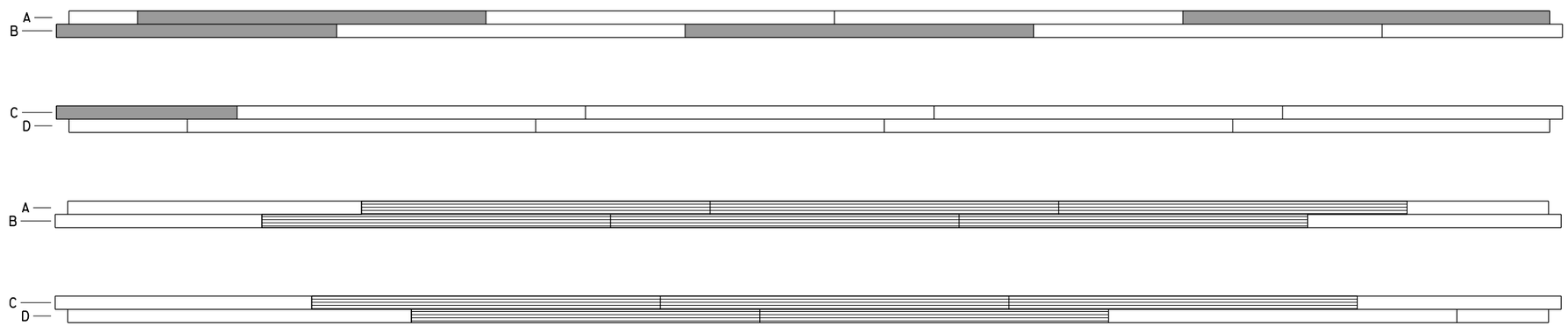
SCALE: 3/16" = 1'-0"
NTS (V)



WEST TRUSS (LOOKING WEST)
SCALE: 3/16" = 1'-0"



TYPICAL TRUSS SECTION
SCALE: 3/16" = 1'-0"



CHORD 3 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

CHORD 4 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

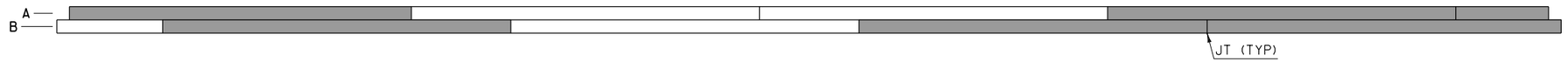
LEGEND

- PREDETERMINED MEMBER TO BE REPLACED
- MEMBER TO BE REPLACED WITH 4½"xII" TIMBER
- MEMBER TO BE REPLACED WITH 3"xI5" TIMBER
- JT — CHORD PLY BUTT JOINT
- (XX) — TRUSS NODE LOCATION

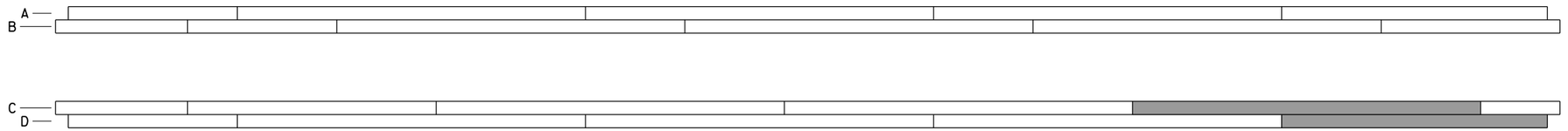
Hoyle, Tanner & Associates, Inc.

PROJECT NAME:	CLARENDON
PROJECT NUMBER:	BO 1443(55)

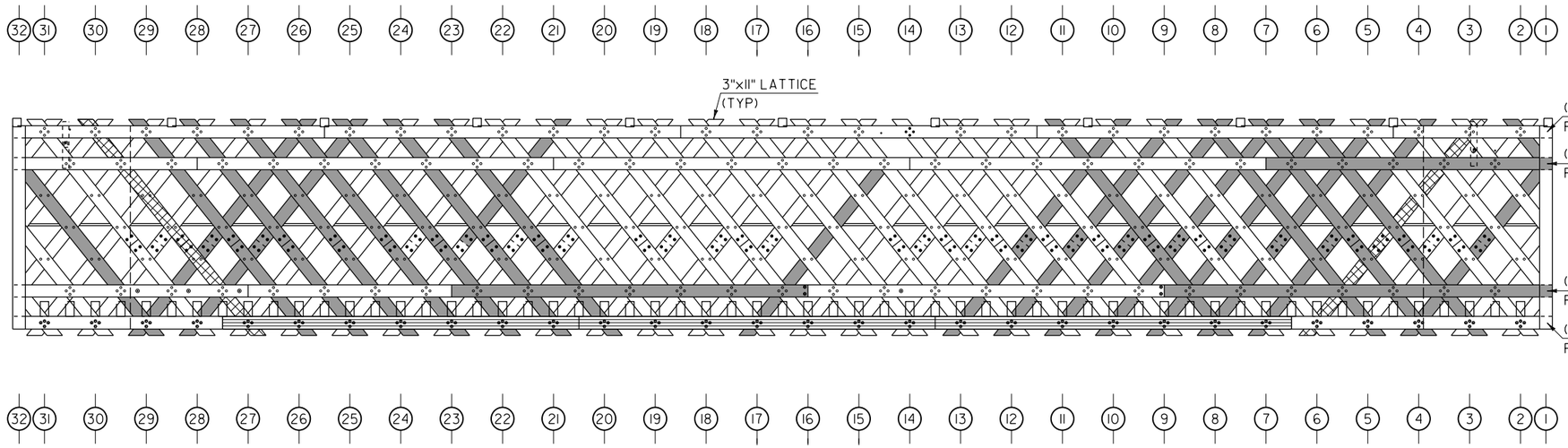
FILE NAME: z19j228sup3.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: J.RIPLEY	CHECKED BY: J.BICJA
WEST TRUSS HI5 LIVE LOADING	SHEET 12 OF 15



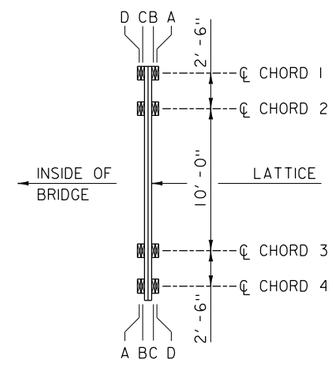
CHORD 1 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



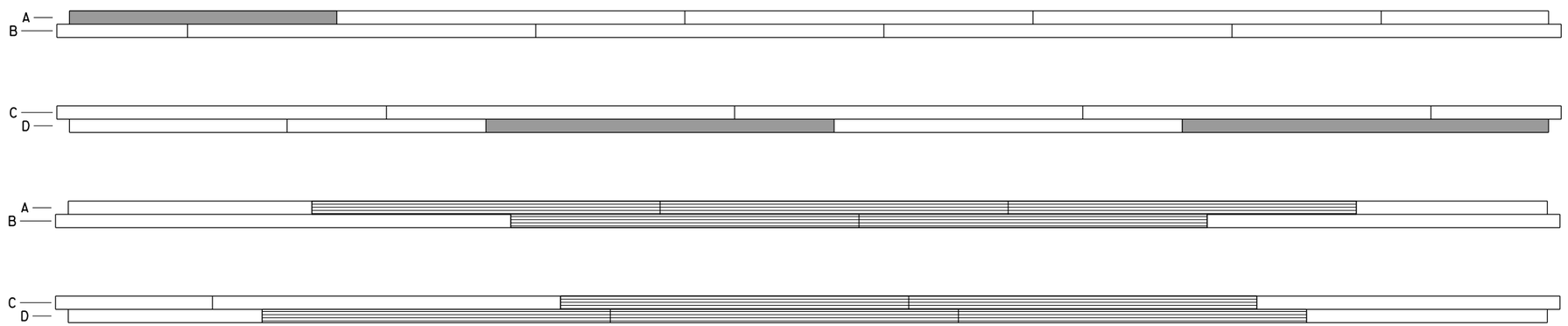
CHORD 2 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



EAST TRUSS (LOOKING EAST)
SCALE: 3/16" = 1'-0"



TYPICAL TRUSS SECTION
SCALE: 3/16" = 1'-0"



CHORD 3 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

CHORD 4 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

LEGEND

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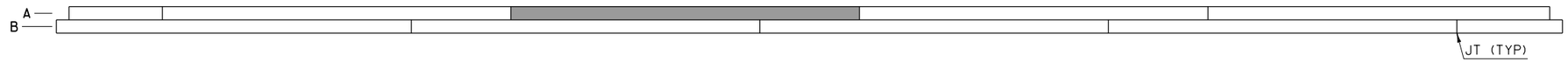
- (XX) — TRUSS NODE LOCATION

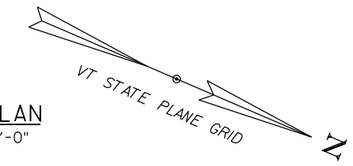
Hoyle, Tanner & Associates, Inc.

PROJECT NAME: CLARENDON
PROJECT NUMBER: BO 1443(55)

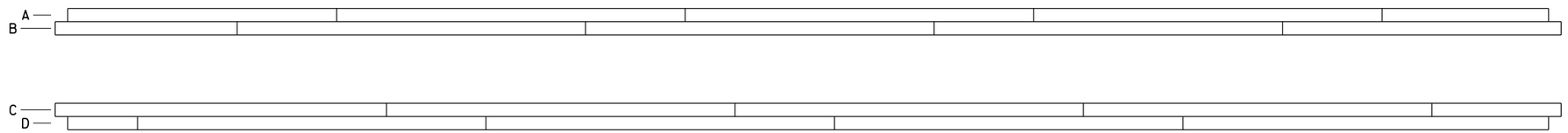
FILE NAME: z19j228sup3.dgn
PROJECT LEADER: L.STONE
DESIGNED BY: J.RIPLEY
EAST TRUSS H15 LIVE LOADING

PLOT DATE: 1/14/2021
DRAWN BY: P.DUSTIN
CHECKED BY: J.BICJA
SHEET 13 OF 15

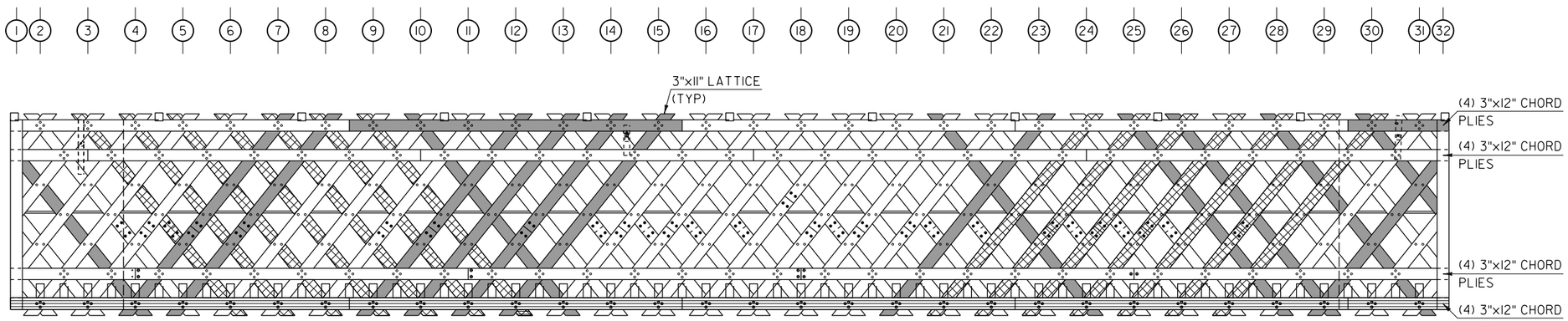


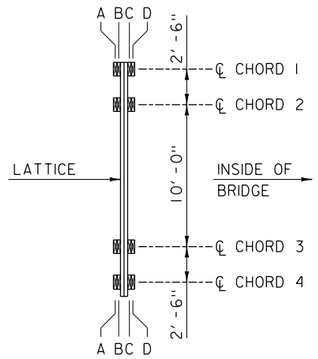


CHORD 1 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



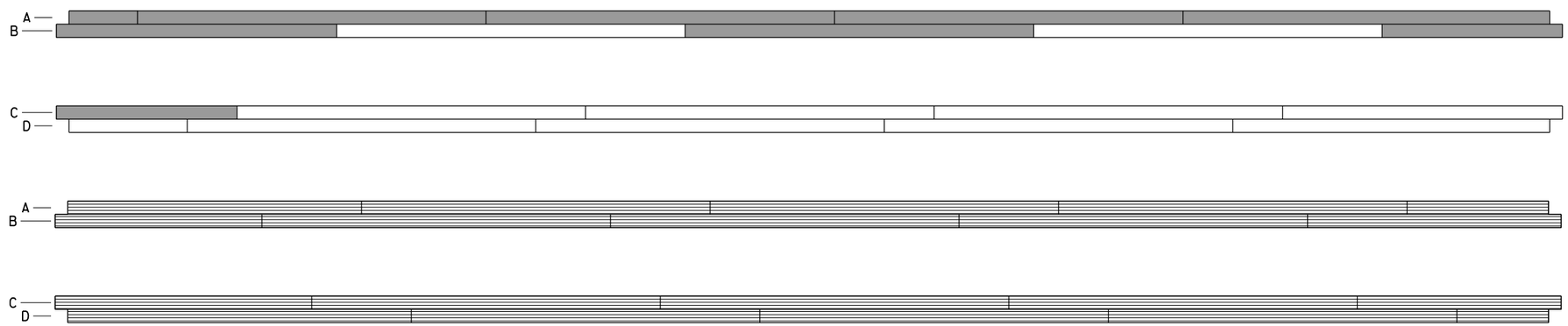
CHORD 2 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)





TYPICAL TRUSS SECTION
SCALE: 3/16" = 1'-0"

WEST TRUSS (LOOKING WEST)
SCALE: 3/16" = 1'-0"



CHORD 3 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

CHORD 4 PLAN
SCALE: 3/16" = 1'-0"
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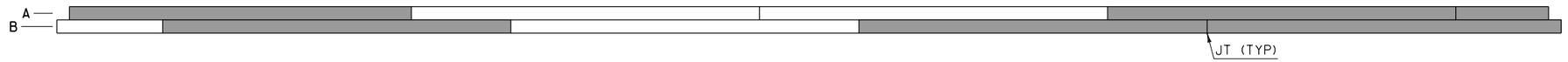
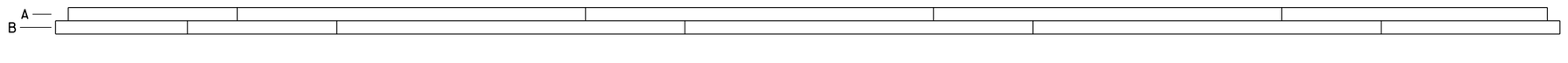
Hoyle, Tanner & Associates, Inc.

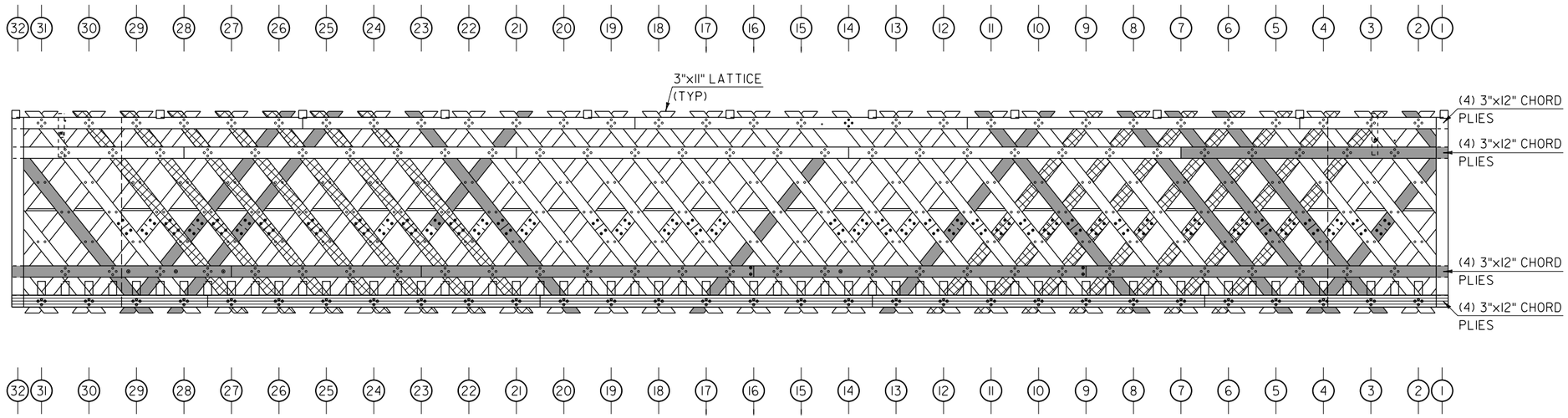
PROJECT NAME: CLARENDON	
PROJECT NUMBER: BO 1443(55)	
FILE NAME: z19j228sup3.dgn	PLOT DATE: 1/14/2021
PROJECT LEADER: L.STONE	DRAWN BY: P.DUSTIN
DESIGNED BY: J.RIPLEY	CHECKED BY: J.BICJA
WEST TRUSS H20 LIVE LOADING	SHEET 14 OF 15



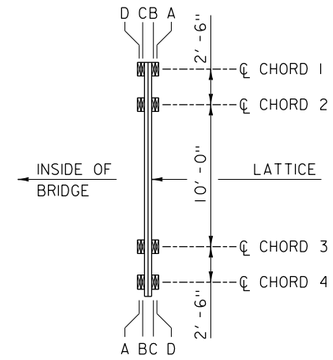
CHORD 1 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



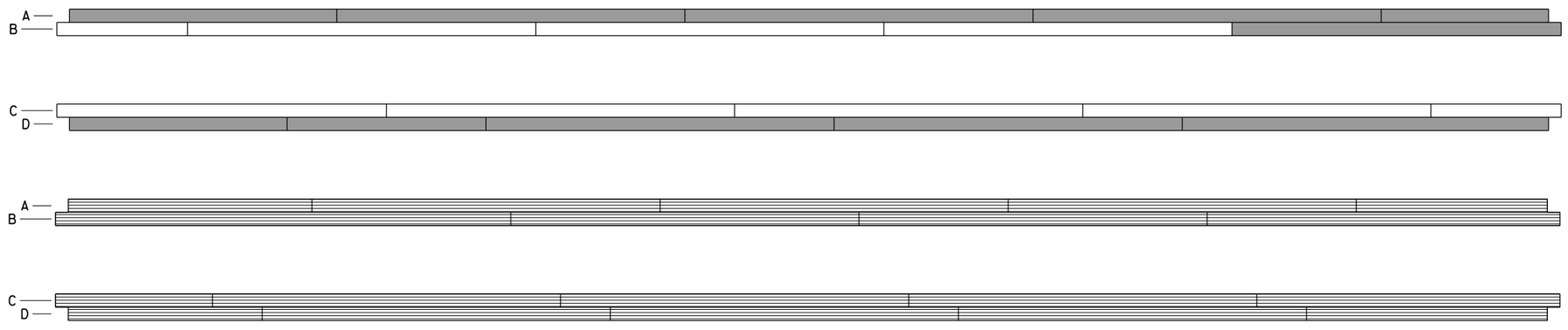
CHORD 2 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)



EAST TRUSS (LOOKING EAST)
SCALE: 3/16" = 1'-0"



TYPICAL TRUSS SECTION
SCALE: 3/16" = 1'-0"



CHORD 3 PLAN
SCALE: 3/16" = 1'-0"
NTS (V)

CHORD 4 PLAN
SCALE: 3/16" = 1'-0"
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Hoyle, Tanner & Associates, Inc.

PROJECT NAME: CLARENDON
PROJECT NUMBER: BO 1443(55)

FILE NAME: z19j228sup3.dgn
PROJECT LEADER: L.STONE
DESIGNED BY: J.RIPLEY
EAST TRUSS H20 LIVE LOADING

PLOT DATE: 1/14/2021
DRAWN BY: P.DUSTIN
CHECKED BY: J.BICJA
SHEET 15 OF 15

APPENDIX F

Local Concerns Meeting Presentation

LOCAL CONCERNS MEETING

KINGSLEY COVERED BRIDGE
CLARENDON BO 1443(55)
TH 39, BRIDGE NO. 28 OVER MILL RIVER

AUGUST 10, 2020

1

PRESENTATION OUTLINE

- Purpose and Need
- Location Map
- Existing Bridge Information
- Inspection Findings
- Rehabilitation & Traffic Control Alternatives
- Cultural & Natural Resources
- Abutters & Right-of-Way
- Your Input is Needed
- Next Steps
- Anticipated Schedule
- Questions

2

PURPOSE AND NEED

Purpose

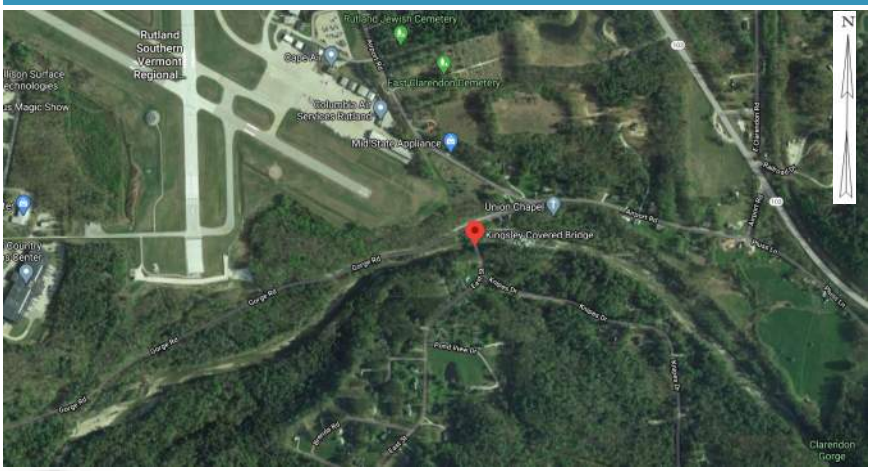
- Evaluate the Kingsley Covered Bridge for continued Special Use on Roads crossing the Mill River and to extend its service life

Need

- Continue to provide access for vehicles across Mill River in the eastern part of the Town of Clarendon

3

LOCATION MAP

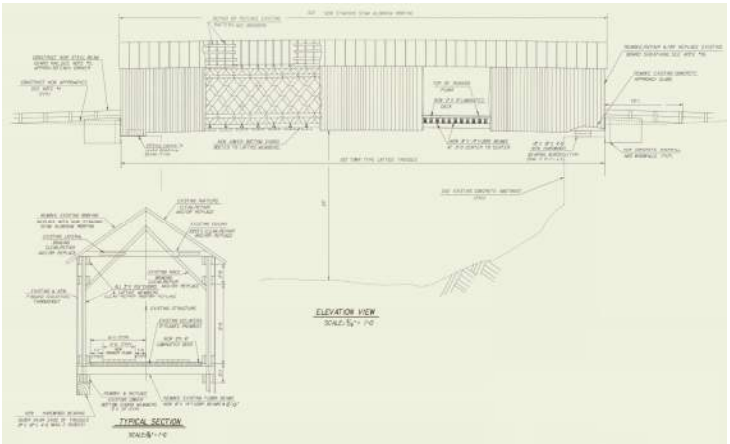


4

EXISTING BRIDGE INFORMATION

- Bridge constructed in 1836, Rehabilitated in 1949 & 1987
- Listed in National Register of Historic Places in 1974
- Town Lattice Trusses:
  - 120' Long (Portal to Portal)
  - 15'-7" On Center
  - 11'-0" Vertical Clearance
  - Posted Weight 3 Tons
- Substructures: Reinforced Concrete Abutments Founded on Bedrock

SECTION AND ELEVATION VIEW



INSPECTION FINDINGS

- National Bridge Inspection Standard Condition Ratings
  - 9 = Excellent
  - 0 = Failed Condition - Closed
- Overall bridge condition is rated 5 or fair.
  - Deck condition is rated 7 or good.
  - Superstructure condition is rated 5 or fair.
  - Substructure condition is rated 7 or good.
  - Channel condition is rated 8 or very good.

7

METAL ROOF

Paint Blistering, Fading, Ridge Cap Attached with Nails & Screws, Trees Overgrown




8

ROOF MEMBERS

Splits, Breaks, Rot, Overcuts, Insect Damage




9

BRACING MEMBERS

Guy wires not well anchored

10

LATTICE MEMBERS

Large Gaps at Previous Splices, Splits, Breaks, Rot, Insect Damage




11

TOP CHORD MEMBERS

Out of Plumb, Splits, Breaks, Rot, Insect Damage



12

BOTTOM CHORD MEMBERS

Bedding Timbers Rotted, Settling of Trusses, Rusting of Bolts




13

FLOOR MEMBERS

Runners Trap Debris, Ramps Each End



14

SUBSTRUCTURE

Concrete Cracks, Spalling, Delamination

15

REHABILITATION ALTERNATIVES ANALYSIS

- Bridge rehabilitation is feasible based on:
  - Current condition of bridge.
  - Deterioration type and level of section losses observed.
  - Expected remaining service life.
- Rehabilitation will extend service life.

16

REHABILITATION ALTERNATIVES ANALYSIS

- Bridge rehabilitation alternatives analysis will consider and evaluate:
  - H-3 (3-Ton) Design Vehicle
  - H-12 (12-Ton) Design Vehicle
  - H-15 (15-Ton) Design Vehicle
  - H-20 (20-Ton) Design Vehicle

17

REHABILITATION ALTERNATIVES ANALYSIS

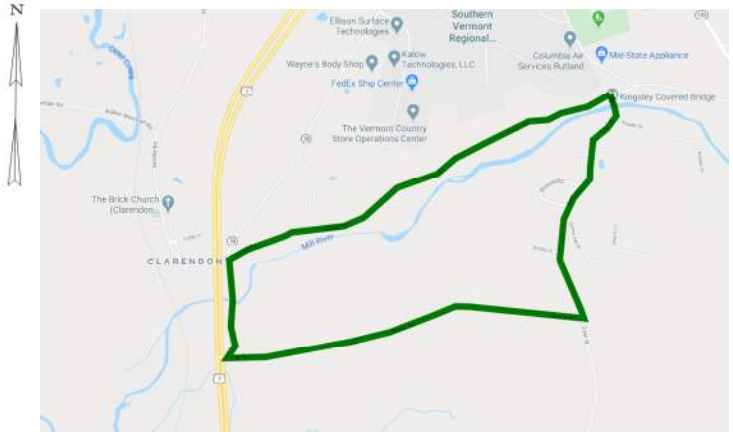
- Rehabilitation alternatives evaluation will include:
  - Initial construction cost.
  - Traffic impact.
  - Public safety.
  - Environmental impacts.
  - Property impacts.
  - Extending remaining service life.
  - Public input.

18

TRAFFIC CONTROL ALTERNATIVES

- Phased construction.
  - One lane of alternating two-way traffic (Not Feasible)
- Temporary bridge (Not Feasible)
- Bridge closure with off-site detour:
  - East St to Gorge Rd, VT Route 7B, Bump Rd, back to East St (3.8 miles)

POTENTIAL DETOUR ROUTE



CULTURAL RESOURCES

- Project must follow Section 106 of the National Historic Preservation Act
- Section 106 requires consideration of cultural resources, including historic buildings, structures & archaeological deposits
- Coordinate with State Historic Preservation Office (SHPO) and Historic Covered Bridge Preservation Committee (HCBPC)

21

NATURAL RESOURCES
ABUTTERS & RIGHT-OF-WAY

- Natural Resources
  - Check project limits for natural resources.
- Abutters & Right-of-Way
  - We currently do not anticipate any property rights needed
    - Temporary easements for construction access may be required

22

YOUR INPUT IS NEEDED

- Abutter concerns
- Emergency response routes
- Bridge usage
- Local events and impacts
- Bridge safety concerns
- Other concerns

23

NEXT STEPS

- Evaluate rehabilitation alternatives
- HCBPC presentation to get input & comments
- Hold Public Information Meeting to present recommended rehabilitation alternative
- Complete National Environmental Policy Act (NEPA) Process for environmental permitting
- Prepare Scoping Report
- Develop contract plan & documents

24

ANTICIPATED SCHEDULE

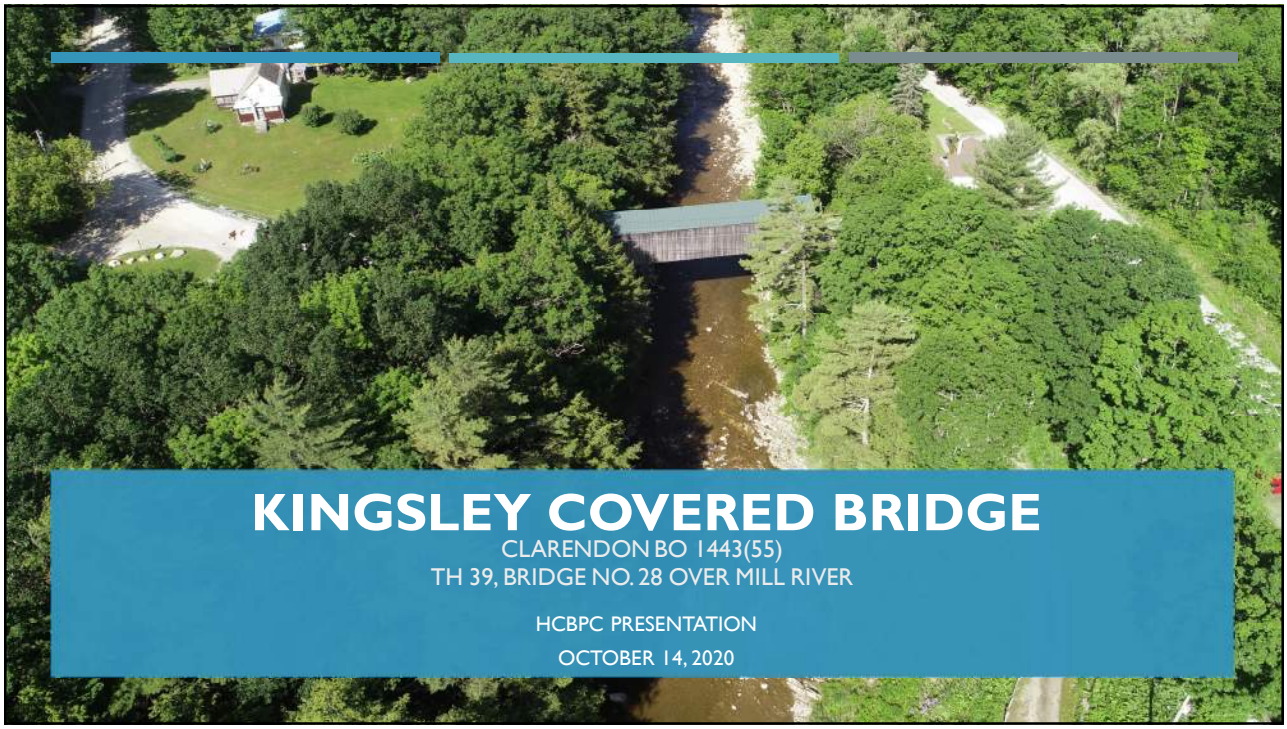
25

QUESTIONS

26

APPENDIX G

Historic Covered Bridge Preservation Committee
Presentation and Meeting Notes



KINGSLEY COVERED BRIDGE

CLARENDON BO 1443(55)
TH 39, BRIDGE NO. 28 OVER MILL RIVER

HCBPC PRESENTATION
OCTOBER 14, 2020

1

PRESENTATION OUTLINE

- Purpose and Need
- Background
- Inspection Findings
- Rehabilitation Alternatives
- Right of Way, Utilities, Fire Protection
- Summary
- Questions

2

PURPOSE AND NEED

Purpose

- Evaluate the Kingsley Covered Bridge for continued Special Use on Roads crossing the Mill River and to extend its service life

Need

- Continue to provide access for vehicles across Mill River in the eastern part of the Town of Clarendon

BACKGROUND

- Bridge constructed in 1836, Rehabilitated in 1949 & 1987
- Listed in National Register of Historic Places in 1974
- Town Lattice Trusses:
  - 121' Long (Portal to Portal)
  - 15'-7" On Center
  - 12'-1" Vertical Clearance
  - Posted Weight 3 Tons
- Substructures: Reinforced Concrete Abutments Founded on Bedrock

INSPECTION FINDINGS

- National Bridge Inspection Standard Condition Ratings
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INSPECTION FINDINGS: METAL ROOF

Paint Blistering, Fading, Ridge Cap Attached with Nails & Screws, Trees Overgrown

INSPECTION FINDINGS: ROOF MEMBERS

Splits, Breaks, Rot, Overcuts, Insect Damage

7

INSPECTION FINDINGS: BRACING MEMBERS

Guy wires not well anchored

8

INSPECTION FINDINGS: LATTICE MEMBERS

Large Gaps at Previous Splices, Splits, Breaks, Rot, Insect Damage




9

INSPECTION FINDINGS: TOP CHORD MEMBERS

Out of Plumb, Splits, Breaks, Rot, Insect Damage



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INSPECTION FINDINGS: BOTTOM CHORD MEMBERS

Bedding Timbers Rotted, Settling of Trusses, Rusting of Bolts




11

INSPECTION FINDINGS: FLOOR MEMBERS

Runners Trap Debris, Ramps Each End



12

INSPECTION FINDINGS: SUBSTRUCTURE

Concrete
Cracks,
Spalling,
Delamination,
Efflorescence
Staining

REHABILITATION ALTERNATIVES

- Bridge Rehabilitation is feasible based on:
  - Current condition of bridge.
  - Deterioration type and level of section losses observed.
- Rehabilitation includes:
  - Repair, Strengthening or Replacement of bridge members
- Bridge Loads
  - Snow – 50 PSF Ground, 27 PSF Roof Applied
  - Wind – 22 PSF
  - Live Load – H3, H12, H15 and H20

ROOF MEMBERS

15

ROOF MEMBERS – RECOMMENDED WORK

Roof Framing

- New Standing Seam Metal Roof
- Rafters are 3”x5” or 4”x5” Eastern Spruce
- Roof Boards are 1” thick Eastern Hemlock
- 20% Replacement of Existing Roof Boards (PTN 2)
- 12 Rafters (19%) to be Replaced due to Condition (PTN 2)
- 5 Rafters to be Epoxy Repaired (PTN 3)

16

LATERAL BRACING MEMBERS

17

LAT. BRACING MEMBERS – RECOMMENDED WORK

Lateral Bracing Members

- Upper Bracing Includes 8”x9” Crossbeams, 4”x5” “X” Braces and 4”x4” Org. Knee Braces and 4”x5” Knee Braces
- Bracing Members are Eastern Spruce
- 3 Crossbeams (27%) to be Replaced due to Condition (PTN 2) and 5 Epoxied Repaired (PTN 3)
- 3 Braces (15%) to be Replaced due to Condition (PTN 2)
- 5 - 4”x5” Knee Braces (23%) and 2 - 4”x4” Knee Braces (9%) to be Replaced due to Condition (PTN 2)

18

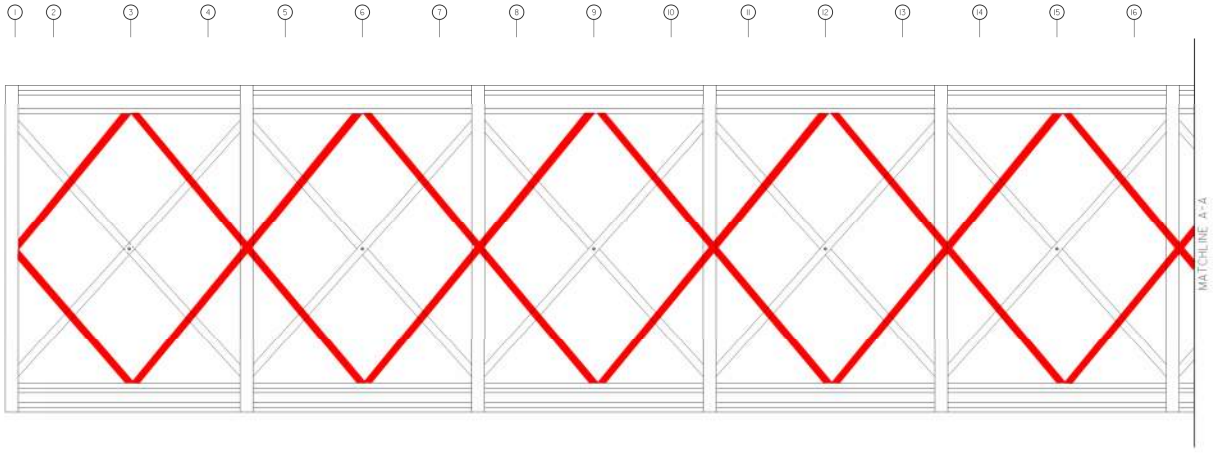
LAT. BRACING MEMBERS – RECOMMENDED WORK

Guy Wiring Members

- Existing Lateral Bracing not Adequate to allow removal of guy wiring.
- Strengthen Crossbeam to Chord connection or
- Add Additional Lateral Bracing Below the Crossbeam

Green River Covered Bridge, Guilford

LAT. BRACING MEMBERS – RECOMMENDED WORK



FLOOR FRAMING MEMBERS

21

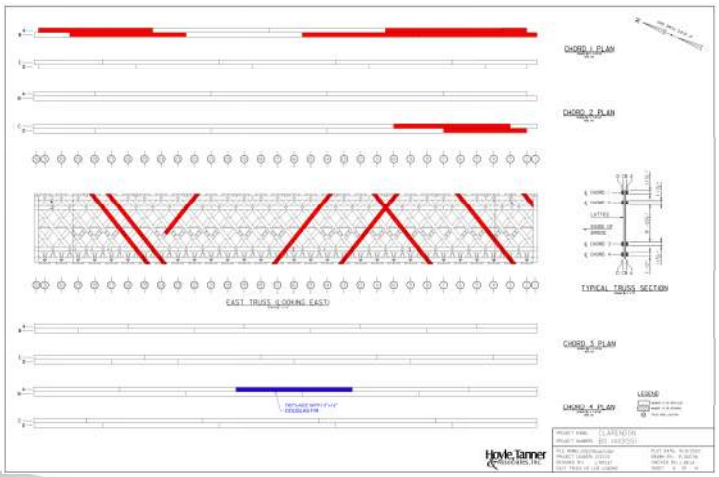
FLOOR MEMBERS – RECOMMENDED WORK

Floor Framing Members

- Floor Members Include 8"x14" Floorbeams, 2"x6" Nail Laminated Deck and 3" thick Runner Boards
- Floorbeams are Southern Pine and Decking is Eastern Spruce
- Nail Laminated Deck Adequate for H20
- Floorbeams Adequate for H15
- Replace Runner Boards with full width Runners (PT 2)
- No Floorbeam/Deck Replacement or Repair Required

22

REHABILITATION ALTERNATIVES: H3 EAST TRUSS



Lattice Replacement 12%

Chord Replacement 12%

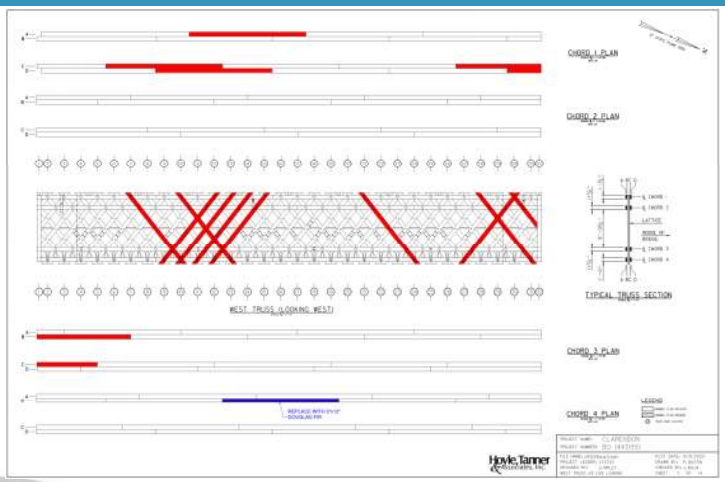
Legend:

Red – Replace due to Condition (PTN 2)

Blue – Replace due to Strength (PTN 2)

23

REHABILITATION ALTERNATIVES: H3 WEST TRUSS



Lattice Replacement 16%

Chord Replacement 10%

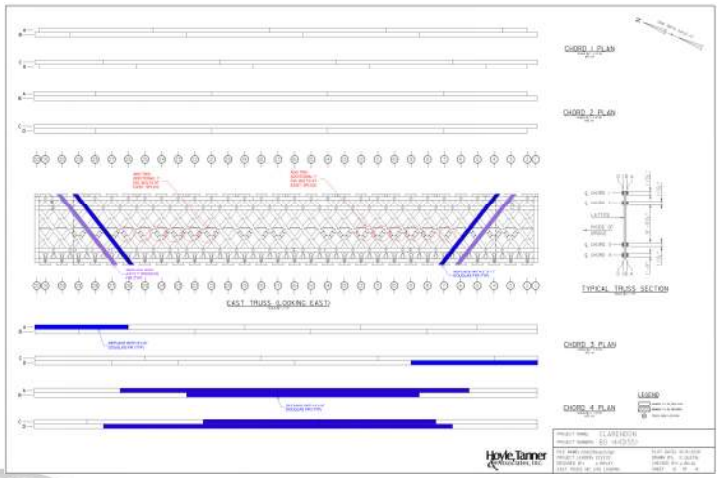
Legend:

Red – Replace due to Condition (PTN 2)

Blue – Replace due to Strength (PTN 2)

24

REHABILITATION ALTERNATIVES: H12 EAST TRUSS



Lattice Replacement +7%

Chord Replacement +18%

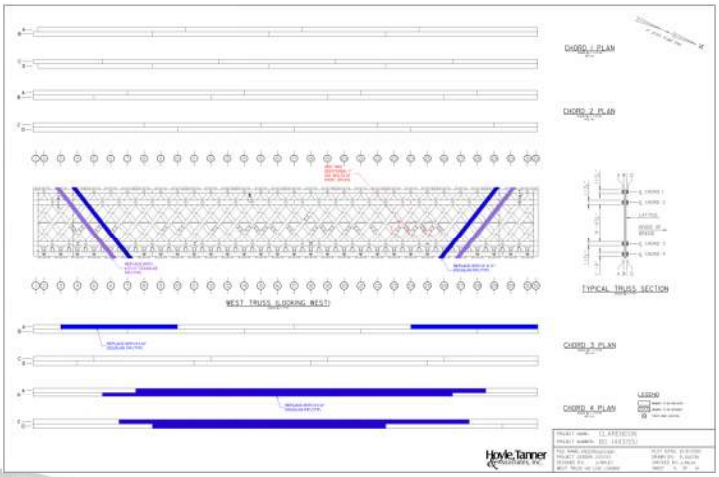
Legend:

Blue – Replace due to Strength (PTN 2)

Purple – Replace due to Strength w/Larger Size (PTN 5)

25

REHABILITATION ALTERNATIVES: H12 WEST TRUSS



Lattice Replacement +7%

Chord Replacement +20%

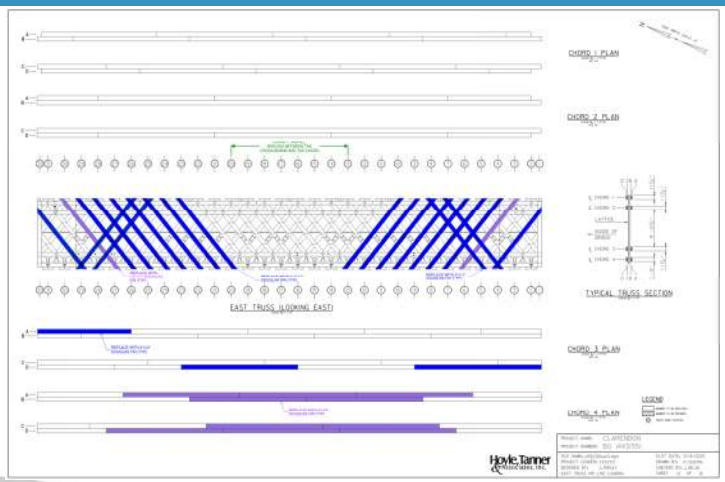
Legend:

Blue – Replace due to Strength (PTN 2)

Purple – Replace due to Strength w/Larger Size (PTN 5)

26

REHABILITATION ALTERNATIVES: H15 EAST TRUSS



Lattice Replacement +37%

Chord Replacement +19%

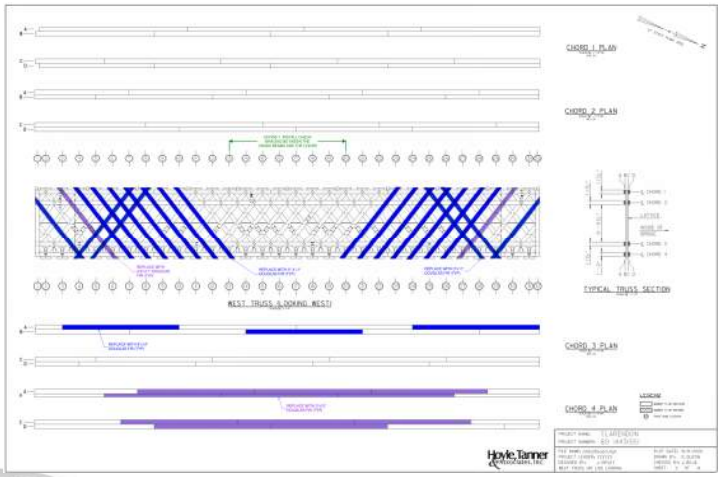
Legend:

Blue – Replace due to Strength (PTN 2)

Purple – Replace due to Strength w/Larger Size (PTN 5)

27

REHABILITATION ALTERNATIVES: H15 WEST TRUSS



Lattice Replacement +37%

Chord Replacement +21%

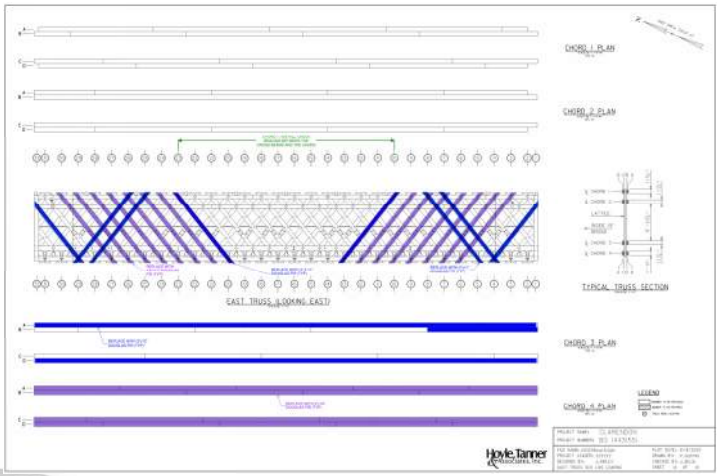
Legend:

Blue – Replace due to Strength (PTN 2)

Purple – Replace due to Strength w/Larger Size (PTN 5)

28

REHABILITATION ALTERNATIVES: H20 EAST TRUSS



Lattice Replacement +37%

Chord Replacement +39%

Legend:

Blue – Replace due to Strength (PTN 2)

Purple – Replace due to Strength w/Larger Size (PTN 5)

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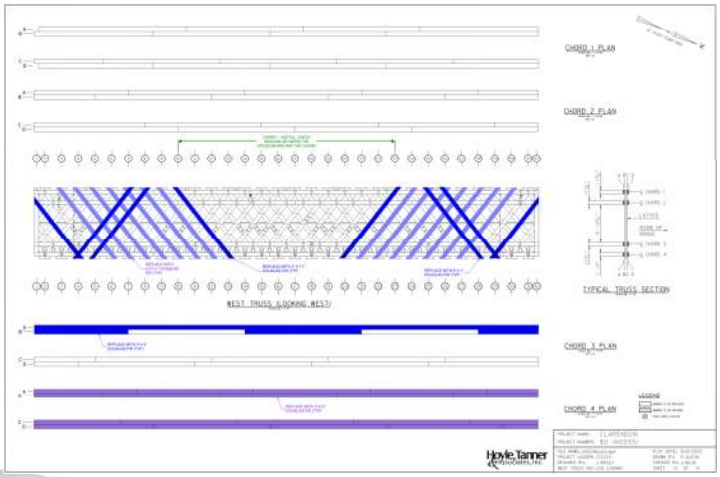
REHABILITATION ALTERNATIVES: H20 WEST TRUSS



Lattice Replacement +37%

Chord Replacement +41%

Legend:

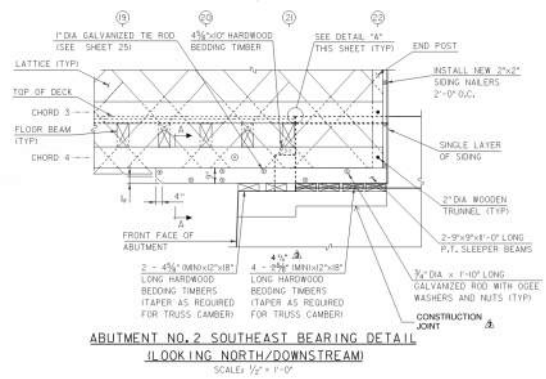
Blue – Replace due to Strength (PTN 2)

Purple – Replace due to Strength w/Larger Size (PTN 5)

30

REHABILITATION ALTERNATIVES: TRUSS BEARINGS

Existing Bearing Blocks



Longley Covered Bridge, Montgomery

SUBSTRUCTURE – RECOMMENDED WORK

Substructure

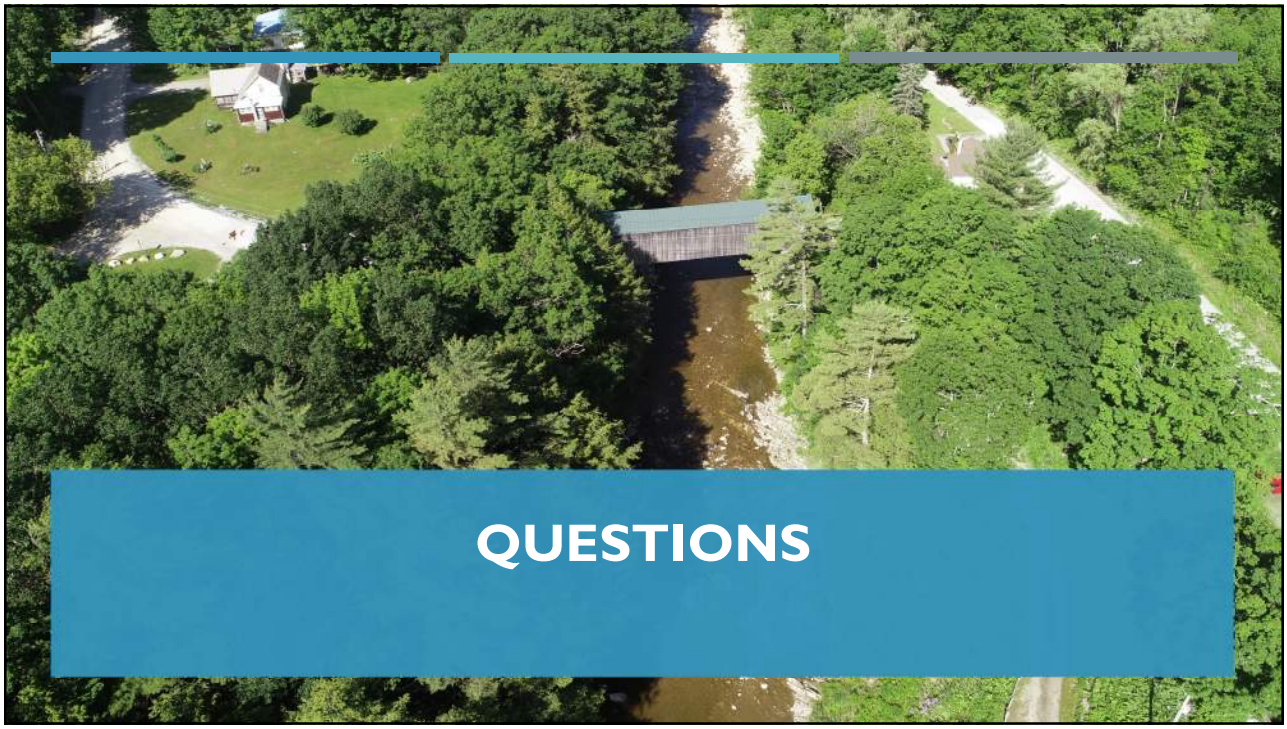
- Concrete Repair / Crack Sealing (PT 1)
- Stain And Seal Concrete (PT 1)

RIGHT OF WAY, UTILITIES, AND FIRE PROTECTION

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

SUMMARY

- Superstructure Replacements/Repairs PTN 1 - 5
- Substructure Repairs PTN 1
- Current Live Load Rating ~ H2 (2 tons)
- Approach Work
  - 250' of Roadway Reconstruction
  - New Signage
  - New Steel Backed Timber Guardrail



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Vermont Agency of Transportation
Historic Covered Bridge Committee Meeting
October 14, 2020
9:30 - 11:00 am
(This Meeting was held via MS Teams due to COVID 19 virus)

Attendance

VTrans Structures Section
Kristin Higgins – Structures Program Manager
Jim Lacroix – Structures Design Engineer
Laura Stone – Scoping Engineer
J. B. McCarthy – Bridge Preservation Engineer
Andrew Lemieux – Bridge Design Engineer

VTrans Asset Management
Pam Thurber – Bridge Management Engineer

VTrans Environmental Section
Judith Ehrlich
Kyle Obenauer

Vermont Covered Bridge Society
Joe Nelson
John Weaver

State Historic Preservation Office
Laura Trieschmann
Devin Colman
Jamie Duggan
Elizabeth Peebles

Special Consultants
Bob McCullough
Eric Gilbertson

Engineering Design Consultant
Hoyle Tanner & Associates
Sean James – Project Manger
Josif Bicja – Design Engineer

Projects
Clarendon BO 1443(55) – Kingsley Covered Bridge

The Kingsley Covered Bridge (Br. 28 on TH 39) in the town of Clarendon has been programmed for a project in the Town Highway Bridge Program. Laura Stone, Structures Scoping Engineer has worked with Hoyle Tanner & Associates to document the history of repairs and develop a list of alternatives for rehabilitation of the covered bridge.

Josif Bicja, of Hoyle Tanner & Associates, gave a PowerPoint presentation of the components of the covered bridge and associated needs. A summary of these concerns is as follows:

Roof System
There is a metal roof on the bridge that is blistering and fading. The ridge cap is attached with nails and screws that may be starting to leak. Many roof boards are cracked. Trees are overgrown at the ends of the bridge covering the roof. There are splits and rotten sections of the roof rafters along with evidence

of insect damage. There are also some broken members and over cut notches. There are guy wires attached to the ends of the covered bridge, but they are not well anchored.

Proposed Work:

A new standing seam metal roof is proposed along with roof boards and 19 % of the rafters.

Truss System

There are large (1 ¼") gaps in the lattice splices. Several lattice members have split ends. A considerable amount of rot was noticed and generally that indicates there is more rot in areas not visible. There is some racking and twisting of the top chord, with rot and insect damage present. The bearing timbers are rotted with some settlement of the truss evident.

The existing lateral bracing is not adequate to allow removal of the guy wires. The solution is to add additional bracing just below the existing or strengthen the cross beam to chord connection to handle the guy wire attachment. There is more than enough freeboard above the stream, therefore the guywire is not needed to anchor the bridge due to stream flow loading.

Proposed Work:

Install additional cross bracing to allow removal of the guy wire.
See design loading below.

Runners

The runners are tapered to match the backwall as the backwall is lower than the finish grade of the deck. This in effect launches vehicles onto the bridge. There is also a considerable gap between the end of the deck and the backwall which traps material and moisture.

Proposed Work:

Replace runners and extend laterally to new curbs.

Deck and Floorbeams

The nail laminated deck and floorbeams are in good condition and not planned for replacement. The deck can handle an H20 loading and the floorbeams are good for H15.

Abutments

There are concrete abutments with evidence of cracks, spalling, delamination, and staining. The abutments are quite high at approximately 32 ft. in height. The abutments appear to be founded on ledge at the stream level.

Proposed work:

Concrete Repair
Stain and seal concrete
Construct new backwalls to match top of runners.

Design Loading

There was a discussion about the appropriate design loading for this bridge. The consultant presented the affects to the trusses for the H3, H12, H15 and H20 truck loadings. The town mentioned the desire to maintain the existing 3 ton loading. A consensus was reached that the H12 (12 ton truck) would be an appropriate design loading. There is a small amount of additional lattice replacement (7%) above and beyond what is needed due to condition and approximately 20% of chord replacement to achieve the H12 loading. There is a significant increase in the lattice replacement needed to go to the H15 or H20 loading (+37%).

Proposed work:

Modify the bottom chord and truss members with in-kind sizes to meet H12 loading.
Keep the current posting at 3 tons.

Portals

There was a discussion to modify the portal to reduce the opening to the covered bridge. The opening is currently posted at 11'- 0" and measured at 12' – 1". There was concern about changing the visual aspect that exists and the decision was to keep the portal as is.

Roadway Approaches

Proposed work;

Slope roadway approaches slightly away from bridge.
Add steel backed timber guard rail.

Lighting and Fire Protection

There will be discussions with the Town on adding lighting to the bridge as there are no windows present and no interior lighting. Given that this covered bridge is 120 ft. long it is quite dark inside the bridge and difficult for drivers to see pedestrians.

Recommendations were made to add NOCHAR to selected members along with possibly installing Protector wire and a sprinkler system. These will be discussed with the Town also.

The meeting adjourned at 11:00 AM.

Hoyle, Tanner & Associates, Inc.

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