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
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; 5 1/2 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 20 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 8 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, 8 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.
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
Bid specs for bottom chord included epoxy bonding all shear connections.
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
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
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
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