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Case Study

Virginia: Overview of the Elizabeth River Tunnels Project

By Chris Guthkelch, Project Director at Skanska Infrastructure Development Americas

The Midtown Tunnel is one of four elements of the Elizabeth River Tunnels Project. In this element, a new 3,800-foot long, two-lane tunnel was constructed, adjacent to the existing Midtown Tunnel, which connects Norfolk and Portsmouth, Virginia. Other elements include a one-mile extension of the Martin Luther King Jr. Freeway — an elevated four-lane, north-south expressway with a raised median connecting State Route 164 to Interstate 264 and includes a new interchange with I-264; upgrading the two Downtown Tunnels and renovating the existing Midtown Tunnel, in part to reconfigure it to two-lane traffic in one direction.

The second lane of the Midtown Tunnel was open in August 2016, six months ahead of schedule. The entire project is slated to be completed in October 2017.

Skanska Project Director, Chris Guthkelch, who led the Elizabeth River Tunnels Project bid team, agreed to provide an overview here of Skanska's first P3 project in the U.S.

What were the Technical challenges?

"Preparing the river for the installation of the tunnel. Trenches were excavated on land and at the bottom of the river, removing existing abandoned timber piles and shoreline debris on land, and 1.5 million cubic yards of sediment in the water. The excavation created a bed for the tunnel that was precisely leveled to an elevation of plus or minus 1 inch, 95-feet underwater from a floating vessel.

"Placing the concrete tunnel elements (used, by the way, instead of steel shell concrete tunnels for cost savings and design flexibility). The 16,000 ton elements were precast in Baltimore and floated down the Chesapeake Bay to Portsmouth for installation. Using a lay barge, with divers below, the elements were carefully lowered and connected together, with rings and gaskets

creating the necessary seal. A three-part backfill operation prevented horizontal movement, provided a protective cover and added an additional layer of protection against scour and marine impacts.

“Traffic management, on land and in the water, during construction. The Elizabeth River is a busy navigational channel, part of the inter-coastal waterway and is heavily used by commercial, military and recreational vessels. The Midtown Tunnel is the most heavily traveled two lane road east of the Mississippi and a vital link between Norfolk and Portsmouth. With part of the tunnel falling within the Federal Channel, there was significant coordination with all key stakeholders, and the schedule and project impacts were continuously updated to them through the project.

How did DBFOM delivery affect the outcome; how might it have been different in a DB contract?

- The DBFOM solution incorporated all the advantages of a DB solution and more (e.g. fixed price, date certain delivery of the asset; involvement of the O&M provider during the project development/design stage)
- The Fully integrated DBFOM solution reduced risk of delay, leading to a 6-month saving in delivering the new Midtown Tunnel.
- DBFOM enabled a seamless transfer of VDOT tunnel staff into the ERC operating company, as well as rollout of all-electronic tolling (AET) solution during construction in order to reduce the toll rate once the project was finally completed.
- The DBFOM enabled a joint developer, contractor and VDOT approach to delivering the contract. Joint workshops co-chaired by each party built a high degree of respect and trust before the contract was mobilized.

Beyond technical, what were the most significant challenges you had to overcome?

There was a political risk related to a change in state administration during the project development stage and the volatility of Hampton Roads politics both north and south of the Elizabeth River. The team worked with both gubernatorial administrations to adapt the contract to gain public approval, while meeting the state’s goals and the team’s business targets.

There was a need for public education related to the implementation of AET for the first time in Hampton Roads, Virginia. A full-scale marketing and media relations campaign was undertaken to inform citizens about tolling procedures and fees.

Workforce and supply chain development for a project that involved construction of the tunnel segments in Baltimore, as well as dispersed site operations in Hampton Roads. Thanks to close communications and involvement of the project team (VDOT, Developer & Design Builder) thru formal and informal partnering, the project was delivered well ahead of schedule.

Who gets the credit?

The list of major players on the project include:

- Skanska ID/Macquarie Investment Holdings (50/50)
- CJV: Skanska USA Civil (45%), Kiewit Construction (40%), Weeks Marine (15%)
- Designers: Parsons Brinckerhoff (lead), Volkert, COWI

What is the financial outcome for VDOT?

Financing would be summarized as follows:

Overall contract value: \$2.08 billion

Financed by:

- \$637.5 million Private Activity Bonds (PABs)
- \$441.4 million TIFIA loan
- \$581 million State subsidy
- \$251 million private equity
- \$150 million toll revenue during construction

The financial outcome for VDOT would be \$2.08 billion of project for a \$581 million state subsidy.

Innovation Savings Linked To Design Control

A recent study published in the Journal of Construction Engineering Management found that the early involvement of the Midtown Tunnel P3 team in the design of the \$2.1-billion project resulted in substantial innovation and lifecycle cost savings. Those findings challenge earlier academic studies in the UK and Spain that found limited or no first-cost savings from P3 procurements.

The Midtown project was the first P3 contract closed in the U.S. by Skanska Infrastructure Development, a 50% partner with Macquarie in the development company, Elizabeth River Crossings OpCo LLC (ERC). The negotiated sole-source procurement by the Virginia Dept. of Transportation (VDOT) was conducted over four year. A predevelopment agreement was signed in 2008, when the tunnel was literally a line on a map, and construction started in 2012.

The relationship between competition and innovation was not part of the research for this paper. Nor was the connection between innovation and design-build savings. Rather, researchers Eric I. Antillón, by Keith Molenaar, and Amy Javernick-Will link the involvement of ERC in the conceptual design stage with the adoption of immersed concrete tube technology and other innovations proposed by Skanska and its designer Parsons Brinckerhoff.

A similar level of innovation and lifecycle savings was not evident in two other completed P3 projects studied by the academics—U.S. 36 phase 2, developed by Plenary Group in Denver, and the Presidio Parkway in San Francisco, developed by Hochtief P3 Solutions and Meridiam. In both these cases the project design was well advanced by the public owner before the private P3 team was awarded a DBFOM contract. Innovation was evident but not to the degree

in the Midtown project.

There have been few studies of innovation in P3s. Early studies of Private Finance Initiative (PFI) projects in the United Kingdom found that frequent segmentation of project disciplines (design-build-finance-operate-maintain or DBFOM) within the private consortium inhibited creative design solutions. Other studies found little evidence of innovation benefits from **design freedom, collaborative working, risk transfer, and long-term commitment**. All of these studies focused on first-cost savings, however.

The new case study, “Evaluating the Effect of Contract Timing on Lifecycle-Design Innovation in Public–Private Partnerships: Comparative Case Study of Highway Projects,” focuses solely on the timing of the private involvement in the public sector’s design process and its effect on lifecycle costs.

Midtown History

Verbatim from the study: “A predevelopment agreement was awarded during the environmental process for the project, prior to completion of the NEPA process. A solicitation for conceptual proposals to develop and operate the project was offered in 2008, and a sole bidder was awarded a predevelopment agreement that began the year after. At this point, the sponsoring agency and the concessionaire began to work as close collaborators in lifecycle-design innovations environmental review, final design, and engineering.

ERC’s design manager noted that the P3 concessionaire and the design-build constructor jointly funded a preliminary engineering phase in which they essentially “brought the design up to approximately a 30% design stage to allow the detailed pricing to occur for the tunnels so they could negotiate a final price.”

Historically, all immersed tunnels in the United States had been traditional steel-shell immersed segments, and this project is only the second one to use concrete immersed segments in the United States. The P3 concessionaire set this preferred approach to build the tunnel, and therefore, many of the subsequent decisions, such as the tunnel systems, configuration, and materials to be used to construct the project, were affected by it. In this study, the authors refer to the decision to use concrete immersed tunnel technology as a *radical* lifecycle-design innovation.

In order to meet a 120-year design life performance requirement, the DB team had to develop a concrete mix design in an extremely corrosive environment without the use of corrosion inhibitors. The project sponsor’s construction manager commented on the concrete mix design developed for this project, an identified innovation, that “it is something like you have probably never seen before, there were a lot of water reducing agents, all sorts of things in there to make it behave properly, and it was a challenge.”

The concrete mix example is an *incremental* lifecycle-design innovation because it is a modified product design that does not disrupt the other project components. Systemic lifecycle-design innovations are those that are considered to have a high level of change, meaning that other components in the project are affected, or readjusted, hence having a systemic change.

In the Midtown Tunnel project the selection of a jet fan–based longitudinal ventilation system changed many of the surrounding project components in the tunnel because it affected the cross-sectional dimensions of the tunnel. As indicated in the P3 team’s proposal, “while jet fans have not been the standard solution in US tunnel applications in the past, they are able to efficiently vent exhaust gases and provide fire/ smoke control in modern tunnels. They can save space and reduce the cost of the tunnel structure by eliminating plenums.” This was also a decision driven by the lifecycle considerations of the project because the operation and maintenance costs for this system are expected to be lower.

The three most common ventilation systems, transverse, semi transverse, and longitudinal ventilation systems, were all evaluated by the P3 team and it was then determined, as indicated in their proposal, that “a longitudinal ventilation system based on jet fans will result in the smallest cross-section while having the lowest future maintenance costs.

The project team team also partially removed the corrosion protection system for the new Midtown Tunnel to account for lifecycle performance of the project. This change was implemented during the predevelopment agreement phase of the project as the technical requirements were being developed. The modification was accepted with the requirement to make the tunnel compatible for future installation of the corrosion protection system if needed.

One project team member stated that their original provisional requirements required a cathodic protection system. They went on to say that the protection system “got to be very expensive very quickly” and “as part of the negotiation process after the end of preliminary design, it was put on a list of things that they were able to then go back and remove. And then we offered to at least make the tunnel compatible with a future cathodic system, so if they wanted to come in later and plug one in, at least all the rebar will be tied so you could get to it and hook the system up.” This is an example of a *disruptive* lifecycle-design innovation implemented in the project.

Such design decisions offset the upfront costs to install a component that is not needed in the first cycles of a project, yet they are able to be installed at a later point in the life of the project, given that they are responsible for the performance of the project and it will need to meet the standards specified in the hand-back requirements of the project.”

Conclusion

In a nutshell, the researchers conclude that “given the purported potential for innovation typically attributed to all P3s, it is worth noting how this potential can be limited, or improved, when innovation is a chief project objective for pursuing a project as a P3 in the first place. This potential is affected when its contract timing is conceptualized as early as in the planning phase, or as late as in the final design phase of the project development process.”

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Midtown Tunnel Financial Close Ignites Virginia Politics

Virginia Gov. Bob McDonnell (R) announced on Monday morning, April 16, that the toll revenue financing had finally closed on a DBFOM concession worth \$2.1 billion for adding two lanes to the Midtown tunnel between Portsmouth and Norfolk, one of the Hampton Roads region's top transportation priorities.

Then all hell broke loose, largely over the \$1.84 peak-period toll that the concession company, Elizabeth River Crossings (ERC), will start collecting in September. The agreement with Virginia DOT envisions that about 17.5% of the \$1.45-billion construction cost will be funded by tolling the existing free tunnels during the five-year construction period. The large savings on capitalized interest in the bond financing helped to reduce the starting toll from \$2.89 in an earlier plan.

Responding to toll protests, McDonnell, who has vice presidential aspirations, agreed to increase the state's share of the funding in order to delay the start of tolling until January 2014, when he leaves office. A contract amendment was signed that allows VDOT to postpone the start of tolling after a 45-day notice provided that the amount of any damages due to the investors has been authorized or appropriated by the General Assembly and allocated to the Commonwealth Transportation Board (CTB).

McDonnell appeared to waffle, and local politicians, anti-tax litigators, and former Gov. Tim Kaine (D), who initiated the Midtown deal—quickly massed to oppose VDOT's heavy reliance on tolls. PWF sources say even the TIFIA Joint Program Office at the U.S. Dept. of Transportation tried to undo its \$422-million loan to the Midtown concession company soon after it closed.

"If it had been 12 hours later, this deal wouldn't have closed," says one of the bond underwriters.

Earlier, when McDonnell indicated additional public funding could be found for Midtown, Democratic state legislators from northern Virginia quickly jumped in with their own demand that state funds be appropriated to reduce the reliance on tolls to finance the proposed Metrorail extension to Dulles airport, in northern Virginia.

(The state's entire contribution to build the \$3.4-billion Metrorail project now is set to come from aggressive toll increases on users of the state-owned Dulles Toll Road, which connects the 495 Beltway and Dulles airport. Without state funds, the current \$2.25 one-way toll for using the 14-mile road would double by 2014 and triple in six years to finance half of the rail project's cost.)

McDonnell refused to commit budget funds to the Dulles rail financing plan. That prompted the Democratic legislators to vote down the entire state budget, which must be approved in July.

Neither McDonnell nor the legislature favors a gas tax increase, and a plan for a sales tax surcharge to fund transportation projects in the Hampton Roads region was defeated by the legislature a few years ago. Local polls taken after the Midtown signing showed only 14% of Hampton Roads respondents support tolling.

VDOT stands behind the ERC concession, which Skanska and Macquarie have been pursuing since 2005. "The Midtown Tunnel project is ranked as the number one transportation priority by the region's leaders and is the largest project to get under way in the region in almost 30 years," said Transportation Secretary Sean T. Connaughton. "Procurement as a public-private partnership is the only feasible way to fund a project of this magnitude, and that depends on tolls."

Having stirred the pot, however, Connaughton now may face stiffer opposition to his plans for toll financing of I-95 managed lanes, U.S. Route 460, the Hampton Roads Bridge Tunnel, the James River Bridge, I-66, I-64 and the Monitor-Merrimac Memorial Bridge-Tunnel.

Anti-toll politics in Virginia won't go away soon. "This is a political issue with significant legs," says a close observer of the Midtown agreement. He believes the politics will force McDonnell to further buy down of the Midtown tunnels during construction of the improvements.

ERC's risk would be reduced if McDonnell finds the money to replace some of the toll financing with public equity. "As long as their construction estimates are good, ERC's standing improves every time the public sector steps in" with more money, he says.

(Forecasts done for ERC by Arup predict tolling the Midtown and Downtown tunnels during construction would net \$362 million, or 17.5% of the total project funding. Shortfalls are possible. Arup's base case estimate for diversion in the first year of toll collections is 28%. Standard & Poors estimates traffic will drop by 44%.)

Reducing the demand risk should be reflected in ERC's concession price, the observer says. So far, there doesn't appear to be a mechanism for calculating that benefit in the concession agreement, however.

VDOT spokesman Ryan Pedrazza, says "VDOT has not engaged ERC as yet" on the compensation question.

Legal Threat

ERC, VDOT and lenders, including TIFIA, also face an undefined but potentially serious threat from a legal challenge being mounted against the Midtown tolling scheme. The democratic state delegate from Norfolk, Ken Alexander, is aligned with former GOP state chairman Pat McSweeney, a Richmond lawyer, to undo the ERC deal.

According to press reports, McSweeney believes the use of Midtown tolls to fund related network improvements is a tax, not a user fee, and, therefore, can't be levied by the Commonwealth Transportation Board, which signed the concession. No lawsuit had been filed as of PWF's press time.

Representing Portsmouth, Alexander is expected to run for Lt. Governor in two years.

McSweeney, a civil litigator, has 40 years of experience in Virginia government. He successfully challenged the state's 2007 transportation funding law as unconstitutional, and has deep knowledge of state government and tax law.

ERC and its lenders, especially TIFIA, "have got to be concerned about this lawsuit," says the observer. "They could be left holding the bag."

Skanska/Kiewit/Weeks

The \$1.45-billion design-build Downtown Tunnel/Midtown Tunnel/MLK Extension project is fully permitted and involves:

- adding a new two-lane car and truck tube next to the existing two-lane Midtown Tunnel under the Elizabeth River between Portsmouth and Norfolk, Va.;
- extending and improving the Martin Luther King Freeway approach road in Portsmouth, including a new I-264 interchange, that will allow travelers to choose either tunnel, depending on congestion levels;
- performing maintenance and safety improvements on the existing Midtown and Downtown Tunnels.

The work will be done at a fixed-price of \$1.47 billion by an integrated joint venture of Skanska Civil (45%); Kiewit (40%) and Weeks Marine (15%). Parsons Brinckerhoff is leading the design work for ERC.

Twenty-four sunken-tube tunnel segments, each about 300 ft long, will be fabricated at Weeks's yard in Baltimore, assembled, and floated into position in the Elizabeth River. Sections will be filled with water, sunk into a dredged trench, and connected together. Key risks are poor foundation conditions, requiring extensive piling in the riverbed, and uncertain labor productivity in the Hampton Roads region.

When completed, average trip times will be reduced by 30%, according to ERC's traffic consultant, Arup.

TIFIA and PABs

The Midtown financing in mid-April is comprised of:

- \$272 million in sponsor equity, including contingent equity
- \$663 million in senior-lien private activity bonds (PAB) secured by toll revenues
- a \$422-million TIFIA subordinate loan, also secured by toll revenues, which defers interest for the first 10 years of the 44-year loan
- a \$308-million contribution from VDOT.

Construction costs are not fully funded in the financing, which triggered concern from both S&P and Fitch, which rated the project debt and BBB-. The plan of finance includes \$368

million from tolling both of the highly congested Midtown and Downtown tunnels starting in September.

ERC's equal partners, Macquarie Financial Holding Limited and Skanska Infrastructure Development Inc., agreed to provide a \$50.6-million line of credit to backstop any shortfall in their base-case revenue estimate. The two partners also put in \$207 million in cash equity (9.8% of the project funding), which also is backed by a letter of credit.

The Virginia Small Business Financing Authority was the conduit issuer of the PABS which were sold by Barclays Capital, Bank of America Merrill Lynch, and BMO Capital Markets. The average life of the tax-exempt PABS was 24 years with coupons ranging from 5.32% to 5.5%.

Halcrow advised VDOT on O&M, C&M Associates, Inc. on traffic, and O.R. Colan Associates on right of way. KPMG was VDOT's financial advisor and Nossaman provided legal and PPP procurement advice. Marsh consulted on insurance.

Arup was traffic and conditions assessment advisor to ERC. Hunton & Williams was its local counsel. Orrick also advised ERC. Traffic consultant Atkins and attorney Dewey & LeBoeuf advised the lenders.

Sidebar

Getting To \$1.84 Toll Took Every Trick

The original Midtown and Downtown tunnels were financed with toll revenue bonds over 50 years ago. Tolls were removed in 1988 and daily traffic, mostly commutes, is now about 90,000 vehicles on the four-lane Downtown Tunnel and 35,000 on the two-lane Midtown Tunnel. Peak-period demand results in backups of two miles or more on weekdays.

Getting political approval of toll rates in the middle- and low-income area served by the Elizabeth River crossings has always been the key hurdle for the financing of the Midtown tunnel. The idea of funding a portion of the Midtown construction costs by tolling the existing tunnels was included in a proposal made to former Gov. Tim Kaine's transportation department in 2008 by Elizabeth River Crossings (ERC). In addition to reducing capitalized interest, early tolling allows fine tuning of revenue forecasts for debt financing.

Made up of Macquarie Group and Skanska Infrastructure Development, ERC was the only PPP team to respond to the state's call for a private partner to help solve the two-mile backups at the tunnels between Norfolk and Portsmouth.

After years of work with Virginia's Dept. of Transportation, the starting toll was set at \$2.86 in an interim agreement signed in January 2010 during the final year of the Kaine administration. Negotiations since then under Gov. Bob McDonnell's watch reduced the starting toll to \$1.84 for peak users and \$1.54 off peak, collected electronically.

To reach that low toll, however, Virginia DOT agreed to:

- allow electronic tolling on two existing tunnels during the six-year construction period for the improvements, as proposed by Skanska in its unsolicited proposal in 2008;

- allow truck tolls that are four times the peak-period car toll;
- allow an aggressive toll escalation schedule of the greater of CPI or 3.5% a year, starting at the completion of the Midtown Tunnel expansion in 2016 and extending for 58 years;
- put in \$308 million of its federal highway funds as public equity to buy down the starting toll.

Most recently, Gov. Bob McDonnell indicated the state would contribute up to \$125 million more in order to delay the start of tolling until January 2014. No funding source has been identified to increase the state's equity contribution, however.

One further option for buying down the Midtown car toll would be for VDOT to make partial or full payment to the private operators for the operation and maintenance component, estimated at \$1.3 billion over the 58-year term of the concession.

While praising VDOT's efforts to reduce the tunnel toll, a transportation leader in the state faults the agency for falling down on public outreach. VDOT met several times with the affected localities and the toll rates were made public last summer. But local issues raised in writing were never responded to in writing, he says, and there were no public presentations on tolls by VDOT, which relied instead on the media.

Sidebar

How Washington State DOT Tolled SR 520

Like the Midtown Tunnel, the SR 520 floating bridge in Seattle was built almost 50 years ago as a tolled commuter crossing. Toll booths were removed in 1979 once bonds were retired. Now, substantial improvements are needed to meet safety and capacity needs in the highly congested corridor, at an estimated cost of \$4.65 billion.

Available funding is well short of that. So Washington State DOT decided in 2008 to toll the existing free bridge while a wider, safer bridge is being built next to it with public financing. The move is part of a larger change in philosophy in Washington State on the role of toll financing, says Craig Stone, toll manager at WashDOT.

Fourteen toll bridges were built in the state a generation ago. Tolls were removed when bonds were repaid. Now those and other transportation assets will be rebuilt with a reasonable contribution from tolls. "Tolls are part of the highway user's contribution to the regional transportation system," says Stone.

WashDOT intends to issue \$1 billion in GO debt backed by bridge tolls to help fund four ongoing design-build contracts for completing the SR 520 bridge and approaches late in 2014.

Variable-rate electronic tolling started last December at a peak-hour charge of \$3.50. After a slow start, February traffic was 19% higher than forecast and revenues were 7% higher.

Diversion rates to the larger I-90 bridge five miles away quickly hit the 48% predicted by

Wilbur Smith Associates. Average daily trips have dropped to 60,000-70,000 from peaks of 115,000, and traffic is in free flow most of the time. Transit ridership is up by 10% and vanpooling by 17% since December, according to Stone.

The first civil penalty notices to violators went out in April seeking the initial toll amount, a \$5 reprocessing fee for each reminder bill, and an added \$40 civil penalty for each unpaid toll transaction.

The first of four 2.5% annual rate increases will take place in July, followed by a 15% hike in 2016, as allowed by the Washington State Transportation Commission. Real rates will remain at about \$4.50 for the remaining term of the bond financing by Citi and J.P. Morgan.

According to Stone, here's how it was done:

> Tolling of the free SR 520 bridge during construction of its replacement was sold to commuters in a wealthy corridor between Seattle and Bellevue/Redmond in a series of public meetings conducted by over two years by the Secretary of Transportation, chairman of the Transportation Commission, which regulates tolls, and the executive director of the metropolitan planning organization. "It was very listening oriented," says Stone.

> The typically well-educated drivers using the bridge understood the tradeoffs on financing costs, largely the savings on capitalized interest. Over \$172 million in capitalized interest was repaid as part of the \$768-million Tacoma Narrows Bridge financing in 2002, which started tolls after completion.

(Another, less apparent, benefit of the SR 520 approach is that toll operations during construction are proving out revenue forecasts, which will reduce WashDOT's credit subsidy in its application for a TIFIA loan.)

> Substantial amounts of work are underway in the corridor with public funds on the \$2.4-billion first phase of the project so commuters can see that their dollars are being spent as promised.

> Time-of-day electronic tolling has reduced congestion in the corridor during peak hours, providing an improved level of service to the bridge users during the initial months of operation.

> The improved corridor will have a transit component—a new transit/HOV lane for buses and carpools in each direction, which pleases Seattle transit advocates.

> Importantly, WashDOT's Secretary Paula Hammond has gained the trust of the legislature, which has given WashDOT the authority to toll the Columbia River Crossing during construction in order to contribute a third of the project funding. It also recently provided funds for a study of construction-period tolling the I-90 floating bridge, the free alternative to SR 520.)

Bottom line, says Stone: "It really hasn't been controversial with the public."

