

A Mega Bridge for a Metropolis

The definition of an ambitious project

The 7.5-mile Woodrow Wilson Bridge (WWB) replacement in the Washington, D.C., area is one ambitious project—from the standpoint of its size, its objective, and its multi-jurisdictional owner. To begin with, the new \$2.4-billion span over the Potomac River between Maryland and Virginia is designed to uncork one of the worst bottlenecks in the U.S. It is a concerted effort of four agencies—the Virginia Department of Transportation, the Maryland State Highway Administration, the District of Columbia Department of Public Works, and the Federal Highway Administration, assisted by jurisdictions in Virginia and Maryland. Potomac Crossing Consultants (PCC), a joint venture of Parsons Brinckerhoff (PB, www.pbworld.com), URS Corporation (www.urscorp.com), and Rummel, Klepper & Kahl (www.rkkengineers.com), is serving as the project's general engineering consultant joint venture, responsible for replacing the existing six-lane bridge on the Capital Beltway with a new 12-lane

structure composed of two side-by-side drawbridge spans. The first twin bridge, the Outer Loop, was dedicated in May 2006, with more than 1,400 guests in attendance. The Inner Loop is slated for completion in 2008. Reconstructing four adjacent interchanges, two in Virginia and two in Maryland, is also part of the project.

To get all the pieces up and running by the deadline, the pace is rapid. "About \$1 million in construction value is being put into place every working day," said Russ Fuhrman, PB's project manager. "At any one time there may be 1,200 construction workers in the field and 20-plus major contracts going full blast." Bob Douglass, WWB Replacement Project Director for the Maryland State Highway Administration, said, "Keeping a mega-project on time and on budget is a huge task, and PCC has been a great partner in achieving that. We are very appreciative of their efforts."

Public Already Benefiting

For residents, the replacement won't come a moment too soon. The original 45-year-old bridge had been a motorist's nightmare for years, and had one of the region's worst safety records. Designed for 75,000 cars a day, it



About \$1 million in construction value is put in place daily at the Woodrow Wilson Bridge project. Photo by David Sailors.

was carrying more than 200,000. With no shoulders to accommodate minor accidents, four-mile backups and 45-minute delays were the rush hour norm.

Motorists are already getting relief. "The bridge's public benefit comes even before the second span is finished," said Fuhrman, noting that despite two-way traffic on one span during the 2006-2008 period, the presence of shoulders ensures that a vehicle breakdown or fender-bender need not cause delay. An additional design element will prevent traffic slowdowns: The clearance under the new span is 20 feet higher than the old bridge, which will reduce the number of annual drawspan openings from 200 to 60—a boon to motorists, as an opening can block traffic for about 15 minutes and cause long backups.

Sensitivity to Local Issues

Because of the bridge's location in a heavily developed metropolitan area rich in parks and natural areas, PCC assisted the owners in assuring that the project was compatible with local aesthetic and environmental standards. The bridge's arched V-pier support scheme, for example, echoes the aesthetics of the Memorial



Seen here during construction in late 2005, the new Woodrow Wilson Bridge features an arched V-pier support scheme, reflecting the aesthetics of other nearby Potomac River Crossings. Photo by David Sailors.

Bridge and Key Bridge, two nearby Potomac River crossings.

Design of the new bridge was chosen through a competition and approved by the U.S. Commission on Fine Arts, whose mission it is to “advise, at the request of the President or any Congressional committee, on all matters of art with which the federal government is concerned.” The result is a distinctive, signature span.

Environmental Initiatives

Environmental mitigation has been a major priority. Throughout the planning phase for the project, both the public and regulators warned of the potential for substantial environmental degradation stemming from construction. After all, the massive project would be built in the Potomac River, its tributaries, and fragile wetlands along its corridor. To address these legitimate concerns, the project’s public sponsors called on PCC to assemble an environmental management group.

The environmental management group comprises three teams: a leadership team, responsible for agency coordination, environmental design, project permitting, and achieving success of the \$65-million compensatory mitigation package; a mitigation team, which manages the environmental enhancement contractors responsible for building wetlands, planting trees and underwater grasses, and restoring streambeds; and an environmental inspection team to address environment-related issues arising from construction of the drawbridge and interchanges.

Foundation construction, which took place from spring 2001 until summer 2003, involved building pyramid-like foundation footings that will support the bridge’s v-shaped piers. A total of 629 steel pipe piles were driven to support the bridge foundations in the Potomac River and 410 concrete piles were driven to support the landside piers, creating tremendous environmental challenges.

“The largest challenge was protecting fish during water pile driving activities,” according to Jim Ruddell, Construction Manager for PCC. “After learning that the large piles, which were driven by a 400,000 pound hydraulic hammer,

could produce pressure waves in the water that could injure or kill fish, we devised a unique solution, called a contained air bubble curtain system, to protect the fish population.”

A temporary large-diameter pipe is placed vertically in the river and the permanent steel pipe pile is set inside; a perforated air hose is placed between these two pipes on the river bottom, creating air bubbles, or a “bubble curtain” that surrounds the surface of the piles within the river. The curtain of air bubbles effectively absorbs and reduces the strength of the pressure waves generated by pile driving and allows fish to swim safely nearby.

Other key environmental successes include:

- Use of minimization techniques, such as selective use of dredging, to reduce disturbance from 15 acres of river bottom to only 4.5 acres.
- Containing, treating, and reusing hundreds of thousands of gallons of wash water necessary to clean heavy-duty concrete conveyor systems.
- Installing silt containing fabric on a chain link fence along the landside perimeter of the work area and a floating turbidity curtain along the shoreline to manage potentially detrimental construction runoff.

Perhaps the most dramatic evidence of the project’s environmental sensitivity is the successful hatching and fledging

of five generations of bald eagles nesting immediately adjacent to the project. As part of a \$65-million environmental mitigation program, the project created a permanent 84-acre bald eagle sanctuary in Prince George’s County, MD. However, over the past several years the nesting pair has built nests progressively closer to project construction—now just yards from the project and the 200,000 vehicles that travel the Capital Beltway each day. Over the course of five seasons, they have hatched and fledged approximately 15 young.

The environmental mitigation program also includes establishment of more than 11 acres of tidal wetlands in Stafford County, VA, removal or circumvention of 23 man-made stream blockages that prevent migratory fish from spawning upstream in Rock Creek and tributaries of the Anacostia River, planting of river grasses, reforestation, parkland creation, and habitat preservation.

Partnering Ensures Success

One of the key factors in keeping such a large, complex project on schedule and within budget has been the partnering system put in place by all the project participants. As noted by Neil Pedersen, Administrator of the Maryland State Highway Administration (MSHA), “You have to have a genuine partnering process in place so trust



Clearance under the new span is 20 feet higher than the old bridge, significantly reducing drawbridge openings. Photo by David Sailors.

has been built to resolve problems as quickly as possible.”

MSHA has had an active statewide partnering program since the early 1990s, and all of the WWB construction contracts awarded by MSHA have offered the construction contractor the opportunity to partner. The partnering program has been successful in degrees varying from one contract to the next, according to Pedersen. The most successful ones have exemplified the values listed in the MSHA Field Guide to Partnering on MSHA Projects. These include trust, teamwork, communication, motivation, empowerment, and issue resolution.

“The most important predictor of success has been trust: the degree to which each party honors the commitments its people make up and down the organizational chain,” Pedersen said. “Some in the construction industry have had bad experiences with partnering, where it became more of a giveaway program or a one-way street. The experience on the WWB project, however, has been overwhelmingly positive.”

Pedersen points to several examples of how the partnering process resulted in positive outcomes. On the foundation contract, MSHA was willing to relax disincentive-burdened contract milestones in exchange for the contractor waiving potential contract extras for differing site conditions. On the Rosalie Island soil improvement contract, the contractor waived potential delay-claim entitlements, while MSHA found ways to break the work into smaller pieces to keep working when soil consolidation timing differed from that predicted. On the bascule span and Maryland approach span contracts, MSHA negotiated price relief for unanticipated steel escalation costs in exchange for placing that relief at risk as an additional critical milestone disincentive. This enabled corridor-long interfaces to be met with greater confidence.

MSHA has used only outside facilitators who specialize in the construction industry to preside at the initial partnering workshop for each WWB contract, and this has proved to be a good investment. “Facilitators who focus exclusively on construction partnering bring a degree of credibility to the workshops



Pyramid-like foundation footings were built from 2001 to 2003 to support the bridge's V-shaped piers. Photo by David Sailors.

that the workshops otherwise would lack,” Pedersen pointed out. “Besides focusing on contract issues, there is a place in the workshops for teaching teamwork and communication skills.”

To keep the partnering process rolling month-in and month-out, a partnering coordinator within the PCC organizes workshops and prepares agendas and meeting minutes for periodic meetings. He also oversees collection and reporting of partnering rating surveys. Preparing and distributing detailed



Environmental scientists and mitigation experts devised, implemented, and are monitoring techniques for air and water quality, noise, and vibration.

meeting minutes within a day or two after each meeting (before their value plummets) is a task that not many resident engineers or office engineers could consistently accomplish.

“There is no set formula on the WWB project for how often to meet,” noted Larry Anderson, the PCC partnering coordinator for the WWB project. “On some contracts everybody meets monthly, with a smaller executive partnering group—comprised of senior owner, contractor, and GEC representatives—added once per quarter. On others, everybody meets every two months, but the executive partnering group meets once per month.”

The partnering coordinator uses the minutes of the previous meeting plus the weekly contract status report to prepare regular meeting agendas. This tends to result in meetings where the talk is of situations and schedules, much like a progress meeting. “Some people would prefer to see the meetings be more like brainstorming sessions, where specific problems are brought up for group resolution,” Anderson observed. “Whatever the format, the essential thing seems to be simply the act of assembling everyone together regularly. Much of the good partnering that happens at these meetings is not scripted on the agenda, and it often happens before or after the formal part of the meeting.”

Traffic congestion and deteriorating infrastructure will demand myriad large highway projects in the future, many on a scale like the WWB. The environmental successes of the project show that enlightened environmental stewardship can and should be used in the construction of major infrastructure undertakings. The extensive WWB partnering program demonstrates that establishing a cooperative structure for resolving problems and coordinating the activities of the many involved parties can indeed make a tangible difference in the execution of a highly complex project.

In the final analysis, the new Woodrow Wilson Bridge, when fully operational, will have done right by area residents—unsnarling traffic, respecting the environment, and making efficient use of taxpayer dollars. An ambitious project, to be sure.



Courtesy of Government Engineering Journal.