BALTIMORE & OHIO RAILROAD, LOCUST POINT TRANSFER BRIDGES
1055 Hull Street
Baltimore
Independent City
Maryland

HAER MD-180
HAER MD-180

PHOTOGRAPHS

COLOR TRANSPARENCIES

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD
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1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

BALTIMORE & OHIO RAILROAD, LOCUST POINT TRANSFER BRIDGES

HAER NO. MD-180

Location: 1055 Hull Street, Baltimore City, Maryland
The Locust Point Transfer Bridges are located at latitude: 39.274788, longitude: -76.588961. The coordinate represents the center of the top of south transfer bridge. This coordinate was obtained on November 1, 2011, by plotting its location on Google Earth. The accuracy of the coordinate is +/- 12 meters.

Dates of Construction: 1910-11 (North Transfer Bridge); 1917-18 (South Transfer Bridge)

Designers: F.L. Stuart, Chief Engineer, and W. S. Bouton, Engineer of Bridges, Baltimore & Ohio Railroad

Builders: Baltimore Bridge Co. (north bridge); American Bridge Co. (south bridge)

Structure Type: Transfer bridges

Present Owner: CSX Transportation/Westway Terminals

Present Use: Inactive

Significance: The Baltimore & Ohio Railroad (B&O) had marine operations in Baltimore Harbor that required the transfer of freight cars onto and off of rail-equipped barges called carfloats. Transfer bridges, such as those at Locust Point, existed at several places in the harbor to enable the transfer of the railroad cars between the carfloats and land. As the only surviving transfer bridges of this design, the Locust Point transfer bridges are important historical survivors of Baltimore's railroad, industrial, maritime, and port history.

Historian: John G. Teichmoeller, 2011

Project Information: The Baltimore & Ohio Railroad, Locust Point Transfer Bridges Recording Project was undertaken by the Historic American Engineering Record (HAER) in 2010. John G. Teichmoeller developed the project and donated the historical report. Christopher H. Marston, HAER Architect served as project leader. Montgomery College intern Benjamin Shakelton produced the drawings. J. Lawrence Lee, HAER Engineer Historian and Justine Christianson, HAER Historian, edited the history. Jet Lowe, HAER Photographer, produced the large-format photography.

Introduction

From time to time since their inception, railroads have found it necessary to transfer railroad equipment onto vessels with tracks. These barges are called carfloats, if they are not self-propelled, or car ferries (sometimes styled as one word, carferries) or trainships (European usage), if they are powered. There are various situations that make this necessary. One is simply the need to cross a body of water. Another is to place railroad cars alongside ships to allow cargo to be transferred between the cars and the ships. Structures of various designs have evolved to permit such transfers. This type of structure is variously called a "transfer bridge," "float bridge" (one word or two), "apron," or "linkspan" (more typical of European usage). The basic design requirement is to have a flexible section of railroad track that permits the land-based railroad equipment to be rolled on and off a rail-equipped floating vessel, the deck height of which varies with water levels and vessel loading.

Three basic categories of transfer bridges evolved: 1) pontoon style, where the outer, or waterside, end is supported by a floating pontoon; 2) a suspension style, where the outer end is suspended from an overhead, counterweighted structure; and 3) the incline, or traveling cradle, style, where fixed rails continue down a trestle into the water and a sliding platform permits transfer to the vessel, functioning much like a marine railway. Some of the suspension-style bridges have been referred to as "electric transfer bridges" because of the then-novel electric motors used to adjust the vertical height to match the vessel's deck. Important design requirements included ease and speed of operation and the minimization of the forces transferred to the vessel that caused listing and pitching during loading and unloading. American railroads serving ports have employed various designs—some of them patented—to accomplish this. These designs ranged from simple to complex, and some were more successful than others. Both pontoon- and suspension-style transfer bridges continue in use.[1]

Railroad marine transfer operations have existed since the early years of railroading (1838 on the Susquehanna River and 1850 on the Tyne in Scotland).[2] Many were abandoned after the construction of tunnels or bridges that rendered them unnecessary. Others were victims of changing traffic patterns that eliminated the need for transfer and lightering service. At one time, New York Harbor supported a vast complex of rail-marine activity operated by the "railroad navies" of carriers such as the New York Central, Pennsylvania, Lehigh Valley, and Jersey Central, among others, who each owned and operated several railroad tugboats—noted for their extra-tall pilothouses—and carfloats.[3]

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[1] An excellent summary of transfer bridge technology may be found in "Railway Car-Ferries, American and Foreign," by E. E. R. Tratman in *Proceedings of the Forty-First Annual Convention of the American Railway Engineering Association, Volume 41*, 1940, pp. 965-1031, and in particular, "Part IV—Car-Ferry Landings," pp. 1010-1030. Similar versions of the same paper were published in earlier *Proceedings* of the American Railway Engineering Association.

[2] George W. Hilton, "The Steamer Maryland Route," *Steamboat Bill*, Fall 1965; P. Ransome-Wallis, *Train Ferries of Western Europe* (London: Ian Allan, 1968), pp. 41-48.

[3] See Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior, "Greenville Yard, Transfer Bridge System," HAER No. NJ-49-A.

Elsewhere on the East Coast, this type of operation could be found in Maine, Long Island Sound, Philadelphia, Baltimore, Florida, and across the mouth of Chesapeake Bay. Vestigial operations remain in service at this writing in New York and across Chesapeake Bay. Car ferries operated across the lower St. Lawrence River and throughout the Great Lakes, and one may still be in service in the former. The Mississippi River supported close to fifty so-called “transfer” services over the years, but all are now gone, having been supplanted by bridges. San Francisco Bay similarly boasted rail-marine operations, by the Santa Fe, Western Pacific, and Southern Pacific (including subsidiary Northwestern Pacific), which operated the largest self-propelled car ferries ever built for inland waters. Prior to the opening of the Huey Long Bridge, the Southern Pacific utilized similar car ferries to cross the Mississippi River at New Orleans. There were numerous operations in the Pacific Northwest including on several geographically constrained Canadian lakes. Some of these operations continue out of Seattle and Vancouver, British Columbia, including the Alaska Railroad’s only interchanges with the North American rail network. Numerous carferry services continue overseas, but they are also declining due to the extensive use of containers for inter-modal shipping.

General Description[4]

The Baltimore and Ohio’s two transfer bridges are located on the north side of Locust Point facing Baltimore’s Northwest Harbor. The railroad designated them as “North” and “South,” and that nomenclature will be used in this report even though the North Transfer Bridge could more accurately be described as being located on the western side of the site.[5] The bridges are close to the foot of Hull Street, in an area called Pier 10 by the Maryland Port Administration, who now owns most of the former B&O port facilities on the north side of Locust Point. The site is presently surrounded by a bulk liquid sea-land terminal operated by Westway Terminals that is secured by a locked chain-link fence.[6] Westway leases most of its terminal site from the Maryland Port Administration. While the specific site occupied by the transfer bridges is inside Westway Terminals’ facility, it is still owned by B&O successor CSX Transportation and leased to Westway.[7] Since Westway does not utilize the transfer bridges, the area immediately adjacent to them is heavily overgrown.

While both transfer bridges operated in essentially the same manner, there are some minor design differences between the two, likely due to their construction by separate companies. The structure of the North Transfer Bridge, built by the Baltimore Bridge Company in 1911 seven years before the South Transfer Bridge, is slightly smaller in most dimensions. The basic form of both transfer bridges consists of two plate-girder bridge spans measuring 48' long, each of which supports a single track. The track centerlines are spaced 14'-10" apart to match the two sets of rails on the carfloats. Each span is hinged on the shore side with 5"-diameter pins that extend through bearings secured to a concrete bulkhead. Straddling each pair of bridge spans is

[4] Description based on fieldwork completed by recording team.
[5] The use of “North” and “South” by the B&O probably relates to what it considered to be operationally “north” and “south” over its loop of track on Locust Point.
[6] The National Molasses Company owned the tanks at the site in the 1970s. The corporate relationship between Westway Terminals and National Molasses has not been researched.
[7] E-mail correspondence from Robert Yarlott, CSX Vice President of International Business Development to E. Ray Lichty, retired CSX Vice President, July 16, 2010 citing ownership of Locust Point Transfer Bridges site.

a steel gantry structure consisting of two towers constructed of riveted **L**-section members that support an overhead plate-girder span approximately 30' above the bridge spans.

These towers, which were constructed on concrete foundations in the water, contain the machinery needed to raise and lower the outer ends of the spans as they pivoted on the landside hinges. This was necessary to accommodate the deck level of each carfloat, which changed with tides as well as the load (number of cars) placed on it. The B&O employed rather small carfloats in Baltimore compared to those used elsewhere. Consequently, a B&O carfloat's draft and list changed significantly during loading and unloading operations, so much so that these transfer bridges included a couple of rarely seen mechanisms to accommodate the motion without placing undue stress on the carfloat or the transfer span.

One of these mechanisms was a tilting head. Located on the waterside end of each bridge span, it featured a horizontal pivot in line with the centerline of its track that furnished rotational flexibility between the carfloat and the span. The tilting head could accommodate list movements while keeping the carfloat closely moored to the span with the tracks in alignment. Without it, a listing carfloat—frequently caused by having cars on only one of its two tracks—could have induced a damaging level of torque to the span. The tilting head also furnished some flexibility to accommodate carfloat movement about its pitch axis.

The second mechanism was an ingenious counterweight system that compensated for the varying weights of cars that crossed the bridge spans and prevented those loads from being transmitted entirely to the carfloat. While this was not a serious problem with large carferries and carfloats, it was critical with the B&O's small carfloats. Like other movable bridges, including suspension-style transfer bridges, the fixed weight of each bridge span, known as its *dead load*, was offset by a counterweight that was connected to the waterside end of the span by cables so that it moved up when that end of the span moved down, keeping the system in balance.[8] Compensating for the variable weight of the cars moving across the span, termed the *live load*, required a novel solution involving a variable-mass counterweight.

The waterside end of each bridge span is supported from the overhead gantry via a mechanism made up of two inter-connected counterweight systems that are linked with cables. One set of cables links the bridge span directly to the dead-load counterweight through a series of fixed-position sheaves and movable blocks. Each set consists of four cables, with one pair connected to each side of the bridge span through a dual-sheave block and vertical steel bars. The opposite ends of all four are attached to the dead-load counterweight. The routing of these cables and an equalizer assembly connected to the dead-load counterweight ensures that the loads from both sides of the bridge span are distributed uniformly regardless of the span's movements or any expansion or contraction of the cables. A second set of cables links the dead-load counterweight to what is called an "operating drum" and a second counterweight known as the "pick-up counterweight." This counterweight is actually a stack of small counterweights, each attached to the one above it with several links of chain designed to counter the varying weight of railroad

[8] In strict parlance, load-bearing "cables" such as these are termed "wire ropes," but the latter term may not be familiar to all readers, so the former term will be used herein.

cars crossing the bridge and prevent the bulk of that live load from being transferred to the carfloat. This second set of cables includes a pair of cables between the dead-load counterweight and a block, and a single cable that passes through the block with one end wound around the operating drum and the other attached to the pick-up counterweight.

At the top of each tower is an electric motor (four motors in total). The motors had to be located on top of the towers because during high tides and storms, the drums could become submerged. To further shelter the motors and the accompanying overhead gearing, machinery houses were constructed over them. The two corrugated-metal machinery houses on the South Transfer Bridge remain, but one on the North Transfer Bridge has collapsed while the second is completely gone. The machinery houses on the North Transfer Bridge appear to have been smaller. Through gearing and a vertical shaft, each motor winds or unwinds the cable on one of the operating drums located at the base of each tower. Each motor had a brake that automatically engaged when the motor stopped. Thus, each bridge span could be raised or lowered independently to match the level of the carfloat and could be adjusted during the car-transfer movements if necessary. An operator manually controlled the movement of the bridge span from a panel in a no-longer-extant control house at the foot of the center pair of towers.

A one-story, wood-frame control house sat on decking located between the two bridge transfer spans. The control house once contained the electrical controls for operation of the transfer bridges. Fragmentary photographic evidence suggests that this structure may have been similar to a “standard small office” design used by the B&O that measured 12' x 14'. Photographic evidence and a 1999 site visit revealed charred wood fragments, indicating the control house was destroyed by fire sometime prior to 1999. The only remnants of the controls are the corroded wiring, conduits, and remnants of broken slate control panels.

A wood-frame, one-story rectangular crew house was once located on shore between the two pairs of tracks serving the transfer bridges. Based on photographic evidence, this building disappeared sometime between 1976 and 1995, and no trace of it remains.

Each transfer bridge had two geared winches with cables that had hooks on their far ends. These hooks were attached to fittings on the bows of the carfloats to hold them securely to the face of the bridge span. Crews used large spoked wheels resembling ship’s wheels to manually operate these winches. Fabric covered their mechanisms, but like most of the facility they were otherwise exposed to the weather.

Condition [9]

The two transfer bridges have been left in place unattended since the B&O discontinued marine operations. Although freight car transfers to Fells Point ended in 1969, occasional transfer bridge operations are known to have continued into the early 1970s, with the last use likely in 1973.[10] As noted earlier, the upper machinery housings of the North Transfer Bridge have

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[9] Condition assessment based on field work completed by the recording team in 2010.

[10] Herbert H. Harwood, Jr., *Impossible Challenge II*, Baltimore: Barnard Roberts and Co., 1994, 302. Also Mike Buckelew to John G. Teichmoeller, Dec. 28, 2011.

essentially disappeared, but the primary structures, including the exposed structural steel towers and bridge spans, remain intact and appear to be in reasonably sound condition. The two slips for the carfloats were defined by three rows of wooden pilings known as “pins.” The outer pins were 100' long, while the center one measured 175' in length. Although the South Transfer Bridge’s outer pin is no longer extant, the other two pins remain, but in a deteriorated condition. The four tracks leading to the transfer bridges (two for each transfer bridge) have either been removed or buried by dirt and gravel.[11]

The mechanisms, while not presently serviceable due to inattention and an accumulation of dirt and debris, appear to be in reasonably good condition. There is no visible damage or vandalism to the mechanical components, though the condition of the numerous bearings is unknown. As noted above, the electrical control components have been destroyed. The wooden decking between the transfer bridges is in very poor condition due to hurricane damage. A hurricane also destroyed the original, wood Pier 10 immediately east of the South Transfer Bridge, and some of its remains now encroach into the South Transfer Bridge’s slip. The mooring winches have also deteriorated. While the metal components are largely intact, the wood parts and foundations are either missing or in suspect condition. The eastern winch for the South Transfer Bridge was destroyed by a hurricane, and while the other three winches remain only the hubs of the other three winches’ spoked operating wheels remain.

Operation

The basic operation of either transfer bridge was as follows. A railroad tugboat maneuvered a carfloat into the slip, and the waterside ends of the two bridge spans would be raised or lowered to match the level of the carfloat’s deck using the electrically-powered operating drums. If the carfloat was listing—a slight amount of list was common—the two bridge spans would be set at different levels to match the carfloat’s tracks. The carfloat tracks would be aligned with the tracks on the transfer bridges using steel bars known as “toggle bars” that slid through hollow fittings called “pockets” on the deck of the transfer bridge’s tilting heads and, in turn, into pockets on the deck of the carfloat when the latter was properly aligned. A prybar would be inserted into a slot in the shoreward end of the toggle bars and levered against a steel plate with transverse slots mounted to the deck of the transfer bridge. This leverage allowed one man to slide a toggle bar into and out of the pockets. This required no small effort, but when in service, the toggle bars would have been well greased. With the carfloat properly aligned, mooring cable hooks would be attached to each side of the bow of the carfloat. Using spoked wheels similar to a ship’s wheel, operators then manually turned the mooring winches to tighten the cables and pull the carfloat snugly to the face of the bridge span’s tilting head.

Once the carfloat had been moored to the tilting head, the operating-drum brake held that end of the pick-up counterweight’s cable in place. When cars were pushed across the transfer bridge—idler cars were used to keep locomotives off the span—the end of the span moved downward.

[11] B&O RR Co. Bridge Dept., Locust Point, Md. Transfer Bridges, 3 sheets: Sheet 1 (plan view), January 23, 1918, revisions August 17, 1952; Sheet 2 (side and front elevation of South Bridge), December 20, 1917; Sheet 3 (side and front elevation of North Bridge), no date. Located in Baltimore & Ohio Railroad Historical Society Archives, Arbutus, Maryland.

This motion was conveyed via cables to the top of the pick-up counterweight, which began to lift the top counterweight. Additional motion raised additional counterweights until the live load had been balanced. Because the operating drum-to-pick-up counterweight cable passed through a block pulled by a doubled cable connected through the dead-load counterweight to the span, the vertical motion at the pick-up counterweight was twice that of the span. After the unloading and loading operations were completed and one of the B&O's tugs had been tied to the carfloat, it was cast off by unhooking the mooring cable and disengaging the toggle bars. This mechanism was described in somewhat confusing detail in an article entitled "Baltimore's Car Ferry," by Harry C. Plummer in *Scientific American*, August 15, 1914. A more detailed description with the components described and keyed to a drawing, has been prepared for this documentation in the form of a technical appendix.

Design and Patents

The once extensive collection of railroad carfloat operations in various locations of the United States, and particularly along the east coast, is nearly extinct. Various transfer bridge designs were employed, and some of these were patented. Plummer credits F.L. Stuart, Chief Engineer of the B&O and W. S. Bouton, Engineer of Bridges of the B&O, with the design in "Baltimore's Car Ferry." The B&O's—and other railroads' for that matter—engineering management regularly patented their designs. As far as is known, transfer bridges employing pick-up counterweights of this design were only used on Baltimore Harbor. One example (a single installation) was located on Clinton Street in the Canton section of Baltimore, while the other (also a single installation) was located at W.R. Grace/Davison Chemical at Shedd's Point in the Curtis Bay section of Baltimore. Both are now gone.[12]

B&O Marine Operations in Baltimore

An article in the December 9, 1871, issue of the *Railroad Gazette* reported that carfloating in Baltimore Harbor started circa 1871 when the B&O had a steam tugboat and three carfloats constructed.[13] The B&O planned to use the tugboat and carfloats to eliminate the "through the streets" transfer of railroad cars (drawn by teams of horses, as steam locomotives were

[12] The gantry structure of another transfer bridge built by the Pennsylvania Railroad stands slightly offshore in the water near the corner of Boston and Clinton Streets, adjacent to the Maryland Korean War Memorial Park. The bridge spans, mechanism, and tracks are no longer extant, and the site has no identification or interpretation. The design of this transfer bridge, based on a patent by Andrew Mallery (Patent No. 743901, dated November 10, 1903), is entirely different from the B&O's design. Interestingly, the patentable feature of the Mallery patent is its "swiveling headblock," an element attached to the end of each of the transfer bridge spans that provided additional flexibility to the structure at its connection to the carfloats. Although there is no mention of its use on the B&O, the Locust Point transfer bridges clearly employ such a swiveling headblock (tilting head). Conversely, photographs taken of the out-of-service PRR Canton transfer bridge in 1975 appear to show that this facility used a stack of pickup counterweights, although with single- instead of double-bay towers. The rigging appears to have been simpler than that used by the B&O.

[13] "Transfer of Railroad Freights [sic] Through Baltimore," *Railroad Gazette* 3 (December 9, 1871): p. 379. From ship registration information, it appears that this tugboat was the *Transfer*, built at Wilmington, Delaware, with the registered dimensions of 99' length and 27.5' breadth. The tugboat was part of B&O operations until at least 1936 and perhaps as late as 1941. The company later acquired additional tugboats, including the *Baltimore* and the *Oscar G. Murray*, for service in Baltimore Harbor.

prohibited from tracks in the downtown streets by a city ordinance). Transfer of railroad cars, including entire passenger trains, ensued on a much larger scale in 1880, when the B&O started transferring trains across the harbor by ferry from a wooden transfer bridge at the location of the present day Pier 6 in Locust Point to the Philadelphia, Wilmington and Baltimore Railroad's transfer bridge at Boston Street in the Canton area. This operation employed a 324'-long, steam-powered sidewheel ferry named *Canton* and later the similar, 351'-long *John W. Garrett*, but this service was decidedly inferior to the Pennsylvania's all-rail route through the city that had been established with completion of the Union and B&P tunnels in 1873. The situation deteriorated further in 1881, when the B&O lost its friendly connection with the Philadelphia, Wilmington & Baltimore to the Pennsylvania in a complicated corporate battle worthy of the front page of today's *Wall Street Journal*. To counter this advantage, the B&O built the Baltimore Belt Line, including the 1.4-mile Howard Street Tunnel, to obtain its own all-rail route through the city. The Belt Line's opening in 1895 was expected to put an end to the car-ferry operation for passenger trains and most through freight trains.[14]

Within two years, however, increasing traffic volume slowly began to choke the Belt Line, and the B&O decided to divert more of its lower priority freight traffic back to a cross-harbor ferry using carfloats and tugboats (The *Canton* and *John W. Garrett* had been sold.). This increase in traffic began to take its toll on the old port facilities, and by the early 1900s, the B&O's Pier 6 transfer bridge was nearing the end of its useful life. Although no overall photo of the original Locust Point transfer bridge has surfaced, marginal portions of old photos and lithographs suggest that it was a wood Howe truss supported by pontoons, a common design when it was built.[15]

The B&O also needed to expand its marine service in Baltimore harbor. Thus, on August 16, 1910, the railroad awarded a contract to the Baltimore Bridge Company to build a new steel transfer bridge at Curtis Bay, another port facility located about 4 miles south of Locust Point. The rapidly deteriorating condition of the Pier 6 transfer bridge prompted the railroad to erect this new structure at Pier 6 and order a second one of like design from the Baltimore Bridge Company for Curtis Bay. (This Pier 6 facility appears to be the first transfer bridge constructed that was based on the design of Stuart, Bouton, and their team at the B&O.) It opened in fall 1911, and the Curtis Bay facility entered service the following year.

As traffic continued to increase and heavier freight cars came into use, the B&O management decided to make several changes to its Locust Point trackage and add another transfer bridge to

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[14] Herb H. Harwood, Jr., *Royal Blue Line* (Sykesville, MD: Greenberg Publishing Company, Inc., 1990), pp. 1-54. Also J. Lawrence Lee, "Baltimore's Belt," *Railroad History*, no. 192, spring 2005, pp. 32-45.

[15] Plummer, "Baltimore's Car Ferry." Plummer opens with, "To relieve traffic congestion on the electrically operated four-mile belt-line maintained by the Baltimore and Ohio Railroad … that company has restored the car-ferry which formerly was in operation between Locust Point and Canton …" Five new electric locomotives, called "motors" on the B&O, arrived to supplement the original three in 1903 and 1906, and a third-rail power supply replaced the pioneering, but troublesome, overhead rails in 1902. These relieved much of the Belt Line's congestion and most through traffic returned to it, but by then the company realized the potential value of other harbor operations, so it decided to retain and expand its fleet and facilities to support them. Also see Lee, "Baltimore's Belt."

improve its capacity and efficiency throughout the port. Since no room for a second transfer bridge existed at Pier 6, part of the change involved relocating all Locust Point carfloat transfer operations from Pier 6 west to Pier 10. One portion of this project involved disassembly of the 1911 Baltimore Bridge Company transfer bridge and its re-erection on new foundations at Pier 10. The railroad also contracted with the American Bridge Company to build a new steel transfer bridge next to the relocated one. Both installations began in late-1917 and were completed in March 1918. New tracks were laid from existing trackage to both transfer bridges. At Pier 10, the new transfer bridge became the South Transfer Bridge, and the relocated 1911 structure became the North Transfer Bridge. Pier 6 was subsequently rebuilt for other uses.

The timing was fortuitous, since the federal government had decided to nationalize American railroads, including the B&O, under the United States Railroad Administration (USRA) in December 1917, and it is questionable whether or not the USRA would have approved the new construction during wartime. The USRA remained in control throughout the remainder of World War I, and only relinquished control after Congress passed the Transportation Act of 1920. That act returned the carriers to private ownership and control, but under considerably stronger regulation by the Interstate Commerce Commission.[16]

The B&O employed a number of carfloat usage patterns between 1918 and its discontinuance of marine operations in 1969. One was to transfer cars back and forth between the B&O's isolated trackage in the Fells Point section of Baltimore across the harbor from Locust Point. There it had a pair of transfer bridges (of a different design) at the foot of Fell Street alongside Henderson's Wharf. (One of these had been relocated from the foot of President Street.) Cars to or from local side tracks were loaded and unloaded there. Alternatively, freight cars could be loaded and unloaded while they were still on board the carfloats and tied up at Henderson's Wharf. Some of the carfloats were equipped with central platforms at car-floor height and ramps at one, or both, ends to facilitate customers' use of these "floating team tracks."[17] A transfer bridge at the foot of President Street for a number of years was later moved to Fells Point as well.

In addition to cross-harbor car transfers, the B&O used carfloats to service ships directly. Freight cars on carfloats would be towed alongside ships moored at piers other than those serviced by the B&O for loading or unloading freight between these ships and the B&O. An especially important example of this was the use of carfloats to expedite the transfer of bananas. Both the B&O and the Pennsylvania Railroad would bring carfloats with cleaned and prepared refrigerator cars alongside banana boats tied up at Pier 1 on Pratt Street. Longshoremen would carefully unload the stems of bananas and carry them along the center platforms of the carfloats and into the refrigerator cars. Once the cars were loaded, the carfloats carrying them would be promptly moved to the transfer bridges, where the cars were landed and quickly dispatched in fast freight trains for designations west. Manually handled only once during the transloading

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[16] For complete details, see Rogers MacVeagh, *The Transportation Act, 1920* (New York: H. Holt and Co., 1923).
[17] "Team track" is the term for a railroad-owned side track that multiple customers who do not have private sidings can use to load or unload freight cars. The name stems from the teams of horses or mules originally used to pull wagons alongside the cars.

operation, the fragile fruit suffered minimal damage, and the rapid process helped to prevent it from ripening before it reached its destination. This so-called "fruit service" was discontinued when the B&O opened its new fruit pier in "Locust Point. South" on December 1, 1958.

General Baltimore Harbor marine operations—presumably defined as "lighterage" in the tariffs—were officially discontinued in 1969, when the B&O negotiated direct rail interchange arrangements with the Penn Central to service Fells Point.[18] However, the Locust Point transfer bridges were used later on rare occasions; for example, the Chessie System had a carfloat with some railroad equipment on board tied up along the Light Street bulkhead for the 1973 Baltimore City Fair. The transfer bridge would have been used to load and unload this equipment.

No subsequent use of the transfer bridges is known to have occurred. When Westway Terminals established its facility, it leased property from the Maryland Port Administration on both sides of the CSX's abandoned, but still owned, transfer bridges. Needing to establish a contiguous security perimeter for its entire facility, Westway leased the railroad's transfer bridge property. Westway has no need for the transfer bridges, but it does not have plans for new facilities that would necessitate their removal. Thus, these rare remnants of a once-vital operation in Baltimore Harbor remain, essentially intact and secure from vandalism, but largely forgotten and ignored.

[18] Herbert H. Harwood, Jr., *Impossible Challenge II*, 302.

ILLUSTRATED APPENDIX

Figure 1: View of the transfer bridge yard immediately west (left) of the Pier 10 warehouse, March 6, 1924. Between the two transfer bridges are the wooden frame yard office and control house. Except for the transfer bridges, nothing in this scene survives. (B&O photo, John Teichmoeller collection.)

Figure 2: Overall view of transfer bridges and slip with Grain Elevator Terminal (left), and National Molasses tanks (right). Note that the yard office is still standing, June 1979. (Herbert Harwood , Jr. photo.)

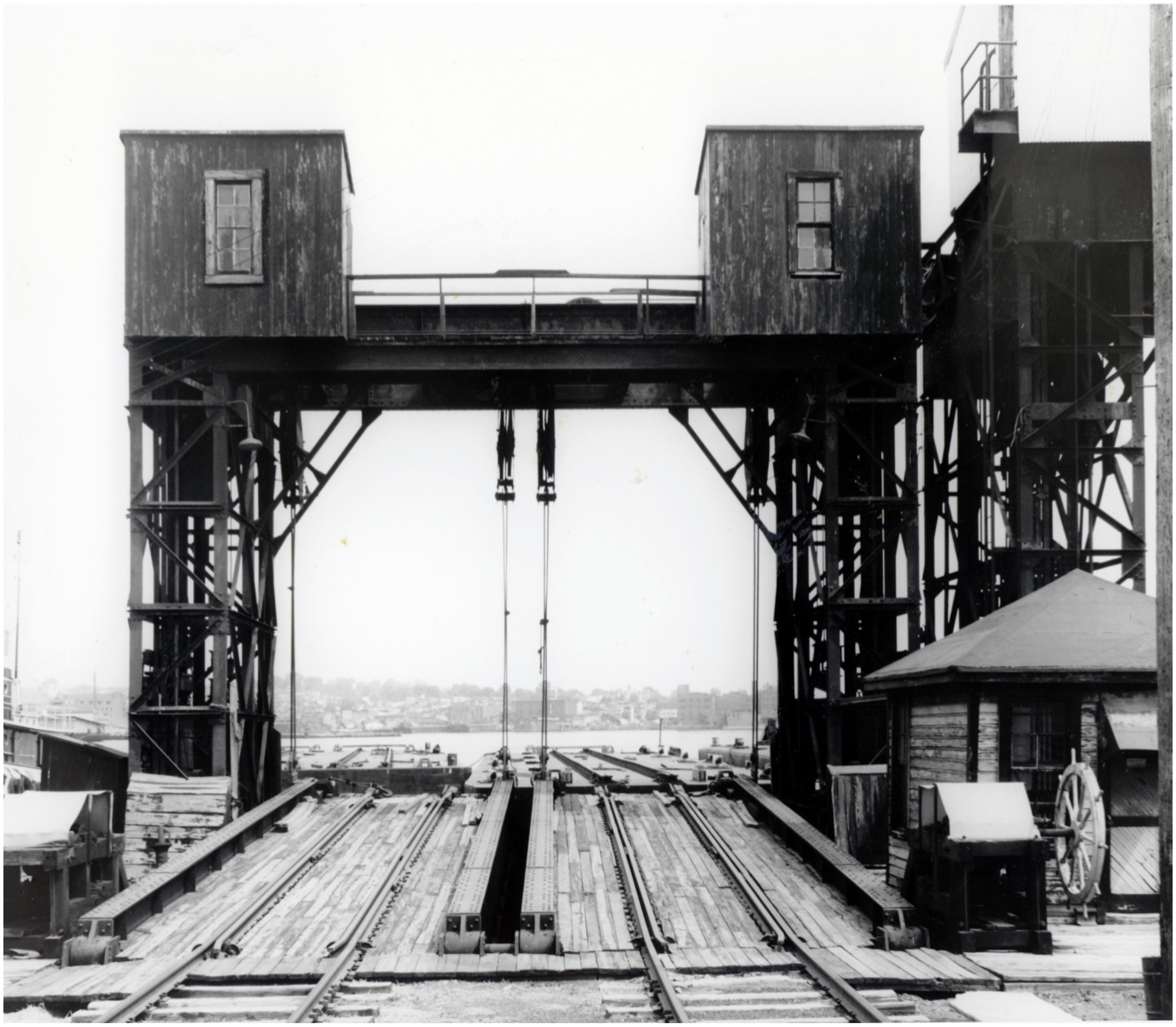

Figure 3: View of North Transfer Bridge from land side, August 1970 (approximately one year after regular carfloat service ended). Note the frame control house on the right, as well as mooring winches on each side. The bridge spans' hinges and the "ship's wheel" of the right winch are clearly visible. Two carfloats can be seen at the end of the bridge spans, one of them equipped with only a single-track. A mooring line with hook attached can be seen at the end of the left bridge span. (Herbert H. Harwood, Jr. photo.)

Figure 4: This early 1950s aerial view shows much of the B&O's railroad infrastructure on Locust Point, including a portion of its loop of track and a sizeable yard. Fort McHenry is at the top, and the Locust Point Grain Terminal Elevator is at center right. The Locust Point transfer bridges at Pier 10 are at bottom center. (B&O photo, Baltimore & Ohio Historical Society collection.)

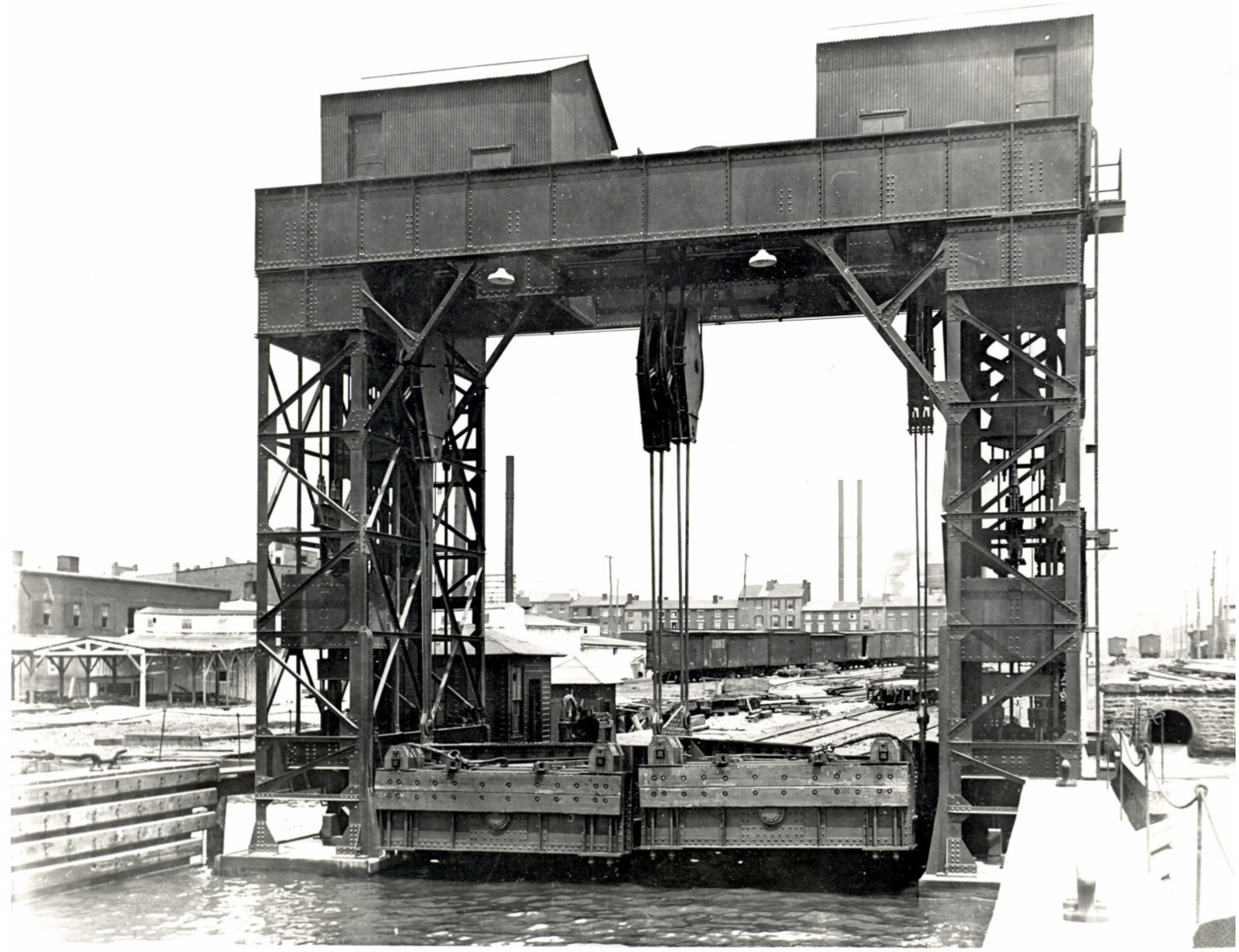

Figure 5: Waterside view of Canton Transfer Bridge, ca. 1914. Note the wooden buffer timbers on the tilting heads, as well as the pins that permit the heads to rotate. This structure is a virtual duplicate of the South Transfer Bridge at Locust Point. Since it appears nearly new, this photo may have been made as early as 1912, when the facility entered service. (B&O photo, John Teichmoeller collection.)

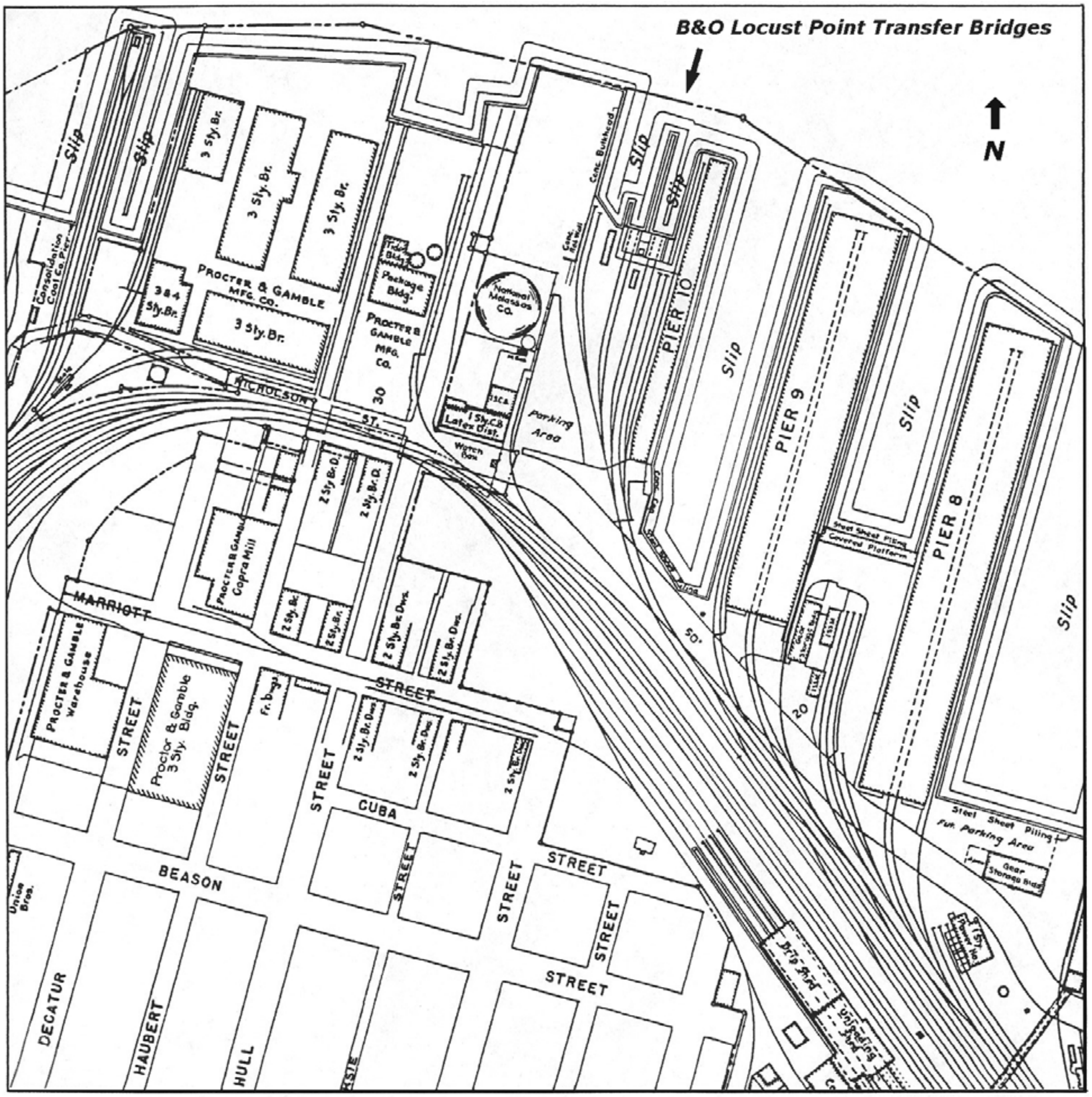

Figure 6. "Locust Point Marine Terminal" pier and B&O track arrangement, 1971. The Locust Point transfer bridges are located where shown on this map of the north side of Locust Point. (Baltimore & Ohio Historical Society collection.)

Figure 7. At right, B&O tug *Baltimore* nudges carfloat 165 into the South Transfer Bridge's slip in this undated view from atop the transfer bridge. Note this carfloat's covered central platform, the timbers used to keep cars from rolling off the end, and its list to port. On the left, B&O tug *Oscar G. Murray* is lashed to another B&O carfloat (with what appears to be a third track) that is being serviced by the North Transfer Bridge. Unfortunately, mooring and end details for it are not visible. Across the river at left is the B&O Tobacco Warehouse with several carfloats moored nearby. (B&O photo, John Teichmoeller collection.)

Figure 8. This ca. 1930 view shows a two-track wooden carfloat loaded with Fruit Growers Express refrigerator cars moored to the North Transfer Bridge. The timber one man is carrying is a bumper that will be inserted in the square slots outside the rails to keep cars from rolling off the carfloat in case the cars' hand brakes were not properly set. One of the mooring cables and hooks is visible at left. The purpose for the circular and square weights is not known. (B&O photo, John Teichmoeller collection.)

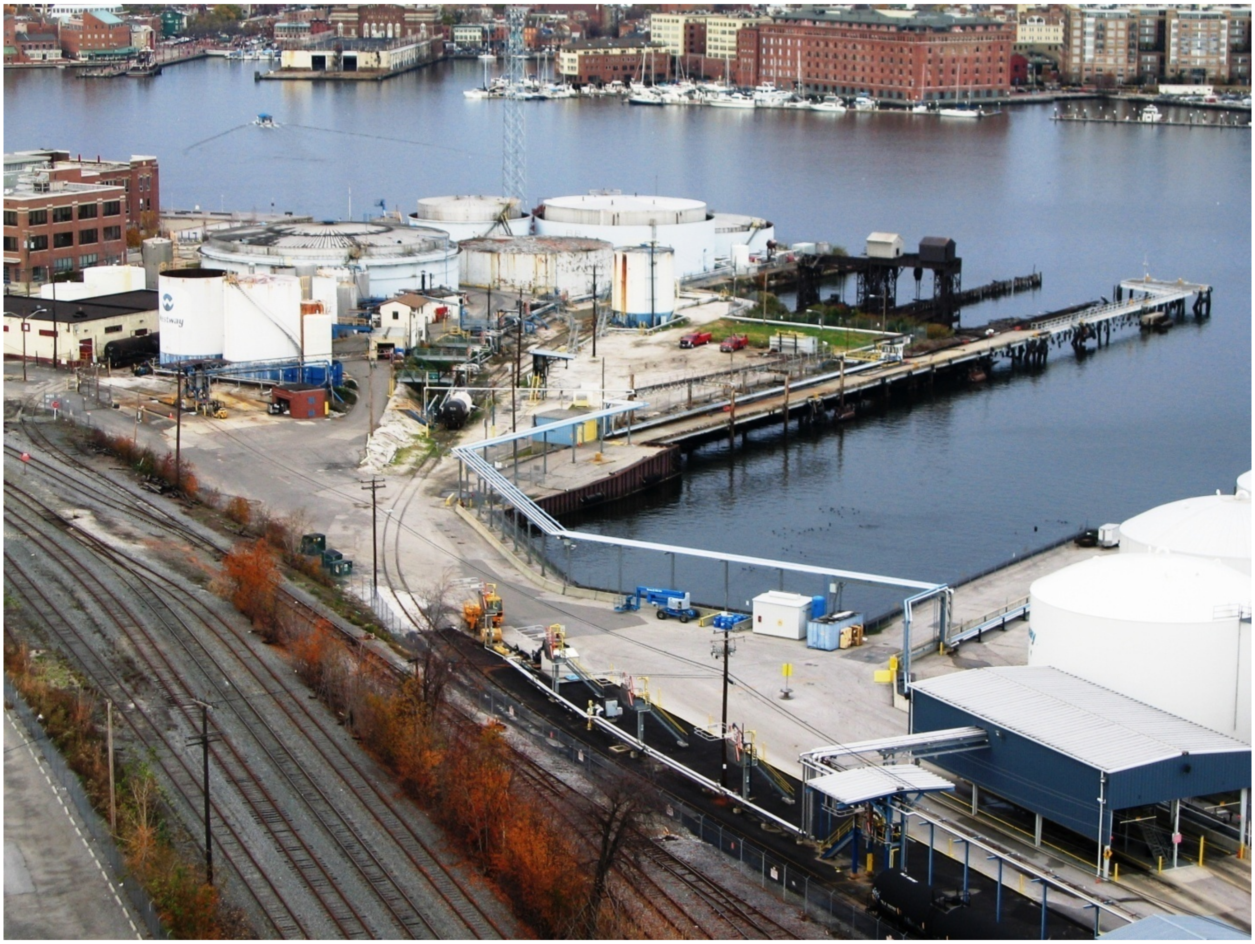

Figure 9: This November 2011 view from atop Silo Point (former Locust Point Grain Terminal Elevator) shows how the transfer bridges are now surrounded by the Westway Terminals facility. The slip of new Pier 10 is at center right. For many years, the B&O also operated a transfer bridge at Fells Point, directly above the transfer bridges on the far side of the river, where it had an isolated section of trackage to serve local businesses. (The large brick building there, now a residence condominium, was originally the B&O's Tobacco Warehouse.) Connection with this trackage was via carfloat from Locust Point. (Photo by John Teichmoeller)

APPENDIX—MECHANICAL DETAILS OF TRANSFER BRIDGE

Although virtually identical in concept and operation, the South and North transfer bridges at Locust Point Pier 10 have detail differences that result from their fabrication and erection by two separate companies. Except as noted, the following description of a single transfer bridge applies to both structures.

Bridge Spans
The B&O's Locust Point transfer bridges consist of a pair of steel structures identified as the North and South transfer bridges. Each transfer bridge has two tracks, with each track carried on a 48'-long, through-plate-girder bridge span. The girder on each side of each span is affixed to the concrete shore abutment with a 5"-diameter, transverse hinge pin that is free to rotate in a fabricated foot secured to the abutment. The bridge spans are free to pivot independently about these hinge pins. The spans' outer, or waterside, ends are suspended by a mechanism that allows them to be independently raised or lowered to mate with an adjacent carfloat, regardless of the water level or attitude of the carfloat. A flexible feature known as a tilting head at each span's waterside end has fittings to maintain continuity of the track alignment between the carfloat and bridge span as the carfloat's attitude (list) changes during loading or unloading.

Fixed Structure
Each of the two transfer bridges has a steel gantry structure that spans the outer ends of its two bridge spans. It supports the mechanism needed to support and adjust the outer ends of the bridge spans, as well as the components that counterbalance the weight of the bridges, or dead load, and the varying weight of cars moving across them, known as the live load. Each of the two gantry towers, fabricated from riveted steel angle stock, has two vertical bays that provide space for the counterweights. The towers are connected at their tops by a plate-girder span, upon which the remaining portions of two machinery houses, one for each bridge span, and the sheaves that route the cables are mounted.

Suspension of the Bridge Spans and "Dead Load" Counterweights
The waterside end of each span is supported from above. This support consists of a pair of vertical steel eyebars on each side with their lower ends pin-connected to the outer ends of the spans' plate girders and their upper ends pin-connected to a pair of blocks with dual sheaves. For each side of the bridge span, a pair of $1^5/_8$"–diameter cables, with one end of each attached to the overhead span, passes through each block.

From the attachment point, each cable is routed downward and around one of the block's two sheaves. This block is suspended with the axles of its sheaves oriented laterally (with respect to the bridge span). The axles are not coaxial, but are instead offset in the block to maintain clearance between the two cables. Each cable circles the lower half of its sheave until it is again oriented vertically.

As each rises above the top of the overhead plate girder span, it encounters another sheave with a longitudinally oriented axle. After circling over the top half of this sheave it continues downward to where it is affixed, via a two-stage equalizer assembly of fabricated steel angles, to a counterweight. (The cables from the far side of the bridge span traverse an additional pair of these sheaves to cross the top span, with each sheave changing its direction by 90º.) The dual-sheave block and equalizer ensure that the stresses in all four cables are equal, regardless of thermal expansion or any other conditions that might cause their lengths to be different, and the block rigging also causes the counterweight to move twice as far as the block, eyebars, and bridge. The weight of this counterweight along with the associated cable attachment components is approximately equal to one half of the weight of the hinged bridge span and its ties, rails, etc., collectively termed the "dead load." The other half is borne by the hinge pins on shore. A mirror-image of this arrangement supports the second bridge span of each transfer bridge.

This rigging arrangement is typical of most suspension-style transfer bridges, but the problem with this arrangement is that, when a railroad car rolled onto the bridge span, the car's weight introduced an additional force, known as the "live load" to the suspension system. With large car ferries and carfloats, a substantial portion of the live load could be taken by the vessel without undue changes in its trim, but the relatively small B&O carfloats were less forgiving. A car on the bridge span caused its outer end to descend, transferring part of the live load to the carfloat, pitching its moored end down and placing severe stresses on the toggle bars and sockets, as well as an undesired bending moment on the carfloat. This movements and forces were reversed when a car being unloaded moves onto land, but the effects were similar in magnitude. Moreover, when the live load occurred on only one of the bridge spans—a common situation—it induced a torsional force on the carfloat, which begins to list, and on the adjacent span that was also securely moored to it. If the freight car transfer was done slowly and deliberately enough, the bridge operator could continually adjust the bridge span levels with an electrically powered winch. The process was, however, slow and the simple design proved to be satisfactory only in low-traffic, low-speed applications.

To expeditiously handle high volumes of traffic, transfer bridges such as those at New York and Baltimore, employed a more-complex suspension that provided some degree of automatic rebalancing or load adjustment as freight cars moved between the carfloat and land. Several such mechanisms were used in New York, and the B&O developed its own design for Baltimore. These designs supplemented the dead-load counterweight with what is termed a "pickup" counterweight, a group of relatively small counterweights that could be individually lifted off the structure as needed to compensate for the live loads, but the B&O's design was particularly elegant in that it was an extension of the dead-load suspension system instead of a separate system, required no additional drive, and automatically engaged and disengaged as needed.

Live Load ("Pickup") Counterweights

Two cables are attached to the bottom of the dead-load counterweight for each bridge span. These continue downward to the base of the tower at which point they pass around the lower half of a pair of sheaves at the base of the tower. The axles of these sheaves are oriented laterally. The cables then pass upward in the land-side tower bay, where they are attached to and terminate at the bottom of another block that contains a single sheave.

At this point a seventh cable came into service. One end of this cable is attached to the top of a frame over a stack of small counterweight segments comprising the pickup counterweight. These segments were cut from thick steel plates, and one or more thinner steel plates rest on most segments to increase their weights. These likely were added to compensate for newer, heavier railroad cars over the years. There appear to be at least 12 of these segments in each stack. Each segment is attached to the one above and below it with 7 links of chain on the South Transfer Bridge (in addition to the fixed attachment links between the segments) and 5 links of larger chain on the North Transfer Bridge. Each segment is actually comprised of two halves, and an **L**-section steel guide bar extends vertically between the two halves to prevent the counterweights from swinging from side to side as they moved.

From its attachment to the pickup counterweight, the cable extends upward to the overhead plate-girder span connecting the two tower bays, over the top of a sheave, and downward to pass around the lower portion of the sheave in the sheave block. It then passes upward to the plate girder span and terminates at the operating drum. The location of the operating drum is the only significant mechanical difference between the North and South bridges. On the North Bridge, the cable passes around the top of another sheave, and from there continues downward to the base of the tower, where it is wrapped around and secured to the operating drum located there. On the South Bridge, the operating drum is mounted on the plate-girder span in place of the sheave. Each bridge span has its own independent system.

Operating Drum Mechanism

With different operating drum locations, the North and South transfer bridges have different drive mechanisms, but their operation is similar. On both bridges, the reversible electric motors that drove the operating drums are located on top of the connecting plate girder spans, but the mechanical power-transmission systems vary significantly. Each motor includes a spring-applied/electrically released shaft brake that stopped and secured the operating-drum mechanism whenever the motor was not running. Engaging the motor released the brake.

Each North Bridge motor turned open, spur, speed-reduction gears and a bevel gear set to rotate a vertical drive shaft that extends to the base of the tower. Here, that shaft's rotation was transmitted through a second bevel gear set and additional spur gears to the operating drum's horizontal shaft. The North Bridge's motors and upper gears were enclosed by wooden machinery houses during its service life, but both were later destroyed by a storm. One has collapsed in place, and the other has completely disappeared. While the motors and most of the mechanical components were protected from flood damage by their height, the operating drums on the North Bridge are at least partially submerged in the Patapsco River during high tides and storm surge events. Any effect of this on the drum bearings is not now known.

Each South Bridge operating drum is turned by a motor acting through one worm-gear reduction unit and four sets of open, spur, speed-reduction gears. All shafts are horizontal, though the worm-gear unit has its output shaft at a right angle to its input shaft. This equipment is entirely enclosed within two corrugated-metal machinery houses mounted on top of the overhead plate-girder span, and none of it is susceptible to flood damage.

Operation

The ingenious design of these transfer bridges allowed both manual adjustment and automatic operation of the pickup counterweight with only one motor and drum per bridge span. From any static position of a bridge span, winding more of the cable on the operating drum caused the single-sheave block to rise. Since only the dead load was involved here, the pickup counterweight acted as a foundation during this motion, holding its end of the cable in place. This pulled on cables and caused the dead-load counterweight to descend, which, in turn, exerted a tensile force on the cables routed through the overhead sheaves and the double-sheave block, thus, pulling on the eyebars and causing the outer end of the bridge span to rise, and *vice versa*. B&O drawings indicate that the design called for a maximum adjustment of 3 ft. above the level position and 4 ft. below level at the end of each bridge span. This adjustment allowed an operator to match the end of each bridge span to the carfloat's deck level and list so that mooring could be solidly done.[19]

When a car rolled onto the bridge span, its weight created a downward force on the eyebars and double-sheave block that was transferred through the cables to produce an additional upward force on the dead-load counterweight. With the dead-load counterweight's mass only sufficient to balance the dead load of the bridge span, it moved upward, passing the live-load force through to the cables that connect it to the single-sheave block, which was pulled down. Since the drum motor was stopped, its brake was engaged, and the drum then acted as the foundation for the cable connecting it to the pickup counterweight. Accordingly, the block's motion pulled the pickup counterweight frame upward, lifting the counterweight segments one by one until the live load was balanced. While the bridge span and the end of the carfloat had to descend somewhat to induce pickup-counterweight motion, the motion was only a fraction of what would otherwise have occurred. The process acted in reverse when a car rolled off the bridge onto either the carfloat or the land.

In an interview, a retired B&O brakeman noted that, while this system worked as described, it did not address every operating condition. The B&O carfloats experienced pronounced lists during loading and unloading process, since the tracks had to be alternately loaded or unloaded. The tilting head connection at the end of each bridge span rotated to permit listing to occur without generating torque forces between the carfloat and the span that the list would have otherwise created. As the carfloat's draft increased during loading, and *vice versa*, the bridge span and dead-load counterweight would have moved as necessary to accommodate the change. If, however, this travel neared its limit, the operator could adjust the operating drum at any time.[20]

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[19] B&O RR Co. Bridge Dept., Locust Point, Md. Transfer Bridges, 3 sheets: Sheet 2.

[20] John G. Teichmoeller with Mike Buckelew, "Operations at B&O's Locust Point Carfloat Yard," *The Sentinel* (September-October 1995), pp. 3-16.

Bibliography

Baltimore & Ohio Railroad. "Locust Point Transfer Bridge," drawings 3 sheets, drawing number not visible, latest revision date, August 27, 1952. Located in Baltimore & Ohio Railroad Historical Society, Arbutus, Maryland.

Dunlap, David W. "Queens West Begins With a Park." *The New York Times*, September 18, 1994, p. 9.

Harwood, Herbert H. Jr. *Impossible Challenge II*. Baltimore: Barnard, Roberts and Co., Inc., 1994.

____________. *Royal Blue Line*. Sykesville, MD: Greenberg Publishing Company, Inc., 1990.

Historic American Engineering Record, National Park Service, U.S. Department of the Interior. "Greenville Yard, Transfer Bridge System." HAER NJ-49-A, 1981.

Keith, Robert C. *Baltimore Harbor–A Picture History, Third Edition*. Baltimore: Johns Hopkins University Press, 2005.

Lee, J. Lawrence. "Baltimore's Belt." *Railroad History*, no. 192, spring 2005, pp. 30-51.

Muschamp, Herbert. "Where Iron Gives Way to Beauty and Games." *The New York Times*, December 13, 1998, p. 35.

Plummer, Harry C. "Baltimore's Carferry." *Scientific American*, August 15, 1914, p. 120.

Rantanes , Eli C. with Laura Sebastian-Coleman. *Railroading Along the Waterfront*. Milwaukee Wm. K. Walthers, 1996

Teichmoeller John G. "Rail-Marine in Baltimore Harbor in Walthers' Railroading Along the Waterfront." *Transfer,* no. 32 (January-August, 2001), pp. 6-15.

Teichmoeller , John G. with Mike Buckelew. "Operations at B&O's Locust Point Carfloat Yard." *The Sentinel*, September-October 1995, pp. 3-16.

"Transfer of Railroad Freights[sic] Through Baltimore." *Railroad Gazette* 3 (December 9, 1871): p. 379

Tratman, E. E. R. "Railway Car-Ferries, American and Foreign." *Proceedings of the Forty-First Annual Convention of the American Railway Engineering Association, Volume 41*, 1940, pp. 965-1031.

Yarlott, Robert, CSX Vice President of International Business Development, to E. Ray Lichty, retired CSX President, email correspondence, July 16, 2010.