INTERLOCKING TOWERS ON AMTRAK'S RIGHT-OF-WAY IN PENNSYLVANIA

A Historic Architectural and Industrial Examination And Determination of Eligibility for Listing into the National Register of Historic Places of 19 Extant Towers along the former Pennsylvania Railroad between Morrisville and Marcus Hook (the Northeast Corridor) and between Philadelphia and Harrisburg (the Keystone Corridor)

Zoo Tower, in Philadelphia where Amtrak's Northeast Corridor Line and Keystone Corridor Line join *(photo by John R. Bowie, A.I.A.)*

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TABLE OF CONTENTS

PART 1 - INTRODUCTION

1.1 Executive Summary:

Within Pennsylvania, the National Passenger Railroad Corporation (Amtrak) operates passenger trains on the route of the former Pennsylvania Railroad (PRR) along the Northeast Corridor, between Morrisville and Marcus Hook, and along the Keystone Corridor, between Philadelphia and Harrisburg. It also owns these sections of track, as well as the rights-of-way and all appurtenant structures, including catenary lines, signals, bridges, culverts, buildings and interlocking towers.

At present, the Northeast Corridor contains eleven (11) interlocking towers in Pennsylvania: Morris, Grundy, Holmes, Shore, North Phil, Zoo, Arsenal, Brill, Baldwin, Lamokin and Hook. Likewise, at present, the Keystone Corridor contains six (6) interlocking towers: Overbrook, Bryn Mawr, Paoli, Thorn, Park and Cork. In addition, along the Keystone Corridor, the Landisville Block Station contains interlocking control for a former Reading Railroad crossing, and State Tower is located within the Harrisburg Pennsylvania Railroad Station.

Amtrak is committed to returning the railroad to a State of Good Repair (SOGR). At present, nine (9) interlocking towers and structures along the Northeast Corridor and Keystone Corridor in Pennsylvania are not occupied, are no longer economical to repair, or else have been deemed redundant, including: Shore, North Phil, Arsenal, Brill, Baldwin, Lamokin, Hook, Bryn Mawr and the Landisville Block Station.

Because all of Amtrak's PRR interlocking towers are more than 50 years old, and because Amtrak proposes to utilize federal funds provided by the Federal Railroad Administration (FRA), an agency of the federal government, for any work on these towers (including demolition), Amtrak is required to establish a context for all 19 towers – both historic architectural and industrial, and to determine their level of cultural significance, both individually and as a group. In addition, Amtrak is required to evaluate whether any actions it may propose will adversely effect those buildings determined to be historic (demolition is always an adverse effect on a historic resource). Finally, Amtrak is required to explore possible ways to avoid, minimize or mitigate the adverse effect on the historic resources as part of its efforts to achieve a SOGR.[1]

In summary, this report has determined that sixteen (16) of Amtrak's 19 interlocking towers in Pennsylvania should be considered eligible for listing into the National Register of Historic Places (the Register). Copies of the individual Pennsylvania Historic Resource Survey Forms are appended herewith. Three (3) of the 19 towers – Brill, Baldwin and Lamokin, are not considered eligible for listing in the Register. This report summarizes these investigations, and is divided into three parts: Part 1 – Introduction, and Part 2 – History and Significance, and Appendix A – the individual survey forms.

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[1] See 36 C.F.R. Part 800(4) entitled "Identification of Historic Properties," and Part 800(5) entitled "Assessment of Adverse Effects." These are included in 36 C.F.R Part 800 – Protection of Historic Properties (incorporating amendments effective August 5, 2004), Subpart B – The Section 106 Process.

1.2 Project Methodology:

The project commenced with Amtrak project managers identifying the nine (9) interlocking towers that are no longer occupied, no longer economical to repair, or deemed redundant. As part of this process, Amtrak project managers interviewed supervisors within Amtrak's Bridges & Buildings (B&B), Communications & Signals (C&S), Electric Traction (ET) and Maintenance-of-Way (MOW) departments to determine if the unoccupied towers could be used by their respective crews for other railroad-related purposes. Also as part of this process, Amtrak project managers and members of the consultant team conducted field surveys of each tower in order to determine its condition and relative level of deterioration. An "Existing Condition Report" was prepared for each tower, which also contained field sketch drawings of plans and elevations, plus field photographs and copies of readily available miscellaneous secondary source documentation.

A related component of this process involved Amtrak project managers and members of the consultant team conducting field surveys of the remaining ten (10) interlocking towers in Pennsylvania. Those towers are presently used for train control (their original use) or else have been converted to alternative rail-related uses (such as offices, workshops and storage spaces) for the various Amtrak crews. A "Historic Building Report" was prepared for each of these towers; each report also contained field sketch drawings of plans and elevations, plus field photographs and copies of readily available miscellaneous source documentation.

Taken together, the "Existing Condition Reports" and "Historic Building Reports" provide a comprehensive view of Amtrak's nineteen (19) extant Pennsylvania towers, and establish the basis for creating a historical context.

1.3 Project Team:

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PART 2 – HISTORY AND SIGNIFICANCE

2.1 Growth of the Pennsylvania Railroad within Pennsylvania:

2.1.1 Three separate companies merge together

The Northeast Corridor and Keystone Corridor of the Pennsylvania Railroad (PRR) came into being with the consolidation of several independent, but related rail lines. The first of these lines, the Philadelphia & Trenton Railroad Company (P&T) was chartered by the Pennsylvania Legislature on February 23, 1832 to construct a 27-mile railroad between those two cities. Construction began in 1833 and the line was subsequently extended southward into Kensington (just north of Philadelphia) in 1834. In 1836, Matthais Baldwin's newly-constructed locomotive made the trip from Kensington to Morrisville (26 miles) in 55 minutes and the return trip in 46 minutes. By 1839, the bridges at Trenton and New Brunswick, New Jersey were reinforced to safely handle the locomotives, and trains were then able to travel from the Philadelphia area to the New York area. The P&T operated this line until after the start of the Civil War.[2]

To the west of Philadelphia, the Keystone Corridor of the PRR came into being with the June 25, 1857 purchase of the Philadelphia & Columbia Railroad (P&C) by PRR President John Edgar Thomson for $7.5 million (the only bid received). The P&C was initially chartered by the Pennsylvania legislature in 1826 to survey and develop a statewide canal system, and which expanded to become a "Main Line of Public Works" in 1828 to include the combined use of canals, railroads and inclined planes to cross the state. The P&C was a component of this system, and it consisted of a combination of inclined planes and tracks that proceeded westward from Philadelphia and reached Columbia on the Susquehanna River as a double-track main line on October 7, 1834. Construction across the rest of the state, and the Allegheny Mountains in particular, was sporadic and fraught with technical and financial problems – and for the next ten years it proceeded at a frustratingly slow pace, exacerbated by poor management and a bad economy.[3]

In April 1846, the Pennsylvania Railroad (PRR) was chartered as a private enterprise separate from the Commonwealth. From the outset, it was better capitalized and employed brilliant young engineers and managers who completed the line to Pittsburgh by 1852.[4] Just five years

[2] The information in this paragraph is taken from David W. Messer and Charles S. Roberts' excellent *Triumph V, Philadelphia to New York, 1830:2002*, see pages 14-15. The *Triumph* series of books provides well-written, authoritative and generously-illustrated chronicles of the development of the various sections of the Pennsylvania Railroad. They are heavily referenced (and footnoted) in this report.

[3] The information in this paragraph taken from David W. Messer's *Triumph II, Philadelphia to Harrisburg, 1828-1998*, see pages 13-19.

[4] It should also be noted that at the same time the charter was issued to the newly-organized PRR to build a railroad from Harrisburg to Pittsburgh, the Pennsylvania legislature also granted a charter to the Baltimore & Ohio Railroad (B&O) to complete its line from Cumberland, Maryland (opened in 1842) to Pittsburgh – which provided a substantial incentive for the PRR to act quickly and efficiently. In the end, the home-grown political influences forced the B&O to open its westward line in Wheeling, Virginia (now West Virginia) on the Ohio River, in 1850 – two years ahead of the PRR at Pittsburgh. See Edward Hungerford's excellent doctoral dissertation *The Story of the Baltimore & Ohio Railroad 1827-1927, Vol. 1*, copyright 1928 by G.P. Putnam's Sons (New York), pages 242-244.

later, the PRR purchased the old P&C (and all the other portage railroad and canal assets) from the Commonwealth and proceeded to institute a nearly 30-year program to upgrade and realign much of the main line between Philadelphia and Harrisburg. By the time of the Civil War, trains carrying troops and supplies could travel eastward across the entire state, but only as far as West Philadelphia.[5]

The third (and final) line of this network of railroads to be integrated into the PRR was the amalgamation of several independent companies that came to be known as the Philadelphia, Wilmington & Baltimore Railroad (PW&B), and later the Philadelphia, Baltimore & Washington Railroad (PB&W). To begin, on April 2, 1831, the Philadelphia & Delaware County Railroad was chartered to construct and provide rail service between Grey's Ferry (just south of Philadelphia) and Wilmington, and on January 18, 1832, the Wilmington & Susquehanna Railroad Company was chartered. Likewise, the Baltimore & Port Deposit Railroad was chartered on March 5, 1832, and the companies were consolidated into the PW&B on March 14, 1836, and service between Philadelphia and Baltimore commenced on January 17, 1838, after construction of a short section of track between Greys Ferry and center city Philadelphia. But up until the time of the Civil War, there was no direct connection in Philadelphia from PW&B trains to P&T trains or vice-versa. Likewise, there was no connection with PRR trains in West Philadelphia.[6]

On May 3, 1860, the Pennsylvania legislature authorized the formation of the Junction Railroad Company, a three-mile long joint effort of the PRR, the PW&B and the Reading Railroad to connect their stations in West Philadelphia and create an alignment with other carriers (notably the P&T) that would link the northern and southern lines and avoid the congested parts of the city. During the Civil War, travelers and materials moving through Philadelphia were mired by transfers from station to station, and construction of the Junction Railroad moved at a slow pace. But the line was eventually opened to traffic on July 1, 1866 – thus enabling passengers to travel direct from New York to Washington, D.C. in ten hours. At roughly the same time, the PRR began construction of a six-mile long Connecting Railroad (chartered in 1863), which ran from West Philadelphia to the Frankford Junction interchange with the P&T, thus linking the north-south route with the east-west lines. It opened for passenger traffic in October 1867.[7]

Over the next several decades, PRR control of these lines increased – first with long-term operating leases, then with exclusive leases, then ultimately with the outright purchase of the companies themselves. In 1871, the Connecting Railroad and the P&T were leased to the PRR, and on March 7, 1881, the PRR bought controlling shares in the PW&B. The PRR consolidated its ownership of the PW&B on November 1, 1902 with the purchase of the Baltimore &

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[5] See *Triumph II, Philadelphia to Harrisburg, 1828-1998*, pages 23-24 for information in this paragraph.

[6] The information in this paragraph taken from Charles S. Roberts and David W. Messer's *Triumph VI, Philadelphia, Columbia, Harrisburg to Baltimore and Washington, D.C., 1827-2003*, see pages 37-39.

[7] The information in this paragraph taken from David W. Messer's *Triumph III, Philadelphia Terminal, 1838-2000*, see pages 11-12, 109-110, and 316.

Potomac Railroad (in Maryland), and it changed the name of this section of track to become the Philadelphia, Baltimore & Washington Railroad (PB&W).[8]

By the early 1900s, the PRR had emerged as the railroad empire that came to control the Northeast Corridor between Washington, D.C. and New York, and the east-west connection between New York, Pittsburgh and points west (including the Keystone Corridor between Philadelphia and Harrisburg).

2.1.2 Electrification

Electrification was installed on the section of main line track between Broad Street Station and Paoli in 1913-15 as a means of improving the flow of commuter traffic into and out of the station. Several years earlier, the PRR electrified the tracks under the Hudson River into the newly-constructed Pennsylvania Station in New York – but that was done with an electrified third-rail. On the 19.9 mile Philadelphia main line, the PRR utilized a series of tubular steel catenary poles with overhead wires carrying 11.0 kV, 25 Hz, a.c. electric power to operate the trains. Power was purchased from the Philadelphia Electric Company where it was stepped up from 13.2 kV to 44.0 kV (to reduce the loss of voltage while in transmission) at the PRR's substation near Arsenal Interlocking Tower (in Southwest Philadelphia). From there, it was carried by transmission lines set on top of the catenary poles to three substations: West Philadelphia, Bryn Mawr and Paoli. From each of those substations, it was stepped back down to 11.0 kV @ 25 Hz to supply the catenary system. Also at the same time, the PRR upgraded the track signaling system to utilize electrical position lamps rather than the old-fashioned manual position semaphores. The electrification was placed into service on September 12, 1915, and within one month, MP54 multiple-unit electric cars had replaced the entire fleet of steam locomotives for main line commuter service.[9]

In 1928, the PRR announced the continued electrification of its system, including 26.7 miles south to Wilmington, Delaware on its main line and 27.5 miles west to West Chester on its suburban line. Shortly thereafter, plans were unveiled that called for total electrification of the entire line between New York and Washington, D.C., including the Sunnyside Yard and Hell Gate Bridge (in New York) and the Potomac Yards (in Virginia). Construction began in November 1929, just after the stock market crash, and continued through the early years of the Great Depression. During that time, the PRR had to contend with lower revenues (from decreased shipping), massive layoffs, and the need to borrow from the federal government to assist in the improvement, as well as the purchase of new electric locomotives. On February 10, 1935, the first electric passenger trains ran between New York and Washington, D.C., with freight service following three months later.[10]

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[8] See *Triumph VI, Philadelphia, Columbia, Harrisburg to Baltimore and Washington, D.C., 1827-2003*, page 43 for information in this paragraph.

[9] See *Triumph III, Philadelphia Terminal, 1838-2000*, pages 163-165 for information in this paragraph.

[10] See *Triumph VI, Philadelphia, Columbia, Harrisburg to Baltimore and Washington, D.C., 1827-2003*, pages 44-45 for information in this paragraph.

Immediately thereafter, the PRR decided to electrify all of its remaining trackage between Philadelphia and Harrisburg, including the remainder of the main line, the Trenton Cut-Off, the Philadelphia & Downingtown Low Grade and the Atglen & Susquehanna Low Grade.[11] Electrification began on these lines in January 1937, utilizing steel H-poles spaced between 250 and 300 feet apart – less costly and easier to install than the tubular steel poles used on the earlier lines. On January 15, 1938, the first passenger train was operated between Philadelphia and Harrisburg (pulled by the newly-delivered GG-1 Number 4859); freight service was initiated three months later (see Fig. 1).[12]

Fig. 1: copy of article from *Model Builder* magazine, page 15, dated May/June 1938 describing how the model railroader can realistically build model catenary wire systems. However, note that the photographs in the article show the construction of the PRR catenary lines in front of Gap Station (in Lancaster County, PA). The photos were most likely taken just before publication of the magazine. *(Article found by Steven C. Smith from www.trainlife.com)*

[11] As a clarification, the western end of the electrification was Enola Yard, on the western side of the Susquehanna River, approximately five miles west of Harrisburg, where the Atglen & Susquehanna Low Grade rejoins the main line. The Port Road section of the main line, which ran along the eastern bank of the Susquehanna River and connected Harrisburg with Perryville, Maryland was also electrified at this time. However, it is currently owned by the Norfolk Southern RR and is not part of this study.

[12] See *Triumph II, Philadelphia to Harrisburg, 1828-1998*, page 43 for information in this paragraph. On the same page, the author goes on to mention that as early as 1908, the PRR had studied electrifying its line all the way to Pittsburgh. However, the cost overruns associated with the Paoli electrification project, combined with a recession, internal debates and World War I caused the idea to be placed on hold. According to Michael Bezilla's excellent *Electric Traction on the Pennsylvania Railroad, 1895-1968,* (The Pennsylvania State University Press, copyright 1980), pages 166-173, the PRR actively continued to investigate the Pittsburgh electrification project up to and throughout World War II. However, the combination of post-War high labor costs, heavy employee lay-offs, loss of profits, and the rapidly-emerging dieselization program (which was a substantially less costly investment), all caused the PRR to ultimately cancel electrification. Both the dieselization program and the electrification program would require massive investments in new motive power; however, new diesel locomotives could run on existing trackage while the electrics would require the construction of catenary lines, substations and transmission lines – a greater investment than the PRR's Board was willing to make – even though it would shorten the New York to Chicago passenger trip to two hours less than the rival New York Central's service.

2.1.3 Other infrastructure upgrades

Throughout the late-19th and early-20th centuries, the PRR constantly upgraded its trackage. Its work included roadbed-specific repairs such as tie replacements, rail upgrades (replacing lighter-gauge rail with heavier-gauge rails to handle heavier cars and locomotives), bridge replacements, culvert replacements, and ballast and drainage upgrades. However, the PRR also undertook extensive upgrades to increase speeds (and thus reduce the amount of time to move passengers and freight between points) and to increase safety to the public – particularly in densely-populated urban areas.

Upgrades along the Keystone Line included significant realignments and new trackage over a 20 year period of time after the PRR took over the former P&C. It also included modifications to the alignments when the Trenton Cut-Off, Philadelphia & Downingtown Low Grade and Atglen & Susquehanna Low Grade lines were completed between 1903 and 1906. Also, it included modifications when the line was electrified first in 1913-15 and again in 1937-38.[13]

Major upgrades along the Northeast Corridor lines occurred at several key times. The first was the 1902 Improvements Plan which elevated the entire main line through Chester and into Wilmington, Delaware. This not only eliminated grade crossings (and the speed restrictions placed on them), it also enabled increased tonnage to be carried by additional tracks south toward Baltimore and Washington, D.C. The second upgrade occurred in 1904-05 in the area between Bristol and Morrisville. The Delaware River bridge into Trenton was reconstructed at that time, and the entire area surrounding Morrisville was elevated and reconfigured to accommodate the newly-constructed Trenton Cut-Off. Likewise, several miles west, the main line through Bristol was realigned to avoid the entire area.[14]

Upgrades along the Connecting Railroad in Philadelphia occurred at numerous times throughout the 1880s up into the 1910s. To begin, the Chestnut Hill Branch (now known as SEPTA's Chestnut Hill West commuter line) was constructed and opened in 1884. At the same time, the entire right-of-way was realigned, elevated and increased to six tracks between 1887 and 1915. And in 1901, North Philadelphia Station opened adjacent to the Connecting Railroad overpass at North Broad Street. This station was used by the PRR for years for passengers on the New York-to-Chicago trains to avoid the congestion of Broad Street Station in center city.[15]

The PRR continued to maintain its infrastructure throughout World War II and into the 1950s. However, as the nation's passengers shifted their travel preferences to the automobile and as more and more companies chose to ship their goods and materials by truck, the precipitous decline in revenues led to eventual decline of the PRR, as well as many other railroads across the country. Soon thereafter, maintenance on the PRR's infrastructure ceased, and by October 1969,

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[13] See *Triumph II, Philadelphia to Harrisburg, 1828-1998*, pages 42-46, and *Triumph III, Philadelphia Terminal, 1838-2000,* for information in this paragraph.

[14] See *Triumph VI, Philadelphia, Columbia, Harrisburg to Baltimore and Washington, D.C., 1827-2003,* page 43 and *Triumph V, Philadelphia to New York, 1830-2002*, pages 33-34 for information in this paragraph.

[15] See *Triumph III, Philadelphia Terminal, 1838-2000*, pages 15-16 for information in this paragraph.

the PRR was merged with the New York Central into the Penn Central Transportation Company. In June 1970, one year later, the Penn Central declared bankruptcy. In May 1971, the National Railroad Passenger Corporation (known initially as Railpax, and later as Amtrak) was created to take over long-distance passenger operations, and in November 1975, the Consolidated Rail Corporation (Conrail) was formed out of the Penn Central and several other failing freight carriers.[16] Today, Amtrak owns the trackage, right-of-way, buildings and structures on which to operate its passenger trains between New York and Washington, D.C., and between Philadelphia and Harrisburg.

<u>2.2 Evolution of Interlocking Control:</u>

<u>*2.2.1. Beginnings of Interlocking Control*</u>

An interlocking is loosely defined as "an arrangement of signals or signal appliances so interconnected that their movements must succeed each other in proper sequence and for which interlocking rules are in effect. It (the interlocking) may be operated manually or automatically."[17] Typically, interlockings were constructed by railroads in such locations as:

- Grade crossings with other rail lines,
- Locations where trains would cross over from one track to another (and hence occupy a section of track normally occupied by trains approaching in the opposite direction),
- Locations where major branch lines and heavily-used sidings join the main line, and
- Lift bridges.

Interlocking control technology began to emerge in the 1860s on England's rail lines with the development of John Saxby's interlocking machine that combined signal and track switch control, which the Prince of Wales (the future King Edward VII) lauded and praised Saxby as having "...done more than any man living in the reign of Queen Victoria to save human life." The first Saxby & Farmer switch machine in America was installed in Trenton, New Jersey by the Camden & Amboy RR in 1870.[18]

<u>*2.2.2. Armstrong Switch Machines*</u>

Initially, switch machines were mechanical in nature. They typically consisted of heavy-metal frames, fastened to the second floor framing and structural elements of the tower. They contained a series of long metal levers – each lever controlled an individual track switch or a semaphore signal by means of a long metal rod that dropped into the basement of the tower, turned 90-degrees to exit the building trackside at grade, and turned 90-degrees again to travel to

[16] See *Triumph III, Philadelphia Terminal, 1838-2000,* pages 341-346 for information in this paragraph.

[17] Stephen A. McEvoy, in his excellent book *The Classic Railway Signal Tower, New Haven Railroad S.S. 44/Berk,* (Western Connecticut Chapter, National Railway Historical Society, Inc., copyright 2007), page 29, gives this definition and attributes it to the New Haven RR, the Penn Central RR, and many other railroad operating rulebooks.

[18] See *The Classic Railway Signal Tower, New Haven Railroad S.S. 44/Berk,* page 29 for information in this paragraph.

the switch or signal it controlled,[19] and turned 90-degrees again (either horizontally for a track switch or vertically for a semaphore signal) to attach to the device. The rods were typically ganged together and generally were supported on rollers set just above the grade. It took a strong-armed operator to be able to successfully move the switch lever – hence the term "Armstrong," which became an industry moniker (see Figs. 2, 3 and 4).

Fig. 2 (above, left): general view of the interior of J Tower at the Strasburg Railroad in Lancaster County, PA. This tower was relocated from its original location in LeMoyne, PA by the Lancaster Chapter of the National Railway Historical Society (NRHS) in 1983. The view features the Armstrong switch levers as well as the reconstructed model board (above). *(Photo by Tony White, Western Connecticut Chapter, NRHS.)*

Fig. 3 (above, right): detail view of the Armstrong switch levers at J Tower in Strasburg, PA; note also the metal locking bed placed on the floor directly behind the switch levers. *(Photo by Tony White, Western Connecticut Chapter, NRHS)*

Fig. 4 (above): copy of image of Dillerville Junction Tower, taken in the 1890s (exact date unknown) by William H. Rau, and published in *Traveling the Pennsylvania Railroad: the Photographs of William H. Rau*, edited by John C. Van Horne with Eileen E. Drelick, (University of Pennsylvania Press, copyright 2002), page 105. This extraordinary image (which looks west – the main line to Harrisburg curves off to the right and the branch line to Columbia goes straight) shows not only the tower (long ago removed) but also the above-grade switch and semaphore signal piping (red arrow).

[19] In some instances, the track switch could be as far as a half-mile away from the tower – a very long distance for a rod to run. In actuality, the rods did not turn 90-degrees – they were in fact lever-connected.

The success of the Armstrong switch machine (and the feature that ultimately led to its use world-wide) was the mechanical interlocking – the lever rods were positioned parallel to each other within the locking bed of the switch machine, which also contained a series of pins (similar to lock tumblers) running perpendicular to the lever rods. A pre-defined quantity of pins needed to be aligned in the correct position within the locking bed for the track switch to be thrown. This would guarantee that a crossover track's switch would not be opened until the opposing track's semaphores were aligned to prohibit an oncoming train from entering the affected section of track (called a "block"). The semaphore would read "stop" to the oncoming train – and likewise, the semaphore to the block in advance would be aligned to read "slow" to give the operator adequate time to safely stop without running the "stop" signal. As the technology grew and emerged, some interlockings would require the alignment of as many as ten lever switches before a track switch could be thrown. If they were not aligned in the proper sequence, the track switch lever would not move.

As would be expected, the totally mechanical switch machine and controls were fraught with constant maintenance and operation requirements. Rods routinely broke or else froze in place (and then snapped); points in the track switches would not stay locked in place and would loosen up beneath the cars – and cause derailments, spills, accidents, injuries, death and track closures. However, in the midst of these mechanical mishaps, the switch machines themselves did not fail to perform as designed.

2.2.3. Pneumatic Switch Control

One of the first refinements in switch and signal control was the use of pneumatic operation. Compressed air was placed into metal pipes, which operated the switch points and semaphores in lieu of the mechanical action of solid metal rods. Towers were outfitted with air compressors (usually two – and they would alternate usage on predetermined schedules so as to be ready in case one compressor malfunctioned), air storage tanks, and compressed air drying pipes (usually located on the building exterior, attached to an exterior wall). When air was compressed, its latent moisture (ordinarily felt as the relative humidity) would condense, causing pitting and rust inside pipe runs and at elbows. More importantly, it would freeze in the wintertime and block the flow of air needed to move the switch points or the semaphores.

Initially, Armstrong switch machines were simply adapted to accommodate the pneumatic switches; they were later modified to contain a relay contact to operate a valve at the switch points or at the semaphore, which allowed a blast of high-pressure compressed air in the pipe to move the track or the signal arm accordingly. However, the fundamental logic of the switch machine remained in place – the lever to activate the track switch would not move until the appropriate levers for all affected signals and other switches were properly aligned in the locking bed – but moving the lever did not require as much brute force as with the mechanical rods.

The installation of the relays (which provided the connection between the mechanical operation of the switch machine and pneumatic compressed air operation of the various pipelines) necessitated the placement of racks of shelves on the first floors of towers (beneath the switch machines, after the heavy metal rods were removed); basements (or sometimes separate outbuildings) were modified to contain air compressors and air gauges.

Another development at this time was the model board; electrical contacts placed onto the levers in the switch machines were wired to lights placed onto overhead model boards. The model boards were usually hung from the ceiling directly above the switch machine; they were typically constructed of sheet metal and painted black with a white schematic track diagram depicting the trackage in the interlocking. Different-colored lights were placed at the locations of the numbered track switches and signals, so that the operator could observe, at a glance, the position of everything within the interlocking in advance of the oncoming train's arrival.

Finally, the most significant development arising from pneumatic switch control was the development of "pistol-grip" switch levers and the eventual obsolescence of the Armstrong lever. Because the control of the switches and signals were now accomplished with air and relays instead of rigid rods, levers to physically move them were no longer required. Instead, switch machines began to be assembled with smaller locking beds and face-mounted pistol grips that functioned in the same controlled, prioritized manner (see Fig. 5).

Fig. 5: copy of 1931 advertisement for Union Switch & Signal Company's (US&S) Model 14 switch machine – its most popular model (and used in most of the PRR towers in the 20th century); ad taken from an affinity website of Ansaldo-STS (US&S's successor company) www.has-been.dyndns.org. The interlocking shown on the model board appears to depict the Broad Street Station interlocking - between the upper level (Suburban) tracks and Broad Street Station (before its demolition). The switch machine was physically located at 30th Street Station.

After the turn of the century, electrical contacts were placed onto switch points to provide a closed circuit connection to relays located in the tower, and integrated into the switch machine logic. Should a pair of switch points not fully close (or fully open), or should they become disengaged at random, they would override the signaling circuits and cause the semaphores to display a "stop" signal, thus preventing trains from possibly being derailed on incompletely aligned points.

<u>2.2.4 Electric Control (and beyond)</u>

By the 1930s, railroads began using electric control, which provided the same prioritized sequence of checks executed by the locking beds, except with a series of relays. Relays controlled each individual track switch and signal, and they were wired to prevent any track switch from operating without all appropriate signals and related track switches being in proper alignment. Electric switch machines, sometimes called "centralized traffic control" (or CTC) machines, were dramatically smaller in size than pistol grip machines with large locking beds; the CTC machine was small enough that, in some interlockings, it could fit onto an operator's desk. It contained a schematic track plan stenciled onto its face, and the compact-sized switch levers were also placed onto the face. Since it was electrically-controlled, it no longer needed the bulky locking bed and ornamental wood cabinet that typically occupied so much room in the tower; likewise, it no longer needed the model board, although in many locations, the existing model board was adapted to graphically depict the switch settings of the CTC machine (usually for the visual benefit of the operator or the dispatcher) – (see Fig. 6).

Electric switch machine control also necessitated the use of large numbers of relays to control the interlockings. Consequently, first floor spaces in many towers were packed tightly with relay shelves (or racks) – and oftentimes, there was barely enough room for the track and signal crews to circulate throughout.

By the time CTC control was employed, most railroads had eliminated the use of semaphore track signals in favor of lights, which were easier to observe at night. They also required dramatically less maintenance, since they no longer had any moving parts subject to freezing or other types of damage (although for many years, the PRR used a hybrid semaphore which contained colored indicator lights as well).

Fig. 6: detail of CTC switch machine at Overbrook Tower; the model board and another electro-pneumatic switch machine are located behind the photographer *(Photo by John R. Bowie, A.I.A.)*

By the 1980s, interlockings were controlled electronically (also called solid-state interlocking – or SSI) using a system of custom-designed software to replace the relays altogether. The software contains the prioritized sequence of checks that subjects commands to the same logic as the locking bed, so that no track switch would be opened until the appropriate signals and related switches were in proper alignment. The principal advantage of SSI is that interlockings could be controlled from remote locations; they were no longer required to be physically located at the interlocking, and numerous interlockings could be controlled from one central, remote location.

Today, nearly all train control for Class I freight railroads and Amtrak are accomplished at remote (usually unpublicized) locations – although in Pennsylvania, Amtrak still maintains physical interlocking tower control at Zoo Tower on the Northeast Corridor, and at Overbrook, Paoli, Thorn, Cork and State on the Keystone Line.

2.3 Design of the PRR's Towers

2.3.1 Towers in general

The PRR's history of tower construction followed closely with available technology as it was developed, placed into use, and found to be safe and reliable in harsh American railroad field conditions. As such, the PRR built, and in many cases, demolished and rebuilt its interlocking towers as it went through its various periods of growth and change. Within the Northeast Corridor and the Keystone Corridor, tower construction fell into three somewhat distinct episodes:

- The first period of the PRR's tower construction growth (from the 1870s to roughly 1900) occurred when the PRR was consolidating its holdings and expanding to be a four-track main line, both from Philadelphia to Trenton and from Philadelphia to Harrisburg (and beyond).

- The second period of PRR's tower construction growth was from roughly 1900 to the late-1930s, before the onset of World War II. This was a period of unmatched growth for the PRR, even considering the setbacks caused by the Great Depression. During this period, the PRR raised its main line to eliminate grade crossings at locations such as Morrisville and Chester, and it straightened (or eliminated) bottlenecks such as Bristol and Lancaster. During this period, the PRR also constructed the Trenton Cut-Off, the Philadelphia & Downingtown Low Grade, and the Atglen & Susquehanna Low Grade, which enabled the increasingly heavy amounts of freight traffic to avoid Philadelphia's congested suburbs. It was also during this period that the PRR electrified its lines: first the line from Broad Street to Paoli (in 1913-15), then the portion of the line along the Northeast Corridor (1929-35), and finally the remainder of the Keystone Corridor plus the heavy freight low grade lines around Philadelphia (1937-38).

- The third period of PRR's tower construction growth was from the late-1930s to the late-1940s. This was also an impressive time of investment into the railroad's infrastructure, in order to remain competitive and shorten the amount of time for freight and passengers along the lines.

2.3.2. The first period of tower design (1870s to roughly 1900)

In this period, PRR towers generally took on the vernacular architectural forms of the period. They were almost always two-stories in height, constructed of brick or wood (or a combination of the two), and set on brick or stone foundations. They typically employed massing and detailing of the Victorian, Queen Anne and other eclectic architectural periods. Some towers contained projecting bays facing trackside, and others did not; however, there does not seem to be any discernible pattern of design evolution within the towers themselves – either in terms of construction date or construction locale.[20] It is also important to note that although this study is restricted to the Northeast Corridor and Keystone Corridor, the PRR was constructing towers throughout its entire main line, including the entire right-of-way to Pittsburgh, the Port Road along the Susquehanna River south into Maryland, and its branch lines into upstate areas.

The roofs of first-period towers were typically hipped in shape, and generally contained a center cupola. On some towers, the cupola was elaborately-sized, with its own hipped roof. However, the roofs were generally clad with slate shingles or else standing seam metal (to prevent flying cinders from catching the building on fire) (see Figs. 7 and 8 – also, refer back to Fig. 3).

Fig. 7 (left): trackside (south) and west elevations of G Tower (in Gap, Lancaster County, PA), constructed in 1884 and photo taken as part of the Interstate Commerce Commission Valuation Survey of 1918 (National Archives Records Admin. Center, College Park, MD) – note also switch rods in foreground just beyond the tracks

Fig. 8 (above): copy of photograph of Forge Tower, Tyrone, PA, undated; image copyright Martin K. O'Toole, www.railpictures.net; it is not known if a cupola existed at the ridgeline of the building.

[20] For instance, towers constructed at roughly the same time do not share the same design, and likewise, towers physically located near one another do not share the same design.

Some towers had interior stairs, but most had exterior stairways between grade and the second floor, and from grade down into the basement. The second floor typically was a single-room containing the Armstrong switch machine, and model board (directly above), along with space for the operator's desk and telegraph (and later telephone). Finishes were typically either plaster or bead-board walls and ceilings (or a combination of the two). Floors were generally wood. The second floor typically contained full elevations of operating double-hung windows facing trackside and the two approaching sides to give maximum visibility for oncoming trains. Many towers also had retractable cloth exterior awnings to shade the operators from the sun. The first floor typically was also a single room with comparable finishes on the ceilings, walls and floor. Much of the space in the center of the room was taken up with the lever bars, and there were less windows than the second floor. Finally, basements typically were service spaces; they contained the boiler and other infrastructure, and much of the space was taken up with the lever bars descending from above and attached to the switch rods exiting the building trackside.

Originally, the PRR had first-period towers along its entire main line throughout Pennsylvania. However, as upgrades and realignments were made over the years, most were demolished and replaced with larger masonry buildings (although several survive intact in the Middle Division between Harrisburg and Hollidaysburg on the present-day Norfolk Southern RR freight line – not part of this study). The only surviving first-period tower within Amtrak's Northeast Corridor or Keystone Corridor is Shore Tower in Philadelphia (dating to 1896) (see Figs. 9 and 10).

Fig. 9: 1973 photograph of the east elevation of Shore Tower (while still in operation) – note the cupola has been removed. Photo from www.thebluecomet.com a website of old PRR railroad images.

Fig. 10: north (trackside) and east elevations of Shore Tower in 2009; the bridge above the Amtrak train carries the SEPTA Market-Frankford elevated line; Kensington Avenue is beneath the Market-Frankford and passes beneath the PRR tracks *(photo by John R. Bowie, A.I.A.)*

Interestingly, Shore originally contained Armstrong switch machinery when it was constructed; however, it was later modified to contain an updated US&S Model 14 electro-pneumatic switch machine, and an addition was added onto the second floor in c.1930 to house the electric catenary power control board (see left side of Fig. 10).

There are no known records surviving in Amtrak's PRR design files to indicate the designers or builders of any of these first period towers. It is possible such records exist in earlier PRR files at the Pennsylvania State Archives or the Railroad Museum of Pennsylvania or the library of the Pennsylvania Railroad Technical & Historical Society, but such research is beyond the scope of this monograph.[21]

2.3.3 The second period of tower design (roughly 1900 to the late-1930s)

In this period, new towers in realigned tracks and new rights-of-way were constructed to accommodate the new electro-pneumatic switch machines, such as Union Switch & Signal's (US&S) Model 13 and Model 14 machines (see Fig. 11 and also refer back to Fig. 5), which were by far, the most popular controls used in all PRR towers (if not the most popular nationwide). During this second period, the towers themselves shifted from wood framing and wood cladding construction techniques (of the revival era) to more substantial, completely fireproof construction, including steel, concrete and concrete-clad steel framing with solid masonry walls (either brick, concrete or terra-cotta with or without stucco finishes), and slate or tile roofs.

Fig. 11: copy of 1931 advertisement for Union Switch & Signal Company's (US&S) electro-pneumatic switch machines, used in many of the PRR's interlockings; ad taken from an affinity website of Ansaldo-STS (US&S's successor company) www.has-been.dyndns.org.

[21] The names of the designers and builders are not mentioned in the 1918 Interstate Commerce Commission (ICC) Valuation Survey files (National Archives Records Administration Center in College Park, MD) or in the PRR Annual Reports of the period 1879 through 1900 (Hagley Museum and Library in Greenville, DE).

This was a dramatic statement by the PRR on several levels. First, (as previously noted), the buildings ultimately became completely fireproof and not subject to damage from flying or blowing cinders. As importantly, they became secure and protected, and not subject to break-ins or vandalism, particularly during hostile times (such as strikes and labor unrest). They were also built of materials that required little maintenance or upkeep – there was little exterior painting required, and roofing systems were virtually maintenance-free. Most importantly, however, was that during this period the PRR made a tangible statement to the world about its commitment to permanence, longevity and safety in their towers – these were buildings that were sturdy and contained the most modern technology to move passengers and freight from point to point in the shortest time possible.

During the early years of this second period, the PRR was still constructing its towers with individual designs – they were not yet standardized in appearance. For example, Brill Tower, in Philadelphia was constructed in 1905 on a brick foundation with a wood frame second floor which contained a projecting trackside bay window; the building was rectangular in plan and had a hipped roof. However, Baldwin Tower (located seven miles away in Eddystone, Delaware County) was constructed at roughly the same time (c.1905), but it was square in plan, set on a stuccoed, terra-cotta foundation with a fenestrated wood-frame second floor (with no bay) and deeply-projecting Arts-&-Crafts style hipped roof. Further down the main line, just north of the Delaware line, Hook Tower (also c.1905) was a single-story brick building divided into two rooms, and containing a wood frame second floor for the switch machine (see Figs. 12-14).[22]

Fig. 12: west (trackside) and north elevations of Brill Tower in 2008 *(photo by John R. Bowie, A.I.A.)*

Fig. 13: west (trackside) and south elevations of Baldwin Tower in 2008 *(photo by J.R. Bowie, A.I.A.)*

[22] Interestingly, Brill and Baldwin Towers were both constructed with Armstrong lever electro-mechanical switch machines, which continued to be used until the towers were decommissioned. Brill's machine was disassembled and moved in its entirety to the relocated and restored former Lemo (Lemoyne) Tower – renamed J Tower, at the Strasburg Railroad, in Lancaster County. Hook Tower contained a US&S Model 13 electro-pneumatic switch machine. It is also interesting to note the inconsistencies in the framing systems of these towers. The roof framing for each tower was composed of wood rafters and wood sheathing beneath fire-proof shingles, such as slate or tile – although at present, each is covered with asphalt-composition shingles. However, the floor framing and decking at Hook and Baldwin was concrete covering steel beams; at Brill, it was wood flooring on top of wood joists. Another inconsistency in the designs of these towers was the second floor stairways – Brill and Baldwin both contained internal stairways, and Hook had an outdoor second floor stair.

Fig. 14: west (trackside) and north elevations of Hook Tower in 2008 *(photo by John R. Bowie, A.I.A.)*

At roughly the same time, the PRR constructed two remarkably similar towers – Bryn Mawr and Paoli, in 1896 on the Keystone Line. Bryn Mawr controlled a full four-track crossover,[23] and Paoli also controlled a full four-track crossover as well as the entrance to Paoli Yard, a large passenger and freight facility. Both towers contained US&S Model 14 electro-pneumatic switch machines and both towers were two stories in height with stone foundations, brick, load-bearing, first floor exterior walls (and containing decorative, recessed panels in the elevations between windows) and wood-framed second floors with decorative recessed wood panels in the mullions between the windows. Both towers contained distinctive, rounded, projecting bays facing trackside on the second floor, and on the interior, both towers had internal stairways and second floor toilet rooms (see Figs. 15, 16 and 17).

Fig. 15 (above, left): south (trackside) and east elevations of Bryn Mawr Tower in 2008 *(photo by John R. Bowie, A.I.A.)*

Fig. 16 (above): south (trackside) and east elevations of Paoli Tower in 2010 *(photo by John R. Bowie, A.I.A.)*

Fig. 17 (left): view of Paoli Tower, taken on June 11, 1966, before the bay was destroyed *(photo copied from* Triumph II, Philadelphia Terminal 1838-2000, *page 205)*

[23] A full crossover is a set of track switches that enables a train to cross from one track to the other in either direction; in extreme locations containing six main line tracks (such as North Phil – see next page), the crossover switches could be configured in a linear (ladder-type) configuration, or they could be intermingled among each other (to save space in the interlocking).

At present, Bryn Mawr is used for office and storage purposes and is in good condition; Paoli, is still used to control train movements, but its bay and most of the south (trackside) elevation were demolished after a derailment, which included a horrendous crash into the building – it was rebuilt flush with the exterior wall.[24]

This second period eventually began to see several distinct types of standardized tower design begin to emerge in the PRR's Northeast Corridor. The first of these occurred between 1910-1915, just before World War I, and is readily exemplified in North Phil Tower (dated 1914), in Philadelphia. North Phil was constructed according to a prototype design also seen at Fair Tower (Trenton, New Jersey, dated 1915), Union Junction Tower (north end of Pennsylvania Station, Baltimore, dated 1910-11) and Baltimore & Potomac Tower (south end of Pennsylvania Station, Baltimore, dated 1910-11) (see Figs. 18-21).

Fig. 18: north (trackside) and east elevations of North Phil Tower, Philadelphia in 2008 *(photo by J.R. Bowie)*

Fig. 19: north (trackside) and east elevations of Fair Tower, Trenton, in 2010 *(photo by L.A. McCrory)*

Fig. 20: north (trackside) and east elevations of Union Junction Tower in Baltimore – demolished *(photo for HAER by William Barrett, 1983 – see HAER MD-50)*

Fig. 21: north (trackside) and west elevations of Baltimore & Potomac Tower in Baltimore *(photo by S. Martin & F. Dunn, 1975 – see www.jdtowers.org)*

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[24] According to the 1896 PRR annual report, Paoli Tower (called PA) opened on March 15, 1896 and Bryn Mawr Tower (called WH) opened on August 11, 1896. However, in field interviews with various Amtrak personnel who worked at Paoli Tower, everyone remembered the crash, but nobody could remember when it occurred.

The design of each of these towers was remarkably similar – they were all two-stories in height, with broad, overhanging hipped roofs, stucco-covered, concrete foundation/first floor walls (although Fair Tower was stucco-covered terra-cotta), wood-framed second floors containing large double-hung banks of windows facing trackside and the approach elevations, and generous amounts of Arts-&-Crafts details in the exterior brackets, cornice details and belt coursing. All of these towers contained interior second floor stairways, second floor toilet rooms, steel and concrete floor framing, and were constructed to correlate with major track and infrastructure improvements along the Northeast Corridor – Union Junction and Baltimore & Potomac when Baltimore's impressive Pennsylvania Station was constructed, Fair when Trenton Station was constructed and North Phil when the Connecting Railroad was enlarged to six-tracks and the Chestnut Hill commuter line constructed. Each of these towers also contained US&S Model 14 electro-pneumatic switch machines on the second floor and relay banks on the first floor. North Phil is the only tower in Pennsylvania of this era to survive.[25]

Another distinct standardized design type of the later second period to emerge from the PRR's design engineers and architects was a more conservative and less-ornamented design – constructed completely of masonry (concrete or brick foundations/first floors) and brick second floors, with considerably less exterior ornamentation. Like many of the earlier towers of this period, these were two-stories in height, rectangular in plan, constructed with steel and concrete framing,[26] and containing internal stairways and second floor toilet rooms. Each of these towers also had a projecting second floor trackside bay and contained a US&S Model 14 switch machine to control their interlocking – Lamokin (c.1925), which controlled a full crossover and the junction with the Chester Creek Branch, Overbrook (1926), which controlled a full crossover on the Keystone Corridor, Zoo Tower (1930), a massive tower containing a 227-lever US&S Model 14 switch machine that controlled the wye where eastbound tracks to New York, westbound tracks to Harrisburg and Pittsburgh, and southbound tracks to Philadelphia's Broad Street Station and all points south converged,[27] and Arsenal Tower (1932), which controlled a full six-track crossover as well as the entrance to the South Philadelphia freight yard and the wye to the High Line (an elevated viaduct that bypassed the congestion of center city Philadelphia), and the West Chester Branch. Each of these towers was remarkably similar in design, proportion and detailing, both on the exterior and the interior, and each tower employed a US&S

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[25] It is not known if there were other PRR towers of this design constructed in Pennsylvania that have long since been removed. Examination of the 1918 ICC Valuation Survey photographs for the PRR's Northeast Corridor and Keystone Corridor might reveal this information – however, that is well beyond the scope of this investigation. Fortunately, the original design drawings of Fair Tower (in Trenton) are located in Amtrak's PRR Design Files in Philadelphia, and they indicate the design to be by the PRR Office of the Chief Engineer (Project 19625, drawn by A.H. Moore; traced by C.F. Seipp, and checked by C.F. Smith – unfortunately, it is not known exactly who the actual designer was for the tower itself). Nonetheless, because of the similarities of the designs of these four towers, it is reasonable to conclude they were all designed by in-house PRR architects and engineers.

[26] Although these towers were constructed with steel and concrete floor systems, they still had wood-framed roofs (although the roofs were covered with fireproof slate shingles).

[27] On the PRR main line between New York and Chicago (including the section of Northeast Corridor from Morrisville to Zoo Tower and the Keystone Corridor between Zoo Tower and all points west, track direction was labeled east-west. On the section of track between Zoo Tower and all points south to Washington, D.C., track direction was labeled north-south. Amtrak continues that nomenclature today.

Model 14 electro-pneumatic switch machine. Today, each of these four towers survives intact. Lamokin and Arsenal have been heavily vandalized, and Lamokin has partially collapsed from weather infiltration associated with roof leaks (see Figs. 22 and 23). However, Zoo and Overbrook still function as operating towers controlling trains (see Figs. 24 and 25).

Fig. 22: east (trackside) elevation of Lamokin Tower in 2008 *(photo by John R. Bowie, A.I.A.)*

Fig. 23: east (trackside) elevation of Arsenal Tower in 2008 *(photo by John R. Bowie, A.I.A.)*

Fig. 24: east (trackside) elevation of Zoo Tower in 2009 *(photo by Lou Anne McCrory, A.I.A.)*

Fig. 25: north (trackside) elevation of Overbrook Tower in 2009 *(photo by John R. Bowie, A.I.A.)*

Another distinct, standardized design during the latter part of the second period to emerge from the PRR's engineers and architects was a highly-ornate and architecturally rich, Colonial Revival style tower. Cork Tower in Lancaster, was constructed in 1929 at the same time as the third Lancaster Station was constructed by the PRR and the main line was realigned one final time away from the congested downtown of the city. Cork Tower is an exact copy of Gwynn Tower along the PRR main line in West Baltimore, Maryland (which was constructed in 1931-32). Both towers housed US&S Model 14 electro-pneumatic switch machines, and both towers were two-stories in height with hipped roofs clad in slate shingles, and constructed of concrete and steel floor framing, with raised concrete foundations and load-bearing brick exterior walls, and containing projecting, trackside second floor bays. However, Cork and Gwynn are unique because of their elegant exterior architectural details. Both towers contained recessed panels cast into the concrete foundation walls; they contain Flemish bond brickwork and projecting brick quoins on the corners, as well ornamental projecting belt courses between floors. However, they also contain copper-clad brackets at the cornices (with molded panels in the copper between the brackets), projecting copper-clad support brackets and corresponding molded panels beneath the projecting bay, and all the copper was scored and painted to resemble dressed stonework. Both towers contained interior stairways connecting the three floors; however, Cork also contained a separate single-story outbuilding of similar design and construction to house its air compressors (to power the track switches and signals). Cork is the only surviving example of this type of tower in Pennsylvania, and it continues to be operational as a working tower. Gwynn is abandoned and in an advanced state of deterioration and vandalism (see Figs. 26 and 27).

Fig. 26: north (trackside) and east elevations of Cork Tower (and adjacent compressor building, in shadow to the right) in 2009 *(photo by John R. Bowie, A.I.A.)*

Fig. 27: east (trackside) and south elevations of Gwynn Tower in Baltimore, Maryland in 2010 *(photo by Tiegan C. Lewis)*

Fig. 28 (left): long view north across the interlocking control room of State Tower in 2010 *(photo by Lou Anne McCrory, A.I.A.)*

The final tower of this period in Pennsylvania is unique – the State Tower (1937) was installed on the eastern side of the second floor of Harrisburg Pennsylvania Station. The station itself was designed and constructed in 1897, with an addition built onto the east end in 1902. A fire severely damaged the station in 1904, and it was completely remodeled soon thereafter. In 1911, another addition was constructed – this time onto the west side of the building, and in 1937, when the Keystone Corridor was being electrified, a third addition was constructed – this one onto the east side of the building. The second floor contained a 127-lever US&S electro-pneumatic switch machine to control the east side of Harrisburg Station (see Fig. 28) and all the freight and passenger trackage to the east. The power director's office and switchboard was constructed on the fourth (directly above the switch room) (see Fig. 29).

Fig. 29: long view northeast across the electric power control room at State Tower in 2010 *(photo by Lou Anne McCrory, A.I.A.)*

<u>*2.3.4. The third period of tower design (the late-1930s to the late-1940s)*</u>

This was the last great period of tower design for the PRR. During this period, towers continued to be outfitted with electro-pneumatic switch machines, and eventually (as the evolving technology was adopted) shifted to all-electric CTC machines. This was also the time when the PRR made its last great infrastructure investment. Fueled in part by war effort of the early and mid-1940s, the PRR continued to look for and develop ways to streamline its operation, improve its efficiency and decrease the time needed to move passengers and freight across its lines.

Tower designs during this time period also reflected the modernization and sleekness seen in its impressive fleet of motive power and passenger cars. Its famed GG-1 locomotive, the product of Donald Dohner and Raymond Loewy's design genius, operated at high speeds pulling passengers in trains named *the Broadway Limited* and *the Congressional* on the all-electric Northeast Corridor and Keystone Corridor, and it pulled long freights on the Port Road, Trenton Cut-Off, Philadelphia & Downingtown Low Grade and Atglen & Susquehanna Low Grade. As such, towers came to epitomize this level of sophistication and refinement of America's industrial-era International Style.

Although towers built during this period varied to some degree in design (mostly to fit to the needs of the individual sites), they were generally consistent in character. The towers were generally two-stories in height and constructed with steel and concrete framing systems and load-bearing brick exterior walls. They all contained broad, overhanging hipped roofs with fireproof (slate, tile or standing seam metal) coverings, and the projecting second floor bays were eliminated entirely. In place of the bay, the designers substituted corner window configurations on the second floor. This "wrap-around" visual effect, accomplished with steel columns buried into the window mullions at the corners, reflected the architectural sensibilities of designers of the 1930s and 1940s; more importantly, however, (and more consistent with PRR's no-nonsense desire to increase efficiency, safety and workability) it gave a much wider view onto the tracks in both directions for the operators in the tower than the bay provided; they could see approaching and passing trains better and from more locations within the tower.

Six towers in Pennsylvania date to this third period. The first, Park (dating to 1937, and located in Parkesburg, Chester County at the eastern end of the high-volume duckunder freight connection with the Atglen & Susquehanna Low Grade[28]) is an anomaly because it was installed in a single-story brick building with round-arched windows and a broadly-overhanging hipped roof. The building contains numerous infilled openings and a projecting bay, which appears to have been added at a date later than its original construction, and it is unclear whether the building was initially constructed as an interlocking tower, or if the tower functions were added to an already-existing building of an earlier era (see Fig. 30). Irrespective of the scenario, the building contains a US&S Style "P" electro-pneumatic switch machine to control the full four-track crossover which provided access to the duckunder.

Fig. 30: south (trackside) and west elevations of Park Tower, in 2010 *(photo by John R. Bowie, A.I.A.)*

Three towers of this period are strikingly similar in design, and include Thorn (1938), Morris (1941) and Grundy (1947). Thorn Tower was located in Thorndale, Chester County, and was situated at the western end of the Philadelphia & Downingtown Low Grade;[29] the four track main line (Tracks 1 and 2 were for eastbound passenger and freight traffic, respectively, and Tracks 3 and 4 were for westbound freight and passenger traffic, respectively) contained a full crossover, and separated between Tracks 2 and 3 (the two freight tracks) to accommodate the freight duckunder with the Downingtown Low Grade. Morris Tower was located at Morrisville, Bucks County, and was situated at the eastern end of the Trenton Cut-Off. Here, the four track main line contained a full crossover and separated between the two center freight tracks to

[28] The PRR constructed duckunders and jumpovers at certain high-volume interlockings (such as Park, Thorn, Paoli, Zoo and Morris) to enable trains to diverge from and reconnect into the main line without slowing down or crossing tracks. A typical duckunder or jumpover would take roughly a mile to achieve the elevation necessary to cross the adjacent track(s).

[29] This branch line was also called the Philadelphia & Thorndale Low Grade, abbreviated the P&T. However, in this report, the P&T also refers to the Philadelphia & Trenton RR (see page 5); therefore, to avoid confusion, the low-grade shall simply be called the Philadelphia & Downingtown Low Grade.

provide the duckunder for the Morrisville freight yard and the Trenton Cut-Off. Finally, Grundy Tower was located near Bristol, Bucks County, and provided a full four-track crossover to access the Bristol Old Line and several local industrial sidings (see Figs. 31, 32 and 33).[30]

Fig. 31 (above, left): south (trackside) and east elevations of Thorn Tower, in 2010 *(photo by Lou Anne McCrory, A.I.A.)*

Fig. 32 (above, right): north (trackside) and east elevations of Morris Tower, in 2009 *(photo by John R. Bowie, A.I.A.)*

Fig. 33 (left): north (trackside) and west elevations of Grundy Tower, in 2009 *(photo by John R. Bowie, A.I.A.)*

All three towers are basically similar in design (with slight variations) – totally brick construction (with Flemish bond) and broad, overhanging hipped roofs. Thorn and Grundy both contain the previously-described ganged corner windows on the second floor facing trackside, but Morris contains a trio of windows positioned in the center of the north (trackside) elevation.[31] Yet all three towers contain a new feature – train inspection lights, one at second floor level (which was also used to alert oncoming locomotive operators of train orders to be grabbed as they passed by the tower), and one at first floor level, which enabled the tower operator to examine train cars and their wheelsets as the trains passed by during the night. These lights were integrated into the design and visual balance of the towers, and were inset into a slight niche in the brickwork. Of the three, Thorn was the starkest in design while Grundy contained the most detail (in fact, Grundy, which closely resembled Nassau and Midway

[30] The PRR main line ran through Bristol, but was rerouted in 1905 to alleviate congestion.

[31] The reason for this aberration is unclear, but it most likely related to the position of the operator's desk and work station inside.

Towers, in Princeton Junction and Monmouth Junction, NJ, respectively, contained design elements that made it resemble Frank Lloyd Wright's early Prairie-style houses of the early-20th century – see Figs. 34 and 35).[32] Grundy's trackside facade contained slightly projecting brick masses that flanked the center bay of windows and were incised by the horizontal lines of the concrete belt courses at the second floor level. All three towers contained US&S Model 14 electro-pneumatic switch machines; however, Thorn was upgraded to contain an all-electric CTC switch machine when this portion of the Keystone Corridor's operations were consolidated into Thorn Tower to control the former Glen, Dale and Caln and Downes interlockings, as well as Thorn itself.

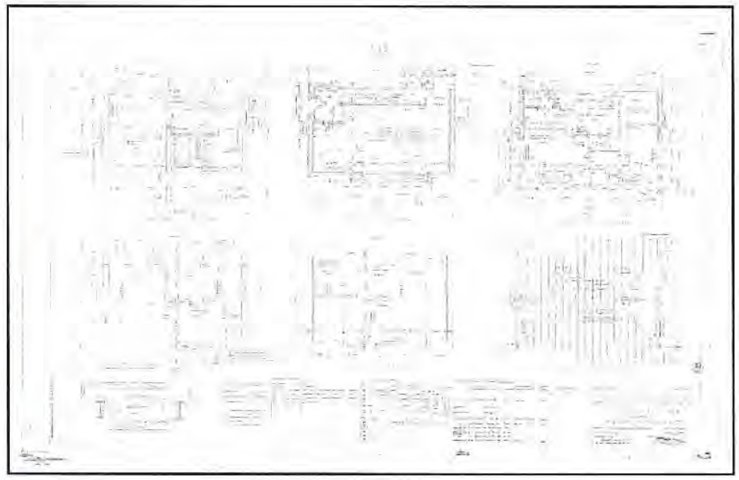

Fig. 34 (left): south (trackside) and west elevations of Midway Tower, Monmouth Junction, NJ, in 2010; note its similarity to Grundy Tower (seen in Fig. 33) *(photo by Tiegan C. Lewis)*

Fig. 35 (above): copy of original PRR Drawing No. 1 for Midway Tower, designed and drawn by N.A. Arvide (drawings located in Amtrak's PRR design files in Philadelphia)

Holmesburg Station/Tower, also dating to 1947, provided a variation on the design of this third period of PRR tower design. At Holmesburg, the two-story tower controlled a full four-track crossover, as well as the junction with the Bustleton Branch, a local freight line that served industries in that part of Philadelphia. However, a one-story wing was placed onto the east side for the Holmesburg PRR commuter rail station (now SEPTA, and currently in daily use). The tower contained a US&S Model 14 switch machine, and its layout and design were the same as other towers of the period (see Fig. 36 – next page).

The final tower on the PRR's electrified system was a unique building that does not fit into any of the categories listed herein. The Landisville Block Station was a small, two-room, single-story building in Landisville, Lancaster County. It was constructed in 1904 to control a grade crossing with the Columbia Branch of the Reading Railroad, which also featured an interchange track (where trains and/or cars could be transferred between the PRR and the Reading). Control

[32] Two original drawings for Midway Tower are located in Amtrak's PRR design files in Philadelphia. They are labeled as Sheets Nos. 1 and 2 (46394), both dated September 2, 1943; both designed and drawn by N.A. Arvide.

was part-time – a PRR agent-operator manned the block station Mondays through Fridays from 9:00 a.m. to 5:00 p.m. to handle local freight deliveries/pick-ups and to manually control the two Reading local freights each day across the PRR tracks.[33]

Fig. 36: south (trackside) and east elevations of Holmesburg Station/Tower in 2010 (the SEPTA station is the single-story portion of the building, to the right) *(photo by John R. Bowie, A.I.A.)*

The Landisville Block Station was non-descript with a shallow gable roof parallel to the PRR tracks, and clad in asbestos siding (which appears to be original), and it contained hold-over eclectic detailing such as the shallow-arched, double freight door and the four-panel office door with transom. The western room was the freight station containing a wood floor and plaster walls and ceiling, and the eastern room was the block operator's office containing a small vestibule, wood floors and wood bead-board wainscot with plaster walls (above) and a plaster ceiling. The office contained a cast-iron stove and a two-person desk. It also contained a US&S timer-controlled switch machine that the block operator manually operated to the control the interlocking (see Figs. 37 and 38).[34]

Fig. 37: north (trackside) and east elevations of Landis-ville Block Station in 2008 *(photo by John R. Bowie, A.I.A.)*

Fig. 38: detail of US&S switch machine at Landis-ville Block Station *(photo by John R. Bowie, A.I.A)*

[33] The construction date for the tower taken from "The Penna. RR Harrisburg District 'Landis' Interlocking" drawing sheet 5 – it states "built 7-22-04." Information in this paragraph taken from Robert J. Yanosey's excellent *Pennsylvania Railroad Facilities In Color, Vol. 5 Harrisburg Division Passenger Lines,"* (Morning Sun Books, Inc., Scotch Plains, NJ, C.2009), pgs. 48-51. The photographs depict the block station in operation in the 1970s and provide a detailed description of how the interlocking was controlled.

[34] The exact model number of the switch machine is not identified either on the machine itself or in the Yanosey book; however, it contained timer controls, which would govern the movement of the track switches within certain pre-set numbers of minutes.

Evidently, the Landisville Block Station was the second tower on this location. In 1863, a combination tower/passenger station was constructed at this site; it was a two-story building remarkably similar in appearance to Dillerville Junction (just three miles to the east – see Fig. 4 of this report) and Gap (just 15 miles to the east – see Fig. 7 of this report), as well as other towers on the Keystone Line (see Fig. 39).[35]

Fig. 39: copy of 1909 photo of the original Landis Tower/station (with railroad hotel in background), taken from *Triumph II Philadelphia to Harrisburg 1828-1998,* page 190. There are slight discrepancies between the 1909 date for this photograph and the 1904 date that the second Landisville Block Station was constructed. It is possible the 1904 date indicated in the drawing refers exclusively to the switch machine itself, which could have been originally installed in the tower/station and then relocated to the single-story building when the tower was demolished.

2.4 Significance of the PRR Towers

2.4.1. Context of PRR's towers with other railroads' towers

To establish the level of historic architectural and historic industrial significance of the PRR's interlocking towers, it is appropriate to examine them relative to the towers of other railroads within the same geographic proximity. In southeastern Pennsylvania, the Baltimore & Ohio RR (B&O) and the Reading Railroad constituted the primary competitors with the PRR, not only in terms of the number of passengers and the amount of freight carried, but in the design and upkeep of their infrastructures.

The B&O's domain in Philadelphia began at Park Junction,[36] on the east side of the Schuylkill River near the Philadelphia Art Museum, and the tracks followed along the east side of the river downstream. The main line joined the B&O's Delaware Branch (which connected to the B&O's Snyder Avenue Yard and Dickinson Yard – both in South Philadelphia) at RG Tower in Greys Ferry, and from there, it crossed the Schuylkill River and headed west basically parallel to the

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[35] See *Triumph II Philadelphia to Harrisburg 1828-1998*, page 190 for information in this paragraph.

[36] Park Junction is where the B&O joined the Reading RR's cross-town main line, which started along the Delaware River, and crossed its 9th Street Branch (from Reading Terminal) and proceeded west along the Schuylkill River toward the Valley Forge and east through Wayne Junction to New York.

PW&B for 98 miles all the way to Baltimore.[37] RG Tower was a two-story, wood frame building that controlled the B&O's trackage in Philadelphia east of the Schuylkill (see Fig. 40). It was replaced in 1960 with a modern office tower as part of a B&O modernization project, and it subsequently closed in 1996.[38]

Fig. 40: 1958 photo showing the B&O's first RG Tower in Philadelphia, taken from Greg Reynolds and Dave Oroszi's excellent *Baltimore & Ohio Railroad (MBI Railroad Color History)*, pg. 66.

There are no other towers on the B&O main line between Philadelphia and the Delaware state line. Consequently, aside from RG, the B&O does not provide a meaningful level of comparison to the PRR's towers.

However, the Reading is truly a Pennsylvania company, much like the PRR, and it also had numerous towers along its main lines throughout the southeastern part of the state. The Reading controlled a significantly smaller portion of the market share than the PRR, and as such, its infrastructure (like many other things) was not as standardized either. However, some of the Reading's facilities include the Ninth Street Tower in Philadelphia (demolished when the Reading Viaduct was constructed to the new Reading Terminal in 1910-14) (see Fig. 41, next page) and Pottstown Tower (also demolished) (see Fig. 42, next page). Both Ninth Street and Pottstown were square in plan, two-stories in height, constructed with wood framing and wood siding, and square hipped roofs. Both towers contained exterior stairways and banks of double-hung windows on the second floor with little fenestration on the first floor; and both buildings were virtually devoid of any ornamentation.

Similarly, the Rutherford Yard Tower was erected in 1914 at the throat of the eastbound hump of the Reading's massive freight facility near Hummelstown; it was also square in plan, two-stories in height, constructed with wood framing and wood siding. However, in contrast to the previously-mentioned towers, Rutherford had a considerably broader eave line for its hipped roof (to shade the sun), and it also contained decorative wood shingle spandrel between the first and second floor windows (see Fig. 43, next page). It is also demolished.

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[37] See *Baltimore and Ohio, Reflections of the Capitol Dome, New York to Cumberland* by Stephen J. Salamon, David P. Oroszi and David P. Ori, (Old Line Graphics, Silver Spring, MD copyright 1993), pages 8-12.

[38] See "RG Tower Closing," in the May 1996 on-line issue of *The Bullsheet* (www.bullsheet.com)

Fig. 41 (above, left): view of Ninth Street Tower in Philadelphia, taken from James L. Holton's excellent *The Reading Railroad: History of a Coal Age Empire – Vol. 2 the Twentieth Century* (Garrigues House, Laurys Station, PA, copyright 1992), page 44

Fig. 42 (above, right): view of Pottstown Tower, taken from Holton, page 116

Fig. 43 (left): view of Rutherford Yard Tower, taken from Holton, page 118

The Reading also boasted idiosyncratically-designed towers as well – something the conservative PRR would never entertain. For example, the "windmill" style tower at the base of the Mahanoy Plane (in Mahanoy City, PA) was a two-story, wood-frame building with tapered exterior surfaces and an octagonal shape. The roof was basically flat and contained a slightly-projecting dentil cornice, and there were double-hung windows on all sides (see Fig. 44, next page). The second floor tower operator's room was small compared to other towers, and it is unclear how the switch machine was laid out (or what type of machine was employed). It is likely that the stair was located on the building's exterior. The tower was long ago demolished.

Another unusually-shaped tower on the Reading line was the Diamond Street Tower, located in a narrow wedge-shaped lot at the base of the 9th Street Viaduct (where the tracks were elevated approaching Reading Terminal in Philadelphia (see Fig. 45, next page). The building was fit into a tight footprint and raised up four stories in order for the tower operator to have a good view of approaching trains on the viaduct. The building was brick, with recessed horizontal scribing to give the appearance of rustication. The fifth floor tower also contained a projecting bay that provided the operator with an unobstructed view of the tracks. The tower was destroyed by a fire on New Years Day 1963.

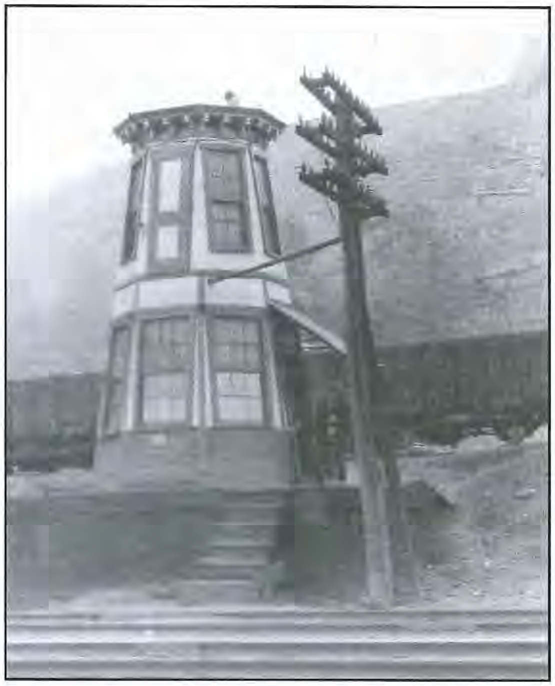

Fig. 44: "windmill" style Reading tower at eastern end of the yard at the Mahanoy Plane – photo dates to 1920s; tower demolished; taken from Holton (page 55)

Fig. 45: Diamond Street Tower, wedge-shaped tower on west side of 9th Street Viaduct leading to Reading Terminal, taken from Holton (page 285)

There are other towers along the Reading's lines, however, the examples presented herein provide enough information to make reasonable observations and draw conclusions about the PRR. To begin, the PRR systematically and painstakingly upgraded its towers and kept them current with the interlocking technology. This was facilitated by the periodic track realignments and roadway separations to increase train speeds and safety. Some towers, such as Morris, were initially constructed in the 1880s, and then demolished and reconstructed in 1903 when the Trenton Cut-Off was completed (and the main line raised up), and then demolished and reconstructed again in the 1941 upgrades immediately prior to World War II. These types of efforts naturally led to the standardization seen throughout the PRR tower inventory; it also enabled tower operators to be competent on the switch machinery throughout the system (since the same US&S machines were employed in nearly all PRR towers). This level of uniformity and standardization did not exist on either the B&O or the Reading.

As the PRR's tower designs evolved in the late-19th and early-20th centuries, several distinct architectural styles also emerged. Specifically, in the first period (1870s to roughly 1900), PRR towers adopted the customary Queen Anne and Victorian design elements and detailing common to utilitarian buildings everywhere, as seen in Shore Tower (1896). During the second period, there were four clearly-defined patterns of standardized design in PRR towers: the early railroad industrial style of Bryn Mawr (1896) and Paoli (also 1896); the Arts-&-Crafts style of North Phil

(1914); the conservative, less-ornamented design of Lamokin (1925), Overbrook (1926), Zoo (1930) and Arsenal (1932; and the Colonial Revival design of Cork (1929). And the third period, tower design became fully developed and standardized in Thorn (1938), Morris (1941), Grundy (1947) and Holmes (also 1947).[39]

In addition, in its design upgrades, the PRR's decision to use masonry and durable materials in its towers: 1) provided permanence (an average lifespan of one-hundred years) and a long-term investment in the future of the railroad, 2) provided for greater resistance to fire from cinders, particularly up into the time of electrification and dieselization, 3) provided a strong sense of security and safety for the tower operators performing an essential task – particularly during times of labor unrest and strikes, and 4) acted as a easily-recognizable moniker that contributed to the PRR's identity – much like the sleek GG-1 locomotive.

<u>*2.4.2. Significance of the Towers*</u>

According to the standards set forth by the Secretary of the Interior, the cultural significance (and hence eligibility for the National Register of Historic Places) of the PRR towers on the Northeast and Keystone Corridors in Pennsylvania can be evaluated according to the following:

- Criterion "A" – resources associated with events that have made a significant contribution to the broad patterns of history, and

- Criterion "C" – resources that embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

As part of Criterion "A", the PRR towers in Pennsylvania are a distinct physical artifact of the technology that ushered safe and efficient high-speed train travel, both for freight and for passengers. Towers were constructed by railroads all across America to control interlockings, and the PRR's towers formed an integral part of this network. Towers gave order to the railroads (much like traffic signals give order to today's highways). Railroads established operating rules for train crews that established priorities for travel on the nation's tracks, and the towers were where physical control of the crossovers, switches, bridges and other deviations in the main line would occur. Tower operators communicated and worked closely with dispatchers who organized the movement of trains so that the main lines, branch lines, spurs and sidings would be packed as tightly as possible with trains moving at the greatest speeds allowed by the weather and the track geometry.

The heart of the tower – the interlocking switch machine, also contained an evolving technology in the late-19th and early-20th centuries. Up until the installation of the first Saxby & Farmer switch machine in Trenton, train control was totally visual. Coordination of train movements

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[39] The other surviving PRR towers along the Northeast and Keystone Corridors (Brill, Baldwin, Hook, State and Landisville) do not neatly fit into these categories of standardized design. Obviously, State and Landisville are each unique; however, it is unclear why the PRR did not upgrade or replace Brill, Baldwin and Hook along with all its other towers.

between track blocks was enhanced with the introduction of telegraphy between stations; however, train operators relied on their collective abilities to physically see semaphores, flagmen, and even oncoming trains. And train operation at night and during inclimate weather greatly increased the risk of collisions. Interlocking towers linked track switches to the corresponding track signals, and dramatically reduced the number of collisions across the country. As the connections between the locking beds (the control components of the switch machines in the towers) and the track switches and signals evolved from mechanical rods to air-powered pneumatic piping and then to all-electric relay control, track safety and operational efficiency increased, and the effects of ice, snow and freezing weather decreased.

Surviving PRR towers along the Northeast and Keystone Corridors in Pennsylvania embody this phenomenon across its entire spectrum. Although no complete Armstrong switch machines remain intact within the towers, electro-pneumatic switch machines may be found in varying states of preservation (including several towers still in full operation). Likewise, CTC electric machines may be found in varying states of preservation (including several towers still in full operation). When taken as a whole, the technology of these interlocking towers exemplifies the evolution of mechanized train control that took place over the course of eighty years in America.

As part of Criterion "C", the PRR towers in Pennsylvania embody distinctive characteristics of several architectural styles: the Queen Anne and Victorian during the first period; the early railroad industrial style; Arts-&-Crafts style; conservative, less ornamented style; and Colonial Revival style of the second period; and finally, the fully developed, standardized design of the third period. When taken together, these towers represent a fully evolving design typology unique to the PRR, and not seen in other railroads anywhere else in the region.

2.4.3. Integrity of the Towers

Today (in 2011), the nineteen PRR towers in the Northeast and Keystone Corridors dramatically vary according to three categories of integrity: 1) integrity of site, 2) integrity of the building itself, and 3) integrity of machinery. For the purposes of this report, all three categories shall be evaluated together and a single level of integrity assigned – high, medium or low.

Morris Tower – overall integrity: medium

- Four-track cross-over and jump-over for Trenton Cut-off both intact – high integrity of site
- Exterior retains 1940s appearance; interior room layouts and finishes heavily altered – medium integrity of building
- All switch machinery removed – low integrity of machinery

Grundy Tower – overall integrity: medium

- Four-track cross-over partially intact – medium integrity of site
- Exterior retains 1940s appearance; interior rooms layouts and finishes heavily altered – medium integrity of building
- All switch machinery removed – low integrity of machinery

Holmes Tower/Station – overall integrity: high

- Four (or six) track cross-over and connection with Bustleton Branch intact – high integrity of site
- Exterior and interior spaces basically retain their 1940s appearance – high integrity of building
- Switch machinery still intact (but nonfunctional) – high integrity of machinery

Shore Tower – overall integrity: medium
- Four-track cross-over and connection with Delair Branch intact – high integrity of site
- Exterior and interior spaces basically retain 1930s (post-electrification) appearance – except exterior stair removed – medium integrity of building
- Switch machinery still intact (but nonfunctional and partially harvested) – medium integrity of machinery

North Phil Tower – overall integrity: high
- Five-track cross-over and connection with Chestnut Hill West line mostly intact – high integrity of site
- Exterior and interior spaces basically retain 1914 appearance (except for 1970s-era exterior paint finish) – high integrity of building
- Switch machinery still intact (but nonfunctional and partially harvested) – medium integrity of machinery

Zoo Tower – overall integrity: high
- Duck-under and wye connection intact – high integrity of site
- Exterior and interior spaces retain 1930s appearance – high integrity of building
- Switch machinery still in use – high integrity of machinery

Arsenal Tower – overall integrity: medium
- Cross-over completely removed; connection to Media/West Chester line intact – medium integrity of site
- Exterior intact but heavily graffitied; interior spaces retain limited 1930s appearance – medium integrity of building
- Switch machinery still intact (but heavily harvested) – medium integrity of machinery

Brill Tower – overall integrity: low
- Cross-over totally removed; connection to Airport Line intact – low integrity of site
- Exterior intact but heavily graffitied; interior spaces heavily altered – low integrity of building
- Switch machinery totally harvested – low integrity of machinery

Baldwin Tower – overall integrity: low
- Cross-over and connection to Chester & Philadelphia Connection totally removed – low integrity of site
- Exterior heavily altered; interior spaces heavily altered – low integrity of building
- Switch machinery totally harvested (except for base of Armstrong switch machine) – low integrity of machinery

Lamokin Tower – overall integrity: low
- Cross-over and connections to Chester Creek Line and Lamokin Street Branch removed – low integrity of site
- Exterior of building heavily graffitied and altered; interior spaces heavily altered – low integrity of building
- Switch machine heavily harvested and fallen through floor – low integrity of machinery

Hook Tower – overall integrity: high
- Four track cross-over and connection to Linwood Branch intact – high integrity of site
- Exterior of building intact (except for modern siding and windows) – medium integrity of building
- Switch machinery intact (some components harvested) – high integrity of machinery

Overbrook Tower – overall integrity: high
- Four track cross-over intact – high integrity of site
- Exterior and interior spaces retain 1930s appearance – high integrity of building
- Switch machinery still in use – high integrity of machinery

Bryn Mawr Tower – overall integrity: medium
- Four track cross-over intact – high integrity of site
- Exterior and interior spaces retain portions of 1896 appearance – medium integrity of building
- Switch machinery still intact but moderately harvested – medium integrity of machinery

Paoli Tower – overall integrity: medium
- Four-track cross-over and duck-under intact; connection to Paoli Yard removed – medium integrity of site
- Much rebuilding after derailment (assume derailment not considered historic now – in 2011), both inside and outside – low integrity of building
- Switch machinery still in use – high integrity of machinery

Thorn Tower – overall integrity: high
- Six track cross-over and jump-over to Philadelphia & Downingtown Low Grade still intact – high integrity of site
- Exterior and interior of building retain 1940s appearance – high integrity of building
- Switch machinery still in use (partially) – high integrity of machinery

Park Tower – overall integrity: high
- Four track cross-over and duck-under to Atglen & Susquehanna Low Grade still intact – high integrity of site
- Exterior and interior of building retain 1940s appearance – high integrity of building
- Switch machinery still in use (partially) – high integrity of machinery

Cork Tower – overall integrity: high

- Cross-over at station and Columbia Line intact – high integrity of site
- Exterior and interior of building retain 1929 appearance – high integrity of building
- Switch machinery still in use – high integrity of machinery

Landisville Block Station – overall integrity: medium

- Former Reading RR grade crossing and two-track cross-over eliminated (still has a single-track spur with present-day NS freight track) – low integrity of site
- Exterior and interior generally retain c.1904 appearance – medium integrity of building
- Switch machine still intact, but heavily harvested – medium integrity of machinery

State Tower – overall integrity: high

- Harrisburg Station cross-over intact – high integrity of site
- Exterior (not applicable) and interior retain their 1930s appearance – high integrity of building
- Switch machine and power director's boards intact and operational – high integrity of machinery

2.4.4. Condition of the Towers

Each of the nine (9) PRR towers in the Northeast and Keystone Corridors that are no longer occupied (Shore, North Phil, Arsenal, Brill, Baldwin, Lamokin, Hook, Bryn Mawr and Landisville) was physically field examined and an "Existing Condition Report" prepared. Each of the ten (10) remaining towers (Morris, Grundy, Holmes, Zoo, Overbrook, Paoli, Thorn, Park, Cork and State) was also physically field examined and a "Historic Building Report" prepared (although these reports did not specifically evaluate each building's existing condition, it was possible to generally assess their condition for the purposes of this report). In keeping with the evaluation categories of the "existing condition reports," each tower's general condition is noted, based on specific criteria, assigned a ranking of good, fair or poor.

Morris Tower – overall condition: good

- Roof and cornice: good
- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: fair

Grundy Tower – overall condition: good

- Roof and cornice: good
- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: fair

Holmes Tower/Station – overall condition: good

- Roof and cornice: good

- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: fair

Shore Tower – overall condition: fair
- Roof and cornice: fair
- Exterior, including doors and windows: poor
- Structural system: good
- Interior, including finishes: fair

North Phil Tower – overall condition: good
- Roof and cornice: good
- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: fair

Zoo Tower – overall condition: good
- Roof and cornice: good
- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: good

Arsenal Tower – overall condition: fair
- Roof and cornice: fair
- Exterior, including doors and windows: fair
- Structural system: good
- Interior, including finishes: poor

Brill Tower – overall condition: poor
- Roof and cornice: poor
- Exterior, including doors and windows: poor
- Structural system: poor
- Interior, including finishes: poor

Baldwin Tower – overall condition: poor
- Roof and cornice: poor
- Exterior, including doors and windows: poor
- Structural system: fair
- Interior, including finishes: poor

Lamokin Tower – overall condition: poor
- Roof and cornice: poor
- Exterior, including doors and windows: poor
- Structural system: poor
- Interior, including finishes: poor

Hook Tower – overall condition: fair
- Roof and cornice: fair
- Exterior, including doors and windows: fair
- Structural system: good
- Interior, including finishes: fair

Overbrook Tower – overall condition: good
- Roof and cornice: good
- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: good

Bryn Mawr Tower – overall condition: fair
- Roof and cornice: fair
- Exterior, including doors and windows: fair
- Structural system: fair
- Interior, including finishes: fair

Paoli Tower – overall condition: fair
- Roof and cornice: fair
- Exterior, including doors and windows: fair
- Structural system: good
- Interior, including finishes: fair

Thorn Tower – overall condition: good
- Roof and cornice: good
- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: fair

Park Tower – overall condition: good
- Roof and cornice: good
- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: fair

Cork Tower – overall condition: good
- Roof and cornice: good
- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: good

Landisville Block Station – overall condition: fair
- Roof and cornice: fair
- Exterior, including doors and windows: poor
- Structural system: fair

- Interior, including finishes: poor

State Tower – overall condition: good
- Roof and cornice: good
- Exterior, including doors and windows: good
- Structural system: good
- Interior, including finishes: good

2.4.5. Determinations of Eligibility

Each of the nineteen PRR towers was evaluated for possible listing based on its integrity and existing condition. Those towers containing low general amounts of integrity and in poor condition are recommended not to be determined eligible for listing onto the National Register of Historic Places. All other towers are recommended to be determined eligible for listing.

Name of Tower	Integrity	Condition	Remarks	Recommend Eligible?
Morris	Medium	Good	In use as offices and MOW base	Yes
Grundy	Medium	Good	In use as offices and MOW base	Yes
Holmes	High	Good	In use as SEPTA station	Yes
Shore	Medium	Fair		Yes
North Phil	High	Good	In use for emergency interlocking control	Yes
Zoo	High	Good	In use for interlocking control	Yes
Arsenal	Medium	Fair	Inaccessible[40]	Yes
Brill	Low	Poor		No
Baldwin	Low	Poor		No
Lamokin	Low	Poor		No
Hook	High	Fair		Yes
Overbrook	High	Good	In use for interlocking control	Yes
Bryn Mawr	Medium	Fair		Yes
Paoli	Medium	Fair	In use for interlocking control	Yes
Thorn	High	Good	In use for interlocking control	Yes
Park	High	Good	In use for interlocking control	Yes
Cork	High	Good	In use for interlocking control	Yes
Landis	Medium	Fair		Yes
State	High	Good	In use for interlocking control	Yes

- End of Document –

[40] Arsenal Tower is considered inaccessible; it is surrounded on both sides by active, high-traffic rail lines (Amtrak to the west and CSX freight to the east – Amtrak does not own the CSX right-of-way).