1. NAME AND LOCATION OF PROPERTY

Historic Name: Western Railroad Stone Arch Bridges and Chester Factory Village Depot

Other Name/Site Number: Keystone Arch Bridges**,** Whistler Bridge No. 2 and No. 4, Middlefield–Becket Railroad Bridge No. 5 and No. 6, Penn Central Railroad Depot

Street and Number (if applicable)**:** Vicinity of Herbert Cross Road, Middlefield/Becket line (Bridges and Roadbed); 10 Prospect Street (Depot)

City/Town: Becket, Middlefield, and Chester **County:** Berkshire, Hampshire, and Hampden **State:** MA

Designated a National Historic Landmark by the Secretary of the Interior January 13, 2021.

2. SIGNIFICANCE DATA

NHL Criteria: 1, 2, and 4

NHL Criteria Exceptions: 2

NHL Theme(s): V. Developing the American Economy
    3. Transportation and Communication
VI. Expanding Science and Technology
    2. Technological Applications

Period(s) of Significance: 1841–1867

Significant Person(s) (only Criterion 2)**:** George Washington Whistler (1800–1849)

Cultural Affiliation (only Criterion 6)**:**

Designer/Creator/Architect/Builder: George Washington Whistler (1800–1849)

Historic Contexts: XVIII. Technology (Engineering and Invention)
    B. Transportation

3. WITHHOLDING SENSITIVE INFORMATION

Does this nomination contain sensitive information that should be withheld under Section 304 of the National Historic Preservation Act?

___ Yes

_X_ No

4. GEOGRAPHICAL DATA

1. **Acreage of Property:** Stone bridges and connecting roadbed: 4.53 acres
Railroad Station: less than one acre

2. **Use either Latitude/Longitude Coordinates or the UTM system:**

Latitude/Longitude Coordinates:
Datum if other than WGS84:
(enter coordinates to 6 decimal places)

Lat/Long for Arch Bridges

A.	**Latitude**	42.305989
	Longitude	-73.010806

Lat/Long for Chester Factory Depot

B.	**Latitude**	42.280508
.	**Longitude**	-72.978629

3. Verbal Boundary Description: The nominated property consists of two discontiguous parcels. These boundaries are shown on the attached district map “Western Railroad Stone Arch Bridges National Historic Landmark District Map.”

4. Boundary Justification: The boundaries of the portion in Middlefield and Becket include all the historic resources that maintain integrity to the period of significance and that conform to the structural footprints of the Western Railroad Stone Arch Bridges and adjacent Western Railroad Roadbed. The boundary of the portion in Chester includes the historic Chester Factory Village Depot, which maintains integrity to the period of significance.

5. SIGNIFICANCE STATEMENT AND DISCUSSION

INTRODUCTION: SUMMARY STATEMENT OF SIGNIFICANCE

The nominated property consists of two noncontiguous parcels containing four resources. One parcel contains a segment of the historic Western Railroad Roadbed and two Western Railroad Stone Arch Bridges that were constructed by 1841. The other parcel contains the Chester Factory Village Depot, a railroad station constructed in 1862 in the village of Chester adjacent to the Western Railroad line (now an active CSX railroad line). All four resources are nationally significant under Criterion 1 in the area of Transportation as representative surviving components of the Western Railroad that connected Worcester, Massachusetts, and Albany, New York. When completed, it was the longest railroad constructed and operated in America by a single corporation and was one of the first four inter-regional railroads in the country. The company structure of the Western Railroad incorporated a new and innovative management hierarchy that became standard American corporate practice. The railroad segment and bridges are significant under Criterion 2 as the best representative works and highest achievement of George Washington Whistler (1800–1849), one of the country’s leading practitioners of civil engineering in the early nineteenth century and a pioneering designer of railroads. The railroad segment and bridges are significant under Criterion 4 in the area of Engineering as an intact segment of the first railroad in the United States—perhaps the world—to demonstrate the feasibility of moving trains across a mountain range using only traction, or the friction between the wheels of the train and the tracks, for propulsion and braking.

To accomplish the mountain ascent, the Western Railroad, with Whistler as its lead engineer, built a group of ten large masonry arch bridges and made extensive cuts and fills to accommodate the roadbed within a winding three-mile section of the Westfield River Valley. As surviving components of that section of railroad, the Western Railroad Stone Arch Bridges, and the segment of Western Railroad Roadbed that connects them, exemplify the engineering accomplishment of the mountain crossing. Unfortunately, only four of Whistler’s original masonry arch structures (including the two bridges that are the subject of this National Historic Landmark nomination) survive currently. The other two surviving masonry arch bridges (one of which is altered) are part of an active freight railroad owned by the CSX Corporation. The remaining spans consist of one two-span stone arch structure (built 1866), one steel girder structure, and four concrete arch structures. The ten bridges are listed in the National Register as the Middlefield–Becket Stone Arch Railroad Bridge District.

The period of significance for the Western Railroad Stone Arch Bridges, Western Railroad Roadbed, and Chester Factory Village Depot begins in 1838 with the commencement of construction on the mountain division of the railroad west of Springfield and ends in 1867 when the Western Railroad was merged into the Boston & Albany Railroad. This period encompasses the construction and operation of the Western Railroad Stone Arch Bridges within the mountain section of the Western Railroad Corporation’s line, the construction of the Chester Factory Village Depot, and the years in which Whistler made his important contributions to the railroad’s success.

PROVIDE RELEVANT PROPERTY-SPECIFIC HISTORY, HISTORICAL CONTEXT, AND THEMES. JUSTIFY CRITERIA, EXCEPTIONS, AND PERIODS OF SIGNIFICANCE LISTED IN SECTION 2.

CRITERION 1

The Western Railroad Stone Arch Bridges, Western Railroad Roadbed, and Chester Factory Village Depot[1] meet National Historic Landmark Criterion 1 in the area of Transportation as components of the Western Railroad Corporation's railroad line through the Berkshire Hills of Massachusetts. The properties are associated with the National Historic Landmark theme of Developing the American Economy. The Western Railroad was chartered in 1831 to connect Worcester, Massachusetts, with the Massachusetts–New York border as part of a longer railroad system, conceived in 1825, that would connect Boston, Massachusetts, and Albany, New York. Construction of the Western Railroad began in 1837, and the complete 156-mile line to Albany opened in 1841. The Western Railroad's length and geographic reach made it one of the earliest inter-regional railroads in the country and, thus, an important development in American transportation history. The line's length, combined with the mountainous terrain, variable weather, and difficulty of communications, created substantial operational difficulties in the company's first years and led the Western Railroad to institute the first corps of full-time managers ever adopted by a business in the United States. This innovation was highly significant in the history of railroad transportation and general American business practice.

Studies for a Railroad to the "West"

After the American Revolution, improvements to inland transportation, or "internal improvements" as they were commonly known, became one of the most hotly debated political issues of the time. Existing roads and water courses in the new nation were inadequate to provide communication between the shipping ports on the East Coast and the fertile and mineral rich lands that attracted ever-increasing settlement and expansion of the western interior (i.e., the Ohio and the Great Lakes Region).[2] Americans from all strata of society were involved in the discussion whether the states or the federal government should be responsible for promoting, authorizing, and subsidizing internal improvements, especially those that crossed state lines and were seen as a benefit to the nation as a whole. During the early 1800s, internal improvements were generally limited to clearing and dredging rivers to make them more navigable and the construction of canals and turnpikes. In the 1810s, railways, which were not restricted to a particular location like rivers and canals and were capable of moving heavy loads more efficiently than turnpikes, began to emerge as a potential solution to the country's transportation problem. The marriage of tracked roadbeds with steam engine technology beginning in the 1820s added to the promise of railroads, but it took time for locomotive technology and railroad engineering to conquer the challenges posed by steep grades. The completion of the Western Railroad in 1841 constituted

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[1] Names for these properties and resources were chosen based on the nomenclature established in the National Register of Historic Places Nomination for the Middlefield–Becket Stone Arch Railroad Bridge District. Bridge numbering and naming conventions differ in other documentation for the structures. Western Railroad Stone Arch Bridge No. 5 is referred to as the Whistler Bridge No. 4 in its HAER documentation (HAER MA-155) and as the Middlefield–Becket Railroad Bridge No. 5 and Western Railroad Stone Arch Bridge in its MHC Inventory Form (BEC.911/MIF.902). Western Railroad Stone Arch Bridge No. 6 (later referred to as Bridge No. 6) is referred to as the Whistler Bridge No. 3 in its HAER documentation (HAER MA-154) and as the Middlefield–Becket Railroad Bridge No. 6 and Western Railroad Stone Arch Bridge in its MHC Inventory Form (BEC.912/MIF.903). The Chester Railroad Depot is referred to as the Penn Central Railroad Depot in its MHC Inventory Form (CHT.172).

[2] John Lauritz Larson, *Internal Improvement: National Public Works and the Promise of Popular Government in the United States* (Chapel Hill, NC: The University of North Carolina Press, 2001), 3; National Park Service (NPS), *The National Survey of Historic Sites and Buildings Theme 28: Travel and Communication* (Washington, DC: NPS, 1963); Sarah H. Gordon, *Passage to Union: How Railroads Transformed American Life, 1829–1929* (Chicago, IL: Ivan R. Dee, 1996), 13–16.

a major step toward solving the problem by proving that, with proper railroad design, steam locomotives could operate in mountainous regions. The technology and engineering advancements demonstrated by the Western Railroad were essential to the subsequent expansion of the nation's railroad system to the West.[3]

The railroads of the nineteenth century trace their lineage to the horse-drawn rail carting systems used in European mines and collieries as early as the 1600s.[4] In England, Richard Trevithick first successfully introduced the steam locomotive to railways in 1804, and George Stephenson (1781–1848) achieved prominent success in steam railroading with his completion of the Stockton and Darlington Railway in 1825 and the Liverpool and Manchester Railway in 1830.[5]

British railroad operations precipitated a high level of interest on the part of Americans, who embarked on a period of study and trials. After 1800, as part of the ongoing debate over internal improvements, prospective railroad developers began lobbying for support for their projects. America's first railway, a horse- or human-powered inclined plane or tramway, was constructed in 1805 up Beacon Hill in Boston. The Granite Railway, an animal-drawn railway built in 1825 to carry granite for the construction of the Bunker Hill Monument in Charlestown, Massachusetts, was the first long-distance freight railroad in the United States, running three miles from a quarry in Quincy to a wharf on the Neponset River in Milton. The Delaware & Hudson Canal Company operated the first steam locomotive in the country in 1829.[6] The first railroads chartered with steam locomotives as the intended motive power were the Mohawk & Hudson, chartered in New York in 1826, and the South Carolina Canal and Railroad Company, chartered in 1827 to run west from Charleston to Hamburg, South Carolina.[7]

The rate of corporations seeking railroad charters increased dramatically in the 1830s. The first operational American railroad routes were inter-city lines between adjacent cities or smaller, essentially captive, railroads built to service specific industries. These companies established the viability of the technology, but were of relatively little importance with respect to solving America's intra-regional transportation problem. Simultaneously, however, entrepreneurs and politicians contemplated and chartered more ambitious railroads that sought to link urban ports and markets with western agricultural regions in emulation of the highly successful Erie Canal (opened 1825). These first inter-regional railroads were the Pennsylvania Canal (a hybrid canal-railroad system), chartered in 1824 and completed in 1834; the Baltimore and Ohio Railroad (B&O), chartered in 1827 and completed in 1852; and the South Carolina Canal and Railroad Company (informally, the Charleston & Hamburg), chartered in 1827 and completed in 1833 with a 136-mile line. These large railroads were founded during the late 1820s and early 1830s, and railroad expansion hastened through the 1850s until, in

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[3] Larson, *Internal Improvement,* 3, 11; NPS *Theme 28*; Gordon, *Passage to Union*, 13–16.

[4] The idea of a technological continuum as applied to railroads is introduced and discussed within an anthropological framework in Frederick C. Gamst's "The Context and Significance of America's First Railroad, on Boston's Beacon Hill," published in *Technology and Culture* Vol. 33, No. 1 (1992):66–100.

[5] Richard Shelton Kirby, Sidney Withington, Arthur Burr Darling, and Frederick Gridley Kilgour (Kirby et al.), *Engineering in History* (New York, NY: Dover Publications, 1990), 273–278; NPS *Theme 28,* 30.

[6] Use of steam engines is a contested area in railroad historiography and depends on the qualifications attached to the superlative. For example, according to Gordon, the Baltimore & Ohio Railroad (B&O) was still debating the type of motive power that it would employ, thus making the North Carolina railroad the first one to use a steam engine (Gordon, *Passage to Union*, 27). However, James D. Dilts in his *The Great Road* argues this claim on the basis that the B&O preceded the South Carolina Railroad because it contemplated the use of locomotives even before its founders and American engineers knew if the technology was practical. James D. Dilts, *The Great Road: The Building of the Baltimore and Ohio, the Nation's First Railroad, 1828–1853* (Stanford, CA: Stanford University Press, 1993), 412–413.

[7] Frederick C. Gamst, "The Context and Significance of America's First Railroad, on Boston's Beacon Hill," *Technology and Culture* Vol. 33, No. 1 (1992), 78–79; Robert E. Carlson, "British Railroads and Engineers and the Beginning of American Railroad Development," *The Business History Review*, Vol. 34, No. 2, (Summer 1960), 147; Gordon, *Passage to Union*, 27–31; Kirby et al., *Engineering in History,* 281, 285–290; Larson, *Internal Improvement,* 227–228; NPS, *Theme 28,* 30–34, 42.

the decade after the Civil War, the railroad emerged as the dominant means of transportation in the United States and an essential tool for transcontinental settlement and Manifest Destiny. But first, these inter-regional railroads needed to solve technical, financial, and managerial problems to achieve this geographic expansion.[8]

The Western Railroad is not consistently listed among America's first inter-regional railroads because of its somewhat fractured corporate history, but deserves inclusion.[9] After 1790, Massachusetts' economy seemed to stagnate, as national expansion beyond the eastern thirteen states reoriented trade and led to expansion of the state's Atlantic Coast rivals—Pennsylvania and New York. Geographic barriers within Massachusetts and competition from other states threatened to divert trade away from Boston and eastern Massachusetts. Boston and other coastal communities felt limited by the lack of a "back country"—an inland region on which they could base their sea trade—while western regions of the state were isolated and thus hindered in their economic expansion, while also in danger of being drawn into the economic orbit of New York. New York's success was attributed largely to the availability of its so-called "water level route" up the Hudson and Mohawk rivers that provided the only natural access through the Appalachian Mountain chain into the country's interior. The completion of the Erie Canal along this route sparked an unprecedented financial boom in New York and led other coastal states, including Massachusetts, to seek their own means in the 1820s to reach the "West" and to develop trade.[10]

Internal improvements advocates and state officials in Massachusetts faced significant geographic obstacles in establishing east–west trade routes. New England is separated geographically by hill and mountain ranges that run north–south through almost the whole length of the region. The approximately 200-mile-wide state of Massachusetts encompasses six distinct geographic regions (east to west): the coastal plain, the upland hills of Worcester County, the Connecticut River Valley, the Berkshire Hills, the valleys of the Housatonic and Hoosic Rivers, and the Taconic Range (on the Massachusetts-New York border).[11]

Proponents of internal improvements in Massachusetts at first envisioned a system of publicly financed and operated canals, but developments in railroads quickly shifted advocates' interest in that direction, and a flurry of survey and report activity followed. In 1825, the state governor proposed a study for a railroad from Boston to Albany. In June 1826, the Massachusetts General Court (MGC, the Massachusetts state legislature) appointed a committee "to consider the practicability and expedience of constructing a railway from Boston … to the western line of the county of Berkshire, in order that, if leave can be obtained from the government of New York, it may be extended to the Hudson River, at or near Albany." The committee's report (the so-called Phelps Committee, after leader Dr. Abner Phelps) was issued in January 1827, but no route or survey of a route was

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[8] Gordon, *Passage to Union*, 27–31; Kirby et al., *Engineering in History*, 281, 285–290; Larson, *Internal Improvement*, 227–228; NPS, *Theme 28*, 30–34, 42.

[9] For example, John Lauritz Larson's 2001 study of internal improvements identifies the Western as a "great interregional pioneer railroad," one of two he lists nationwide (the other is the B&O); while Kirby et al.'s study does not include the Western in its list (Kirby et al., *Engineering in History*, 287–289; Larson, *Internal Improvement*, 230). Because the Massachusetts state legislature was contemplating state control of an east–west railroad link, and because of the doubts concerning mountain railroad engineering (discussed under Criterion 4), the Western Railroad was not chartered until 1833, well after the South Carolina Canal and Railroad Company and the B&O. However, the first surveys done by the Western and the South Carolina Company were nearly simultaneous. Ulrich Bonnell Phillips, *A History of Transportation in the Eastern Cotton Belt to 1860* (New York, NY: The Columbia University Press, 1908), 138–140.

[10] Larson, *Internal Improvement*, 228–229; Stephen Salsbury, *The State, the Investor, and the Railroad: The Boston & Albany, 1825–1867* (Cambridge, MA: Harvard University Press, 1967), 1–23; Edward C. Kirkland, *Men, Cities and Transportation, a Study in New England History, 1820–1900* (Cambridge, MA: Harvard University Press, 1948), 92–109.

[11] George Pierce Baker, *The Formation of the New England Railroad System: A Study of Railroad Combination in the Nineteenth Century* (Cambridge, MA: Harvard University Press, 1937), xv–xvi; Salsbury, *The State, the Investor, and the Railroad*, 1–23; United States Geological Survey (USGS). "Geographic Names Information System, 2016."

proposed.[12] The MGC established a Board of Internal Improvements to examine routes for canals and railroads in February–March 1827, and then in June authorized a survey to identify the best route for a railway from Boston to the Massachusetts–New York state line and a route to the Hudson River near Albany, if permission could be obtained. James F. Baldwin (1782–1862) was appointed engineer for the survey.[13]

Baldwin evaluated two routes, a northern and a southern, but only completed surveys of part of the southern route in the Berkshire Hills between Springfield, Massachusetts, and Albany. The report was submitted in February 1828 with a favorable opinion of a railroad, and the MGC appointed an expanded Board of Directors of Internal Improvements in March 1828 to more precisely survey routes from Boston to Albany. Baldwin was again placed in charge of the survey, and his comprehensive report issued in January 1829 provided three route alternatives with a description of the work, maps, and estimates of costs and probable traffic. The southerly of the three routes, which passed through the towns of Worcester, Springfield, Pittsfield, and West Stockbridge, Massachusetts, was recommended for construction and established the basic location of the future Western Railroad.[14]

Meanwhile, citizens in Massachusetts (mostly in Boston) embarked on a campaign of public education concerning railroads, and established in 1829 the private Massachusetts Rail Road Association to educate the legislature and the public about the workings and benefits of railroads. Leading this campaign were Dr. Abner Phelps and Nathan Hale. Both had served as members on the various MGC committees and boards. Hale was a polymath dedicated to civic improvements and owner of a newspaper, the *Daily Advertiser*. He believed trade from upstate New York should “eventually find its way by the railroad to Boston” and that a railroad was essential to keep Boston from entering an economic decline.[15] The association built a railroad demonstration model in Boston, and Hale used his newspaper as a platform for railroad promotion by issuing a steady stream of editorials, news releases, and reprints of MGC studies and surveys.[16]

State funding for railroads became the subject of a protracted political controversy and public debate that threatened to delay indefinitely any construction of a railroad to Albany. However, with increasing public recognition of the viability and necessity of railroads, Hale and others determined that a start should be made on a railroad to Albany using private funds. The proponents selected Worcester, an industrial community that lay to the east of the formidable Berkshire Hills, as a logical intermediate destination and obtained a charter for the Boston & Worcester Railroad on June 23, 1831. By this date, steam locomotives had been sufficiently tested such that the incorporators determined to use steam locomotives on the line instead of horse power.[17] The approximately forty-three mile Boston & Worcester Railroad main line was completed in 1835 and was an immediate and outstanding success, prompting renewed interest in completing the next leg of a regional route to Albany.

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[12] George Bliss, *Historical Memoirs of the Western Railroad* (Springfield, MA: Bowles and Company, 1863), 6–7.

[13] Baldwin was an important Massachusetts engineer who later oversaw construction of the Boston & Lowell Railroad (chartered 1830). George L. Vose, *A Sketch of the Life and Works of George W. Whistler, Civil Engineer* (Boston, MA: Lee and Shepard, 1887), 11.

[14] Kirkland, *Men, Cities and Transportation*, 92–109; Salsbury, *The State, the Investor, and the Railroad*, 1–2, 60–63; Caroline E. MacGill, *History of Transportation in the United States before 1860* (Washington, DC: Carnegie Institution of Washington, 1917), 309; Bliss, *Historical Memoirs*, 8–14.

[15] Salsbury, *The State, the Investor, and the Railroad*, 48.

[16] Kirkland, *Men, Cities and Transportation*, 92–109; Larson, *Internal Improvement*, 228–229; Salsbury, *The State, the Investor, and the Railroad*, 55.

[17] The Boston & Worcester was the third steam-powered railroad chartered in Massachusetts. The Boston & Lowell was the first (and also the first common carrier in New England), having obtained its charter on June 5, 1830. The second railroad chartered in the state was the Boston & Providence in 1831. Ronald Dale Karr, *Railroads of Southern New England* (Pepperell, MA: Branch Line Press, 1993); Salsbury, *The State, the Investor, and the Railroad*, 63–79, 99; Larson, *Internal Improvement*, 228–229.

Engineering and Construction of the Western Railroad

The directors of the Boston & Worcester Railroad obtained a charter for the Western Railroad Corporation to extend from Worcester to the Massachusetts–New York state line via Springfield in 1833, with shareholders in the Boston & Worcester given preference in purchasing stock of the company. However, the charter holders did not activate it due to the ongoing technical doubts concerning the feasibility of building and operating a railroad over the Berkshires. The beginning of train service to Worcester lent sufficient enthusiasm to the enterprise that the charter recipients in 1835 began considering the activation of their charter.[18] In March 1835, charter holders held a convention to consider the question and came away with a mandate and some funding to move forward with railroad surveys. They commissioned Colonel John M. Fessenden (a West Point graduate and veteran of the Chesapeake and Ohio Canal and the B&O Railroad who had just completed construction of the Boston & Worcester) to complete a topographical survey for the Worcester–Springfield portion of the route, results of which were circulated in July 1835. The opinions of Fessenden and the attendant positive public reception led the founders of the Western Railroad to activate their charter and begin selling stock in August 1835. Sales were completed in December 1835.[19]

In January 1836, the first meeting of the Board of Directors was held. Thomas B. Wales was chosen president to lead the new company in its charge over the mountains. On March 17, George Bliss was chosen as general agent for business and construction. Bliss, a Springfield lawyer, politician, and businessman, served in this capacity from 1836 until 1842 and played an important role in the selection and construction of the route and the purchase of locomotives and cars, along with shaping the company's finances.[20]

There was still substantial doubt among the professional engineering community and general populace (and one member of the company's board of directors) concerning the ability of steam-powered trains to operate over the mountainous terrain of western Massachusetts (discussed below under Criterion 4).[21] At the time the Western was conceived, the line was "remarkable for the boldness of its engineering" and required engineers who were "cautious and skillful, as well as heroic."[22] Accordingly, the directors appointed a committee to seek out the best and most experienced railroad engineers in the country from the limited pool of candidates available. Their first choice for Consulting Engineer was George W. Whistler (1800–1849), a West Point graduate who had studied railroads in Great Britain and had prior experience on the B&O and several other early American railroads (see Criterion 2 statement below). The board offered him the position in January 1836, but he turned them down because of unspecified conflicting circumstances. The directors then offered Whistler's friend and former co-worker Major William Gibbs McNeill (1801–1853) the job (possibly on Whistler's suggestion). McNeill accepted the position in early February and immediately suggested the board hire Captain William H. Swift (1800–1879) as Resident Engineer.[23]

The Western Railroad's Worcester–Albany course logically fell into two sections: a comparatively easy eastern half between Worcester and Springfield and a formidable western portion over the Berkshire Hills between Springfield and the state line with New York. Extensive studies and topographical surveys were needed in 1836 to refine Fessenden's proposed route for the Western Railroad from Worcester to Springfield. Survey of the

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[18] Bliss, *Historical Memoirs,* 22; Salsbury, *The State, the Investor, and the Railroad*, 133.

[19] Salsbury, *The State, the Investor, and the Railroad*, 135–136, 140; Bliss, *Historical Memoirs,* 23–25.

[20] Salsbury, *The State, the Investor, and the Railroad*, 157; Charles E. Fisher, "The Western Railroad," *The Railway and Locomotive Historical Society* (Bulletin No. 69, 1988), 19.

[21] Bliss, *Historical Memoirs,* 148.

[22] Vose, *A Sketch*, 20.

[23] Salsbury, *The State, the Investor, and the Railroad*, 161, 370; Western Railroad Corporation Letter Books, 1836–1838, Series B, v. B145, p. 1–12, Boston and Albany Railroad Co. Records, Baker Library, Harvard Business School (hereafter referred to as WRR Letter Books, v. B145, p. X, Baker Library).

eastern portion commenced in April 1836, undertaken by two parties of assistant engineers under the direction of Swift. After some difficulty ascertaining a route over the summit of the Charlton-Spencer ridge east of Springfield, construction on this part of the line was let to bid in January 1837 and commenced at Worcester. The first train ran between Worcester and Springfield on October 1, 1839.[24]

About July 1836, McNeill was called away from his duties on the Western Railroad to other work[25] and requested that Whistler be hired by the board to share equally the position of consulting engineer and thereafter "proceed to the aid and counsel of the resident engineer [Swift]."[26] The directors appointed Whistler as chief engineer in October 1836, in time to assume leadership for the most difficult aspects of the line west of the Connecticut River.[27]

Topographical surveys for a route from the Connecticut River to the state line had begun in June 1836. With the prospect of difficult mountain construction and operation, Whistler and McNeill did not immediately finalize the route through the Berkshire Hills but instead developed two alternatives for the directors' consideration.[28] One was a northerly route that followed Baldwin's conceptual alignment running up the Westfield River through Westfield and Chester to the summit in Washington, Massachusetts, then descending via Pittsfield to West Stockbridge and the state line. The second route was more southerly and diverged south at Westfield from the first route to pass through Lee, Stockbridge, and West Stockbridge. After much debate, the directors formally voted in August 1837 for the northern route because of its more favorable grades and economic benefits promised by the town of Pittsfield, and ordered the engineers to begin a location survey to lay out the line more precisely.[29]

In the fall of 1837, location surveys proceeded from Westfield, and a final route between that town and the state line at Canaan's Gap in West Stockbridge was accepted at a March 1838 meeting of the directors, who then ordered that multiple sections of the route be put under contract and built at once, including the portion from Middlefield to the state line and the Washington–Pittsfield section (the west slope of the mountain ascent).[30] In July 1838, Swift resigned as resident engineer and his duties were assumed by Whistler and McNeill, making them directly responsible for overseeing construction of the line through the Berkshire Hills. Later in the summer, the engineers prepared a report on the location of the line and depot within Springfield.[31] In May 1840, engineering responsibilities for the railroad were reassigned again. Whistler and McNeill continued to share the position of chief engineer, and Whistler was assigned the additional responsibility of "resident engineer and superintendent of the business of the road."[32]

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[24] Bliss, *Historical Memoirs,* 33–35, 38; Salsbury, *The State, the Investor, and the Railroad*, 144–145, 162; WRR Letter Books, v. B145, pp. 13–14, Baker Library; Franz Anton von Gerstner, *Early American Railroads.* (1843. Reprint, Stanford, CA: Stanford University Press, 1997), 354; Kirkland, *Men, Cities and Transportation,* 135.

[25] A letter from McNeill to the Western's board of directors in September 1836 indicates he was ordered to North Carolina to attend a convention on internal improvements. WRR Letter Books, v. B145, pp. 73–74, Baker Library.

[26] Western Railroad Corporation Directors' Records, 1836–1841, Series B, v. B2, p. 50, Boston and Albany Railroad Co. Records, Baker Library, Harvard Business School (hereafter referred to as WRR Directors' Records, v. B2, p. *X*, Baker Library).

[27] By this time, and for unknown reasons, the Board of Directors appears to have replaced the title Consulting Engineer for Whistler and McNeill with Chief Engineer. It is not apparent that there was any change of duty associated with this change. WRR Directors' Records, v. B2, p. 52, Baker Library; Salsbury, *The State, the Investor, and the Railroad*, 161, 370.

[28] Bliss, *Historical Memoirs,* 38.

[29] Salsbury, *The State, the Investor, and the Railroad*, 169–170; Bliss, *Historical Memoirs,* 38; Fisher, "The Western Railroad," 21–23; WRR Directors' Records, v. B2, pp. 114–115, Baker Library.

[30] Fisher, "The Western Railroad," 24.

[31] Fisher, "The Western Railroad," 25; WRR Letter Books, v. B145, p. 319, Baker Library.

[32] WRR Directors' Records, v. B2, pp. 114–115, Baker Library; Bliss, *Historical Memoirs,* 42; WRR Letter Books, v. B145, p. 319, Baker Library; Vose, *A Sketch*, 23.

Construction across the Berkshire Hills included the **Western Railroad Stone Arch Bridges** and the **Western Railroad Roadbed** from 1838 to 1841, with Whistler now presumably in direct control of the work. In 1840, 53 of the 62.5 miles of road was graded west of the Connecticut River and rail laid on 35 miles.[33] Construction of the roadbed on the eastern slopes of the Berkshires between West Springfield and the Chester Factory Village (now Chester), concluded in March 1841. The eleven-mile section between West Stockbridge and Pittsfield opened May 4, 1841.[34] Beginning in the summer of 1841, all effort was directed toward the 35-mile mountain stretch between Pittsfield and Chester Factory Village, which was completed on October 4, 1841.[35]

Railroad officials also determined the locations for passenger and freight depots. In addition to having an important functional role, depots served as the public face of the corporation; thus, railroad officials and the general public gave close scrutiny to the buildings' location and appearance. Accordingly, in May 1840, the Western Railroad appointed a committee of board members to oversee the location and construction of the depots west of the Connecticut River. Initially, eight depot sites were selected along this portion of the railroad between Westfield and West Stockbridge, including Chester Factory Village.[36] The committee chose a standardized design intended to "meet the wants of the public and of the corporation" but, after consultation with the engineer (presumably Whistler), proposed to vary the size of one or two of the buildings (including Chester Factory Village—see *Western Railroad Operations in Chester*, below).[37] The corporation's January 1843 Annual Report referenced these enlarged depots, noting that "increased accommodations at the various depots" resulted in costs exceeding the original budget.[38]

With construction progressing steadily through western Massachusetts, Whistler turned his attention to the line's connection with the Hudson River. A total of 38 miles of track were needed to run from the Massachusetts/New York state line across the Taconic Range to the banks of the Hudson River in Greenbush, across the river from Albany. That section was originally supposed to be constructed by an independent company chartered in New York. The Hudson and Berkshire Railroad completed a line along that route in 1838, but Whistler found it to be of such inferior construction that he determined new railroad on a separate alignment was needed. In 1840, the Western Railroad gained control of the Albany & West Stockbridge Railroad, which had also received permission through a New York charter to construct a rail line in the area and used those rights to begin work on the new line. Whistler commenced location surveys in May 1840 and the work was completed in December 1841. In the meantime, the Hudson and Berkshire Railroad allowed the Western temporary access to the Hudson River via its route.[39]

On December 27 and December 29, 1841, the Western Railroad celebrated its grand opening by providing rides for local dignitaries in Albany and Boston on trains that ran between the two cities. Festivities held at each locale were said to have dwarfed all previous events of a similar kind and were attended by city and state

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[33] Bliss, *Historical Memoirs*, 61.

[34] The railhead took advantage of the Hudson & Berkshire Railroad, which had begun in 1838. Salsbury, *The State, the Investor, and the Railroad*, 171–172; William Guild, *A Chart and Description of the Boston and Worcester and Western Railroads* (Boston, MA, 1847), 11.

[35] Salsbury, *The State, the Investor, and the Railroad*, 171–172.

[36] Fisher, "The Western Railroad," 32; WRR Directors' Records, v. B2, p. 223, Baker Library.

[37] WRR Directors' Records, v. B2, p. 225, Baker Library.

[38] Western Railroad Corporation, *Seventh Annual Report of the Directors of the Western Rail-Road Corporation to the Legislature, January, 1843* (Boston, MA: Dutton & Wentworth, 1843c), 18.

[39] Salsbury, *The State, the Investor, and the Railroad*, 51–152, 171; Karr, *Railroads of Southern New England*, 156, 158; WRR Directors' Records, v. B2, pp. 204–207, Baker Library; Kirkland, *Men, Cities and Transportation*, 135; von Gerstner, *Early American Railroads*, 354; Bliss, *Historical Memoirs*, 47; Baker, *The Formation of the New England Railroad System*, 8.

officials who were thrilled by the speed of the trains (about 20 miles per hour) and the opening of commerce between western regions and Boston.[40] A Utica newspaper reporter described the importance of the event:

> A new era commences with the opening of the Great Western Railroad which connects Albany and New Bedford [sic]. New England … which we have been accustomed to regard as far removed from us, has, by this magical operation, approximated to our border. The influence of this road upon New England and upon New York can hardly be estimated.[41]

At its opening, the Western's approximately 156-mile route between Worcester and Albany made it the longest and most expensive railroad yet constructed in America by a single corporation. Railway engineer Franz Anton Ritter von Gerstner identified the Western Railroad in his 1842–1843 survey of American transportation infrastructure as "one of the largest and most important of its kind in the United States."[42]

Early Operation

With construction complete, the matter of operating such a long railroad in mountainous and remote terrain came to the fore.[43] Safety and right-of-way maintenance emerged as a significant concern for the Western after a series of fatal accidents occurred in 1840 and 1841. In February 1840, an engine killed a man at a crossing in West Brookfield; in December 1840, an engineer running a 40-car train downgrade into Springfield lost control and the train derailed, killing four crew members. Managing the train movements over the single-track, un-signaled line was also difficult. The length of the railroad route and the timing of trains in the early schedules created 12 daily meets (when trains going in opposite directions pass each other) at various locations. In Westfield Township on October 5, 1841 (one day after the railroad opened between Springfield and Stockbridge), two passenger trains traveling in opposite directions collided, killing a conductor and a passenger and maiming eight other persons.

The string of fatalities and injuries in 1840 and 1841 shocked and alarmed the general public, politicians, and the Western's board. Members of the professional railroad community felt there must be faults in the corporation's regulations or disciplinary practices. Consequently, the Western Railroad's directors moved quickly to identify and resolve any problems of operational or maintenance practices. In November 1841, a committee that included Whistler provided sweeping new reforms to the regulation of train movements and right-of-way maintenance. The new rules included the institution of three divisions on the railroad, each with a roadmaster to make regular inspections and repairs, and the provision of a master of transportation to oversee train movements. These regulations made the Western Railroad "the first American business enterprise to operate through a formal administrative structure manned by full-time salaried managers."[44] In grappling with its mountain railroad operations, the Western Railroad set the precedent for the principles of regulation and organization that made railroad companies the pioneers of modern business management.[45]

Western Railroad Operations in Chester

Chester Factory Village (referred to in the Western's corporate literature as Chester Factory or Chester Factories) was historically an important node for the Western Railroad's passenger and freight operations. The

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[40] Salsbury, *The State, the Investor, and the Railroad,* 178–179; Alvin H. Harlow, *Steelways of New England* (New York, NY: Creative Age Press, 1946), 31–32.

[41] *Utica Daily News*, as quoted in Bliss, *Historical Memoirs*, 154. New Bedford" seems to be a typographical error on the part of the Utica *Daily News* or Bliss—the remainder of the article references the city of Boston.

[42] von Gerstner, *Early American Railroads*, 352.

[43] Harlow, *Steelways of New England*, 134.

[44] Alfred D. Chandler Jr., *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, MA: The Belknap Press of Harvard University Press, 1977), 98.

[45] Salsbury, *The State, the Investor, and the Railroad*, 183–187.

extant **Chester Factory Village Depot** is the railroad building most closely associated with the company's mountain region operations, as well as the best-preserved of the Western Railroad's standardized wood depots and an early example of a depot that included room for a passenger refreshment area.[46] Although the depot is physically separate from the Western Railroad Stone Arch Bridges, its setting within Chester Factory Village along a steep railroad grade and its isolated location in a mountainous area illustrate the historical character of the Western Railroad as a regional transportation corridor that passed through isolated and sparsely populated areas en route between its larger metropolitan Boston and Albany terminals. The depot's design as a pre-Civil War wood passenger station conveys its association with the railroad's earliest period of operations. Thus, the Chester Factory Village Depot and the Western Railroad Stone Arch Bridges collectively possess the essential physical features (the setting, feeling, and association) required to convey the significance of the Western Railroad in American history.

Chester Factory Village (listed in the National Register on May 16, 1989, NRIS No. 89000145), an isolated commercial and municipal hamlet in the southwest portion of the town of Chester, was first settled in the late 1700s by millers and manufacturers seeking to capitalize on the Westfield River's potential waterpower. The village's original name came from the Chester Glass Factory, which ceased operation after the War of 1812 (1812–1814). More substantial industrial development occurred after 1864, when local emery deposits were exploited by the abrasives industry, chiefly the Chester Emery Company and the Hampden Emery Company.[47]

Western Railroad officials established a station location at Chester Factory Village "on land of the route near Steven's farm" as part of their May 1840 committee work and constructed a depot there by 1841, when the line opened. In contrast to other mountain community depots established by the Western Railroad, the Chester Factory Village Depot possessed particular importance in company operations because of its situation in relation to the railroad's route termini and its location at the base of the steepest ascent of the Berkshires. Travel through the mountains was relatively slow (by modern standards), and a trip from Worcester to Albany took approximately nine hours. Thus, Chester Factory Village, as a halfway point between Springfield and Pittsfield, was one of the more important passenger stops on the route. All daytime trains paused long enough for passengers to obtain food at the station from a refreshments table.[48] A chart and description of the Western Railroad published in 1847, six years after the line opened, noted that as Chester Factories "is also at the bottom of the heavy mountain section grades, a stop of several minutes is required to prepare for the ascent."[49]

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[46] The company officially changed Chester Factories to Chester in 1859, although Chester Factories remained in use. The Western Railroad also ran through and stopped at a depot in Chester Village, in the southeastern portion of the town of Chester. In 1853, Chester Village was annexed to the neighboring town of Norwich, which changed its name to Huntington in 1855. Chester Village is now generally known as Huntington Village (listed in the National Register in 1999, NRIS No. 99001080). The original railroad depot in Huntington Village was replaced in 1891–1892 with a Richardsonian stone building designed by Shepley, Rutan & Coolidge that closed in 1957 and was demolished in 1959. Massachusetts Historical Commission, *Reconnaissance Survey Town Report: Huntington* (On file, Massachusetts Historical Commission, Boston, MA), 1982; Heli Meltsner and Betsy Friedberg, "Huntington Village Historic District," National Register of Historic Places Nomination Form (Washington, DC: U.S. Department of the Interior, NPS, 1999), 8.8; Henry F. Walling, *Map of Hampden County, Massachusetts* (Boston, MA: H. A. Haley, 1857); Jeffrey Karl Ochsner, "Architecture for the Boston & Albany Railroad: 1881–1894," *The Journal of the Society of Architectural Historians,* Vol. 47, No. 2 (June 1988), 129; *Pittsfield Sun,* March 10, 1859.

[47] E. Brabec and D. Smith, *Chester Factories, Massachusetts Historical Commission Form A–Area Form* (On file, Massachusetts Historical Commission, Boston, MA), 1986.

[48] John Wright Crane, "The Western Railway…The B&A Railroad," from *History of Washington, MA* (1918), printed in *Stone Walls* (Spring 1991), 5.

[49] Guild, *A Chart and Description,* 57; WRR Directors' Records, v. B2, p. 223, Baker Library; Alfred Minot Copeland, ed., *Our County and Its People: A History of Hampden County, Massachusetts, Volume 3* (Holyoke, MA: The Century Memorial Publishing Company, 1902), 382; Salsbury, *The State, the Investor, and the Railroad,* 183.

Chester Factory Village held importance in freight operations because of its location at the base of the steepest portion of the westbound ascent to Washington Summit. Here, pusher engines (aka helper engines) were added to assist trains up the mountain grade. Trainmen would also wind up hand brakes on the freight cars (before air brakes were in use) to aid the engineer in descending the grade. Locomotive maintenance and layover facilities, including an engine house immediately north of the depot, were established by 1857 to support the pusher engines. By 1885, the engine house was replaced with a larger brick roundhouse (still extant in altered form) approximately 1,000 feet northwest (upgrade) of the depot and original engine house (outside the property boundaries). A water tank for locomotives was located near the station, and a second tank was added at the roundhouse, where a large coal bunker was also sited. Freight was handled in a separate freight house across one set of tracks from the depot.[50]

The 1847 guidebook to the Western Railroad included a small engraved sketch of the station at Chester Factories and several others along the route, drawn "from nature" by a Mr. H. Billings, presumably the well-known Boston illustrator and architect Hammatt Billings (1818–1874).[51] The sketch shows that Chester Factories was one of the stations accorded special significance by Whistler, presumably because of its high visibility to passengers and its prime location at the entrance to the mountains. It employed a distinctive Egyptian Revival design with a columned arcade built directly over the railroad tracks, monolithic towers at each end, and a central tower that may have housed a water tank. The illustrations of the Pittsfield and State Line (West Stockbridge) stations also documented monolithic columned architecture.[52]

Early wood-frame railroad depots were particularly vulnerable to fire, and many were destroyed within a decade or two of construction. The original Pittsfield depot burned in November 1854, and the Western Railroad replaced it with a more modest building nearby.[53] A similar fate apparently befell the original depot at Chester Factory Village, as the *Pittsfield Sun* reported on September 18, 1862, that the "new depot of the Western Railroad at Chester Factories is now completed and opened for use."[54] The extant Chester Factory Village Depot, originally located between two sets of railroad tracks about 100 feet northwest of its current location, was apparently built to the standard specifications and plans (albeit lengthened slightly to accommodate an eating area) used by the Western Railroad during the 1840s for wood-frame depots at many of its original stations. While many early railroad companies employed unique and picturesque stations at their various stops, the Western Railroad had built similar one-story, gable-roofed depots of a seemingly standardized design at Russell, Becket, and Hinsdale along the main line between Springfield and the Massachusetts state line.[55] The picturesque stations were apparently preserved for more important locations such as Chester Factories, Worcester, and Pittsfield. The Western Railroad's approach to its lesser stations anticipated the standardized approach that railroad companies would adopt in succeeding decades, when railroad carpenters or engineers

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[50] Copeland, *Our County and Its People*, 382; Walling, *Map of Hampden County, Massachusetts*; L. R. Burleigh, *Chester, Mass., 1885* (Milwaukee, WI: Beck & Pauli, Lithographers, 1885); L. J. Richards & Co., *New Topographical Atlas of the County of Hampden, Massachusetts* (Springfield, MA: L.J. Richards & Co., 1894); Solomon & Hemphill, "Boston & Albany," 40; Linden, *A Branch of the Linden Tree*, 1; Parker, *Memories of the Boston & Albany Railroad*, 74–75, 78.

[51] Hammatt Billings was born in Boston, with the full name of Charles Howland Hammatt Billings, and used the name Hammatt Billings after 1842. Richard Stoddard, "Hammatt Billings, Artist and Architect," *Old-Time New England*, Volume LXII, No. 3 (January–March 1972), 57–79.

[52] Guild, *A Chart and Description*, 57, 67, 71; Anthony J. Bianculli, *Trains and Technology: The American Railroad in the Nineteenth Century. Volume 3: Track and Structures* (Newark, DE: University of Delaware Press, 2003), 133–175; Carroll L. V. Meeks, *The Railroad Station: An Architectural History* (New York, NY: Dover Publications, Inc., 1956), 48–54; WRR Directors' Records, v. B2, p. 225, Baker Library. According to Dario Gasparini, Professor of Civil Engineering at Case Western Reserve University, the Egyptian Revival style employed at the original station is evidence of Whistler's personal involvement—Whistler is supposed to have been enamored of Egyptian architecture. Dario Gasparini, personal communication with David Pierce, FoKA, n.d.

[53] Bernard R. Carman, "The Railroad's White Elephants," *Berkshire Eagle*, December 28, 1956, pp. 20–21.

[54] *Pittsfield Sun*, September 18, 1862.

[55] The stations at Russell and Becket are no longer extant, and the Hinsdale station was moved and converted into a residence.

typically provided companies with standardized plans for depots and other necessary track-side buildings, and the railroads often used the same plans with few alterations for decades. The Boston & Albany Railroad (B&A) replaced many of the Western Railroad's wood-frame depots between 1881 and 1894 with more elaborate stone buildings designed by Boston architect H. H. Richardson or his successor firm (Shepley, Rutan and Coolidge), but the 1862 Chester Factory Village Depot remained in use through the 1950s. The Chester Foundation moved the building to the east side of the train tracks in 1990 and subsequently restored it.[56] While the station has been moved (NHL Exception 2), its new location on the opposite side of the tracks from its original site does not significantly detract from the relationship between the property and its historic surroundings. Currently, the Chester Factory Village Depot is one of only four surviving Western Railroad stations built prior to the Civil War and retains the highest degree of integrity of these four.[57]

CRITERION 2

The Western Railroad Stone Arch Bridges meet National Historic Landmark Criterion 2 in the area of Engineering as key works of **George Washington Whistler** (1800–1849), a nationally significant early American engineer who specialized in railroads. They are associated with the National Historic Landmark theme of Expanding Science and Technology: Technological Applications. Whistler's career as an engineer in the U.S. Army from 1819 to 1833, a civil engineer in the United States from 1833 to 1842, and a civil engineer in Russia from 1842 until his death in 1849 contributed substantially to the technological development and global expansion of the railroad. Whistler received his education in engineering at the United States Military Academy (USMA) at West Point, where he gained particular experience in topographical surveying. He first worked on railroads as an officer engineer assigned to civilian projects during the late 1820s and 1830s. In this capacity, Whistler belonged to a select group of military engineers who had the opportunity to study nascent British railroad technology in person, which they subsequently applied and adapted to railroad development in the United States. His skill and expertise in the field led to more lucrative positions with various railroads after his resignation from the Army, and he became a leader among the country's earliest generation of professionally trained engineers. The Western Railroad was Whistler's last, and largest, project in America. As chief engineer for the Western from 1836 to 1842, he oversaw the survey and construction of the most difficult mountain segment, which included a series of massive masonry arch bridges to navigate the steep and circuitous route.[58] This exceptional engineering feat served as a capstone to his successful career in American railroad engineering, as well as the catalyst for a prestigious invitation from Russian Tsar Nicholas I to oversee the development and construction of Russia's first long-distance railroad, which traveled between Moscow and St. Petersburg.

George Washington Whistler was born on May 19, 1800, at the military outpost of Fort Wayne (now Indiana) in the Northwest Territory, the youngest son of Major John Whistler and Anna Bishop, and spent his youth at various military stations in the Midwest. His father had fought as a British soldier at Saratoga during the Revolutionary War and briefly returned to England before immigrating to America and joining the U.S. Army. George was appointed a cadet to the USMA on July 31, 1814 and graduated as Second Lieutenant in the U.S. Army on July 1, 1819. For the next two years, he served part-time on topographical duty and part-time in

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[56] Ochsner, "Architecture for the Boston & Albany Railroad: 1881–1894."

[57] The other three stations are at Cheshire, Hinsdale, and West Brookfield and possess less integrity than the station at Chester. The Cheshire Station is similar to Chester but was converted into a business in 1978, and the tracks have been removed. The Hinsdale Station was moved and converted into a residence in 1892. The most architecturally distinctive (and earliest) of these early stations, West Brookfield, was moved for the construction of a new station circa 1880. It is currently in commercial use and has a large addition on the rear. The Chester station is the only one originally built with room for an eating area.

[58] Whistler shared the post of chief engineer for the Western Railroad with his friend and fellow West Point engineer Captain William Gibbs McNeill (1801–1853), but Whistler directly oversaw the railroad section that includes the Western Railroad Stone Arch Bridges. The bridges do not have any significance in relation to McNeill.

garrison at Fort Columbus, New York. For one of his first topographical projects, Whistler surveyed the military defenses at Salem, Massachusetts, with his friend from the USMA, Captain William Gibbs McNeill (1801–1853). The detailed maps they produced included an early example of the contour line method of terrain rendering, first developed by a French engineer in 1791 but not widely used until much later in the nineteenth century. In 1821, Whistler married his first wife, Mary Roberdeau Swift, with whom he had three children—George William (1822–1869),[59] Joseph Swift (1824–1840), and Deborah Delano (1825–1908)—before her death on December 9, 1827. From November 1821 to April 1822, he taught drawing to engineering students at the USMA. In 1822, he went on a topographical detail under Major John James Abert to survey the United States/Canada boundary in the wilderness area between Lake Superior and Lake of the Woods. He remained involved with the boundary survey through 1828.[60]

Whistler gained his first experience with railroad engineering on the survey and construction of the B&O Railroad, the project that initiated the careers of several prominent American railroad engineers. The USMA, the only school in the United States with a formal program of engineering instruction until the mid-1840s, supplied almost all of the country's academically trained engineers in the early nineteenth century. As early as 1816, Army engineers often provided assistance to state and local navigation projects along the Atlantic coast and western rivers and lakes. In 1824, Congress passed the General Survey Act authorizing the president to assign Army engineers to "cause the necessary surveys, plans, and estimates, to be made of the routes of such roads and canals as he may deem of national importance, in a commercial or military point of view."[61] The legislators intended to facilitate the long-desired development of a centralized national transportation system, partially funded by the federal government. However, state or private monies ultimately financed most of the resulting internal improvements, which proceeded in a relatively piecemeal fashion. Congressmen or high-ranking state officials sent formal requests to the War Department on behalf of private companies for engineers to complete surveys of proposed routes through their states. Although the Act mentioned only roads and canals, not railroads, many of the early surveys implemented under the legislation were intended to provide comparisons of railways and canals. The B&O survey was the first to receive assistance under the General Survey Act. The Army assigned Captain McNeill, Colonel Stephen H. Long, and William Howard to the B&O survey in 1827. The officers requested several particular Army lieutenants, including Whistler, to assist them, but the Army initially responded that Whistler could not be spared from his current duties. When the railroad again requested his services in October 1828, Whistler was available.[62]

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[59] Whistler's eldest son and namesake, George William, later became a railway engineer like his father, married Ross Winans' daughter Julia, and worked with his brothers-in-law on the manufacture of locomotives in Russia after his father's death. Vose, *A Sketch*, 41; Albert Parry, *Whistler's Father* (New York, NY: The Bobbs-Merrill Company, 1939), xv, 242. While employed by the Winans firm in Baltimore, Maryland, in April 1849, George William authored a comparative study on coal-burning locomotives for the president of the Reading Railroad that also appeared in several railroad journals. See George W. Whistler Jr., *Report upon the use of Anthracite Coal in Locomotive Engines on the Reading Rail Road* (Baltimore, MD: John D. Toy, 1849); Edward F. Keuchel, "Coal-Burning Locomotives: A Technological Development of the 1850's," *The Pennsylvania Magazine of History and Biography*, Vol. 94, No. 4 (October 1970), 486.

[60] George W. Cullum, *Biographical Register of the Officers and Graduates of the U.S. Military Academy at West Point, NY, from its Est. in 1802 to 1890*, Vol. 1 (Boston, MA: Houghton, Mifflin and Company, 1891), 214–216; Vose, *A Sketch*, 10–15, 40; Parry, *Whistler's Father*, 26; American Society of Civil Engineering (ASCE), "George Washington Whistler"; Gardner C. Teall, "Whistler's Father," *New England Magazine: An Illustrated Monthly* 29 (1903–1904): 235.

[61] Quoted in Forest G. Hill, "Government Engineering Aid to Railroads before the Civil War," *The Journal of Economic History*, 11, No. 3 (Summer 1951), 236.

[62] Cullum, *Biographical Register*, 216; Vose, *A Sketch*, 15–16; Parry, *Whistler's Father*, 26; Robert G. Angevine, "Individuals, Organizations, and Engineering: U.S. Army Officers and the American Railroads, 1827–1838," *Technology and Culture* 42, No. 2 (April 2001), 296–298, 307–308; Dilts, *The Great Road*, 52, 55, 69; Hill, "Government Engineering," 235–239, 243; Larson, *Internal Improvement*, 143–148; Forest G. Hill, *Roads, Rails, and Waterways: The Army Engineers and Early Transportation* (Norman, OK: University of Oklahoma, 1956), 111–112, 143–145.

The B&O sent Whistler, McNeill, Jonathan Knight, and Ross Winans on a trip to England to study the organization, construction, and equipment of the two British railroads then in operation. About a dozen American civil engineers visited England between 1825 and 1831 to learn from British experience with railroad technologies. The B&O group left the United States in November 1828 and spent several months in England, returning in May 1829 to supervise the construction of their employer's railroad line. While in England, Whistler and the others met with the steam locomotive pioneers George and Robert Stephenson and other prominent British engineers such as Nicholas Wood, Benjamin Thompson, and Timothy Hackworth during a period of critical debate over methods of motive power. They toured the Stockton & Darlington Railway in operation and the Liverpool & Manchester line under construction, observing the most current applications of rail technology. Back in Baltimore, Whistler, who was promoted to First Lieutenant on August 16, 1829, personally oversaw the first mile of track laid, connecting Pratt Street to the Carrollton Viaduct (the first stone arch railroad bridge in the United States), in October 1829.[63]

Requests for assistance from Army engineers, particularly those with experience on the B&O, increased as other railroad companies incorporated throughout the 1830s. The Army paid all the costs for the initial B&O survey, but after 1828 it only covered the salaries of those officers assigned to a survey project. Railroad companies or states often compensated officers in addition to their regular Army pay, however, making survey assignments very attractive to the military's engineers. Other financial incentives included allowances for federal benefits, such as double rations. Many officers also preferred railroad survey locales to more isolated posts in the South and West. Between 1832 and 1836, Army officers provided assistance to over 20 different railroad companies, either on temporary detail assignments (known as detached service) or leaves of absence (furloughs). In 1835 alone, at least 15 railroads received engineering aid from the Army. By 1840, 49 of the 572 graduates of West Point between 1802 and 1829 had been appointed chief or resident engineer on a railroad or canal project. In 1850, Francis Wayland, the president of Brown University in Providence, Rhode Island, summarized the military's contributions to the railroad industry: "The single academy at West Point has done more toward the construction of railroads than all our … colleges united."[64]

The Army transferred Whistler and McNeill in June 1830 to the Baltimore & Susquehanna Railroad, where they remained until about 20 miles of track were completed. From late 1831 to 1833, both men worked on the Paterson & Hudson River Railroad in New Jersey, with Whistler serving as associate engineer under McNeill.[65] Whistler married McNeill's sister Anna Matilda in 1831. In 1833, the couple moved to Stonington, Connecticut, where Whistler oversaw the survey for the Providence & Stonington Railroad. He also assisted McNeill with the construction of the Canton Viaduct (1834), another early masonry arch railroad bridge, on the Boston & Providence Railroad to the north.[66]

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[63] Cullum, *Biographical Register,* 216; Vose, *A Sketch,* 16–17; Dilts, *The Great Road,* 69, 85–86, 128; David Gwyn, "Tredegar, Newcastle, Baltimore: The Swivel Truck as Paradigm of Technology Transfer," *Technology and Culture,* Vol. 45, No. 4, (October 2004): 788; Hill, "Government Engineering," 238–239; Hill, *Roads, Rails, and Waterways,* 103–104.

[64] Quoted in Angevine, "Individuals, Organizations, and Engineering," 298; Hill, "Government Engineering," 239–240; William H. Wisely, *American Civil Engineer, 1852–1974: The History, Tradition, and Development of the American Society of Civil Engineers* (New York: ASCE, 1974), 1.

[65] The first two locomotives for the Paterson and Hudson River Railroad were named *McNeill* and *Whistler*. Hill, *Roads, Rails, and Waterways*, 113.

[66] The Canton Viaduct and the Western Railroad Stone Arch Bridges are the only bridges with which Whistler is believed to have been directly involved. Whether Whistler's experience at the Canton Viaduct bore directly in any way on his Western Railroad bridges is unknown. The Canton Viaduct makes use of a distinctive design feature in its superstructure—a pair of masonry walls with a void between them that are connected by the piers and abutments. The Western Railroad Stone Arch Bridges also make use of a masonry void between the abutments and arches, but whether this is an extension of traditional vernacular construction techniques or derived from experience at Canton Viaduct is not clear. Peter Stott, George T. Comeau, and the Canton Historical Commission (Stott et al.), "The Canton Viaduct." National Register of Historic Places Nomination Form (Washington, DC: U.S. Department of the Interior,

Whistler resigned from the Army on December 31, 1833, as part of a wave of officers with railroad experience leaving their military commissions. The War Department had begun implementing restrictions on detached service or furlough in the 1830s as a result of concern over the increasing number of engineers working on railroads and other non-military efforts. A November 1831 regulation withdrawing line officers from duties not directly under the Department's command effectively ended the practice of furloughing officers to railroad companies. In May 1833, the Department required officers to serve three years with their regiments before they could be assigned to detached service and limited the detached service and furlough time. At the same time, growth in the railroad industry offered more lucrative employment opportunities for engineers in the private sector. Between 1830 and 1834, a chief engineer earned between $3,500 and $5,000 annually for a large project and between $2,000 and $3,000 for smaller projects. Prominent officers like McNeill held chief engineer positions on more than one project simultaneously. Resident or principal assistant engineers made between $1,000 and $1,700, assistants between $360 and $800. Salaries rose higher from 1835 to 1837. The largest number of officers resigned in 1836; that year, the number of West Point graduates working as civil engineers more than doubled from 39 to 96. Some officers, such as McNeill, obtained repeated exceptions to the regulations and continued to work on railroad surveys while in the Army. McNeill resigned in late 1837 rather than follow orders to report to his regiment in Florida. The following year, Congress repealed the General Survey Act, terminating direct federal engineering aid to railroads based on the argument that the supply of civilian engineers was sufficient to allow military engineers to remain in the service of the Army.[67]

After leaving the Army, Whistler accepted a position in the machine shop of the Proprietor of Locks and Canals in Lowell, Massachusetts, where he superintended the building of locomotives for the Boston & Lowell Railroad (the earliest ones built in New England) from 1834 to 1837. The first two of his five sons with Anna were born in Lowell: James Abbott McNeill (1834–1903, the future renowned artist) and William Gibbs McNeill (1836–1900). In 1837, the Whistlers returned to Stonington, Connecticut, where they stayed for three years, with George overseeing the completion of the Stonington line under McNeill and where their third child, Kirk Boott (1838–1842), was born. Whistler's involvement with the Western Railroad also started during this period. Thomas B. Wales, the president of the Western's board of directors, wrote to Whistler in January 1836 asking if he would be available to work for the railroad. Whistler responded at that time from Lowell that his circumstances did not permit him to accept but agreed to meet with Wales in Boston and provide recommendations for suitable engineers to hire. Wales then offered the position of chief engineer to McNeill, who accepted in writing on February 5, 1836, and recommended Whistler's classmate at West Point (also Whistler's first wife's brother), William Swift, as the resident engineer. The Western Railroad Corporation appointed McNeill and Swift to their positions on March 16, 1836. By October of that year, Whistler's circumstances had apparently changed, since the board of directors voted to accept McNeill's proposal that Whistler be recognized jointly with him as chief engineer for the Western.[68]

Whistler directed the final survey of the Western's route from the Connecticut River at Springfield, Massachusetts, to the western state line at West Stockbridge, Massachusetts, while still living in Stonington, Connecticut. His first task was the evaluation of two previous surveys to prepare recommendations for the

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NPS, 1984), 8.1; Cullum, *Biographical Register,* 216; Vose, *A Sketch,* 16–17, 40; Parry, *Whistler's Father,* 26; Hill, "Government Engineering," 239–240; Hill, *Roads, Rails, and Waterways,* 110–113.

[67] Cullum, *Biographical Register,* 215; Vose, *A Sketch,* 17; Angevine, "Individuals, Organizations, and Engineering," 313–316; Robert G. Angevine, *The Railroad and the State: War, Politics, and Technology in Nineteenth-Century America* (Stanford, CA: Stanford University Press, 2004), 94–101; Fisher, "The Western Railroad," 24–25; Hill, "Government Engineering," 240–242; Hill, *Roads, Rails, and Waterways,* 117, 146–147.

[68] Cullum, *Biographical Register,* 216–217; Vose, *A Sketch,* 17–21, 40–41; WRR Letter Books, v. B145, p. 1–2, 6–7, Baker Library; WRR Directors' Records, v. B2, pp. 50–52, Baker Library; Fisher, "The Western Railroad," 18, 23; John H. White Jr., *A History of the American Locomotive, Its Development: 1830–1880* (New York, NY: Dover Publications, Inc., 1968), 457.

board. Grading of the route began in early 1839 and was well underway by October 1, when passenger trains began running on the Western Railroad between Worcester and Springfield. On July 5, 1839, McNeill and Whistler took over Swift's duties as resident engineer following Swift's resignation from the post. The Western's board of directors had unsuccessfully appealed to Congress in January to exempt Swift from the repeal of the General Survey Act as an officer already engaged on private works of internal improvement. Swift subsequently chose to terminate his employment with the railroad and retain his military commission. The following May, the corporation negotiated a contract with Whistler for "his future services," acknowledging that "the Engineering talent now employed on the road is of the highest order in the country and … should be retained throughout the approaching summer and fall."[69] The contract spelled out that Whistler and McNeill would continue as chief engineers for the road from Worcester to Albany and for an extension of the road from Albany to a junction with the Hudson & Berkshire Railroad. It also stipulated that Whistler would act as resident engineer and superintendent of the road and "devote his whole time and attention to the interests of the Corporation." The two chief engineers would each be paid $6,000 per year. Whistler moved in 1840 to the Western's headquarters in Springfield.[70]

Throughout 1840 and 1841, Whistler supervised the grading and laying of rail for the 62.5-mile stretch west of the Connecticut River. Engineering was crucial to the success of the railroad. In June 1840, the state appointed a legislative committee to investigate whether the corporation was representing its interests appropriately. A specific complaint was the exorbitant expense incurred by hiring consulting and resident engineers rather than common businessmen and mechanics from towns along the route. The committee reported that this concern was "removed by a careful examination of the manner in which the road has been constructed, and by further consideration of the difficulty and importance of the work, and the disastrous consequences which might result from a single error."[71] Whistler's engineering expertise and prudent management of the location and construction work minimized costs and resulted in the completion of the line on schedule. The work on Division 7, the 13.75-mile mountain section from Chester to Washington Summit, in which the line crosses the West Branch of the Westfield River 21 times, included drilling through rock cuts and constructing stone bridges. Whistler insisted that all the bridges, as well as the deeper cuts and higher embankments, be built to double-track width, although the railroad only laid a single track initially. When a second track was needed within a decade, Whistler's foresight saved the company substantial money in expansion costs. The 28-mile segment between the Connecticut River and Chester Factories at the base of the mountains opened on May 21, 1841, and the road from the New York state line to Pittsfield opened the same month. The intervening stretch from Chester Factories through the summit sections to Pittsfield opened on October 4, 1841.[72]

The successful completion of the most challenging route yet attempted by railroad engineers elevated Whistler's professional reputation and led directly to new opportunities abroad. In May 1842, Whistler accepted an invitation from Tsar Nicholas I of Russia to serve as consulting engineer for a new railroad connecting St. Petersburg and Moscow, and Whistler submitted his resignation to the Western's board of directors. The tsar had sent two Russian transportation engineers, Colonels Pavel Melnikov and Nikolai Kraft, to the United States in June 1839 to study American railroads. Similar to Whistler's own fact-gathering tour of British railways a decade earlier, Melnikov and Kraft traveled throughout the United States for 15 months, inspecting locomotive

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[69] WRR Directors' Records, v. B2, p. 192, Baker Library.

[70] Cullum, *Biographical Register*, 216–217; Vose, *A Sketch*, 19–23, 41; Brian Solomon, *North American Railroad Bridges* (St. Paul, MN: Voyageur Press, 2007), 19–20; Hill, *Roads, Rails, and Waterways*, 128; WRR Directors' Records, v. B2, p. 158, Baker Library; Fisher, "The Western Railroad," 14–29; Benjamin Homans, ed., *The Army and Navy Chronicle*, Volume VIII (Washington, DC: B. Homans, 1839), 17–18; Bliss, *Historical Memoirs*, 51.

[71] Quoted in Bliss, *Historical Memoirs*, 60.

[72] Bliss, *Historical Memoirs*, 5–56, 60; Vose, *A Sketch*, 23–24; Fisher, "The Western Railroad," 31–33; Salsbury, *The State, the Investor, and the Railroad*, 172–173, 372; Solomon, *North American Railroad Bridges*, 19–20.

works, touring railroads under construction and in operation (most extensively the B&O but also the Western), and making contacts with railroad professionals. Whistler's skill in surveying and managing the construction of the technically challenging Western route impressed them. After returning to Russia in September 1840, Melnikov produced a five-volume technical report containing detailed descriptions of American railroads, including route surveys, profiles, roadbeds, track structures, other engineering structures, depots, and rolling stock, along with his favorable assessments of the American system in general and of Whistler in particular. The tsar of vast, resource-rich Russia had the means to secure the highest professional talent in the world for his planned state-of-the-art rail line. When he acted on Melnikov's suggestion to recruit Whistler for the project (included in the report presented to Nicholas in early 1842), he signaled his agreement that Whistler belonged to the top ranks of the engineering profession.[73]

Whistler arrived in St. Petersburg on July 30, 1842, only weeks after the death of his three-year-old son Kirk. The rest of his family followed him to Russia within the year. In collaboration with Melnikov and Kraft, Whistler designed a double-track, 5-foot gauge, 420-mile railroad, on which construction started in 1844, and oversaw the construction of the railroad's locomotives and rolling stock. The tsar allowed Whistler to select his own advisors and colleagues to superintend the manufacturing process, so Whistler invited his friend Ross Winans, a leading American railroad machinery expert, to Russia. Winans instead sent two of his sons to manage the ultimately very lucrative commission, in which the American company managed a Russian labor force in a Russian machine shop. In addition to the railroad project, Whistler also consulted on improvements to the fortifications and docks at Kronstadt, St. Petersburg's main seaport; construction projects at the Naval Academy and the Riding Academy in St. Petersburg; and the building of an iron and stone bridge over the Neva River. The tsar awarded him the Cross of St. Anne, a Russian imperial order of chivalry given for distinguished careers in civil service, in 1847.

While in Russia, Whistler experienced several personal losses, including the deaths of two of his sons. When an Asiatic cholera epidemic broke out in the country in 1848, Whistler sent his family abroad but remained to continue supervising the construction of the rail line, which was nearing completion. In November of that year, he came down with the disease and died in Russia on April 9, 1849. His body was transferred to the United States and interred in the family plot at Stonington, Connecticut. The tsar hired another American army engineer, Major Thompson S. Brown of the Erie Railroad, to finish the St. Petersburg to Moscow railroad, which opened on November 1, 1851.[74]

The Western Railroad is Whistler's premier American work and served as a demonstration of the feasibility of mountain railroading that led to subsequent groundbreaking railroad construction in this country and abroad. The Western Railroad Corporation acknowledged Whistler's achievement in their official response to his resignation letter:

> Employed in surveying, locating and constructing a railroad over a section of country and through mountain passes which seemed to bid defiance to the power of man, his genius and

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[73] Cullum, *Biographical Register*, 217–220; Vose, *A Sketch*, 25–29; White Jr., *A History of the American Locomotive*, 457; Parry, *Whistler's Father*, 46–47; Frederick C. Gamst ed. "The Long Road to a Terminus in America: The Railroad Engineering Career of Franz Anton von Gerstner," In *Early American Railroads: Franz Anton Ritter von Gerstner's* Die inner Communicationen *(1842–1843*) (Stanford, CA: Stanford University Press, 1997), 30–33; Fisher, "The Western Railroad," 36; Alexandre Tarsaidze, "American Pioneers in Russian Railroad Building," *The Russian Review* Vol. 9, No. 4 (October 1950): 289.

[74] Cullum, *Biographical Register*, 217–220; Vose, *A Sketch*, 29, 36; Gamst, ed., "The Long Road to a Terminus," 30–33; Tarsaidze, "American Pioneers," 289–295; Stanley Weintraub, *Whistler: A Biography* (1974. Reprint, Boston: Da Capo Press, 2001), 4–12.

> industry have triumphed over all obstacles and have succeeded in surmounting a summit of more than 1400 feet without in any case losing the elevation that had previously been obtained.[75]

His fellow engineers also held him in high esteem. About four months after his death, a group of them decided to erect a monument to Whistler at Greenwood Cemetery in Brooklyn, New York, where his first wife was buried. The cenotaph's inscription summarizes his professional contributions: "He was distinguished for theoretical and practical ability, coupled with sound judgment and great integrity."[76]

CRITERION 4

The Western Railroad Stone Arch Bridges and Western Railroad Roadbed meet National Historic Landmark Criterion 4 in the area of Engineering under the theme of Expanding Science and Technology: Technological Applications. The properties are components of the Western Railroad's line through the Berkshire Hills of Massachusetts, construction of which set a highly important precedent—the construction and operation of mountain railroads—for other railroads in the United States and, thus, represent a critical development in American railroad history that was essential to the transportation technology's application to inter-regional transportation. This mountain section between Chester, Massachusetts, and the line's summit (Washington Summit, elevation 1,459 feet above sea level [asl]) in Hinsdale, Massachusetts, was the final portion of the railroad to be built and included most of the easterly ascent of the Berkshire Hills—the steepest climb on the railroad. Utilizing consistent gradients of up to 1.57 percent, the railroad followed the West Branch of the Westfield River and incorporated ten large stone masonry arch bridges and multiple cuts and fills to negotiate the river's gorge. Completed just 11 years after the first steam-powered locomotives were employed for rail travel in the United States, the Western Railroad's conquest of the Berkshire Hills was essentially a technical experiment that demonstrated the feasibility of railroads that relied solely on the adhesion, or traction, of steam locomotives (as opposed to use of cogs, racks, etc.) to move trains over mountain grades, a concept previously doubted and untested in practical applications.

Engineering of Gradients on Early Railroads

The greatest technical challenge for the Western Railroad—and the source of its engineering significance in American railroading—was the construction and operation of a steam-powered railroad over the Berkshire Hills. James Baldwin's recommended route between Worcester and the Connecticut River at Springfield had hills reaching an elevation of 918 feet asl, while between Springfield and Pittsfield lay the Berkshire Hills with an elevation of 1,459 feet asl at Washington Summit in Hinsdale. Moving westward, trains would have to ascend the 24 miles between Springfield and Washington Summit on consistent gradients of 0.98 to 1.57 percent.[77] Moving eastbound up to the summit, there were 27 miles of consistent gradients (although none reached 1.57 percent). Steam locomotives were in their infancy, and there was substantial doubt as to whether they could pull loaded trains up hills of any grade. None of the railroads chartered and built up to that time had conquered solely with locomotive adhesion the steep gradients that confronted the Western Railroad, much less attempted to climb any consistent grade at all. "Whether steam transportation over such a route was feasible was

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[75] Quoted in Fisher, "The Western Railroad," 96–97.

[76] Vose, *A Sketch*, 42.

[77] On modern first-class railroads, grades of 0.3 to 0.6 percent are considered acceptable, and on mountain railroads, 2- to 3-percent grades are acceptable. Dilts, *The Great Road*, 411–412. Railroad gradients may be expressed as percentages, in feet per mile, or as a ratio of rise to run. A 1.57-percent grade is equivalent to 1.57 feet of rise in 100 feet of horizontal run. Where historical accounts reference gradients in expressions other than percentages, the authors have converted these expressions to percentages for consistency in this document.

still a question to which American development had given no answer," and thus the construction and operation of such a railroad was a great experiment in railroading.[78]

The expectations and perceived limits for steam locomotive performance on grades had been established by George Stephenson's pioneering English railways, which in the late 1820s and early 1830s were undergoing intensive study by American engineers as well as being adapted to American circumstances.[79] Stephenson had established a critical principle of railroad engineering: that friction was constant at all speeds given a level track (and exclusive of air resistance), but that sloping tracks would introduce an exponential rise in the amount of resistance, and thus the amount of tractive effort[80] that a locomotive had to provide. For example, a track gradient of 1 percent would double the amount of train resistance and more than triple the amount of required tractive effort. Curves could also introduce friction and lengthened a roadway. Therefore, the most efficient railroads were as close to level (assuming loads were to be transported in both directions on the line) and as straight as possible. Where elevation needed to be gained and thus grades imposed, inclined planes with stationary steam engines were employed. Because of his immense influence, Stephenson's railroads were adopted as an archetype for the earliest American railroads, resulting in considerable financial, engineering, and operational hardships. Reducing grades meant deep cuts, tunnels, and extensive fills that raised costs and slowed construction, while stationary inclines imposed additional costs and slowed the overall speed of transportation.[81]

Many early American engineers did not seem to have understood that Stephenson's flat and straight railroads were based both on his recognition that the earliest locomotives produced little tractive effort *and* a desire for energy efficiency. Instead, they overlooked Stephenson's concern with energy efficiency and seem to have mistaken or conflated the Stephensonian archetype of a straight and level road for an absolute limit on the adhesion of a locomotive's metal wheels on metal rails. In fact, English engineer Nicholas Wood had published in 1825 a basic (although now outdated) formula for adhesion indicating that the adhesion of iron steam locomotive wheels on iron rails was sufficient for any gradient (no theoretical limit), assuming an adequate locomotive weight and appropriate train load.[82] However, many early American railroad engineers persisted in a belief that the wheels of an engine would slide or skid with more than a light load and could not move the engine and train if there were any grade. Consequently, a number of patents were awarded for devices such as cog systems, racks, and even "claws" that would allow locomotives to climb grades. Barring use of these, "it seemed at one time to be absolutely necessary that railways intended to traverse mountainous countries over routes which necessitated heavy grades should be supplemented by inclined planes, on which a stationary engine would furnish the motive power."[83] If inclined planes were not practicable, horses would be needed to haul trains up the grades. Even practical demonstrations were not at first sufficient to dispel the mistaken belief concerning adhesion. In 1836, mechanic and locomotive builder William Norris of Philadelphia ran a steam

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[78] Kirkland, *Men, Cities and Transportation,* 115; Vose, *A Sketch,* 23.

[79] Carlson, "British Railroads," 138; Gamst, "The Context and Significance," 80–81.

[80] Tractive effort, measured in pounds, is the theoretical force a locomotive is capable of generating to achieve or sustain motion. For steam locomotives, the tractive force is a function of cylinder diameter and stroke, steam pressure, and the diameter of the driving wheels. White Jr., *A History of the American Locomotive*, 75.

[81] Americans did selectively adopt Stephenson's model because of their desire to avoid high construction costs. To avoid large cuts or fills, engineers quickly abandoned the restrictions on curvature. William H. Brown, *The History of the First Locomotives in America* (New York, NY: D. Appleton and Company, 1871), 106; Carlson, "British Railroads," 141; Kirby et al., *Engineering in History* 276–278; Samuel Smiles, *The Life of George Stephenson, Railway Engineer* (London, England: John Murray, 1858), 142–145.

[82] Nicholas Wood, *A Practical Treatise on Rail-Roads and Interior Communication in General; with Original Experiments, etc.* (London, England: Knight and Lacey, 1825), 134–135, 246.

[83] James L. Ringwalt, *Development of the Transportation Systems of the United States* (Philadelphia, PA: Self-Published, 1888), 90.

engine up a nearly 7-percent grade. The trial was observed by witnesses and reported in the press, but arguments persisted into 1837 in the pages of *Railroad Journal* (the leading trade publication of the time) regarding the possibility of whether locomotives and trains could indeed run up hills with reliance solely on adhesion.[84]

The misunderstanding about Stephenson's calculations regarding traction and adherence meant that many of the pioneer railroads in America strictly avoided grades above 1 percent or employed inclined planes that were unnecessary and detrimental to operations. The Western Railroad was the first major exception, as it was designed to cross a mountain range at sustained grades over 1 percent using steam locomotives that relied only on their own adhesion for traction.[85] The Pennsylvania Canal's Philadelphia and Columbia Railroad had a maximum grade of 0.83 percent for unassisted locomotive operations, while the system's Portage Railroad over the Allegheny Mountains was designed with 10 inclined planes totaling 4 miles and with a total elevation gain of 1,400 feet. Design of the railroad was based on the recommendations of William Strickland, whom the Pennsylvania Society for the Promotion of Internal Improvement had dispatched to England in 1826 with the express instruction that he determine the greatest possible grades for steam railroads.[86]

The B&O Railroad is sometimes given credit for being the first rail line constructed in mountainous country that used traction as its means of propulsion.[87] The B&O sent multiple engineers, including McNeill and Whistler in 1828, to study British railroads. These engineers witnessed loaded trains ascend grades of about 1.2–1.3 percent with less "disadvantage" than was previously thought and were convinced of the ability of steam locomotives to operate effectively on grades.[88] However, B&O's engineer Jonathan Knight (1787–1858) used Stephenson's archetype in laying out the first segment of the railroad route between Baltimore, Maryland, and Harper's Ferry, West Virginia (completed 1834) with shallow gradients that averaged 0.3–0.5 percent. Any grades above 0.6 percent in this segment, including the summit over the Piedmont Plateau at Parrs Spring Ridge (elevation 813 feet, ascended over 40 miles), were provided with inclined planes.[89] The Parrs Spring Ridge inclines were not eliminated until 1838, and the new route employed grades of just less than 1.6 percent (less than that of the Western Railroad) along its 5.5-mile length.[90] The company did not finish the survey for its mountain segment west of Harper's Ferry between Cumberland, Maryland, and Wheeling, West Virginia (then part of Virginia), with its maximum 2.2 percent grade, until 1838, and this line was not completed until 1852.[91]

The South Carolina Canal and Railroad Company, which opened in 1833, did not span any significant mountain formation and used gradients of not more than 0.5 percent for unassisted trains or inclines for other situations.[92] No other railroads completed by 1842, the year after the Western Railroad opened, had lengthy grades (over 1

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[84] MacGill, *History of Transportation*, 315–316; Vaughan Pendred, "On the Adhesion of Locomotive Engines and Certain Expedients for Increasing or Supplementing That Function," *Society of Engineers: Transactions for 1865* (London, England: E. & F. N. Spon, 1865), 221, 224; Wood, *A Practical Treatise*, 128–130; Ringwalt, *Development of the Transportation Systems,* 91, 95; David Stevenson, *Sketch of the Civil Engineering of North America* (London, England: John Weale, 1838), 164; Charles Frederick Carter, *When Railroads Were New* (New York, NY: Henry Holt and Company, 1910), 127–133.

[85] Vose, *A Sketch,* 21–22; MacGill, *History of Transportation,* 315–316.

[86] Kirby et al., *Engineering in History,* 287; Carter, *When Railroads Were New,* 127; Carlson, "British Railroads," 139–141.

[87] See, for example, Kirby et al., *Engineering in History,* 287.

[88] Knight et al., Letter Dated January 26, 1829, reprinted in *Nile's Weekly Register* Vol. 6 (April 4): 92, accessed May 2016.

[89] John F. Stover, in his *History of the Baltimore and Ohio Railroad*, notes in retrospect that the engineers were "far too pessimistic about the ability of steam locomotives to climb grades." John F. Stover, *History of the Baltimore and Ohio Railroad* (West Lafayette, IN: Purdue University Press, 1987), 23; Carlson, "British Railroads," 148; Dilts, *The Great Road*, 85–86, 96, 411–412; Stover, *History of the Baltimore and Ohio,* 23.

[90] William Prescott Smith, *A History and Description of the Baltimore and Ohio Rail Road* (Baltimore, MD: John Murphy & Co., 1853), 58; Stover, *History of the Baltimore and Ohio,* 49.

[91] Stover, *History of the Baltimore and Ohio,* xviii, 69–72; von Gerstner, *Early American Railroads*, Appendix, 640–643.

[92] Phillips, *A History of Transportation,* 147–159; Carlson, "British Railroads," 147.

mile) exceeding the 1.51 percent of the Western's, and most steeper grades on these railroads were accomplished using horse- or steam-powered inclines.[93]

It was in this climate of technical doubt that internal improvements proponents and the founders of the Western Railroad had studied a railroad to Albany in the 1820s. Baldwin's first reports for the Boston–Albany railroad had not envisioned steam locomotives, much less steam locomotives operating on steep grades for extended distances. The 1827 Phelps Committee report had recommended horse-drawn trains, noting that steam locomotives were limited to gradients less than 0.5 percent.[94] The MGC Board of Directors of Internal Improvements' 1829 report had recommended horse-drawn trains up to a maximum of 1.51 percent grade, with the use of stationary engines on inclines for steeper grades.[95] The *Boston Courier* infamously responded to these studies by declaring that a railroad through the mountains would be "impracticable" and "as useless as a railroad from Boston to the moon."[96]

Construction and Operation of the Western Railroad

Construction of the Western Railroad was an exceptionally difficult endeavor, with high engineering standards as well as unanticipated setbacks. There were only seven miles of level track on the entire route. The railroad over the Berkshire Hills had a total elevation gain of approximately 1,350 feet and reached an elevation of 1,459 feet asl. The ascent of the east slope to Washington Summit required that a majority of this elevation gain be achieved in the 26 miles from Westfield to the summit, necessitating grades of more than 1.13 percent for over 12 miles, a 1.51-percent gradient for over six miles, and a maximum gradient of 1.57 percent.[97] With the technical limits of locomotive operation on grades still an open question, there was a mandate to keep the ascent and curves as gentle as possible, despite the temptation to save money by using steeper and more winding alignments. This in turn imposed demands for greater numbers of cuts and embankments, broader radius curves, and more river crossings than envisioned in Baldwin's 1827–1828 survey. The engineers were building a "permanent" roadbed that employed iron rails and wood ties set in trenches of ballast, and the directors and the engineers were envisioning two tracks in the future, which would raise costs still further.[98]

The consideration of double-track construction came to the fore in the fall of 1836. Seeking to cut costs, the directors were thinking about using narrower cuts and embankments, and President Wales wrote to Whistler and McNeill to request their opinion. On the one hand, the directors were only intending to construct a single track in the near term. On the other, "the road … will be the great communication between Eastern & Western America … and … the character of the great enterprise and the interest of the stockholders require the road to be graded for a double track."[99] Ultimately, a two-track roadbed was constructed for all masonry (i.e., bridges) and expensive work (i.e., deep cuts and high embankments) that was 30 feet wide for cuts and 26 feet wide for

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[93] Evaluation of lengths and steepness of gradients was prepared using tabular and descriptive data contained in Franz Anton Ritter von Gerstner's 1842–1843 survey of American transportation infrastructure titled *Die inner Communicationen der Vereinigten Staaten von Nordamerica* (von Gerstner, *Early American Railroads*), which is recognized as perhaps "the most comprehensive and information-rich survey published on early American railroads." Gamst, ed. "The Long Road to a Terminus," 29; von Gerstner, *Early American Railroads*.

[94] Bliss, *Historical Memoirs*, 6–7, 8.

[95] Bliss, *Historical Memoirs*, 15–17.

[96] *Boston Courier*, June 27, 1827, as quoted in Kirkland, *Men, Cities and Transportation*, 106; Salsbury, *The State, the Investor, and the Railroad*, 62–79, 99.

[97] Kirkland, *Men, Cities and Transportation*, 136; von Gerstner, *Early American Railroads*, 355–356; Salsbury, *The State, the Investor, and the Railroad*, 173.

[98] James F. Baldwin, *Plan of a Survey for Rail-Road from Boston to Albany, Made pursuant to a Resolve of the Legislature of Massachusetts of June 14th, 1827*. Sheet No. 1. On file, Massachusetts State Library, Boston, MA, 1828; Vose, *A Sketch*, 21–22; von Gerstner, *Early American Railroads*, 355–356.

[99] Salsbury, *The State, the Investor, and the Railroad*, 172–173, 372; WRR Letter Books, v. B145, p. 92, Baker Library.

embankments. For other areas, economy prevailed and cuts were 20 feet wide and fills were 16 feet wide.[100] These cuts and fills were extensive and included a 2,600-foot-long cut at Washington Summit that reached up to 52 feet in depth.[101] In 1839, damage from a flood along the Westfield River required reconstruction of 28 miles of roadbed to an elevation three feet above its original height.[102] A 1,100-foot-long embankment across Richmond Swamp near the Berkshire Hills summit required vast quantities of fill, as it settled about 75 to 90 feet below the water's surface while under construction.[103]

Bridges, particularly for river crossings, were another substantial component of crossing the mountainous terrain. The Western Railroad's summary of the line after its completion identified the bridge work: construction of 48 wood truss bridges in Massachusetts; a 1,264-foot Howe truss mounted on stone piers over the Connecticut River; 14 stone arch bridges built of 5.5 million cubic feet of masonry west of the Connecticut River in Massachusetts; and 17 wood truss bridges and two stone arch bridges in New York.[104] This matter-of-fact list belied the difficulties of bridge construction encountered on the eastern ascent to Washington Summit. To maintain manageable track grades through the Berkshire Hills, the selected route followed the Westfield River gorge and crossed the river more than 20 times within 13 miles.[105] Ten of these Westfield River crossings utilized stone arch bridges (the others were truss bridges) to ensure that the structures could survive floods and scouring from the active river. Collectively, these stone arch bridges, including Western Railroad Stone Arch Bridges No. 5 and No. 6, represented an extraordinary work of early railroad bridge engineering and construction. Ten of the structures were concentrated along an approximately three-mile-long stretch of river that ran through a narrow 300- to 400-foot gorge between Walnut Hill and Collins Hill to the north and Gobble Mountain to the south.[106] To allow the necessary track gradient and river clearance, they utilized spans of up to 60 feet in length that rose up to 70 feet above the water.[107] Four additional stone arch spans were built over roadways or to carry roadways over the railroad.

The rough terrain of the Westfield River gorge west of Chester prevented surveyors from establishing a complete understanding of the layout, size, and engineering of the bridges before construction, leading to unanticipated complications and costs during the work. Founding of the bridges required extensive excavations to reach stable bedrock that would not be undermined by floods and had to be coordinated with pumping to keep the work areas dry. Studies completed in 1828 near the route through the mountains had identified gneiss thought to be adequate for the roadbed's "rail stone" (presumably stone ties under the rails); consequently, engineers had anticipated that "common rubble masonry" would be adequate for bridge abutments and spandrel walls.[108] However, as construction progressed, they soon realized that "stone arches of large openings" would

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[100] Salsbury, *The State, the Investor, and the Railroad*, 172–173, 372; WRR Letter Books, v. B145, p. 92, Baker Library.

[101] von Gerstner, *Early American Railroads*, 355–356.

[102] Bliss, *Historical Memoirs,* 61; Salsbury, *The State, the Investor, and the Railroad,* 174.

[103] Bliss, *Historical Memoirs,* 72.

[104] Western Railroad Corporation, "Extracts from the Report of the Western Railroad," *American Railroad Journal and Mechanics Magazine XVI* (1843a), 107–110.

[105] von Gerstner, *Early American Railroads*, 355–356.

[106] When completed, the original masonry arch structures were neither the earliest nor largest examples to date of masonry arch railroad bridges, being outranked in both categories by those of the B&O, for example (see the *Comparison of Properties* section below). However, the grouping of ten large railroad bridges in a three-mile stretch of railroad was an exceptional achievement. Unfortunately, only four of Whistler's original masonry arch structures (including the two bridges that are the subject of this National Historic Landmark nomination) survive currently. The other two surviving masonry arch bridges (one of which is altered) are part of an active freight railroad owned by the CSX Corporation. The remaining spans consist of one two-span stone arch structure (built 1866), one steel girder structure, and four concrete arch structures. The ten bridges are listed in the National Register as the Middlefield–Becket Stone Arch Railroad Bridge District.

[107] Salsbury, *The State, the Investor, and the Railroad*, 174.

[108] Solomon Willard, "Mr. Willard's Report on the Cost of Stone for the Rail-Road. From Board of Directors of Internal Improvements, 1829," *Report of the Board of Directors of Internal Improvements of the State of Massachusetts on the Practicability*

be needed, requiring “masonry of a very different and superior character to support them.”[109] Therefore, granite had to be quarried from more remote locations and hauled to the bridge sites.[110]

Account entries for February 1837 through January 1839 for masonry work done on Division 7 by Birnie & McManus of Berkshire County provide a basic sequence for the construction of the bridges. Foundations for abutments and piers were excavated and pumped free of water during construction, followed by masonry for the abutments, wingwalls, and “counterforts” (buttresses at the rear, or backfilled, side of a wall) with backfilling behind the walls. Centering for the masonry arches was erected and the arches laid, then the spandrel walls were raised to finish grade. Cement was employed in the masonry of critical portions of the structures.[111] At some bridge locations, such as Bridge No. 6, the structures were particularly vulnerable to damage from the river and were accessed via long fill approaches. In these cases, the contractor and Whistler resorted to dramatic angled buttresses and wingwalls that consumed large amounts of masonry and entailed a level of structural reinforcement far outside the norms of typical nineteenth-century stone arch bridge construction.[112]

In New York, the Western’s Albany & West Stockbridge Railroad required additional heavy engineering. The Hudson and Berkshire Railroad lay within a portion of the projected route for the Western and had to be relocated, so two railroads were effectively under construction at the same time. Maximum grades of 0.83 percent were employed, with the requisite cuts and fills to achieve this. In Canaan, New York, the railroad crossed the Hoosac Range via a deep cut and a 548-foot-long tunnel at Curtis Summit.[113]

The railroad construction required a large amount of labor, much of which was provided by immigrants of Irish, Russian, and Italian descent. More than 50 separate contractors were employed on the line to provide grading, material hauling, carpentry, masonry, and other construction services. The labor was almost solely done by hand, horse, and oxen. Churn drills and black powder were used to blast rock, chisels were used to cut it to shape, derricks hoisted blocks for masonry, and teams hauled stone and fill. A steam-powered excavator (the first to be used in the country) augmented the hand labor from ca. 1837 to 1841 near Springfield and Worcester. By June 1838, 1,175 men were working on the line east of Springfield. As the line extended up the Westfield River past Chester in 1840–1841, the labor force increased to at least 2,000 men, most of whom were housed in shantytowns along the route. As many as 500 laborers lived at a shantytown at Middlefield on the Westfield River from 1838 to 1842. Middlefield’s population rose from 720 in 1830 to over 1,700 in 1840. According to

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and Expediency of a Rail-Road from Boston to the Hudson River, and from Boston to Providence (Boston, MA: Press of the Boston Daily Advertiser, 1828), 113–119; Western Railroad Corporation, *Fifth Annual Report of the Directors of the Western Rail-Road Corporation to the Legislature, January, 1841* (Boston, MA: Dutton & Wentworth, 1841a), 13–14.

[109] Western Railroad Corporation, *Fifth Annual Report*, 13–14. The reference to common rubblestone in historical accounts and the current appearance of the bridges indicate that Whistler and Birnie & McManus were not particularly interested in the aesthetics of the stone bridges. This is not surprising, since the logistical and financial challenges of building the bridges probably outweighed all consideration of appearance. In addition, the structures were (and still are) in an isolated location with site constraints that limited public visibility. It is not surprising, therefore, that the masonry is of solid, but rough, workmanship and does not employ the Neoclassical ornamentation that is evident in other earlier American railroad masonry bridges, such as those of the B&O.

[110] Salsbury, *The State, the Investor, and the Railroad*, 174; Elizabeth Durfee and Charles T. Lennon (Durfee et al.), “Middlefield–Becket Stone Arch Railroad Bridge District,” National Register of Historic Places Form (Washington, DC: U.S. Department of the Interior, National Park Service, 1979); Bliss, *Historical Memoirs*, 61.

[111] Woodhead Photo Co., Photograph Collection of Damage to the Boston & Albany Railroad, November 6–8, 1927, Baker Library, Harvard Business School.

[112] Of interest is that the B&O’s Thomas Viaduct, of which Whistler had first-hand knowledge, also employed angled buttresses and abutments, though not to the same degree as Bridge No. 6.

[113] Bliss, *Historical Memoirs*, 51–52; Western Railroad Corporation, “Extracts from the Report of the Western Railroad,” 110.

Whistler, there were "many cases" of death during construction. The exact number was never recorded, although nine deaths were identified in non-railroad documents.[114]

Birnie & McManus built the Westfield River masonry arch bridges, as well as the Connecticut River Bridge in Springfield. Scottish stonemason Alexander Birnie (1803–1858) was born in Portobello, Scotland, in May 1803 and immigrated to Morris County, New Jersey, with his family in 1827. He and his father, George Birnie Sr., found work as stonemasons on the Morris Canal. After George's death about a year later, Alexander completed the canal contract and then accepted a contract with the Paterson and Hudson River Railroad, where he first worked with Whistler and McNeill. He moved to Massachusetts ca. 1832 to work on the Boston & Providence and Providence & Stonington lines. Birnie married Mary S. Adams of Providence, Rhode Island, in 1836, and the couple settled in Berkshire County. He formed a business partnership with fellow Scotsmen John T. McManus and John M. Ross and hired his brother-in-law John B. Adams as financial manager and his younger brother William as labor overseer. Birnie & McManus had the exclusive contract for the masonry on Division 7: 27 bridges, culverts, and walls, some of which were abutments for Howe truss bridges. Birnie's earnings from the Western, with 85 percent of the $350,030 total for the Division 7 stonework, enabled him to retire to Hastings-on-Hudson, New York, in 1843, at the age of 39.[115]

The technical difficulties associated with the railroad construction necessitated repeated declarations from the Western Railroad Corporation to defend escalating costs:

> The estimates for the road westward of the Connecticut have from the beginning been a source of great difficulty and embarrassment. A considerable portion of the country was of such a character that the officers of the company could form no judgment from a comparison of it with other routes and could gain but little satisfactory aid from past experience.[116]
>
> Whoever considers that we have to break asunder the continuation of the Allegheny Mountains and to cross more chains than one; –that in 13 miles of Mountain Passes, we have 21 bridges, some of which are 70 feet above the stream; –and that nature has interposed an almost insuperable Barrier between us and the Great West, –will deem the cost of the Western Rail-Road, rather below, than above, what might have been expected.[117]

The company's initial charter limited capitalization at $2 million, but by 1835 this figure was clearly inadequate for construction. In 1836, the MGC approved an increase to $3 million and provided an additional $1 million in state funds.[118] On completion of the survey through the Berkshires in 1838, Whistler and McNeill promptly announced that the construction cost would be $4 million. This need for additional funds followed the Panic of 1837, which severely constricted stockholder payments and lines of credit and forced a temporary stoppage of work in May 1837 on the Worcester–Springfield portion of the line. Additional loans from the state totaling $4

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[114] Edward J. O'Day, "Constructing the Western Railroad: The Irish Dimension," 1982, On file, Friends of the Keystone Arches, Huntington, MA, 12, 15; Durfee et al. "Middlefield–Becket Stone Arch Railroad Bridge District"; Samuel Stueland, "The Otis Steam Excavator," *Technology and Culture*, Vol. 35, No. 3 (July 1994): 571–574.

[115] WRR Directors' Records, v. B2, p. 177, Baker Library; Louis H. Everts, *History of the Connecticut Valley in Massachusetts, Volume II: History of Franklin and Hampden Counties* (Philadelphia, PA: J. B. Lippincott & Co., 1879), 892–894; O'Day, "Constructing the Western Railroad," 16.

[116] Western Railroad Corporation, *Fifth Annual Report,* 9.

[117] Western Railroad Corporation, "Brief Statement of Facts in relation to the Western Rail-Road, February 6th, 1841," *Reports of the Engineers of the Western Rail Road Corporation made to the Directory in 1836–7* (Springfield, MA: Merriam, Wood and Company, 1841b), 11.

[118] Kirkland, *Men, Cities and Transportation,* 124–130.

million were eventually needed to complete construction to the state line.[119] The total cost of the route surpassed $7.5 million, with $5.8 million of this for the Western Railroad and the remainder for the Western's Albany & West Stockbridge Railroad. The 13-mile crossing of the Berkshire Hills was responsible for $980,000 of the total cost, with one mile on this stretch costing $219,929.[120]

With the railroad completed, Whistler and the Western's board of directors had to actually operate their new line through the mountains. Traffic dispatching and right-of-way maintenance (discussed under the Criterion 1 statement) provided substantial challenges. So too did acquiring and operating locomotives capable of hauling heavy freight up the mountains. Whistler had previously overseen the purchase of locomotives and cars for the eastern portion of the railroad between Worcester and Springfield. In 1841, with the railroad largely complete, the directors and Whistler turned their attention to new locomotive purchases for the mountain sections. The men recognized that their existing locomotives provided inadequate tractive effort and adhesion to haul heavy trains up the long mountain grade, so a dozen or more new and more powerful engines were needed. The Western's territory offered an unprecedented and unique proving ground for locomotive manufacturers, who stepped in eagerly with multiple offers to supply locomotives. Proposals came in from six manufacturers. None of the models were satisfactory, as they utilized horizontal boilers and two or four large drive wheels that Whistler feared would damage the track, especially when running on the lightly built Hudson and Berkshire Railroad that provided the Western with a temporary route to the Hudson River.[121]

Whistler turned to Baltimore's Ross Winans (an acquaintance of his from his work on the B&O), who offered a different locomotive design referred to as the "crab." These 22-ton locomotives were intended for sharp curves and steep grades and had eight small drive wheels (an 0-8-0 configuration with no leading or trailing trucks) under a vertical boiler.[122] Winans claimed the crab could move trains of up to 140 tons (80 tons of merchandise and 60 tons of cars) on gradients of 1.55 percent at eight miles per hour. Whistler participated in tests and demonstrations of a crab (the *Maryland*) on the B&O, then advised the Western to purchase seven of the engines at a cost of $11,000 each.[123]

The Western Railroad portrayed the successful operation over Washington Summit as almost inextricably linked with the Winans engines:

> No other railroad in our country, probably none in the world, has such high grades in parts of the line as ours; no other employs so large engines as these from Winans.[124]

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[119] Ibid., 130–134.

[120] Salsbury, *The State, the Investor, and the Railroad*, 144–145, 148–150; von Gerstner, *Early American Railroads*, 359; Bliss, *Historical Memoirs,* 72.

[121] Salsbury, *The State, the Investor and the Railroad*, 176–177; WRR Letter Books, v. B145, September 22, 1898, no page no., Baker Library; Harlow, *Steelways of New England*, 136.

[122] This was only the second locomotive with an 0-8-0 configuration to be designed in the country. The first, named the *Monster*, was built by the Camden and Amboy Railroad between 1835 and 1838. White Jr. *A History of the American Locomotive*, 66.

[123] According to Bliss, a primary reason for Whistler's selection of the crab was the need to accommodate a requirement of the Hudson and Berkshire Railroad in New York that only light engines be used upon its track (Bliss *Historical Memoirs,* 9). The track of this company was used until September 1842, when the Western completed its own Albany & West Stockbridge Railroad line (Bliss, *Historical Memoirs,* 69). Bliss, *Historical Memoirs,* 73–75; Kirkland, *Men, Cities and Transportation,* 306; Salsbury, *The State, the Investor, and the Railroad*, 177–179.

[124] Western Railroad Corporation, *Proceedings of the Western Railroad Corporation, with a Report of the Committee of Investigation* (Boston, MA: Freeman and Bolles, 1843b), 26.

> Engines of this capacity with greater adhesion than any others known, are indispensable to our heavy freighting business over high grades.[125]

Unfortunately, the Winans engines were not delivered on time and suffered from a series of technical problems. Their smokestacks were too high for overhead bridge clearances but lowering them reduced the locomotive's draft and performance. They did not convert from coal to wood fuel as easily as promised. The engines never produced enough steam, requiring two firemen to stoke them, whereas equivalent locomotives from other works needed only one. Their workmanship was shoddy and they suffered frequent breakdowns, leading to excess operating costs on a per-mile basis. The breakdowns occurred at a time when shipping on the reliable Erie Canal was near its peak, making the railroad inferior by contrast. The Winans engines became a matter of protracted controversy and an embarrassment for Whistler (one of the few of his career). Ultimately, the batch of engines had been purchased without adequate testing of the first to be delivered, but this misjudgment was excused by the urgent need to have freight locomotives on the line. In 1847–1848, the Western purchased 35 new engines to replace the crabs and other retired engines; by 1849, all seven crabs had been scrapped. Beginning in 1850, the Western constructed heavy locomotives designed to meet the stiff operating requirements imposed by the Berkshires in its own Springfield shops. Even with this progress in locomotive design, by the mid-1860s, the Western's most powerful engines could haul only eight to ten cars in a train, averaging 10 tons per car fully loaded.[126]

Despite the early difficulties, Western Railroad passengers were deeply impressed (as are historians from later periods) by the eastern ascent to Washington Summit through the Westfield River gorge and over the Western Railroad Stone Arch Bridges. Accounts from the 1840s, including the following, identified this segment as one of the most spectacular locations on the entire journey between Boston and Albany:

> No language that we are master of could give the traveler any proper description of the wildness, the grandeur, or the obstacles surmounted in the construction of this portion of the route. The river is exceedingly crooked, and the lofty mountains, which are very steep and rugged, and of solid rock, shut down quite to the river on both sides, their sharp points shooting by each other, rendering crossing at every bed of the stream indispensable. In addition to this, the points of the hills must be cut away, and for many miles these rock cuttings and bridges follow each other in regular and rapid succession.[127]
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> … I have scarcely ever seen a wilder and more picturesque country. …A place called Chester Factory, which we stopped five minutes, is beautifully situated among encircling mountains which rise like an amphitheater around it, to the height of many hundred feet, wooded to the summit. It almost resembled New Hampshire scenery. …The whole is a succession of beautiful scenes. The Irishmen who worked on the road made a most praiseworthy selection of places for their shanties, which many of them are wise enough to occupy still. Three or four of these outlandish cabins, ranged along the banks of a stream flowing through a woody glen extending back among the hills, made with their turf walls and slant roofs a most picturesque addition to the scene.[128]

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[125] President of the Western Railroad, quoted in Kirkland, *Men, Cities and Transportation*, 306.

[126] Kirkland, *Men, Cities and Transportation*, 137, 306; Salsbury, *The State, the Investor, and the Railroad*, 176–178, 190–191, 193, 267, 272–273; Bliss, *Historical Memoirs*, 73–76,78.

[127] Guild, *A Chart and Description*, 58–59.

[128] Francis Parkman, 1842, as quoted in Durfee et al. "Middlefield–Becket Stone Arch Railroad Bridge District."

Charles Francis Adams wrote in his *Memorial History of Boston*:

> The Western Railroad was the most considerable enterprise of its kind which had then been undertaken in America and taking all the circumstances of the time, novelty and financial disturbance into account, it may well be questioned whether anything equal to it has been accomplished since … it showed what could be done, and how the locomotive could climb.[129]

George Vose's biography of Whistler identified the Western as "one of the greatest works in the world."[130] Transportation historian Caroline MacGill identified the Western as the first road built through a mountainous region without inclines.[131] Finally, William Middleton's 1999 survey of railroad engineering landmarks, *Landmarks on the Iron Road,* described the Western Railroad's mountain pass through the Berkshires as an "unprecedented achievement in the still-new field of railroad engineering."[132]

ALTERATIONS AND LATER HISTORY OF THE WESTERN RAILROAD

After his extensive involvement in the design, construction, and early operation of the Western Railroad, Whistler offered his resignation to the directors of the corporation in May 1842 and left in June to design a railroad in Russia. The Western Railroad soon benefited from the large sums of money spent on construction and became an important regional connection between the Great Lakes region and upstate New York and Boston throughout the remainder of the nineteenth and the first half of the twentieth century. The line was double-tracked between 1847 and 1868, and important branch lines to various industrial cities were established in Massachusetts.[133] A Hudson River bridge, the final link in the Western's route to Albany, was completed in 1866. From 1849 until 1889, the Western between Worcester and Springfield was part of the first all-rail route between Boston and New York City.[134] In 1867, the Boston & Worcester and the Western merged as the Boston & Albany Railroad (B&A). The B&A was financially successful, technologically advanced, and enjoyed a near monopolistic position in east–west freight derived from import-export business in the Port of Boston. The B&A was leased to the New York Central system in 1900, then formally merged into that company in 1961. The line was folded into the Penn Central when that company formed from the bankrupt New York Central and Pennsylvania railroads, and the Penn Central was merged into Conrail in 1976. CSX acquired the Boston–Albany corridor, including the original Western Railroad main line, in 1998. The Western's original route continues to provide an important line for freight between New York and New England.[135]

The Western Railroad Stone Arch Bridges (and the rest of the Western Railroad line) continued to carry the trains of the Western's successors over the Westfield River well into the twentieth century, with little alteration and no need for additional reinforcement despite the heavier trains. In 1912, the New York Central realigned approximately 4,000 feet of railroad along the east ascent to Washington Summit in Chester and Becket, shifting the railroad to the south side of the river and eliminating the two Western Railroad Stone Arch Bridges, as well as a third bridge (now in ruins just a short distance west of Bridge No. 6), from the route. A second State

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[129] Justin Winsor, *The Memorial History of Boston, Including Suffolk County, Massachusetts: 1630–1880,* Volume IV (Boston, MA: James R. Osgood & Company, 1883), 134–135.

[130] Vose, *A Sketch,* 24.

[131] MacGill, *History of Transportation,* 315–316.

[132] William D. Middleton, *Landmarks on the Iron Road: Two Centuries of North American Railroad Engineering* (Indianapolis, IN: Indiana University Press, 1999), 78.

[133] Salsbury, *The State, the Investor, and the Railroad,* 244, 272–273.

[134] The New York, New Haven and Hartford Railroad's route through Connecticut had some river crossings that were without bridges until 1889. Karr, *Railroads of Southern New England,* 158–159.

[135] Baker, *The Formation of the New England Railroad System* 11–12, 16–17; Karr, *Railroads of Southern New England,* 158–159; Kirkland, *Men, Cities and Transportation,* 138, 369–376; Fisher, "The Western Railroad," 96.

Line Tunnel was built parallel to the original bore at Canaan. On November 3 and 4, 1927, massive floods resulting from heavy rainfalls swept through the Connecticut River Valley. The retaining wall of Western Railroad Stone Arch Bridge No. 6 washed away at the northeast (upstream) corner and had to be rebuilt; Western Railroad Stone Arch Bridge No. 5 escaped almost unscathed.[136]

The Western Railroad Stone Arch Bridges remained in the ownership of the successor corporations to the Western Railroad until 1979, when the Penn Central put the land parcels containing the unused railroad gradient on the market.[137] Concern over the vandalism of the bridges prompted preservation efforts to save the structures and, in 1984, the Massachusetts State Division of Fisheries and Wildlife purchased the land parcels and bridges contained therein.[138] In February 2006, Jet Lowe of the Historic American Engineering Record photographed all the surviving stone arch bridges, as well as the remnant abutment of one bridge.[139]

Chester's importance as a passenger and freight node waned after the mid-twentieth century. Regular passenger service was discontinued between Springfield and Albany in 1971 and succeeded by Amtrak, which operates Boston–Albany trains without a stop at Chester Depot.[140] In April 1951, the end of steam locomotive use and a move to exclusively diesel power diminished the need for the extensive locomotive service facilities, as neither the coal tower (extant) nor the water tower were necessary. In 1982, diesel helpers were discontinued on the grade, and freight trains now pass through Chester without stopping.[141]

COMPARISON OF PROPERTIES

Eight railroad properties have been recognized as nationally significant in the areas of transportation history or engineering and designated as National Historic Landmarks. The Thomas Viaduct (NRIS No. 66000388) in Relay, Maryland, was designated a National Historic Landmark in 1964. This 612-foot-long, multiple-span, masonry ashlar structure was designed by the civil engineer Benjamin H. Latrobe to span the Patapsco River and was completed by the B&O in 1835. Incorporating eight 58-foot arches, the viaduct is thought to be the world's oldest multiple stone arch railroad bridge and America's earliest notable example of railroad bridge construction.[142] The Carrollton Viaduct (NRIS No. 71001032) is a 297-foot-long structure that includes a single 80-foot-span masonry arch over the water, a smaller arch over a wagon road, and lengthy buttressed masonry approaches. Located in Baltimore City, Maryland, the Carrollton Viaduct was designed by James Lloyd for the B&O, which completed the structure in 1829. The viaduct is significant as the first masonry railroad bridge constructed in the United States and was designated a National Historic Landmark in 1971.[143] The Allegheny Portage Railroad (NRIS No. 66000648) and the related Staple Bend Tunnel (aka the Allegheny Portage Railroad Tunnel, NRIS No. 94001187) in Blair and Cambria counties, Pennsylvania, were designated as National Historic Landmarks in 1962 and 1994, respectively. The railroad and its tunnel were built from 1831

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[136] Brian Solomon and Mark Hemphill, "Boston & Albany," *CTC Board* (November 1989), 39; Woodhead Photo Co., Photograph Collection of Damage to the Boston & Albany Railroad, November 6–8, 1927, Baker Library, Harvard Business School.

[137] William J. LaMontagne, "The Penn Central Corporation," Written correspondence to Charles T. Lennon, Lower Pioneer Valley Regional Planning Commission, February 9, 1979 (On file, Friends of the Keystone Arches, Huntington, MA).

[138] Anonymous, "Unattributed newspaper clipping," October 15, 1994 (On file, Friends of the Keystone Arches, Huntington, MA).

[139] HAER MA-154 through MA-158, now deposited with the Library of Congress.

[140] Copeland, ed., *Our County and Its People*, 382; Salsbury, *The State, the Investor, and the Railroad*, 183.

[141] Solomon & Hemphill, "Boston & Albany," 40; Elmer F. Linden, *A Branch of the Linden Tree* (Self-Published, n.d., On file, Friends of the Keystone Arches, Huntington, MA), 1; Norvel C. Parker, *Memories of the Boston & Albany Railroad* (Self-Published, 1976, On file, Friends of the Keystone Arches, Huntington, MA), 74–75, 78.

[142] Patricia Heintelman and S. Sydney Bradford, "Thomas Viaduct, National Historic Landmark Nomination Form" (Washington, DC: U.S. Department of the Interior, National Park Service, 1964).

[143] W. Brown Morton III, "Carrollton Viaduct, National Historic Landmark Nomination Form" (Washington, DC: U.S. Department of the Interior, National Park Service, 1971).

to 1834 as part of the Pennsylvania Canal System during the so-called "canal era" of American internal improvements. The railroad's design and construction represented a significant engineering achievement in the country, as well as an important step in the development of regional transportation systems. The railroad's National Historic Landmark designation also includes inclined planes and related engine houses, masonry bridges and culverts, segments of railroad roadbed, and mines and quarries. The Staple Bend Tunnel was designated individually because of its engineering significance as America's first railroad tunnel.[144] Horseshoe Curve (NRIS No. 66000647), a horseshoe-shaped railroad curve spanning two ravines west of Altoona, Pennsylvania, was designated a National Historic Landmark in 1966. The curve was completed in 1854 by the Pennsylvania Railroad to carry the line from Harrisburg to Pittsburgh that eventually replaced the Allegheny Portage Railroad through the Allegheny Mountains. It is 2,375 feet long and 1,300 feet in diameter, bending 220 degrees around a dam and lake and ascending 896 feet. The curve remains in use by the Norfolk Southern Railway's Pittsburgh Line.[145] The Bollman Truss Railroad Bridge (NRIS No. 72000582) in Savage, Maryland, was designated a National Historic Landmark in 2000. The bridge fabricated in 1869 for the B&O is the only surviving example of the bridge truss configuration invented and patented in 1852 by civil engineer Wendel A. Bollman, which was the first all-iron bridge design to be adopted and consistently used on a railroad. It is also one of the oldest standing iron railroad bridges in the United States.[146]

The William Aiken House and Associated Railroad Structures (NRIS No. 74001296) in Charleston, South Carolina, were designated a National Historic Landmark in 1963. The property includes a residence, depot, shops, and warehouses built between 1807 and 1857 by the South Carolina Canal and Railroad Company and its first president, William Aiken Sr. The property is significant for its associations with the early development of railroad transportation in the United States and as an outstanding example of antebellum railroad buildings that illustrate the development of an early railroad terminal facility.[147] The Ellicott City Station (NRIS No. 68000025) in Ellicott City, Maryland, was designated a National Historic Landmark in 1968. The two-story stone station was constructed in 1830–1831 as the original terminus for the B&O and is significant as the oldest extant passenger railroad station in the United States.[148]

These railroad properties illustrate the history and engineering of three of the nation's recognized pioneering inter-regional railroads: the Pennsylvania Canal, the B&O, and the South Carolina Canal and Railroad Company. However, the Western Railroad Stone Arch Bridges and Chester Factory Village Depot are unique in illustrating the development of railroad transportation, railroad engineering, and the career of George Washington Whistler. As discussed above, the Western Railroad should be considered as a fourth pioneering American inter-regional railroad because of the length of the line and the innovative and influential managerial strategies employed in its operation. The railroad's technical achievement in operating steam-powered trains over mountain grades was exceptional and further demonstrated the viability of the transportation mode in America.

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[144] Frank Barnes, "Allegheny Portage Railroad, National Historic Landmark Nomination Form" (Washington, DC: U.S. Department of the Interior, National Park Service, 1962); Berle Clemensen, "Staple Bend Tunnel, National Historic Landmark Nomination Form" (Washington, DC: U.S. Department of the Interior, National Park Service, 1994).

[145] Richard Greenwood, "Horseshoe Curve, National Historic Landmark Nomination Form" (Washington, DC: U.S. Department of the Interior, National Park Service, 1975).

[146] Michael W. Caplinger, "Bollman Truss Railroad Bridge, National Historic Landmark Nomination Form" (Washington, DC: U.S. Department of the Interior, National Park Service, 1999).

[147] Dillon and McKithan, "William Aiken House, Associated Railroad Structures; National Historic Landmark Nomination Form."

[148] Joseph Scott Mendinghall, "Ellicott City Station, National Historic Landmark Nomination Form" (Washington, DC: U.S. Department of the Interior, National Park Service, 1975).

The three aforementioned regional railroads adhered to the established precept of minimal gradients and inclines. The Allegheny Portage Railroad and the B&O employed inclines, and the B&O did not begin operating trains on gradients equivalent to the Western Railroad's until 11 years after the Western Railroad opened. Finally, although Whistler worked on the B&O and other early railroads, no other extant resources illustrate his engineering skills or represent the pinnacle of his career in the United States as do the Western Railroad Stone Arch Bridges.

6. PROPERTY DESCRIPTION AND STATEMENT OF INTEGRITY

Ownership of Property	Category of Property
Private: X	Building(s):
Public-Local:	District: X
Public-State: X	Site:
Public-Federal:	Structure:
	Object:

Number of Resources within Boundary of Property:

Contributing		Noncontributing	
buildings	1	buildings	0
sites	0	sites	0
structures	3	structures	0
objects	0	objects	0
Total	4	Total	0

PROVIDE PRESENT AND PAST PHYSICAL DESCRIPTIONS OF PROPERTY
(Please see specific guidance for type of resource[s] being nominated)

The Western Railroad Stone Arch Bridges and Chester Factory Village Depot National Historic Landmark District (the District) consists of four nationally significant resources associated with the construction and operation of the Western Railroad from 1841 to 1862. The Western Railroad Stone Arch Bridge No. 5 and Western Railroad Stone Arch Bridge No. 6 are single-span masonry arch bridges situated about 0.7 mile apart and located in Becket (Berkshire County) and Middlefield (Hampshire County), Massachusetts, respectively. Constructed in 1840–1841 to carry the railroad across the Westfield River, the bridges, along with the Western Railroad Roadbed that connects the two structures, were abandoned in a 1912 route realignment and acquired by the Massachusetts State Division of Fisheries and Wildlife in 1984. The non-profit Friends of the Keystone Arches, Inc. (FoKA) coordinated the development of the Keystone Arch Bridges Trail, a hiking trail incorporating the Western Railroad Stone Arch Bridges and Western Railroad Roadbed that opened in 2001.

The Chester Factory Village Depot in Chester (Hampden County), Massachusetts, is discontiguous with and approximately 2.25 miles southeast of the remainder of the District. The one-story, wood-frame building at 10 Prospect Street is within Chester's compact village center, alongside the still-active portion of the railroad right-of-way. Constructed ca. 1862 as a passenger depot for the Western Railroad (replacing an earlier building at the same location), the building remained in use as such through the mid-1950s. The non-profit Chester Foundation, Inc. acquired the building in 1990 and rehabilitated it for use as a railway museum and meeting hall on a site across the tracks from its original location.

The District is in the Berkshire Hills region of Western Massachusetts, a geologic region within the Appalachian Mountains that is between the Connecticut River Valley to the east and the Taconic Range (aka Taconic Mountains) to the west. The District's resources are part of the Western Railroad Corporation's former ascent of the east slope of the Berkshire Hills, an approximately 24-mile climb accomplished by following the course of the Westfield River. The ascent is gradual moving west from Springfield. At Chester, the grade steepens to an average of 1.63 percent all the way to Washington Summit, the highest point on the Western

Railroad and the route between Boston and Albany. The Westfield River flows generally west–east through the region but winds with multiple bends on a sinuous course around the lobes of the adjacent mountainsides. The District's bridges and associated roadbed are situated in the deepest and narrowest part of the Westfield River gorge, straddling the Middlefield (Hampshire County) and Becket (Berkshire County) corporate line. The massive bridges rise dramatically within their valley setting because of the route alignment and employ long arch spans with lengthy earth and masonry approaches and projecting buttresses. Their setting, visibility, and robust and extensive ashlar masonry emphasize the engineering accomplishment of the railroad's construction. Chester Factory Village Depot's location in an isolated village along a visibly ascending railroad roadbed conveys the Western Railroad's historical importance as a regional railroad that passed through isolated country regions to connect its terminal points.

Both bridges are listed in the Middlefield–Becket Stone Arch Railroad Bridge District (1980, revised 2001), while Chester Station contributes to the Chester Factory Village Historic District (1989). Not all resources within the Middlefield–Becket Stone Arch Railroad Bridge District and Chester Factory Village Historic District are included in the proposed NHL District. The previously listed railroad district in Becket and Chester, Massachusetts, consists of ten structures: the three surviving arch bridges completed in the 1840s, an 1866 double arch bridge, a steel deck girder span, and four concrete arch bridges in Chester. The proposed NHL District is intended to encompass those resources that have the highest level of integrity to the period of national significance and that are under the ownership of public or private entities favorable toward an NHL listing.

Western Railroad Roadbed (contributing structure)

The Western Railroad roadbed, built 1840–1841, is an approximately 3,800-foot-long section of the original Western Railroad located in Middlefield and Becket, Massachusetts, which was abandoned in 1912 after a partial realignment of the east ascent to Washington Summit. The roadbed follows a winding course through the narrow Westfield River Gorge, crossing the Westfield River (and the town boundary) twice on the nominated roadbed segment. It descends from west to east on a gradient of approximately 1.57 percent, beginning at an elevation of approximately 890 feet asl and ending at an elevation of approximately 835 feet asl. The Western Railroad Stone Arch Bridge No. 6 is located at the west end of the roadbed, and the Western Railroad Stone Arch Bridge No. 5 is at the east end of the roadbed. The roadbed is composed of earth and gravel fills, and all of the superstructure (tracks, ties, and ballast) is now removed. The width of the roadbed ranges from approximately 25 feet (at the tops of embankments) to 31 feet on the bridges. The center of the roadbed at the former track location is maintained as a clear walking trail, and the sides of the roadbed are overgrown with trees.

The roadbed is composed of alternating cuts and fills to accommodate the river course and the slopes of adjacent Walnut Hill and Mount Gobble. The roadbed commences at its west end with a northwest–southeast alignment on an approximately 200-foot-long, 75-foot-high embankment. It crosses the Westfield River via the Western Railroad Stone Arch Bridge No. 6 then passes onto another 75-foot-high embankment retained by the bridge's wingwalls (described below). The embankment curves to the southeast and terminates on the south slope of Walnut Hill, where the roadbed continues on a curving terrace around the shoulder of the hill for approximately 800 feet. A pair of poured-concrete signal footings flank this section of the roadbed. The roadbed then enters an approximately 575-foot-long, 30- to 40-foot deep rock cut through the shoulder of Walnut Hill. The sides of the cut slope steeply down to the roadbed, and the west end of the cut is enlarged with a small quarry pit on the north side of the cut. There are multiple drill marks evident in the stone of the cut. Exiting the cut, the roadbed runs east across a narrow bench built through a combination of cutting and filling the flank of Walnut Hill. An approximately 100-foot-long stone wall contains the downslope side of the bench and roadbed, below which the steep hillside drops precipitously down to the river. The wall is assembled from dry-laid granite and gneiss in a random ashlar bond and is topped by a low parapet with its capstones finished with chiseled margins on their top faces. Leaving the terrace, the roadbed continues to curve to the east–northeast, entering a shorter, shallower rock cut, then passing onto the approximately 100-foot-long, 65-foot-high approach embankment for the Western Railroad Stone Arch Bridge No. 5. After passing over the bridge, the roadbed is supported on a short stretch of embankment and then exits the boundary of the property.

Western Railroad Stone Arch Bridge No. 6 (contributing structure)

The Western Railroad Stone Arch Bridge No. 6 (Bridge No. 6), built 1840–1844, is a single-span arch structure with long approach embankments that crosses the Westfield River gorge at an elevation of approximately 75 feet above the water. The over 500-foot-long ashlar masonry bridge carries the former Western Railroad roadbed on an oblique southeast–northwest[149] course relative to the river, which approaches the bridge from the northwest, turns and flows south below the bridge, and then flows southeast away from the structure. The roadbed approaches to both ends of the bridge are raised on earth embankments to accommodate the steep and sinuous valley walls and have a maximum height of approximately 75 feet above the river and valley floor. The northwest embankment projects southeast from the north flank of Gobble Hill for approximately 200 feet. The southeast embankment is built into the south shoulder of Walnut Hill, which rises steeply to the north and is approximately 250 feet long. Stone wingwalls (described below) extend from the ends of the bridge to retain the fill of the earth embankments.

The Westfield River’s channel ranges from 70 to 95 feet wide at the bridge, and the bridge abutments rise vertically from the river channel. At the east corner of the bridge, an approximately 15-foot-high curving retaining/training wall of coursed ashlar masonry projects from the side of the bridge abutment and extends north–northwest along the edge of the river channel.

Bridge No. 6 is a Roman (aka barrel) stone arch bridge with earth fill and no skew. It comprises a high single arch with abutments that drop vertically to the river channel, spandrel walls and deck reinforced with buttresses, and flaring battered wingwalls behind the buttresses. The overall structure is about 550 feet long as measured to the ends of the longest wingwalls, approximately 42 feet wide as measured to the outside face of the buttresses, and approximately 70 feet, six inches high as measured from the riverbank to the top of the parapet. Most of the bridge masonry (excepting details noted below) is composed of quarry- and split-faced granite tightly laid in a combination of coursed and random ashlar bond without mortar.

The arch barrel rises 60 feet above the river surface, has a 54-foot span (between the faces of the abutments at the springline), and is 31 feet long. The barrel and voussoirs are mortared, wedge-shaped, split-faced granite blocks about two feet by two feet in section. The arch rises from rectangular granite blocks at the springline and terminates at a raised keystone; the voussoirs and keystone have chiseled margins. At the northwest side of the arch, the springstones project a few inches from the face of the abutment as a cornice. At the southeast side of the arch, the blocks project perhaps six to eight inches, apparently having never been dressed after the removal of the arch falsework.[150] The faces of the abutments are coursed granite ashlar, the abutment returns are random ashlar, and the corners of the abutments are hammered to form an arris.[151]

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[149] Northwest is upslope, with the direction of travel toward Albany; southeast is downslope, with the direction of travel toward Boston. Although the angle of the railroad crossing with respect to the river is skewed, the arch barrel is not.

[150] The springstones have chiseled margins, indicating that this was the intent.

[151] An arris is the sharp edge produced by the intersection of planes at a corner. The hammered arris provides an even appearance to the corners and promotes the laying and maintenance of the stones in the correct vertical alignment.

The random ashlar spandrel walls rise up to the level of the parapets without stringcourses or other decorative elements. At the crown of the arch, the bridge structure is approximately seven-and-one-half feet thick to the deck. The 25-foot- six -inch-wide bridge deck is packed earth and gravel without the railroad roadbed track structure and slopes from southeast to northwest to match the railroad gradient of the railroad. The parapets are approximately three feet high and three feet wide. They are assembled from pairs of stone slabs laid on edge about eight inches apart and capped with projecting coping stones; the void between the stones is filled with earth. The top face and ends of the parapets have chiseled margins, and the date 1844 is chiseled into the west end of the northerly parapet.[152] Only about 25 to 30 percent of the parapets remain; the rest have been pushed off the bridge into the stream bed by vandals.

Stone buttresses reinforce the spandrel walls at both ends of Bridge No. 6 and are set approximately 13 feet, six inches back from the abutments' faces. The design of the buttresses is not consistent at all four corners of the bridge; each buttress was designed to protect against the unique erosional forces and/or load requirements of its location. The east and west buttresses are identical—each is 15 feet wide and projects approximately six feet out from the face of the spandrel wall and abutments. Their masonry is random ashlar, and the corner blocks of the buttresses are hammered to form arrises. Curved wingwalls extend from the rear of these two buttresses on a curving footprint. The west wingwall is about 70 feet long and the east wingwall is about 55 feet long. Both rise to a maximum elevation that matches the railroad roadbed and fill and steps down along the slope of the roadbed fill. The wingwall masonry is consistent in design with the spandrel walls.

The north and south buttresses have cores identical to the east and west buttresses but are reinforced with massive bulwarks of additional masonry. On the outside face of the south buttress, the buttress masonry steps out at an elevation of approximately 48 feet above grade and is battered below this elevation at an angle of approximately 75 to 80 degrees. The battered portion is laid primarily in coursed ashlar, and the courses are angled back approximately 25 degrees toward the spandrel wall. A second buttress is laid against the abutment wingwall directly behind the first buttress. This buttress angles out at a more radical slope of approximately 60 degrees, with coursed ashlar masonry also laid at a 25-degree angle. The corner blocks of the buttresses are hammered to form arrises, and the stone blocks are roughly faced off in the plane of the batter. A large retaining wall extends for a distance 230 feet southeast from the buttresses along the railroad roadbed. The gneiss or granitic schist structure is battered, curves slightly to follow the roadbed alignment, and steps gradually down in height as it progresses east. Where the retaining wall is level with the roadbed elevation, it is topped with a parapet of solid granite blocks.

The buttress at the north spandrel wall is almost fully ensconced within additional masonry. A second buttress, which is about 20 feet wide, extends horizontally to the southeast to encompass the full thickness of the abutment wall return. It commences at an elevation of approximately 50 feet above grade then steps down at a slope of approximately 45 degrees before dropping near vertically into the water. The stone is coursed granite ashlar, with a slope of approximately 20 degrees that angles back toward the spandrel wall. A large coursed ashlar wingwall/revetment is integrated with this buttress and runs northwest away from the buttress at an angle along the south bank of the river, retaining and protecting the railroad embankment fill for a distance of about 75 feet.

The historic fabric of Bridge No. 6 appears to be in fair condition; the most substantial condition (and integrity) problem is the absence of the parapets and some stones in the pier tops. There is evidence of water permeation through the spandrel fill and modest settlement and outward bulging in the masonry of the spandrel walls. There are multiple cracked stones in the structure. The river retaining/training wall at the east corner of the bridge is

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[152] Because multiple accounts confirm that the Western Railroad began operation in December 1841, the date of 1844 on the bridge is presumed to indicate that some finish work on the bridge or bridges continued after the railroad opened.

collapsing adjacent to the bridge abutment, and a few stones have consequently been plucked out of the bottom of the abutment.

Western Railroad Stone Arch Bridge No. 5 (contributing structure)

The Western Railroad Stone Arch Bridge No. 5 (Bridge No. 5), built 1840–1841, is a single-span arch bridge that rises approximately 65 feet above the gorge of the Westfield River and is over 150 feet long. The bridge carries the former Western Railroad Roadbed on a nearly east–west course[153] over the Westfield River, which approaches the bridge from the southwest, turns and flows south–north below the bridge, and then flows north–northwest away from the structure. The roadbed approaches to both ends of the bridges are raised earth embankments that project from the steep sides of the gorge and rise to a height of approximately 65 feet. The west embankment extends east from the southerly lobe of Walnut Hill for approximately 100 feet; the shorter east embankment projects from the lower flank of Gobble Mountain for approximately 40 feet. Stone wingwalls (described below) extend from the ends of the bridge to retain the outward ends of the approach fill.

The Westfield River's channel is approximately 55 feet wide below the bridge (nearly equivalent to the bridge's arch span), and the bridge abutments rise vertically from the watercourse's rock banks. At the southwest corner of the bridge, a steep revetment of loosely stacked split granite rubble projects from (but is not integrated with) the west abutment and is stacked against the abutment wall to a height of approximately 25 feet. At the northwest corner, granite riprap lines the river channel. The slope on the outside corner of the river where it meets the southwest corner of the bridge is protected by bedrock outcrops.

Bridge No. 5 is a segmental or parabolic arch stone bridge with earth fill and no skew. It comprises a high single arch with abutments that drop vertically to the river channel, spandrel walls and a deck reinforced with buttresses, and flaring wingwalls behind the buttresses. The overall structure is approximately 160 feet long as measured to the ends of the wingwalls, 45 feet wide as measured to the outside face of the buttresses, and 65 feet high as measured from the riverbank to the top of the parapet. The majority of the masonry, except the arch barrel and other details (noted below), is composed of quarry-faced gneiss or schist tightly laid in a combination of coursed and random ashlar bond without mortar.

The segmental arch barrel rises 56 feet above the river surface, has a span of 53 feet, three inches (between the faces of the abutments), is 31 feet long, and is built to a radius of approximately 26 feet, six inches. The barrel and voussoirs are mortared, wedge-shaped, split granite or granitic schist blocks about two feet by two feet in section. The arch rises from angled granite "skewback" blocks at the springline and terminates at a raised and projecting keystone; the arch's voussoirs and keystones have chiseled margins. The faces of the abutments are coursed granite ashlar, and the corner blocks of the abutments are hammered to form an arris.

The spandrel walls rise up to the level of the parapets without stringcourses or other decorative elements. At the crown of the arch, the bridge structure is approximately five feet thick to the deck. The approximately 25-foot, six-inch-wide bridge deck, which formerly carried two railroad tracks, is packed earth and gravel and is missing nearly all of its parapet stones, except for three at the northwest corner.[154] The bridge deck slopes from east to west to match the gradient of the railroad and is therefore about two to three feet higher at its west end than its east end. There are no date stones, builder's plaques, or other commemorative items attached to the bridge.[155]

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[153] For the purpose of this description, the bridge shall be assumed to have a longitudinal axis running east–west, with east being the downslope direction of travel (toward Worcester) and west being the upslope direction of travel (toward Albany).

[154] The width of the bridge deck is calculated to exclude the approximate width of the missing abutments.

[155] Other stone arch bridges of the Western Railroad in the Westfield River gorge have date stones and sometimes initials carved

Pairs of buttresses reinforce the spandrel walls at each end of the bridge and are set approximately 11 feet, six inches back from the abutments' faces. Each buttress is 15 feet wide and projects approximately seven feet, six inches out from the face of the spandrel wall and abutments. The southwest and northeast buttresses step out and have battered faces below the level of the arch springline. Corner blocks of the buttresses are hammered to form arrises. Each of the buttresses continues above the height of the bridge deck to form a raised pier, pairs of which form portals onto the bridge. The inside faces (those facing the roadbed) of the piers are now missing many of their stones. On the piers' outside faces, one to two courses of stone project slightly outward from the buttress face to form a cornice. Historical photos show that the bottoms of these cornices are at the same elevation as the lowest stones in the now-missing parapets, so the two architectural components were integrated to form a continuous band along the top of the bridge.

The wingwalls at each of the four corners of the bridge have curving footprints, top surfaces that step down from a maximum elevation matching that of the roadway, and lengths ranging from about 25 to 45 feet. The wingwall masonry is consistent in design with the spandrel walls. At the west end of the bridge, poured concrete retaining walls (dating to the late nineteenth or early twentieth century) have been added behind (to the west and upslope of) the stone wingwalls as supplemental roadbed fill retention structures. These supplemental wingwalls are structurally independent of Bridge No. 5 and do not impinge on the integrity of the original wingwalls.

The historic fabric of Bridge No. 5 is in fair condition; the most substantial condition (and integrity) problem is the absence of the parapets and some stones in the pier tops. There is evidence of water permeation through the spandrel fill and modest settlement in the southwest spandrel wall masonry. There are multiple cracked stones in the voussoirs, abutments (particularly the west abutment), and spandrel walls. A section of masonry approximately 21 feet by 12 feet in the southwest buttress is spalling or otherwise degrading.

Integrity of Western Railroad Roadbed and Stone Arch Bridge Nos. 6 and 5

Collectively, the Western Railroad Roadbed and Stone Arch Bridge Nos. 6 and 5 retain integrity such that they convey the Western Railroad's significance as one of America's earliest regional railroads, the country's first mountain railroad, and as a work of George Washington Whistler. The design, materials, and workmanship of the three structures remain intact, excepting the railroad tracks, ties, and ballast—perhaps the most substantial impingement on the grouping's collective integrity. The roadbed and bridges maintain their original alignment without any apparent widening or alteration. As a group, the bridges' extensive and awe-inspiring masonry arches and retaining walls, combined with the rock and earth cuts, embankments, and frequent and tight radius curves of the Western Railroad Roadbed, demonstrate the boldness of vision and strenuous manual labor that were necessary to build the Western Railroad through mountains in a remote part of Massachusetts in the 1830s and 1840s. They also illustrate the engineering genius of Whistler's design. The three structures' location and setting in a narrow, isolated mountain valley underscore the engineering achievement and convey the lengthy distances and logistical and managerial difficulties that were overcome during the railroad's early years of operation. The railroad's historical location and setting are still appreciable for contemporary visitors, who are afforded picturesque views of the river and adjacent mountains comparable to those enjoyed in the past by railroad passengers and employees. Although the resources themselves are on an inactive portion of railroad, the remainder of the Western Railroad's historical right-of-way is still actively used by trains that are visible from the property and serve to enhance the setting, feeling, and association of the resources.

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into prominent locations such as keystones, pier ends, and parapets. Such stones may have been present on Bridge No. 5 but have been lost due to vandalism.

The Western Railroad Roadbed provides important physical context for the Western Railroad Stone Arches, with its sole apparent alteration being the removal of the track structure. Bridge No. 6 retains a high degree of integrity, with only one substantial alteration: the vandalism and consequent loss of a majority of the parapets. The structure retains integrity of location, setting, materials, workmanship, feeling, and association. The loss of the parapets impinges on the bridge's design integrity, but sufficient portions of the parapets remain such that the overall design of the structure is intelligible. Similarly, Bridge No. 5 also retains a high degree of integrity, with its sole alteration being the destruction of most of the parapet walls. The bridge retains integrity of location, setting, materials, workmanship, feeling, and association. The bridge's essential design as a stone masonry arch is retained, although the loss of the parapets impinges on this aspect of the structure's integrity. The concrete retaining walls are minor additions to Bridge No. 5's immediate setting that do not directly impact any historic component of the structure and are of low visibility.

Chester Factory Village Depot (contributing building)

The Chester Factory Village Depot (now Chester Depot) is located on a clear, level parcel between the east side of the active CSX (formerly Western Railroad) railroad tracks and the west side of Prospect Street. Constructed ca. 1862, the Italianate style depot was originally located on the opposite side of the railroad tracks, slightly northwest of its current location, between the existing tracks and a parallel set of tracks to the west. The Chester Foundation, Inc. moved the building to its current location in 1990 to prevent its demolition and subsequently restored it. The one-story, rectangular building is set back about 45 feet from the railroad right-of-way and is oriented with its long sides north–south and parallel to the railroad tracks, as it was in its original location. It is surrounded by a non-historic wood platform set on wood posts and concrete pilings with a metal balustrade along the north and west sides. Railed wood steps to the ground are located at the north and south ends of the deck, and a third set of wood steps with simpler pipe railings is located on the east side.

Prospect Street is a paved local road that runs parallel to the east side of the railroad tracks for approximately one-third of a mile, crosses beneath the tracks about 275 feet south of the depot, then runs north along the tracks to intersect with Main Street almost directly opposite the depot. A few small residences are located on the hillside opposite the depot on the east side of Prospect Street. The area between the depot and the street is paved for parking, with a small grassy section south of the building. A mix of deciduous and coniferous trees screens the tracks from Prospect Street north of the depot. The building is clearly visible from Main Street as one enters the town.

The wood post-and-beam depot measures about 90 feet by 25 feet. It has a side-gable roof clad in slate shingles with a small brick ridge chimney at the south end, clapboard walls with narrow corner boards, and a poured concrete foundation with a leveling course of concrete masonry units. The foundation dates to the 1990 move, when the building was elevated and a basement added. Chamfered brackets ornament the north and south gable ends, and carved wood scroll brackets with pendentives support the overhanging boxed eaves on all sides. The scroll brackets also divide the east and west side elevations into eight bays. Moving north to south, the second, fourth, and sixth bays of the east elevation contain single wood doors; a double wood door is located in the eighth bay. The west elevation has single wood doors in the second and eighth bays and a double wood door in the fourth bay. Each door opening features a flat board surround and, except for the west double door, wood square-arched hood molding (also called label molding). Exterior concrete steps provide access to a metal basement door in the north wall of the building's foundation. Window openings in the depot contain wood double-hung sash: nine six-over-six in the east elevation; five six-over-six and a pair of four-over-four in the west elevation; two six-over-six in the north and south end elevations; and a six-over-six centered in the north gable end. The windows also have flat board surrounds trimmed with wood square-arched hood molding and wood bull-nose sills. The sixth bay of the west elevation contains no openings.

The interior plan of the depot consists primarily of a single large room (roughly 78 feet by 25 feet) at the north end that served as the passenger waiting room and included a refreshment area. A longitudinal wall, historic and possibly original, divides the south end of the building into a room roughly 24 feet by 18 feet (currently used as a "dish room") and an L-shaped hallway. Two separate restrooms and a staircase to the basement were added to the hallway during 1990–1993 renovations. The interior finishes consist of painted beadboard ceilings and walls and hardwood floors. The waiting room features cove and bead crown molding and chair rail and an ogee plank baseboard. The south end of the building has ogee and bead crown molding. All the windows and doors are trimmed with heavy molded surrounds, and the interior doors are wood paneled. A square ticket window, likely original, with a paneled wood screen and a bracketed bull-nose sill is located near the east end of the south waiting room wall. Access to the unfinished attic is through a trap door in the south restroom ceiling.

The Chester Depot is one of few remaining examples of a pre-Civil War, post-and-beam railroad depot associated with the Western Railroad and the only one extant on the difficult segment through the mountains of western Massachusetts. It is also an early example of a station built with an area for passengers to purchase refreshments. The 1990 relocation of the depot to a raised concrete foundation on the east side of the tracks to prevent its demolition compromised the building's integrity, but the depot retains its original north–south orientation parallel to the tracks at the east end of Main Street. The wood platform around the building emulates the original ground-level platform that existed when the tracks ran along both sides of the depot. The building retains much of its original historic fabric, with deteriorated or missing elements replaced in-kind during the 1990s rehabilitation. Overall, the depot's integrity of materials, workmanship, design, setting, feeling, and association remain intact. The property therefore meets NHL Criteria Exception 2.

Archeological Resources

No archeological sites have been identified within the District, nor have any professional archeological excavations been conducted within its boundaries. A cluster of post-contact sites consisting of the remains of the nineteenth- and twentieth-century Bulkley, Dunton, and Company Paper Mill complex and several nineteenth-century residential resources (e.g., houses, a schoolhouse, and a dump) are recorded in the towns of Becket and Middlefield approximately 1 mile west of Stone Arch Bridge No. 6, and the remains of the Chester-Becket Granite Railroad (Massachusetts Historical Commission No. BEC.935) run immediately south and west of the Chester Depot.[156] The mill and residential resources were part of the now largely abandoned mill community of Bancroft that emerged after the construction of the Western Railroad in 1840, and the Granite Railroad was constructed in 1898 to connect the Becket granite quarries to the finishing sheds and the railroad in Chester Factory Village.

Although the District boundaries are fairly circumscribed, the resources within them have the potential to provide information about the construction, maintenance, and evolution of the Western Railroad. As with many major infrastructure projects, the construction of the railroad exceeded original cost estimates by a considerable margin, a fact that generated a great deal of anxiety among the project investors. How this anxiety was communicated by the project engineers to the more than 50 separate contractors employed to build the rail line is unknown, but it is possible that the exacting standards dictated by the construction plans may have been finessed in the field to meet cost and scheduling imperatives. One documented and visible cost-saving measure was the use of narrower roadbed (excepting for major cuts and embankments) along the mountain segment of the rail line rather than the full double-track alignment originally envisioned for the route. Other, undocumented measures may have been employed by the railroad field engineers, such as accommodations in materials and

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[156] Mitchell T. Mullholland, Jennifer Wendt, and Joannah I. Whitney. *Archaeological Intensive (Locational) Survey and Site Examination for the Bancroft Road/Town Hill Road Bridge Replacement Project, Becket and Middlefield, Massachusetts.* On file, Massachusetts Historical Commission, Boston, MA, 2004.

construction techniques used for the rail bed that would be visible only through an excavated cross section of the feature.

An example of this kind of "field-expedient" construction was identified during archeological excavations of a segment of the ca. 1803 Middlesex Canal in Wilmington, Massachusetts.[157] Like the Western Railroad, the canal was well over budget toward the end of construction, and several shortcuts were authorized by the engineers. One of these cost-cutting shortcuts consisted of a modified form of waterproofing, or puddling, along the canal walls using a thin layer of clay laid over pounded and compacted soils instead of the more than two feet of clay called for in the original construction plans. However, even this modified form of puddling appears to have been a time, money, and labor-intensive approach that the dwindling budget could not sustain. An archeological cross section of the canal in Wilmington—one of the last sections of the canal to be constructed—showed that to speed work and cut costs, the builders dispensed with clay altogether in favor of pounding and "seasoning" the trench walls and adjacent towpath to form a reasonably waterproof surface.

Evidence of railroad maintenance may also be buried in and around the extant Western Railroad rail bed and provide glimpses of how well or poorly the line was looked after during its many years of service. For example, a policy of benign neglect was archeologically documented during excavations along an abandoned branch of the ca. 1890 Knoxville and Bristol Railroad, or Peavine Railroad, in East Tennessee. Unprofitable, but popular and regularly used by local townspeople, the branch was shut down by the railroad owners due to its "poor condition." Soil profiles recorded from trench excavations along the branch, however, suggest that the poor condition of the rail bed was the result of the erosional sediment being allowed to fill in the ditches parallel to the track contrary to standard railroad line maintenance, an infilling that appears to have been tacitly approved by the railroad owners to provide a justification for the branch closure.[158]

Evidence of construction techniques or shortcuts may also be buried within the surviving Western Railroad stone arch bridges. Archeological excavations at the Bunker Hill Monument in Boston showed that, despite clear and strident dictates from the monument engineer Loammi Baldwin, roughly hewn granite blocks joined with mortar and varying amounts of rubble infill were used for the base of the obelisk rather than the dressed and hammered stone with no rubble work called for in the original plans. This strategy no doubt was used to control the ballooning costs of the monument construction and, perhaps just as importantly, because the inferior materials would be buried out of sight of the exacting but absentee Baldwin.[159] In the face of mounting financial and political pressures, substitute materials and creative building techniques could have been similarly employed during the construction of the foundations and superstructure of Stone Arch Bridge No. 5 and Stone Arch Bridge No. 6. While these materials and techniques, if used, clearly did not compromise the structural integrity of the bridges, they would reflect expedient and perhaps vernacular construction methods that are otherwise undocumented in the bridges' construction history.

The Chester Factory Village Depot was relocated from its original site west of the railroad tracks to its new site east of the tracks in 1990. As such, the land within the District boundaries surrounding the building will not contain any archeological resources directly associated with the construction or use of the depot when the Western Railroad was active. An 1885 bird's-eye map of Chester, however, shows a small, unlabeled structure

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[157] Kristen Heitert and Matthew Kierstead. *Existing Conditions Documentation, 911 Main Street, Wilmington, Massachusetts.* The Public Archaeology Laboratory, Inc. Report No. 1714. Submitted to Robert Autenzio, Wilmington, MA, 2004.

[158] Faulkner, Charles H. *Industrial Archaeology of the "Peavine Railroad": An Archaeological and Historical Study of an Abandoned Railroad in East Tennessee.* Tennessee Historical Quarterly 44, no. 1 (Spring 1985):40–58.

[159] Heitert, Kristen. *Archaeological Overview and Assessment, Bunker Hill Monument, Charlestown, Massachusetts.* The Public Archaeology Laboratory, Inc. Report No. 2141. Submitted to Northeast Region Archeology Program, National Park Service, Lowell, MA, 2009.

immediately north of the current depot location; the structure does not appear on an 1857 map and is gone by the time of an 1894 map of the village. The function of the structure is unknown; however, given its location between the rail lines, it is assumed to be associated in some way with general railroad operations. Archival and archeological research into the resource could provide insights into its size, configuration, and function that would supplement and enhance the history of the railroad.

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Woodhead Photo Co. Photograph Collection of Damage to the Boston & Albany Railroad, November 6–8, 1927. Baker Library, Harvard Business School.

Previous documentation on file (NPS):

_X_ Previously listed in the National Register (fill in 1 through 6 below)
__ Not previously listed in the National Register (fill in **only** 4, 5, and 6 below)

1. NR #: 80000502 (Bridges and Roadbed)
   NR #: 89000145 (Chester Factory Village Historic District includes Depot)
2. Date of listing: April 11, 1980, with 2001 amendment (Bridges and Roadbed)
   Date of listing: May 16, 1989 (Depot)
3. Level of significance: National (Bridges and Roadbed); Local (Depot)
4. Applicable National Register Criteria: A_X_ B__ C_X_ D__
5. Criteria Considerations (Exceptions): A__ B__ C__ D__ E__ F__ G__
6. Areas of Significance: Transportation and Engineering

__ Previously Determined Eligible for the National Register: Date of determination:
__ Designated a National Historic Landmark: Date of designation:
__ Recorded by Historic American Buildings Survey: HABS No.
X_ Recorded by Historic American Engineering Record: HAER No. MA-154 and MA-155
__ Recorded by Historic American Landscapes Survey: HALS No.

Location of additional data:

State Historic Preservation Office: Massachusetts Historical Commission
Other State Agency:
Federal Agency:
Local Government:
University: Baker Library, Harvard Business School
Other (Specify Repository): Friends of the Keystone Arches, Chester, Massachusetts

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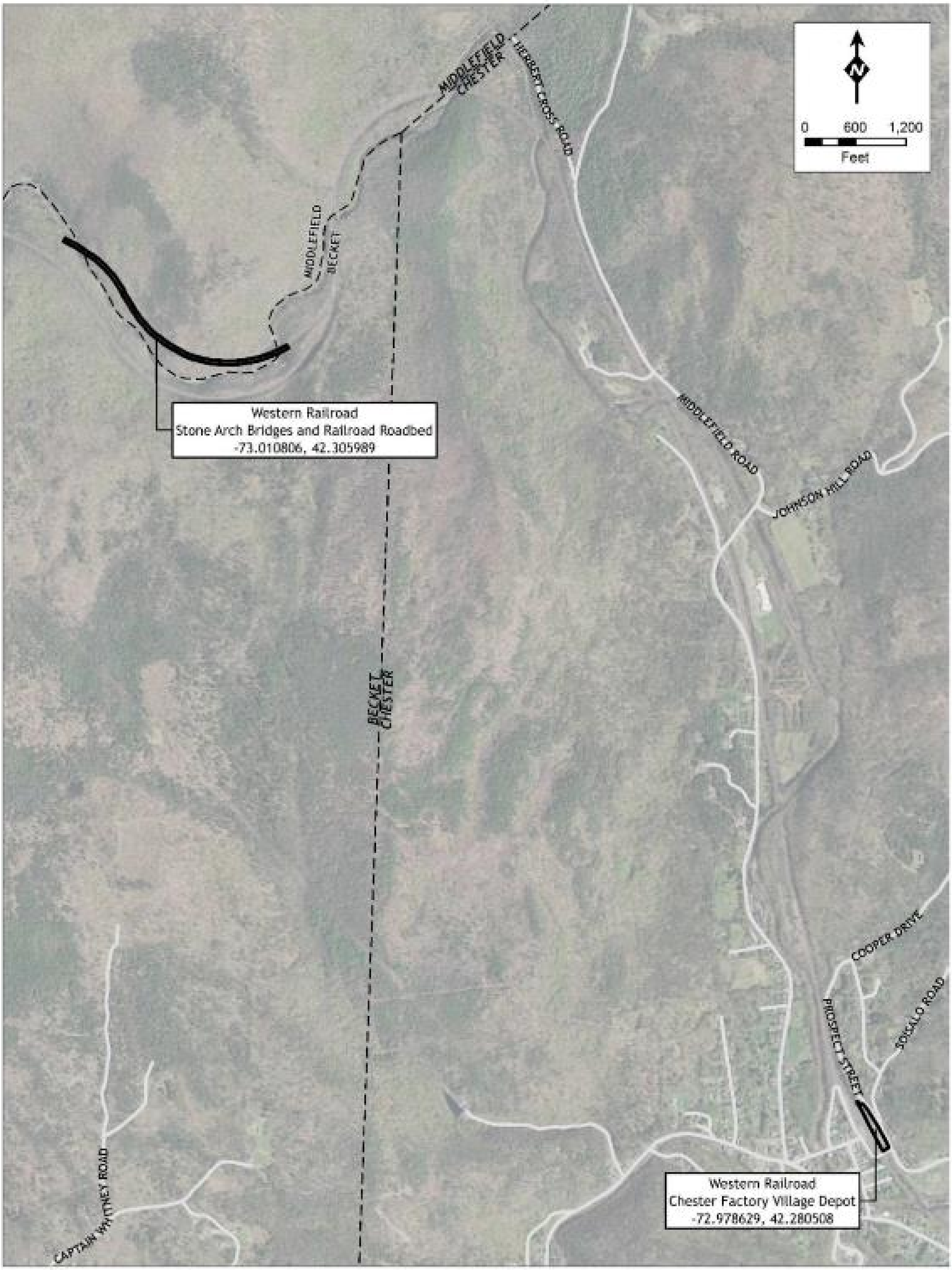
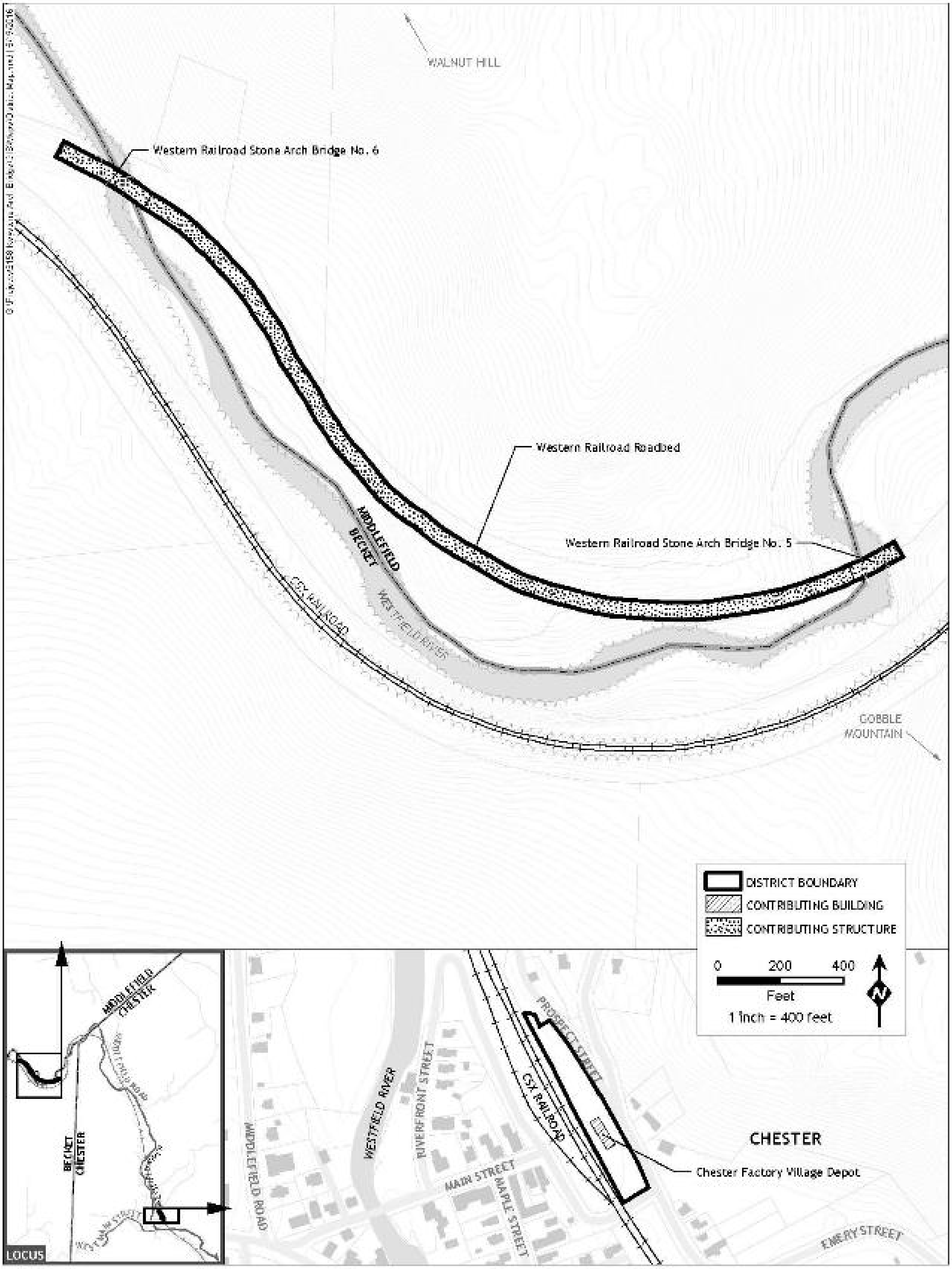


Western Railroad Stone Arch Bridges National Historic Landmark (NHL) District Coordinate Map.

Location: Becket, Middlefield, and Chester, Massachusetts
Datum: WGS84



Western Railroad Stone Arch Bridges National Historic Landmark (NHL) District Map

1. Western Railroad Roadbed and deck of Western Railroad Stone Arch Bridge No. 6 (Bridge No. 6) in the Westfield River gorge, looking southeast (downgrade, toward Worcester). John Daly, Public Archeology Laboratory (PAL), 2017.

2. Oblique view of southwest (downstream) elevation of Bridge No. 6, looking east. John Daly, PAL, 2017.

3. Southwest elevation of Bridge No. 6, looking north. John Daly, PAL, 2017.

4. Southeast abutment and buttresses of Bridge No. 6, looking east. John Daly, PAL, 2017.

5. Northeast elevation of Bridge No. 6, looking south. John Daly, PAL, 2017.

6. Buttresses and revetment/retaining wall at north corner of Bridge No. 6, looking northwest. John Daly, PAL, 2017.

7. North parapet and date stone of Bridge No. 6, looking southeast. John Daly, PAL, 2017.

8. View of roadbed at narrow cut, looking northeast. Roger Reed, National Park Service (NPS), National Historic Landmarks Program, 2014.

9. Embankment and retaining wall of Western Railroad Roadbed between Bridges No. 5 and 6, looking east. Roger Reed, NPS, 2014.

10. Western Railroad Roadbed and Western Railroad Stone Arch Bridge No. 5 (Bridge No. 5) in the Westfield River gorge, looking north (downstream). John Daly, PAL 2017.

11. South side of Bridge No. 5, looking north. John Daly, PAL, 2017.

12. North side of Bridge No. 5, looking southeast. John Daly, PAL, 2017.

13. Deck view of Bridge No. 5, looking west. John Daly, PAL, 2017.

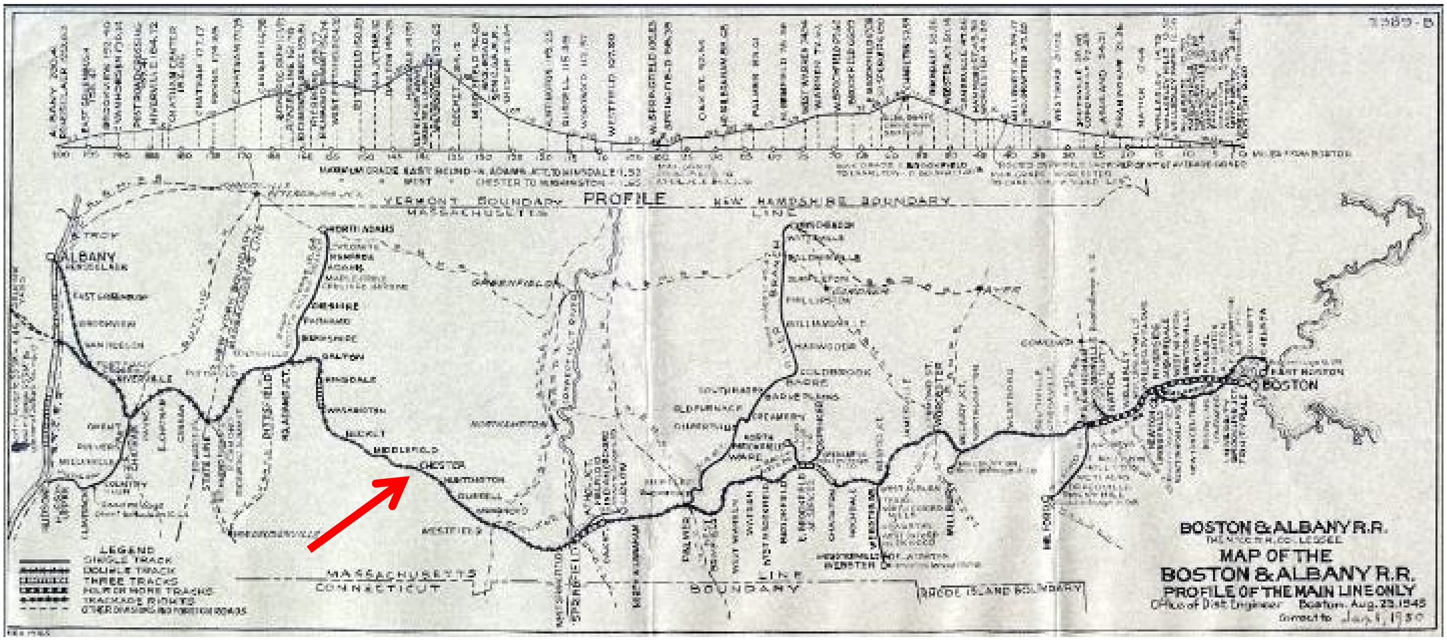
14. Detail of northwest pier and parapet remnant on Bridge No. 5, looking northwest. John Daly, PAL, 2017.

15. Chester Factory Village Railroad Depot (Chester Depot), looking northeast. John Daly, PAL, 2017.

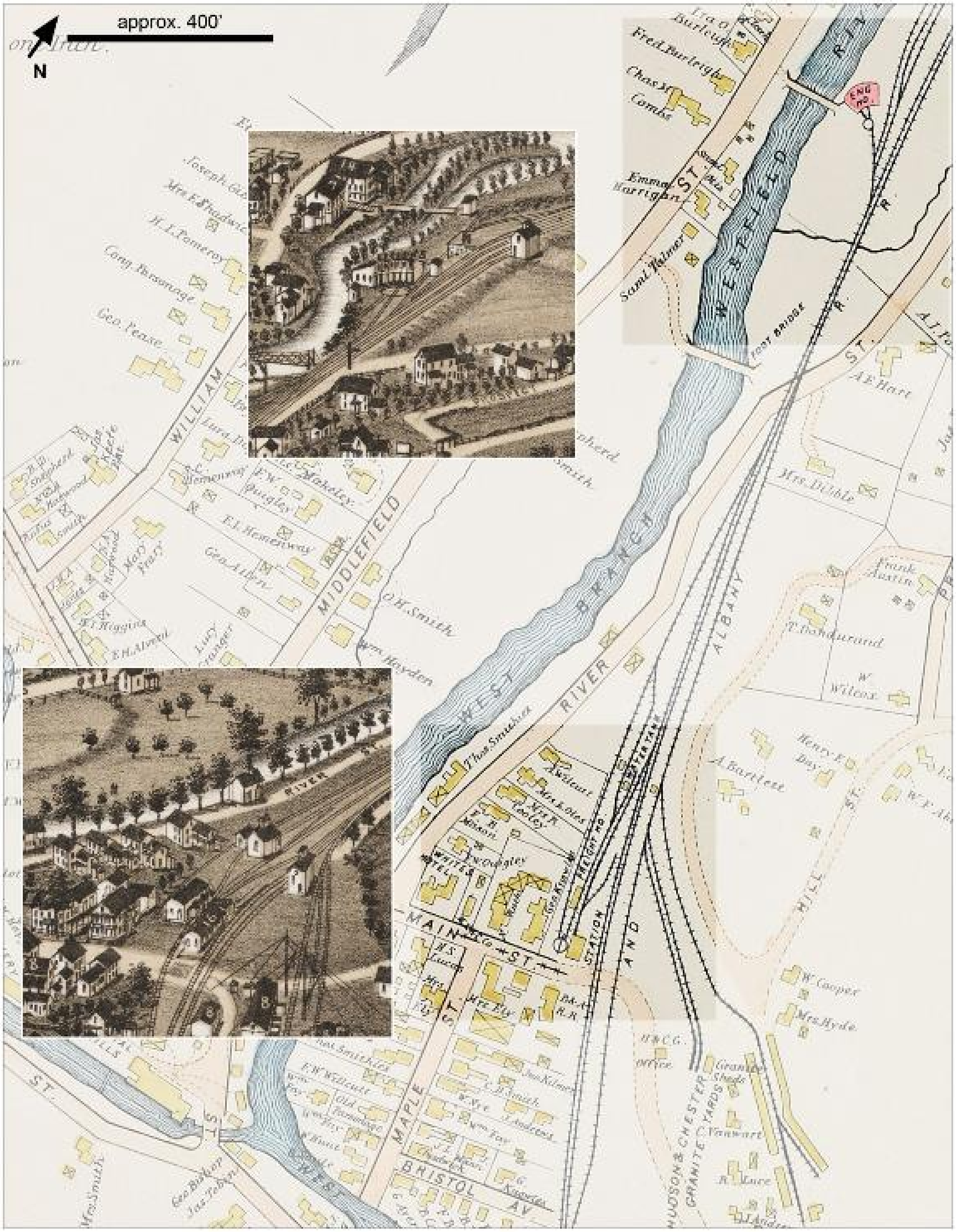
16. Chester Depot, looking southwest. John Daly, PAL, 2017.

17. Detail of north end of Chester Depot. John Daly, PAL, 2017.

18. Waiting room of Chester Depot, looking north. John Daly, PAL, 2017.



19. Profile of the Western Railroad as owned by the Boston & Albany R.R., July 1, 1950. Courtesy of Chester Railway and Museum.



20. Section of 1894 map of Chester (L. J. Richards & Co.) overlaid with images from 1885 bird's-eye map (L. R. Burleigh) showing the Chester Factory Village Depot in its original location on the west side of the railroad tracks, with the freight house (not extant) just to the north and the brick roundhouse (extant but altered) farther north (outside the property boundaries). Composite image by PAL (courtesy of Library of Congress).