ADDENDUM TO:
BALTIMORE & OHIO RAILROAD, BALTIMORE BELT LINE, HOWARD STREET TUNNEL HAER No. MD-11
Beneath Howard Street from Mount Royal Station to Camden Station
Baltimore City
Maryland

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
Interior Region 1, North Atlantic - Appalachian
1234 Market Street, 20th Floor
Philadelphia, PA 19107

HISTORIC AMERICAN ENGINEERING RECORD
BALTIMORE & OHIO RAILROAD, BALTIMORE BELT LINE, HOWARD STREET TUNNEL
(Baltimore & Ohio Railroad: Howard Street Tunnel)

HAER No. MD-11

Two pages were previously transmitted to the Library of Congress.

Location: Beneath Howard Street from Mount Royal Station to Camden Station, Baltimore City, Maryland.

The Baltimore & Ohio (B&O) Railroad, Baltimore Belt Line (Belt Line), Howard Street Tunnel is located at latitude: 39.3051393001, longitude: -76.6203045845. The coordinate represents the tunnel's northern terminus at Mount Royal Station. This coordinate was obtained on January 3, 2022, by plotting its location using the National Geodetic Survey website's Conversion and Transformation Tool. The coordinate's datum is North American Datum 1983. The Howard Street Tunnel location has no restriction on its release to the public.

Present Owner/ Occupant: CSX Transportation.

Present Use: Railroad tunnel.

Significance: The early 1890s B&O Railroad Howard Street Tunnel is a well-preserved example of a railroad tunnel and is a centerpiece of the B&O Railroad's Baltimore Belt Line, a railroad segment built between 1890 and 1895 in Baltimore, Maryland. The Belt Line was a major infrastructure improvement that was part of a larger effort by the B&O to provide through service between Washington, DC, and New York City. The Belt Line allowed the B&O to connect its yards in Mount Clare on the west side of Baltimore to Bay View Junction on the east. The Belt Line was the first electrified railroad in the United States. Howard Street Tunnel is also a good example of a late nineteenth-century masonry tunnel that utilized a modified version of the German method of excavation to address issues relating to tunneling in soft soil.

Historian(s): Meghan P. White, Laura E. van Opstal, and Nicole A. Diehlmann, Rummel, Klepper, & Kahl (RK&K), LLP, 2022.

Project Information: Howard Street Tunnel was recorded between November 2021 and March 2022 by RK&K, LLP, Baltimore, Maryland, for CSX Transportation (CSX). The recordation was undertaken pursuant to a stipulation of the *Memorandum of Agreement Among the Federal*

Railroad Administration, the Maryland State Historic Preservation Officer, the Pennsylvania State Historic Preservation Officer, the Maryland Department of Transportation Port Administration, and CSX Transportation Regarding the Howard Street Tunnel Project Baltimore City, Maryland and Delaware County, Pennsylvania. Project personnel included RK&K historians Meghan P. White, Laura E. van Opstal, and Nicole A. Diehlmann and photographer Jet Lowe. The sponsor for the recordation is CSX. Cooperating agencies include the Federal Railroad Administration; the Maryland State Historic Preservation Officer; and the Maryland Department of Transportation (MDOT) Maryland Port Administration (MPA).

Part I. Historical Information

A. Physical History:

1. **Date(s) of construction:** 1890-95, as documented in as-built construction plans and contemporary newspapers.

2. **Architect/Engineer:** The "Records of Construction of Section No. 4 of the Baltimore Belt Railroad," which includes the Howard Street Tunnel, list Samuel Rea, Chief Engineer, September 1889 to April 15, 1891; Richard Randolph, Chief Engineer, April 15, 1891, to August 22, 1892; and W. T. Manning, Chief Engineer, August 22, 1892 to completion.

   Rea was instrumental in making the Howard Street Tunnel and the Belt Line a reality. Rea had spent most of his career working for various railroads, including the Pennsylvania Railroad (PRR) and the Pittsburgh, Virginia, and Charleston Railroad. As an assistant engineer, he helped with the construction of the 1877 Point Bridge, a chain suspension bridge over the Monongahela River in Pittsburgh and the construction of the Pittsburgh and Lake Erie Railroad. In 1879, he served as assistant engineer of the construction of the Pittsburgh, Virginia, and Charleston Railroad, and in 1888, he was made assistant to the PRR's second vice-president. In 1889, he resigned and joined the Belt Line project as vice-president of the Maryland Central Railroad and chief engineer of the Baltimore Belt Railroad Company, although ill health forced his resignation from work beginning in 1891. Rea returned to the PRR as assistant to the president in 1892, later serving in various vice-president roles until he was elected president of the company in 1912.[1]

   Manning became chief engineer of the Baltimore Belt Railroad Company and assistant chief engineer of the B&O Railroad in 1892. In 1894 he became chief

[1] "Blair County Holds Record as Maker of Great Railroad Presidents," *Altoona Tribune* (Altoona, PA), October 1, 1925.

engineer of the B&O Railroad. He oversaw construction of the Belt Line before retiring from the B&O in 1899.

3. **Builder/Contractor/Supplier:** Ryan and McDonald Construction Company and L. B. McCabe and Brother, contractors. The Baltimore Belt Railroad Company established these two firms as The Maryland Construction Company, which was listed as the builder on the "Records of Construction of Section No. 4 of the Baltimore Belt Railroad."[2]

4. **Original plans and construction:** The 1895 as-built construction plans show the tunnel's original construction. The brick and concrete tunnel measured approximately 7,341' long, 21' high, and 29' wide, and was placed approximately between 50' and 70' below grade. Trains entered the tunnel southeast of Camden Station, then climbed eastbound (north to Philadelphia) at a 0.8 percent grade until exiting out of the tunnel at Mount Royal Station. The original tunnel consisted of three sections—1) an approximately 300' cut-and-cover section from just north of West Preston Street to just southwest of Mount Royal Station; 2) an approximately 5,900' bored section from just north of West Preston Street south to north of West Lombard Street; and 3) an approximately 1,150' cut-and-cover section between north of West Lombard Street to just south of West Camden Street.[3]

   The tunnel was arched, and for the majority of its length the flooring contained an inverted brick and concrete arch that provided additional strength to the sidewalls. The tunnel walls were generally constructed of brick, with a rusticated limestone foundation in sections of the tunnel, including a short distance at the north portal and longer stretches at the south portal. Recessed brick arched alcoves were placed throughout the tunnel to provide pedestrian safety from passing trains. Vertically oriented rectangular wood blocks were mounted on the tunnel walls to secure wiring and lighting.

   The north portal was approximately 51' wide and 27' tall and faced in rusticated cut limestone.[4] The arched opening was lined with unevenly shaped voussoirs (see Figure 1 for as-built plans of the north portal). Limestone abutments were set perpendicular to the portal and were topped with a series of stepped capstones. At the north portal, the tunnel bellmouth was constructed wider than the rest of the tunnel to accommodate sidings that split from the main track to access Mount Royal Station. The tunnel narrowed and curved slightly as it approached West Preston Street and transitioned to the bored section. It then continued south directly under North Howard Street. Near

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[2] Paul Manion, "Howard Street Tunnel," *The Sentinel* 12, no. 4 (July-August 1990): 6-21.
[3] Matt Bray, Nicole A. Diehlmann, Laura van Opstal, and Meghan P. White, "Howard Street Tunnel Project Architectural Historic Properties Identification and Effects Assessment Technical Report" (Baltimore, MD: RK&K, 2021), 8.
[4] Lawrence Lee, "Baltimore's Unseen Artery: A Brief History of the Baltimore Belt Railroad and its Howard Street Tunnel," in *Baltimore Civil Engineering History*, ed. Bernard G. Dennis Jr. and Matthew C. Fenton IV, P.E. (Reston, VA: American Society of Civil Engineers, 2004), 163-91.

West Lombard Street, the tunnel widened to accommodate space for a siding and a recessed platform on the east side of the tracks for a planned but uncompleted station. A single large arched opening was built on both the north and west sides of the platform. South of West Lombard Street, steel girders ran east-west across the tops of the arches to support the ceiling over the underground platform. The southern cut-and-cover section of the tunnel began here where the distance between the top of the tunnel and Howard Street is shallow. At the southern end of this cut-and-cover section, the roof was arched. Tall limestone foundations were at the sidewalls. The arched opening of the south portal was lined with unevenly shaped voussoirs (see Figure 2 for as-built plans of the south portal).

5. **Alterations and additions:** The Belt Line operated on the overhead electric rail system for several years. In 1902, it was replaced with a third electrified rail at ground level, which remained in use for several decades.[5] In 1937, engineers added a gauntlet to the two tracks within the Howard Street Tunnel to allow clearance in the center of the tunnel for newer and taller freight cars. For a gauntlet configuration, two parallel tracks partially overlapped. Each track operated independently, but trains traveling on either track were moved closer to the center of the arch, the tallest section, for additional height clearance. Within the Howard Street Tunnel, a third track was added to overlap partially with the eastbound tracks, allowing the existing track to move closer to the arch center (See Figure 3). The westbound tracks were unaltered. Electrified shoes were placed on one side of the electric locomotives on swinging arms or booms so they could extend to the existing third rail. The B&O removed this entire electrification system ca. 1952, when the B&O completed its shift to diesel locomotives.[6]

   Beginning in the late twentieth century, major changes were made to the Howard Street Tunnel. In 1982, after the tunnel was under the control of CSX, it was extended approximately 1,393' to the south, primarily over the existing cut, which was covered with reinforced concrete and fill to allow the new elevated Interstate 395 to slope down toward Howard Street. A new portal for trains was constructed south of Lee Street.[7]

   In 1984, CSX sought to raise train height restrictions along the Belt Line following the expansion of the General Motors plant in southeast Baltimore. The railroad company lowered the tracks within the tunnel to provide a higher 19'-3" clearance to accommodate multi-level automobile carriers. The tracks in the early 1890s section of the Howard Street Tunnel were lowered using a switch panelizer machine that removed the tracks, which allowed old ballast to be removed and new ballast laid down, before laying the tracks back in place. The 1982 southern extension of the tunnel had already been built with the required clearance height.[8]

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[5] Lee, "Baltimore's Unseen Artery," 182.
[6] Lawrence W. Sagle, *B&O Power: Steam, Diesel and Electric Power of the Baltimore and Ohio Railroad 1829-1964* (n.p.: Alvin F. Staufer, 1964), 310.
[7] Lee, "Baltimore's Unseen Artery," 186.
[8] "Belt Line Clearance Project," *The Sentinel* 6, no. 5 (September-October 1984): 7.

In the early 1990s, the Maryland Department of Transportation (MDOT) Maryland Transit Administration (MTA) constructed a new light-rail system, necessitating an extension of the tunnel's southern end by 50'-0" to allow for the crossing of the light-rail tracks over the Belt Line's tracks. The southern end of the tunnel now exits through a square, poured-concrete portal and carries CSX beneath the light-rail. A small station building and platform serving both the light-rail and Maryland Area Regional Commuter (MARC) trains were constructed on the site, south of Camden Station and west of the tunnel.[9]

More changes came to the Howard Street Tunnel at the turn of the twenty-first century. Telecommunication companies negotiated with CSX to bury their fiber-optic cables along the right-of-way inside the Howard Street Tunnel. The cables were severely damaged in 2001, when a sixty-car train derailed inside the tunnel and the cars carrying hazardous materials ignited. Temperatures inside the tunnel reached 1,500 degrees Fahrenheit, and smoke filled the tunnel for hours. Despite the high temperatures, the tunnel sustained minimal damage.[10] After the fire, corrugated-steel cladding was added to the interior of the tunnel in the damaged section, and the fiber optic cables were removed.

As of 2022, alterations to the tunnel are proposed as part of a project to allow double stacking of freight trains along CSX's route between Baltimore and Philadelphia.

B. **Historical Context:** The Howard Street Tunnel was the centerpiece of the Belt Line, a railroad segment constructed between 1890 and 1895 in Baltimore, Maryland. The Belt Line was a major infrastructure improvement that was part of a larger effort by the B&O to provide through service between Washington, DC, and New York City. The Belt Line allowed the B&O to connect its yards in Mount Clare on the west side of Baltimore to Bay View Junction on the east. Prior to its completion, the B&O used barges to ship its railcars over the Patapsco River. Once completed, the Howard Street Tunnel was the country's largest soft-ground tunnel and the longest tunnel operated by the B&O Railroad.[11] The Belt Line was the most complicated part of the overall objective to providing service between Washington, DC, and New York. All other segments of the overall B&O project lacked the significant obstacles posed by the construction of the tunnel and the route through Baltimore City. As it compares to projects by competitors, it is unique because the primary competitor of the B&O was the Pennsylvania Railroad, which grew by acquisitions rather than new capital construction. The Pennsylvania Railroad acquired existing lines and associated infrastructure while the B&O undertook this massive-scale construction project.

[9] M. Chris Manning, "B&O Railroad Baltimore Belt Line," Maryland Inventory of Historic Properties Record B-5287 (Crownsville, MD: Maryland Historical Trust, 2015), 4; Lee, "Baltimore's Unseen Artery," 186; "Historic Aerials," Nationwide Environmental Title Research, LLC (NETROnline), accessed November 1, 2021, https://www.historicaerials.com/viewer.
[10] Lee, "Baltimore's Unseen Artery," 188-89.
[11] Herbert H. Harwood Jr., *Royal Blue Line* (Baltimore and London: Johns Hopkins University press, 1990; repr. 2002), 86.

The historical context for the Baltimore & Ohio Railroad Baltimore Belt Line can be found in HAER Report No. MD-203.

History and Construction of Howard Street Tunnel

Site conditions made the construction of the Howard Street Tunnel challenging. Above ground were buildings ranging from three to eight stories high. A horse-drawn street railway operated along Howard Street for almost the entirety of the tunnel route, and three blocks at the south end of the tunnel had a new cable railway. In addition, the soil at the Howard Street Tunnel location was composed of loam, clay, and gravel but primarily fine, soft sand. The discovery of water, in combination with the soft soil, caused concerns regarding potential damage to buildings and streets above the tunnel due to settling from construction.[12] It was imperative to the B&O Railroad that construction proceed as precisely and carefully as possible to ensure minimal disruption above. Because of these conditions, the B&O engineers chose to use two separate tunneling techniques—a large bored section in the center, flanked by cut-and-cover sections at either end. For most of the length of the Howard Street Tunnel, the B&O engineers selected a modified version of the so-called "German method," a soft-ground tunneling technique developed in 1803 for the St. Quentin Canal in France. It was used again in 1837 for the Königsdorf Tunnel in North-Rhine Westphalia in Germany, under conditions similar to the Howard Street Tunnel. The technique was known as the "German method" for its widespread use in that country.[13]

The German method involved constructing the sidewalls and roof before excavating the central tunnel core and constructing the bottom invert. This was accomplished by excavating two small areas, called drifts, on either side of the tunnel where the sidewalls are constructed. The drifts were supported by wood framing that prevented earth from collapsing into the opening. The drifts were excavated to the height of the springing line of the arch. As the drifts increased in height, the wood framing was reinforced with additional posts. The drifts created a passageway into the tunnel, known as an annular gallery, from which earth could be excavated and tunnel walls constructed. At the same time, another opening, approximately one-third the total height of the tunnel, was excavated at the top center of the arch. Wood trusses and metal ribbing supported the central opening until the sidewalls and top of the arch were completed, and then they were removed. The masonry lining of the tunnel was constructed at the foundation of the sidewalls and built toward the roof arch. The invert, a shallow inverted arch that provides additional support to the main arch, was constructed last, after the earth in the central section of the tunnel was removed. See Figure 4 for section drawings illustrating the German method construction process.[14]

The German method had its advantages and disadvantages. An advantage of the method is that the annular gallery first created in the excavation was small, minimizing earth

[12] Charles Prelini, *Tunneling: A Practical Treatise*, 6th ed. (New York: D. van Nostrand Company, 1912), 160-61, Gutenberg.org.
[13] Lee "Baltimore's Unseen Artery," 174; Prelini, *Tunneling*, 155; Manion, "Howard Street Tunnel," 17.
[14] Prelini, *Tunneling*, 155, 158.

disturbance. Additionally, building the masonry lining from the bottom and working upwards allowed for a more stable construction. However, the small size of the annular gallery meant that the spoil cars hauling soil out of the tunnel took up nearly all of the space, making it extremely difficult for laborers to work. A second disadvantage was the possibility that the sidewalls would move closer together due to the loose soil before the invert masonry could stabilize them. Overall, the German method's disadvantages often increased the cost of tunneling projects, leading to the technique's increasingly infrequent use.[15]

As a result of these challenges, the Howard Street Tunnel was excavated using a modified German method, which was detailed by Charles Prelini in 1912 in the sixth edition of his work, *Tunneling: A Practical Treatise*. The side drifts were excavated as normal, reaching the springing line of the arch. The masonry lining was constructed along the side drifts, resting on a thick concrete foundation. The central heading was excavated next, but unlike the traditional German method of construction, in the Howard Street Tunnel the central heading was enlarged to the whole section of the tunnel. The supporting framework applied to the upper portion of the tunnel created a floor upon which side cuts were formed to reach the top of the masonry of the side drifts, allowing the tunnel walls to be created in a continuous lining up to the keystone (See Figures 5 and 6). The side drifts in the Howard Street Tunnel were approximately 8' x 8', though they often extended below the floor level for a stronger foundation. The supporting frames were built approximately 4' apart.[16] To drain the copious amount of water within the tunnel, E. J. Farrell, Ryan and McDonald's General Manager, created a system involving drilling over forty wells and air-driven pumps.[17]

The roof arches were constructed of both wood and iron. For the iron centers, 6" x 6" angles were butted together and bent to form the shape of an arch rib. Six ribs were built 4'-0" apart. The masonry portion of the roof was between five to eight bricks thick, depending on the softness of the soil. Each arch section measured approximately 18' and took up to 125 hours to complete. The timber strutting above the arch and outside of the side walls was left in place, and the empty space between the strutting and the masonry lining was filled with rubble and mortar (See Figure 7).[18]

Construction of the masonry invert, upon which the arch of the tunnel would rest, had to be modified from the typical method for the Howard Street Tunnel due to the soft soil. Timbers stretched from one side of the tunnel to the other and rested on vertical posts. Sheet piles were driven into the ground outside of the vertical posts, forming an enclosure in which to excavate safely. Then, an 8" layer of concrete was poured, and the masonry invert was built upon the concrete foundation at a depth of 2'-6". The invert measured more than a mile. The soil north of Madison Street was considered hard enough and did not need

[15] Prelini, *Tunneling*, 159-160.
[16] Prelini, *Tunneling*, 160-62.
[17] Lee, "Baltimore's Unseen Artery," 174.
[18] Prelini, *Tunneling*, 162-64.

the inverted arch.[19]

The original northern and southern portions of the Howard Street Tunnel, above West Preston Street and below West Lombard Street, were constructed above ground using the cut-and-over method. This comprised approximately one-fifth of the tunnel length. Below West Lombard Street, five vertical shafts below ground were built for the tunnel's excavation, spaced approximately 1,000' apart. Men worked in three eight-hour shifts a day. Each uncompleted tunnel section, totaling no more than 400'-0" long, was not allowed to be within two contiguous blocks to prevent safety issues like building collapses or street sinking.[20]

Ryan and McDonald Construction Company and L. B. McCabe and Brother began construction on the tunnel in September 1890.[21] Despite the precautions taken, a cave-in occurred in 1891 after workers encountered quicksand; two workers died in the incident, and the ca. 1874 City College at Howard and Center streets collapsed. In the section of the tunnel excavated using the modified German method, the centers were excavated too quickly before the mortar in the rubble filling had time to set. This caused the masonry lining to flatten and bulge. Above, Howard Street experienced between 1" and 18" of sinking, damaging gas and water mains. The construction companies rebuilt City College and the damaged portions of the tunnel, strengthening the walls with wood bracing.[22]

The B&O built a platform beneath West Lombard Street in the Howard Street Tunnel on the east side of the tracks approximately 350 yards north of Camden Station to serve as the underground portion of a new station at the intersection of Howard and West Lombard Streets to supplement the ca. 1856 Camden Station. The platform was intended to be accessed from the street level by stairs and elevators. However, because of financial constraints, the station was never built, and the underground platform was never used.[23]

Part II. Structural/Design Information

A. General Statement:

1. **Character:** The Howard Street Tunnel is a good example of an underground rail connection excavated using a modified soft-ground tunneling technique known as the German method to address the soft earth beneath Howard Street.

2. **Condition of fabric:** The Howard Street Tunnel is in good condition.

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[19] Prelini, *Tunneling*, 162-64; *The Sun* (Baltimore, MD), "An Inverted Arch," September 13, 1892, 8.
[20] Manion, "Howard Street Tunnel," 17.
[21] Manion, "Howard Street Tunnel," 15.
[22] Manion, "Howard Street Tunnel," 19; Prelini, *Tunneling*, 165; *The Sun* (Baltimore, MD), "An Inverted Arch," September 13, 1892, 8; Harwood, *Royal Blue Line*, 91.
[23] Lee, "Baltimore's Unseen Artery," 178; *The Sun* (Baltimore, MD), "Baltimore's Secret Basement," January 6, 1951.

B. Description: The Howard Street Tunnel is an underground rail connection beneath Howard Street between the Mount Royal and Camden Stations of the B&O Railroad. The brick and concrete tunnel measures approximately 8,700' long, 21' high, and 29' wide and is placed approximately between 50' and 70' below grade. Trains enter the tunnel southeast of Camden Station, then climb eastbound (north to Philadelphia) for about 8,780' at a 0.8 percent grade until exiting out of the tunnel at Mount Royal Station. The tunnel currently consists of four distinct sections—1) an approximately 300' cut-and-cover section from just north of West Preston Street to just southwest of Mount Royal Station; 2) an approximately 5,900' bored section from just north of West Preston Street south to north of West Lombard Street; 3) an approximately 1,150' cut-and-cover section between north of West Lombard Street to just south of West Camden Street; and 4) an approximately 1,393' box culvert section, dating to 1982, extends from just south of West Camden Street to north of Martin Luther King Jr. Boulevard. Ca. 1990, this section was extended an additional 50'-0" to the south to just north of Martin Luther King Jr. Boulevard in the same box culvert design as the ca. 1982 section.[24]

The tunnel is arched, and for the majority of its length the flooring contains an inverted brick and concrete arch that provides additional strength to the sidewalls. The tunnel walls are generally constructed of brick, although a rusticated limestone foundation is present for a short distance at the north portal and for a longer stretch at the 1895 south portal. Applied utility piping runs horizontally across both sides of the interior. Recessed arched alcoves are placed throughout the tunnel to provide pedestrian safety from passing trains. Vertically oriented rectangular wood blocks are found along the tunnel walls and are used to secure wires and lighting. A single non-electrified track consisting of metal rails and wood ties on gravel ballast runs through the center of the tunnel. Signaling equipment is adjacent to the track.

The north portal is approximately 51' wide and 27' tall and faced in rusticated cut limestone.[25] The arched opening is lined with unevenly shaped voussoirs. Metal fencing lines the parapet above the arch. Limestone abutments are set perpendicular to the portal and are topped with a series of stepped capstones. Immediately north of the north portal is the Mount Royal Station and trainshed, set in a deep cut of land. At the north portal the tunnel bellmouth widens to accommodate sidings that split from the main track to access Mount Royal Station. The original tunnel narrows and curves slightly as it approaches West Preston Street and transitions to the bored section. It then continues south directly under North Howard Street. Near West Lombard Street, the tunnel widens to accommodate space for a former siding and a recessed platform on the east side of the tracks for a planned but uncompleted station. There is a single large arched opening on both the north and west sides of the platform. South of West Lombard Street, original steel girders run east-west across the tops of the arches to support the ceiling over the underground platform.

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[24] Bray et al., "Howard Street Tunnel Project," 8; Lee, "Baltimore's Unseen Artery," 176, 186.
[25] Lee, "Baltimore's Unseen Artery," 178.

The southern cut-and-cover section of the tunnel completed in the early 1890s begins here where the distance between the top of the tunnel and Howard Street is shallow. At the southern end of this cut-and-cover section, the roof is arched, and tall limestone foundations are at the sidewalls. North of West Lombard Street, a portion of the brick tunnel walls are clad in corrugated steel. The original arched-stone south portal near West Camden Street has been obscured by the 1982 poured-concrete box-culvert section, but portions of the portal, including stone voussoirs, are visible from inside the tunnel. The box-culvert section is narrower than the arched section, and an angled poured-concrete wall on the west side connects the 1895 portal to the box-culvert section. The east side of the 1982 section is parallel to the 1895 tunnel wall. The junction between the 1982 boxed culvert section and 50'-0" ca. 1990 section is marked by a simple seam in the poured concrete. The ca. 1990 south portal is poured concrete with a square opening and poured-concrete abutments perpendicular to the tracks.

C. Mechanicals/Operation: Not applicable.

D. Site Information: Howard Street Tunnel is an underground rail connection beneath Howard Street between the Mount Royal Station and Camden Station in an urban area.

Part III. Sources of Information

A. Primary Sources:

Baltimore & Ohio Railroad Historical Society. “Belt Line Clearance Project.” *The Sentinel* 6, no. 5 (September-October 1984): 7. Baltimore & Ohio Railroad Museum Collection, Baltimore, Maryland.

Bray, Matt, Nicole A. Diehlmann, Laura van Opstal, and Meghan P. White. “Howard Street Tunnel Project Architectural Historic Properties Identification and Effects Assessment Technical Report.” Baltimore, MD: RK&K, 2021.

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Sagle, Lawrence W. *B&O Power: Steam, Diesel and Electric Power of the Baltimore and Ohio Railroad 1829-1964*. n.p.: Alvin F. Staufer, 1964.

White, Meghan P., and Nicole A. Diehlmann. "Baltimore & Ohio Railroad, Baltimore Belt Line." HAER No. MD-203. Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior, 2022.

B. Likely Sources Not Yet Investigated: Interstate Commerce Commission (ICC) valuation records may exist for this structure. These records are held by the National Archives and Records Administration.

Part IV. Figures

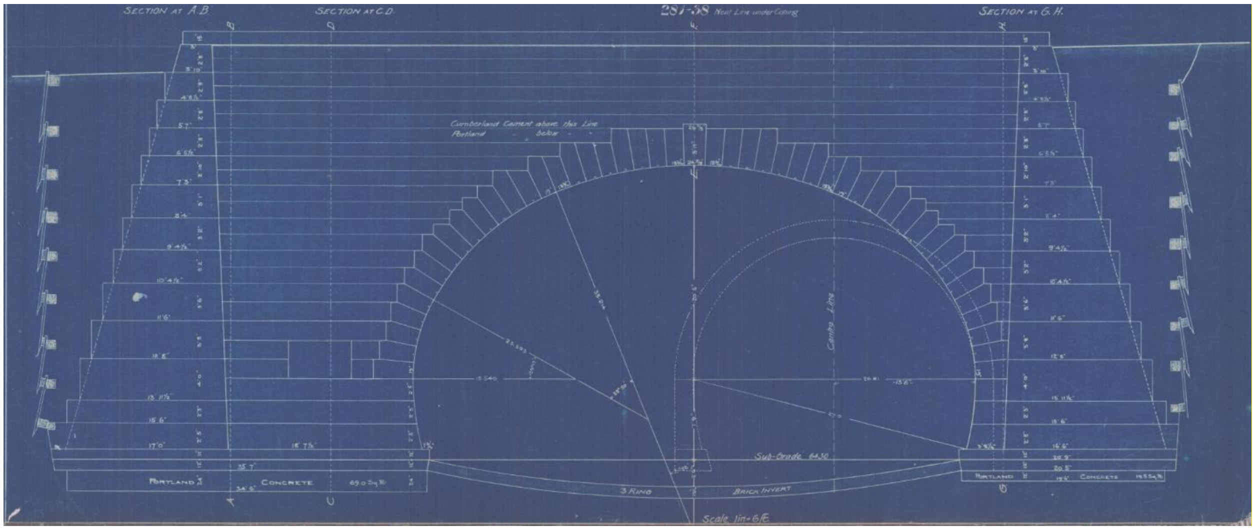

Figure 1: Drawing showing the north portal with its wide bellmouth. The smaller arch indicates the width of the tunnel itself, from “The Baltimore Belt Railroad, Records of Construction of Sec. No. 4,” 36, 1895. (Drawing courtesy of CSX Transportation.)

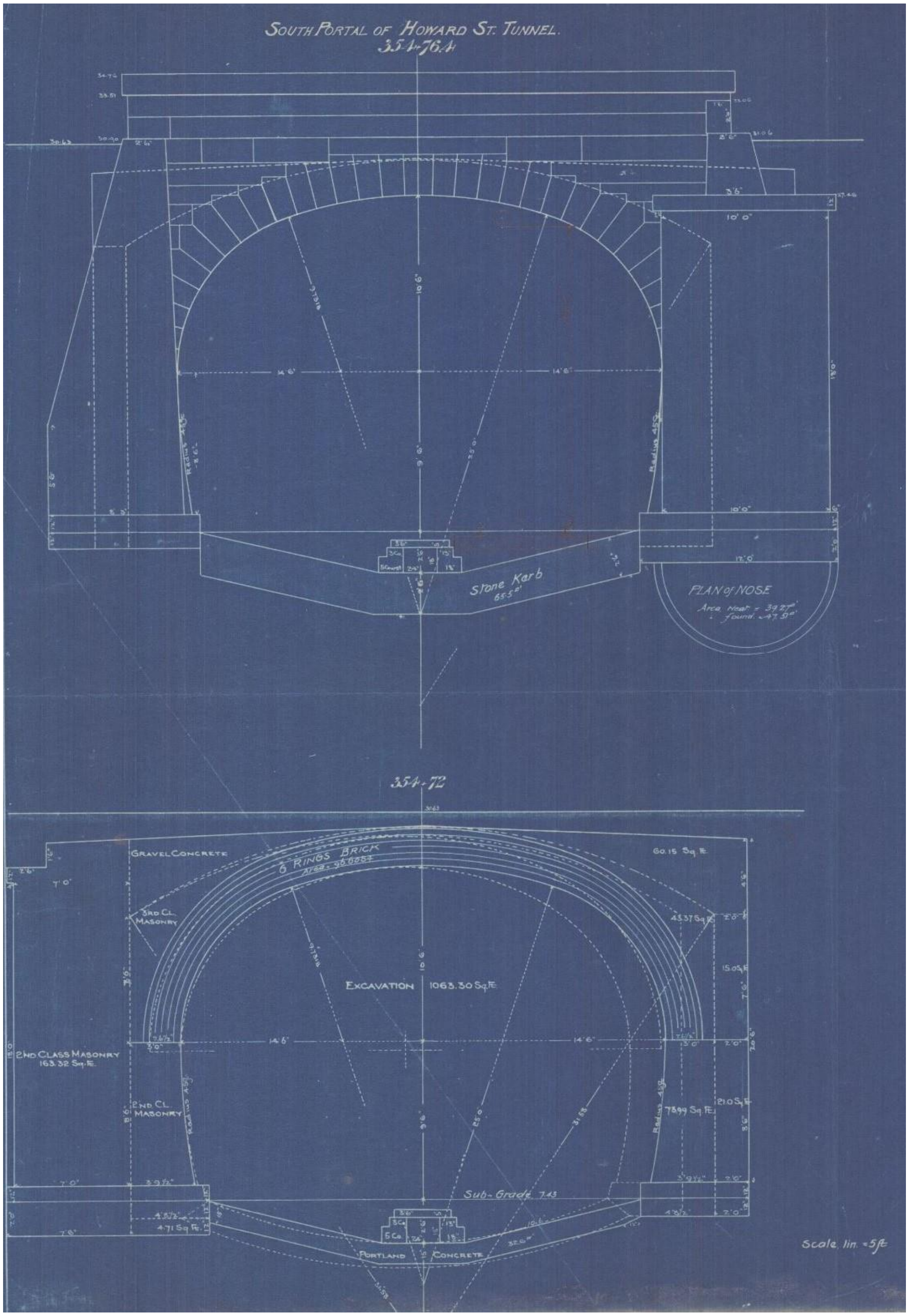

Figure 2: Façade and section drawings showing the south portal, from "The Baltimore Belt Railroad, Records of Construction of Sec. No. 4," 70, 1895. (Drawing courtesy of CSX Transportation.)

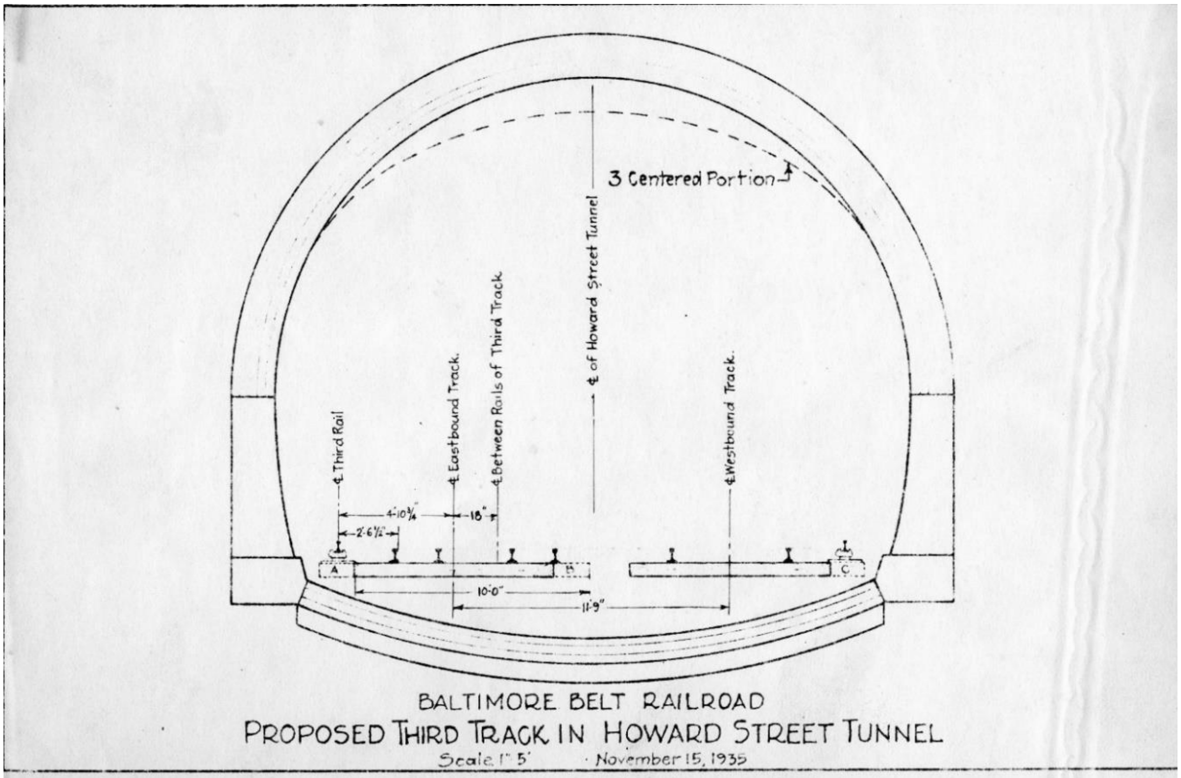

Figure 3: Section drawing showing the proposed gauntlet in the Howard Street Tunnel, 1935. (Drawing courtesy of B&O Railroad Museum.)

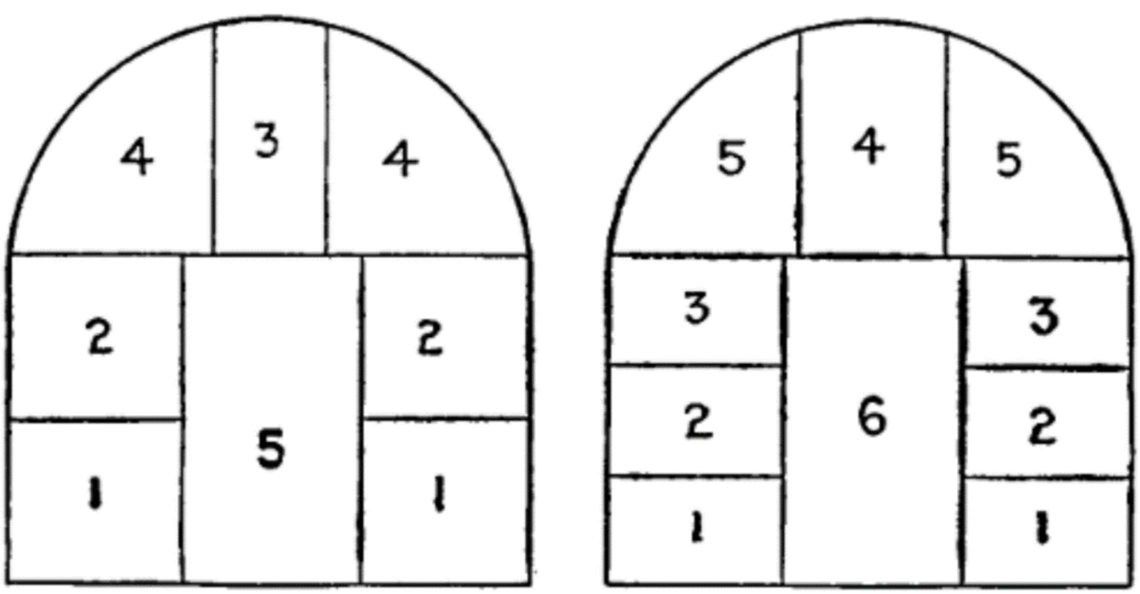

Figure 4: Diagrams showing sequence of excavation in the German method of tunneling, 1912. (Drawing by Charles Prelini.)

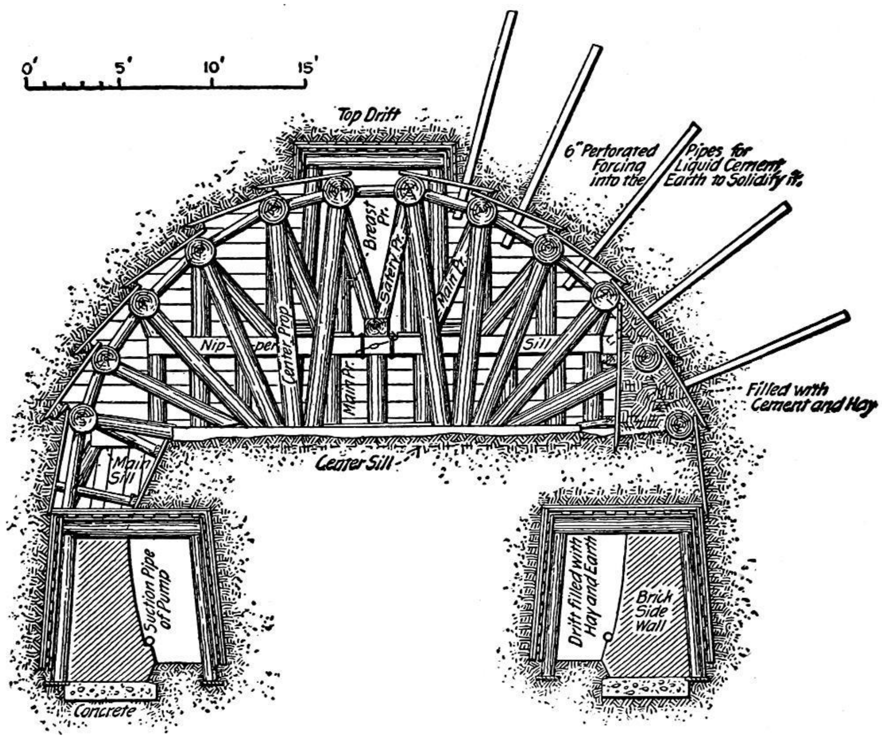

Figure 5: Sketch showing method of excavating and strutting Howard Street Tunnel, 1912. (Drawing by Charles Prelini.)

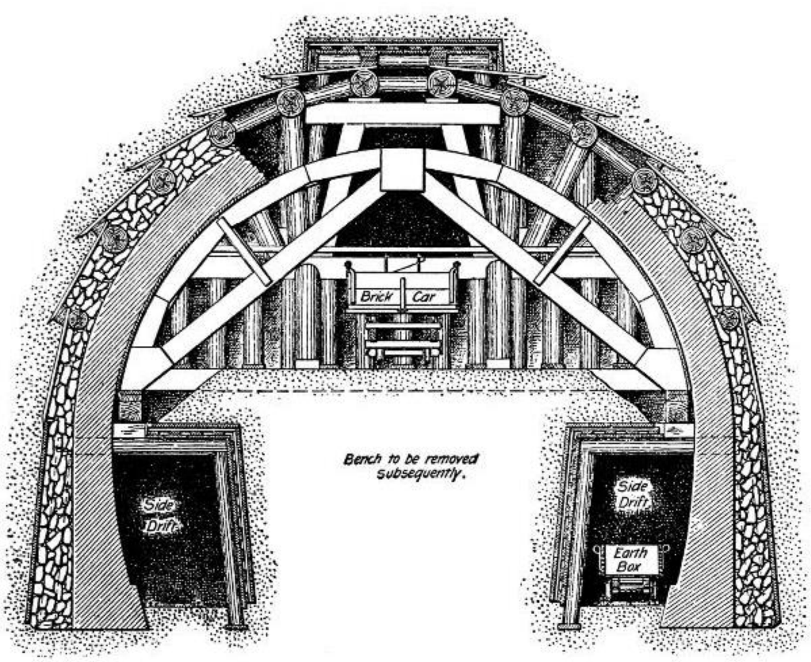

Figure 6: Sketch showing roof arch construction with timber centers, Howard Street Tunnel, 1912. (Drawing by Charles Prelini.)

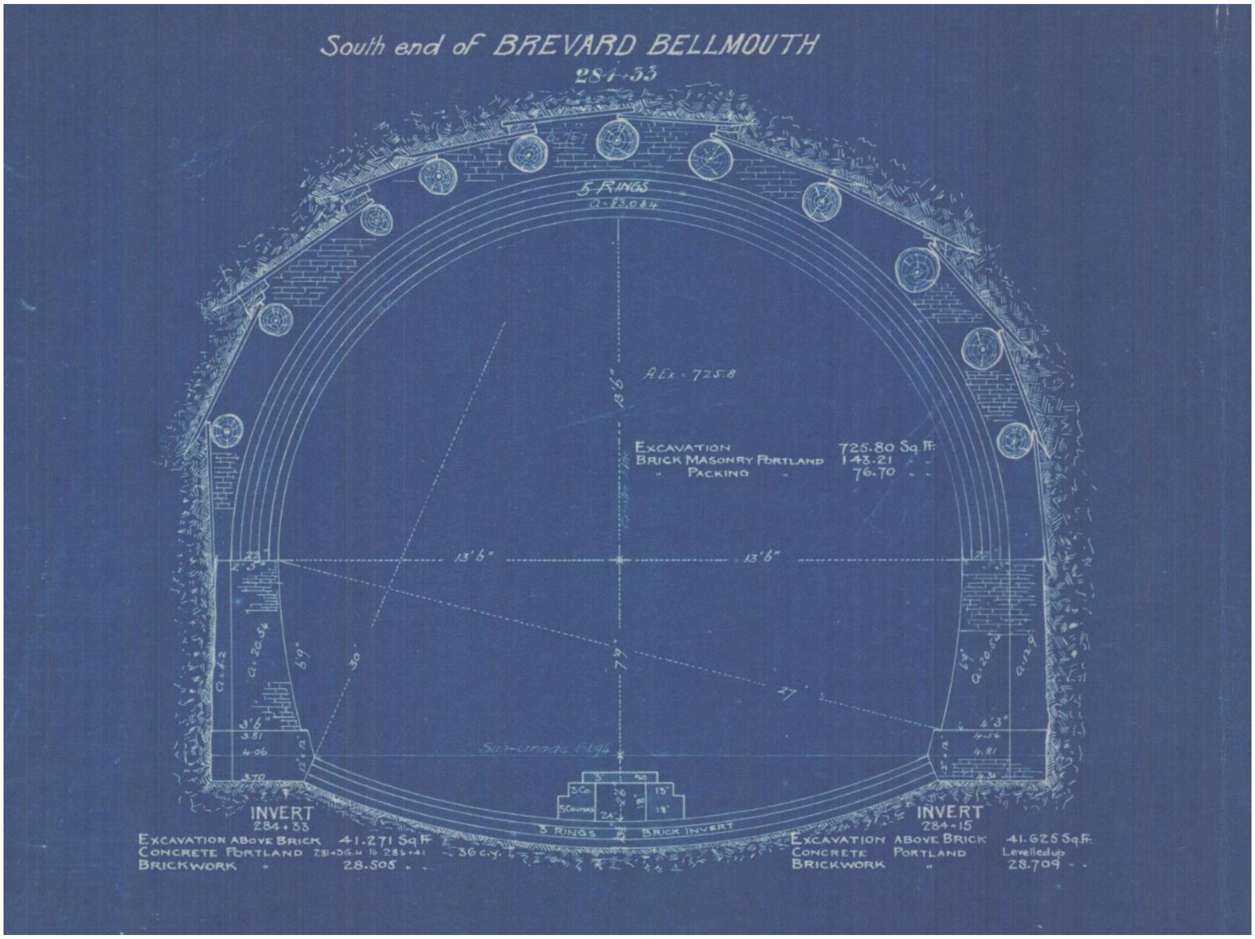

Figure 7: Section drawing showing the masonry and concrete invert, timber strutting, and roof arch construction, from "The Baltimore Belt Railroad, Records of Construction of Sec. No. 4," 47, 1895. (Drawing courtesy of CSX Transportation.)

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ADDENDUM TO:
BALTIMORE & OHIO RAILROAD, BALTIMORE BELT LINE, HOWARD STREET TUNNEL HAER No. MD-11
Beneath Howard Street from Mount Royal Station to Camden Station
Baltimore City
Maryland

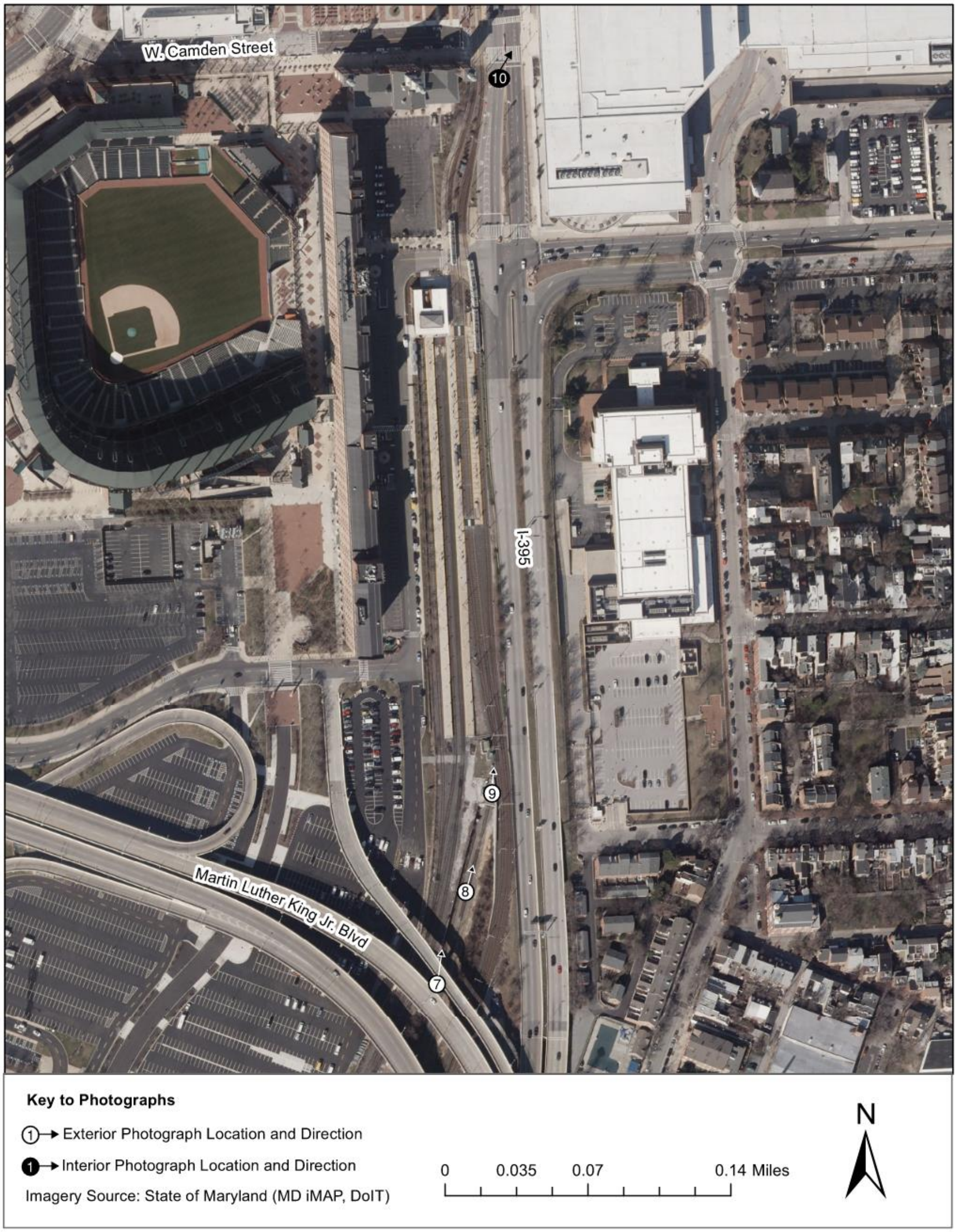
Photographs HAER 11-1 through HAER-11-6 were previously transmitted to the Library of Congress.

INDEX TO BLACK AND WHITE PHOTOGRAPHS

Jet Lowe, photographer, November 2021

MD-11-7	Exterior view of the ca.-1990 south portal and setting, looking north from the CSX Transportation railroad tracks. Note the replacement tie-plates and rails along the track bed and the northwest-bound Martin Luther King Jr. Boulevard overpass above.
MD-11-8	Exterior view of the ca.-1990 south portal looking northeast. The MDOT MTA light rail passes over the tunnel.
MD-11-9	Interior view of the 1982 poured-concrete, box-culvert tunnel section, looking north.
MD-11-10	Interior view of the original arched-stone south portal near W. Camden Street where it meets the 1982 poured concrete box culvert section, looking northeast. The original south tunnel voussoirs are visible at the top of the arch. The angled poured-concrete wall on the west side of the 1982 section connects the 1895 portal to the narrower box-culvert section. The east side of the 1982 section is parallel to the 1985 tunnel wall.
MD-11-11	Interior view of the original, early 1890s south cut-and-cover section, looking north.
MD-11-12	Interior view of the original, early 1890s south cut-and-cover section, looking northeast from approximately 20 feet south of the STA 6300 sign. The horizontal steel girders run east-west across the top of the arch to support the ceiling of a planned, but ultimately unbuilt underground platform. Visible in the distance is the beginning of the original, early 1890s bored section.

MD-11-13	Interior view of the original, early 1890s bored section, looking south from approximately 8 feet south of the STA 6300 sign. Note the transition from the bored section in the foreground, seen with the arched brick ceiling, to the original, early 1890s south cut-and-cover section with horizontal steel girders. In the foreground, east (left) of the tracks, is an arched opening leading to the underground platform that was not completed. A second arched opening on the east wall of the tunnel, parallel to the tracks, also leads to the underground platform.
MD-11-14	Interior view of the original, early 1890s north cut-and-cover section of the tunnel, looking southwest from near the north portal. At this location the tunnel widens to a bellmouth. Note the brick arch construction and rusticated limestone foundation. Original brackets from the early electrification remain attached along the base of the brick arches with modern utility piping applied above.
MD-11-15	Interior view of the north portal and west abutment, looking north toward the trainshed at the Mount Royal Station. The paired south portals of the Mount Royal Tunnel are visible in the background.
MD-11-16	Exterior view of the north portal, looking south.
MD-11-17	Exterior view of the north portal, looking south from under the trainshed at the Mount Royal Station.
MD-11-18	View south along N. Howard Street from near 847 N. Howard Street. The Howard Street Tunnel is below.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I-395
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Martin Luther King Jr. Blvd
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1 Interior Photograph Location and Direction
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Key to Photographs

① → Exterior Photograph Location and Direction

❶ → Interior Photograph Location and Direction

Imagery Source: State of Maryland (MD iMAP, DoIT)

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N. Howard Street
W. Preston Street
Dolphin Street
17
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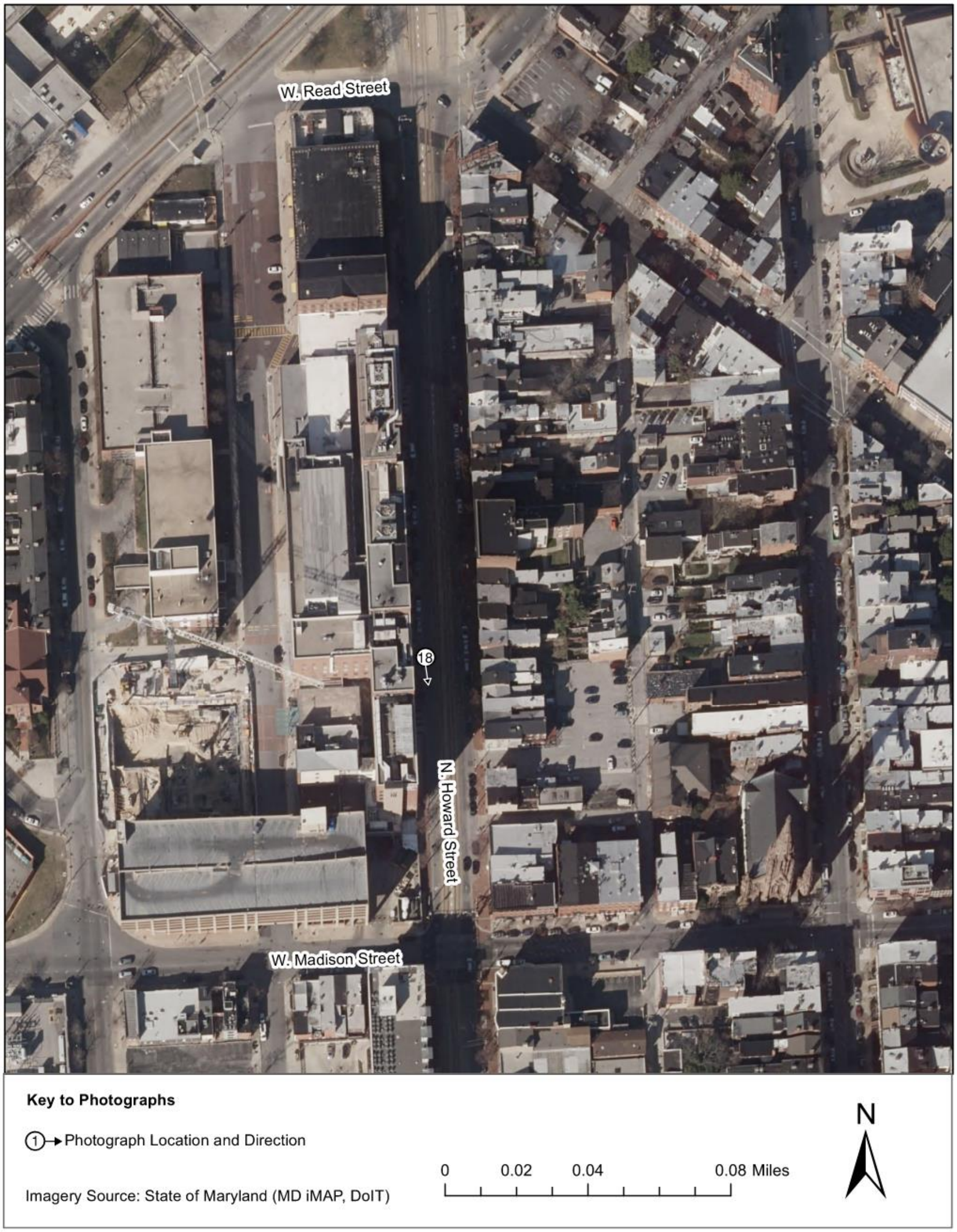
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