Ohio's Covered Bridges: Preserving our Heritage for the Future

righter
GENERAL CONTRACTOR

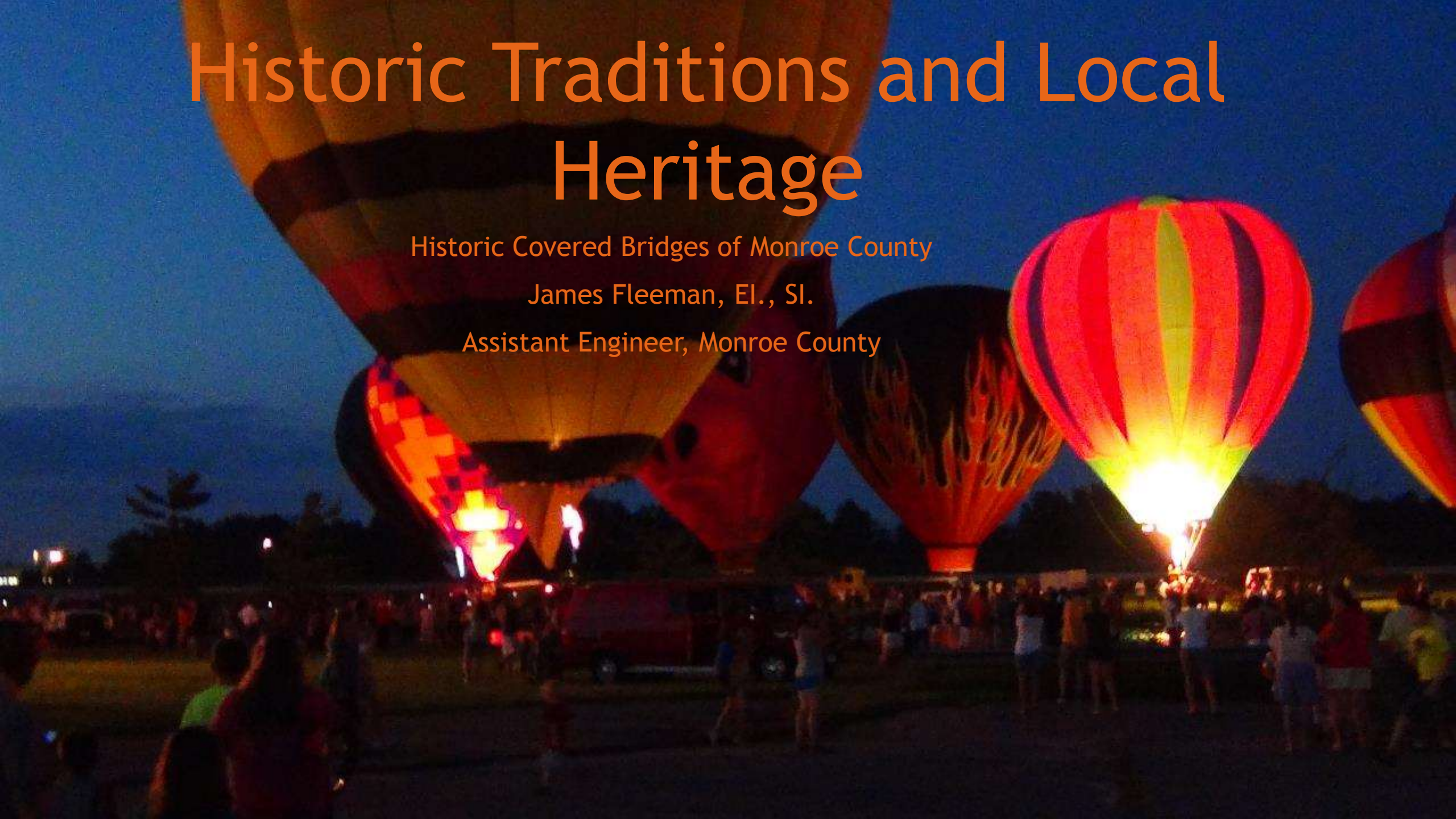
WOOLPERT

Historic Traditions and Local Heritage

Historic Covered Bridges of Monroe County

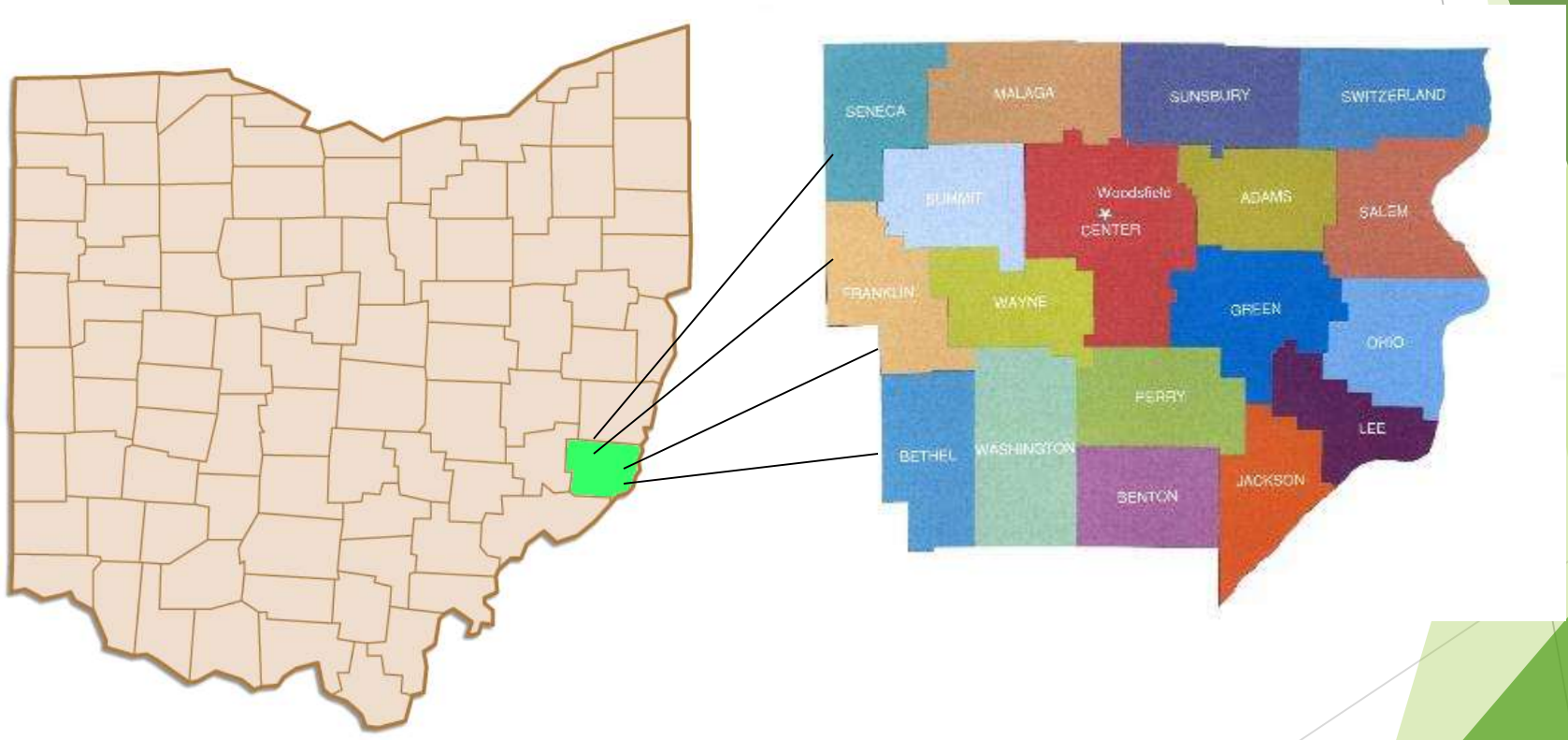
James Fleeman, EI., SI.

Assistant Engineer, Monroe County



Monroe County

Woodsfield, Ohio




Typical Monroe County
Scenery

Covered Bridges Of Monroe County Ohio

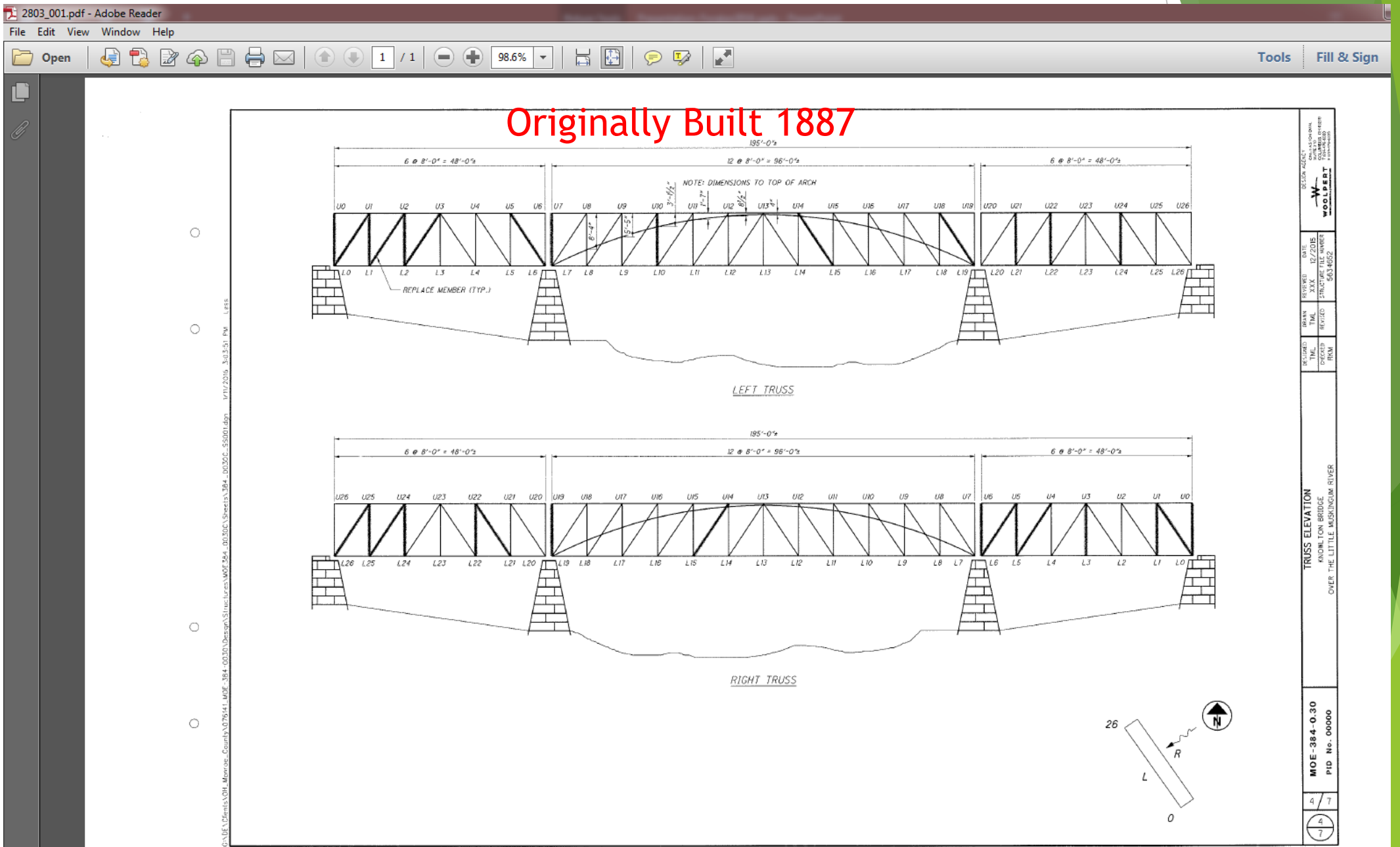
Foraker Covered Bridge CR 40 – M.P. 0.99 SFN5633230 Built 1887 Last Rehab: 2005 Multiple King Post Truss

Span 95.5’ Current Inspection Condition 3P

Knowlton Covered Bridge Washington Twp Rd 834A -0.30 Built 1887 Last Rehab 1994 Retired SFN in 1990’s with County Commissioners retaining ownership of structure. Park and structure administered by Knowlton Covered Bridge Park Board

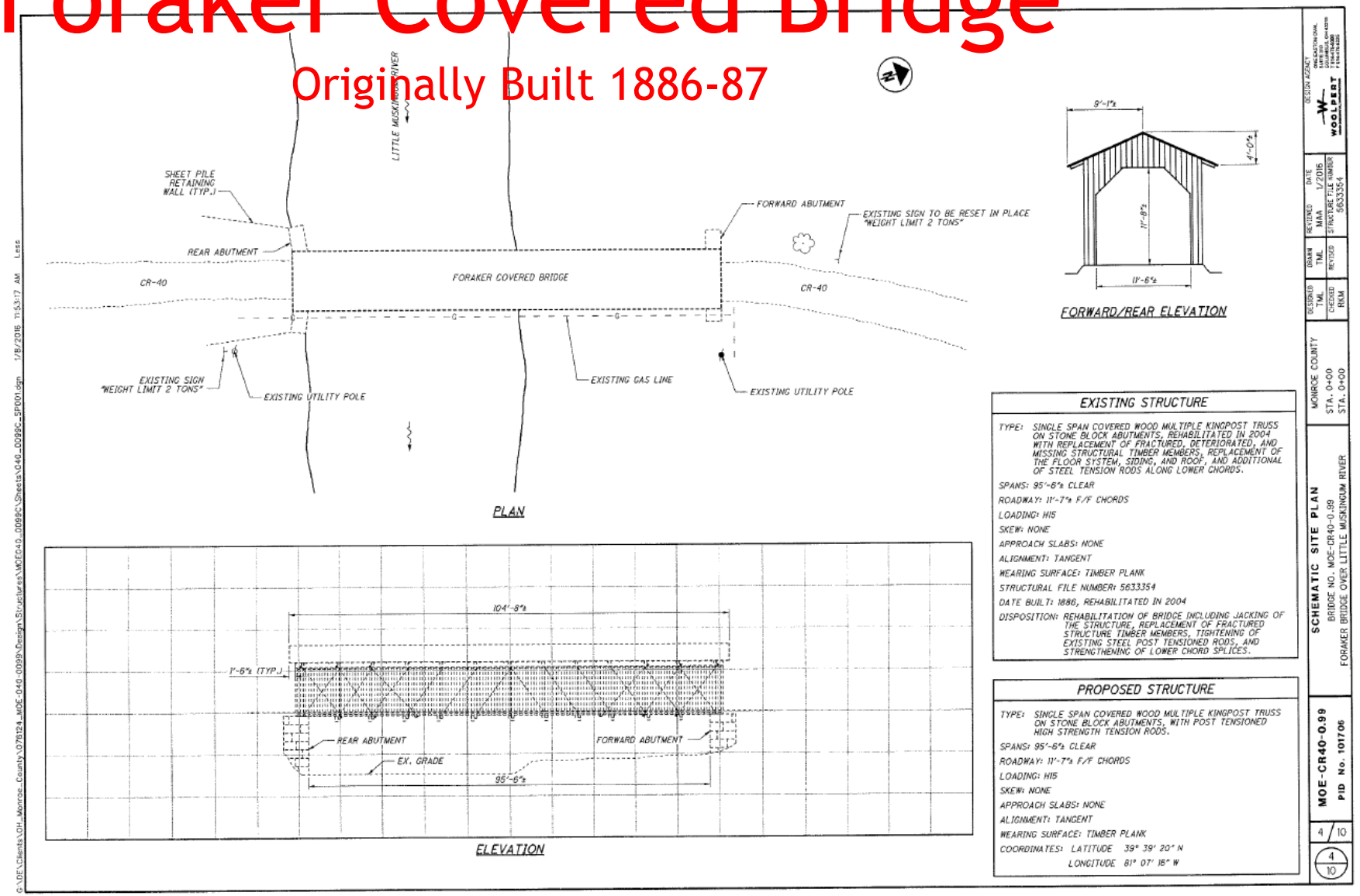
3 Span (48’, 96’, 48’) Multiple King Post Tied Arch Truss Current Inspection Condition 1P

Knowlton Covered Bridge



Foraker Covered Bridge

Originally Built 1886-87



Foraker Covered Bridge

Length 104’-8” Span 95’ – 6”
Last Rehab: 2005
Date of picture: 2007

Relocated Local Bridge Monitor to Foraker Covered Bridge

Foraker Covered Bridge

SFN5633230

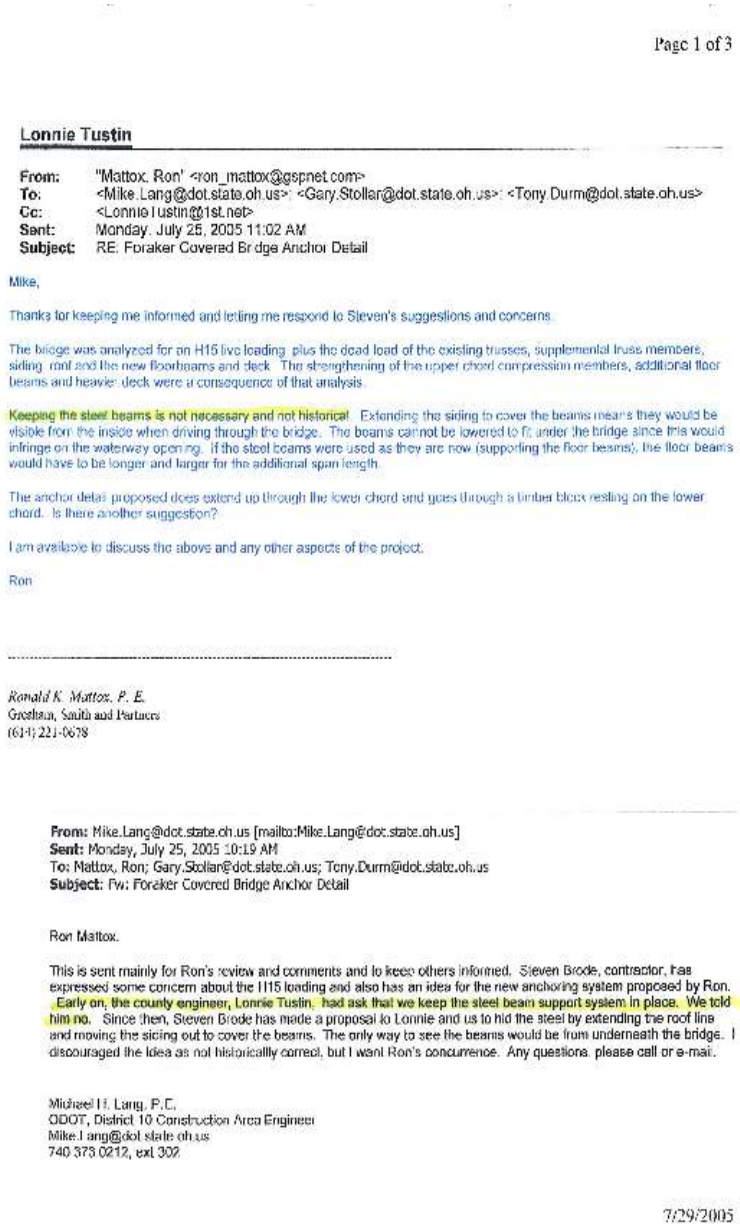
Within 10 years of monitoring the sag it has become a pressing issue at >10” on span of 96 feet.

Bridge in Current Condition

August 8th, 2016

Foraker Covered Bridge 2001

NO SAG ISSUE, advanced deterioration and decay



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Lonnie Tustin

From: "Mattox, Ron" <ron_mattox@gspnet.com>
To: <Mike.Lang@dot.state.oh.us>; <Gary.Stollar@dot.state.oh.us>; <Tony.Durm@dot.state.oh.us>
Cc: <Lonnie1ustin@1st.net>
Sent: Monday, July 25, 2005 11:02 AM
Subject: RE: Foraker Covered Bridge Anchor Detail

Mike,

Thanks for keeping me informed and letting me respond to Steven's suggestions and concerns.

The bridge was analyzed for an H15 live loading plus the dead load of the existing trusses, supplemental truss members, siding, roof and the new floorbeams and deck. The strengthening of the upper chord compression members, additional floor beams and heavier deck were a consequence of that analysis.

Keeping the steel beams is not necessary and not historical. Extending the siding to cover the beams means they would be visible from the inside when driving through the bridge. The beams cannot be lowered to fit under the bridge since this would infringe on the waterway opening. If the steel beams were used as they are now (supporting the floor beams), the floor beams would have to be longer and larger for the additional span length.

The anchor detail proposed does extend up through the lower chord and goes through a timber block resting on the lower chord. Is there another suggestion?

I am available to discuss the above and any other aspects of the project.

Ron

Ronald K. Mattox, P. E.
Gresham, Smith and Partners
(614) 221-0678

From: Mike.Lang@dot.state.oh.us [mailto:Mike.Lang@dot.state.oh.us]
Sent: Monday, July 25, 2005 10:19 AM
To: Mattox, Ron; Gary.Stollar@dot.state.oh.us; Tony.Durm@dot.state.oh.us
Subject: FW: Foraker Covered Bridge Anchor Detail

Ron Mattox,

This is sent mainly for Ron's review and comments and to keep others informed. Steven Brode, contractor, has expressed some concern about the H15 loading and also has an idea for the new anchoring system proposed by Ron. Early on, the county engineer, Lonnie Tustin, had ask that we keep the steel beam support system in place. We told him no. Since then, Steven Brode has made a proposal to Lonnie and us to hid the steel by extending the roof line and moving the siding out to cover the beams. The only way to see the beams would be from underneath the bridge. I discouraged the idea as not historically correct, but I want Ron's concurrence. Any questions, please call or e-mail.

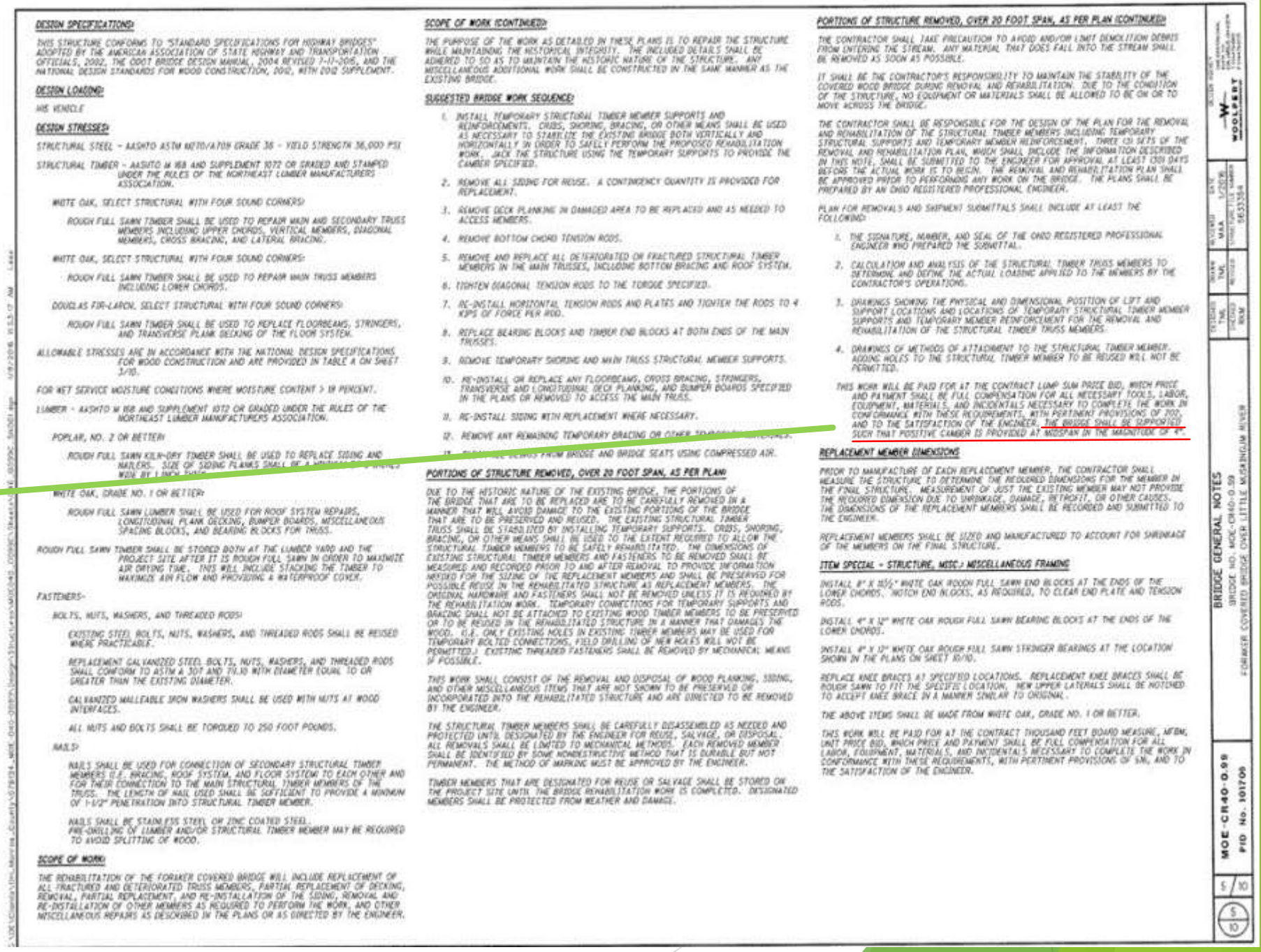
Michael H. Lang, P.E.
ODOT, District 10 Construction Area Engineer
Mike.Lang@dot.state.oh.us
740 373 0212, ext 302

7/29/2005

Keeping the steel beams is not necessary and not historical. – Ron Mattox, Project Manager

Early on, the county engineer, Lonnie Tustin, had asked that we keep the steel beam support system in place. We told him NO. - ODOT district 10

The Bridge shall be supported such that positive chamber is provided at midspan in the magnitude of 4”



DESIGN SPECIFICATIONS:

THIS STRUCTURE CONFORMS TO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" ADOPTED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, 2002, THE ODOT BRIDGE DESIGN MANUAL, 2004 REVISED 7-11-2016, AND THE NATIONAL DESIGN STANDARDS FOR WOOD CONSTRUCTION, 2012, WITH 2012 SUPPLEMENT.

DESIGN LOADING:

H15 VEHICLE

DESIGN STRESSES:

STRUCTURAL STEEL - AASHTO ASTM M270/A709 GRADE 36 - YIELD STRENGTH 36,000 PSI

STRUCTURAL TIMBER - AASHTO M 168 AND SUPPLEMENT 1072 OR GRADED AND STAMPED UNDER THE RULES OF THE NORTHEAST LUMBER MANUFACTURERS ASSOCIATION.

WHITE OAK, SELECT STRUCTURAL WITH FOUR SOUND CORNERS:

ROUGH FULL SAWN TIMBER SHALL BE USED TO REPAIR MAIN AND SECONDARY TRUSS MEMBERS INCLUDING UPPER CHORDS, VERTICAL MEMBERS, DIAGONAL MEMBERS, CROSS BRACING, AND LATERAL BRACING.

WHITE OAK, SELECT STRUCTURAL WITH FOUR SOUND CORNERS:

ROUGH FULL SAWN TIMBER SHALL BE USED TO REPAIR MAIN TRUSS MEMBERS INCLUDING LOWER CHORDS.

DOUGLAS FIR-LARCH, SELECT STRUCTURAL WITH FOUR SOUND CORNERS:

ROUGH FULL SAWN TIMBER SHALL BE USED TO REPLACE FLOORBEAMS, STRINGERS, AND TRANSVERSE PLANK DECKING OF THE FLOOR SYSTEM.

ALLOWABLE STRESSES ARE IN ACCORDANCE WITH THE NATIONAL DESIGN SPECIFICATIONS FOR WOOD CONSTRUCTION AND ARE PROVIDED IN TABLE A ON SHEET 3/10.

FOR WET SERVICE MOISTURE CONDITIONS WHERE MOISTURE CONTENT > 19 PERCENT.

LUMBER - AASHTO M 168 AND SUPPLEMENT 1072 OR GRADED UNDER THE RULES OF THE NORTHEAST LUMBER MANUFACTURERS ASSOCIATION.

POPLAR, NO. 2 OR BETTER:

ROUGH FULL SAWN KILN-DRY TIMBER SHALL BE USED TO REPLACE SIDING AND NAILERS. SIZE OF SIDING PLANKS SHALL BE A MINIMUM OF 8" WIDE BY 1-INCH THICK.

WHITE OAK, GRADE NO. 1 OR BETTER:

ROUGH FULL SAWN LUMBER SHALL BE USED FOR ROOF SYSTEM REPAIRS, LONGITUDINAL PLANK DECKING, BUMPER BOARDS, MISCELLANEOUS SPACING BLOCKS, AND BEARING BLOCKS FOR TRUSS.

ROUGH FULL SAWN TIMBER SHALL BE STORED BOTH AT THE LUMBER YARD AND THE PROJECT SITE AFTER IT IS ROUGH FULL SAWN IN ORDER TO MAXIMIZE AIR DRYING TIME. THIS WILL INCLUDE STACKING THE TIMBER TO MAXIMIZE AIR FLOW AND PROVIDING A WATERPROOF COVER.

FASTENERS:

BOLTS, NUTS, WASHERS, AND THREADED RODS:

EXISTING STEEL BOLTS, NUTS, WASHERS, AND THREADED RODS SHALL BE REUSED WHERE PRACTICABLE.

REPLACEMENT GALVANIZED STEEL BOLTS, NUTS, WASHERS, AND THREADED RODS SHALL CONFORM TO ASTM A 307 AND IFI.10 WITH DIAMETER EQUAL TO OR GREATER THAN THE EXISTING DIAMETER.

GALVANIZED MALLEABLE IRON WASHERS SHALL BE USED WITH NUTS AT WOOD INTERFACES.

ALL NUTS AND BOLTS SHALL BE TORQUED TO 250 FOOT POUNDS.

NAILS:

NAILS SHALL BE USED FOR CONNECTION OF SECONDARY STRUCTURAL TIMBER MEMBERS (I.E. BRACING, ROOF SYSTEM, AND FLOOR SYSTEM) TO EACH OTHER AND FOR THEIR CONNECTION TO THE MAIN STRUCTURAL TIMBER MEMBERS OF THE TRUSS. THE LENGTH OF NAIL USED SHALL BE SUFFICIENT TO PROVIDE A MINIMUM OF 1-1/2" PENETRATION INTO STRUCTURAL TIMBER MEMBER.

NAILS SHALL BE STAINLESS STEEL OR ZINC COATED STEEL. PRE-DRILLING OF LUMBER AND/OR STRUCTURAL TIMBER MEMBER MAY BE REQUIRED TO AVOID SPLITTING OF WOOD.

SCOPE OF WORK:

THE REHABILITATION OF THE FORAKER COVERED BRIDGE WILL INCLUDE REPLACEMENT OF ALL FRACTURED AND DETERIORATED TRUSS MEMBERS, PARTIAL REPLACEMENT OF DECKING, REMOVAL, PARTIAL REPLACEMENT, AND RE-INSTALLATION OF THE SIDING, REMOVAL AND RE-INSTALLATION OF OTHER MEMBERS AS REQUIRED TO PERFORM THE WORK, AND OTHER MISCELLANEOUS REPAIRS AS DESCRIBED IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

SCOPE OF WORK (CONTINUED):

THE PURPOSE OF THE WORK AS DETAILED IN THESE PLANS IS TO REPAIR THE STRUCTURE WHILE MAINTAINING THE HISTORICAL INTEGRITY. THE INCLUDED DETAILS SHALL BE ADHERED TO SO AS TO MAINTAIN THE HISTORIC NATURE OF THE STRUCTURE. ANY MISCELLANEOUS ADDITIONAL WORK SHALL BE CONSTRUCTED IN THE SAME MANNER AS THE EXISTING BRIDGE.

SUGGESTED BRIDGE WORK SEQUENCE:

1. INSTALL TEMPORARY STRUCTURAL TIMBER MEMBER SUPPORTS AND REINFORCEMENTS. CRIBS, SHORING, BRACING, OR OTHER MEANS SHALL BE USED AS NECESSARY TO STABILIZE THE EXISTING BRIDGE BOTH VERTICALLY AND HORIZONTALLY IN ORDER TO SAFELY PERFORM THE PROPOSED REHABILITATION WORK. JACK THE STRUCTURE USING THE TEMPORARY SUPPORTS TO PROVIDE THE CAMBER SPECIFIED.
2. REMOVE ALL SIDING FOR REUSE. A CONTINGENCY QUANTITY IS PROVIDED FOR REPLACEMENT.
3. REMOVE DECK PLANKING IN DAMAGED AREA TO BE REPLACED AND AS NEEDED TO ACCESS MEMBERS.
4. REMOVE BOTTOM CHORD TENSION RODS.
5. REMOVE AND REPLACE ALL DETERIORATED OR FRACTURED STRUCTURAL TIMBER MEMBERS IN THE MAIN TRUSSES, INCLUDING BOTTOM BRACING AND ROOF SYSTEM.
6. TIGHTEN DIAGONAL TENSION RODS TO THE TORQUE SPECIFIED.
7. RE-INSTALL HORIZONTAL TENSION RODS AND PLATES AND TIGHTEN THE RODS TO 4 KIPS OF FORCE PER ROD.
8. REPLACE BEARING BLOCKS AND TIMBER END BLOCKS AT BOTH ENDS OF THE MAIN TRUSSES.
9. REMOVE TEMPORARY SHORING AND MAIN TRUSS STRUCTURAL MEMBER SUPPORTS.
10. RE-INSTALL OR REPLACE ANY FLOORBEAMS, CROSS BRACING, STRINGERS, TRANSVERSE AND LONGITUDINAL DECK PLANKING, AND BUMPER BOARDS SPECIFIED IN THE PLANS OR REMOVED TO ACCESS THE MAIN TRUSS.
11. RE-INSTALL SIDING WITH REPLACEMENT WHERE NECESSARY.
12. REMOVE ANY REMAINING TEMPORARY BRACING OR OTHER TEMPORARY SUPPORTS.
13. CLEAN DEBRIS FROM BRIDGE AND BRIDGE SEATS USING COMPRESSED AIR.

PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN, AS PER PLAN:

DUE TO THE HISTORIC NATURE OF THE EXISTING BRIDGE, THE PORTIONS OF THE BRIDGE THAT ARE TO BE REPLACED ARE TO BE CAREFULLY REMOVED IN A MANNER THAT WILL AVOID DAMAGE TO THE EXISTING PORTIONS OF THE BRIDGE THAT ARE TO BE PRESERVED AND REUSED. THE EXISTING STRUCTURAL TIMBER TRUSS SHALL BE STABILIZED BY INSTALLING TEMPORARY SUPPORTS. CRIBS, SHORING, BRACING, OR OTHER MEANS SHALL BE USED TO THE EXTENT REQUIRED TO ALLOW THE STRUCTURAL TIMBER MEMBERS TO BE SAFELY REHABILITATED. THE DIMENSIONS OF EXISTING STRUCTURAL TIMBER MEMBERS AND FASTENERS TO BE REMOVED SHALL BE MEASURED AND RECORDED PRIOR TO AND AFTER REMOVAL TO PROVIDE INFORMATION NEEDED FOR THE SIZING OF THE REPLACEMENT MEMBERS AND SHALL BE PRESERVED FOR POSSIBLE REUSE IN THE REHABILITATED STRUCTURE AS REPLACEMENT MEMBERS. THE ORIGINAL HARDWARE AND FASTENERS SHALL NOT BE REMOVED UNLESS IT IS REQUIRED BY THE REHABILITATION WORK. TEMPORARY CONNECTIONS FOR TEMPORARY SUPPORTS AND BRACING SHALL NOT BE ATTACHED TO EXISTING WOOD TIMBER MEMBERS TO BE PRESERVED OR TO BE REUSED IN THE REHABILITATED STRUCTURE IN A MANNER THAT DAMAGES THE WOOD. (I.E. ONLY EXISTING HOLES IN EXISTING TIMBER MEMBERS MAY BE USED FOR TEMPORARY BOLTED CONNECTIONS. FIELD DRILLING OF NEW HOLES WILL NOT BE PERMITTED.) EXISTING THREADED FASTENERS SHALL BE REMOVED BY MECHANICAL MEANS IF POSSIBLE.

THIS WORK SHALL CONSIST OF THE REMOVAL AND DISPOSAL OF WOOD PLANKING, SIDING, AND OTHER MISCELLANEOUS ITEMS THAT ARE NOT SHOWN TO BE PRESERVED OR INCORPORATED INTO THE REHABILITATED STRUCTURE AND ARE DIRECTED TO BE REMOVED BY THE ENGINEER.

THE STRUCTURAL TIMBER MEMBERS SHALL BE CAREFULLY DISASSEMBLED AS NEEDED AND PROTECTED UNTIL DESIGNATED BY THE ENGINEER FOR REUSE, SALVAGE, OR DISPOSAL. ALL REMOVALS SHALL BE LIMITED TO MECHANICAL METHODS. EACH REMOVED MEMBER SHALL BE IDENTIFIED BY SOME NONDESTRUCTIVE METHOD THAT IS DURABLE BUT NOT PERMANENT. THE METHOD OF MARKING MUST BE APPROVED BY THE ENGINEER.

TIMBER MEMBERS THAT ARE DESIGNATED FOR REUSE OR SALVAGE SHALL BE STORED ON THE PROJECT SITE UNTIL THE BRIDGE REHABILITATION WORK IS COMPLETED. DESIGNATED MEMBERS SHALL BE PROTECTED FROM WEATHER AND DAMAGE.

PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN, AS PER PLAN (CONTINUED):

THE CONTRACTOR SHALL TAKE PRECAUTION TO AVOID AND/OR LIMIT DEMOLITION DEBRIS FROM ENTERING THE STREAM. ANY MATERIAL THAT DOES FALL INTO THE STREAM SHALL BE REMOVED AS SOON AS POSSIBLE.

IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN THE STABILITY OF THE COVERED WOOD BRIDGE DURING REMOVAL AND REHABILITATION. DUE TO THE CONDITION OF THE STRUCTURE, NO EQUIPMENT OR MATERIALS SHALL BE ALLOWED TO BE ON OR TO MOVE ACROSS THE BRIDGE.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF THE PLAN FOR THE REMOVAL AND REHABILITATION OF THE STRUCTURAL TIMBER MEMBERS INCLUDING TEMPORARY STRUCTURAL SUPPORTS AND TEMPORARY MEMBER REINFORCEMENT. THREE (3) SETS OF THE REMOVAL AND REHABILITATION PLAN, WHICH SHALL INCLUDE THE INFORMATION DESCRIBED IN THIS NOTE, SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL AT LEAST (30) DAYS BEFORE THE ACTUAL WORK IS TO BEGIN. THE REMOVAL AND REHABILITATION PLAN SHALL BE APPROVED PRIOR TO PERFORMING ANY WORK ON THE BRIDGE. THE PLANS SHALL BE PREPARED BY AN OHIO REGISTERED PROFESSIONAL ENGINEER.

PLAN FOR REMOVALS AND SHIPMENT SUBMITTALS SHALL INCLUDE AT LEAST THE FOLLOWING:

1. THE SIGNATURE, NUMBER, AND SEAL OF THE OHIO REGISTERED PROFESSIONAL ENGINEER WHO PREPARED THE SUBMITTAL.
2. CALCULATION AND ANALYSIS OF THE STRUCTURAL TIMBER TRUSS MEMBERS TO DETERMINE AND DEFINE THE ACTUAL LOADING APPLIED TO THE MEMBERS BY THE CONTRACTOR'S OPERATIONS.
3. DRAWINGS SHOWING THE PHYSICAL AND DIMENSIONAL POSITION OF LIFT AND SUPPORT LOCATIONS AND LOCATIONS OF TEMPORARY STRUCTURAL TIMBER MEMBER SUPPORTS AND TEMPORARY MEMBER REINFORCEMENT FOR THE REMOVAL AND REHABILITATION OF THE STRUCTURAL TIMBER TRUSS MEMBERS.
4. DRAWINGS OF METHODS OF ATTACHMENT TO THE STRUCTURAL TIMBER MEMBER. ADDING HOLES TO THE STRUCTURAL TIMBER MEMBER TO BE REUSED WILL NOT BE PERMITTED.

THIS WORK WILL BE PAID FOR AT THE CONTRACT LUMP SUM PRICE BID, WHICH PRICE AND PAYMENT SHALL BE FULL COMPENSATION FOR ALL NECESSARY TOOLS, LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS NECESSARY TO COMPLETE THE WORK IN CONFORMANCE WITH THESE REQUIREMENTS, WITH PERTINENT PROVISIONS OF 202, AND TO THE SATISFACTION OF THE ENGINEER. THE BRIDGE SHALL BE SUPPORTED SUCH THAT POSITIVE CAMBER IS PROVIDED AT MIDSPAN IN THE MAGNITUDE OF 4".

REPLACEMENT MEMBER DIMENSIONS

PRIOR TO MANUFACTURE OF EACH REPLACEMENT MEMBER, THE CONTRACTOR SHALL MEASURE THE STRUCTURE TO DETERMINE THE REQUIRED DIMENSIONS FOR THE MEMBER IN THE FINAL STRUCTURE. MEASUREMENT OF JUST THE EXISTING MEMBER MAY NOT PROVIDE THE REQUIRED DIMENSION DUE TO SHRINKAGE, DAMAGE, RETROFIT, OR OTHER CAUSES. THE DIMENSIONS OF THE REPLACEMENT MEMBERS SHALL BE RECORDED AND SUBMITTED TO THE ENGINEER.

REPLACEMENT MEMBERS SHALL BE SIZED AND MANUFACTURED TO ACCOUNT FOR SHRINKAGE OF THE MEMBERS ON THE FINAL STRUCTURE.

ITEM SPECIAL - STRUCTURE, MISC.; MISCELLANEOUS FRAMING

INSTALL 8" X 30½" WHITE OAK ROUGH FULL SAWN END BLOCKS AT THE ENDS OF THE LOWER CHORDS. NOTCH END BLOCKS, AS REQUIRED, TO CLEAR END PLATE AND TENSION RODS.

INSTALL 4" X 12" WHITE OAK ROUGH FULL SAWN BEARING BLOCKS AT THE ENDS OF THE LOWER CHORDS.

INSTALL 4" X 12" WHITE OAK ROUGH FULL SAWN STRINGER BEARINGS AT THE LOCATION SHOWN IN THE PLANS ON SHEET 10/10.

REPLACE KNEE BRACES AT SPECIFIED LOCATIONS. REPLACEMENT KNEE BRACES SHALL BE ROUGH SAWN TO FIT THE SPECIFIC LOCATION. NEW UPPER LATERALS SHALL BE NOTCHED TO ACCEPT KNEE BRACE IN A MANNER SIMILAR TO ORIGINAL.

THE ABOVE ITEMS SHALL BE MADE FROM WHITE OAK, GRADE NO. 1 OR BETTER.

THIS WORK WILL BE PAID FOR AT THE CONTRACT THOUSAND FEET BOARD MEASURE, MFBM, UNIT PRICE BID, WHICH PRICE AND PAYMENT SHALL BE FULL COMPENSATION FOR ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS NECESSARY TO COMPLETE THE WORK IN CONFORMANCE WITH THESE REQUIREMENTS, WITH PERTINENT PROVISIONS OF 518, AND TO THE SATISFACTION OF THE ENGINEER.

BRIDGE GENERAL NOTES

BRIDGE NO. MOE-CR40-0.99

FORAKER COVERED BRIDGE OVER LITTLE MUSKINGUM RIVER

MOE-CR40-0.99

PID No. 101706

5 / 10

5
10

BRIDGE NOTES

DESIGN SPECIFICATIONS:

THIS STRUCTURE CONFORMS TO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" ADOPTED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, 2002, THE ODOT BRIDGE DESIGN MANUAL, 2004, AND THE NATIONAL DESIGN STANDARDS FOR WOOD CONSTRUCTION, 2001 WITH 2001 SUPPLEMENT.

DESIGN LOADING: H10 VEHICLE

DESIGN DATA:

STRUCTURAL STEEL - ASTM A36/A709 GRADE 36 - FIELD STRENGTH 36,000 PSI

STRUCTURAL TIMBER - AASHTO M 168 AND SUPPLEMENT 1572 OR GRADED UNDER THE RULES OF THE NORTHEAST LUMBER MANUFACTURERS ASSOCIATION.

WHITE OAK, SELECT STRUCTURAL WITH FOUR SOUND CORNERS:

ROUGH FULL SAWN TIMBER SHALL BE USED TO REPAIR MAIN AND SECONDARY TRUSS MEMBERS INCLUDING UPPER CHORDS, VERTICAL MEMBERS, DIAGONAL MEMBERS, CROSS BRACING, AND LATERAL BRACING.

DOUGLAS FIR-LARCH, DENSE SELECT STRUCTURAL WITH FOUR SOUND CORNERS:

ROUGH FULL SAWN TIMBER SHALL BE USED TO REPAIR MAIN TRUSS MEMBERS INCLUDING LOWER CHORDS.

DOUGLAS FIR-LARCH, SELECT STRUCTURAL WITH FOUR SOUND CORNERS:

ROUGH FULL SAWN TIMBER SHALL BE USED TO REPLACE FLOORBEAMS, STRINGERS, AND TRANSVERSE PLANK DECKING OF THE FLOOR SYSTEM.

ALLOWABLE STRESSES ARE IN ACCORDANCE WITH THE NATIONAL DESIGN SPECIFICATIONS FOR WOOD CONSTRUCTION AND ARE PROVIDED IN TABLE A ON SHEET 6 OF 12.

FOR WET SERVICE MOISTURE CONDITIONS WHERE MOISTURE CONTENT > 19 PERCENT.

LUMBER - AASHTO M 168 AND SUPPLEMENT 1072 OR GRADED UNDER THE RULES OF THE NORTHEAST LUMBER MANUFACTURERS ASSOCIATION.

POPLAR, NO. 2 OR BETTER:

ROUGH FULL SAWN KILN-DRY TIMBER SHALL BE USED TO REPLACE SIDING AND NAILERS. SIZE OF SIDING PLANKS SHALL BE A MINIMUM OF 8 INCHES WIDE BY 1 INCH THICK.

WHITE OAK, GRADE NO. 1 OR BETTER:

ROUGH FULL SAWN LUMBER SHALL BE USED FOR ROOF SYSTEM REPAIRS, LONGITUDINAL PLANK DECKING, BUMPER BOARDS, MISCELLANEOUS SPACING BLOCKS, AND BEARING BLOCKS FOR TRUSS.

ROUGH FULL SAWN TIMBER SHALL BE STORED BOTH AT THE LUMBER YARD AND THE PROJECT SITE AFTER IT IS ROUGH FULL SAWN IN ORDER TO MAXIMIZE AIR DRYING TIME. THIS WILL INCLUDE STACKING THE TIMBER TO MAXIMIZE AIR FLOW AND PROVIDING A WATERPROOF COVER.

FASTENERS:

BOLTS, NUTS, WASHERS, AND THREADED RODS:

EXISTING STEEL BOLTS, NUTS, WASHERS, AND THREADED RODS SHALL BE REUSED WHERE PRACTICABLE.

REPLACEMENT GALVANIZED STEEL BOLTS, NUTS, WASHERS, AND THREADED RODS SHALL CONFORM TO ASTM A 307 AND F 11.10 WITH DIAMETER EQUAL TO OR GREATER THAN THE EXISTING DIAMETER.

GALVANIZED MALLEABLE IRON WASHERS SHALL BE USED WITH NUTS AT WOOD INTERFACES.

ALL NUTS AND BOLTS SHALL BE TORQUED TO 250 FOOT POUNDS.

NAILS:

NAILS SHALL BE USED FOR CONNECTION OF SECONDARY STRUCTURAL TIMBER MEMBERS (I.E. BRACING, ROOF SYSTEM, AND FLOOR SYSTEM) TO EACH OTHER AND FOR THEIR CONNECTION TO THE MAIN STRUCTURAL TIMBER MEMBERS OF THE TRUSS. THE LENGTH OF NAIL USED SHALL BE SUFFICIENT TO PROVIDE A MINIMUM OF 1-1/2" PENETRATION INTO STRUCTURAL TIMBER MEMBER.

NAILS SHALL BE STAINLESS STEEL OR ZINC COATED STEEL. PRE-DRILLING OF LUMBER AND/OR STRUCTURAL TIMBER MEMBER MAY BE REQUIRED TO AVOID SPLITTING OF WOOD.

SCOPE OF WORK

THE REHABILITATION OF THE FORKER COVERED BRIDGE WILL INCLUDE REPLACEMENT OF ALL FRACTURED AND DETERIORATED TRUSS MEMBERS, REPLACEMENT OF THE EXISTING FLOOR SYSTEM, REPLACEMENT OF THE ROOF SYSTEM, REPLACEMENT OF THE SIDING, COATING THE INTERIOR OF THE STRUCTURE WITH FIRE RETARDANT, PAINTING THE EXTERIOR OF THE STRUCTURE, AND OTHER MISCELLANEOUS REPAIRS AS DESCRIBED IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

THE PURPOSE OF THE WORK AS DETAILED IN THESE PLANS IS TO REPAIR THE STRUCTURE WHILE MAINTAINING THE HISTORICAL INTEGRITY. THE INCLUDED DETAILS SHALL BE ADHERED TO SO AS TO MAINTAIN THE HISTORIC NATURE OF THE STRUCTURE. ANY MISCELLANEOUS ADDITIONAL WORK SHALL BE CONSTRUCTED IN THE SAME MANNER AS THE EXISTING BRIDGE.

SUGGESTED BRIDGE WORK SEQUENCE

1. INSTALL TEMPORARY STRUCTURAL TIMBER MEMBER SUPPORTS AND REINFORCEMENTS. CRIBS, SHORING, BRACING, OR OTHER MEANS SHALL BE USED AS NECESSARY TO STABILIZE THE EXISTING BRIDGE BOTH VERTICALLY AND HORIZONTALLY IN ORDER TO SAFELY PERFORM THE PROPOSED REHABILITATION WORK AND TO REMOVE THE EXISTING TEMPORARY SUPPORTS.
2. REMOVE SIDING AND ROOF.
3. REMOVE DECK PLANKING AND FLOORBEAMS.
4. REMOVE AND REPLACE ALL DETERIORATED OR FRACTURED STRUCTURAL TIMBER MEMBERS IN THE MAIN TRUSSES, INCLUDING BOTTOM BRACING AND ROOF SYSTEM, AND REMOVE TEMPORARY STRUCTURAL MEMBER SUPPORTS.
5. INSTALL TENSION RODS ON BOTH SIDES OF LOWER CHORDS.
6. INSTALL ½" PREFORMED BEARING PADS AND REPLACE BEARING BLOCKS AT BOTH ENDS OF THE MAIN TRUSSES.
7. REMOVE TEMPORARY CRIBS AND SHORING FOR THE MAIN TRUSSES.
8. INSTALL FLOORBEAMS, CROSS BRACING, STRINGERS, TRANSVERSE AND LONGITUDINAL DECK PLANKING, AND BUMPER BOARDS.
9. INSTALL NEW ROOF SYSTEM INCLUDING TIMBER RAFTERS AND RAFTER SILLS, AS INDICATED.
10. INSTALL NEW SIDING AND PAINT BRIDGE.
11. REMOVE ANY REMAINING TEMPORARY BRACING OR OTHER TEMPORARY MATERIALS.
12. APPLY FIRE RETARDANT TO ALL EXPOSED WOOD SURFACES ON THE INTERIOR OF BRIDGE, INCLUDING SIDING, AND ON EXPOSED WOOD SURFACES ON THE FLOOR AND ROOF SYSTEMS.
13. INSTALL STANDING SEAM ROOFING.
14. CLEAN ALL DEBRIS FROM BRIDGE AND BRIDGE SEATS USING COMPRESSED AIR.

PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN, AS PER PLAN:

DUE TO THE HISTORIC NATURE OF THE EXISTING BRIDGE, THE PORTIONS OF THE BRIDGE THAT ARE TO BE REPLACED ARE TO BE CAREFULLY REMOVED IN A MANNER THAT WILL AVOID DAMAGE TO THE EXISTING PORTIONS OF THE BRIDGE THAT ARE TO BE PRESERVED AND REUSED. THE EXISTING STRUCTURAL TIMBER TRUSS SHALL BE STABILIZED BY INSTALLING TEMPORARY STRUCTURAL TIMBER MEMBER SUPPORTS AND TEMPORARY MEMBER REINFORCEMENT. CRIBS, SHORING, BRACING, OR OTHER MEANS SHALL BE USED TO THE EXTENT REQUIRED TO ALLOW THE STRUCTURAL TIMBER MEMBERS TO BE SAFELY REHABILITATED. THE DIMENSIONS OF EXISTING STRUCTURAL TIMBER MEMBERS AND FASTENERS TO BE REMOVED SHALL BE MEASURED AND RECORDED PRIOR TO AND AFTER REMOVAL TO PROVIDE INFORMATION NEEDED FOR THE SIZING OF THE REPLACEMENT MEMBERS AND SHALL BE PRESERVED FOR POSSIBLE REUSE IN THE REHABILITATED STRUCTURE AS REPLACEMENT MEMBERS. THE ORIGINAL HARDWARE AND FASTENERS SHALL NOT BE REMOVED UNLESS IT IS REQUIRED BY THE REHABILITATION WORK. TEMPORARY CONNECTIONS FOR TEMPORARY SUPPORTS AND BRACING SHALL NOT BE ATTACHED TO EXISTING WOOD TIMBER MEMBERS TO BE PRESERVED OR TO BE REUSED IN THE REHABILITATED STRUCTURE IN A MANNER THAT DAMAGES THE WOOD. (I.E. ONLY EXISTING HOLES IN EXISTING TIMBER MEMBERS MAY BE USED FOR TEMPORARY BOLTED CONNECTIONS; FIELD DRILLING OF NEW HOLES WILL NOT BE PERMITTED.) EXISTING THREADED FASTENERS SHALL BE REMOVED BY MECHANICAL MEANS IF POSSIBLE.

THIS WORK SHALL CONSIST OF THE REMOVAL AND DISPOSAL OF WOOD PLANKING, CURB BOARDS, SIDING, ROOFING, EXISTING TEMPORARY SUPPORTS, AND OTHER MISCELLANEOUS ITEMS THAT ARE NOT SHOWN TO BE PRESERVED OR INCORPORATED INTO THE REHABILITATED STRUCTURE AND ARE DIRECTED TO BE REMOVED BY THE ENGINEER.

THE STRUCTURAL TIMBER MEMBERS SHALL BE CAREFULLY DISASSEMBLED AS NEEDED AND PROTECTED UNTIL DESIGNATED BY THE ENGINEER FOR REUSE, SALVAGE, OR DISPOSAL. ALL REMOVALS SHALL BE LIMITED TO MECHANICAL METHODS. EACH REMOVED MEMBER SHALL BE IDENTIFIED BY SOME NONDESTRUCTIVE METHOD THAT IS DURABLE BUT NOT PERMANENT. THE METHOD OF MARKING MUST BE APPROVED BY THE ENGINEER.

TIMBER MEMBERS THAT ARE DESIGNATED FOR REUSE OR SALVAGE SHALL BE STORED ON THE PROJECT UNTIL THE BRIDGE REHABILITATION WORK IS COMPLETED. DESIGNATED MEMBERS SHALL BE PROTECTED FROM WEATHER AND DAMAGE. THE MONROE COUNTY ENGINEER WILL PICK UP THE TIMBER MEMBERS THAT REMAIN.

THE CONTRACTOR SHALL TAKE PRECAUTION TO AVOID AND/OR LIMIT DEMOLITION DEBRIS FROM ENTERING THE STREAM. ANY MATERIAL THAT DOES FALL INTO THE STREAM SHALL BE REMOVED AS SOON AS POSSIBLE.

IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN THE STABILITY OF THE COVERED WOOD BRIDGE DURING REMOVAL AND REHABILITATION. DUE TO THE CONDITION OF THE STRUCTURE, NO EQUIPMENT OR MATERIALS SHALL BE ALLOWED TO BE ON OR TO MOVE ACROSS THE BRIDGE.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF THE PLAN FOR THE REMOVAL AND REHABILITATION OF THE STRUCTURAL TIMBER MEMBERS INCLUDING TEMPORARY STRUCTURAL TIMBER MEMBER SUPPORTS AND TEMPORARY MEMBER REINFORCEMENT. THREE (3) SETS OF THE REMOVAL AND REHABILITATION PLAN, WHICH SHALL INCLUDE THE INFORMATION DESCRIBED IN THIS NOTE, SHALL BE SUBMITTED TO THE DIRECTOR FOR APPROVAL AT LEAST (30) DAYS BEFORE THE ACTUAL WORK IS TO BEGIN. THE REMOVAL AND REHABILITATION PLAN SHALL BE APPROVED PRIOR TO PERFORMING ANY WORK ON THE BRIDGE. THE PLANS SHALL BE PREPARED BY AN OHIO REGISTERED PROFESSIONAL ENGINEER.

PLAN FOR REMOVALS AND SHIPMENT SUBMITTALS SHALL INCLUDE AT LEAST THE FOLLOWING:

1. THE SIGNATURE, NUMBER, AND SEAL OF THE OHIO REGISTERED PROFESSIONAL ENGINEER WHO PREPARED THE SUBMITTAL.
2. CALCULATION AND ANALYSIS OF THE STRUCTURAL TIMBER TRUSS MEMBERS TO DETERMINE AND DEFINE THE ACTUAL LOADING APPLIED TO THE MEMBERS BY THE CONTRACTOR'S OPERATIONS.

BRIDGE GENERAL NOTES I
BRIDGE NO. MOE-CR40-0.99
OVER LITTLE MUSKINGUM RIVER

MOE-ER40-0.99

5/12

6/15

Verbiage concentrates on historical nature while not emphasizing structural aspects (service stresses and future load considerations)

1 New Truss under Construction

old Truss

2

3

8 New Truss under Construction

9

10

11

7 Lifting Completed Truss 5

8 6

7

3

New Tusses

1

4

2

11

7

New Trusses with Flood Beam + Top Framing 5

8

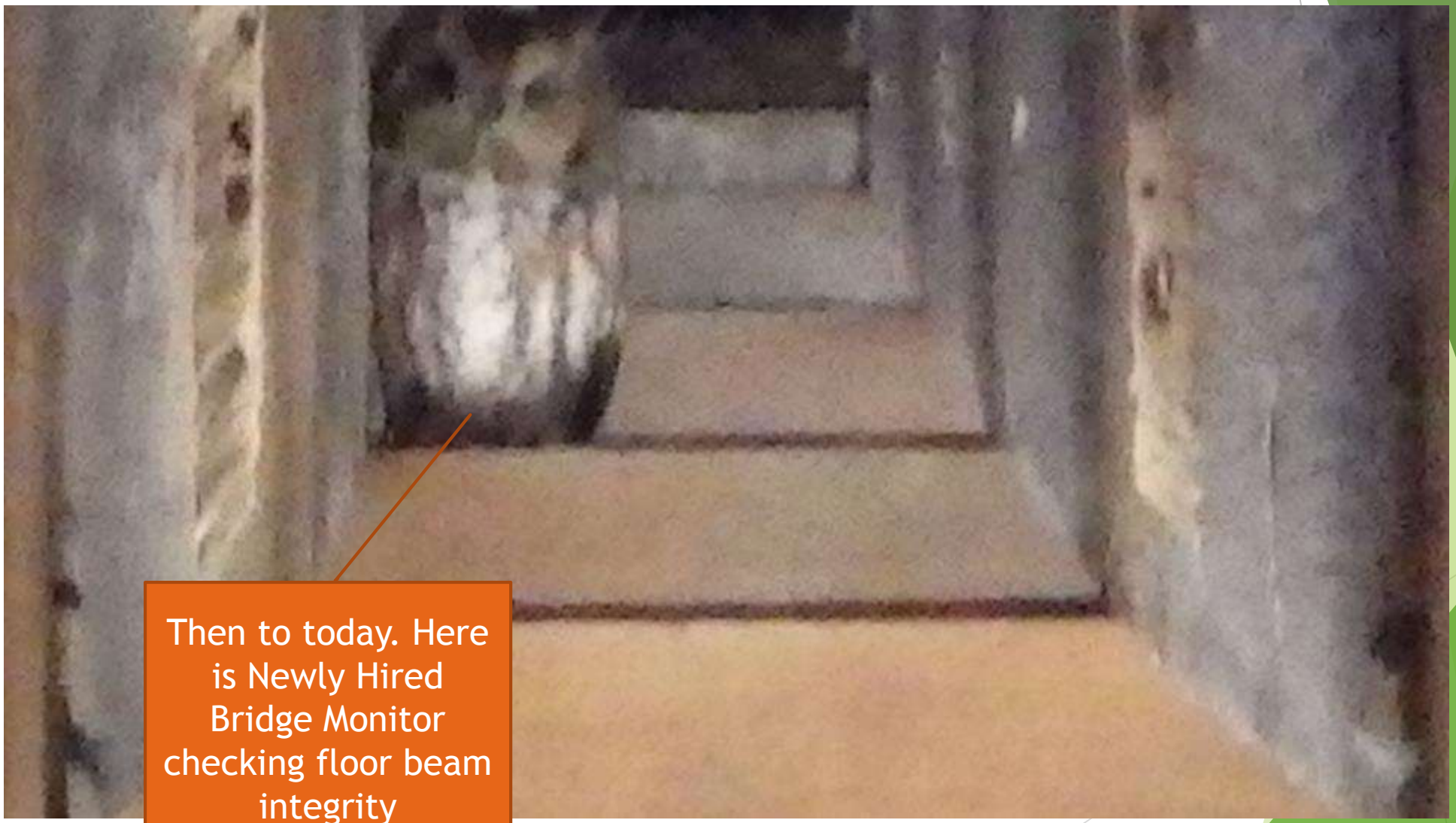
6

At this stage project is starting to burn a hole in the budget
The extra change order work: Abutment wingwalls, Concrete Cap and Approach pavement amounted to $14,592.64


Finally a
SIGHT TO BEHOLD


Fast-forward to
winter of 2014


Then forward
onward to 2016



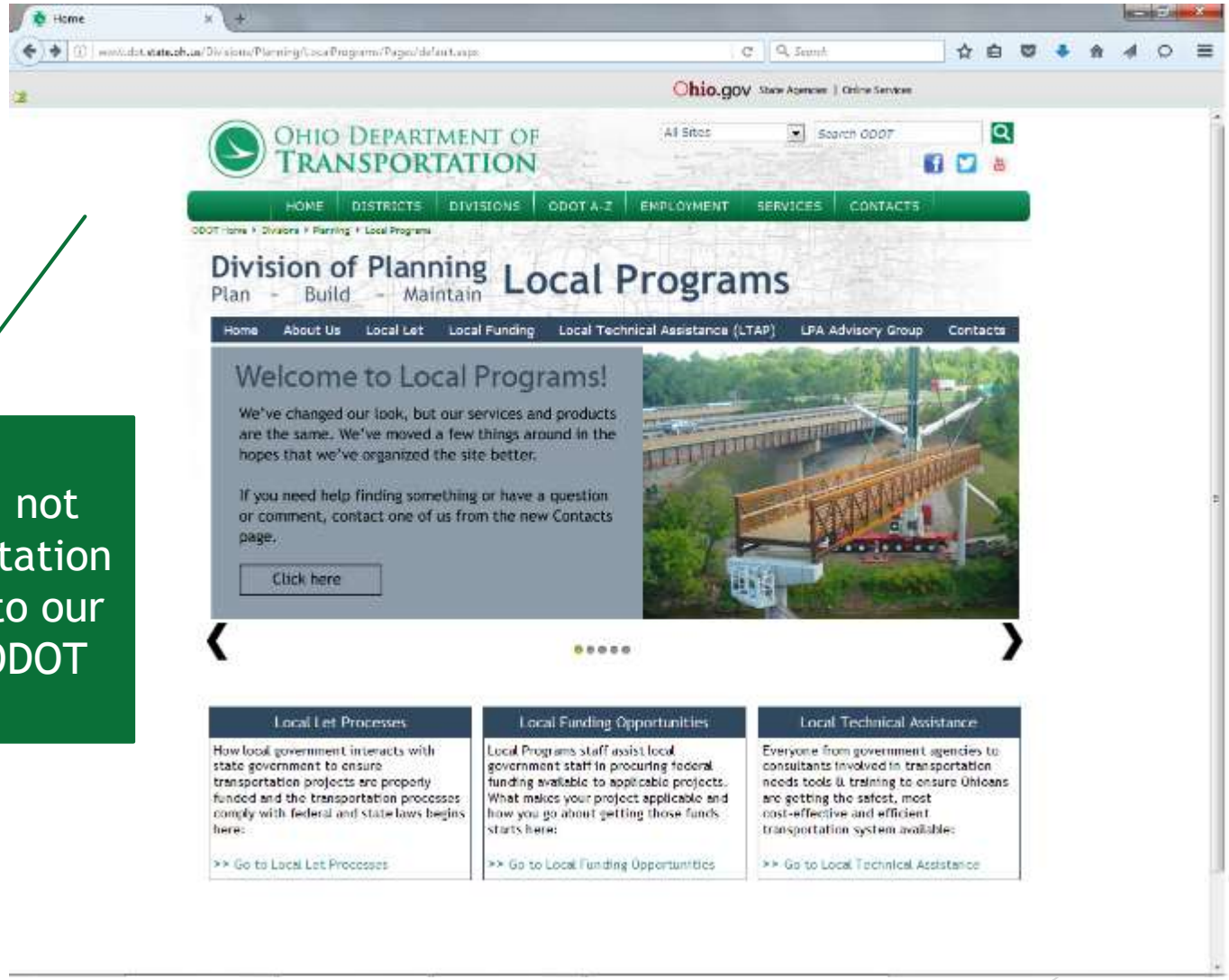
Then to today. Here is Newly Hired Bridge Monitor checking floor beam integrity

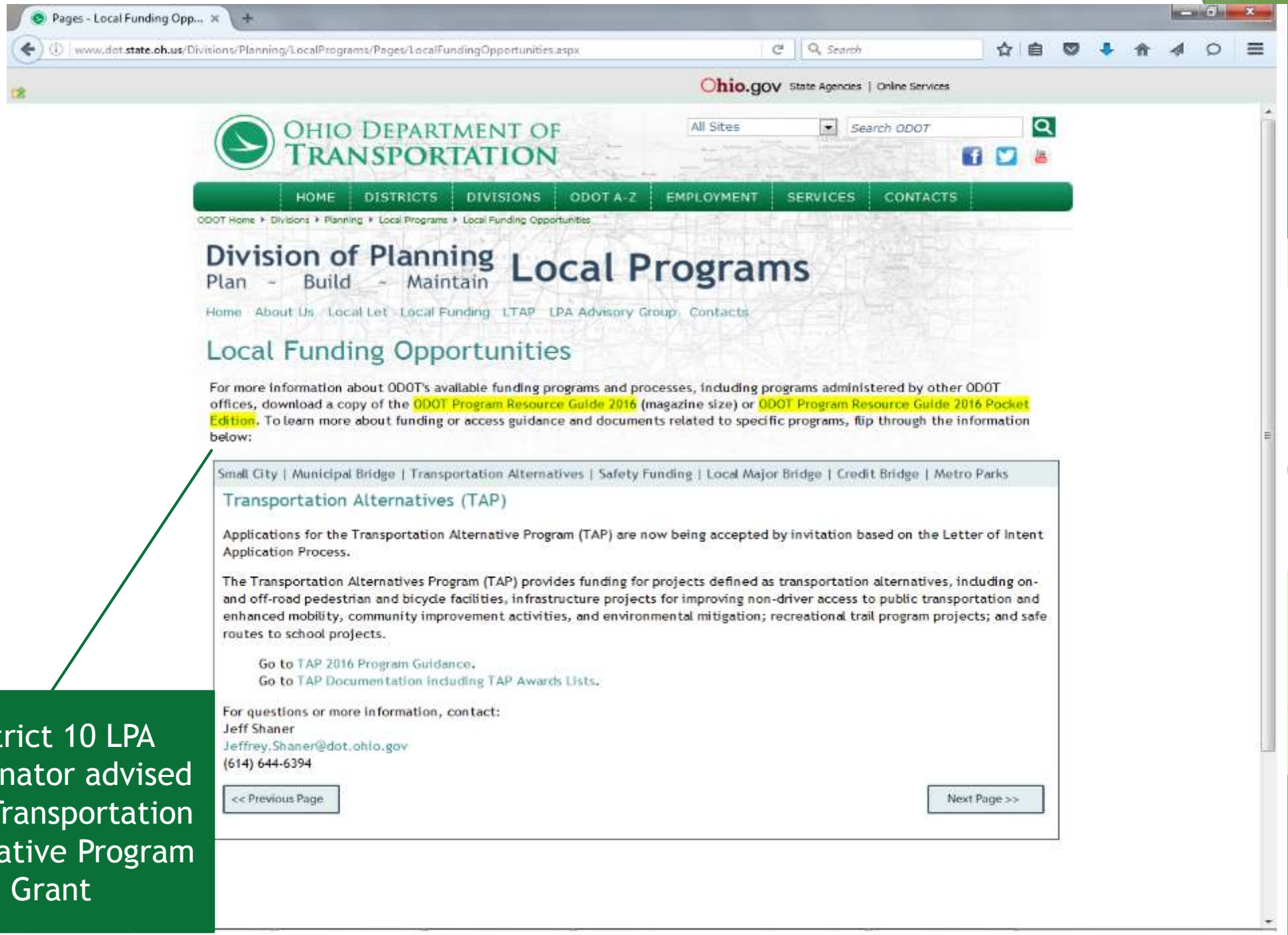
Associated problems with a sagging timber structure

Lower Chord Connections INTACT

Lower Chord Connections in stages of SHEAR FAILURE

County could not afford rehabilitation so we turned to our BIG brother ODOT





District 10 LPA coordinator advised for a Transportation Alternative Program Grant

Our engineer filled out LETTER OF INTEREST FORM and emailed it to district with supporting documentation for the project on Feb 4th, 2014

TRANSPORTATION ALTERNATIVE PROGRAM
2014 LETTER OF INTEREST FORM

Local Government: ___MONROE COUNTY ENGINEER'S DEPARTMENT

Local Government Contact Person & Title: __LONNIE TUSTIN, COUNTY ENGINEER

Street Address: ___47134 MOORE RIDGE ROAD

City, State & ZIP: WOODSFIELD, OH 43793

Telephone: __740-472-2537 _____ Fax: _740-472-2530___ E-Mail:mceng555@sbcglobal.net

Estimated total construction cost and amount of Federal Funds to be requested (Include 5 percent for construction inspection and administration, and adjust for annual inflation, considering the time element to bring a project to completion.)

TOTAL CONSTRUCTION COST $_60,000.00_____ FEDERAL FUNDS $48,000.00__ %___80_____

Identify source of 20% Cash match. If match is not currently available, please explain.
County License Plate and Gas Tax Funds/Contract Service-Bridge Fund

Describe the project including project location, termini, and purpose.
County Road #40, (Plainview Rd.) – M.P. 00.99
Rehabilitation of Historic Covered Bridge

Explain the project's relationship to surface transportation, or well-defined benefits if recreational trail facility. In order to determine if there is a direct relationship to surface transportation, the applicant may have to ask and answer some questions. For example, how is the project related to surface transportation through present or past use as a transportation resource? Is there a direct connection to a person or event nationally significant in the development of surface transportation? What groups and individuals are affected by the relationship(s) and are these relationship(s) still in existence? Is a relationship substantial enough to justify the investment of transportation funds?

Bridge located on thru County Road System

Describe if the project is in conjunction with another planned transportation, or other, project, or has multi-modal components.

Monroe County Road System

Describe the Purpose and Need and the expected Public Benefit.

Preserve Bridge at current load rating

After not hearing back for obscene amount of time, this was our response from ODOT after inquiry

From: Gawell, Shyna
Sent: Monday, December 08, 2014 9:45 AM
To: Fought, Debbie
Subject: Monroe County

Deb,

I have went through everything. And it does appear that I accidently let Monroe County slip through the cracks. They were not listed on my LOI spreadsheet (attached) and I did not send them an invite to apply. It appears that I failed to print their LOI form that you emailed me and therefore I did not have it when I went through the paper LOIs.

My apologies. You can offer for them to apply for 2015. I am hoping to have an online LOI process that should assist in "keeping up" with all the submittals. Everything will be housed in Adobe Forms rather than getting mixed into my email.

Regards,

Shyna Gawell

Program Manager

TAP, Ferry Boat & Scenic Byways

Office of Local Programs

1980 W. Broad Street MS# 3180

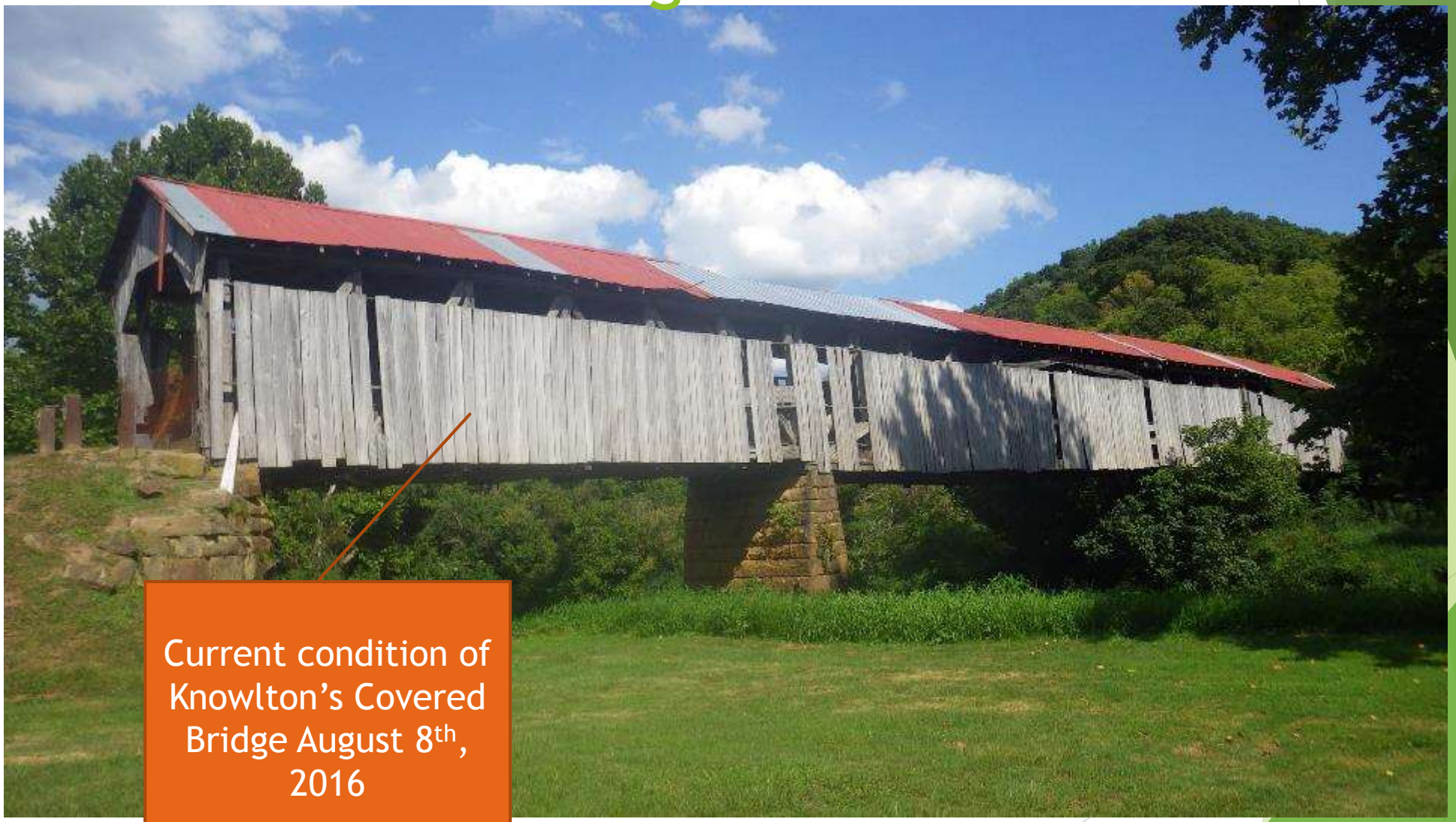
Columbus, Ohio 43223

(614) 728-2065

- Not to be discouraged, we reapplied in 2015 with assurance that it would be processed properly.
- Applied for TAP Grant in May.
- Received notice in August that we had been awarded the project and was given scope and schedule details.
- Hired Woolpert to inspect and prepare rehabilitation plans for Foraker as well as inspect and prepare preliminary plans for Knowlton Covered Bridge.
- Woolpert submitted plans in January 2016

- March 2016 - Signed ODOT LET Contract and encumbered funds for project
- Bid out and awarded to RIGHTER COMPANY INC in April 2016 for $206,600.00
- Preconstruction Meeting was held in May with a scheduled start date of August 1
- Start Date has been pushed back to August 15, 2016

Knowlton Covered Bridge

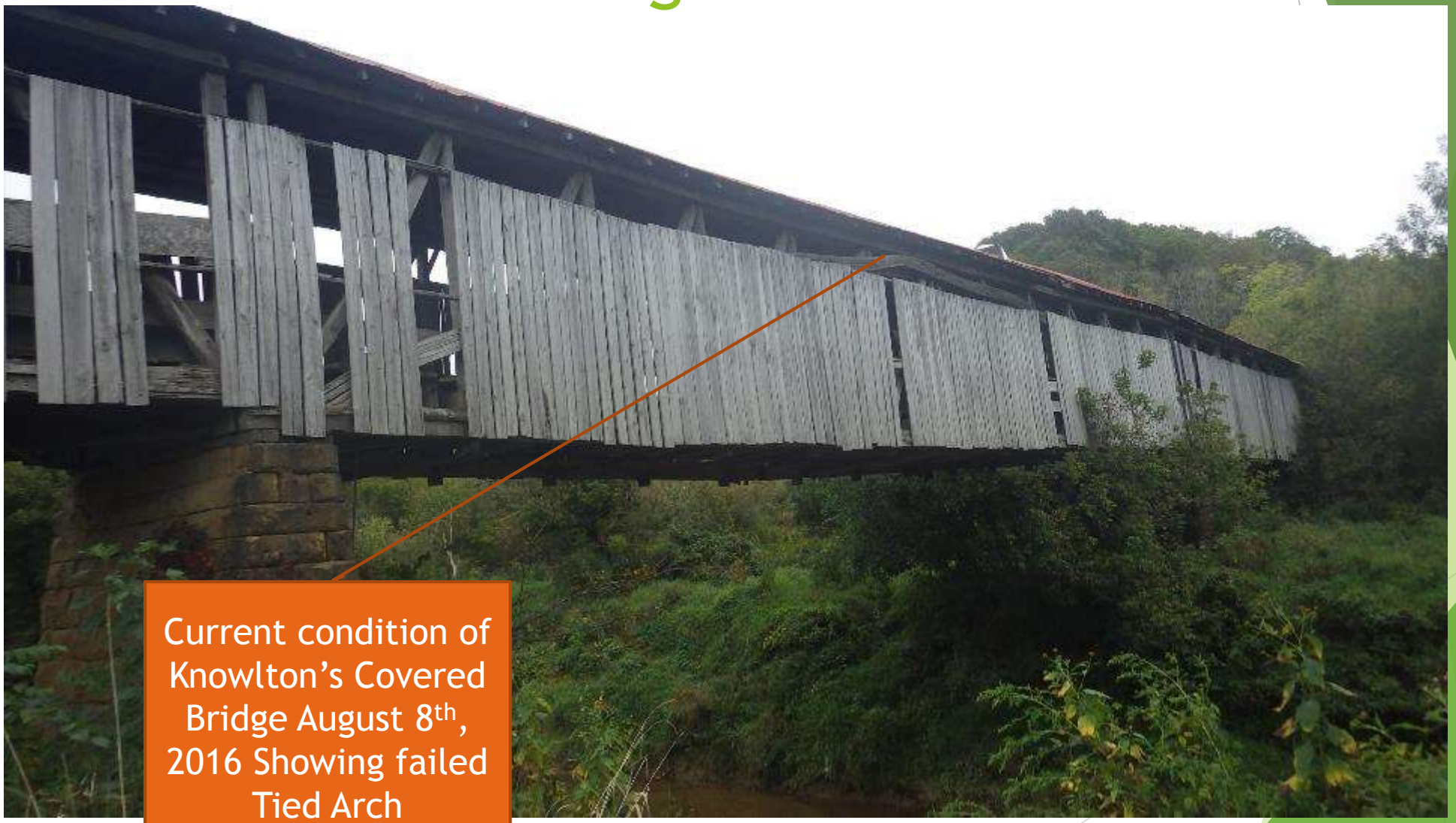


Current condition of Knowlton's Covered Bridge August 8th, 2016

Knowlton Covered Bridge

Current condition of Knowlton's Covered Bridge August 8th, 2016

Knowlton Covered Bridge



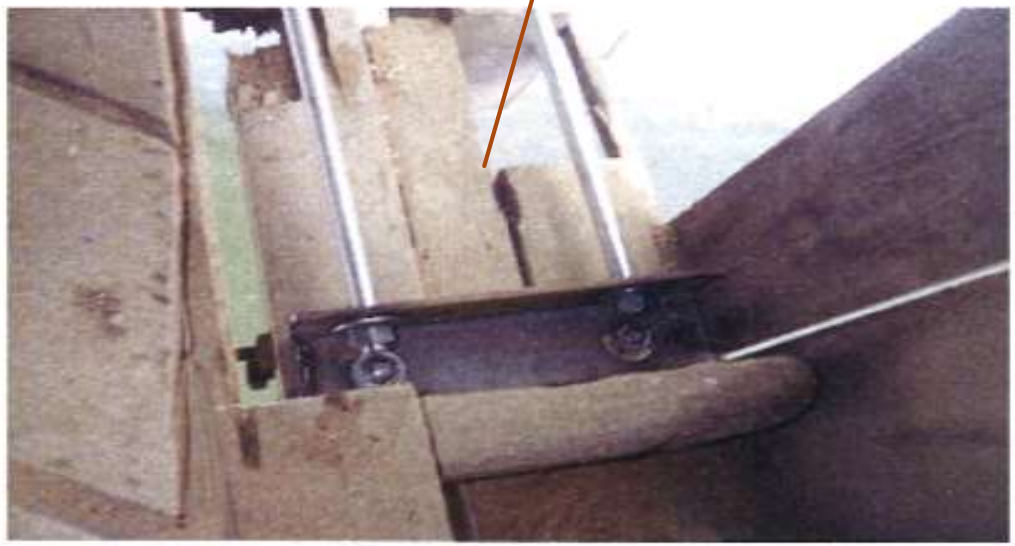
Current condition of Knowlton's Covered Bridge August 8th, 2016 Showing failed Tied Arch

Knowlton Covered Bridge

Current condition of Knowlton's Covered Bridge August 8th, 2016 Showing 2nd span global racking towards upstream side

Knowlton Covered Bridge Lower Chord Repair

Jan 22, 2016



Condition of Knowlton's Covered Bridge January, 2016 County Force Account Labor emergency fix to lower chord connection

Condition of Knowlton's Covered Bridge Febuary 22th, 2016 Showing Wind damage

Condition of Knowlton's Covered Bridge Mid-March, 2016 County Force Account Labor rebuilding roof

Condition of Knowlton's Covered Bridge Mid-March, 2016 County Force Account Labor rebuilding roof

- ODOT announces extra funds to equal 5% local match plus design cost for various project categories including TAP Grant
- Febuary 2016 – Submitted LOI for Knowlton Covered Bridge to ODOT as project sponsor for $1 million dollar complete rehabilitation with local match funding provided for by County Commissioners
- May 2016 – Submitted Transportation Alternative Grant to ODOT
- August 2016 - Waiting to here Grant award Recipients from ODOT

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Form Name:	Letter of Interest
Submission Time:	January 5, 2016 11:35 am
Browser:	Firefox 43.0 / Windows 7
IP Address:	68.252.57.39
Unique ID:	232051672
Location:	39.964900970459, -83.138298034668

Project Sponsor Information

Local Government Name:	MONROE COUNTY ENGINEER'S DEPARTMENT
Local Government Contact Person & Title:	LONNIE TUSTIN, COUNTY ENGINEER
Street Address:	47134 MOORE RIDGE ROAD
City, State & Zip Code:	WOODSFIELD, OHIO 43793
Telephone:	740-472-2537
Email Address	MCENG555@SBCGLOBAL.NET

Project Information

Describe the project including project location, termini and purpose	WASHINGTON TWP 384A MILE PT 0.30. ROAD VACATED AT BRIDGE BRIDGE IS CLOSED TO VEHICULAR TRAFFIC, OPEN TO PEDESTRIAN TRAVEL OWNED BY MONROE COUNTY COMMISSIONERS MAINTAINED BY KNOWLTON COVERED BRIDGE PARK BOARD REHABILITATE HISTORIC COVERED BRIDGE COVETED BY COMMUNITY AND REGISTERED BY NRHP #80003165
Describe the project's relationship to surface transportation, or well-defined benefits if it is a recreational facility. In order to determine a direct relationship to transportation you may need to determine: Is there a direct connection to a person or event nationally significant in the development of surface transportation? What groups and/or individuals are affected by the relationship(s) and are these relationship(s) still in existence? Is the relationship substantial enough to justify the investment of transportation funds?	BRIDGE LOCATED AT TERMINUS OF ROAD SYSTEM. HISTORICALLY SIGNIFICANT KINGPOST TRUSS STRUCTURE WITH UNIQUE TIED ARCH MAIN SPAN. AT 192', IT IS ONE OF THE TWO LONGEST COVERED BRIDGES IN OHIO. BUILT IN 1867, THIS BRIDGE SERVES AS A HISTORIC LANDMARK AND TOURIST ATTRACTION IN THE PARK IT RESIDES.
Describe the Purpose and Need and the expected public benefit.	BRIDGE IS FAILING AND HAS A INSPECTION RATING OF 1P. LOWER CHORD, FLOORBEAMS, KINGPOST TRUSS MEMBERS, AND TIED ARCH NEED REPLACED TO PREVENT IMMINENT FAILURE AND COLLAPSE OF STRUCTURE. BENEFITS WOULD INCLUDE PRESERVING HISTORICAL AND CULTURAL SIGNIFICANT STRUCTURE AS WELL AS PROMOTING TOURISM TO PARK
Describe the project's accessibility to the public (days and hours of operation).	PARK HAS CAMPSITES, PAVALION, AND IS OPEN TO PUBLIC 24HRS/DAY

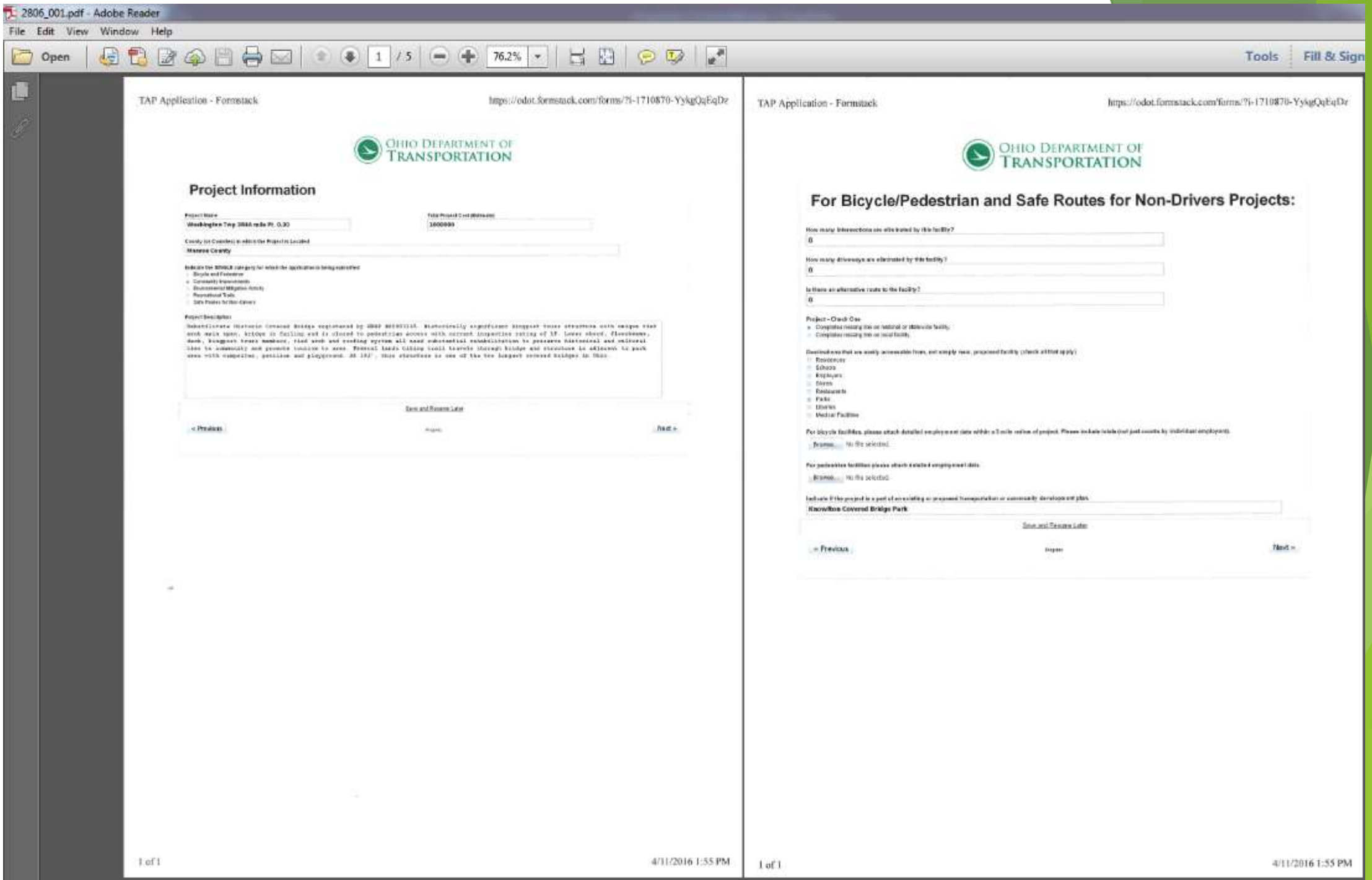
Which ONE of the eligible categories does the project qualify for?	Community Improvements (includes preservation for historic transportation facilities)
If the project is a preservation of a historic transportation facility, verify that the structure or site is listed on or is eligible for the National Register of Historic Places, please include a copy of the letter from the State Historic Preservation Office with the LOI.	SEE INCLUDED SPREADSHEET OF NATIONAL REGISTER OF HISTORIC PLACES IN MONROE COUNTY
Verify that the proposed project is publicly owned by the project sponsor and on publicly owned property (if not a qualifying acquisition).	BRIDGE LOCATED AT TERMINAL OF WASHINGTON TWP RD 384 MILE PT 00.30 SFN 5634652
Identify who will be responsible for maintaining project upon completion?	MONROE COUNTY
Have there been any maintenance issues with past performance concerning liability, negligence or safety? If so, please explain.	HISTORIC COVERED BRIDGE WAS REHABILITATED IN 1994, LOWER CHORD HAS FAILED AND MAIN SPAN LEFT TIED ARCH HAS FAILED WITH THE ARCHES IN DANGER OF IMMINENT FAILURE

Project Costs

Total Construction Cost	1000000
Federal Funds Required (This will be Funded at 95%)	950000
Percentage of Federal Funds	95
Identify source of 5% cash match.	MONROE COUNTY COMMISSIONERS
Identify source of 100% funded items for Design, PE, utility relocation, possible overages and possible ineligible items.	MONROE COUNTY COMMISSIONERS

Attachments

Attachment 1	https://s3.amazonaws.com/files.formstack.com/uploads/2207252/38125407/232051672/38125407_nrhp_links_2015-1_monroe_countylist.pdf
Attachment 2	https://s3.amazonaws.com/files.formstack.com/uploads/2207252/38125417/232051672/38125417_knowlton_covered_bridge_sfn5634652_4.jpg
Attachment 3	https://s3.amazonaws.com/files.formstack.com/uploads/2207252/38125418/232051672/38125418_2528_001.pdf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OHIO DEPARTMENT OF TRANSPORTATION
Project Information
Project Description:
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https://odot.formstack.com/forms/?i-1710870-YykgQqEqDz
OHIO DEPARTMENT OF TRANSPORTATION
For Bicycle/Pedestrian and Safe Routes for Non-Drivers Projects:
How many intersections are eliminated by this facility?
0
How many driveways are eliminated by this facility?
0
Is there an alternative route to the facility?
0
Project - Check One
Residences
Schools
Employers
Stores
Restaurants
Parks
Libraries
Medical Facilities
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Indicate if the project is a part of an existing or proposed transportation or community development plan.
Knowlton Covered Bridge Park
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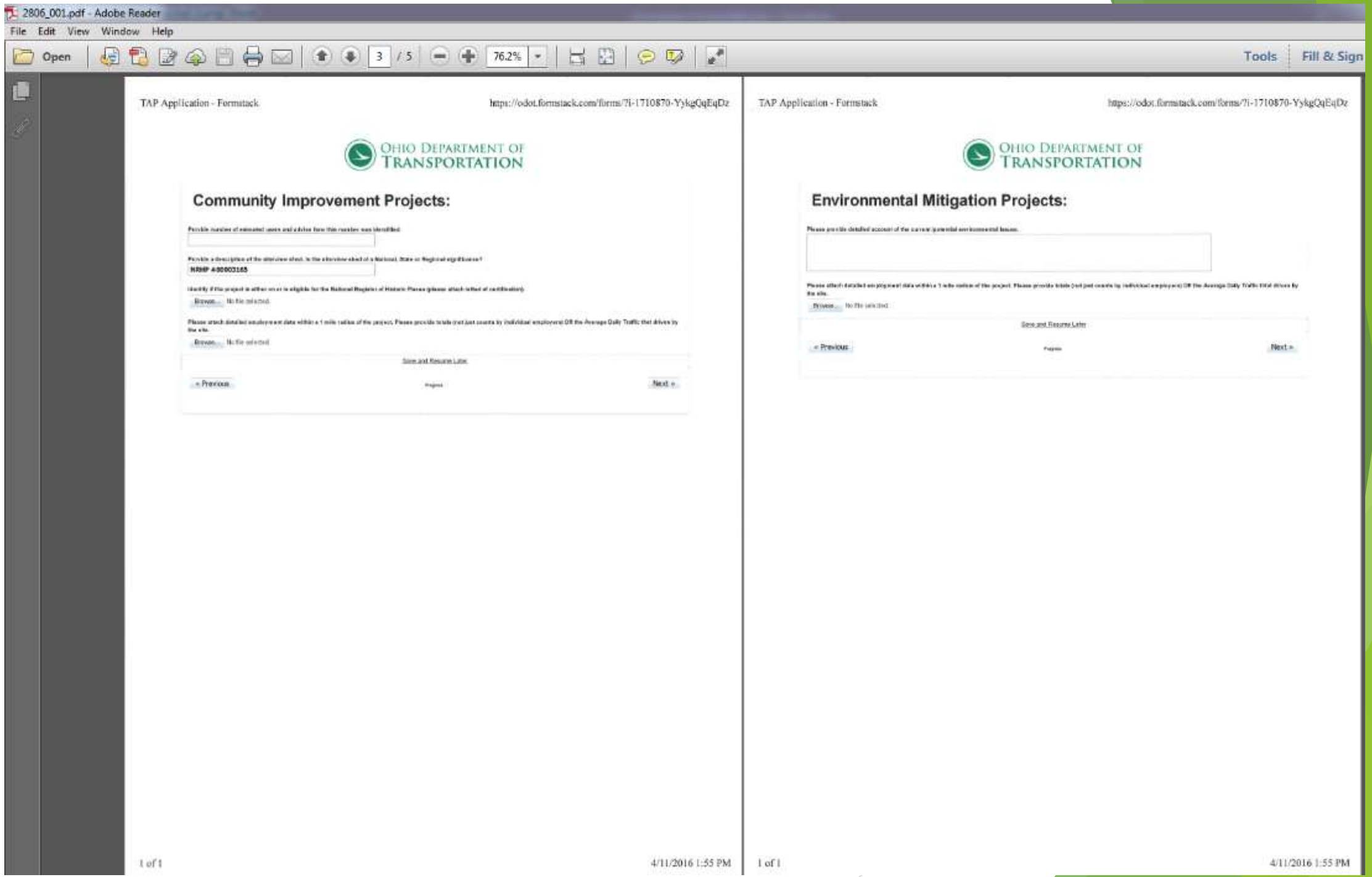
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Community Improvement Projects:
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Environmental Mitigation Projects:
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OHIO DEPARTMENT OF TRANSPORTATION

Miscellaneous:

Present status of property ownership and plan preparation (MUST be on existing publicly-owned property). *

Knowlton Covered Bridge Park Board
Hired Woolpert for structural inspection, feasibility study to rehab structure, and preliminary rehab plan formulation

Please list all public involvement efforts. *

Monroe County Engineer's Dept.
Monroe County Commissioners
ODOT

How would you develop this project if you only received partial funding. *

Would be able to correct immediate destabilizing issues of the superstructure to allow for time to apply for more funding through multiple potential sources.

Save and Resume Later

« Previous Next »

CURRENT CONDITION OF MONROE COUNTY'S BUDGET TO FUND THESE PROJECTS INHOUSE
CHECK THE POCKET LINT FOR PENNIES

Ohio's Covered Bridges: Preserving our Heritage for the Future

Design Perspective

Tom Less, PE

WOOLPERT

Foraker Covered Bridge

Foraker Covered Bridge

- Finite Element Model (Staad) of deflection with lost connection

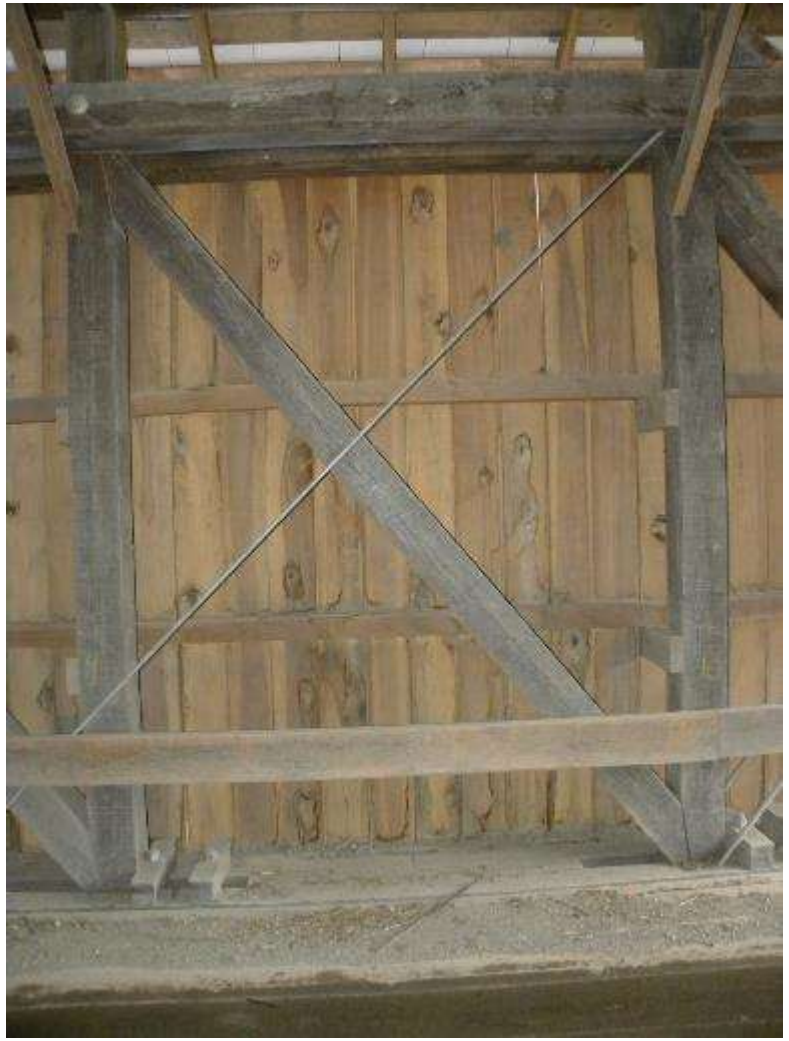
WOOLPERT

Foraker Covered Bridge

- FEM Modeling
  - 2-D frame analysis using beam members specified as “TRUSS”, tension-compression only action. Also included tension only members for post-tensioned rods.
  - External load applied to model the original post-tensioning at the ends of the truss.
  - Failure model removed the post-tensioning external loads and instead modeled one end as having a roller type connection with a spring in the longitudinal direction. This allowed the truss to deflect horizontally and vertically and the post-tensioned rods to pick up additional load from the original connection.
  - A small amount of horizontal deflection in the lower chord resulted in large vertical displacement at mid-span.

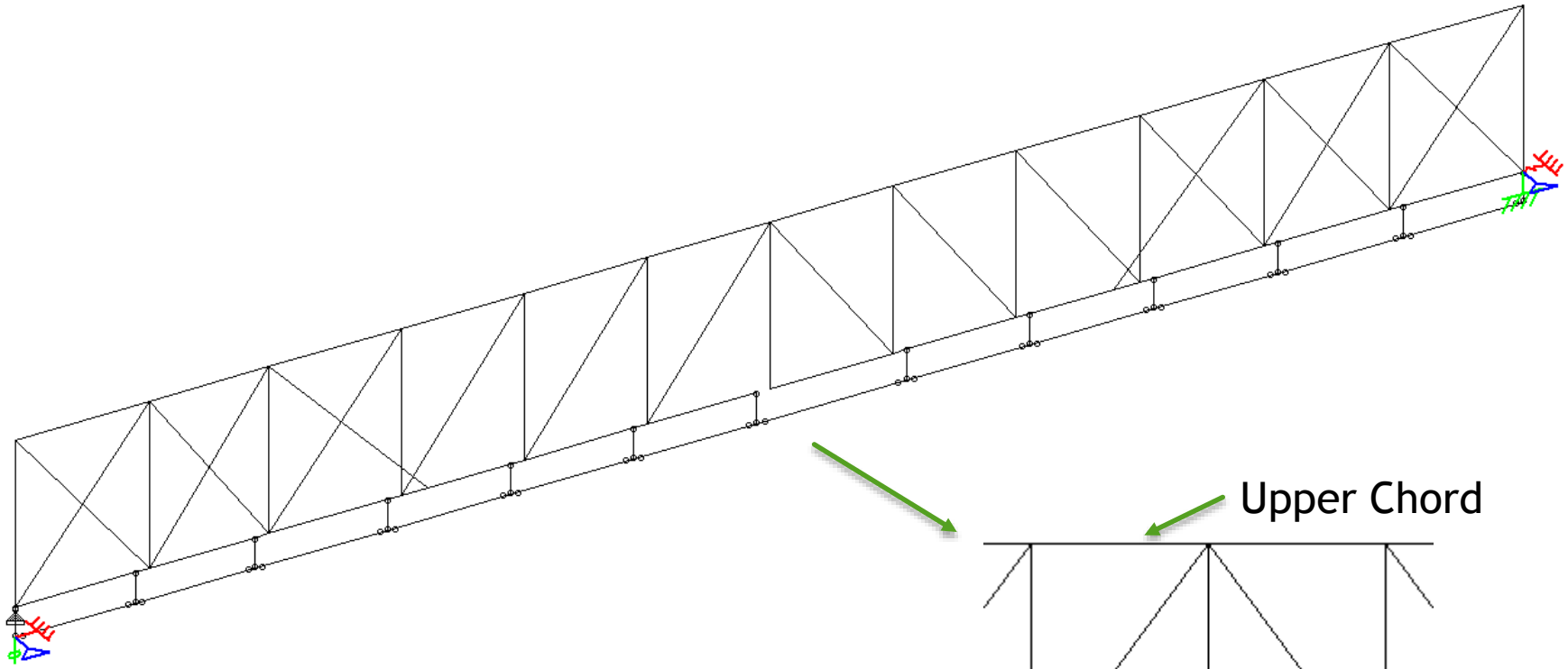
WOOLPERT

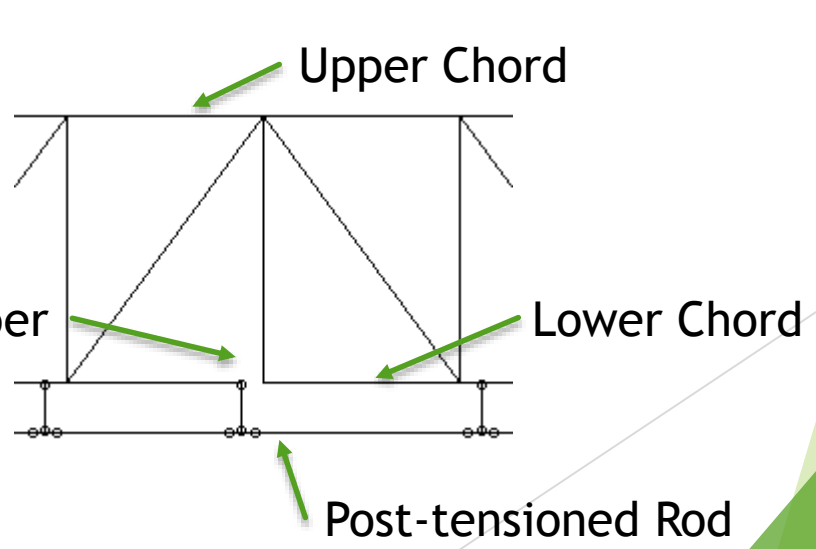
Foraker Covered Bridge



WOOLPERT

Foraker Covered Bridge





WOOLPERT

Foraker Covered Bridge

- Connection Failure
  - Prior rehabilitation included a connection design that used a combination of incised shear joint in wood and bolts.
  - Bolt bearing checks fail and over time the bolts will ‘work’ the holes larger in wood due to sustained stress.
  - When bolt holes deform the bolts become no longer fully engaged and the shear connection becomes the primary load carrying mechanism.
  - The wood in the shear connection fails, and the connection deflects/expands until the bolts re-engage. In this case the prior rehabilitation included post-tensioned rods which picked up more load, allowing the bolted-only connection to be sufficient to prevent further failure.
  - In summary the prior design failed to account for bolt bearing deformation and differential mobilization of the two connection methods (wood shear connection and bolts). This is similar to combining welds and bolts in a steel connection.

WOOLPERT

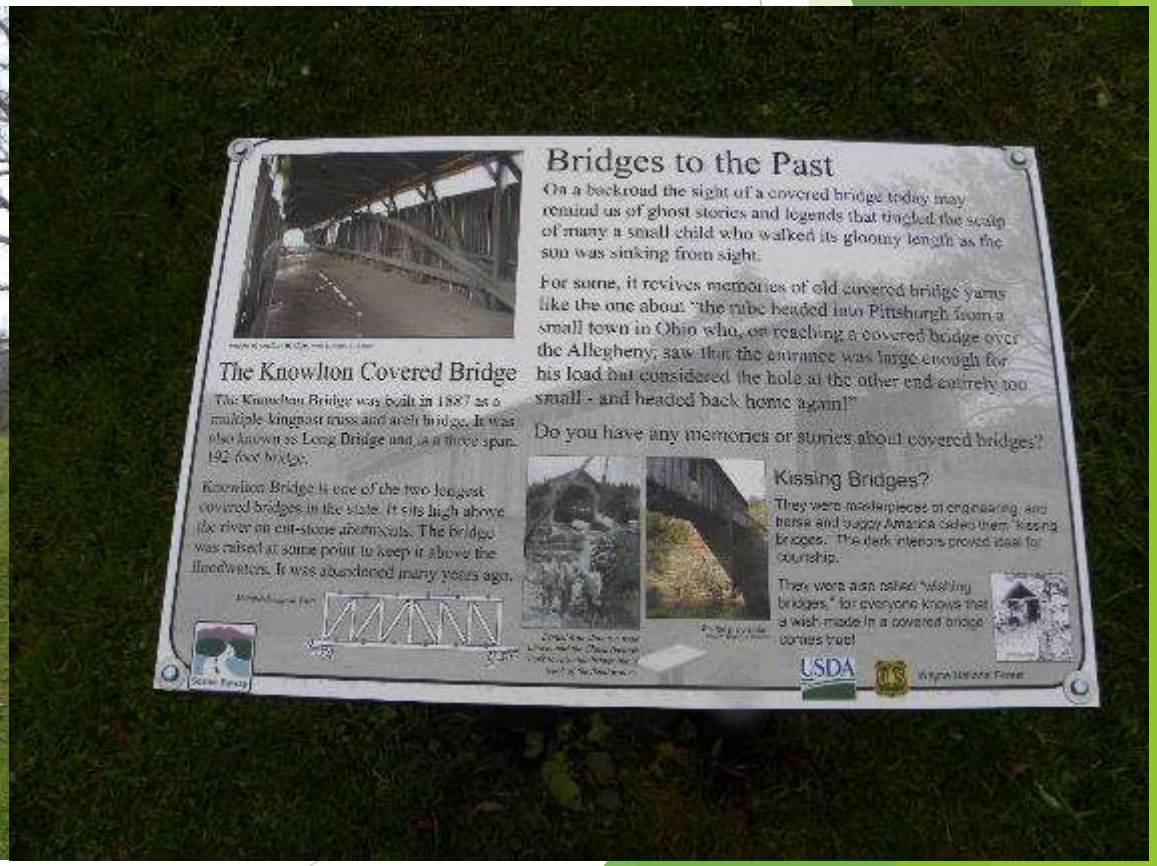
Foraker Covered Bridge

- Recommendations
  - Design shear connection and bolted connection to carry the load independently, similar to steel design with bolts and welds.
  - Consider using undersized bolt holes to provide an interference fit to help ensure full bolt engagement. Similar to rivets.
  - Make sure to check bolt bearing calculations to help minimize hole deformation. Some deformation will still likely occur over time due to sustained loads.
  - Consider using shear rings with the bolts. This can however lead to maintenance in the future if the rings start to corrode. Recommend galvanized.

WOOLPERT

Knowlton Covered Bridge

- Grant application submitted for $1,000,000 rehabilitation
- Emergency Repair for Lower Chord

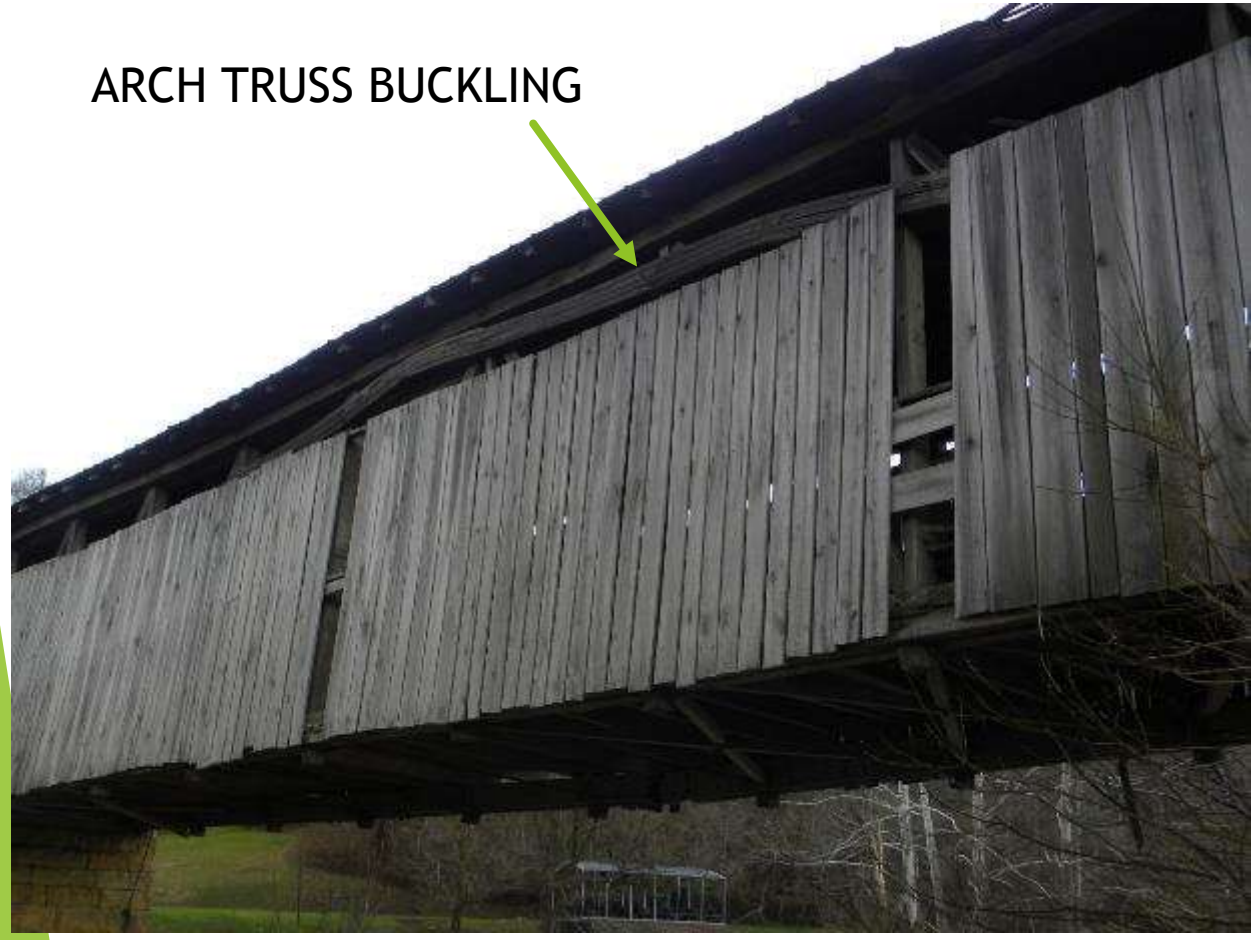


Knowlton Covered Bridge

- Lower Chord at Center Span Midspan Has Fractured in Tension

Knowlton Covered Bridge

- Truss Arch Buckling and Racking

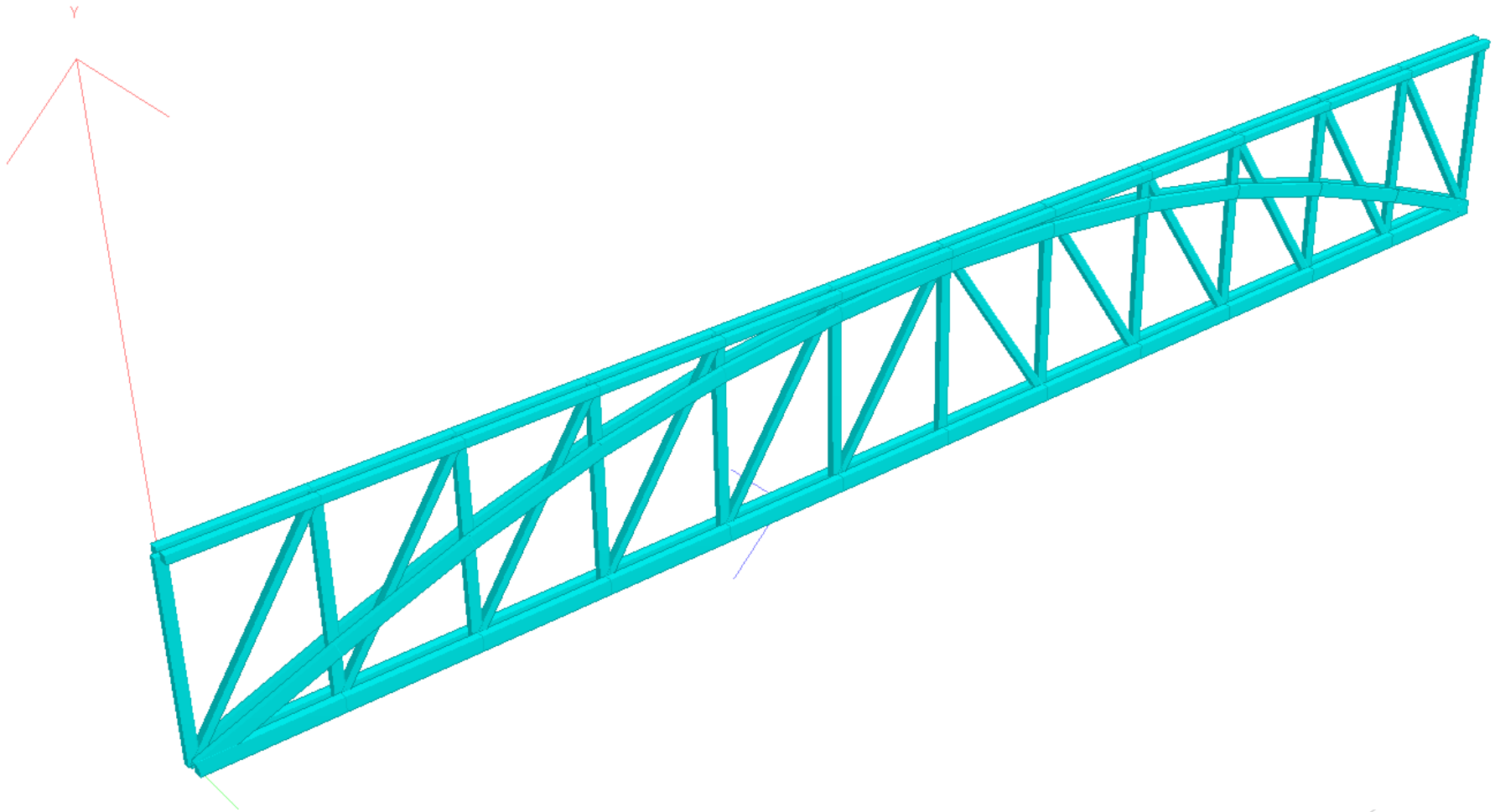


Knowlton Covered Bridge

- First End Span already shored

WOOLPERT

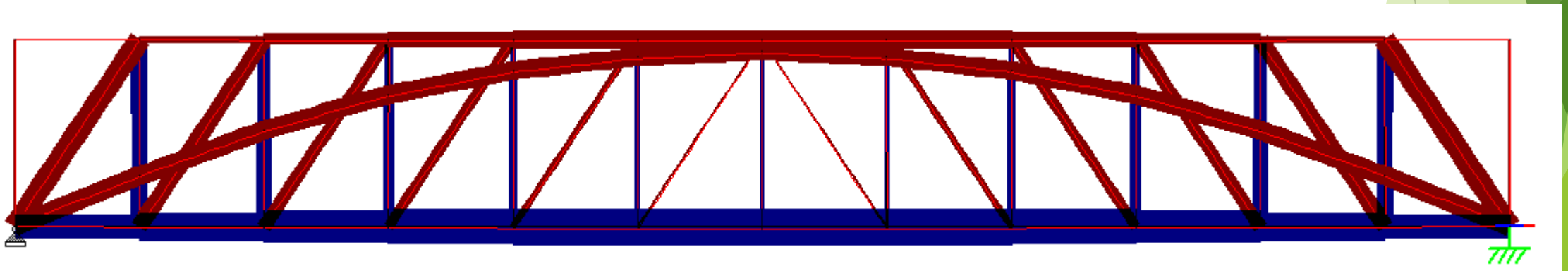
Knowlton Covered Bridge



WOOLPERT

Knowlton Covered Bridge

- FEM Modeling
  - 2-D frame analysis using beam members specified as “TRUSS”, tension-compression only action. Similar to Foraker. In future will expand to 3D model to capture structure-wide distribution of force, out-of-plane effects, and racking/buckling.
  - Analyzed original condition for dead and snow load to determine repair forces.
  - Arch in truss adds redundancy to the structure – the reason it is standing!



WOOLPERT

Knowlton Covered Bridge

- County commissioner met on site, and brought local artwork

WOOLPERT

Knowlton Covered Bridge

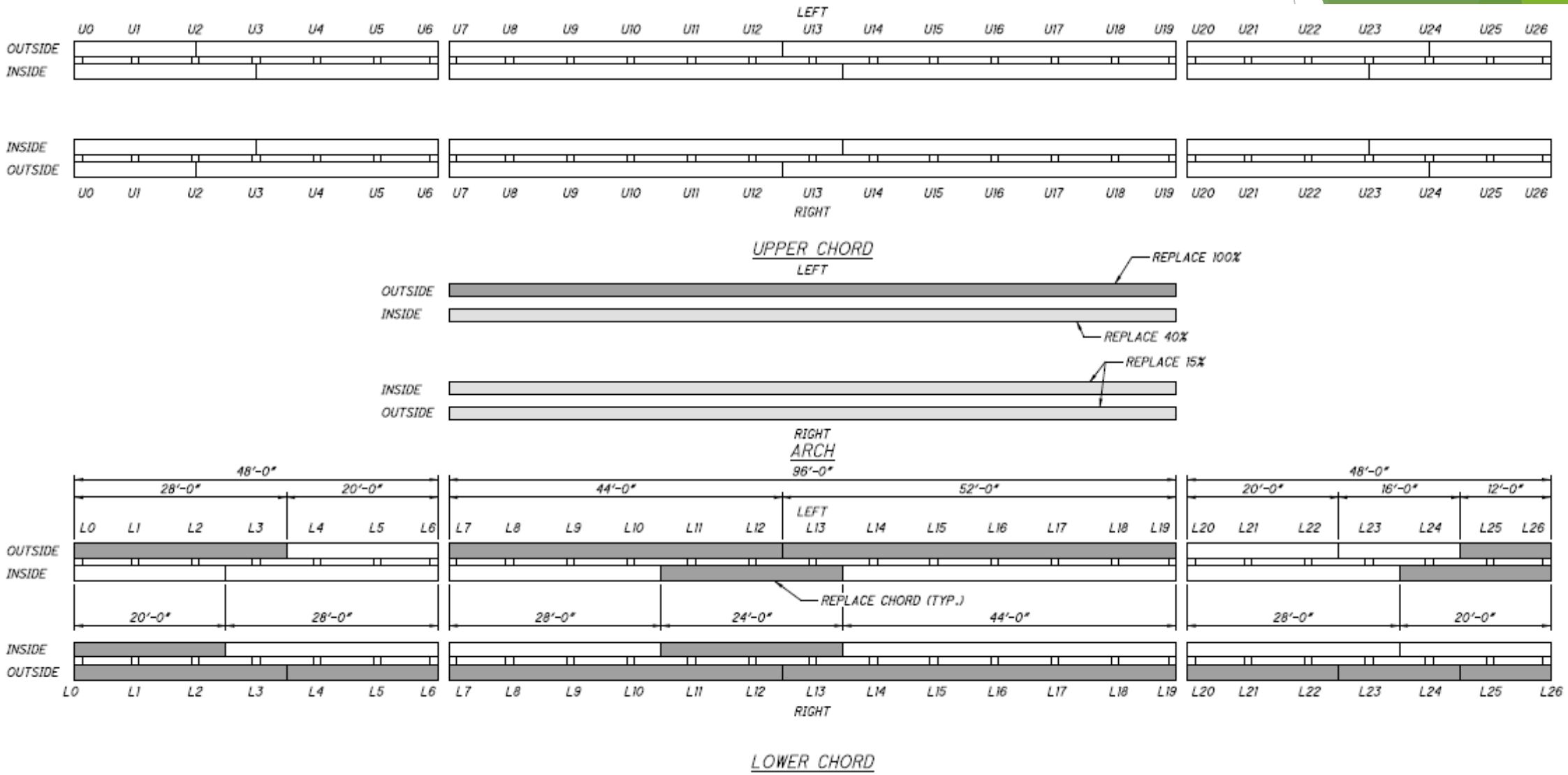
WOOLPERT

Knowlton Covered Bridge

- Some original chord members are 6”x11” or 6”x6” x 52 feet long white oak – would be very hard to find to replace in kind.

WOOLPERT

Knowlton Covered Bridge



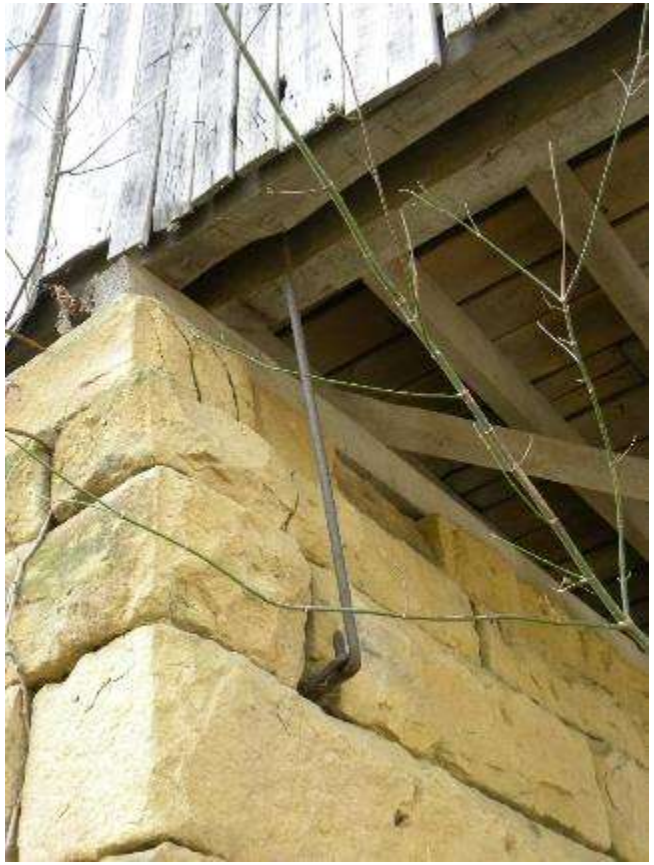
WOOLPERT

Knowlton Covered Bridge

- Historic Detail

Knowlton Covered Bridge

- Don’t want the bridge to float away



Ohio's Covered Bridges: Preserving our Heritage for the Future

Contractor's Perspective

Brad Nadolson, PE

About Us

- Involved in bridge construction since 1977
- Repaired, reconstructed or built over 100 highway and pedestrian bridges since 1986
- Level 1, 2 & 3 Bridge Prequalified with ODOT
- City of Columbus Prequalified
- **Over 50 Covered Bridge Rehabilitation, Repair and New Construction Projects since 1996, in three states**

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Issues to be Considered/Challenges

- Access & Site Constraints
  - Right of Way and Construction Easements – Is there enough room?
  - Relationships with the neighbors
  - Water way restrictions – Can we get in the stream?
    - Siding work
    - Support of structure

Foraker Covered Bridge

Issues to be Considered/Challenges

- Condition of the Existing Structure
  - Hidden issues
    - **Rot**
    - **Insect damage**
    - Structural damage
    - Corrosion on steel members
    - Contingency Quantities

Rot/Insect Damage

Rot/Insect Damage

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Rot/Insect Damage

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Rot/Insect Damage

Issues to be Considered/Challenges

- Condition of the Existing Structure
  - Hidden issues
    - Rot
    - Insect damage
    - Structural damage
    - Corrosion on steel members
    - Contingency Quantities

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Steel Corrosion

Issues to be Considered/Challenges

- Condition of the Existing Structure
  - Hidden issues
    - Rot
    - Insect damage
    - Structural damage
    - Corrosion on steel members
    - Contingency Quantities

Issues to be Considered/Challenges

- Access to Materials
  - Wood species/Grading and availability – Lead times
  - Drying/Moisture Content specifications

Recommendations from Experience

- Never specify kiln-dried white oak
- If you are replacing the roof, consider replacing the roof system wood (purlins for sure)!
- Get the needed permits for water-way access
- Make sure you have enough right-of way or temporary construction easements
- Allow enough time for material lead-times when considering bid and completion dates
- Specify plain/black steel or weathering steel (check availability)

Recommendations from Experience

- Recognize that these bridges do require maintenance & inspection!
  - Tighten bolts
  - Inspect timbers
  - Maintain roof and siding
  - Clean debris – especially off of lower chord
  - Vandalism/Impact damage

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Impact Damage

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Impact Damage – Repaired!

Recommendations from Experience

- Fire Retardant on every bridge – existing and new
- Tim-bor/Borate Treatment to prevent insect and fungal damage
- Experience requirement – don't let just anyone work on your bridge!
  - Submit with the bid for evaluation
- It is never too late to rehabilitate the bridge – preserve a piece of history!

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Experience Requirement

SUPERVISOR QUALIFICATIONS:

THE CONTRACTOR SHALL OBTAIN THE SERVICES OF A PERSON OR PERSONS PERSONALLY EXPERIENCED IN TIMBER FRAME CONSTRUCTION OF HISTORIC COVERED BRIDGES. THIS SHALL INCLUDE TIMBER SELECTION, ORIENTATION, MEASUREMENT, LAYOUT, FABRICATION, AND INSTALLATION. THIS PERSON SHALL BE KNOWN AS THE TIMBER FRAMER.

THE TIMBER FRAMER SHALL BE IN CHARGE OF AND RESPONSIBLE FOR THE SELECTION OF TIMBER TO BE USED FOR REPAIR OF THE TRUSSES. THE TIMBER FRAMER SHALL BE PRESENT AT THE JOB SITE AT ALL TIMES DURING THE PERFORMANCE OF TIMBER FRAMING WORK. THE TIMBER FRAMER NEED NOT BE PRESENT DURING OTHER ACTIVITIES.

THE TIMBER FRAMER SHALL HAVE A MINIMUM EXPERIENCE IN TIMBER FRAME CONSTRUCTION OF AT LEAST TEN HISTORIC COVERED BRIDGES IN THE LAST TEN YEARS.

THE ENGINEER WILL APPROVE OR REJECT THE CONTRACTOR'S TIMBER FRAMER WITHIN 10 CALENDAR DAYS FOLLOWING THE SUBMISSION OF THE REPORT OF NAMES AND VERIFIABLE RESUME INFORMATION. WORK ON THE BRIDGE STRUCTURE SHALL NOT COMMENCE UNTIL THE CONTRACTOR RECEIVES WRITTEN APPROVAL OF ITS TIMBER FRAMER FROM THE ENGINEER. IN THE EVENT THE CONTRACTOR ELECTS TO SUBSTITUTE AN ALTERNATE, VERIFIABLE RESUME INFORMATION SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO THAT INDIVIDUAL'S PERFORMANCE OF TIMBER FRAMING RELATED WORK. THE ENGINEER WILL APPROVE OR REJECT THE CONTRACTOR'S PROPOSED SUBSTITUTE WITHIN 10 CALENDAR DAYS. FAILURE TO UTILIZE THE TIMBER FRAMER WHOSE EXPERIENCE RESUMES WERE SUBMITTED MAY BE CAUSE FOR SUSPENSION OF THAT PORTION OF THE WORK. DELAYS CAUSED BY THE CONTRACTOR'S FAILURE TO MEET THIS REQUIREMENT SHALL BE THE CONTRACTOR'S SOLE RESPONSIBILITY AND SHALL NOT BE CAUSE FOR EXTENSION OF TIME.

Recommendations from Experience

- Fire Retardant on every bridge – existing and new
- Tim-bor/Borate Treatment to prevent insect and fungal damage
- Experience requirement – don't let just anyone work on your bridge!
    - Submit with the bid for evaluation
- It is never too late to rehabilitate the bridge – preserve a piece of history!

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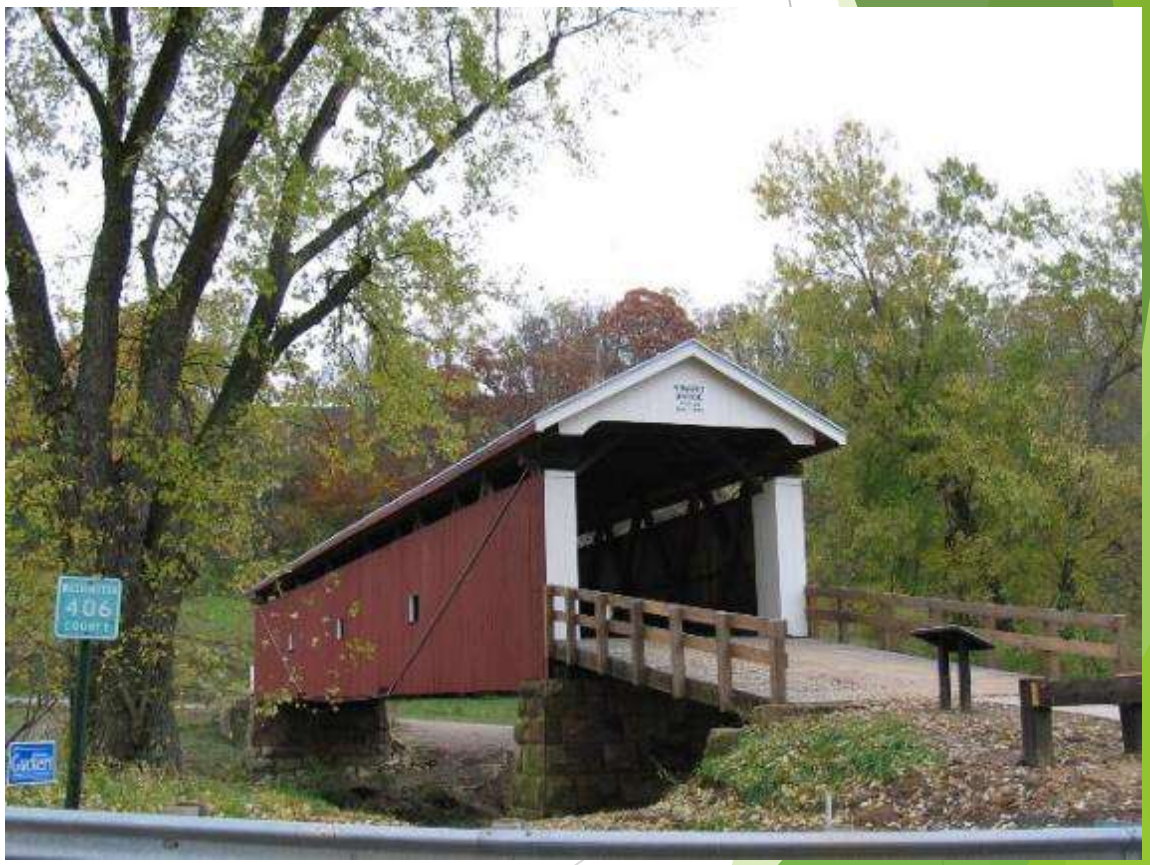
Before and After…Engle Mill Covered Bridge

Before and After…Engle Mill Covered Bridge

Before & After…Rinard Covered Bridge



Questions?

Brad Nadolson

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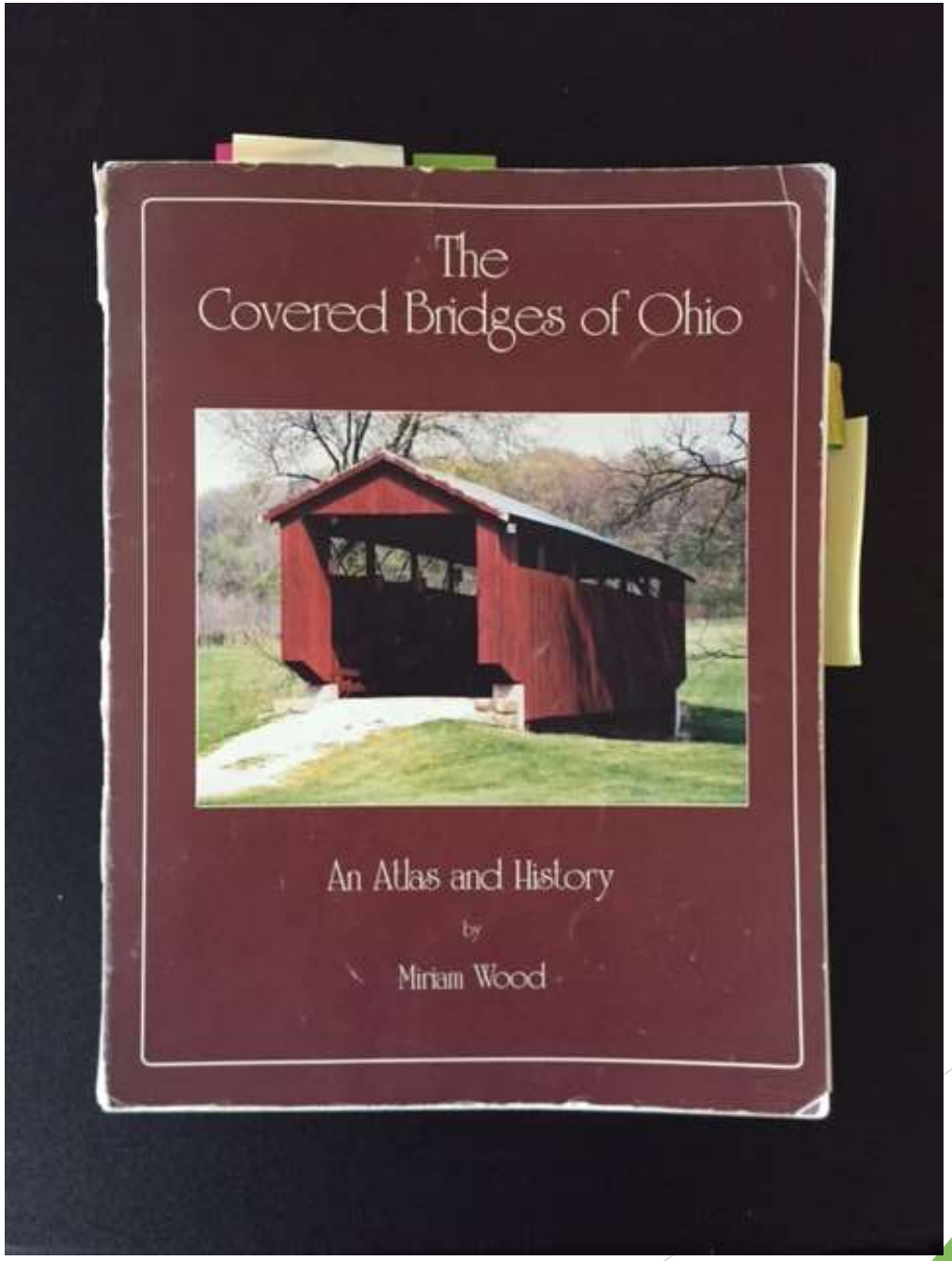
Ohio's Covered Bridges: Preserving our Heritage for the Future

My Perspective

Ron Mattox, PE

WOOLPERT

Miriam Wood



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By the numbers

- None in 1803 – Statehood
- 1809 first recorded sighting
- 3,850 documented in 85 of 88 counties
- Today 80 to 130 depending on definition

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Significance and my Passion

- Historic
- Creative solutions
- Construction and Materials
- Bridge Design (Geek)
- Feeling

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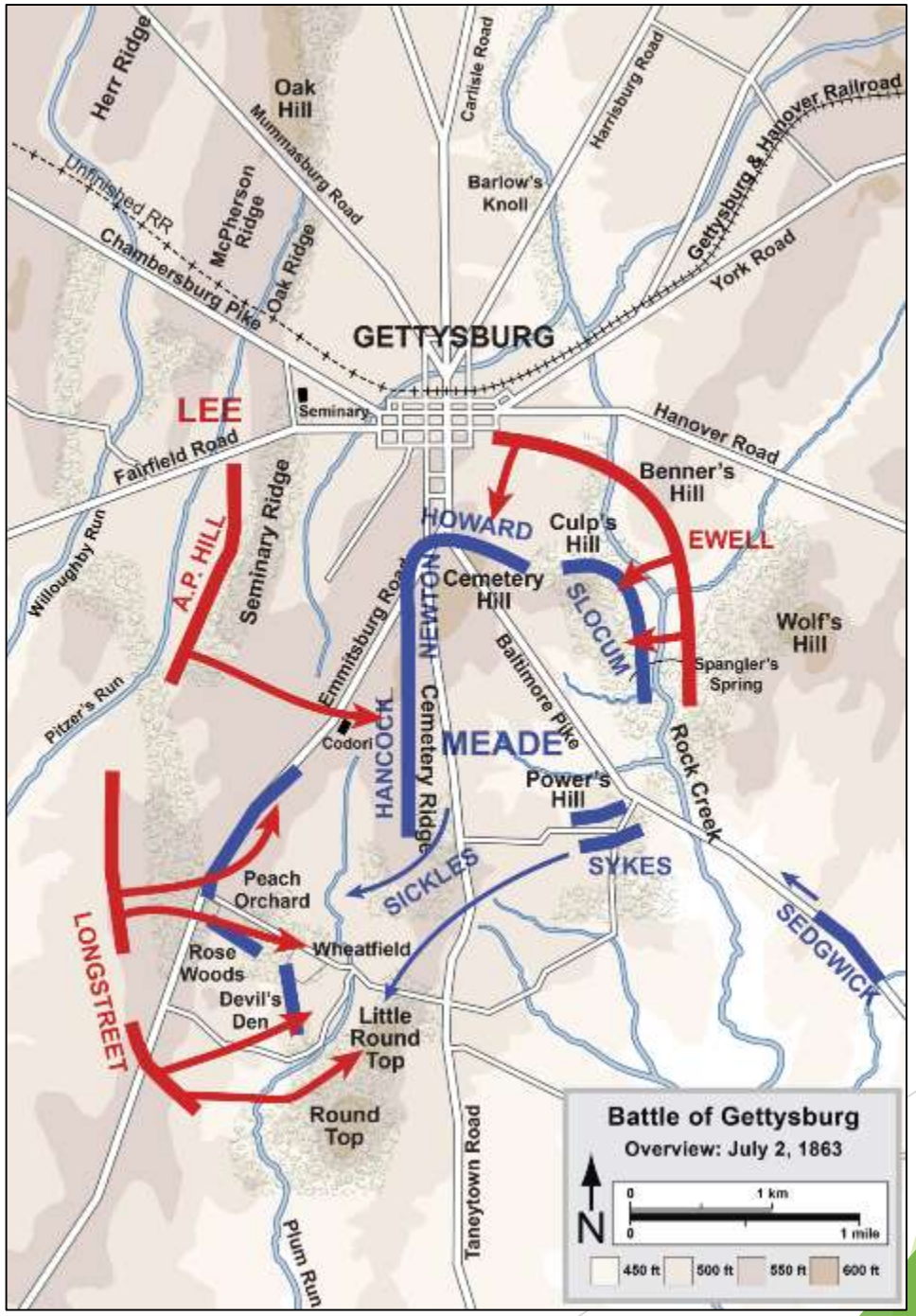
Little Round Top
July 2, 1863



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Roberts 1829
Newton Falls 1831

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17 truss types

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Chord joints

Details

Complexity
Craftsmanship
Knowledge

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Species
Size

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Champions

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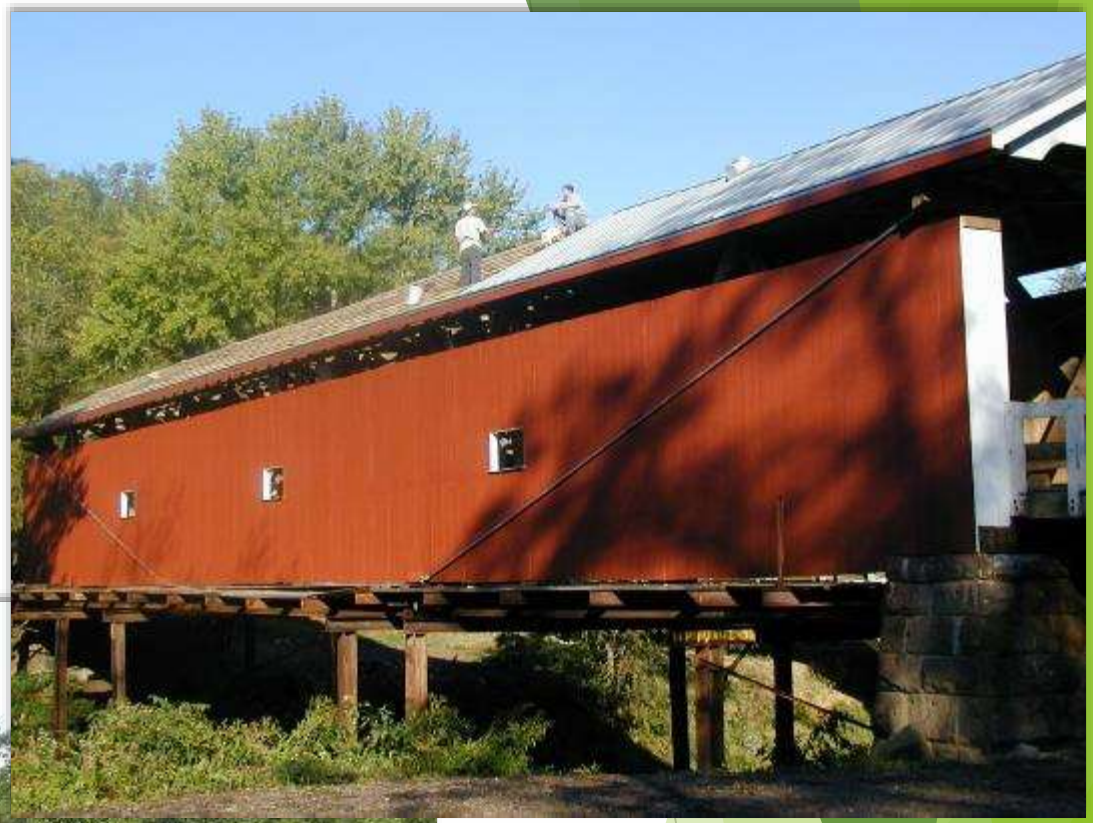
Rinard Covered Bridge



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Thank you
Questions?