The overshadowed tunnel

B&P Tunnel is Amtrak’s Baltimore bottleneck, but replacement is stalled in planning stage

by Dan Zukowski

Along the Northeast Corridor, where the dasgnally specified Hudson River tunnels are media superstars, Amtrak’s Baltimore & Potomac Tunnel in the B&P Early celebrity struggling for attention.

It predated the Manhattan-entrance tubes by nearly four decades, and it was in serious need of replacement. Water undermines the B&P Tunnel floor, seeps through tunnel walls and leaks from utility lines, while cables and ships run on tracks and mortar.

As is the case with the Hudson tunnels, a plan exists to replace the B&P Tunnel—one which would have cost $4.3 billion when selected by the Federal Railroad Administration in 2017—but so far, not a shovel has been turned.

More than 190 trains squeeze through the two-track tunnel, just south of Baltimore’s Penn Station, each weekday. They include 35 MARC commuter trains, 34 Amtrak trains, 54 regional and long-distance Amtrak trains, and one daily Nord Lofk Southern local round trip.

As service has grown, the two-track tunnel has constrained the scheduling of trains passing through Baltimore Penn Station and the B&P Tunnel,” Amtrak spokeswoman Beth Tolito TRAINS. “The design of the tunnel and Charles Interlocking connecting the tunnel to Baltimore Penn Station also cause severe conflicts in the passway of MARC commuter trains back to Washington in the face of Amtrak and MARC trains.

The tunnel’s tight curves restrict passenger trains to 20 mph and freight to 20 mph. It takes an Amtrak regional train more than an hour to traverse the 1.4-mile tunnel.

"Functionally obsolete‘

The FRA defines the B&P Tunnel as ‘functionally obsolete.’ But when built, it was both an engineering masterpiece and a savvy business move building what was then the nation’s second-largest city. Benefiting from its natural harbor, Baltimore became a major market for manufacturing and shipbuilding. The city was the birthplace of O.C. railroad, where the Baltimore & Ohio Railroad was chartered in 1827 and began operation in 1830.

By the 1850s, the city was home to nearly 270,000 people. In 1873, the year the Amtrak Tunnel was completed, Baltimore’s Pennsylvania Railroad held the first Pennsylvania Railroad, part of the nation’s Triple Crown.

The B&P, with its early start, controlled rail traffic through and within Baltimore. But the Pennsylvania Railroad’s first chief engineer and third president, John Edgar Thomson, having already forged the line’s network through innovation and teamwork, expected to run trains to the city.

Since before the Civil War, the PRR had relied on the independent Philadelphia, Wilmington & Baltimore Railroad to handle east-west traffic. For its connection to Harrisburg, Pa., Thomson had wrested control of the Northern Central Railway Co., but that still left the PRR to rely on a connection with the Baltimore & Ohio to get trains through to Washington. The B&O was not about to help rival road.

William Bender Wilson, in his 1895 book, ‘History of the Pennsylvania Rail-
A history of modifications

In the subsequent 147 years, the tunnel has undergone numerous modifications. In 1859, the service was lowered to create an additional 2.5 feet of clearance. In the early 1930s, the tunnel floor was further lowered by about a foot for the installation of overhead catenary lines, ready for the Pennsylvania’s GG1 locomotives to whom passengers to Washington. More work was done in 1953 and from 1981 to 1983, each time again lowering the floor. This included replacing the floor and reparing the tunnel lining, but was intended only as a temporary fix. Ownership changed hands to Penn Central in 1968 when the Pennsylvania merged with the New York Central, and then to Amtrak in 1976 as part of the federal reorganization of troubled northeast railroads that created Conrail.

The tunnel’s 19th-century builders encountered the wet earth, quicksand, and underground springs that still plague the tunnel. Decades of neglect have combined with over-increasing train traffic to create mounting troubles.

In 2014, Amtrak was forced to perform emergency repairs as the concrete floor continued to settle due to water infiltration. Toll says that many problems cause delays, including “defects with the track profile due to drainage in the tunnel and the deterioration of the concrete slab.”

The B&P Tunnel is actually three tunnels connected by two open cuts.

Southbound trains leave Penn Station and enter the 1,152-foot 40th Street Tunnel on an eight-degree curve. They emerge to a 200-foot cut and then enter the 1,683-foot Wilson Street Tunnel. Another 330-foot cut, followed by the 2,490-foot Calmer Street Tunnel, brings trains to West Baltimore.

Amtrak asked engineering firm Parsons Corp. to conduct a thorough visual inspection including all three tunnels with which to purchase a separate BRQ ticket. The B&R set commercial rates to discourage private work.

Thomson saw that he had to have his own line to the nation’s capital. In 1868, he gained control of the Baltimore & Potomac Railroad, chartered in 1835 but not completed. The Potomac Railroad moved quickly to construct the B&R to Washington, testing the line in its PRB’s 1871 annual report as it was being built. The report declared “there will be an uninterrupted railroad” from Baltimore to the nation’s South.

Tunnel construction cost $2.3 million, or about $54 million in current dollars. “The materials used in its construction are the best that could be procured,” boasted “The Pennsylvania Railroad’s Its Origin, Construction, Conditions, and Connections,” an 1875 book written by William B. Nipps and published by the PRR.

The author details how the tunnel was built: solid masonry side walls of 15-foot high Blacksville marble, the same stone used for the Washington Monument. Five courses of brick line the roof, beneath the tunnel floor, an inverted brick arch — essentially a roof turned upside down — was added to strengthen the structure and stabilize it in the wet earth. Construction required 15 million bricks and 1.25 million feet of masonry.

The first train through the tunnel, a northbound originating in Richmond, Va., arrived early on June 29, 1873. Through service from New Jersey to Washington began with two daily round trips, with a train added the following month. By the end of the year, trains would travel through sleepers to Chicago, St. Louis, and Buffalo.

Its useful life has passed. In 2017, the FRA looked at 16 alternatives for replacing the tunnel, narrowed that to four — including a no-build do-nothing option — then issued its Record of Decision.

A plan to rebuild the existing tunnel was discarded. It would require complete shutdown or single-track running during construction, and leave in place the severe constraints of two-track operations. By 2050, 2½ hours of cumulative delays for Amtrak and MARC are expected daily.

The alignment selected by the FRA envision a 2-mile tunnel and a rebuilt West Baltimore MARC station. Overall, 367 miles of new four-track main line will carry trains at higher speeds on more gentle curves. Southbound trains leaving Baltimore Penn Station will enter a reconstructed Charles Hollrock, taking seven station
tracks to four mainline tracks using No. 10 and No. 15 switches. This new interlocking is designed to reduce conflicting movements.

A massive stone pier supporting a CSX bridge needs to be relocated to accommodate the new Northeast Corridor four-track alignment. After passing under the rebuilt span, trains will slip through the new tunnel's North Portal just east of the North Avenue light rail station. Light rail service will not be disrupted by the construction.

Each track will reside in a separate bore. And there will be a fifth tunnel on 8-foot-wide, 16.5-foot-high emergency exit passageway, parallel to the main tunnels. It leads to ground level at both portals and a midway location.

The tunnel area gradually to the south. Three of the four tracks, designated A, 1, and 2, begin a 1.75% descending grade. Track 3 descends further and more steeply on a 1.625% grade, curving toward to track under tracks 1 and 2 and become the outer southbound track.

Armstrong explains that many MARC trains turn back at Baltimore, so their northbound and southbound tracks are adjacent at Penn Station. South of the tunnel, however, MARC trains use the outside tracks to make their station stops.

Dominic Olivetti, a principal engineer at Parsons, speaking at an industry conference, said, "To avoid at-grade conflicts through the Charles Interlocking just south of Penn Station, we devised this way to sort the trains underground.

After climbing a 1.5% grade from the tunnel's low point, the four tracks exit the South Portal at Riggs Avenue.

The current route restricts trains to 55 mph through a compound curve in West Baltimore, known as Curve 381, which prohibits high-level platforms at the MARC station. The curve will be eased and the current track-center spacing of 13 feet will be increased to 15 feet to enable Acela trains to operate at up to 180 mph. The station will be rebuilt with 800-foot, high-level platforms, allowing faster boarding.

South of the station, just beyond the Gwynns Falls Bridge, the new alignment will retain the existing Northeast Corridor right-of-way. There, a new universal interlocking to be called "Gwynnys," comprised of four No. 20 crossovers and two No. 15 crossovers, will be installed.

**Modern methods**

The tools of tunnel building in 1873 — explosives and steam drills — will give way to tunnel boring machines, or TBMs.

These machines will face hard rock, soft soil, and a mix of the two in a city that's beset by frequent sinkholes that have closed streets, highways, and the light rail line. The problems are compounded by storm water...
An artist's conception of the new concourse planned as part of the redevelopment of Baltimore Penn Station. While the station project is net fed to the tunnel plan, it does allow for infrastructure and the anticipated additional capacity resulting from the new tunnel, Interstate Pinkus Partners.

and ground water that bleeds into tunnels and under roadbeds.

One or more tunnel boring machines will scoop out the entire portion of the four tunnel segments. As the machines progress, their cutter heads bore out a perfect circle, pulling back concrete rings and soil as hydraulic cylinders force the bores forward.

Meanwhile, precision-made, prestressed concrete lining segments are continuously carried forward and assembled into a circular ring, which is pressed against the exposed tunnel wall. Each ring is then bolted to the preceding ring, forming a continuous, unbroken lining. The process repeats as the tunnel boring machine advances.

For the long, constant-radius arc required by the new tunnel, the tunnel boring machine operator steers using a computer interface, by applying slightly more pressure to one side of the cutting head.

Tunnel boring machines are quieter, create less vibration, and protect the streets and structures overhead better than other tunneling methods, an important consideration for the mostly residential community above the new tunnel. But near tunnel portals, excavation by cut-and-cover is called for. From the surface, wooden timbers or steel piles are placed to shore up the walls and street, after which the concrete floor slab can be cast and fully completed. Cut-and-cover will also be used for ventilation facilities and vertical exit shafts.

Some utility structures and the cross-passages between tunnels will require controlled blasting into the tunnel face.

$5 billion price tag

Amtrak now quotes a $5.3 billion price tag for the replacement tunnel, up from the FRA's $4.5 billion estimate in 2017. The cost will likely continue to climb with each year that passes. Once started, the project could take up to 12 years.

But the start of construction is far off. Tell says Amtrak has allocated $12 million of its fiscal year 2020 federal funding to advance design work on the B&P project. She notes the railroad has met with CSX engineering regarding the proposed modification to the freight railroad’s bridge near the South Portal and has worked on design development, project delivery strategy, and construction staging issues.

"The essential element that Amtrak dedicates to the B&P Tunnel Replacement Project is dependent on the amount of federal funding that may be provided by Congress to Amtrak through the annual appropriation process," Tell says. Amtrak has also applied for grants under the Federal-State Partnership for State of Good Repair Program and the Consolidated Rail Infrastructure and Safety Improvements Program.

The new tunnel will also accommodate added Amtrak passengers, as much as Amtrak passengers, remain at the mercy of the delays and slow crawl of trains through the existing tunnel. MARC commuter trains, operated by the Maryland Department of Transportation, carry 9 million passengers a year. But MDTA spokesman Jim Trenary confirmed to Tolls that the agency does not currently have a role in the project. Plans for the new tunnel have encountered some community opposition.

The FRA estimates 22 residential buildings need to be demolished, 15 of them occupied. An additional 13 businesses and four places of worship will have to relocate. At a series of open houses and other meetings in 2016, residents expressed concerns about noise and potential emissions from the three ventilation facilities planned for the new tunnel. Of particular concern was the intermediate ventilation building, to be located in a residential neighborhood. It has been relocated, at additional cost, to the edge of the neighborhood.

Historic structures along Curve 301 posed challenges to crafting the final alignment, which threads between four such buildings in West Baltimore, beyond the South Portal.

"By keeping an open dialogue with historic preservationists and stakeholders, we produced an alignment that both respects the historic neighborhoods and resources while meeting Amtrak's needs and requirements," Olverit say.

In addition, members also asked what would happen to the current tunnel. Amtrak tells Tolls it will continue to own the existing B&P Tunnel and rights-of-way.