

## The Second National Covered Bridge Conference

Dayton, Ohio  
June 5-8, 2013

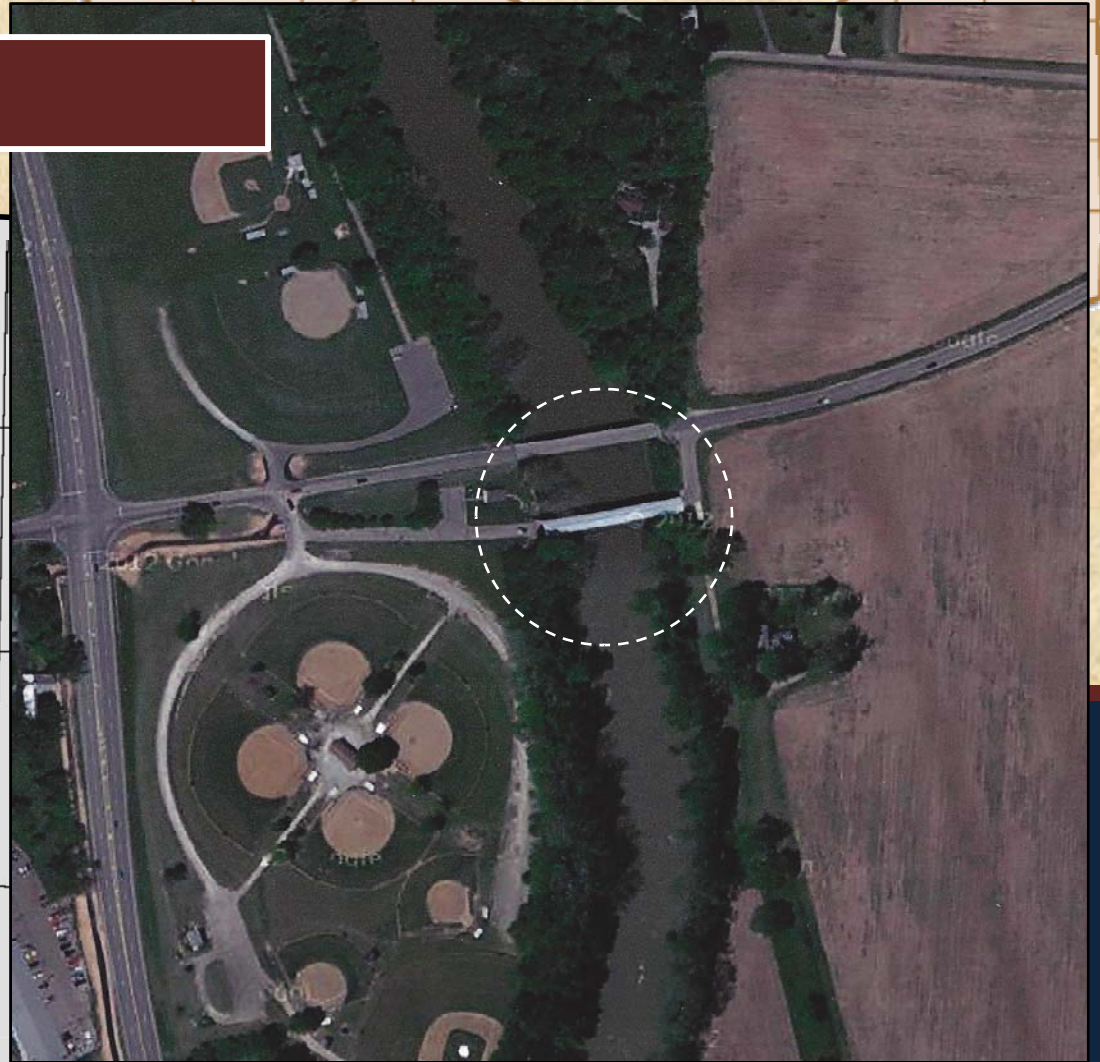


# The Historic Eldean Covered Bridge

Presented by Douglas L. Christian, PE, PS

Miami County Engineer, retired - Troy, Ohio, USA - [dcsc305@msn.com](mailto:dcsc305@msn.com)

# Location







Old Red Covered Bridge



Special Meeting  
Letting of River and Canal Bridges.

Fry April 13, 1860

The Commissioners met at the Auditor's Office for the purpose of receiving and examining bids for the several Bridges advertised for letting— all the members present. A large number of bidders were present and an unusual number of bids were received. The time for the reception of bids having elapsed, the Board proceeded to examine those received, and award the contracts.

Allen's Mill Bridge

The Bridge across the Miami River at Allen's Mill was awarded to Messrs J. & W. Hamilton as follows:

For Stone work on abutments—everything by contractors and no extra charge for  
Two dollars and seventy-three cents per twenty five cubic feet, and for Pier two ninety-five cents per perch.

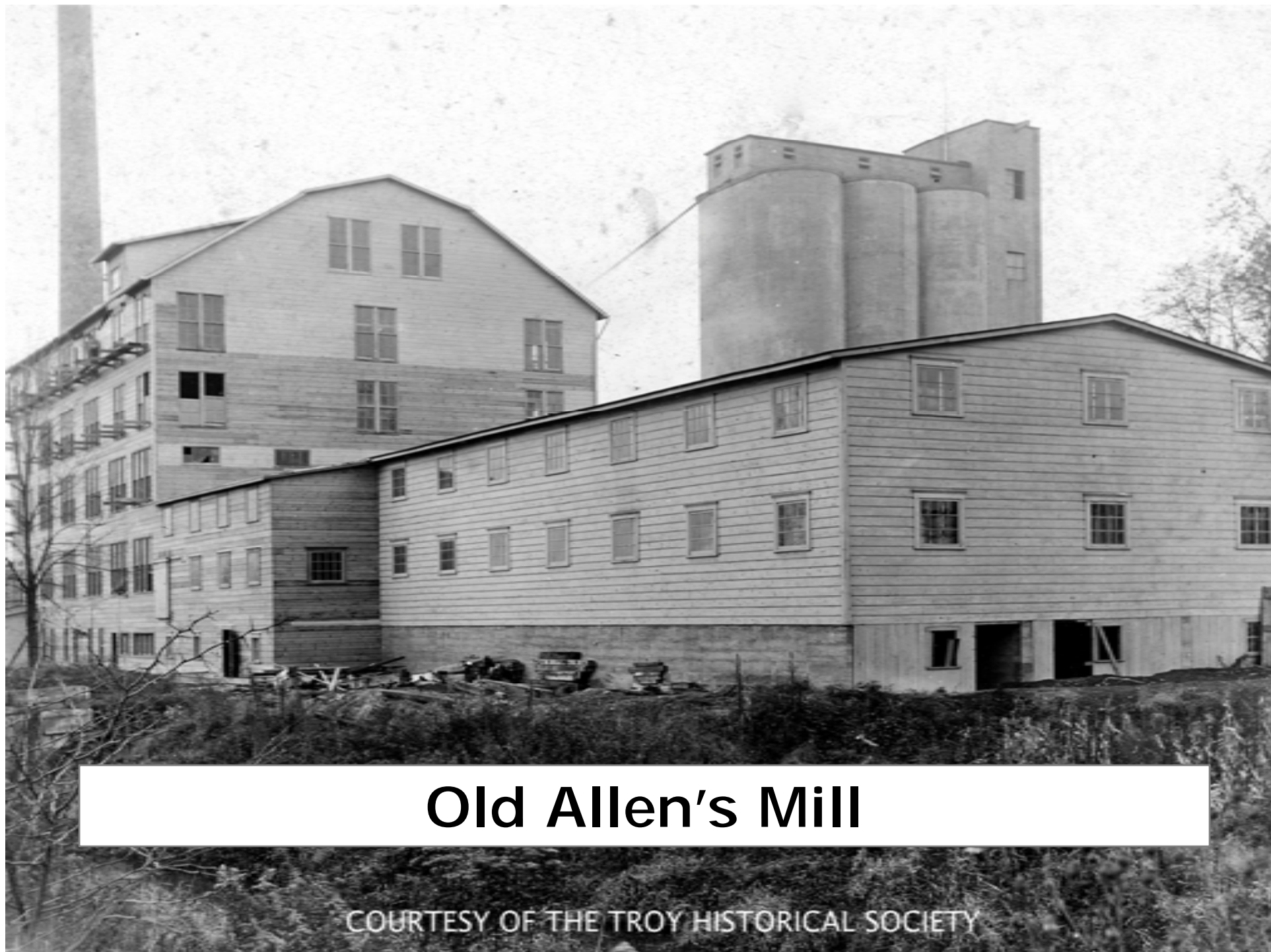
For Superstructure of Bridge—to be on according to specifications exhibited, file in the Auditor's office—eleven seventy-five cents per foot lineal.

Greenville Creek Bridge



## Bridge Built in 1860

as follows: at two dollars and twenty cents per perch of twenty five cubic feet.

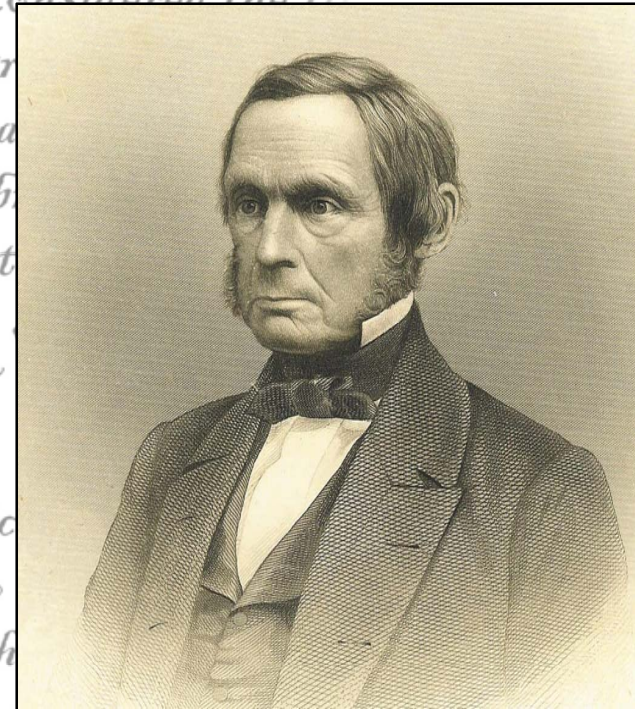
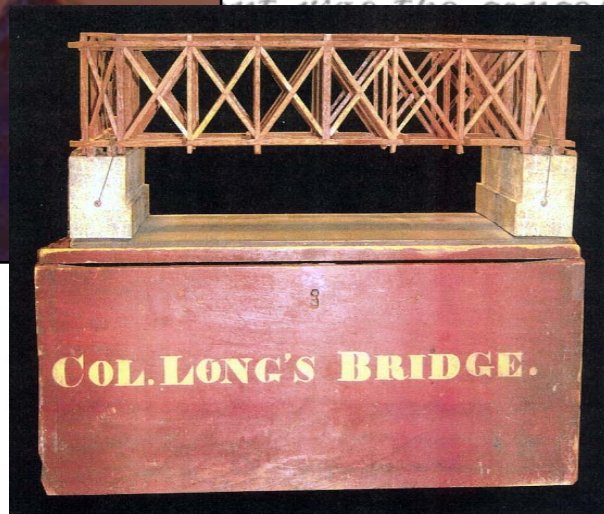


## Old Allen's Mill

COURTESY OF THE TROY HISTORICAL SOCIETY



...amples of a Long Truss, patented in 1830  
...Stephen H. Long of the United States  
...ographical Engineers. The Long



...es diagonal compression members, as  
...ion members and is considered the first  
...y designed bridge truss  
...in the members carried  
...ssly, where earlier bridges  
...ed by empirical methods  
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...venty nine covered  
...dges were built in Miami County in the mid

Stephen H. Long



**Long's Wedge**





**Bridge After Rehabilitation**





**Eldean Covered Bridge - c1933**




Eldean Covered Bridge - 1932





**Steel Rods & Steel Members**





This portion of the metal roof and roofing nails, which were installed over the original wood shingles, were removed from the Eldean Covered Bridge. The metal roof was installed in 1936 by Roy Wilt, Hayes Wilt, Jim Covault and Bill Smith, all from Fletcher, Ohio. Material cost \$235, labor cost \$45.

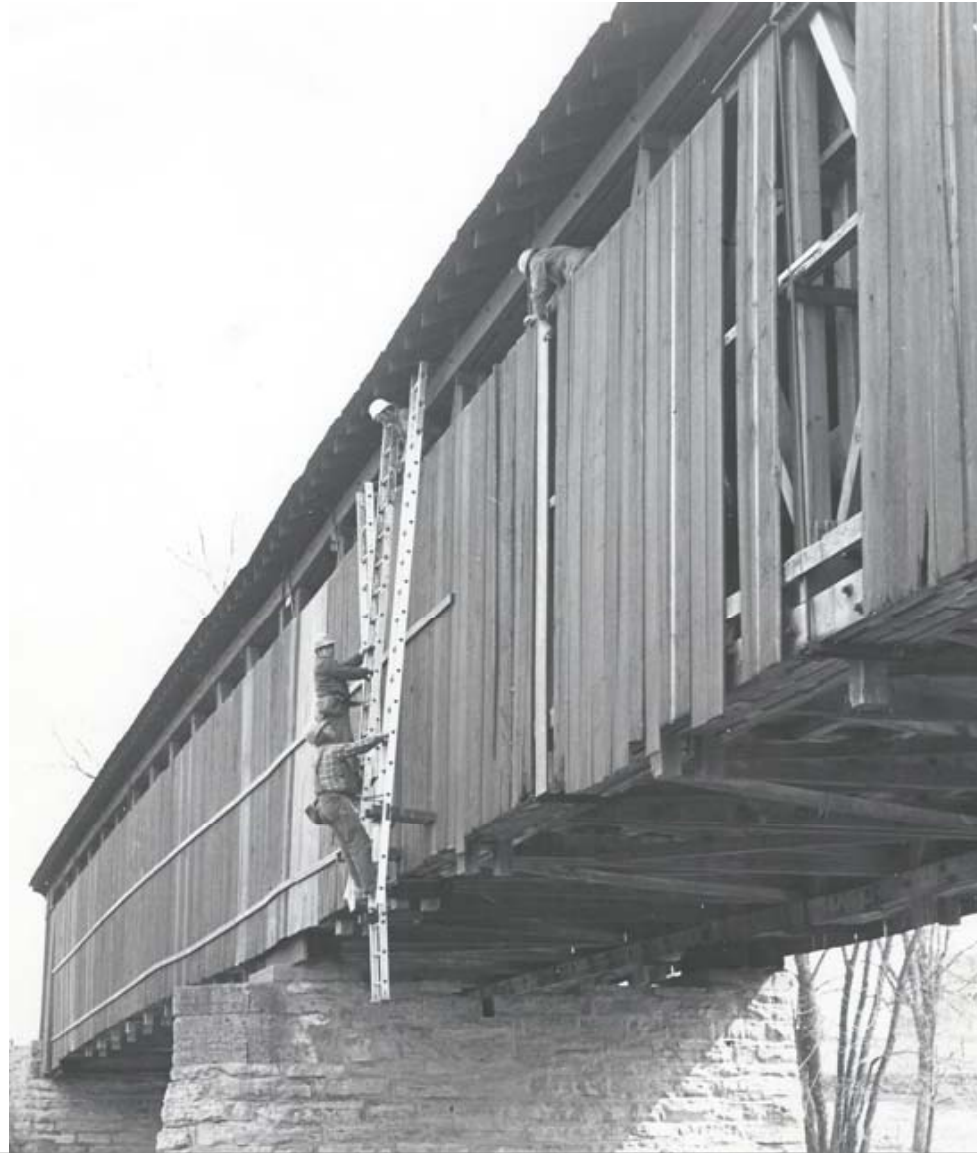
## Old Metal Roof & Roofing Nails





## Eldean Covered Bridge Closed

COURTESY OF THE TROY HISTORICAL SOCIETY



**Repairs to Siding by County Forces**







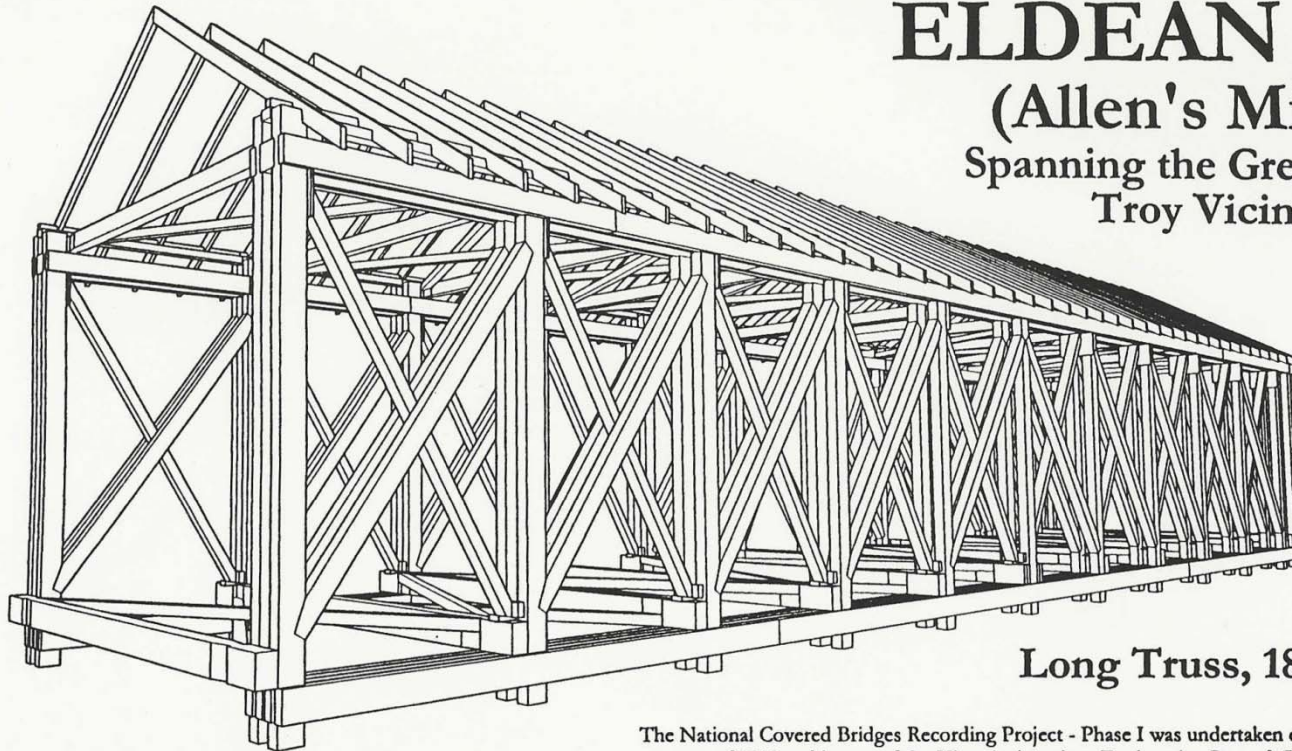
**Bridge After 1976 & 1977 Repairs**



# ELDEAN BRIDGE

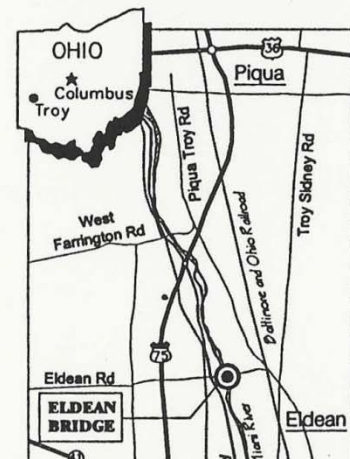
(Allen's Mill Bridge)

Spanning the Great Miami River  
Troy Vicinity, Ohio



Long Truss, 1860

Built in 1860 near the site of Henry Allen's flour mill (est. 1848) and Eldean Station on the B&O branch line between Troy and Piqua, the Eldean Bridge is the second bridge to span the Great Miami River at this site. The contractors were John and William Hamilton, stone cutters and quarry owners from the neighboring town of Piqua. The bridge was completed in the fall of 1860 at a total cost of \$4,080.83.



The Eldean Bridge is one of the best surviving examples of a Long Truss, patented in 1830 by Col. Stephen H. Long of the United States Army Topographical Engineers. The Long truss features diagonal compression members and vertical tension members and is considered the first scientifically designed bridge truss type because the forces in the members can be determined mathematically, where earlier bridge trusses had been designed by empirical method. Central to Long's patent was the concept of driving wedges into the connections, which prestressed the structure, ensuring that the compression and tension members functioned efficiently. Long

The National Covered Bridges Recording Project - Phase I was undertaken during the summer of 2002 and is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Historic American Buildings Survey/Historic American Engineering Record (E. Blaine Cliver, Chief), a division of the National Park Service, U.S. Department of the Interior. The Federal Highway Administration funded the project. The Miami County Engineering Department (Doug Christian, Chief) and David Simmons (Ohio Historical Society) provided assistance at the Eldean Bridge.

The field work, measured drawings, historical report, and photography were completed under the direction of Eric DeLony, Chief of HAER, Christopher Marston, Project Leader, and Richard O'Connor, HAER Senior Historian. The field team consisted of Field Supervisor Naomi Hernandez (Pratt Institute), Architects Kimberly

## HAER Drawing with Bridge Descriptions

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standing. At 218' 10" span, the two span Eldean Bridge is the second longest bridge in Ohio.

MA), and Sarah Dangelas (U. of Maryland). Dr. Dario Gasparini, P.E. (Case Western Reserve U.), and Dr. Ben Schafer, P.E. (Johns Hopkins U.), served as engineering consultants. Large-format photography was produced by Jet Lowe.



LOCATOR MAP





## Structural Concept

"... A system of counter bracing, by means of which the truss frames are rendered stiff and unyielding, and the bridge kept in uniform action, whether loaded or unloaded ..."

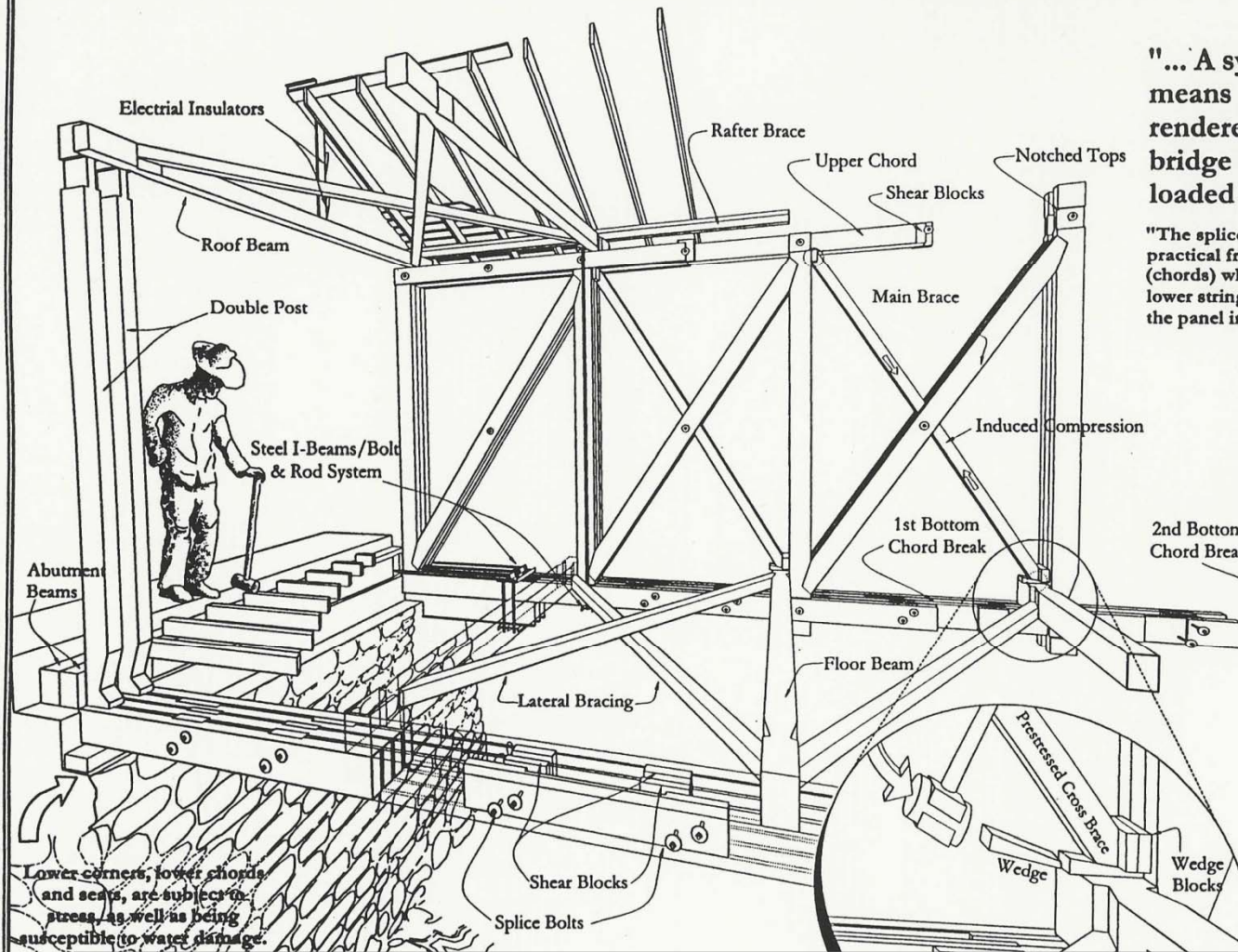
"The splices should always occur at points as remote as practical from the points of greatest tension in the springs, (chords) which are situated at the center of the span, for the lower strings. They should also be located about midway of the panel in which they occur."

-Patent, granted to S.H Long,  
Bt. Lt. Col. Of the United  
States' Topographical  
Engineers, March 6, 1830.



## Abutment Condition

In the original bridge design the ends of the lower chords were seated on wood sills, usually only an extra piece or two of wood, on top of the stone abutments and piers. Weather severely affected this part of the bridge. At the wood stone contact moisture slowly penetrates the wood. In 1936 several important modifications were made to the bridge to insure it's continual structural integrity, including inserting steel between these connections and replacing decayed wood.



# HAER Drawing with Structural Details

Not to Scale

the bridge.



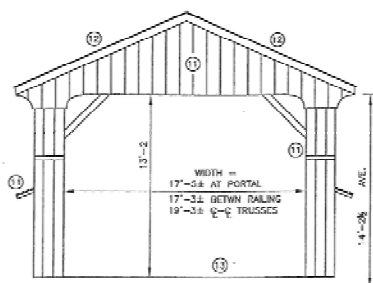
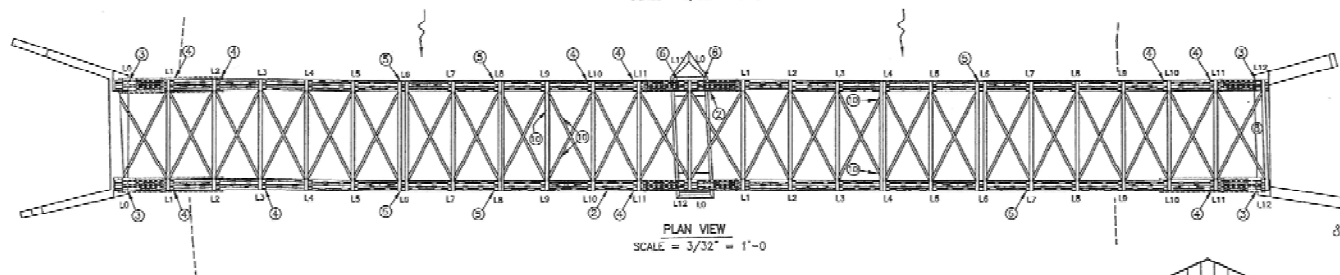
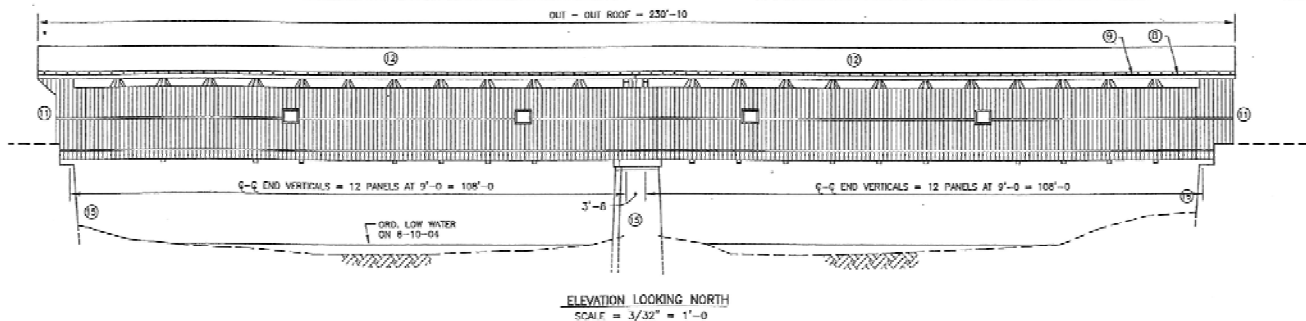


**Bridge Prior to Rehabilitation**





**Bridge Interior Prior to Rehabilitation**

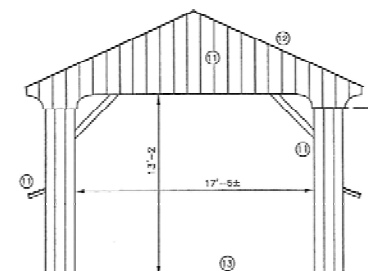


WEST ELEVATION  
SCALE 1/4" = 1'-0"

#### GENERAL DESCRIPTION OF WORK

Major parts of the project are enumerated below. This list is intended for general orientation, and does not list everything required by these plans and specifications.

1. Install temporary shoring and bracing and jack each span slightly to remove present sag.
2. Replace deteriorated timbers in lower chord, removing steel reinforcements (two locations).
3. At all four corners of bridge, replace ends of lower chord timbers and lower ends of verticals, removing present steel rods & hardware and side channels there. Replace lower ends of diagonals at several of these corners.
4. Vertical timbers at these locations have failed. Replace both vertical timbers at these panel points with new ones, removing the present steel rods. (10 locations = 20 timbers)
5. Vertical timbers at these locations have failed. However they will not be replaced. Instead, replace the two present steel rods with a single new one. (6 locations)
6. Replace deteriorated lower ends of vertical timber(s) and/or diagonal timber(s).
7. Repair cracks & localized distress in lower chord timbers. (locations per sheets 8 & 9)
8. Replace missing upper chord timber near SE corner of bridge.
9. Replace missing upper lateral bracing.
10. Replace floorbeam and adjacent lower lateral bracing timbers. Reinforce ends of certain other lower lateral bracing timbers.
11. Rebuild east and west portals and repair holes in rest of siding. Provide small awnings above the windows.
12. Remove existing roof and install new roof.
13. Replace badly damaged floor boards. This engineer shall be responsible for determining which floor board are badly damaged.
14. Apply fire retardant treatment to bridge superstructure.
15. Repaint abutments and pier, & replace top of nose of pier.



EAST ELEVATION  
SCALE 1/4" = 1'-0"

#### EXISTING AND PROPOSED STRUCTURE

PROPOSED WORK: REHABILITATION OF THE ELEANOR COVERED BRIDGE WHILE MAINTAINING ITS HISTORICAL INTEGRITY. WORK WILL INCLUDE THE REPAIR OR REPLACEMENT OF DETRIORATED OR MISSING MEMBERS; AND MISCELLANEOUS REPAIRS.

TYPE: LONG TRUSS, BUILT IN 1880

SPAN: 2 SPANS AT 108'-0"± EACH

ROADWAY: 17'-3" FACE-TO-FACE BRIDGE RAIL

GENERAL PLAN

J.A. Barker Engineering, Inc.  
4503 E. HIGHWAY 44  
BLOOMINGTON, IN 47403  
PHONE 812-332-3024  
FAX 812-332-3022

DATE: 01/10/06  
REVISION: 01/10/06  
DRAWN BY: JAB  
CHECKED BY: JAB

GENERAL PLAN  
ELEANOR COVERED BRIDGE REHABILITATION  
JAMES BARKER ENGINEERING, INC.

MIA-TR262-00.15

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# James Barker's General Plan for Bridge Rehabilitation





**Driving Piling at Beginning of Rehabilitation**





**Repair During Winter**







**Repair During Early Fall**



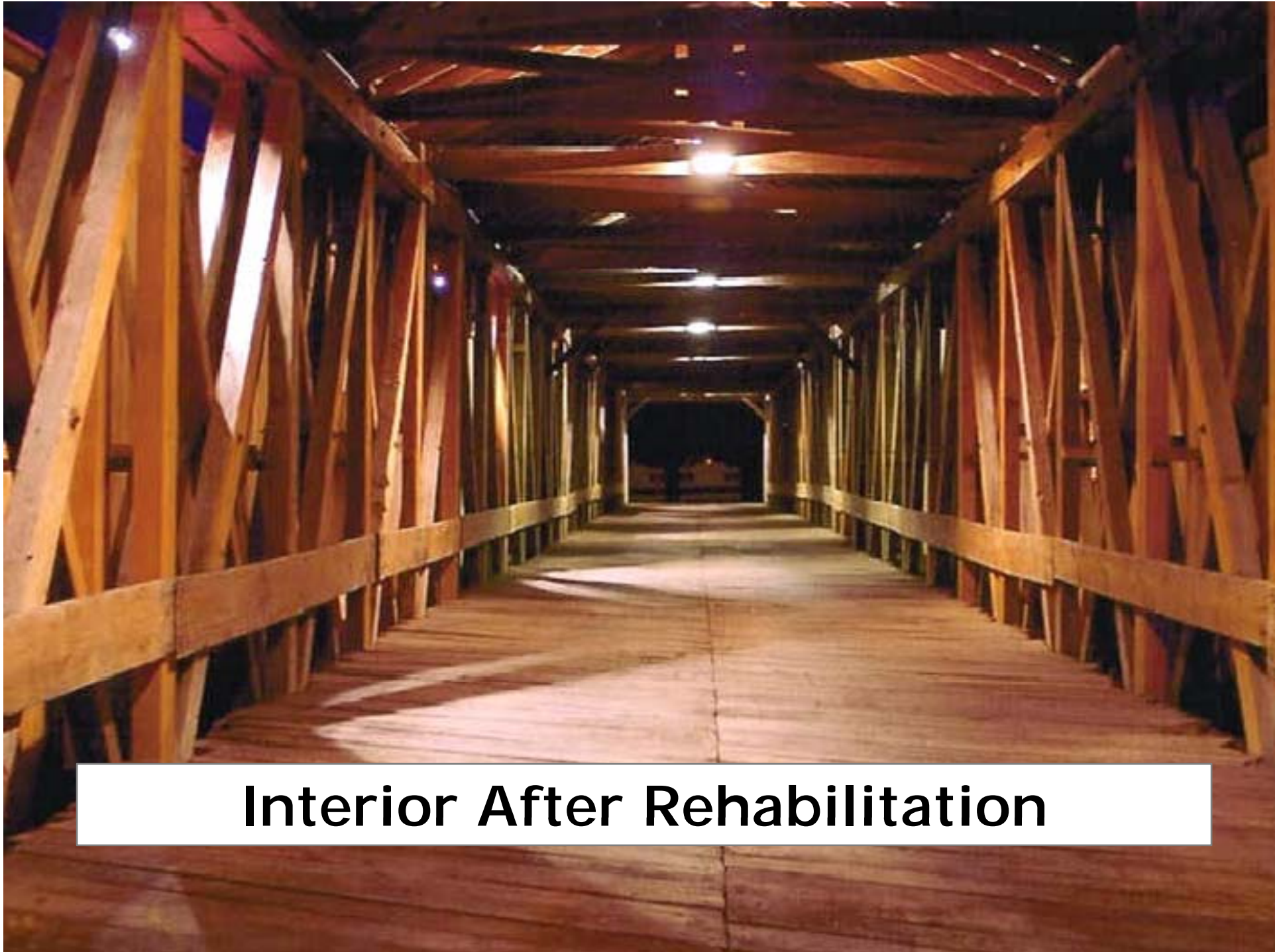
**New Metal Roof**





**New Siding**



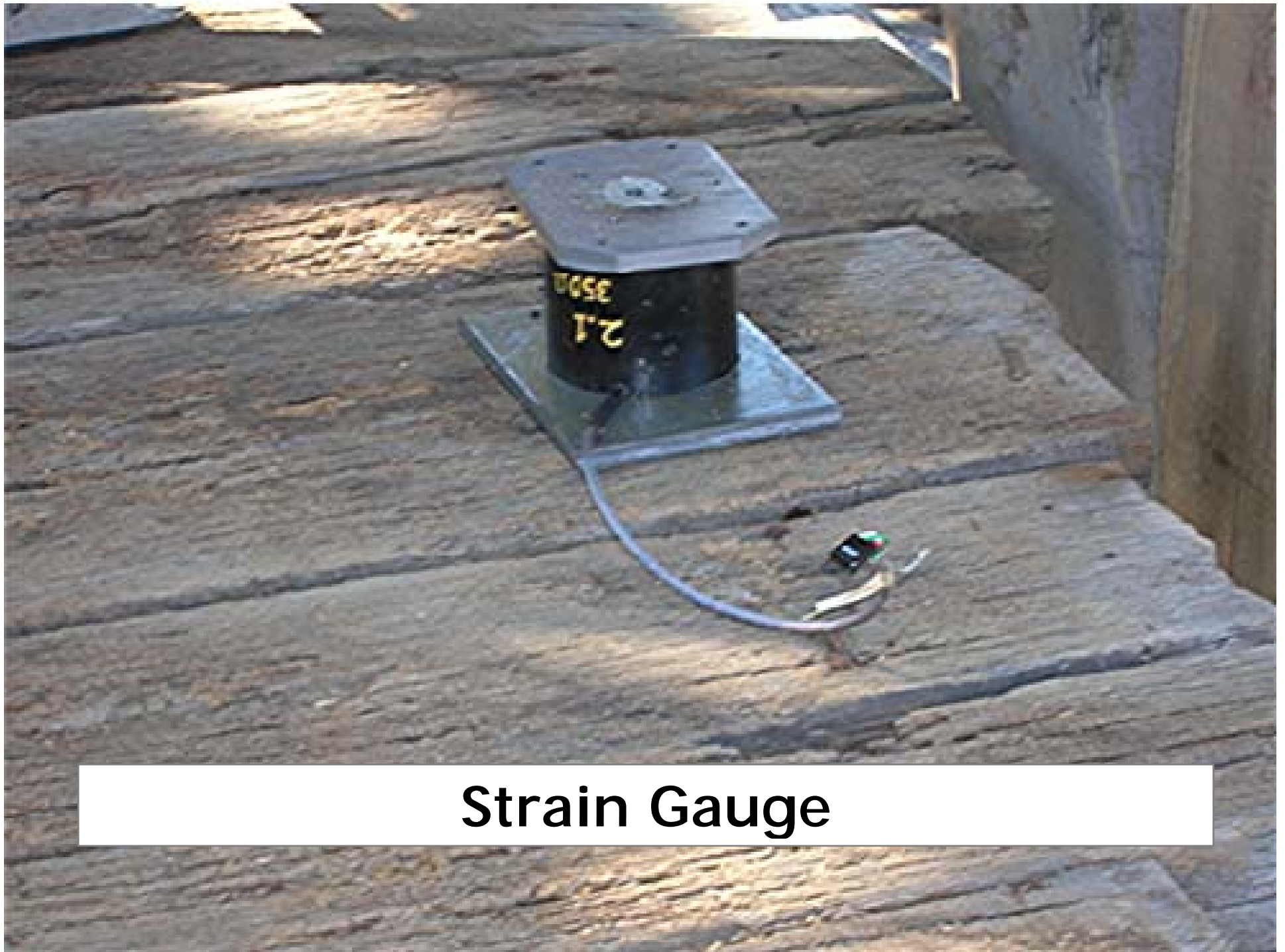


**Interior After Rehabilitation**





**Bridge After Rehabilitation**



**Strain Gauge**





**Installed Strain Gauge**



**Flooding**





**Ice Jam Upstream @ Farrington Covered Bridge**



**15" I-Beams at East Abutment**





**2004 Fire Damage to Roof & Rafters**

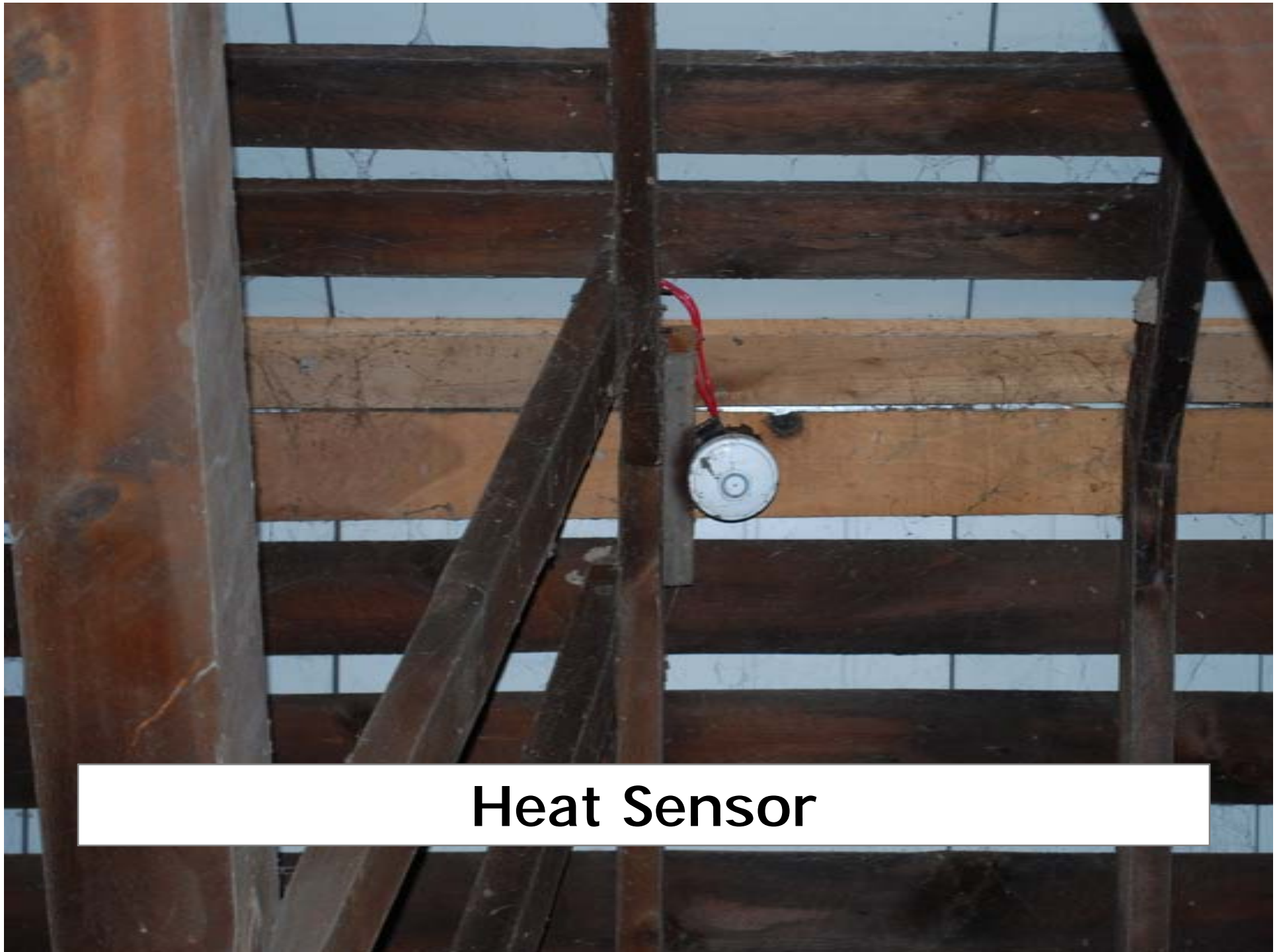


**Sheared Verticals @ Southeast Corner of Bridge**





## Interior & Exterior Lighting



**Heat Sensor**





**Video Surveillance Camera**



**Video Surveillance Camera Monitor**





**Existing Eldean Covered Bridge**