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





WOOLPERT

Historic Traditions and Local Heritage

Historic Covered Bridges of Monroe County James Fleeman, El., 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 <u>3P</u>

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 <u>1P</u>





Tools

Fill & Sign

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Originally Built 1887 6 @ 8'-0" = 48'-0"# 6 @ 8'-0" = 48'-0"± 12 @ 8'-0" = 96'-0'2 MOOLPER. NOTE: DIMENSIONS TO TOP OF ARCH U12 🖏 013 U3U4115 U8 UU ~ UM. U15U16 1017 U18UI8 U20 021 U22 U23 U24 U25 U26 0 1.3 L4 15 L9 L10 LBL.12 1.13 £14 L 15 L 16 L17 LIB LIG 120 L21 1.22 1.23 124 L25 L261 12 16 L7 L8 - REPLACE MEMBER (TYP.) 0 LEFT TRUSS 195'-0** 6 @ 8'-0" = 48'-0"± 12 @ 8'-0" = 96'-0" 6 @ 8'-0" = 48'-0"= ELEVATION U24U23 U22 U21 U20 U19 018 1317 U16 U/5UM U13 U12 UЮ 118 1/3 U25 126 125 L23 122 L21 L20 119 L18 L17 L.16 L15 L14 L13 L12 L11 £10 L9 L8 L7 L6 L5 14 13 12 L1 LOП 1.24 RIGHT TRUSS MOE-384-0.30 PID No. 00000 0



Foraker Covered Bridge

Length 104'-8" Span 95' - 6" Last Rehab: 2005 Date of picture: 2007

Bridge in Freshly Minted Condition

Notice the sag already forming within 2 years of rehabilitation completion

Ominous Sign of times ahead

Relocated Local Bridge Monitor to Foraker Covered Bridge

Ready to work Boss!

Foraker Covered Bridge SFN5633230

Bildge

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

Foraker Covered Bridge 2001



NO SAG ISSUE, advanced deterioration and decay Page 1 of 3

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: <Lonnie Lustin@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 bidge was analyzed for an H16 live loading, plus the dead load of the existing trusses, supplemental truss members, siding, runt and the new Bootboarrs and deck. The strengthening of the upper cheed 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 alloe this would infinge on the waterway opening. If the steel beams were used as they are new (supporting the floor beams), the floor beams would have to be longer and larger for the additional spon length.

The anchor detail proposed does extend up through the lower chord and goes through a timber block realing 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. Greshsin, Smith and Partners (614) 221-0678

> From: Mike.Lang@dot.state.ch.us [mailto:/Mike.Lang@dot.state.ch.us] Senit: Monday, July 25, 2005 10:19 AM To: Nattox, Ron; Gary.Scollan@dot.state.ch.us; Tony.Durm@dot.state.ch.us Subject: Fw: Focaker Covered Bridge Anchor Detail

Ron Mattox.

This is sent mainly for Ron's review and comments and to keep others informed. Steven Brock, contractor, has expressed some concern about the 115 loading and also has an idea for the new anchoring system proposed by Ron. Early on the county engineer, Lonris Tustin, had ask that we keep the steet beam support system in place. We told him no. Since then, Steven Brock has made a proposal to Lonnie and us to hid the steet by extending the roof line and moving the sticing out to cover the beams. The only way to see the beams would be frum underneath the bridge. I discoursged the Idea as no historically correct, but I want Ron's concurrence. Any guestions please cell or e-mail.

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

7/29/2005

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

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DESIGN SPECIFICATIONS	SCOPE OF NORK ICONTINUES	
BUTS STRUCTURE CONFORMS TO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" ADDRETED BY THE AUGRICAN ASSOCIATION OF STATE REMNAY AND TRANSPORTATION OFTICIALS, 2002, THE CONT BRIDGE RESTIN MANNUM, JOOR BRYTED, 2017, THE CONT NATIONAL DESIGN STANDARDS FOR REDGE CONSTRUCTION, DOG, RITH 2018 SUPPLEMENT.	THE PURPOSE OF THE WORK WHILE MAINTAINING THE HIST ADMERTO TO SO AS TO MAIN MISTORILAMEOUS ADDITIONAL EXISTING BRIDGE.	
DESIDN LOADING:	SUGGESTED ARIDGE NORK SE	
MIS VENILLE <u>OCSTON STRESSES</u> STRUCTURAL STEEL – AASHTD ASTM METOVATON GRADE 36 – VILLO STRENGTH 36,000 PSI STRUCTURAL TUNIER – AASHTD M WA AND SUPPLEMENT 1072 OR GRADED AND STAMPLD	 INSTALL MEMPORARY REINFORCEMENTS, AS RECESSARY TO S MORIZONTALLY W O MORE, ARX THE CAMPER SPECIFIED. 	
UNDER THE RULES OF THE NURTHEAST LUMBER MANUFACTURERS #SSOCIATION.	2. REMOVE ALL SERVE REPLACEMENT.	
WHITE OAK, SELECT STRUCTURAL WITH FOUR SOUND CORMARS!	3. REMOVE DECK PLAN	
ROUGH FULL SAME THARER SHALL BE USED TO REFAIN WAIN AND SECONDART FRISS WEMER'S INCLUDING UPPER CHICRDS, VIRTICAL MEMORRS, DIACOMAL MUMBRER, CHICSS REALPAR, AND LATTRAL REALFOR.	4. RENOVE BOTTON CH	
WHITE OAK, SELECT STRUCTURAL WITH FOUR SOUND CORNERS:	5. REMOVE AND REPLA	
ROUGH FULL SAME TIMBER SHALL BE USED TO REPARE MAIN TRUSS MEMBERS	ACTION TO A CONTRACT AND A CONTRACT	
DOWELAS FUR-LARCH, SELECT STRUCTURAL WITH FOUR SOUND CORRERS	7. RE-DISTALL HORIZO	
ROUGH FULL SAWN THAGER SHALL BE USED TO REPLACE FLOORBEAKS, STRINGERS, AND TRANSVERSE PLANK GELANG OF THE FLOOR STSTEM.	RIPS OF FORCE PER 8. REPLACE BEARING B	
ALLOWABLE STRESSES ARE IN ACCORDANCE WITH THE NATIONAL DESIGN SPECIFICATIONS FOR WOOD CONSTRUCTION AND ARE PROVIDED IN TABLE A ON SHET	3. REMOVE TEMPORATI	
3/10.	ID. RE-INSTALL OR RU	
FOR NET SURVICE NOISTURE CONCITIONS WHERE WORSTURE CONTENT > IN PERSONT. LIAMPER - ALORTO W HER AND SUPPO CHEMIC 1012 OR ONADED UNDER THE BLAES OF THE	IN THE PLANS OF N	
NORTHEAST LINGER MANUFACTURERS ASSOCIATION.	II, AC-INSTALL SUDING	
POPLAR, NO. 2 OF BETTER	IV. REBOVE ANT REMAI	
NOUGH FOLL SAME KENNONT TOBER SHOLL BE DIAD TO REPLACE SAME AND MARCESS. SIZE OF SUDDLOF LANKS SMALL BE A MOMENTUM AND NUMBER AND DATES	PORTIONS OF STRUCTURE R	
WITE ONE DEADE NO. I OR RETURN	DUE TO THE HISTORIC NATU	
ROUDH FULL SAMN LUMBER SUBLE BE USED FOR ROOF SYSTEM REPAIRS. LONGTUDINN, PLAN GECKING, RUMPLE BOARDS, MISCELLINEOUS SPACINE BLOCKS, AND BEARING BLOCKS FOR TRISS.	ΤΗ BRIDE THAT ARE TO BE MANNED PEAR WELL AVOID D INNET ARE TO BE PRESERVO THOSS SHOLL OF START AND TO BRACING, OR OTHER WEARS STRUCTARE. THATE WEARS STRUCTARE AND RECORDED P MEMORY AND THE ADD PRESERVE AND RECORDED F MEMORY AND THE ADD CREEDER, MARCHIEF AND AT THE REMAIN ITATION WORK. THE REMAIN ITATION WORK THE REMAIN ITATION WORK. THE REMAIN ITATION WORK TO DE REMAIN IN THE ADD CREEDER, CARTON AND AT THE MEMORY AND THE ADD PRESERVE SHALL CONSIST AND OTHER MASSIZIANEOUS INCOMPORATED AND THE RE OF THE COMMEND.	
ROUGH FULL SAME THEOR SHALL BE STORED DOTH AT THE LIMBLE HADD AND THE PROJECT SITE AFTER IT IS ROUGH FOLL SAME IN ORDER TO MAXIMITE AIR ONTING THE. THIS MELL INCLUE STACKING THE THBER TO MAXIMUST ANY FLOW AND PROVIDENCE A BATEMPOOP COVER.		
FASTEMERS-		
HOLPS, MUTS, MASHERS, AND THREADED RODSI		
EXISTING STIFL ROLTS, NUTS, WASHERS, AND THREADED ROOS SHALL BE HEUSED WHERE PRACTICARLE.		
REPLACEMENT GALVANZED STEEL BOLTS, NUTS, RADRESS, AND THREADED ROOS SHALL COMPONE TO ASTM A 307 AND TVLID MITH DIAMETER ROUML TO GR GREATER THIN THE EXISTING OLMETER.		
CAL BANZED MALLEABLE STON WASHERS SHALL BE USED WITH MUTS AT WOOD INTERFACES.		
ALL MUTS AND BOXTS SHALL BE TOPOLED TO 250 FOOT POLNOS.	THE STRUCTURAL TIMBER M	
MIP	ALL REMEVALS SMALL BE LI SHALL BE INDUTSIED BY DE PERMANENT. THE METHOD TUMBER MEMBERS THAT ARE THE PROJECT SITE ANTI: 1 MEMBERS SHALL BE PROTEC	
HAILS SHALL BE USED FOR CONSCIENCE OF SECONDAY STRUCTURAL THREE MEMBERS IT & BRECHN, BOOS STATUL, AND FLOOD SYSTEM TO EAR OFHER AND FOR THER COMBETTION TO THE MADE STRUCTURAL THREE MOMERS OF THE TRUES. THE LENETH OF HAIL OLD SHALL BE SUFFICIENT TO PROVIDE A MINIMUM OF 1-02" PRAETATION INTO STRUCTURAL THREE MEMBER.		
MALS SHALL BE STADN FIS STEPL OF ZDEC CONTED STEEL. FRE-DRILLING OF LIMITER MOUCH STRUCTURAL TIMEER NEWBER MAY HE REGOURED TO AVOID SPLITTING OF ROOD.		
SCOPE OF WORK		
THE REPREDITATION OF THE FORMER COVERED AND/OF WILL INCLUDE REPLICEMENT OF ALL FRACTURED AND DETERIORATED TRUSS MANAGES, ARTIM REPLICEMENT OF DECKING, REDUCHL, PARTIM, REPLACEMENT, AND RE-INSTALLATION OF THE SIDING, REDUCHL AND RE-DISTALLATION OF OTHER MEMBERS AS REGUCINE TO PERFORM INFORM, AND OTHER		

INTEGLLANEOUS REPAIRS AS DESCRIBED IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

AS DETAILED IN THESE PLANS IL TO REPAIR THE STRUCTURE TONICAL INTEGRITY. THE INCLUDED DETAILS SHALL BE NTAIN THE HISTORIC NATURE OF THE STRUCTURE. ANY WORK SHALL BE CONSTRUCTED IN THE SAME MANNER AS THE

OLENCE:

- STRUCTURAL TIMEER MEMBER SUPPORTS AND CRUBS, SHORINE, BRACINE, OR OTHER MEANS SHALL BE LISED STATELITE THE EXISTING ARBIDE BOTH VERTICALLY AND ROOR TO SAFELY PERFORM THE PROPOSED REMADILITATION TRUCTURE USING THE TEMPORART SUPPORTS TO PROVIDE THE
- FOR RESSE. A CONTINUENCY QUANTITY IS PROVIDED FOR
- KINE IN GAMAGED AREA TO BE RIPLACED AND 45 MEEDED TO
- KOAD TENSION RODS.
- CÉ ALL DETERIORATED ON FRECTURED STRUCTURAL TIMBER IN TRUSSES, INCLUDIE BOTTON BRIETIN AND ROOF SYSTEM.
- tention roos to the tongoe specified.
- WT41, TENSION ROOS AND PLATES AND TIONTER THE ROOS TO 4
- LOCKS AND THUBLE END BLOCKS AT BOTH ENDS OF THE MAIN
- SIGNINE AND MUN TRUSS STRUCTORM. NEWLER SUPPORTS.
- PLACE ANY FLOORBEAMS, CROSS BRACING, STRINGERS CHOTFUTTHE OF OF PLAKENC, AND DUMPER BOLINDS SPECIFIED REMOVED TO ACCESS THE MUDI TRUES.
- WITH REPLACEMENT WHERE NECESSARY.
- HANG TEMPORARY BRACING OR OTHER TEMPORAL
 - FROM BRIDGE AND BRIDGE SEATS USINE COMPRESSED AIR.

EMOVED, OVER 20 FOOT SPAN, AS FER PLAND

USE OF THE EXISTING BRIDGE, THE PORTIONS OF BE REPLACED ARE TO BE CAREFULLY REMOVED IN A DAMAGE TO THE EXISTING PORTIONS OF THE BRIDGE provide the second seco MIGH TO AND AFTER REMOVAL TO PROVIDE IN ORMATION THE REPLACEMENT MEMORY AND SHALL BE PRESERVED FOR MADILITATED STRUCTURE AS REPLACEMENT MEMORYS. THE DUMENTATION STINCTOWE AS NEX-ACCOUNT MEMBERS. THE ASTINGUES OWARL NOT BE MEMORID UNESST ITS REPORTED BY I. TEMPORARY CONNECTIONS FOR TEMPORARY SUPPORTS AND TEAMOR TO EXISTANCE NOTO THAT MEMORIS TO BE PRESENTED REMAINLIFATED STRUCTURE IN A MANNER THAT DUMARES ING MORES IN EXISTING THREE MEMBERS MAY BE USED FOR EXISTORS, FILD DIMLING OF MEMORIES MAY BE USED FOR EXISTORS, FILD DIMLING OF MEMORIES MAY BE USED FOR EXISTING. EADED FASTENERS SHALL BE REMOVED BY MEDIUNICAL MEANS

T OF THE REMOVAL AND DISPOSAL OF BOOD FLANKING, SIDING, S ITEMS THAT ARE NOT SHORN TO BE PRESERVED OR REMARKITATED STRUCTURE AND ARE DIRECTED TO BE REMOVED

WHERPS SHILL BE CAREFULT DUSASSEMELTO AS METEOD AND TED BY THE ENGINEER FOR MEDEL, SALVIGE, METEOPS AND MATED TO MEDIANTEAL BY THOSE. CALL READVED BASHER OWE MEDESTRUCTIVE WETHOD THAT IS DURABLE BUT NOT OF MARGINE MEST BE EPROPORTED BY THE PROVIDER.

DESTORATED FOR REITE OR SALVAGE SHALL BE STORED ON WE BREDGE REVISED LITATION WORK IS COMPLETED. DESTONATED TED TROM MEATHER AND DAMAGE.

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

THE SONTRACTOR SHALL TAKE PRECAUTION TO A FORD AND/OR LIMIT DEMOLITION DEBRIS TROM INTERINE THE STREAM. ANY MATERIAL THAT DOES FALL INTO THE STREAM SPALL BE REMOVED AS SOON AS POSSIBLE.

IT SHALL BE THE CONTRACTOR'S RESPONSIBLITY TO MAINTAIN THE STABLITY OF THE COVERED BOCE BRIDGE SUMARE RENOVAL AND REMARE ITATION. DUE TO THE CONDITION OF THE STRUCTURE, NO EQUIPMENT OR MATERIALS SHALL BE ALLOWED TO BE ON OR TO MOVE ACTIONS THE BRIDGE.

Woorsent

NOTES

BRIDGE

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THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF THE PLAN FOR THE REMOVAL AND ROMANLITATION OF THE STREETONAL THREEF MEMBERS INCLUDING TERFOLARY STREETONAL SUPPORTS AND TEMPORARY THREE MEMBERS INTERCIDENT, DATES OF THE STRUCTURE STORAGE TO BE TRANSFORMED WARDS THAT DECLOSE THE INFORMATION DESCRIPTION IN THIS WORK, SMALL HE STRUMETED TO THE ENCAREM FOR APPROVAL AT LEAST ON APPR DECLOSE THE RETURE WORK IN TO RELEAST. THE REWARD AND REMAINS (TATION PLAN WITH) HE APPROVAL HOW TO PERFORMED ANY WORK ON THE BRIDGE. THE PLANS SHALL BE PREPARED BY AN CHILD RECISTERED PROFESSIONAL ENGINEER.

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

- THE SISNATURE, MOBER, AND SEAL OF THE OND RESISTENCE PROFESSIONAL ENGINEER IND PREPARED THE SOBNITTAL.
- CALCULATION AND ANALYSIS OF THE STRUCTURAL TUNDER TRUCK MEMBERS TO SATEMENE AND DETINE THE ACTUAL LOADING APPLIED TO THE MEMBERS BY THE CONTRACTOR'S OPERATION. 2.
- DRAWING SHOWING THE PHYSICAL AND DIMENSIONAL POSITION OF LITT AND DIMPORT LOCALIDANS AND LOCATIONS OF TEMPORTY STRUCTURE, TABLER MOMER SUPPORTS AND TRAVERARY MOMER REPROVEMENT FOR THE REMOVAL AND REWARD, ITATION OF THE STRUCTURAL TIMBER THUSS MEMBERS.
- 4. DRAWINGS OF INTERDEDS OF ATTACHMENT TO THE STRUCTURAL TUMER MEMBER. ADDING HOLES TO THE STRUCTURAL TUMBER MEMBER TO BE REUSED INCL NOT BE PERMITTER.
- THIS WORK WILL BE PAID FOR AT THE CONTRACT LUMP SUM PARCE BID, WHICH PRICE The manufacture of the second second

REPLACEMENT MEMBER LIMENSIONS

PRIOR TO MARKACTURE OF EACH REPLACEMENT MEMBER. THE CONTRACTOR SHELL HEASURE THE STRUCTURE TO DETERMINE THE REDURED DIMENSIONS FOR THE MEMBER IN THE FORL STRUCTURE, MEASUREMENT OF JUST THE EXISTING IMMERT MAY NOT PROTIE THE INCOMPD DUMENDANC DUMENTAGE AUMONT, INTROCTI, DR OTHER CAUDES, THE DUMENSON OF THE APPLICADENT MARKERS SMILL BE RECORDED AND SMINITIA TO THE ENGINEER.

REPLACEMENT MEMBERS SHILL BE SLOLD AND MARKFACTURED TO ACCOUNT FOR SHRINKACE OF THE MEMBERS ON THE FINAL STRUCTURE.

ITEM SPECIAL - STRUCTURE, MISC.) MISCELLANEOUS FRAMING

DISTALL #" X 1155" WATE CAN ROOM FULL SAWN END IN OCKS AT THE DIDS OF THE LOWER CHORDS. "NOTCH END INLIGIDS, AS REQUIRED, TO CLEAR END PLATE AND TENSION

DISTALL 4" X 12" WRITE OAK ROUGH FULL SAWN BEARINE BLOOKS AT THE ENDS OF THE LOHER CHINGS.

INSTALL #" X 12" WHITE OAX ROUGH FULL SAWN STRINGER BEARINGS AT THE LOCATION SHOWN IN THE PLANS ON SHEET ROAD.

REPLACE KNEE BRACES AT SPECIFED LOCATIONS. REPLACEMENT KNEE BRACES SHALL BE BOLGH SAWN TO FIT THE SPECIFIC LOCATION. NEW LAPPER LATERALS SHALL BE NOTIMED TO ACCEPT WAT BRACE IN A MANNER STRUCAR TO ORIGINAL.

THE ABOVE THENE SHALL BE WADE FROM WRITE DAX, DRADE NO. 1 OR INTER-

THIS WORK MILL BE PAID FOR AT THE CONTRACT THOUSAND FEET BOARD MEASURE, MEM, UNIT PRICE BUD, BAUCH PRICE AND PARTNENT SHALL BE FUEL COMPENSATION FOR ALL LABOR, FOURPENT, WATERIALS, AND INCIDENTALS MECESSART TO COMPLETE THE WORK IN CONFORMANCE WITH THESE REQUIREMENTS, WITH PERTIMENT PROVISIONS OF SM, AND TO THE SATISFACTION OF THE ENGINEER.

BRIDGE NOTES

CESION SPECIFICATIONS.

THIS STRUCTURE CONFORMS TO "STANDARD SPECIFICATIONS FOR HIGHMAN CHIDDES" ADDFTED BY THE AMERICAN ASDOLATION OF STATE HIGHMAN AND THANSPORTATION OFFICIALS, 2002, THE COOT BRIDGE DESIGN WANNAN, 2004, AND THE BATTORNE DÉSIGN STANDARDS FOR WOOD CONSTRUCTION, 2004 WITH 2004 SUPPLICEMENT.

DESIGN LOADING, HIS VEHICLE

DESION DATA:

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STRUCTURAL STEEL - ASTN ASS/ATON GRADE 30 - FIELD STRENDTH 35,000 PSI

STAUCTURAL TIMARA - AASHTO N ISE AND SUPPLEMENT ISTE OR SRADED UNDER THE RULES OF THE NORTHEAST LUMBER WARWFACTURERS ASSOCIATION.

WHITE OAK, SELECT STRUCTURAL WITH FOUR SOUND CORRERS!

ROUGH FULL SAME TIMBER SHALL BE USED TO REPAIR DAIN AND SECONDARY TRUSS REWERS INCLUDIRE UPPER CHORDS, VERTICAL MEMBERS, DIADORAL WENDERS, CROSS BRACING, AND LATERAL BRACING,

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

HOUGH FULL SAMM TIMBER SHALL BE USED TO REPAIR WAIN TRUSS WEMBERS INDICOING LOWER CHCADS.

DOUGLAS FIR-LAACH, SELECT STAUCTURAL WITH FOUR SOUND COANERS.

POUGH FULL SAME TIMBED SHALL BE USED TO REPLACE FLOORDEAND, STRINGERS, AND TRANSVERSE PLANE DECRING OF THE FLOOR STRIPS.

ALLOWABLE STRESSES ARE IN ACCORDANCE WITH THE RATIONAL DESIGN SPECIFICATIONS FOR WOOD CONSTRUCTION AND ARE MONIDED IN TABLE & ON SMEET & OF 12.

FOR MET SERVICE WOISTURE CONDITIONS WHERE WOISTURE CONTENT > IS MERCENT.

LUWBER - AASHTO W IEB AND SUPPLEMENT 1012 OR CRADED UNDER THE RULES OF THE MORTHEAST LUWBER WARUFACTURERS ASSOCIATION.

POPLAR, NO. 2 ON BETTER,

ROUGH FULL SAME FILM OUT FINDER SAMLL & USED TO REPLACE SIDING AND WALLORS, SIZE OF FIDING PLANES SHALL BE A MINIMUM OF & INCRES WIDE BY I INCH FMICE.

WHITE OAK, EAADE NO. I OR BETTER.

ROUGH FULL SAWN LUMBER SHALL BE USED FOR ROOF STITEM REPAIRS, LONDITUDINAL PLANK BECKING, BUMPER BOARDS, MISCELLANEOUS SPACING BLOCKS, AND BEARING BLOCKS FOR TAUSS.

ROUCH FULL SAMM TINDER SMALL DE STORED BOTH AT THE LUNDER TARD AND THE ARDUNCT SITE AFTER IT IS ROUCH FULL SAMM IN ORDER TO MAKINIZE AIR DRYING TIME. THIS WILL INCLUDE STARTING THE TIMBER TO MAKINIZE AIR FLOW AND ARDIVIDING A WATCHARDER CORER.

FASTENERS.

ADLTS, NUTS, WASHERS, AND THREADED RODS.

EFISTING STEEL BOLTS, RUTS, RASHERS, AND THREADED ROOS SHALL BE REUSED WHERE PRACTICABLE.

REPLACEMENT DALVARISED STEEL BULTS, NUTS, WASHERS, ARD THREARED RODS SHALL CONFORM TO ASTW A 307 AND 111.10 WITH DIAMETER EQUAL TO OR OPEATER THAN THE EXISTING DIAMETER.

CALVANIZED WALLEABLE IRON WASHERS SHALL BE USED WITH MUTS AT WOOD INTERPACES.

ALL NUTS AND BOLTS SMALL BE TOROUGD TO 250 FOOT POUNDS.

HA11.5-

ANIS STALL BE USED FOR CORRECTION OF SECREDAR STRUCTURE TIMORE WEERERS IL. 6. ARACING. MORE STSTEN. AND FLOOR STSTENI TO EACH OTHER AND FOR THEIR CONNECTION TO THE MAIN STRUCTURE TIMBER MEMOERS OF THE TRUSS. THE LENGTH OF MAIL USED STALL BE SERVICEENT TO MOVIES A WININGH OF 1-1/2" REMETRATION INTO STRUCTUREL TIMBER MEMOER

NAILS SHALL BE STAINLESS STREE OB JIRC CONTED STEEL. PRE-DRILLING OF LUMBER AND/OR STRUCTURAL TIMBER MEMBER MAT BE REDVIED TO APDID SPLITING OF MODD.

SCOPE OF HORE

THE REHABLITATION OF THE FORKER CONCERCE BAIDDE WILL INCLUDE REPLACEMENT OF ALL FARCTURED NON OFTENIORIED THUSS WEMBERS, REPLACEMENT OF THE EXISTING FLOOR SISTEM, REPLACEMENT OF THE MODE SISTEM, REPLACEMENT OF THE SIDING, CONTING THE INTERIOR OF THE STRUCTURE, AND OTHER WISELLANDOUS MEDA/RE AS DESCRIBED IN THE PLANE OR AS DIRECTED BY THE EMBLANED.

THE MORPOSE OF THE WORK AS DETAILED IN THESE PLANS IS TO REPARE THE STRUCTURE WHILE MAINTAINING THE HISTORICAL INTEORITY. THE INCLUDED DETAILS SHALL BE ADDINED TO SO AS TO MAINTAIN THE HISTORIC WALLAND OF THE STRUCTURE. MAY MISEELLANEOUS ADDITIONAL WORK SHALL OR CONSTRUCTORE IN THE STRUCTURE AS THE EASTING BRIDGE

SUGGESTED BRIDGE WORK SEQUENCE

INSTALL TEMPORAT STRUCTURAL TIMBER WEMBER SUPPORTS AND REINFORCEMENTS. CRIBS. SHORING, CRACING, CR OTHER MEANS STALL DE USED AS MEETSANKET TO STADILIZE THE EXISTING BUILDE BOTH STRICALLT AND HORIZONTALLY IN ORDER TO SAFELY PERFORM THE PROPOSED REMARIITATION NORM AND TO REMOVE THE EXISTING TEMPORATE SUPPORTS.

2. AENOVE . IDING AND ROOF.

- 3. REMOVE DECK PLANKING AND FLOORBEAKS.
- REMOVE AND REPIRE ALL DETERIORATED OR PRACTURED STRUCTURAL TIMBER MEMBERS IN THE MAIN TRUSSES, INCLUDING BOTTOW BRACING AND NOT SISTEM, AND INFORE TEMPORARY STRUCTURAL MEMBER SUPPORTS.
- 3. INSTALL TEASION ADDS ... BOTH SIDES OF LOWER CHORDS.
- E. INSTALL & PREFORMED BEAM OF PADE AND REPLACE BEAMING BLOCKS AT DOTH ENDS OF THE WAIN TRUSSES.
- 1. REMOVE TEMPORARY CRIME AND SHOLYNS FOR THE WAIN TRUSSES.
- W. INSTALL FLOORBEAKS, CROSS BAACING, STRINGERS, TRANSVERSE AND LONGITUDINAL DEEK PLANTING, AND RUM, IR BEARDS.
- INSTALL NEW ADDE STSTER INCLUDING TINDE ANTTER AND PARTER STLLS. NS INDICATED.
- 10. INSTALL NOW SIZING AND PAINT BRIDGE.
- REMOVE ANY REMAINING TEMPORARY BRACING OR OTHER TEMPORARY WATERIALS.
- APPLY FIRE DETARDART TO ALL EXPOSED FOOD SURFACES OF THE INTERIOR OF MRIDEL, INCLUDING SIDING, AND ON EXPOSED NOO SURFACES ON THE FLOOR AND PROFESSION.
- 13. INSTALL STANDING STAN ADDRING.
- 14. CLEAN ALL DEBRIS FROM BRIDGE AND BRIDGE SEATS USING COMPRESSED

PORTIONS OF STRUCTURE REMOVED, OWER DO FOOT SPAN, AS PER PLAN.

DUE TO THE MISTORIC NATURE OF THE EXISTING BRIDGE, THE PORTIONS OF THE BRIDGE THAT ARE TO BE REPLACED ARE TO BE CAREFULLY REMOVED IN A WANNER THAT WILL AVOID DAWADE TO THE EXISTING PORTIONS OF THE BRIDGE THAT ARE TO BE PRESERVED AND REUSED. THE EXISTING STRUCTURAL TIMBER TRUSS SMALL BE STABILIZED OF INSTALLING TEMPORARY STRUCTURAL TIMBER WEWBER SUPPORTS IND TEMPORARY WEMBER REINFORCEMENT. CRIBS, SHORING. BRACING. ON OTHER WEARS SHALL BE USED TO THE EXTENT REQUIRED TO ALLOW THE STRUCTURAL TIWBER WENDERS TO BE SAFELT HEMABILITATED. THE DIWENSIONS OF EXISTING STRUCTURAL TIMBER NEWBERS AND FASTEWERS TO BC. REMOVED SMALL BE WEASVRED AND RECORDED FRIDA TO AND AFTER REMOVAL TO PROVIDE INFORMATION NEEDED FOR THE SIZING OF THE REPLACEMENT NEWBERS AND SMALL BE PRESERVED FOR POSSIBLE REUSE IN THE REMABILITATED STRUCTURE AS REPLACEMENT NEWBERS. THE DRIGIRAL MARDWARE AND FASTENERS SHALL NOT BE REMOVED UNLESS IT IS REDUIDED BY THE REMABILITATION WORK. TEWODRARY CONNECTIONS FOR TEMPORARY SUPPORTS AND BRACING SHALL NOT BE ATTACHED TO EXISTING WOOD TIMBER WENDERS TO BE PRESERVED ON TO BE REUSED IN THE REMABILITATED STRUCTURE IN A WANNER THAT CANALES THE WOOD. 11.E. ONLY EXISTING NOLES IN EXISTING TINDER NEWBERS WAY BE USED FOR TEMPORARY BOLTED CONVECTIONS, FIELD DRILLING OF NEW MOLES WILL NOT BE FERWITTED. I EXISTING THREADED FASTENERS SMALL BE REMOVED BY MECHANICAL WEARS IF POSSIBLE.

THIS NORM SHALL CONSIST OF THE REMOVAL AND DISPOSAL OF NODO PLANKING, CURB BOARDS, SIDING, ROOFING, EXISTING TEMPORAR SUPPORTS, AND OTHER WISCELLAREOUS ITEMS THAT ARE NOT SHOW TO BE PRESERVED DA INCOMPONATED INTO THE REMAINLIFATED STRUCTORE AND ARE DIRECTED TO BE REMOVED BY THE SUPIRIER.

THE STRUCTURAL TINDER NEWBERS SHALL BE CAREFULLT DISASSENDLED AS NEEDED AND PROTECTED WITH. DESIGNATED BY THE CHRINECH FAN REUSE, SALVAGE, OR DISPOSAL, ALL REWORKS SHALL DE IDENTIFIED BY SOME METHODS. EACH REWORD WENDER SHALL DE IDENTIFIED BY SOME NONDESTRUCTIVE METHOD THAT IS DURAGLE DUT NOT PERMANENT. THE METHOD OF WARKING WIST BE APPROVED BY THE EXPIREN.

TINEER WEWEERS THAT ARE DESIGNATED FOR ROUSE OF SALVARE SHALL BE STORED ON THE PROJECT UNTIL THE BRIDGE REHABILITATION WORK IS COMPLETED. DESIGNATED WEWEERS SHALL BE PROTECTED FROM WEATHER AND GAMMEE. THE WENNEE COURT ENSINEER WILL PICK OF THE TIMER MEMORY THAT REMARK.

THE CONTRACTOR SHALL THE PRECAUTION TO AVOID AND/OR LINIT DENDITION DEBNIS PROM ENTERING THE STREAM, JAY WATERIAL THAT DOES FALLING THE STREAM SHALL BE REMOVED AS TOOM AS POSSIBLE.

IT SMALL BE THE CONTRACTOR'S RESPONDIBILITY TO WAIRTAIN THE STABLLIT OF THE COVERED BODD BRIDGE DURING REWOND, AND REMADILITATION, DUE TO THE CONDITION OF THE SIMUCTURE, NO EQUIPMENT OM MATERIALS SHALL BE ALLEWED TO BE ON OF TO NOVE ALROSS THE BRIDGE.

THE CONTINUED BALL BE REFORED BE FOR THE DESIGN OF THE PLAN FOR THE ARMOVAL AND ARMADILITATION OF THE STAUCTUAR, TINDER WENDERS INCLUDING TEMPORARE STAUCTUAR. TINDER WENDER SUPPORTS AND TENPORARE WENDER ARTNORCEMENT. THREE (3) SETS OF THE ARMOVAL AND REMAILITATION PLAN. WHICH THALL INCLUDE THE INFORMATION DESCRIDED IN THIS NOTE, SHALL BE EVENTITED TO THE INFORMATION DESCRIDED IN THIS NOTE, SHALL BE EVENTITED TO THE INFORMATION DESCRIDED IN THIS NOTE, SHALL BE EVENTITED TO THE INFORMATION AT LEAST 1301 DAYS BEFORE THE ACTUAL WORK IS TO DECHN. THE ARMOVAL AND MEMORILITATION PLAN SHALL BE ARMOVED AND TO DEARCHWING WAY MORE ON THE BRIDDE, THE PLANS SHALL BE ARMOVED AND TO DEARCHWING MAY MORE ON THE BRIDDE. THE PLANS SHALL BE ARMOVED AND BE INFORMAL EMENTED.

PLAN FOR ACROVALS AND SHIPMENT SUBWITTALS SHALL INCLUDE AT LEAST THE FOLLOWING.

- THE SIGNATURE, NUMBER, AND SEAL OF THE ONIO RECISTERED PROFESSIONAL ENGINEER WAD PREPARED THE SUBWITTAL.
- 8. CALCULATION AND ANALYSIS OF THE STRUCTURAL TIMBED TAUSS MEMORY TO DETERMINE AND DEFINE THE ACTUAL LOADING APPLIED TO THE WEARDERS BY THE CONTRACTOR'S OPPONENTIONS.

Click on PDF 6 đ

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



















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











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



	TRANSPORTATION ALTERNATIVE PROGRAM 2014 LETTER OF INTEREST FORM
	Local Government:
	Local Government Contact Person & Title: <u>LONNIE TUSTIN, COUNTY ENGINEER</u>
	Street Address:47134 MOORE RIDGE ROAD
	City, State & ZIP: WOODSFIELD, OH 43793
	Telephone: <u>740-472-2537</u> Fax: <u>740-472-2530</u> E-Mail: <u>mceng555@sbcglobal.net</u>
	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 <u>\$48,000.00</u> % <u>80</u>
Our engineer filled	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
INTEREST FORM and emailed it to district	Describe the project including project location, termini, and purpose. County Road #40, (Plainview Rd.) – M.P. 00.99 Rehabilitation of Historic Covered Bridge
with supporting documentation for the project on Feb 4 th , 2014	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

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

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

- 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

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

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

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



Knowlton Covered Bridge Lover Chord Repair





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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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/2207252/3 8125407/232051672/38125407_nrhp_links_2015-1_monroe_count ylist.pdf		
Attachment 2	https://s3.amazonaws.com/files.formstack.com/uploads/2207252/3 8125417/232051672/38125417_knowlton_covered_bridge_sfn563 4652_4.jpg		
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Miscellaneous:

Present status of property ownership and plan preparation (MUST be on existying 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. Honroe County Commissioners ODOT

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

Hould 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 Resime Later

= Previous

Property

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







Finite Element Model (Staad) of deflection with lost connection





11" Sag in model matched field

Load 1 : Displacement



- 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.











- 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.





- 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.



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





The Knowlton Covered Bridge The Knowlton Bridge was beak in 1887 as a multiple kingpost russ and arefr bridge. It was obse known as Long Bridge and as a three span. 192 free bridge.

Knowled Bridge is one of the two longest coursed bridges in the state if this high above the river on cut-stone arothestats. The bridge was called at some point to keep it above the flordwriters. It was accordinged many years ago



Bridges to the Past On a backroad the sight of a covered bridge today may remaind us of ghost stories and legends that tingled the scolp

remind us of ghost stories and legends that tracked the scalp of many a small child who walked its gloomy length as the s00 was sinking from sight.

For some, it revives memories of old covered bridge years like the one about "the rule headed into Pittshurgh from a small town in Ohio who, on reaching a covered bridge over the Allegheny, saw that the entrance was large enough for his load but considered the hole at the other end entirely too small - and headed back home again!"

Do you have any memories or sturies about covered bridges?

WYOW HE ONE FOR





Lower Chord at Center Span Midspan Has Fractured in Tension





• Truss Arch Buckling and Racking

ARCH TRUSS BUCKLING



First End Span already shored











- 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!





County commissioner met on site, and brought local artwork













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.







LOWER CHORD



• Historic Detail





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





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







Issues to be Considered/Challenges

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


GENERAL CONTRACTOR Rot/Insect Damage





GENERAL CONTRACTOR Rot/Insect Damage





GENERAL CONTRACTOR Rot/Insect Damage





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







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



Impact Damage





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!



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!



Before and After...Engle Mill Covered Bridge







Before and After...Engle Mill Covered Bridge





Before & After...Rinard Covered Bridge







Brad Nadolson

Phone Number: 614-272-9700 Ext. 102

Email: brad@rightercompany.com

Website: www.rightercompany.com

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

My Perspective Ron Mattox, PE



Miriam Wood





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



Significance and my Passion

Historic

\ \ /

WOOLPERT

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



WOOLPERT

Little Round Top July 2, 1863





Roberts 1829 Newton Falls 1831















Chord joints







Details





Complexity Craftsmanship Knowledge





Species Size





Champions





Rinard Covered Bridge



THE REAL PROPERTY AND INCOMES

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Thank you Questions?



