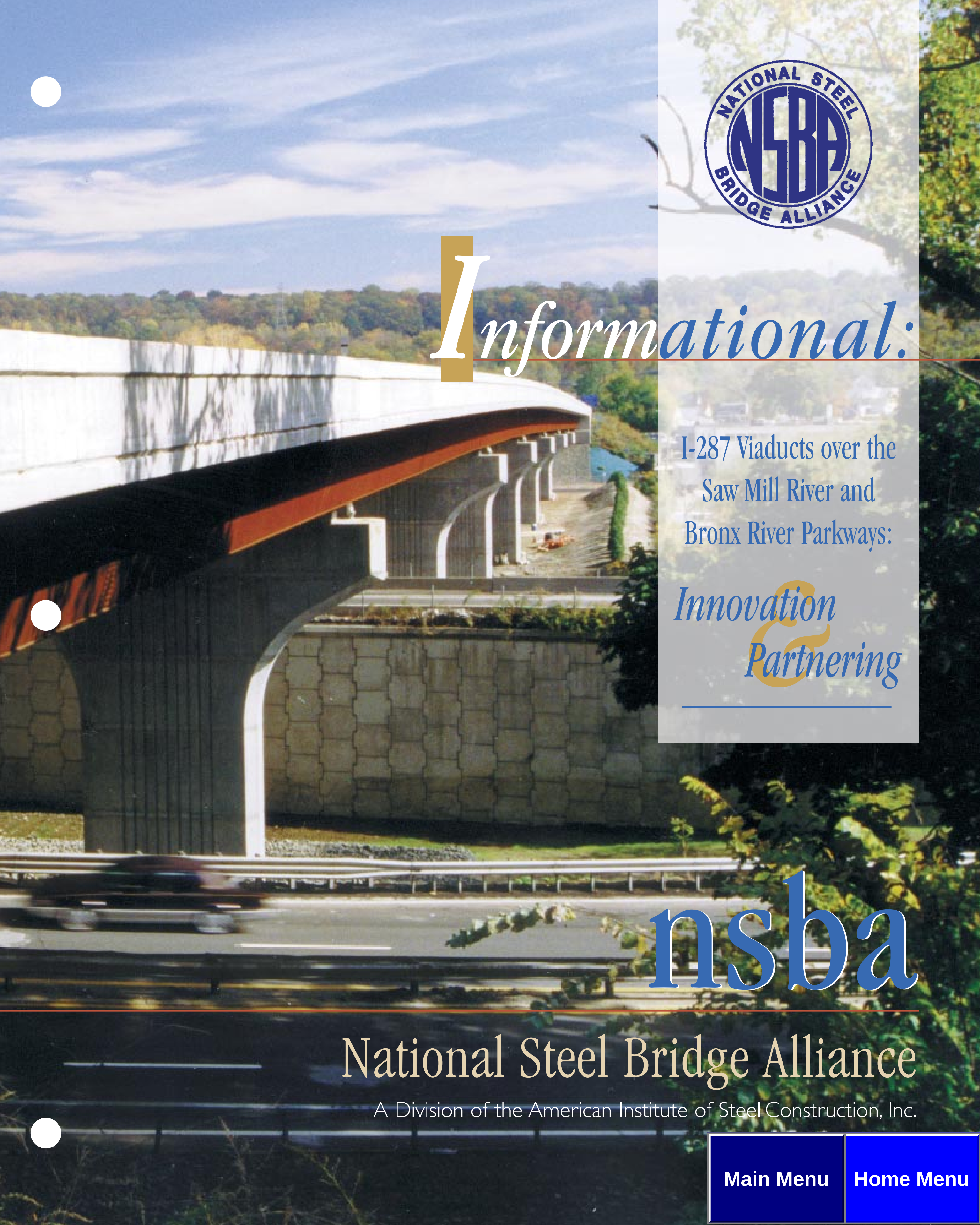

Informational:

I-287 Viaducts over the Saw Mill River and Bronx River Parkways:

Innovation & Partnering

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National Steel Bridge Alliance

A Division of the American Institute of Steel Construction, Inc.

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The National Steel Bridge Alliance has published this document in its continuing effort to enhance the state-of-the-art of steel bridge design and construction in the United States.

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I-287 Viaducts over the Saw Mill River and Bronx River Parkways:

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Introduction:

Replacing the two viaduct structures carrying the I-287 Cross Westchester Expressway over the Saw Mill River and Bronx River Parkways had to be accomplished on a tight schedule with minimal disruption to traffic on one of New York State's most heavily traveled corridors. The design required that the existing six lanes of traffic be maintained throughout construction, with only short duration single lane closures allowed during off-peak hours and subject to lane rental provisions contained in the contract. Innovative "A plus B" bidding procedures were used to encourage minimum construction time. The replacement viaducts also had to be designed to carry an unspecified future corridor improvement configuration that could possibly include a light rail system. Located in developed suburban areas and being highly visible, overall appearance of the new viaducts was considered a design priority. The New York State Department of Transportation decided that a box girder structure would give the desired visual effect and made it a design requirement. Both steel and concrete box girder alternatives were designed, with steel chosen in competitive bidding. The Department's Structures Division designed the steel structures.

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The Viaduct Structures

The viaducts each consist of multiple steel box girders fully composite with a concrete deck. The girders are continuous for the full length of each structure. The viaduct over the Saw Mill River Parkway is a 1025 foot long, seven span (135 to 184 feet) structure. It is built on a tangent alignment with small skews only at the west abutment and the first adjacent pier. The viaduct over the Bronx River Parkway is 1280 foot long, with nine spans (110 to 155 feet). All piers and abutments are on skews of about 33 degrees, and the bridge is on a 23,000 foot radius horizontal curve. Each viaduct is supported by six steel trapezoidal box (tub) girders and have deck widths of 150 and 138 feet. The web depth for all girders is 76 inches, and box widths (between tops of webs) of 12 ft. 8 in. and 11 ft. 3 in. were used. The structures were designed using the AASHTO load factor design method for an HS-25 live load. Design checks for accommodating a future light rail system were also conducted.

Stage Construction

To maintain existing traffic lanes in service during construction, the new structures were built in three longitudinal stages. Preceding each construction stage for the new structures was a staged removal of the existing viaducts. Each stage consisted of two box girder units and concrete deck having widths of about 45 feet; with the stages connected by a 3 foot wide deck closure pour. The girders for the first stage were erected from the ground using cranes. Cranes were positioned on the previously completed stage for the second and third stages. Scheduled off-peak temporary lane closures and nighttime construction minimized traffic disruptions.

Steel Industry Role

During the design process, National Steel Bridge Alliance provided assistance to the State Department of Transportation by arranging meetings with fabricators as well as providing technical reviews of the steel details. The technical assistance included advice on state-of-the-art fabrication and erection practices for steel box girders. Of equal significance was the foresight and planning by the steel industry that helped ensure that a very tight steel delivery schedule would be met. Before bidding, but prior to award of the contract, the industry arranged to have Tensor Engineering, Co. to begin developing fabrication drawings. This head start enabled the girders (fabricated by High Steel Structures, Inc.) for stage one to be erected during the first construction season and contributed to the early project completion.

This head start... ...contributed to the early project completion.

Project*Partnering*

Because of the project's size, complexity and public impact, New York State Department of Transportation and the project contractor, Halmar Builders of New York, Inc., entered into a formal Partnering Agreement. The goal was to enhance cooperation and communication between the contracted parties, thereby facilitating a successful project. Early in the project, the contractor submitted an innovative Value Engineering proposal to use precast concrete in lieu of cast-in-place concrete for the support piers and the superstructure deck. The Contractor's goal was to reduce overall construction time from three years (as originally scheduled) to two years. Since this anticipated savings in time would be a significant benefit to the traveling public, New York State Department of Transportation was anxious to evaluate the proposal. Of particular interest was the proposal to use precast, post-tensioned concrete panels for the stage-constructed deck. Department design staff worked with the Contractor's engineer to evaluate the proposal and possible effects of new loading conditions on the steel girders, including the redistribution of forces caused by the time dependent effects from the post-tensioned concrete deck. The analysis demonstrated that the as-designed girders could resist these additional stresses within allowable limits, and modifications to the girders were not needed.

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The box girders were able to easily accommodate the precast deck panels. The panels were fabricated to the length of each construction stage and in 10 foot widths, with each line of panels supported by two girders. The panels were erected on shims pre-placed on the top flanges of the girders, which allowed for longitudinal movement during the post-tensioning operation. The transverse joints between the panels were grouted, and the panels were then post-tensioned in the longitudinal direction in order to create a "zero tension" deck under design live loads. After post-tensioning, the deck was connected to the girder top flanges by grouting through shear connecter pockets. To erect the 25-ton deck panels for the center stage, where there was no access from the ground, the contractor used the center steel box girders as an erection platform. A crane on a temporary platform was placed directly on the girders, and both the crane and the platform were advanced along the girders ahead of the deck panel placement operation. By staying within the construction stage lateral limits, traffic lane closures were kept to a minimum and construction could proceed during daylight hours. The girders provided a stable platform for this operation and the contractor was able to erect as many as fifteen panels per day. Site access for the third construction stage also had some restrictions, so the contractor opted to erect these deck panels using the same method as was developed for the center stage.

Summary:

The unique and innovative combination of steel box girders and precast, post-tensioned concrete deck construction resulted in structures of enhanced quality and value. The structures are expected to have increased durability and lower maintenance requirements, important factors when considering the heavy traffic volumes to which they will be subjected. The clean, continuous girder lines also provide a desirable appearance and complement the viaducts' role as an integral part of a major metropolitan transportation corridor. Of equal importance was the time that was saved and minimal inconvenience to traffic during construction.

Project Partnering created a cooperative environment, which allowed the contractor and owner to work together to produce a successful project. The intent and spirit of true partnering by all stakeholders was very evident throughout the course of the project and it proved to be key to its successful early completion. Of special note was the total commitment by all involved toward making the partnering effort an unqualified success in terms of constructibility and superior quality.

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