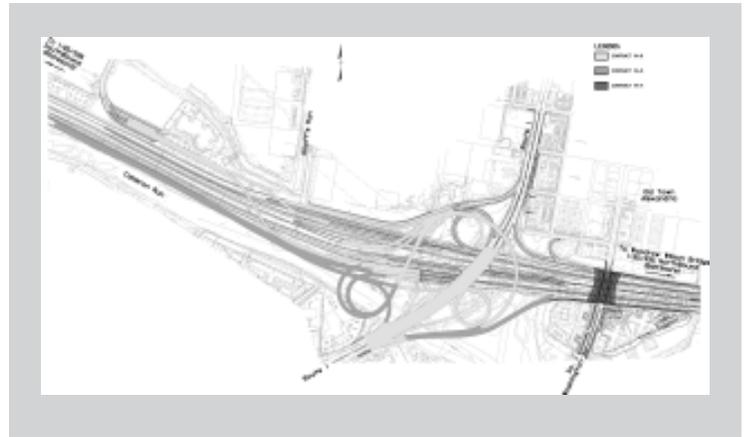


# I-95/US Route 1 Interchange Improvements

## Mega Project Takes Shape

*Peter F. Bonaccorsi, P.E. (HNTB)*

*“The Woodrow Wilson Bridge Project is the largest active public works project in the country, and the US Route 1 interchange is the second largest component with a budget of over \$620 million. The project is currently ahead of schedule and under budget, which says a lot for a mega project these days.” - VDOT Project Manager, Ronaldo T. Nicholson, P.E.*



At an expected total cost of \$2.5 billion and spanning three jurisdictions, Maryland, Virginia and the District of Columbia, the Woodrow Wilson Bridge Project is one of the largest ongoing infrastructure projects in the United States. The current focal point of the Virginia portion of the work is the \$620 million replacement of the US Route 1 interchange. Located in the City of Alexandria and at the southern tip of Washington, D.C., the interchange is a three-level semi-directional interchange with flyover ramps serving 12 lanes of express and local roadways on the I-95/I-495 Capital Beltway. The interchange reconstruction includes over 30 bridges, 14 ramps and a 1.3-acre landscaped urban deck carrying Washington Street over the Capital Beltway at the gateway to historic Old Town Alexandria.

### Getting Started

Design of the interchange began in late 1998 and was put on hold for one year while environmental and funding issues were resolved. Construction of the first significant contract, Contract VA-2, started in 2001 and included extensive geotechnical and ground improvement construction. The purpose was to consolidate soft underlying alluvial clays with an extensive system of surcharging and wick drains. Where the time required to adequately consolidate the fills by placement of surcharge fills and wick drains was excessive, soil-cement columns were installed to adequately transfer the proposed embankment loads to the bearing strata. This was VDOT's first experience using soil-cement column technology. Contract VA-3 involved the demolition of a nine-story apartment building to create space for the new 12-lane Beltway and approach to the new Outer Loop Span of the bridge.

### Phasing

Three contracts are currently under construction. Contract VA-4, which includes the Urban Deck, will transition and tie the existing six-lane Beltway into the new Outer Loop Woodrow Wilson Bridge Span

which is scheduled to be completed in June 2006. Contract VA-5, which is substantially complete, is an advanced bridge contract constructing mainline and ramp structures along and over Cameron Run. Contract VA-6/7 comprises the majority of the interchange including reconstruction and widening of the mainline to 12 lanes, flyover ramps and all of the improvements along Route 1 including a new eight-lane Route 1 bridge over the Beltway. To date, the interchange construction is about fifty percent complete.

### Challenges

In addition to solving the geotechnical and construction sequencing issues, some of the more challenging aspects of the design included determining economical and constructible structural and foundation systems for each of the 33 bridges, working within constrained right-of-way adjacent to historical and archaeological resources, and the development of complex staging and maintenance of traffic plans to facilitate construction while moving over 200,000 vehicles per day through the existing interchange.

### Constrained Right-of-Way

The project required 9.7 acres of additional right-of-way. Most of the right-of-way acquisition occurred along the Beltway which is being widened from six to twelve lanes. More critical was the reconstruction and widening along South Washington Street which connects historic Old Town Alexandria with the George Washington Memorial Parkway. The frontage along this section of the project included two historic cemeteries, an elementary school and high-rise and garden apartment complexes. There was virtually no room for temporary widening and traffic shifts. To solve this problem, the existing four-lane section was converted to a three-lane section with a reversible center lane carrying traffic in two lanes northbound during the A.M. peak and two lanes southbound in the P.M. peak. The reversible lane configuration is

controlled by a lane signal control system using a series of green and red lane control signals spaced at 400 feet. The system has operated remarkably smoothly with little or no complaints from the traveling public and more importantly with no reported increase in accident rates or congestion.

## Bridges

Of the thirty-three bridge structures in the project, structural configurations consisting of multi-span prestressed Bulb-Tee beams supported on multi-pile bents were selected for roughly one-half of the bridges due to the inherent economy provided by this configuration. Integral abutments were utilized on these structures to further enhance the durability of the structures and reduce life-cycle maintenance costs for the client. The remaining bridges on the project were constructed of high-strength, curved, structural steel superstructures configured in 3 to 5 span-continuous units. Due to the unique geology of the area, including subsurface conditions exhibiting a relatively thick soft clay stratum, all piers/bents were founded on plumb 24" square prestressed concrete piles. The inherent stiffness of this foundation configuration allowed for the elimination of battered piles which enhanced the constructability of the bridge foundations.

As noted previously, also included in the project was a deck-over of interstate I-95. The deck-over posed some unique constraints due to the need to accommodate raised planting areas with trees, extensive architectural enhancements including granite veneers and cap stones, decorative pedestrian and vehicular lighting, and roadway and planter drainage requirements. Ultimately, the selected structural configuration employed for this unique structure consisted of 69" deep prestressed Bulb-Tee beams. The span lengths of the beams ranged from 75 to 100 feet. The framing scheme for the structure utilized a splayed configuration of the beams to accommodate the variable width of the deck and planting areas. Precast concrete fascia panels were also used on this structure resulting in a more aesthetically pleasing structure as compared to typical prestressed beam bridges.

## Maintenance-of-Traffic

The challenge of building the new interchange virtually on top of the existing interchange required approximately 15 major stages and maintenance-of-traffic sequences. All major lane and traffic shifts are publicized well in advance through electronic message boards, newsletters, the project website, and radio and television coverage. The most notable traffic switch occurred in August of 2005 when the Capital Beltway was reduced from four lanes to one lane for two weekends during the summer to allow for the construction of a reverse curve realignment of the eight-lane Beltway to allow for the construction of the South Washington Street urban deck and overpass. The lane closure was publicized from North Carolina to New Jersey to allow motorists and truckers to plan accordingly and choose alternate routes. The traffic shift occurred on schedule, with back-ups and delays significantly less than anticipated. The original plan called for only a shift to the new Outer Loop span. The plan was adjusted and redesigned as a result of discussions with the owner and contractor. This one change in sequence alone saved the project at least six months in construction time and allowed construction of the north half of the urban deck to proceed without having to wait for completion of the Outer Loop span.

## Partnering Pays Off

The Virginia Department of Transportation (VDOT), supported by staff of the general engineering consultant Potomac Crossing Consultants (PCC), has been responsible for overall project management and construction inspection. The VDOT core management and PCC staffs are co-located in a project office near the site. The proximity and full-time dedication of VDOT staff to the project has been instrumental in enabling timely decision making and problem solving.

In addition, formal partnering and value engineering among the owner, contractor and engineer have been used from the outset and have yielded tangible savings in both cost and time. As a result, the US Route 1 Interchange reconstruction is currently within budget and on schedule to be opened to traffic in 2008 to coincide with the completion of both the Inner and Outer Loop spans of the new Woodrow Wilson Bridge. ■

