Rehabilitation of the Blaine Hill Viaduct

After approximately 46 years in service, the need for rehabilitation of the Blaine Hill Viaduct, located in Belmont County in east central Ohio, had become apparent. Four concrete arch spans and seven concrete beam spans cross Wheeling Creek as well as tracks of the B & O Railroad. Although the substructure needed only moderate repair and modification, the superstructure needed to be completely replaced.

Precast and precast prestressed concrete were selected in order to upgrade the bridge's load carrying capacity with the greatest possible efficiency of both construction time and cost. In 1980 the bridge served an average daily traffic load of 7800 vehicles; the renovated structure is designed to accommodate a daily traffic load of 12,480 vehicles by the year 2000. Furthermore, the

renovation program sought to preserve the appearance of the historic structure, which was built in the early 1930's as a WPA project and which stands as a memorial to the veterans of World War I.

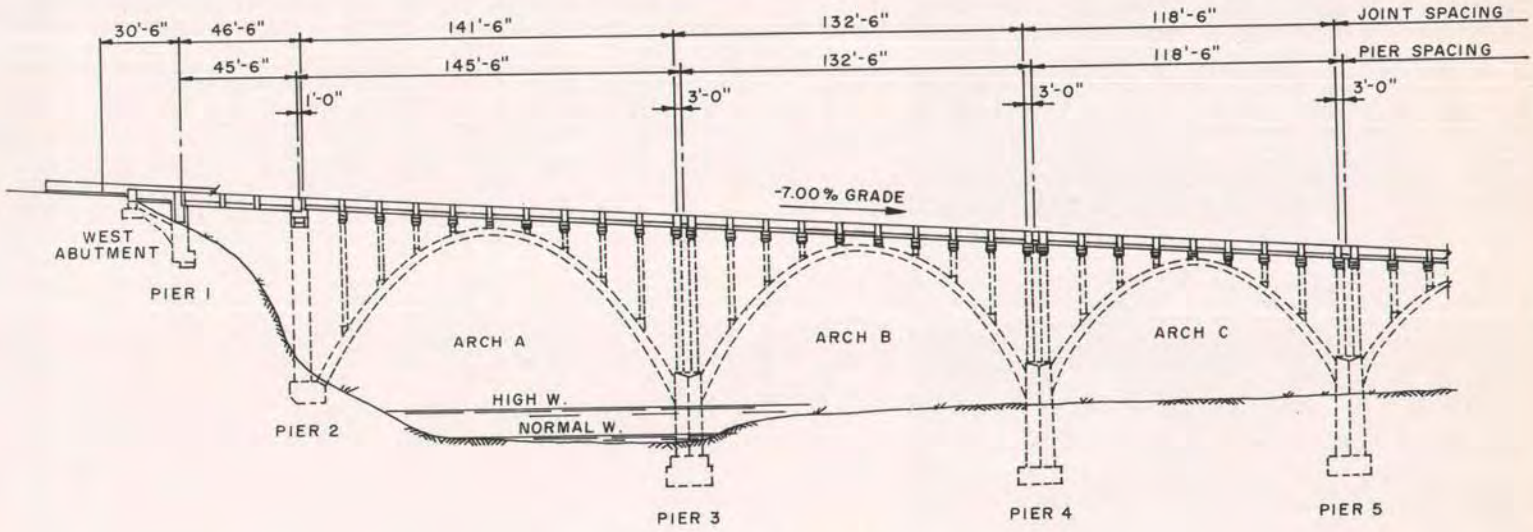
The lengths of the 11 spans are 16.7 ft - 45.5 ft - 145.5 ft - 132.5 ft - 118.5 ft - 103.5 ft - 29.75 ft - 34.75 ft - 37.75 ft - 46.0 ft - 44.5 ft (5.1 - 13.9 - 44.3 - 40.4 - 36.1 - 31.5 - 9.1 - 10.6 - 11.5 - 14.0 - 13.6 m). The total length of the structure from the end of the wing at the west abutment to the end of the retaining wall at the east abutment is 1015 ft (309.4 m), including the length of slab on grade for the approaches.

The roadway width, face-to-face of curbs, is 38 ft (11.6 m). Including parapets and a 3 ft (914 mm) sidewalk, the out-to-out width is 43 ft 6 in. (13.3 m).

In the four arch spans, precast concrete transverse beams were used to span the existing arch columns, thereby serving as pier caps. A total of 39 were used, 33 measuring 42 ft 6 in. long x 2 ft 6 in. wide x 3 ft 6 in. deep (13 m x 762 mm x 1.1 m) and 6 measuring 13 ft 5 in. long x 2 ft 6 in. wide x 3 ft 4 in. deep (4.1 m x 762 mm x 1 m).

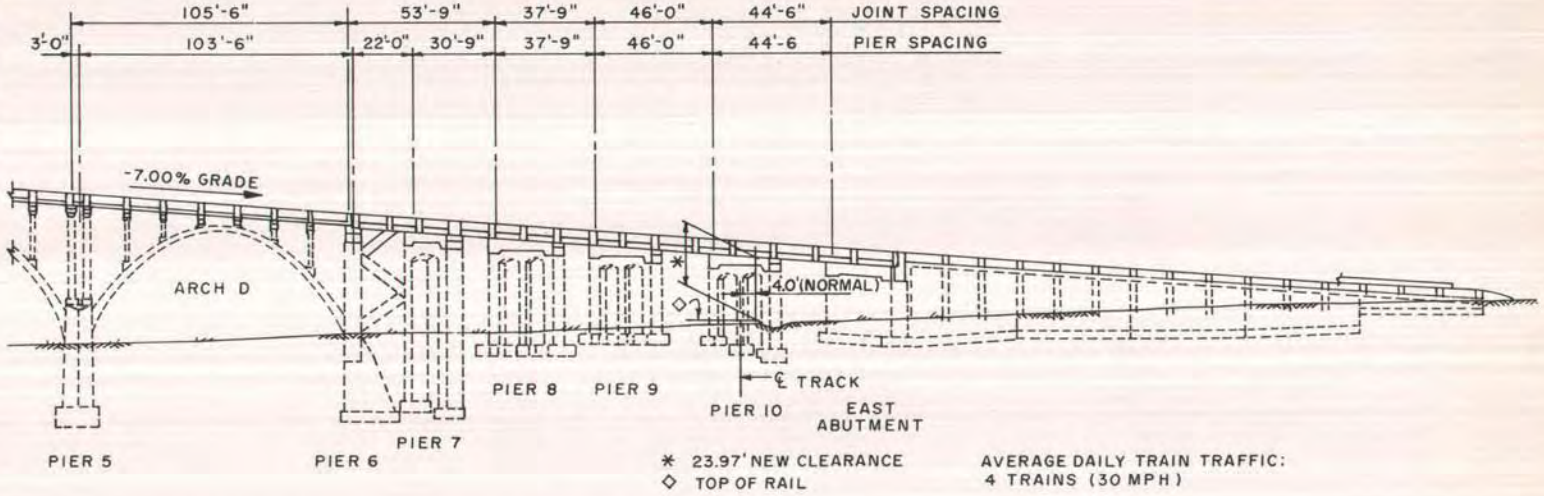
The transverse beams in turn supported the precast prestressed longitudinal box beams, placed 11 across side by side to form the bridge deck. In the beam spans, after modification of the pier tops, precast prestressed box beams were also used as the longitudinal load carrying members. Non-laminated elastomeric bearing pads provided the intermediate bearing surface for the longitudinal members.

For the arch spans, 374 box beams were used, each 12 in. (305 mm) deep. Of this total, 4831 lin ft (1472.5 m) of beam were 48 in. (1.2 m) wide and 483 lin ft (147.2 m) of beam were 36 in. (914 mm) wide. For the beam spans, 66 box beams were used. The beam span box beams were 21 in. (533 mm) deep, with two variations in width such that 239 lin ft (72.8 m) were 36 in. (914 mm) wide and 2395 lin ft were 48 in. (1.2 m) wide.



ELEVATION

BLAINE HILL VIADUCT



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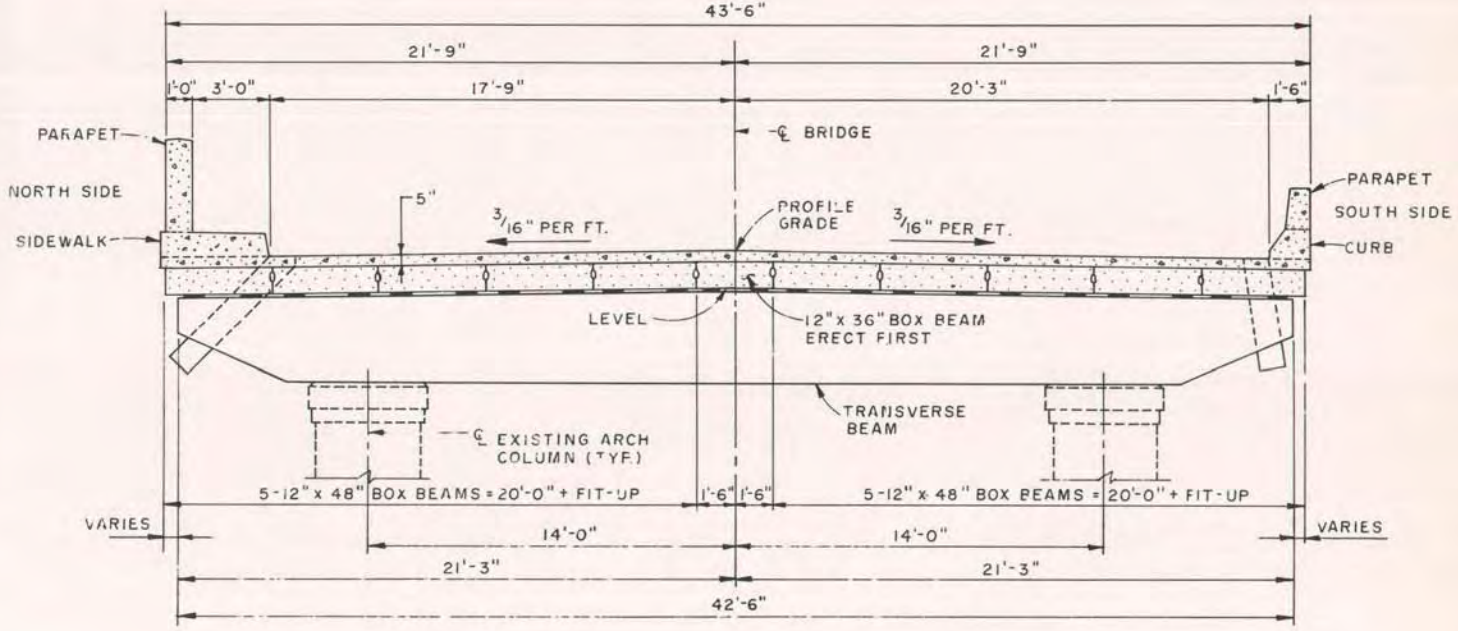
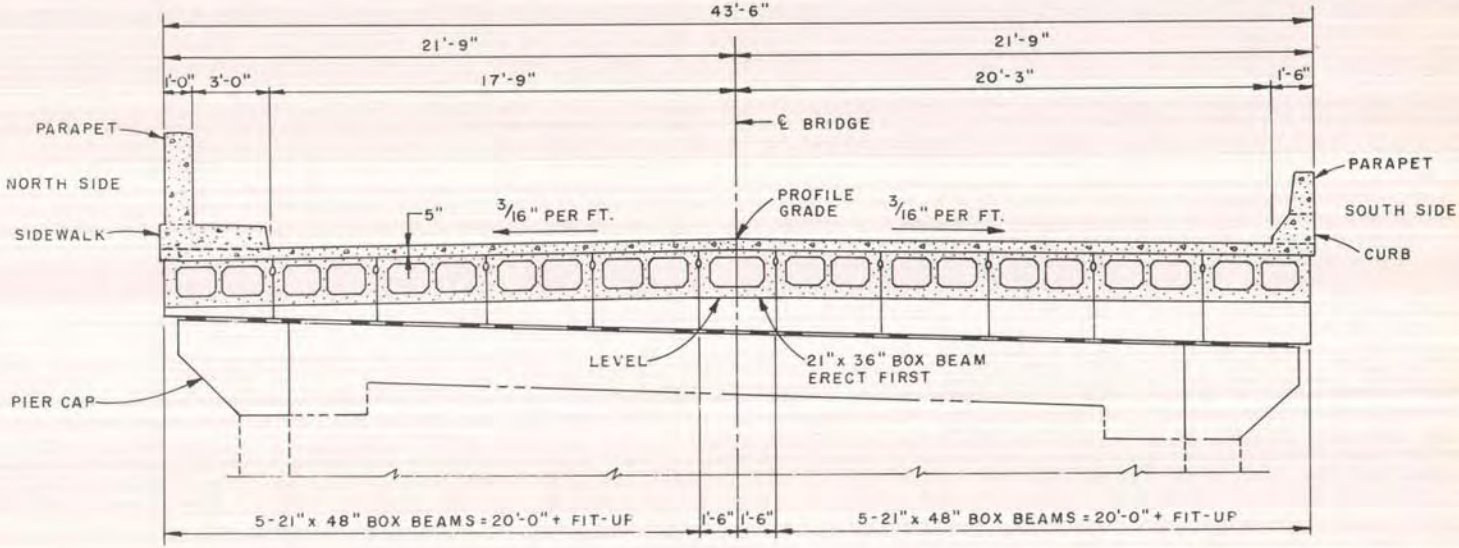


TRANSVERSE DECK SECTION THRU ARCH SPANS

BLAINE HILL VIADUCT



TRANSVERSE DECK SECTION THRU BEAM SPANS

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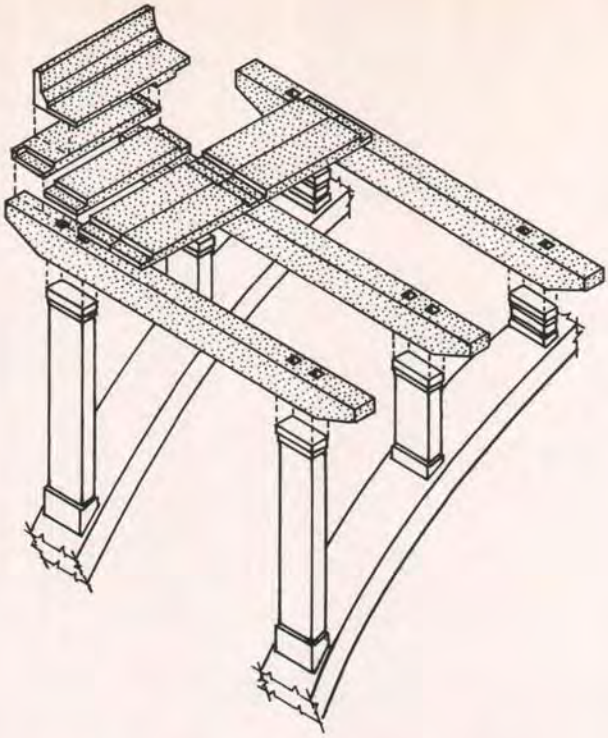
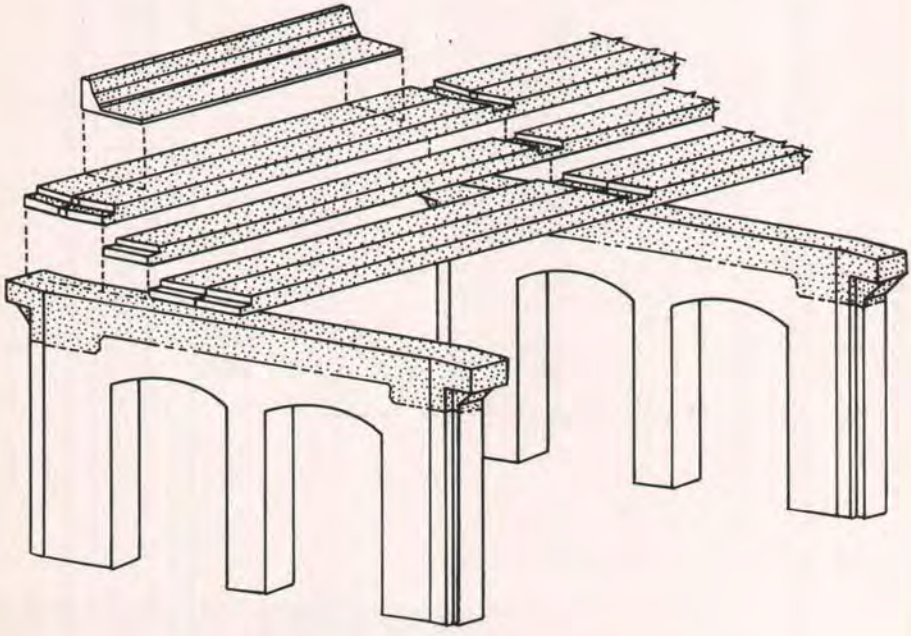
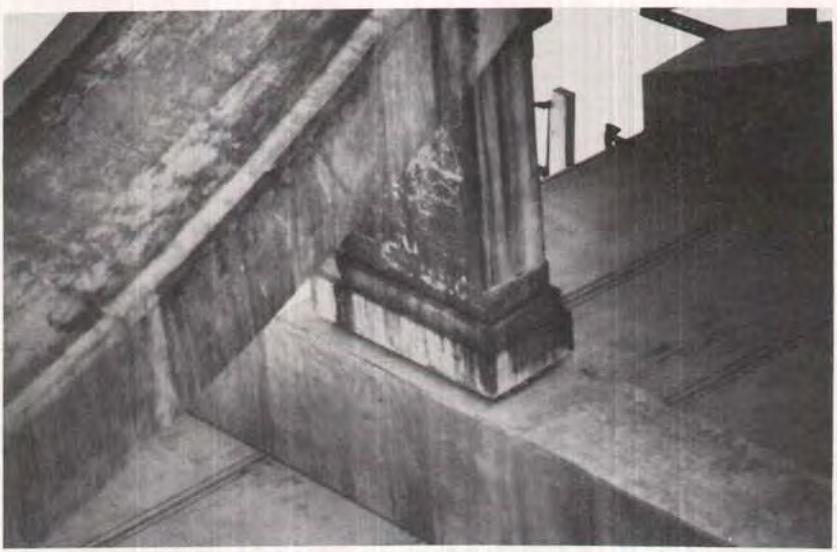


Simplified schematics showing sections of arch bridge that were replaced.





A non-shrink mortar was placed between the beams at the transverse joints, and a concrete mix commonly used for highway bridge applications was placed between the beams longitudinally. In addition, a 5-in. (127 mm) reinforced concrete composite overlay was used for the roadway wearing surface. Stratification ribs approximately ¼-in. (6.4 mm) wide were cast into this monolithic concrete deck to improve traction on the roadway.

The efficiency provided by precast and prestressed concrete allowed

construction to be completed within 13 months. Because the precast concrete members were placed on the substructure directly from the delivery trucks, no on-site storage facilities were needed. The new members were placed in a construction sequence closely following the removal of the previous superstructure.

The total cost of the renovation project was $1,595,058, or approximately $36.10 per sq ft ($388.85 per m^2). Of this total, the precast concrete transverse beams (pier caps) accounted for $121,000. The longitudinal box beams accounted for an additional $524,890 of the total, which breaks down to an average cost of approximately $66 per lin ft ($216.65 per m) of beam. Since its completion in September 1982 the project has performed up to its expected high standards.

Credits

Engineer: Bureau of Bridges and Structural Design, Ohio Department of Transportation, Columbus, Ohio. (Design Engineers: Robert L. Dickson, Walter J. Jestings, Adam J. Marcum, and Joseph A. Mekush).

Owner: Ohio Department of Transportation, Columbus, Ohio.

General Contractor: Kokosing Construction Company, Fredericktown, Ohio.

Precast Concrete Manufacturer: Belot Concrete Industries, Inc., Tiltonsville, Ohio.

Precast Prestressed Concrete Manufacturer: Centurial Products Corporation, Waverly, West Virginia.