

**OWNER CHARETTE SHAPES PENNSYLVANIA FIRST PRECAST SEGMENTAL
VEHICULAR BRIDGE**

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ABSTRACT

A new Susquehanna River Bridge will replace the existing facility near exit 19 on the Pennsylvania Turnpike in Harrisburg, Pennsylvania. The new twin 5,910' long by 57' wide precast concrete segmental box girder structures provide the Commission with an opportunity to introduce an economical and attractive new structure type to the State of Pennsylvania.

Early in the design process, a charette was held by FIGG with top members of the Pennsylvania Turnpike Commission staff to discuss and evaluate aesthetic features of the bridge through consensus voting. The Commission provided clear design direction by identifying preferences for a sweeping superstructure shape on oval piers with an open barrier rail. Wash lighting on the superstructure and vertical pier rustication to enhance the slender appearance of the supports were also identified as preferences.

Keywords: Charette, Aesthetics, Precast, Segmental, Pennsylvania, Lighting, Economical, Speed of Construction

INTRODUCTION

The proposed replacement Susquehanna River Bridge near exit 19 (See Figure 1) on the Pennsylvania Turnpike in Harrisburg, Pennsylvania, will be the second longest bridge on the Pennsylvania Turnpike system. A precast concrete segmental bridge has been selected to replace the existing facility and the Commission is using this as an opportunity to introduce an economical and attractive new structure type to the State of Pennsylvania.



Figure 1 – Susquehanna River Bridge Location

Early in the design process, a Charette was performed by Figg Bridge Engineers, Inc. (FIGG) with leading members of the Pennsylvania Turnpike Commission staff to discuss, evaluate and select important aesthetic and contracting features of the bridge.

OWNER CHARETTE SHAPES AESTHETIC BRIDGE

During the preliminary phase of the project, a Charette with the Pennsylvania Turnpike Commission was arranged in order to establish key global decisions that would guide the team throughout the entire design process. By performing this activity early, FIGG was able to identify the general preferences of the owner that provided a clear direction for the ensuing design. It was particularly valuable that the participants included all the Commissions' key

decision makers. This generated an early consensus within the owner's organization of key aesthetic bridge feature preferences that allowed for a straightforward evolution of the bridge design. This also established the owner's confidence in the final design early in the process, since they knew that the bridge would evolve based on their defined preferences.

The key steps for this Charette were to assemble the proper participants and follow a set agenda where project background and then design options are presented that are within the owner's budget. Within the framework of this agenda, open discussion is encouraged among the participants. This is followed by each Commission representative indicating their option preference on a voting form.

Eight members of the Pennsylvania Turnpike Commission were assembled for the Charette. The participants included the Executive Director, Chief Engineers of Design and Construction, Bridge Engineer, Project Manager along with members from the Public Relations and Roadway sections. This provided a broad representative group of all the key Commission decision makers to ensure a comprehensive consensus.

CHARETTE DETAILS

The agenda for this replacement Susquehanna River Bridge Charette started with a project review of the established design criteria such as alignment and roadway cross-section requirements. The anticipated construction schedule and critical considerations were explored with a review of similar successfully completed bridges.

The background information established that the proposed Susquehanna River Bridge is comprised of twin 5,910' long by 57' wide concrete box girder structures, with typical spans of 150'. The bridge will carry three lanes of traffic in each direction on a new alignment that is offset north of the existing bridge. This allows for completing construction of the new twin structures without impacting traffic on the existing bridge. Including approach roadways, the entire project length is over 13,600' (See Figure 2).

The new bridge will span over a number of railway lines and a local state road. The Susquehanna River is considered commercially non-navigable, but is extremely wide. The winter ice flows and spring floods present a significant challenge for construction access. The owner recognized that using precast segmental technology is a means of minimizing the time frame required for construction access in the river.

Foundations are comprised of drilled shafts that support piers varying in height from 30' to 80'. Precast piers can be quickly erected and are offered as an option for the Contractor in the construction documents. The combination of drilled shafts and precast piers is designed to allow for quick substructure construction that can offset the difficult access conditions in the river.

A precast segmental span-by-span superstructure erection technique is incorporated into the design. This is intended to allow the Contractor to progress construction of the superstructure from above by delivering segments over previously completed spans. This will also minimize the overall project time that is necessary for access in the river and across the adjacent railroad grade crossings.

Local context sensitive concerns include a Park and Boat Ramp along the eastern shore under the bridge that is being planned by the Borough of Steelton. The bridge location is within sight of the Turnpike Commission headquarters office and the Harrisburg International Airport. Fishermen and recreational boaters that utilize the Susquehanna River will enjoy spectacular views of the bridge from water level.

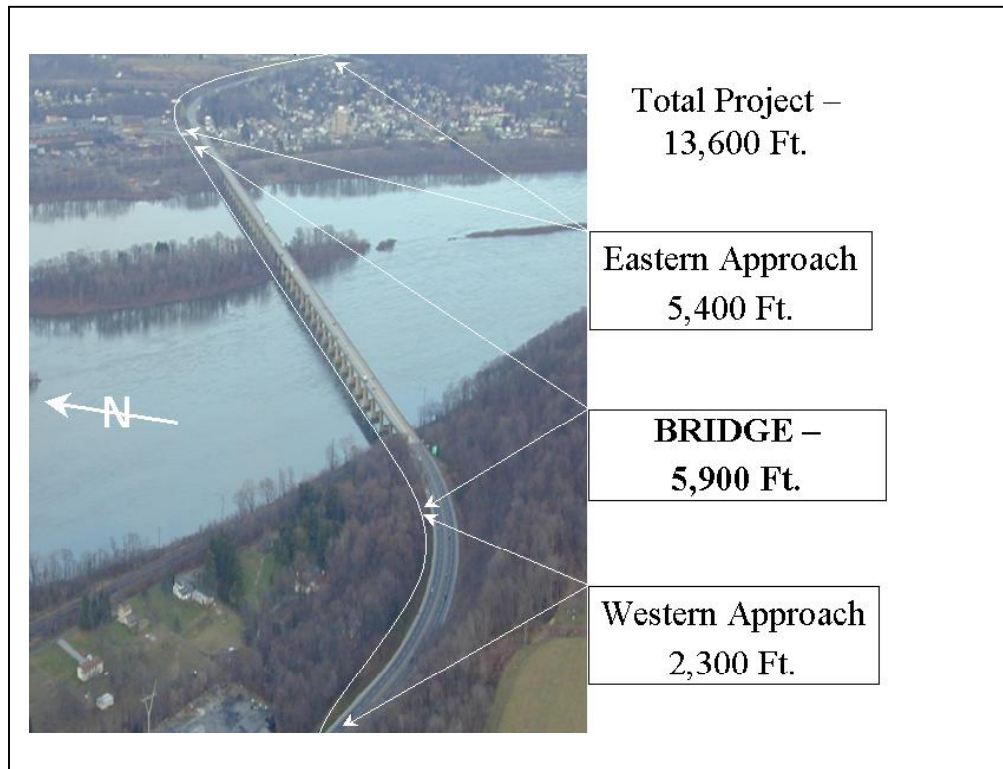


Figure 2 – Proposed Susquehanna River Bridge Alignment

Given this project specific background, the participants were then prepared to consider specific design options. The options presented were: superstructure and substructure shapes, bridge railings, concrete color, aesthetic lighting, and pier rustication. In addition, some innovative ideas related to construction were presented for consideration by the group. After presenting each option, an open discussion was encouraged between the participants. This was followed by each individual indicating their option preference on a voting form. The average score of all the participant votes was then used as an indicator of the groups' preference.

A consensus voting format on a scale of 1 to 10 was used, with 10 reflecting the most preferred solution. Based on this consensus voting, the Charette process established that the owners preferred bridge features are:

- sweeping (nonlinear) external superstructure faces (Vote = 9.2)
- oval piers (Vote = 7.6)
- vertical rustication on the piers (Vote = 8.1) to enhance the slender appearance of the supports
- open barrier rail (Vote = 7.6) to allow motorists views of the scenic river and surrounding areas.
- wash lighting (Vote = 9.3) along the superstructure

These preferences were then used as the guidelines for evolving the bridge concepts through final design (See the rendering in Figure 3).



Figure 3 – Rendering of Proposed Susquehanna River Bridge

The Charette also indicated the Pennsylvania Turnpike Commission's preferences for innovations during the design and bidding process that included pre-qualifying Contractors (Vote = 9.9), providing construction drawings (no shop drawings) (Vote = 8.3) and using 3D integrated color drawings (Vote = 8.1) in the construction plan set.

All of these innovative techniques are designed to improve the Contractors' opportunity for success during construction, which in turn means a better price and quality product for the owner. Prequalified Contractors are more successful because they are required to guarantee the use of experienced project managers and superintendents.

The benefit from these techniques will be reflected in lower bid prices because of Contractor's awareness of reduced risk. The concept of construction drawings without shop drawings and 3D color drawings provide the Contractor with advance comfort in knowing that this design has been thoughtfully developed in order to create drawings with this degree of detail. In other words, it is less likely that conflicts will be experienced in the field during construction, which correlates to less expense.

CONCLUSION

The Pennsylvania Turnpike Commission benefited from the Owner Charette as a means for providing clear final design direction to FIGG and simultaneously creating a beautiful bridge. Preliminary Design was completed in September 2001 with Final Design successfully completed in the Fall of 2002. The project will be advertised for construction in 2003 with construction of the replacement bridge and demolition of the existing structure scheduled for 36 months.

Three preliminary phase contractor information meetings have been provided with two more planned for 2003 prior to the bid advertisement. The Pennsylvania Turnpike Commission is extending extra effort towards communicating the details of this design with Contractors. The intent is to share the specific details of this design early with the Contracting community. This will provide Contractors with ample time to explore subcontractor and vendor relationships along with construction methods that will lead to competitive bid prices for this first use of the precast segmental span-by-span bridge type in Pennsylvania.

The use of the Owner Charette early in the design process has resulted in the design of a unique bridge with many aesthetic features that can be incorporated within the Commission's overall budget. The Charette successfully contributed to a timely design that is within the engineering budget for design. The Commission was intimately involved in defining the appearance of the bridge, and they are excited about seeing this structure in completed form by 2006.