

Rehabilitating 19th Century Bridges using 19th Century Solutions

Presented by
Timothy Andrews
Owner of
Barns & Bridges Of New England
Gilford, NH, USA
bbofne@gmail.com



Original builder Joseph G. Johnson

TO BRIDGE BUILDERS AND CONTRACTORS.

PROPOSALS will be received by the County Commissioners of Cecil county, to be directed to them at their office in Elkton, up to Tuesday, the 11th day of September next, at 2 o'clock, p. m. for the building of a Bridge over the North East Creek at Gilpin's Falls, the site of which to be within from three to five feet of the present bridge, according to the following

PLAN:

THE ABUTMENTS to be 20 feet long at the base and 19 feet long at the top; 5½ feet thick at the base and 4 feet thick at the top; 7 feet high above ordinary water level, and to extend, in depth, to 4 feet below the bed of the creek, or deeper if necessary to secure a solid foundation.

THE WING WALLS to be 25 feet long and 30 feet apart at the ends; their foundation to extend the same depth as those of the abutments at the ends next the same, and to run by steps of equal height to 3 feet below the surface of the ground at the opposite ends, to be 4 feet thick at the abutments and 3 feet thick at the opposite ends, built in with the abutments and to the level of the same and battered to 2 feet thick at the top.

THE GUARD WALLS to be the same length as the wing walls, 3 feet high above the proper grading of roadways, and 20 inches thick, to have good fastenings built therein for a roof to pitch outwards.

The Abutments and Wing Walls to be built of large stone, laid in good mortar or cement, to be filled in and the roadways to be graded from the abutments to the road at a grade of one foot in twelve.

THE WOOD WORK to be on the "Burr" plan; span 100 feet; width from out to out 17 feet; 14 feet from string pieces to square; to have double ribbed segments, double arch, and double string pieces.

Sizes of timbers and full specifications to accompany proposals.

The Bridge to be completed by the middle of November next, under the direction and control of the County Commissioners of Cecil county.

The contractor will be required to give bond with approved Maryland security for the faithful performance of the contract.

By order,

J. S. CRAWFORD, Clerk,
aug 18-4w Com'rs. Cecil county.

Cecil Wig Newspaper advertisement
Request for proposals
Design/Build specifications



Gilpin's Falls before rehabilitation- lateral bow 18.5", 12.5" sag



Arch/ bottom chord failure



Typical shear key failure



1930's splice plate accelerated decay



Embedded arch ends, bottom chord



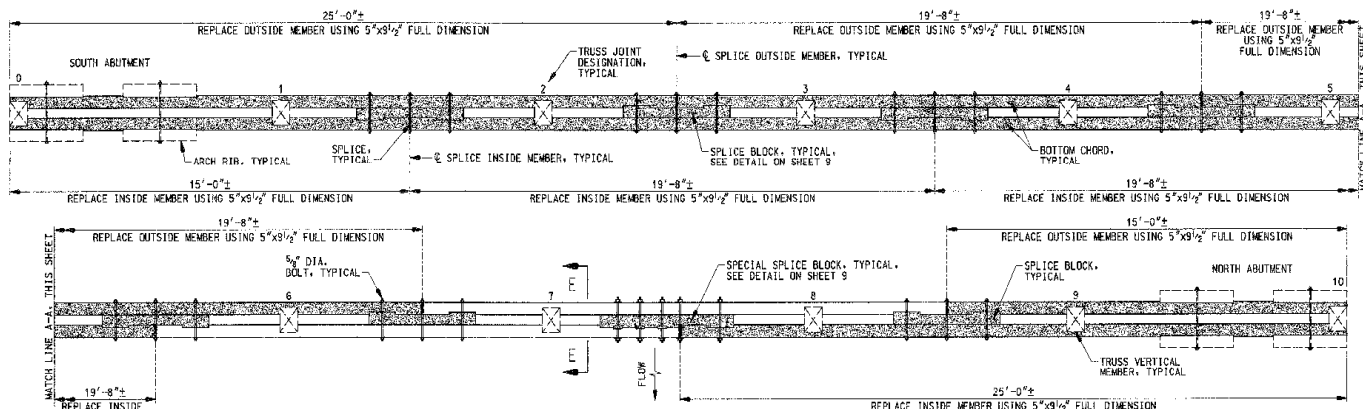
Embedded arch bearing timbers; severe decay at arch contact points



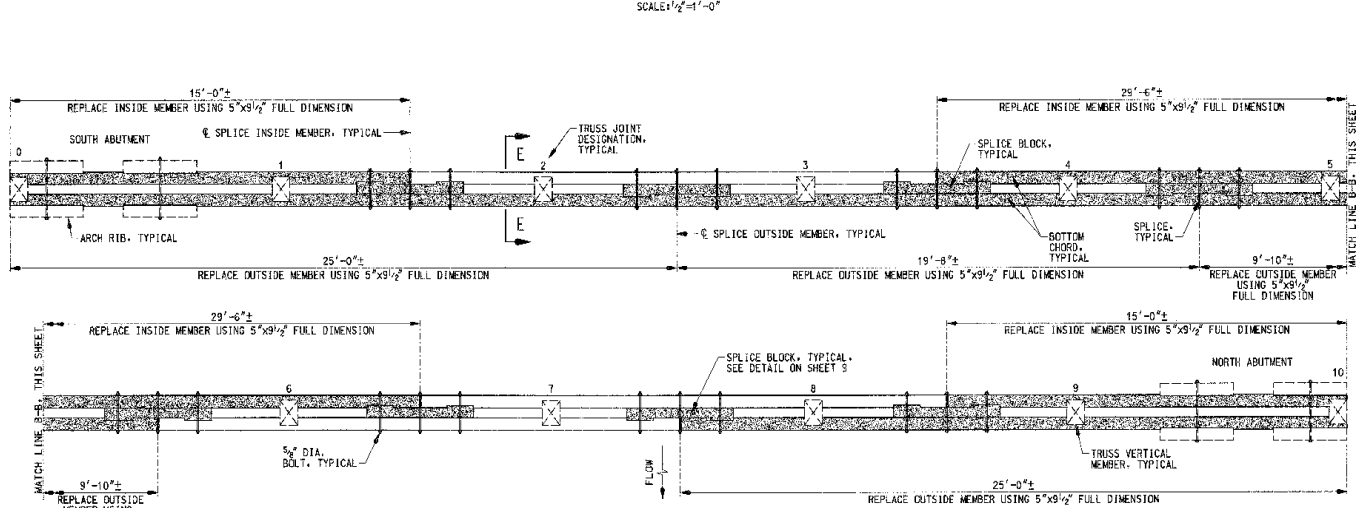
Too far gone to repair. Note squirrel nest



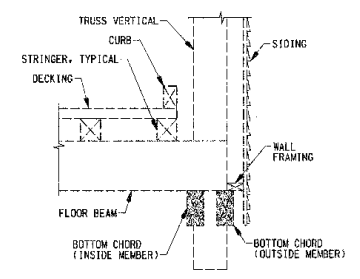
Water fed decay from post/ brace “step” clear through to chord connection



PLAN
SCALE: 1/4" = 1'-0"



PLAN
SCALE: 1/4" = 1'-0"



SECTION E-E
SCALE: 1/2" = 1'-0"

INDICATES MEMBER TO BE REPLACED

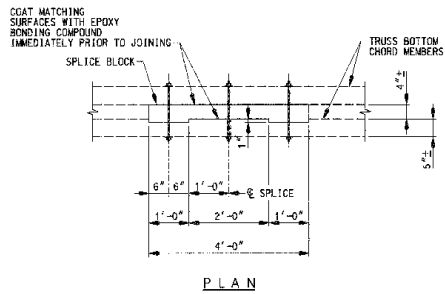
- NOTES:
1. ALL DIMENSIONS OF NEW TIMBERS MUST BE FIELD VERIFIED PRIOR TO FABRICATION.
 2. SEE SHEET NO. 9 FOR ADDITIONAL DETAILS.

REVISIONS

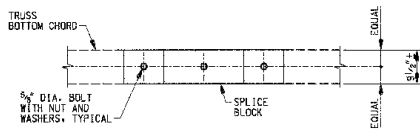
DEEL COUNTY DEPARTMENT OF PUBLIC WORKS ENGINEERING AND CONSTRUCTION DIVISION REHABILITATION OF BRIDGE NO. CE 110 GILPIN FALLS COVERED BRIDGE OVER NORTHEAST CREEK	
TRUSS BOTTOM CHORD	
DESIGNED BY: J.T./R.J.D. DRAWN BY: C.G.A. CHECKED BY: S.B.T. F.A.P. NO. SEE TITLE SHEET	CONTRACT NO.: 08-29-73913 SCALE: AS SHOWN DATE: JULY 2008
DRAWING NO. 51 - 8 OF 12	SHEET NO. 8 OF 17

WALLACE MONTGOMERY & ASSOCIATES, LLP
 CIVIL AND STRUCTURAL ENGINEERS
 110 West Road
 Suite 300
 Towson, Maryland 21204

Bid specs for bottom chord included epoxy bonding all shear connections

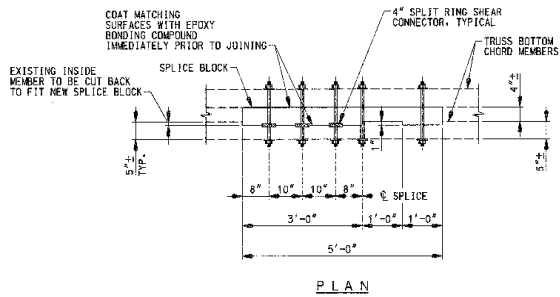


PLAN

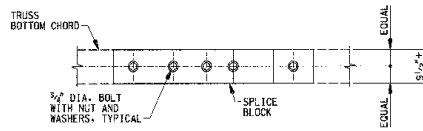


ELEVATION

SPLICE BLOCK DETAIL
SCALE: 3/4" = 1'-0"

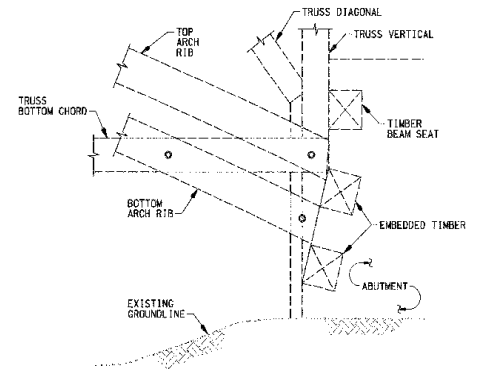


PLAN



ELEVATION

SPECIAL SPLICE BLOCK
UPSTREAM TRUSS L7 TO L8
SCALE: 3/4" = 1'-0"



BOTTOM CHORD AT ABUTMENT
SCALE: 3/4" = 1'-0"


REVISIONS

GEIL COUNTY
 DEPARTMENT OF PUBLIC WORKS
 ENGINEERING AND CONSTRUCTION DIVISION
 REHABILITATION OF BRIDGE NO. CE 110
 GILPIN FALLS COVERED BRIDGE OVER
 NORTHEAST CREEK

TRUSS BOTTOM CHORD

DESIGNED BY J.T./R.J.D. CONTRACT NO. 09-29-73013
 DRAWN BY C.G.A. SCALE AS SHOWN
 CHECKED BY S.B.T. DATE JULY 2008
 F.A.P. NO. SEE TITLE SHEET

DRAWING NO. 51 - 9 OF 12 SHEET NO. 9 OF 17


WALLACE, MONTGOMERY & ASSOCIATES, LLP
 CIVIL AND STRUCTURAL ENGINEERS
 110 West Road
 Suite 300
 Towson, Maryland 21284

Bottom chord splice details



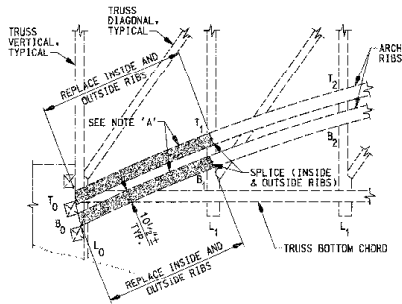
Design change for shear connections- double the inclusion, double the shear “heads”



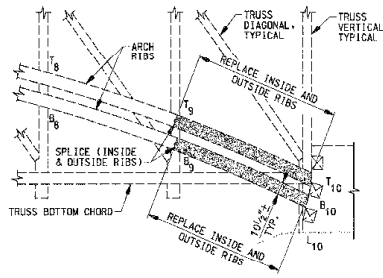
Modified shear connection



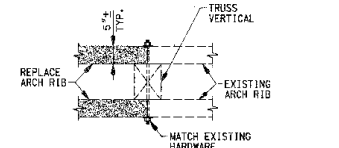
Double shear daps chord splice -note preservative treatment



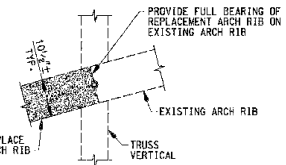
PARTIAL ELEVATION - UPSTREAM ARCH RIBS
(LOOKING UPSTREAM)
SCALE: 1/4" = 1'-0"



NOTE 'A':
REPLACEMENT MEMBERS SHALL BE CURVED TO MATCH THE CURVATURE OF THE EXISTING ARCH BY CUTTING MEMBERS FROM LARGER PIECES.

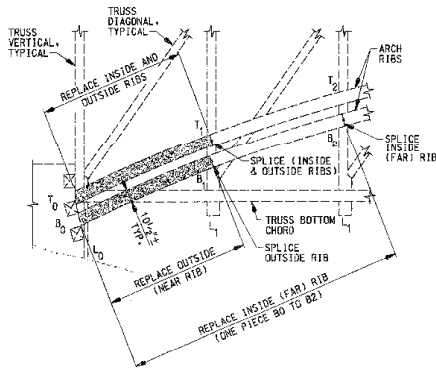


PLAN

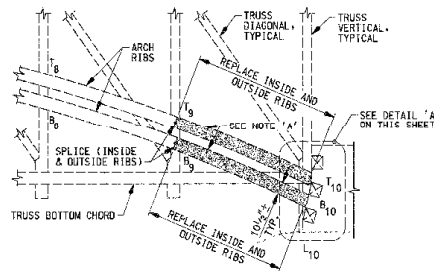


ELEVATION

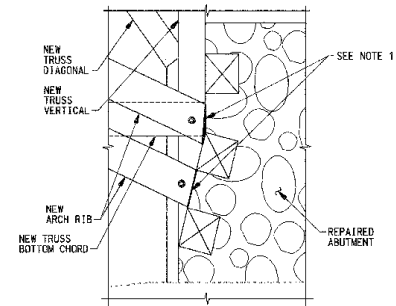
SPLICE DETAIL
SCALE: 1/4" = 1'-0"



PARTIAL ELEVATION - DOWNSTREAM ARCH RIBS
(LOOKING UPSTREAM)
SCALE: 1/4" = 1'-0"



SEE DETAIL 'A' ON THIS SHEET



DETAIL 'A'
SCALE: 1/4" = 1'-0"

- NOTES:
1. END OF ARCH RIBS SHALL BE COATED WITH ROOFING CEMENT AND SHALL BEAR FULLY ON THE REPAIRED ABUTMENT.
 2. FOR ABUTMENT REPAIR DETAILS, SEE SHEET 4.

INDICATES MEMBER TO BE REPLACED

REVISIONS

OSOL COUNTY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING AND CONSTRUCTION DIVISION
REHABILITATION OF BRIDGE NO. CE 110
GILPIN FALLS COVERED BRIDGE OVER
NORTHEAST CREEK

ARCH RIB DETAILS

DESIGNED BY J.T./R.J.D. CONTRACT NO. 08-29-73013
DRAWN BY C.G.A. SCALE AS SHOWN
CHECKED BY S.B.T. DATE JULY 2008
F.A.P. NO. SEE TITLE SHEET

DRAWING NO. 51 - 7 OF 12 SHEET NO. 7 OF 17

WALLACE, MONTGOMERY & ASSOCIATES, LLP
CIVIL AND STRUCTURAL ENGINEERS
110 West Road
Suite 300
Towson, Maryland 21284

Design arch replacements changed spatial relationship, created multiple "hinges"



Arch spatial relationship



10" of camber restored, self supporting bridge



Original White Pine floor beam reinforced



Floor beam framed through mid span king post



Replaced non historical Ash floor beam with historically correct White pine



Tight joinery, preservative treatment at member interface, bolt head orientation



In kind replacements in materials and craftsmanship



Embedded arch bearing timbers installed in 1959



Design change- end posts atop concrete footings Black Locust spacers below



New concrete thrust wall, gaps designed to facilitate free movement of air



Locust wedges separate arch ends and post from concrete



Vertical air shaft created for free movement of air @ chord, floor beam



Original shelter panel detail



Restored shelter panel sill separated from concrete with Locust spacer



Shear failure post top



Initial glue repair



Second glue up of repair



Prep for third glue up tight fitting Dutchman



Completed repair



Hidden repair, epoxy used for shallow pockets



Clothespin scarf on truss brace



In line arch Dutchman repair



Pre construction floor plank arrangement

“A Series of Directions to Builders “

By Col. Stephen H. Long

First published in the 1830’s

In addition to the floor timbers heretofore described, the flooring of the bridge comprises the following parts viz: flooring joists, flooring plank, flooring guards and floor binders. The floor joists should be laid lengthwise of the bridge.

The floor guards consist of timbers placed edgewise in contact with the posts and on both sides of the roadway, the lower edge being coincident with the lower side of the floor plank.

The floor binders are ribands of any convenient dimensions attached to the guards in a manner to confine the ends of the floor plank and keep them in their proper places.

In cases where all the parts of the flooring are here considered, are applied, no nails spikes or treenails will be required.



Nail free floor reproduced matching the original



Wood never in contact with concrete or ground



1909 photo note camber



1999 photo



2010 photo



2010 photo



7300 # vehicle, 1/16" deflection recorded by strain gauge



10"x16" post timber, 2nd shipment, high quality material



For the fun of it, original means and methods



Preparing to “wet the bow” when last frame member in place



Close to completion

Photo credits

•

Kinsley Construction (General Contractor)

Tim Andrews

Will Truax

Jeremy Woodliff

Earl Simmers

Of the four awards given for the project the most notable were;

**The American Public Works Association Virginia/DC/Maryland Chapter 2010 project
of the year award for historical restoration**

And the

2011 Maryland Historical Trust Preservation Award for Project Excellence

**The NPS prepared a case study of the rehabilitation that will be transmitted to the
Library of Congress**