Somerset County Bridge: A Precast Replacement Solution

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Precast concrete played a prominent role in constructing the new Somerset County Bridge — a distinguished precast, reinforced concrete arch structure, which replaced an old deteriorated highway bridge in Somerville, New Jersey. The new crossing comprises two precast, reinforced concrete curved members to form a 60 ft (18.3 m) clear span with a 9 ft 6 in. (2.90 m) rise and a 50 ft (15.2 m) width. The overall length of the structure, including retaining walls, is 90 ft (27.4 m). The bridge incorporates 18 precast panel components that mimic the look of stone as well as 120 precast balusters made with white concrete. The precast concept used in this project is being advocated by county officials as an example for other damaged or new arch bridges in a similar span range.

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The new Somerset County Bridge #F0805 (see Fig. 1) in Somerville, New Jersey, is a good example of the effective use of precast concrete in replacing or rehabilitating old deteriorated bridges. In this particular replacement bridge, precast concrete brought in a harmony between structure, function, and aesthetics. Spanning a brook in a picturesque area near the center of town, the design of this two-lane highway bridge required a delicate understanding of aesthetics.

The original bridge was a distinguished reinforced concrete arch structure built in the 1920s. The design was architecturally attractive, featuring a detailed style with decorative balusters and other small-scale elements. However, during the next 70 years, the bridge suffered severe deterioration from de-icing salts, air pollution, and other corrosive agents (see Figs. 2 and 3). The bridge, in fact, had deteriorated so much that county officials declared it could not be repaired, but needed to be completely replaced.

For the new bridge, the county issued the following requirements:

- Design a bridge that retained the architectural features of the old bridge.
- Design a structure that was in harmony with the other buildings and the natural environment of the area.
- Minimize disruption to local traffic around the constricted downtown construction site.

Fig. 1. Somerset County Bridge #F0805, Somerville, New Jersey.

- Complete the bridge on a strict schedule and within budget.

The selected design comprises two precast, reinforced concrete curved members that form a 60 ft (18.3 m) clear span with a 9 ft 6 in. (2.90 m) rise and a 50 ft (15.2 m) width. The overall length of the structure, including retaining walls, is 90 ft (27.4 m).

The bridge incorporates 18 precast panel components that mimic the look of stone; in addition, 120 precast balusters made with white concrete form the railing. These panels create the distinguished side view shown in Fig. 1. A basic feature of the bridge is the two 29 ft 6 in. (8.99 m) half-arch precast panels that are integrated on each side with a 5 ft (1.52 m) cast-in-place keystone piece (see Fig. 4). Each curved structural panel measures 14 in. (356 mm) thick x 7 ft 9 in. (2.36 m) wide.

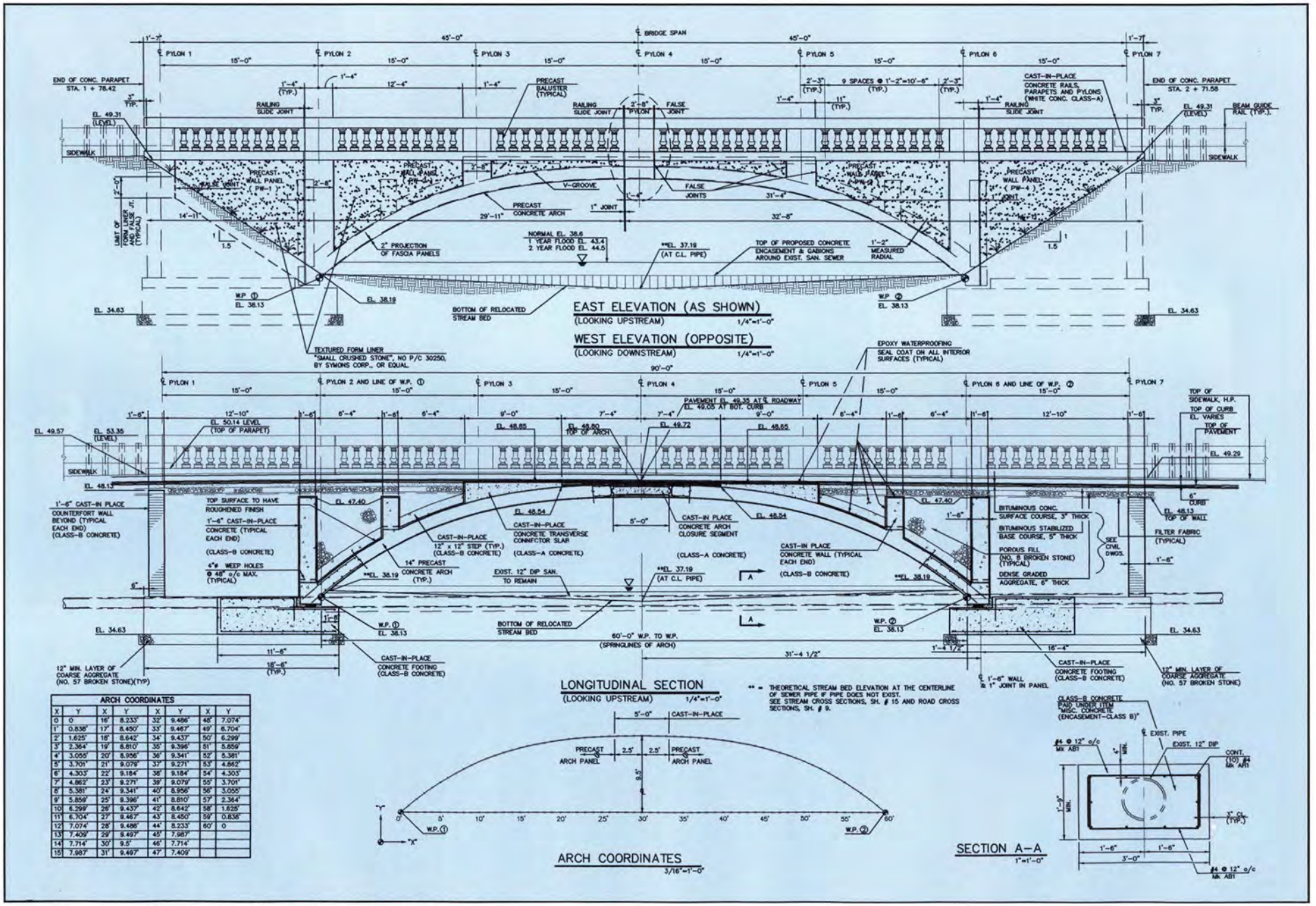
In addition, four precast concrete fascia wall panels were fastened by three tie walls across the 48 ft (14.6 m) wide curved panels, with 12 precast curved panels used in the construction. A railing system made of cast-in-place concrete rails and pylons as well as all of the precast balusters were then placed on top of the fascia wall panels.

The concrete balusters were not only decorative but also functioned as a structural element in transferring traffic impact loads on the railing.

Figs. 4 through 7 show various working drawings of the elevations, sections, and other details of the bridge.

Fig. 2. Old deteriorated arch bridge showing extent of damage.

Fig. 3. Close-up of bridge showing significant deterioration of concrete.



ARCH COORDINATES							
X	Y	X	Y	X	Y	X	Y
0	0	16'	8.233'	32'	9.486'	48'	7.074'
1'	0.838'	17'	8.450'	33'	9.467'	49'	6.704'
2'	1.625'	18'	8.642'	34'	9.437'	50'	6.299'
3'	2.364'	19'	8.810'	35'	9.396'	51'	5.859'
4'	3.055'	20'	8.956'	36'	9.341'	52'	5.381'
5'	3.701'	21'	9.079'	37'	9.271'	53'	4.862'
6'	4.303'	22'	9.184'	38'	9.184'	54'	4.303'
7'	4.862'	23'	9.271'	39'	9.079'	55'	3.701'
8'	5.381'	24'	9.341'	40'	8.956'	56'	3.055'
9'	5.859'	25'	9.396'	41'	8.810'	57'	2.364'
10'	6.299'	26'	9.437'	42'	8.642'	58'	1.625'
11'	6.704'	27'	9.467'	43'	8.450'	59'	0.838'
12'	7.074'	28'	9.486'	44'	8.233'	60'	0
13'	7.409'	29'	9.497'	45'	7.987'		
14'	7.714'	30'	9.5'	46'	7.714'		
15'	7.987'	31'	9.497'	47'	7.409'		

Fig. 4. East and west elevations, and longitudinal section of bridge.

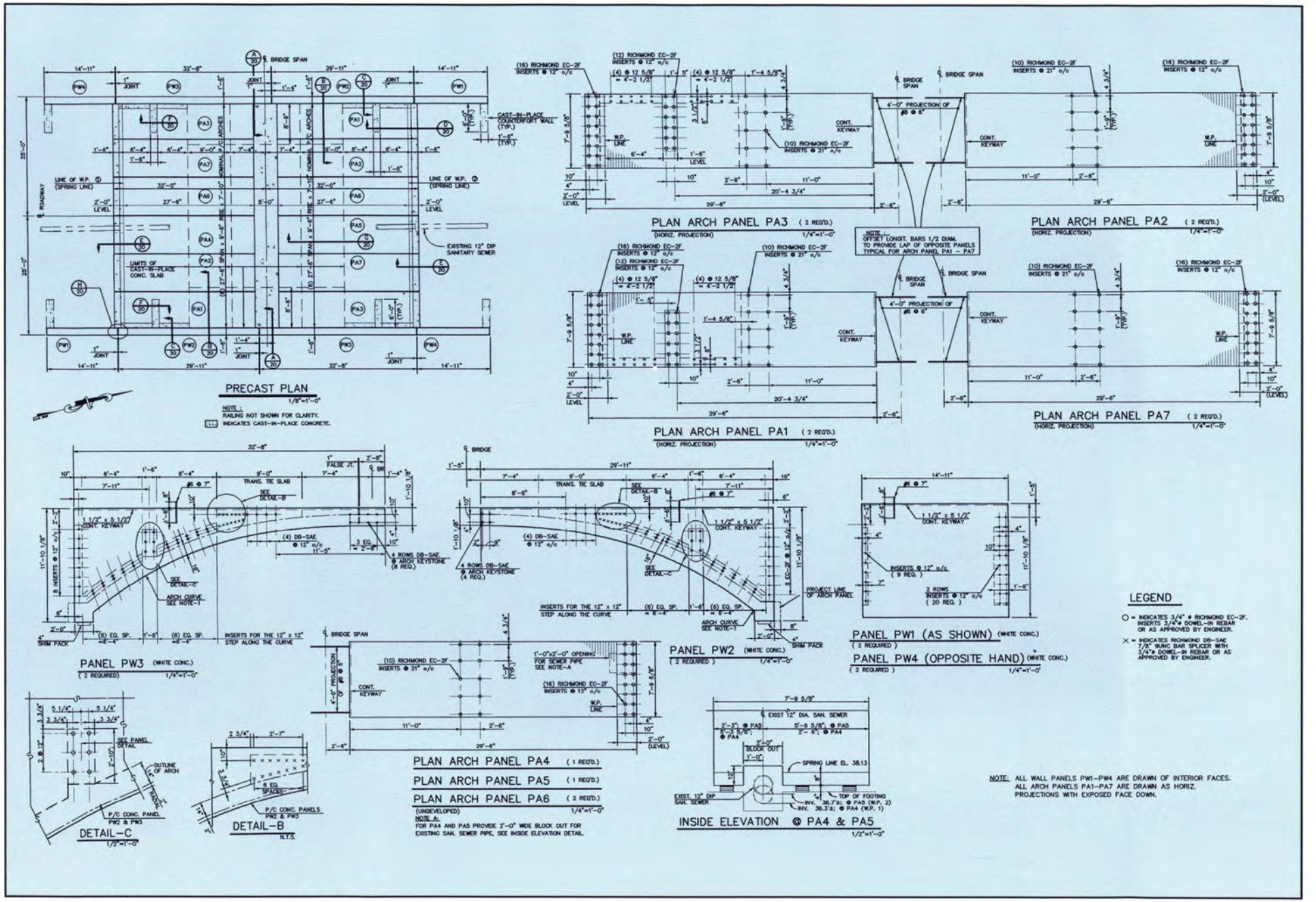


Fig. 5. Precast plan and details of arch and wall panels.

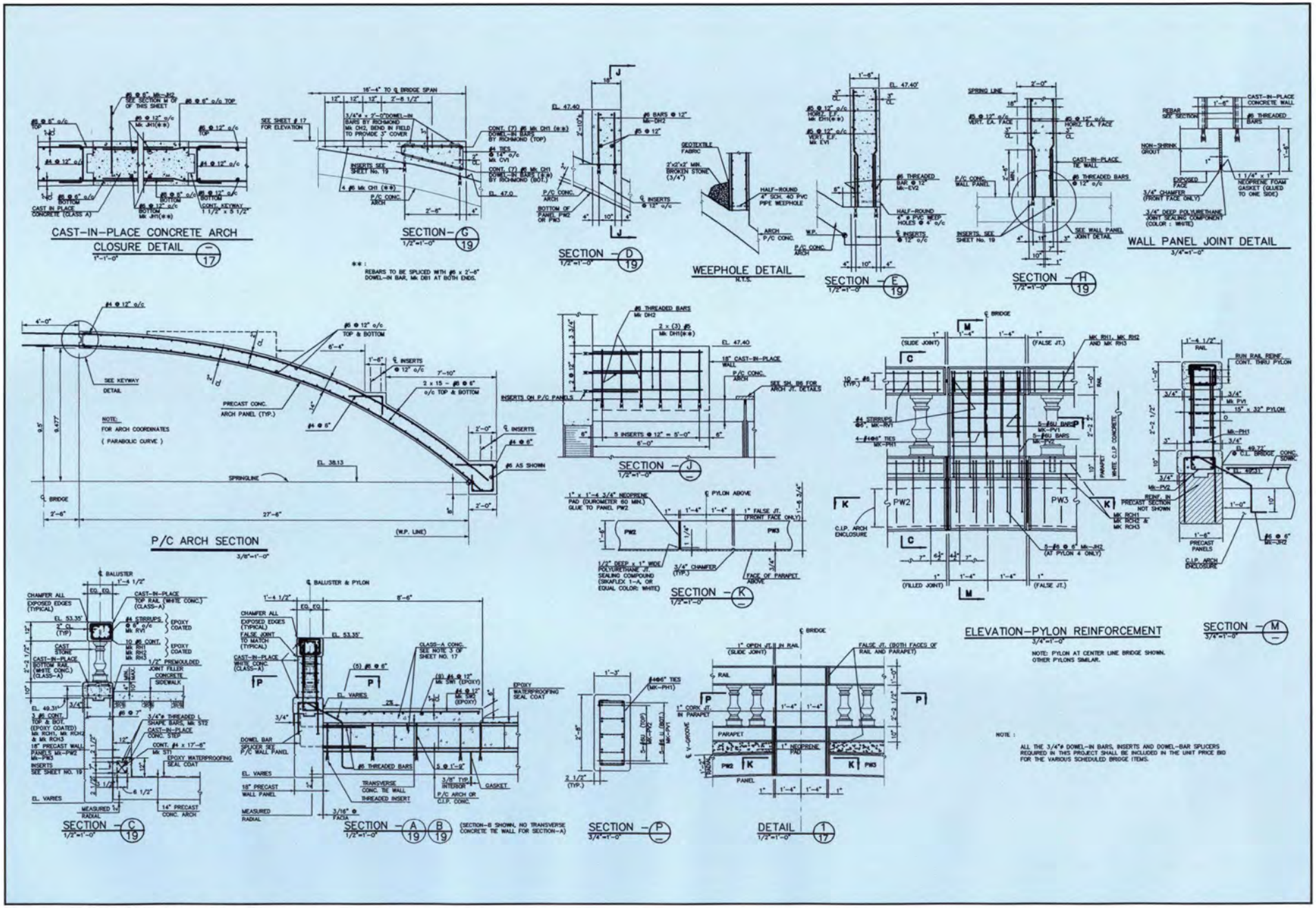


Fig. 6. Reinforcement details of bridge sections.

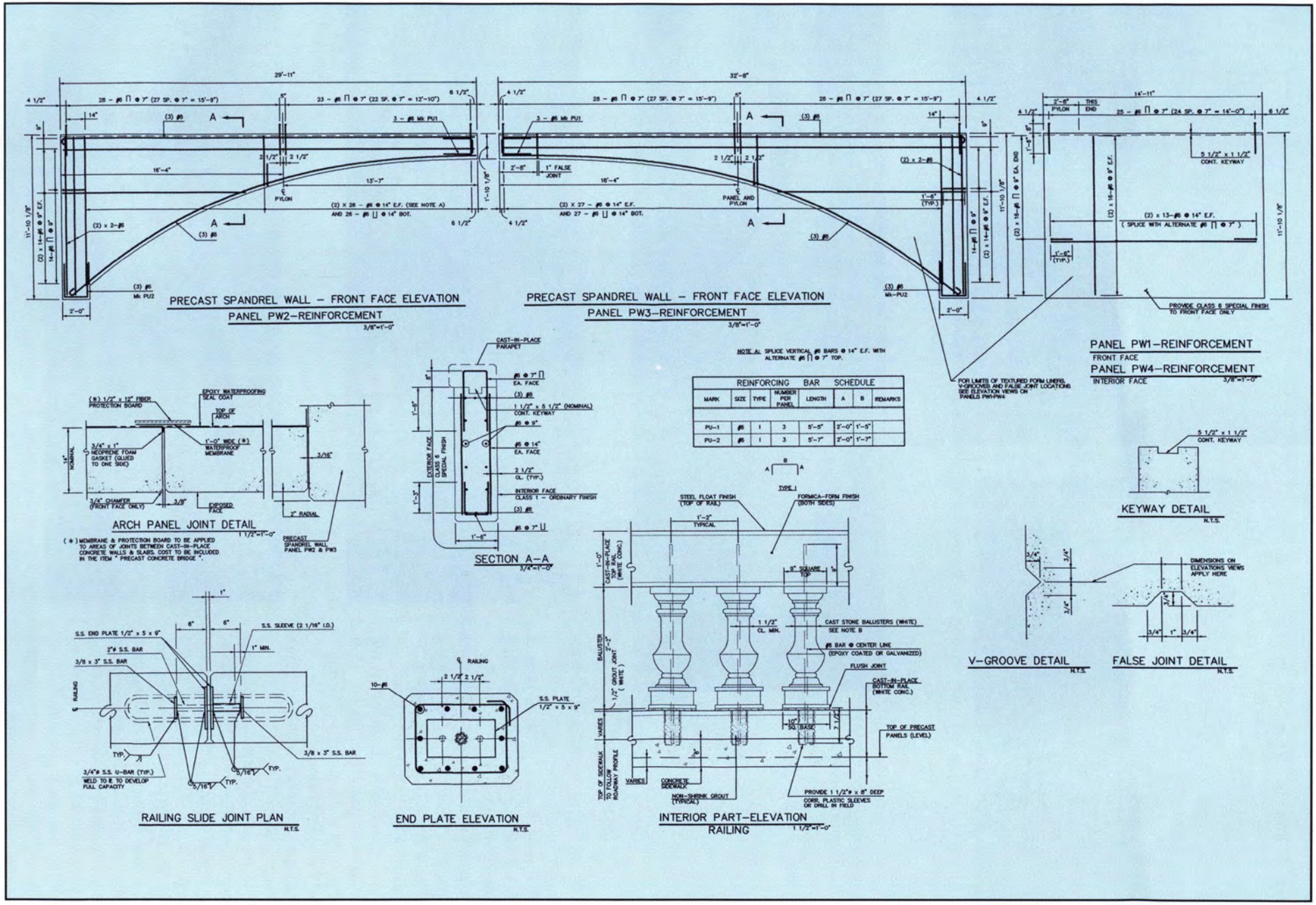


Fig. 7. Precast spandrel wall and railing details.

Fig. 8. Fabrication of arched panel showing reinforcement and formwork.

Fig. 10. Hoisting curved panel.

Fig. 9. Finished arched panels at precasting plant ready for shipment to project site.

The following precast components were used on this project:

- Twelve arch panels: 14 in. thick x 29 ft 6 in. long x 7 ft 9 in. wide (356 mm x 8.99 m x 2.36 m).
- Four fascia wall panels using white concrete: 18 in. thick x 30 ft long x 1 ft 10 in. to 11 ft 10 in. high (457 mm x 9.14 m x 0.56 to 3.61 m)
- Two retaining wall panels using white concrete: 18 in. thick x 15 ft long x 11 ft 10 in. high (457 mm x 4.57 m x 3.61 m).
- 120 precast stone balusters using white concrete.

The precast concrete components were manufactured by J & R Slaw, Inc. at their plant in Bowmanstown, Pennsylvania. The company, a PCI Plant Certified Producer Member, has had a long history of providing high quality products and reliable service. The precast components were hauled a distance of about 50 miles (80 km) by truck-trailer to the project site.

Figs. 8 through 13 show various erection stages of the bridge.

Fig. 11. Installing fascia panel.

Fig. 12. Hoisting precast panel on top of balusters as a bottom form for cast-in-place top rail.

The bridge was constructed in 2½ months and was essentially completed by December 1996. The total cost of the bridge was about $775,000. Figs. 14 through 16 show various shots of the finished structure.

In June 1997, the Somerset County Bridge won a PCI design award for "Best Bridge with Spans Under 65 ft (19.8 m)." The jury had the following comments:

> "The designers did an excellent job of replicating the existing bridge by incorporating many innovative precast elements, including the balusters and balustrades. The ability to create such strong aesthetics and blend the bridge into the community is commendable."

In retrospect, the owner and the design and construction team are satisfied that the selection of precast concrete as the primary material for replacing this bridge was the proper choice. Specifying precast concrete ensured high quality products, reduced the need for falsework, and minimized defects and construction errors. Bringing in prefabricated components to the project site reduced the construction period because it was very important to minimize disruption to local traffic. In addition, the uniform color and texture of the components, together with their precise dimensions and accurate tolerances, allowed this project to be completed on schedule and within budget.

Today, the bridge stands as a distin-

Fig. 13. Reinforcing cage for cast-in-place top rail.

Fig. 14. Close-up of completed bridge showing distinctive panels and railing.

Fig. 15. Roadway showing railing.

Fig. 16. Award winning bridge shows attractive precast panels integrated with cast-in-place keystone piece.

guished landmark in downtown Somerville. Indeed, the precast concept used in the bridge is being advocated by county officials as an example for more such arch bridges in a similar span range. The results and experience gained from this project can be used to replace other bridges using the same construction methods. The versatility of precast concrete allows a harmony between structure, function, and aesthetics.

CREDITS

Owner: Somerset County, Somerville, New Jersey

Structural Engineer: French & Parrello Associates, Holmdel, New Jersey

General Contractor: H & G Contractors, Inc., Ridgewood, New Jersey

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