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Steamtown

DELAWARE, LACKAWANNA and WESTERN RAILROAD

BOXCAR No. 43651

HISTORIC STRUCTURE REPORT

Part I

Prepared by
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July 1996

United States Department of the Interior
National Park Service
Steamtown National Historic Site

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Introduction

This report is the first of a two-part study prepared by Steamtown National Historic Site (NHS) on Delaware, Lackawanna and Western Railroad boxcar No. 43651. The objective was thorough documentation of the car's construction and operating history. The car is scheduled for restoration by Steamtown National Historic Site.

Part one covers the history and physical configuration of the car. Documentation includes car and corporate histories, specifications, evaluation of the car's current condition, component analyses, and restoration recommendations. Part two of the study will document the restoration of the car.

Boxcar No. 43651 operated on the Delaware, Lackawanna and Western Railroad for approximately thirty-five years. It was owned by the Norton Abrasives Company for about twenty-three years, and by the Railroad Museum of New England for an additional thirteen years. The car has been a component of the Steamtown NHS collection since March 1993. It was delivered to the park in July 1995.

At seventy-four years of age, the car has suffered the effects of hard service and neglect and is in poor condition. However, portions of the car's original fabric are intact. Modifications made to the car over the years can be identified and corrected. Boxcar No. 43651 is a worthy candidate for preservation and restoration.

Boxcar No. 43651 is on the National Park Service List of Classified Structures and the National Register of Historic Places (No. 90001739, 21 November 1990).

Administrative Data

Management Data

Delaware, Lackawanna and Western Railroad No. 43651 is a thirty-six-foot, steel frame wood boxcar, manufactured in 1922 by the American Car and Foundry Company in Berwick, PA. It has been a component of the Steamtown NHS collection since March 1993.[1]

Proposed Use

The National Park Service will restore the car to correct Lackawanna steam era appearance and operating condition. Following restoration the car will recieve minor modifications for service as a "boxcar theater" in the park's technology museum.

Planning Background

Steamtown National Historic Site was established by Public Law 99-591 on 30 October 1986. The Steamtown National Historic Site Comprehensive Management Plan was released seventeen months later, in March 1988. The Railroad Yard Design Program/Interpretive Concept for Steamtown National Historic Site was approved in August 1989.

Proposed Treatment and Justification

Boxcar No. 43651 is representative of northeastern steam era freight railroading. Modifications to the car that have been identified are listed in chapters three and four of this document.

Number 43651 will be returned to its correct Lackawanna steam era appearance. Restoration actions and modifications will be documented in the completion report.

Recommended Treatment for Materials Collected in Preparing This Report

All materials collected for this report, including photographs, drawings, field notes, and other research materials will be turned over to the park's archives for placement in appropriate files.

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[1] Acquisition documentation is provided in Appendix 1.

Source Materials

Several individuals were contacted for information, and generously made available documentary materials regarding the Delaware, Lackawanna and Western Railroad and boxcar No. 43651. Steamtown NHS appreciates the assistance of:

James Dalberg	- Erie Lackawanna Railroad Historical Society, Berwyn, PA
Larry DeYoung	- Erie Lackawanna Railroad Historical Society, Flemington, NJ
Kay Harmon	- Executive Assistant, Berwick Chamber of Commerce, Berwick, PA
John Krug	- Chief, Research and Engineering Development, ACF Industries, Mound City, IL
Schuyler Larrabee	- Erie Lackawanna Railroad Historical Society, Newton Centre, MA
Benji Levy	- Owner. B. Levy Shoes, Scranton, PA
Henry Parrish	- Car repair foreman, Berwick Freight Car Company, Berwick, PA

Pennsylvania State University, Worthington Scranton Campus Library

Howard Pincus	- President, Railroad Museum of New England, Old Saybrook, CT
Jeremiah Segure	- Erie Lackawanna Railroad Historical Society, Rochester, NY
Chuck Yungkurth	- Erie Lackawanna Railroad Historical Society, Elmira, NY

Robert Davis, Park Ranger, Steamtown National Historic Site, performed the initial research on the history of ACF Industries.

The following institutions possess archival material on the Delaware, Lackawanna and Western Railroad or the American Car and Foundry company, but were not contacted. In future endeavors, researchers should contact or visit these repositories.

Delaware, Lackawanna & Western Railroad:

George Arents Research Library, Syracuse University, Syracuse, NY

Railroad Museum of Pennsylvania, Strasburg, PA

American Car and Foundry:

John W. Barriger III, Collection, St. Louis Mercantile Library Association, St. Louis, MO

Documentary History and Structural Analysis

The Delaware, Lackawanna and Western Railroad

In the nineteenth century, "the railroad companies drew the map of the urban age," and the Delaware, Lackawanna and Western Railroad (DL&W or Lackawanna) did its share of the drawing.[2] The DL&W was a vital force in the industrialization and growth of all the regions it served; these regions developed as the railroad grew. The decline of industries that the Lackawanna Railroad had once made possible, serviced and traditionally relied on for revenue caused the DL&W's own decline. The DL&W's rise, prosperity, and eventual fall is a textbook case in the relationship between railroading and the nation's cities and businesses.

Like many other railroad systems the DL&W grew through the construction of new lines and the absorption of existing railroads. It was started by the iron firm of Scrantons and Platt, in Slocums Hollow in northeastern Pennsylvania. The company, formed in 1840, saw initial success through the manufacture of iron t-rail for the New York and Erie Railroad (Erie).

The Erie was under pressure from the New York state legislature to complete its line as far as Binghamton, NY, by 31 December 1848. Construction to Binghamton had slowed due to difficulty in finding an adequate supply of iron T-rail. Suitable rail was available in quantity from England, but delivery was uncertain and the price high at eighty dollars per ton. If the Erie failed to complete the line by the deadline, it would loose three million dollars in state grants and probably go bankrupt.[3]

The Erie provided financial support for the acquisition of rail-rolling machinery, and Scrantons and Platt agreed to deliver twelve thousand tons of T-rail at forty-six dollars per ton. Retooled, and with a customer secured, Scrantons and Platt became the first American concern to successfully mass-produce iron rails. The transaction saved both the iron mill and the New York and Erie, which reached Binghamton with only four days to spare.[4]

Delivery of the rail to the Erie was by a combination of horse team and canal. Clearly, this was no way to ship iron products. For Scrantons and Platt, the solution was to build a railroad of its own. The first three components were the chartered but never built

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[2] Otto L. Bettman, The Good Old Days--They Were Terrible (New York: Random House, Inc., 1974), 24.

[3] Edward Harold Mott, Between the Ocean and the Lakes: The Story of Erie (New York: John S. Collins Publisher, 1900), 91.

[4] Ibid.

Liggett's Gap Railroad, a new line named the Delaware and Cobb's Gap Railroad, and the Cayuga and Susquehanna Railroad in New York.

The iron company purchased the Liggett's Gap charter in 1849, and started building towards Great Bend, PA, and a connection with the Erie in 1850. The track gauge was six feet, conforming with the width then used by the Erie. In April 1851, the Liggett's Gap name was changed to the Lackawanna and Western Railroad. The line formally opened on 15 October 1851, with a ceremonial train and a banquet in Scranton for Erie and Lackawanna and Western dignitaries. Revenue operations began on the twentieth of October.[5]

The state chartered the Delaware and Cobb's Gap line on 7 April 1849, to build from a point "at or near" Cobb's Gap southeast of Slocums Hollow, eastward to the Delaware Water Gap and into New Jersey. The route approximated an older surveyed route known as "Drinker's Road" but, significantly, included permission to bridge the Delaware River and interchange with other transportation systems in New Jersey.[6]

The same year, Scrantons and Platt purchased the moribund Cayuga and Susquehanna Railroad. The line was chartered in 1828 as the Ithaca and Owego Railroad, making it the oldest component of the DL&W. The railroad was not notably successful and, in 1842, rechartered as the Cayuga and Susquehanna Railroad (C&S). In 1849, owner Archibald McIntyre wrote of his hope to "close this unfortunate speculation," and raised the possibility of sale to Scrantons and Platt. The iron company bought the C&S and extended the right-of-way south to Owego. Using trackage rights from Great Bend to Owego, the growing L&W gained access to northern New York.[7]

On 11 March 1853, the Pennsylvania legislature agreed to the consolidation of the Lackawanna and Western and Delaware and Cobb's Gap Railroads as the Delaware, Lackawanna and Western Railroad. The line into New Jersey was completed to Delaware Station, NJ, on 15 May 1856, and less than two weeks later opened to New Hampton, where it connected with the Central Rail Road of New Jersey (CNJ or

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[5] Robert J. Casey and W.A.S. Douglas, The Lackawanna Story (New York: McGraw-Hill Company, Inc., 1951), 61-68.

[6] Ibid., 71-72.

[7] H. Hollister, History of the Lackawanna Valley, 2d ed. (New York: C.A. Alvord, 1869), 254; Casey and Douglas, Lackawanna Story, 56-58, 62, 71-72; A.W. McIntyre to [J.B. Williams, Esq.], 20 June 1849, Museum Collection, Catalog Number 2510A, Steamtown National Historic Site, Scranton, PA.

Jersey Central). Interchange with the CNJ at New Hampton enabled the DL&W to ship to and from New York harbor.[8]

The arrangement with the Jersey Central did not work well and, in February 1869, the DL&W leased the Morris and Essex Railroad (M&E). The M&E, chartered on 29 January 1835, ran from Phillipsburg, on the Delaware River, to Hoboken, directly opposite Manhattan Island. The line thus connected the Hudson River and the harbor of New York City with the other important transportation systems, such as the Pennsylvania Railroad, the Morris Canal, and the Central Railroad of New Jersey. Through the lease, the Lackawanna Railroad achieved a direct connection to New York City via Washington, NJ, and bypassed the CNJ.[9]

The Lackawanna next freed itself from direct reliance on the Erie Railroad and reached for the Great Lakes. In 1869, the DL&W incorporated the Valley Railroad to construct trackage from Great Bend to Ithaca. This eliminated the need to use Erie tracks to reach the former C&S, now the DL&W's Ithaca Branch. The same year, the Lackawanna bought the Syracuse, Binghamton and New York Railroad and leased the Oswego and Syracuse Railroad, giving it access to the city of Syracuse.[10]

Other acquisitions over the following forty years completed the DL&W system. In 1852, to tap the coal fields in the Wyoming Valley south of Scranton, the DL&W arranged to incorporate and construct the Lackawanna and Bloomsburg Railroad (L&B). The L&B opened from Scranton to Nanticoke in 1856, and was completed to Northumberland in 1860. The L&B legally merged with the Lackawanna in 1873, and became the railroad's Bloomsburg Division.[11]

The New York, Lackawanna and Western Railroad between Binghamton and Buffalo was built and leased to the Lackawanna in 1882. Thus, the DL&W acquired its westernmost terminal: Buffalo, NY, on Lake Erie. In thirty years, the Liggett's Gap Railroad had grown from

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[8] Thomas Murphy, History of Lackawanna County Pennsylvania, vol. 1 (Topeka (KS)-Indianapolis: Historical Publishing Co., 1928), 100-101.

[9] Thomas Townsend Taber, The Delaware, Lackawanna & Western Railroad in the Nineteenth Century (Muncy, PA: Thomas T. Taber III, 1977), 77-78; Sheldon S. King, The Route of Phoebe Snow, (Lyons, NY: By the author, 361 Route 14, 1986), 37.

[10] Murphy, Lackawanna County, 100-101; George H. Drury, The Historical Guide to North American Railroads (Waukesha, WI: Kalmbach Publishing Co., 1991), 108.

[11] Casey and Douglas, Lackawanna Story, 81; Taber, Nineteenth Century, 193-196.

a shortline serving an iron mill into a major trunk line between New York City and the Great Lakes.[12]

The final component, acquired in 1900, was the Bangor and Portland Railroad, which connected the mainline at Portland with the cement belt north of Easton. The acquisition brought the railroad additional freight revenue and a ready source of concrete.[13]

These were prosperous times. The Lackawanna Iron and Coal Company and the DL&W cooperated closely. Both companies owned vast anthracite reserves in Northeastern Pennsylvania, insuring a supply of coal for the iron furnaces. The railroad's coal department advertised the fuel aggressively, and its uses grew. The Lackawanna's own mines produced antthracite for the iron mills and consumers throughout the northeast, from Lake Erie to New York harbor. The DL&W trains rolled on rail produced by the Scranton mills, and carried the rail LI&C sold to its customers.

As the region's coal and iron industries prospered, its population grew. The mid-point for the DL&W was the city of Scranton, renamed from Slocum Hollow by 1850 and incorporated in 1866. Lackawanna County was carved out from the large Luzerne County in 1878, with Scranton as its county seat, business and government center. Mining activities dominated the region, but other enterprises moved into Northeastern Pennsylvania to take advantage of the labor pool and transportation system. Railroads became major employers, as did silk mills, industrial suppliers, food brokers, foundries and machine shops, newspapers, business and trade schools, bottlers, construction firms - the list seemed interminable. The DL&W profited from the city's growth by transporting raw materials, goods and people.[14]

Prosperity allowed the railroad to make a major engineering change in 1876. To that time most of the DL&W railroad system was built to a "broad" gauge of six feet, a legacy of the Liggett's Gap's early association with the Erie. Other gauges of varying width were common throughout the country, making interchange between individual railroads difficult.

An 1846 act of the British Parliament defined four-feet, eight-and-one-half inches as the standard gauge for English railways. Many

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[12] Drury, Historic Guide, 108.

[13] Thomas Townsend Taber and Thomas Townsend Taber III, The Delaware, Lackawanna & Western Railroad in the Twentieth Century, vol. 2, (Muncy, PA: Thomas T. Taber III, 1981), 22.

[14] Murphy, Lackawanna County, 404-408; Burton W. Folsom, Jr., Urban Capitalists (Baltimore: Johns Hopkins University Press, 1981), 32.

American railroads adopted the same measurement as their "standard gauge," but proponents of other gauges remained steadfast in their belief that their system was superior. Arguments for and against the different gauges continued for several years.

The completion of the standard gauge transcontinental railroad in 1869 rendered the question moot. Thereafter, to compete and interchange equipment off-line, a railroad would need standard gauge equipment. Non-standard railroads quickly converted their tracks and equipment during the 1870s. The Lackawanna converted all its trackage, locomotives and rolling stock in 1876, at a cost of $1.25 million.[15]

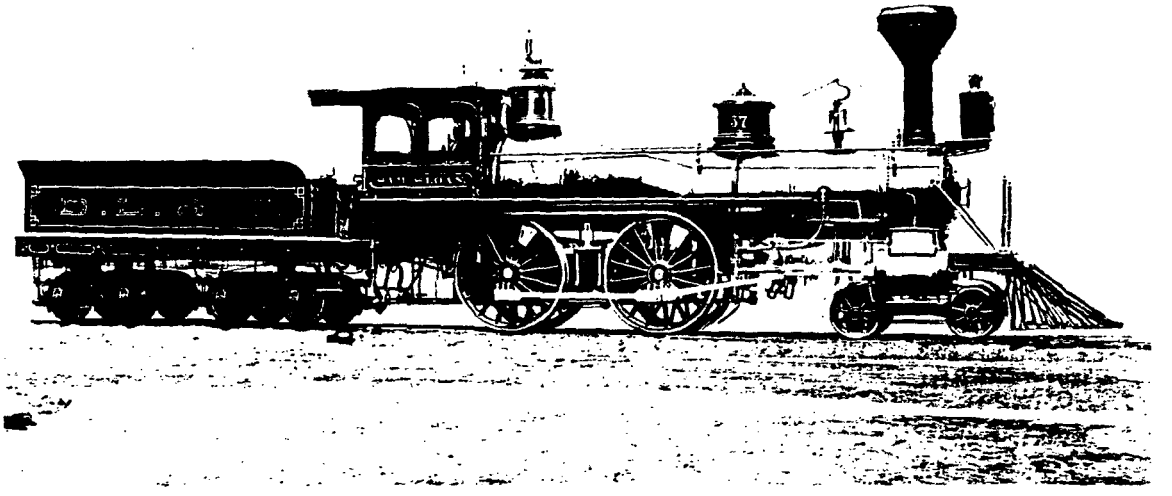

Fig. 1. DL&W No. 57, the "Sam Sloan," one of the locomotives converted to standard gauge in 1876. From Thomas T. Taber, The Delaware, Lackawanna and Western Railroad In the Nineteenth Century (Muncy, PA: Thomas T. Taber III, 1977), 320.

The Lackawanna's next major system upgrade occured in the first few years of the twentieth century. In 1899, William H. Truesdale began a twenty-five year term as president of the the railroad. He immediately embarked on a campaign to rebuild the Lackawanna from terminal to terminal. Powerful standardized locomotives and high capacity cars replaced the equipment inherited from the DL&W's component lines. Trackage was upgraded to accommodate longer, heavier and more profitable trains.[16]

In Scranton, the industrial center of the DL&W, facilities were totally rebuilt. State-of-the-art locomotive erecting shops were

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[15] Casey and Douglas, Lackawanna Story, 94; James Dugan, The Great Iron Ship (New York: Harper & Brothers, 1953), 24.

[16] Taber and Taber, Twentieth Century, vol. 2, 22.

completed in 1910. A new freight car shop (1904) and huge freight marshalling yard (1911) were constructed in Keyser Valley on Scranton's western border. The downtown yard received a new roundhouse (1902) and larger turntable (1912). In 1908, the railroad dedicated a palatial new French Renaissance-style passenger terminal.[17]

Between 1902 and 1908, the main line between Scranton and Pocono Summit was triple-tracked for eastbound, westbound and slow freight, allowing fast freight and passenger trains to bypass coal drags. New tunnels were driven. Wherever possible, tracks were raised to eliminate grade crossings, which especially improved suburban commuter service in New Jersey.[18]

Two achievements became particularly well-known. The first was the Lackawanna Cutoff in northwestern New Jersey, which substituted twenty-eight miles of "dream railroad" for forty miles of slow, hilly, curvy trackage. The symbol of that project was the Paulins Kill Viaduct, the world's largest concrete structure when it was completed in 1910. Northwest of Scranton, the Nicholson Cutoff replaced forty more miles of meandering track. The new route opened to traffic in 1915 with the dedication of the Nicholson Bridge, which is still the largest concrete bridge in the world. The Lackawanna's most-publicized edifice, it symbolized Truesdale's claim of having made the Lackawanna "the most highly developed railroad in America." More importantly, the efficient new DL&W now competed profitably with larger roads.[19]

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[17] Ibid., 30.

[18] Ibid.

[19] Casey and Douglas, Lackawanna Story, 144, 154; Robert A. Le Massena, "Steam Out of Scranton," Trains, September 1965, 29.

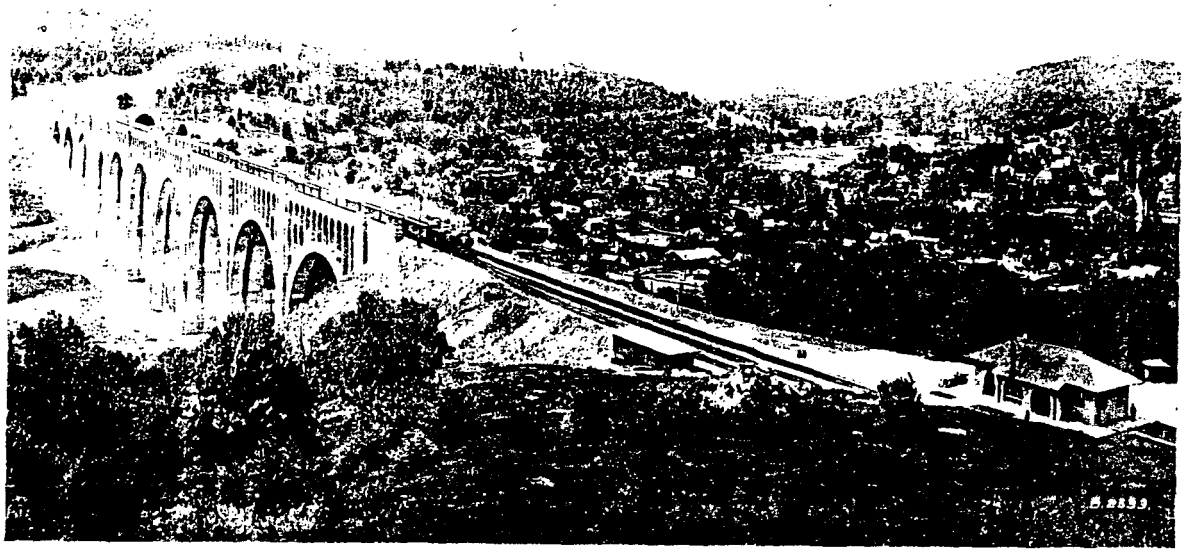

Fig. 2. An eastbound DL&W milk train pulled by a camelback 4-6-0 crosses Tunkhannock Viaduct. From Thomas Townsend Taber and Thomas Townsend Taber III, The Delaware, Lackawanna & Western Railroad in the Twentieth Century, vol. 1 (Muncy, PA: Thomas T. Taber III, 1980), 13.

The improvements in operating efficiency were tempered by three major events in 1906. The first was Congress' passage of the Hepburn Act, which prohibited railroads from transporting or selling any commodity which they "mined or produced." The Lackawanna and other coal-hauling railroads were forced to divest themselves of their profitable coal subsidiaries. Also in 1906, Congress passed legislation directing the Interstate Commerce Commission to regulate railroad freight rates. Thereafter, railroads could alter their fees only with ICC approval, which sometimes took years to obtain. The long-term effect was to artificially freeze freight rates, without regard for changes in the market or economic reality.[20]

The third event was directly related to the railroad's success in the regions they served. The railroads had valuable real estate,

[20] Casey and Douglas, Lackawanna Story, 145-147; Albro Martin, Enterprise Denied (New York: Columbia University Press, 1971), 113-115.

expensive equipment, huge payrolls, and enormous cash flow, which led to their becoming prominent names on local tax assessment rolls. In 1906, New Jersey doubled its taxes on the railroads operating in the state, including the Lackawanna. Thus began the a cycle of inequitable rail taxation which would thereafter plague the Lackawanna and other railroads. Railroad property in many locations was eventually assessed at one hundred percent of its value. As competition from other methods of transportation increased, decreasing cash flow and frozen freight rates combined with higher taxes to weaken many roads. The Lackawanna was one of the railroads affected.[21]

The railroads attempted to balance the financial weakening by boosting revenue in other markets. One of the Lackawanna's approaches was through public promotion. In 1900, the DL&W introduced the image of an auburn-haired woman whose white dress symbolized the cleanliness of anthracite-burning DL&W passenger trains. Two years later, the advertising agency of Calkins and Holden named the damsel "Phoebe Snow," and fashioned an advertising campaign around her. Ubiquitous versified ads portrayed Miss Snow, "dressed in white," enjoying travel everywhere on the "Road of Anthracite." The program succeeded: passenger business increased eighty percent between 1900 and 1910.[22]

In 1917, the United States entered World War I. The government commandeered anthracite to fuel ships. The DL&W and other anthracite burning railroads were forced to convert their locomotives to burn soft coal, and Phoebe "retired." Her memory, however, persisted, as did the "Road of Anthracite" slogan.[23]

From January 1918 until 29 February 1920, the war emergency caused the government's United States Railway Administration to assume operation of the nation's rail system. During the war the DL&W benefited from increased passenger business and steady freight revenues, but the railroad's physical plant and equipment deteriorated from hard use. The DL&W eventually received five million dollars in compensation for the damage to its equipment.[24]

John M. Davis succeeded Truesdale as president of the Lackawanna Railroad in 1925. Despite the depression of 1920, and labor

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[21] Thomas Townsend Taber and Thomas Townsend Taber III, The Delaware, Lackawanna & Western Railroad In the Twentieth Century, vol. 1 (Muncy, PA: Thomas T. Taber III, 1980), 32, 112, 129.

[22] Rodney O. Davis, "Earnest Elmo Calkins and Phoebe Snow," Railroad History 163 (Autumn 1990), 89-90.

[23] Ibid.

[24] Taber and Taber, Twentieth Century, vol. 1, 59-61.

problems in the first three years of the decade, the postwar period was a time of prosperity for the DL&W. The Lackawanna, under Davis' guidance, built on this prosperity and was able to survive the Great Depression without slipping into bankruptcy. By 1941, it was evident that the United States would be drawn into the growing world conflict. William White succeeded Davis as president in 1940, and ordered all heavy freight locomotives reconditioned and new rails laid wherever needed. The DL&W ordered 1,250 new boxcars. These were delivered early in 1942, in time to reinforce the rolling stock fleet for the demands of another world war.[25]

During World War II, troop movements, gasoline rationing and tire shortages contributed to an increase in passenger business. Freight revenue grew by $14 million between 1941 and 1943. Gross revenue in 1943 matched the previous high in 1929. Anthracite production and shipments increased (for what would be the last time). Phoebe Snow reappeared in a WAC uniform to symbolize the railroad's commitment to victory.[26]

The DL&W's postwar years were marked by rear-guard actions against inevitable decline, with few bright spots. The railroad lost most of its wartime profit to taxation. New Jersey and Federal taxes took up to one-sixth of the Lackawanna's freight revenue by the mid-1940s. The merger of the railroad's subsidiary companies, completed between 1942 and 1947, lowered yearly fixed expenses by over one million dollars and eased some of the tax burden, but irreparable damage had already been done. The collapse of the anthracite industry, decline of the passenger train, and inroads by private automobiles, trucks, and airlines, all dragged the railroad down.[27]

Whether the Lackawanna could have survived independently is still debated, but Hurricane Diane terminated practical discussion in 1955. On 18 and 19 August, floods destroyed sixty miles of the mainline between Scranton and the Delaware Water Gap. The DL&W was effectively out of business for twenty-nine days and lost untold revenue. Repairs cost nearly eight million dollars. The DL&W never recovered economically. Five years later, following

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[25] Casey and Douglas, Lackawanna Story, 161-162.

[26] Le Massena, "Out of Scranton," 43; Casey and Douglas, Lackawanna Story, 164; Lackawanna, the Route of Phoebe Snow: Brief History of the Railroad, with Photographs and Description of its Motive Power, pamphlet (Hoboken: Delaware, Lackawanna and Western Railroad, 1944), Museum Collection, Catalog Number 2435, Steamtown National Historic Site, Scranton, PA.

[27] Casey and Douglas, Lackawanna Story, 164-167. For a more complete treatment of these problems, refer also to Taber and Taber, Twentieth Century, vol. 1, 32, 112, 120-124.

extensive negotiations, the DL&W merged with the Erie to form the Erie Lackawanna Railroad (EL).[28]

No great money-maker, the EL at least seemed to hold its own. The merger was well-planned and proved technically successful. Duplicate lines and services were discontinued, including most of the DL&W's tracks west of Binghamton and several of the railroad's servicing facilities. The new company emphasized freight service and allowed passenger service to wither: the "Phoebe Snow" ran for the last time on 27 November 1966, and the final Hoboken to Chicago passenger train was scratched in 1970. The State of New Jersey began subsidizing the EL's commuter service in 1970, and eventually acquired the operation, lest the state completely lose the commuter service.[29]

The Erie Lackawanna Railroad became the Erie Lackawanna Railway in 1968, following its acquisition by Dereco. Dereco was a holding company set up by the Norfolk and Western Railway (N&W) to facilitate a merger with the Chesapeake and Ohio Railroad. The merger never occurred, but the EL remained indirectly owned by the N&W system.[30]

22 June 1972, Hurricane Agnes struck the eastern United States. Damage to the EL between Binghamton and Salamanca, NY, was estimated at over nine million dollars. Four days later, the Erie Lackawanna filed for bankruptcy. The railroad soldiered on in receivership for nearly four years before becoming part of the government-owned Consolidated Rail Corporation, or Conrail, on 1 April 1976.[31]

In 1996, major portions of the old "Route of Phoebe Snow" are abandoned. The Scranton-Binghamton main line is still in use under the Canadian Pacific Railway. In Scranton, B. Levy Shoes still retails "Lackawanna" work shoes, a house brand the firm introduced in the 1920s to appeal to railroaders; their trademark is a steam locomotive at the head of a speeding train. Every day, freight trains thunder across the Nicholson Bridge, which stands as a civil

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[28] Drury, Historical Guide, 109.

[29] "Exit Phoebe Snow," Railroad, March 1967, 58; Drury, Historical Guide, 133.

[30] Drury, Historical Guide, 133-134.

[31] Ibid., 134, 135.

engineering milestone and an icon of the vision that built the nation's rail system.[32]

American Car and Foundry

The American Car and Foundry Company (AC&F) was created by railroad industrialist William F. Bixby on 20 February 1899, through the merger of thirteen individual railroad car builders. The resulting corporation was one of the largest railroad car manufacturers of its time and a major force in the passenger and freight car market throughout the twentieth century.[33]

AC&F is notable for surviving in the market. Unlike its historic competitors, ACF Industries still builds railroad equipment, albeit as a small part of its total business.

A native of Adrian, MI, Bixby began his railroad career as a baggageman in 1873, at the age of sixteen. Twelve years later he joined the Missouri Car and Foundry Company of St. Louis, MO, as a lumber agent. Within two years of his arrival at the company he advanced to vice president. In 1888, Bixby became president of Missouri Car and Foundry and successfully concluded a merger with the Michigan-Peninsular Car Company of Detroit, MI. Still merger minded, Bixby looked for other companies to acquire.[34]

Mergers and empire building were characteristic of this period, known as "the golden age of railroads." Between 1873 and 1903, business and industry in the United States boomed. Financiers and speculators created monopolies in the oil, tobacco and transportation industries, among others. Railroads were acquired and merged, creating vast networks that were linked from one end of the country to the other, often under the control of one individual.[35]

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[32] Benji Levy, telephone conversation with Thomas H.E. Campion, 16 June 1993; Daniel L. Schodek, Landmarks in American Civil Engineering (Cambridge, MA: Massachusetts Institute of Technology Press, 1988), 148-152.

[33] John H. White, Jr., The American Railroad Passenger Car, pt. 2 (Baltimore: The Johns Hopkins University Press, 1978), 648.

[34] Ibid.

[35] Albro Martin, Enterprise Denied (New York: Columbia University Press, 1971), 17; Robert L. Frey, ed., Encyclopedia of American Business History and Biography: Railroads In the Nineteenth Century (New York: Facts On File, 1988), xxxii.

Powerful men such as Edward H. Harriman, James J. Hill, Colis P. Huntington, John Pierpont Morgan, William Henry Vanderbilt, Cornelius Vanderbilt II, Jay Gould, and his son George Jay Gould, maneuvered with and against each other, fixed traffic rates, and built railroad empires. The American public and government officials viewed the proceedings with fear and mistrust, and the term "robber baron" was coined for these railroad and financial leaders.[36]

Congress passed the Sherman Anti-Trust Act in 1890, in an attempt to reign in and break up the monopolies formed by these men. For the most part the law was ineffective and the government was unwilling to enforce it. A nationwide financial panic in 1893 resulted in the suspension of the act for nearly ten years. Mergers among the railroad companies and manufacturers resumed. Those corporations that survived the Panic of 1893 swallowed up their lesser relations with minimal interference from the government and grew even stronger.[37]

By the time of the 1896 presidential election of William McKinley, the railroads were inundated with freight and passenger business and manufacturers were turning out cars as fast as humanly possible. It was in this atmosphere of corporate success and expansion that Bixby formed American Car and Foundry. Bixby became the first president of the corporation and was later made chairman of the board. He retired from AC&F in 1905.[38]

The companies Bixby merged included the Buffalo Car Manufacturing Company of Buffalo, NY; the Ensign Car Manufacturing Company of Huntington, WV; the Jackson and Woodin Car Company of Berwick, PA; the Michigan Peninsular Car Company of Detroit, MI; the Missouri Car and Foundry Company of St. Louis, MO; the Murray, Dougal and Company of Milton, PA; the Niagara Car Wheel Company Buffalo, NY; the Ohio Falls Car Company of Jeffersonville, IN; Pennock Brothers of Minerva, OH; the St. Charles Car Company of St. Charles, MO; the Terre Haute Car and Manufacturing Company of Terre Haute, IN: the

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[36] Drury, Historical Guide, 147, 157, 211, 306, 342; David Mountfield, The Railway Barons (New York: W.W. Norton & Company, 1979), 129-130.

[37] Frey, Railroads In the Nineteenth Century, 251; Albro Martin, Railroads Triumphant (New York: Oxford University Press, 1992), 217.

[38] Martin, Railroads Triumphant, 240; White, Passenger Car, pt. 2, 648.

Union Car Company of Depew, NY; and the Wells and French Company of Chicago, IL.[39]

These component companies possessed a varied amount of experience and success in the construction and sales of freight and passenger cars. The Michigan Car Company of Detroit was formed by James McMillian, a Canadian from Hamilton, ON, and John S. Newberry in 1864. Within ten years the company became one of the nation's biggest car builders, and its 1881 merger with the Peninsular Car Company made the company even stronger. As Michigan-Peninsular, the builder provided a strong foundation for American Car and Foundry, with experience in both freight and passenger car construction. The Missouri Car and Foundry Company of St. Louis possessed an equal level of experience with freight cars, including specialized types such as buggy cars.[40]

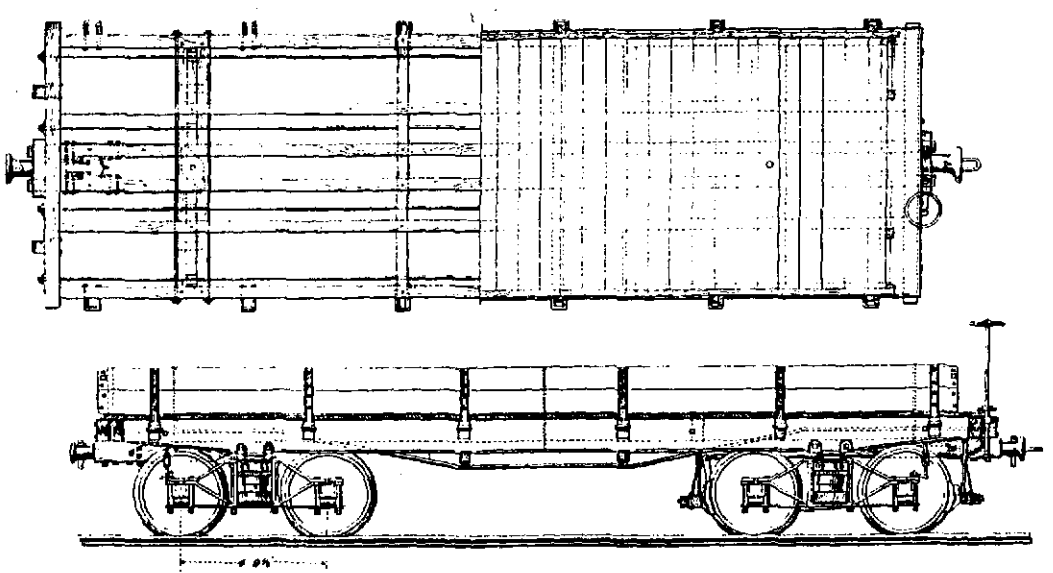

Fig. 3. Illustration of a gondola built by Missouri Car and Foundry. From John H. White, Jr., From the Wood-Car Era to the Coming of Steel: The American Railroad Freight Car (Baltimore: The Johns Hopkins University Press, 1993), 317.

The Buffalo Car Works opened in 1853. Its plant featured a large freight car erecting shop, measuring 60 feet by 280 feet, where 24

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[39] John Sherman Porter, ed., Moody's Analyses of Investments (New York: Moody's Investors Service, 1925), 4.

[40] John H. White, Jr., From the Wood-Car Era to the Coming of Steel: The American Railroad Freight Car (Baltimore: The Johns Hopkins University Press, 1993), 202, 604.

freight cars could be built per week. The Ensign Car Works of Huntington, WV, opened in 1872 and had facilities similar to the Buffalo works. The company received its financial backing from W.H. Barnum, a car wheel maker from Connecticut, and financier Collis P. Huntington. Car designer Ferdinand E. Canda became general manager of Ensign in 1881. Known for his technologically advanced designs, he later became president of Ensign and a director of AC&F.[41]

The St. Charles Car Company of St. Charles, MO, was founded in the mid-1850s and went bankrupt in 1867. It reopened in 1873 with funding from local businessmen and began production of passenger cars in 1886. This plant later became the primary passenger car facility for American Car and Foundry. Wells, French and Company was already an established bridge builder in Chicago, IL, when it decided to open a freight car plant in 1871. It too was soon prospering.[42]

The Ohio Falls Car Company of Jeffersonville, IN, started building light narrow-gauge excursion cars during the 1850s. The company went bankrupt and, in 1866, Joseph W. Sprague assumed the manager's position. He expanded the facility, survived another bankruptcy, and had Ohio Falls profitable by the time of his 1888 retirement. The plant would remain in operation under AC&F until about 1945.[44]

Two of AC&F's original plants were located in the Commonwealth of Pennsylvania. Samuel W. Murray, a former locomotive builder and machinist for Matthias W. Baldwin, founded a car building company in Milton, PA, in 1864. Murray, Dougal and Company rapidly became one of the largest freight car builders in the northeast.[45] The other Keystone State manufacturer was Jackson and Woodin (J&W) of Berwick. The company started in 1861 as a plow manufacturer, but by the end of the decade was building mine and freight cars. By 1880, the Berwick plant was one of the largest car manufacturers in the country. William H. Woodin, president of J&W and grandson of the company's founder, became president of AC&F in 1916. He later became president of the American Locomotive Company and served as

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[41] Ibid., 142, 600.

[42] White, Freight Car, 142, 606; John H. White, Jr., The American Railroad Passenger Car, pt. 1 (Baltimore: The Johns Hopkins University Press, 1978), 104.

[44] White, Freight Car, 606; White, Passenger Car, pt. 1, 31.

[45] White, Freight Car, 605.

Secretary of the Treasury during President Franklin D. Roosevelt's first term.[46]

Among the companies American Car and Foundry acquired after 1899 were the Bloomsburg Car Manufacturing Company of Bloomsburg, PA; the Common Sense Bolster Company of Chicago, IL; the Indiana Car and Foundry Company of Indianapolis, IN; and the Southern Car and Foundry Company of Memphis, TN. The two largest acquisitions were of the Jackson and Sharp Company of Wilmington, DE; and the J.G. Brill Company of Philadelphia, PA.[47]

AC&F acquired Jackson and Sharp, a long time builder of freight and passenger cars, in 1901. The corporation concentrated its narrow gauge and foreign export production at that plant.[48] John G. Brill founded the company bearing his name in 1868 for the purpose of building streetcars. Over the years, he acquired other companies and established several subsidiaries, including the J.G. Brill Company of Missouri (formerly the American Car Company, St. Louis); the J.G. Brill Company of Ohio (formerly the G.C. Kuhlman Company, Cleveland); *Compagnie J.G. Brill France* in Paris; and the J.G. Brill Company of Massachusetts (formerly the Wason Manufacturing Company, Springfield).[49]

At the time of its formation, American Car and Foundry's component manufacturers produced a wide range of industrial, freight, and passenger cars. Several of the companies were well into the design and production of standardized iron and steel and composite iron/wood construction freight cars.

The Ohio Falls Car Company offered standard designs for boxcars, flatcars and hoppers as early as 1868. During the late 1870s, Michigan-Peninsular built 650 30-ton gondolas of a single design for the Cleveland, Lorain and Wheeling Railroad. The railroad also bought an additional 150 hoppers from Wells and French. Murray, Dougal and Company, located near the Pennsylvania oil fields, developed and patented a standardized tank car with a composite wood and iron frame during the same period. By the 1890s, the company was building all-steel 6500-gallon tank cars. Willard Pennock, co-owner of the Pennock Brothers car plant in Minerva, OH, was one of the leading proponents of steel railroad cars. Pennock and his brother had operated the Minerva car works since about

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[46] Ibid., 141; White, Passenger Car, pt. 2, 656; "Arrivals and Departures, Trains, February 1962, 12.

[47] Porter, Moody's Manual, 1932, 2661.

[48] White, Passenger Car, pt. 2, 652.

[49] Ibid., 649; Porter, Moody's Manual, 1932, 2661.

1875. By 1892, they were publishing designs for steel flatcars and boxcars and then began building steel cars in 1895.[50]

American Car and Foundry built its first steel-body passenger cars between 1901 and 1905, at the former Jackson and Woodin plant in Berwick. The three hundred cars, manufactured for the Pennsylvania Railroad's cross-Hudson subway, contained only small amounts of wood in their structure. In 1904, AC&F built 134 steel suburban coaches for the Long Island Railroad using the basic subway car design.[51]

In 1907, AC&F participated in the first mass production of all-steel passenger coaches in the United States. The design, an eighty-foot-long passenger coach designated the P-70, was developed by the Pennsylvania Railroad (PRR). The PRR ordered two hundred P-70s and allocated the work among American Car and Foundry, the Pressed Steel Car Company, and the railroad's own Altoona shops. Later that year AC&F shared an order for fifty all-steel cars designed by Lewis B. Stillwell for the Manhattan Tubes subway in New York City. During 1909 and 1910, AC&F built 222 powered MP-54 suburban coaches for the Long Island Railroad.[52]

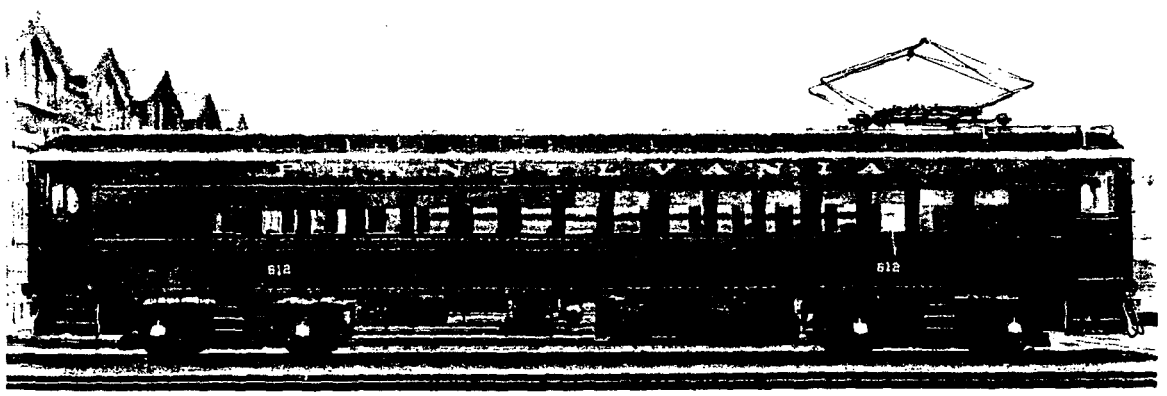

Fig. 4. Pennsylvania Railroad MP-54 all-steel powered suburban coach. AC&F built identical cars for the Long Island Railroad. From Alvin F. Staufer and Bert Pennypacker, Pennsy Power II (Medina, OH: Staufer Litho Plate Co., 1968), 171.

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[50] White, Freight Car, 368, 376, 408-409, 590-591.

[51] White, Passenger Car, pt. 1, 131-132. The cars contained only a small amount of wood in their superstructure.

[52] Ibid., pt. 1, 137, 147-148; pt. 2, 632.

By 1912, AC&F had fully converted its passenger car production from wood to steel. Customers for the final orders for wood cars included the New York, Chicago and St. Louis Railroad, better known as the "Nickel Plate," which bought its last wood coaches from AC&F between 1907 and 1910. The cars were built at the former Ohio Falls Car Company plant at Jeffersonville, IN. In 1911, AC&F produced several wood coaches for the New York Central (NYC) Railroad. The final car in the order, No. 1799, was the last wood coach bought by the NYC.[53]

During the early 1920s, AC&F management decided to diversify the corporation's product line to reduce the company's reliance on the railroad car market. American Car and Foundry acquired the Carter Carburetor Company in 1922. In 1925, AC&F acquired the Fageol Motor Company, a bus importer and builder, and the Hall-Scott Motor Car Company of Berkeley, CA, a builder of rail cars since 1909.[54] At the time of Hall-Scott's acquisition by AC&F it was building gasoline engines and thirty-two passenger gas rail cars for railroads such as the Nevada Copper Belt. On 26 January 1926, American Car and Foundry organized the Brill Corporation as a consolidation of the J.G. Brill Company and American Car and Foundry Motors, which controlled Hall-Scott Motors and the Fageol Motor Company. By 1927, AC&F manufactured highway buses, trucks and rail buses through its Brill Corporation subsidiary.[55]

At the end of 1926, AC&F owned and operated three passenger car plants (Berwick, Jeffersonville, St. Charles); nine freight car plants (Berwick, Buffalo, Jeffersonville, Huntington, St. Charles, Madison, Detroit, St. Louis and Chicago), two tank car plants (Milton, PA, and Kansas City, MO); nine wheel foundries; seven grey iron foundries; one malleable iron foundry; one brass foundry; two rolling mills and forges; an architectural woodworking mill; one freight car leasing company, Shippers Car Lines; and a plant for building and repairing car floats and small vessels. The company additionally owned substantial interests in the Pacific Car and Foundry Company and the Sligo Furnace Company.[56]

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[53] Ibid., pt. 1, 108, 114.

[54] Porter, Moody's Analyses, 1927, 1197.

[55] White, Passenger Car, pt. 2, 600, 602; Porter, Moody's Analyses, 1927, 1197.

[56] Porter, Moody's Analyses, 1925, 4.

Fig. 5. The locations of American Car & Foundry's major car building factories in 1926. Illustration by author.

During the 1930s, American Car and Foundry worked to consolidate its share of the passenger and freight car markets. Through its subsidiaries, the company was able to continue its expansion into non-rail markets and survive the Depression. One of the areas AC&F moved into was lightweight self-propelled trains.

AC&F built its first motor train, The Rebel, for the Gulf, Mobile and Northern Railroad (GM&N) in 1935. Two complete four-car sets were financed through a Works Progress Administration loan and built at the Berwick plant. Each set consisted of a seventy-three foot motor car with baggage and mail compartments; two seventy-five foot coaches, the first with a small buffet; and a seventy-seven foot observation car with a sleeping section. An additional coach was added to the train for the run between Jackson, MS, and New Orleans, LA.[57]

The Rebels were not designed for high-speed long distance service, but served well in replacing the GM&N's steam-powered locals. The GM&N was apparently satisfied and ordered a third train set in

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[57] White, Passenger Car, 620-621; Drury, Historical Guide, 151. The coaches also had separate seating and toilet facilities for blacks and whites.

1938. The Rebels served on the GM&N, and its successor, the Gulf, Mobile and Ohio Railroad, through 1954.[58]

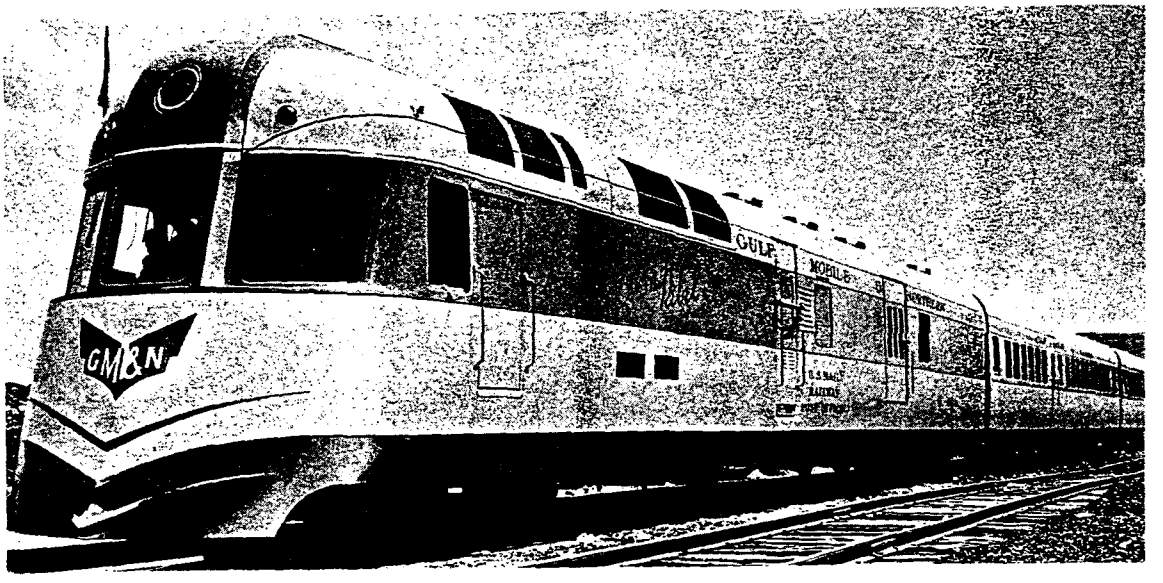

Fig. 6. The Gulf, Mobile and Northern's Rebel. From Jerry A. Pinkepank, The Diesel Spotter's Guide (Milwaukee: Kalmbach Publishing Company, 1967), ALCO-54.

American Car and Foundry experimented with aluminum and stainless steel construction of its passenger cars prior to World War II and eventually put both materials into production. The company built its first aluminum lightweight cars for the Alton and Southern Railroad's Abraham Lincoln. Additional aluminum cars were delivered to the Kansas City Southern; Louisville and Nashville; Union Pacific; and Missouri Pacific Railroads.[59]

Stainless steel construction resulted in hardier, longer lasting cars. AC&F switched to a new variant of stainless steel in 1933, known as Cor-Ten, which was lighter than traditional carbon steel but stronger and more rust resistant. In 1934, AC&F built two twenty-six-ton Cor-Ten steel coaches for the Norfolk Southern Railway. The cars were popular, and similar units were ordered by the Seaboard Air Line, Chicago and Eastern Illinois Railway, and Missouri and Arkansas Railway. Powered versions of the cars, known as "Motorailers," were bought by several railroads. The Missouri and Arkansas acquired two and used them to revive passenger service between Joplin, MO, and Helena, AR. Other Motorailers were operated by the New York, Susquehanna and Western Railroad, the

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[58] White, Passenger Car, pt. 2, 621.

[59] Ibid., pt. 1, 165.

Illinois Central Railroad (three units, named the Miss Lou, Illini and Land O'Corn), and the Missouri Pacific Railroad.[60]

AC&F came through the Depression reasonably intact and prosperous, albeit at the expense of a few of the older plants. The freight car facilities at DePew, NY (former Union Car Company), Indianapolis, IN (former Indiana Car and Foundry Company), and Memphis, TN (former Southern Car and Foundry Company), were closed and partially dismantled.[61]

American Car and Foundry mobilized with the rest of the country during World War II. Several plants were converted for war production in 1940, including the Berwick facility. During the course of the conflict the Berwick plant alone produced over 15,000 M3 and M5 "Stuart" tanks for the U.S. Army. AC&F built 117 new structures in Berwick to handle the production, extended the work hours, and by mid-war was turning out thirty-six new tanks per day. The Milton, PA, plant produced masts and king posts for the Navy; Milton and Berwick both manufactured half tracks, tank destroyers, bulldozers, pontoons and bombs for the war effort. Other company facilities manufactured valves in Michigan; pierced-steel plank landing mats in Illinois; fuses and carburetors in Missouri; and landing barges and minesweepers in Delaware.[62]

After the war, the traveling public returned to the rails and production of railroad equipment quickly resumed. Companies such as AC&F and Pullman manufactured millions of dollars worth of new train sets to replace aging prewar equipment.

During the height of this postwar production American Car and Foundry built twenty-two types of freight and passenger cars for nineteen different railroads. Modern box, hopper, gondola, and tank cars went into service. New passenger cars were produced for the Wabash Railway's City of Kansas City; the Central of Georgia Railway's Nancy Hanks II; the Louisville and Nashville Railroad's Humming Bird; the Great Northern Railroad's International and Red River; the Atchison, Topeka and Santa Fe Railroad's Super Chief; and the Kansas City Southern Railway's Southern Belle, among others. Each type of car produced by AC&F required from 500 to

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[60] Ibid., pt. 1, 178; pt. 2, 627; Drury, Historical Guide, 195-196.

[61] Porter, Moody's Manual, 1940, 107.

[62] "Arrivals and Departures," Trains, February 1962, 12; Barbara Blossom, "Pennsylvania and WWII," Pennsylvania, February 1992, 22-23.

2,500 hundred drawings and 500 to 1,000 engineering requisition forms.[63]

Unfortunately for the manufacturers, there were strong indications that the postwar boom would not last. The American public was switching to the airlines for long distance travel and relying on private automobiles for short distances. The growing trucking industry was taking away much of the railroad's freight business. By the mid-1950s, orders for both freight and passenger cars were declining for all manufacturers.[64]

In response to the decline, AC&F sold more assets and closed several additional facilities. The former Jackson and Sharp plant in Wilmington, DE, which had been inactive since the end of the war, was closed and liquidated. American Car and Foundry Company, Ltd., of England, was shut down. The Brill Corporation, which included the J.G. Brill Company, Hall-Scott Motor Car Company, and the Fageol Motor Company, was sold to Consolidated Vultee Aircraft Corporation. The American Welding Company, manufacturer of tanks and containers, was dissolved on 31 December 1945, as was the Railway Equipment Company of Argentina, AC&F's South American sales agent.[65]

The company attempted to boost sales for its remaining units by stressing technology. Advertising stressed that AC&F's line of all-welded freight cars were built with the most modern of production line methods. AC&F applied similar methods to lightweight passenger train construction. The company hoped that "ultra-modern" equipment would take customers away from the airline industry and put them back on trains.[66]

The first of these was the TALGO, which stood for "Train, Articulated, Light, Goicoechea and Oriel" (the last two were the names of the train's Spanish designer and its financial backer). Each train set consisted of several low slung articulated passenger coaches powered by two Fairbanks Morse P12-42 diesels. Three demonstrator trains were built in 1949, and eventually TALGO sets

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[63] White, Passenger Car, pt. 1, 192; "Built by A.C.F.", Trains, April 1951, 12.

[64] Martin, Railroads Triumphant, 375-376.

[65] Porter, Moody's Manual, 1946, 2320.

[66] C.B. Peck, ed., Car Builder's Cyclopedia of American Practice, 18th ed. (New York: Simmons-Boardman Publishing Corp., 1949), 84-86, 118-120, 207-209.

were sold to the Boston and Maine and the New York, New Haven and Hartford Railroads.[67]

The TALGO trains looked modern but were resounding failures in service. Railroaders were not happy with their small size and mechanical problems, while passengers did not approve of their poor quality ride, cheap furnishings, and poor food service. The TALGO trains were tested in the northeast and quickly retired. One string of TALGO passenger cars was later placed in commuter service on the Chicago, Rock Island and Pacific Railroad, behind an EMD Aerotrain locomotive. These, too, were eventually retired and scrapped.[68] AC&F later built two other lightweight trains, named the John Quincy Adams and the Dan'l Webster, for the New York, New Haven and Hartford Railroad. The New York Central, Chicago, Rock Island and Pacific, and the Boston and Maine Railroads expressed an interest in acquiring similar equipment for use on their lines. Despite this interest, the New Haven's trains proved to be failures, and were quickly shunted off to commuter service and eventually retired. AC&F built no additional lightweight train sets.[69]

Despite problems on the passenger car side of the house, AC&F managed to have continued success with its freight car business. During the early 1940s the company developed a series of standardized, lower-cost freight cars. These standardized cars sold well and saw extensive use throughout the country. AC&F offered a line of cars, including covered hoppers, open hoppers, gondolas, tank and boxcars. The company sold almost five thousand of the covered hoppers to forty-eight different railroads between 1947 and 1952. The cars were manufactured at the Berwick plant, which was advertised as the largest freight car facility in the nation.[70]

The market for passenger cars continued to decline during the 1950s. By 1955, the railroads were concentrating on rebuilding existing cars. The passenger car builders such as AC&F were forced to close plants, concentrate on building freight cars, or diversify.[71] AC&F chose to continue moving into new areas, and, on 20 April 1953, purchased the Avion Instrument Company in Paramus, NJ. Avion produced fire control and missile guidance systems for the military. In January 1954, AC&F established a division for

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[67] Jerry E. Pinkepank, Diesel Spotter's Guide (Milwaukee: Kalmbach Publishing Company, 1967), FM-16.

[68] White, Passenger Car, pt. 2, 627; Pinkepank, Spotter's Guide, EMD-79.

[69] White, Passenger Car, pt. 2, 648.

[70] "What's New In Freight Equipment?" Trains, August 1952, 63.

[71] White, Passenger Car, pt. 1, 185.

developing and producing other advanced electronics. The new division was named ACF Electronics Company and was based in Alexandria, VA. The following April, AC&F purchased the W-K-M Company of Houston, a manufacturer of high pressure steel valves for oil field and pipeline use. Later in the year the corporation acquired the Engineering and Research Corporation of Riverdale, MD, a producer of electronics and airplane equipment.[72]

On 1 June 1954, American Car and Foundry changed its name to ACF Industries, Inc. Most of the iron foundries had been closed or sold, and the corporation was now as much involved in aerospace, electronics, and oil component manufacturing as railroad car construction. Car work continued at a greatly reduced level from the immediate postwar period. The company's St. Louis freight car facility was leased to another firm in late 1954, reducing the number of car plants to four.[73]

On 1 June 1955, ACF Industries reorganized along product lines and created eight new divisions:

Advanced Products Division - pressure vessels, tank cars, missile and aircraft components, ordnance, aluminum fabrication. Plants at Milton, PA and St. Charles, Mo.

American Car & Foundry Division - transportation equipment, foundry and forge products, heavy ordnance, materiel handling equipment. Plants at Berwick, PA, and Huntington, WV.

Avion Division - electronic devices and components. Plants at Alexandria, VA, and Paramus, NJ.

Carter Carburetor Division - fuel systems, small machine parts, automotive components. Plants in St. Louis and Olivette, MO.

Erco-Nuclear Products Division - nuclear products, trainers and simulators, nuclear operations. Plants at Albuquerque, NM; Riverdale, MD; and Buffalo, NY.

Shipper's Car Line Division - tank car, hopper car leasing. Plants in East St. Louis, IL; Milton, PA; North Kansas City, MO; Red House, WV; and Smackover, AR.

W-K-M Division - high and low pressure valves and fittings. Plants at Missouri City and Richmond, TX.

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[72] Moody's Investors Service, Moody's Industrial Manual (New York: Moody's Investors Service, 1954), 78, 2875; 1955, 186.

[73] Ibid., 1955, 185-186.

ACF Electronics - research and development of modular electronics. Plant in Alexandria, VA.[74]

The ACF Electronics and Erco-Nuclear Products divisions merged in 1960. At the same time, the Albuquerque Division was formed to manage the Atomic Energy Commission's (AEC) South Albuquerque/ Sandia Base facility and provide support to AEC's laboratories in Los Alamos, NM, and Livermore, CA.[75]

Through all of the corporate reorganizations the Berwick plant continued to turn out railroad cars, including some rather unusual ones. In the late 1950s, ACF and the Boeing Airplane Company of Seattle, WA, built several eighty-eight-foot long freight cars for the United States Air Force. Each car was designed to transport and launch a single LGM-30A/B Minuteman I missile. The program, known as "Mobile Minuteman," was an early attempt to enhance the survivability of the Air Force's intercontinental ballistic missile force. The 4062d Strategic Wing at Hill Air Force Base, Ogden, UT, operated several test trains equipped with the ACF/Boeing missile cars from 1960 through 1961. Secretary of Defense Robert Strange McNamara cancelled the program in 1961 and the missile cars were scrapped.[76]

The last passenger cars made by ACF came from Berwick in 1961, when twenty-five baggage cars were delivered to the Union Pacific Railroad. With the end of passenger car production, ACF closed its Berwick plant in October 1962.[77] In early 1963, ACF Industries released a press release stating:

> We believe there is a place in the railroad equipment picture for a research-minded independent carbuilder who can fill the increasing demand for special-purpose cars even though the railroads continue to pre-empt most of the standard car business for their own shops.[78]

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[74] Ibid., 1958, 2.

[75] Ibid., 1961, 1354.

[76] "Railroad New Photos," Trains, December 1959, 8-9; David P. Morgan, "News & Editorial Comment - L.c.l.", Trains, August 1961, 13; John T. Bohn, ed. From Snark to Peacekeeper - A History of SAC Missile Programs (Omaha, NE: Strategic Air Command, 1988), 135. The Air Force studied the concept once again during the Reagan Administration.

[77] George H. Drury, "ABC's of Railroading: From Pullman to Bombardier," Trains, November 1991, 25; "Arrivals and Departures," Trains, February 1962, 12.

[78] "Arrivals and Departures," Trains, November 1963, 12.

The Berwick Industrial Development Association acquired the massive Berwick facility and converted into an industrial park. One of the early tenants was the Berwick Forge and Foundry Company, which opened in 1963. The company continues in operation under the name of Berwick Forge and Fabricating and shares the former AC&F site with several manufacturers, including Deluxe Homes; Dana Corporation; Stricket; G&B Specialties; and the Berwick Freight Car Company. The latter company uses 51,000 square feet of the former AC&F facility to rebuild freight cars and is thriving. In 1994, Berwick Freight Car repaired and rebuilt 200 gondolas and 100 boxcars for several customers and anticipated additional business.[79]

ACF Industries continued in operation, working in areas never dreamed of by William Bixby and its other founders. Financier Carl C. Icahn acquired ACF in the summer of 1984 and ended the corporation's eighty-five years of independent operations. Icahn merged the Amcar and Shippers Car Lines subsidiaries, which put all freight car construction and leasing activities in one division.[80]

The main business of the Amcar Division of ACF Industries is the management of the lease fleet of over 45,000 cars. Most of the cars are center-flow covered hoppers and tank cars built at Huntington, WV, and Milton, PA. Amcar maintains car repair facilities at Bude, MS; Longview, TX; Milton, PA; and North Kansas City, MO. The division also operates a substantial railroad car parts business, with a factory in Jackson, MO, and a foundry in Texas. The latter, acquired in 1993, was ACF's first company-owned foundry since the late 1950s.[81]

ACF is the last survivor of the great American railroad car builders such as Pullman-Standard, Pressed Steel, and Budd. The market for railroad passenger and freight cars contracted over the years. ACF's corporate diversity enabled it to survive the declining market while its competitors fell by the wayside. Now, under Carl Icahn's leadership, ACF Industries is primarily involved in non-rail activities. While freight car construction continues at a modest rate, the corporation no longer goes by the motto "American Car & Foundry Company - Car Builders to the American Railroads."[82]

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[79] "Berwick Bounces Back With Railroads," Railway Age, 10 May 1965, 20; Kay Harmon, telephone conversation with Mark Morgan, 25 April 1994; Henry Parish, telephone conversation with Mark Morgan, 25 April 1994.

[80] Moody's Investors Service, Industrial Manual, 1984, 901.

[81] John Krug, telephone conversation with Mark L. Morgan, 25 April 1994.

[82] "Built by A.C.F.", Trains, April 1951, 17.

Car Type

At one time, the boxcar was the most numerous type of revenue freight car on American railroads. Historian John White describes the boxcar as:

> ...the universal goods wagon that carried lumber, grain, furniture, machinery, or barreled whiskey equally well. Just about every product of man and nature found shelter and carriage within its wooden walls.[83]

Boxcars could haul just about anything, of any size, making the type the best all-purpose car a railroad could have.

The first boxcars were developed during the 1830s. By 1910, there were 966,600 boxcars in service. The next largest group of freight cars in use were coal cars, with over 818,000 in service. The boxcar remained the most common type of railroad freight car until the late twentieth century, when more specialized railroad equipment began to replace it.[84]

The Baltimore and Ohio (B&O) Railroad produced the first boxcars in 1832, when it introduced seventy "house" or covered freight cars into service. The standard car of the time was the open gondola, developed from English designs. These cars did not protect their cargo, particularly during winter, and cinders from the locomotive often set the contents of the open cars on fire. The B&O's cars were effectively open gondolas with fixed roofs. Later cars were fully enclosed, and by the 1840s the majority of boxcars in the United States were of the classic "box on wheels" configuration.[85]

The earliest boxcars ran on four wheels and had a capacity of about ten tons. By 1870, the basic design characteristics of eight wheels, rectangular body, and sliding side doors were common throughout the railroad industry. The cars rapidly became bigger, heavier, and had increased capacity. By 1899, most of the major railroads were operating thirty-ton capacity cars of thirty-four and thirty-six foot length. The increased capacity meant fewer cars were needed on any particular train, resulting in shorter trains. Fewer brakemen were needed on the shorter trains, thus lowering labor costs.[86]

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[83] White, Freight Car, 192.

[84] Ibid., 121; "Greenville Steel Car 60-foot Boxcar," Railroad Model Craftsman, August 1976, 48.

[85] White, Freight Car, 163-164.

[86] Ibid., 164, 192, 194, 198.

The transition to larger cars meant changes in the fundamental construction of the boxcar. Iron and steel body bolsters replaced wood. Steel underframes replaced wood underframes around the end of the nineteenth century and removed the need for tie rods. The first metal underframes were developed for freight cars in the 1860s. In 1877, an AC&F predecessor, the Milton Car Company, produced a boxcar for the Empire Fast Freight Line that had iron section channels and I-beams and box girder body bolsters. During the 1880s, several manufacturers produced tube-frame or "pipe" freight cars. These included future AC&F affiliates Milton and the Bloomsburg Car Works.[87]

In 1893, the Missouri Car and Foundry Company built a new class of boxcar, the buggy car. These were the largest wood boxcars ever built, measuring sixty feet long and nine feet two inches tall. More common were the thirty-six and forty-foot general merchandise boxcars. Ensign built 2,000 forty-foot, fifty-ton capacity wood boxcars for the Southern Pacific Railroad in the late 1890s. These cars were designed by Canda, and were among the last wood boxcars built by any company.[88]

All-steel construction became technologically feasible towards the end of the nineteenth century. Steel frame cars were less susceptible to damage from yard collisions and hard coupling. Several manufacturers possessed the industrial wherewithal to develop and manufacture steel components, and were doing so. Finally, the Safety Appliance Act of 1893 required that all freight cars be equipped with automatic couplers and air brake systems. This essentially mandated the replacement of wood underframes.[89]

The Schoen Pressed Steel Car Company of Pittsburgh, PA, completed the first mass-produced steel cars in 1892. Other manufacturers produced steel cars within four years. By 1901, fifteen percent of the newly constructed cars in the country were built of steel. By 1905, the total was up to forty-five percent. Boxcars were delivered with steel underframes, ends and roofs, and gradually less and less wood was used in their construction. The first all-steel boxcars were produced around 1906. By 1914, the Pennsylvania Railroad was mass producing all steel boxcars at its own shops.[90]

Composite boxcars, such as DL&W No. 43651, were not developed until after all-steel cars were becoming common. C.A. Seley, master

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[87] Ibid., pt. 2, 567-568, 575.

[88] Ibid., 202.

[89] Ibid., 577.

[90] Ibid., 593, 598; John Nehrich, "The Box Car," The Call Board, July 1993, 8-9.

mechanic on the Norfolk and Western Railroad, first proposed the use of steel truss side framing on hoppers and gondolas in 1900. Designs for composite boxcars, with exposed steel framing and wood bodies, soon followed. The steel truss could be exposed to the elements without suffering quick damage, so many cars used only a single layer of wood to cover the cargo. The wood was mounted to the inside of the trusses, and the cars were known as "single sheathed." "Double sheathed" boxcars had wood siding applied to both sides of, and covering, the steel frame.[91]

The first mass-produced single sheath cars were built for the Canadian National and Canadian Pacific Railroads in 1909. These were thirty-six feet long, had a capacity of thirty tons and a Howe truss configuration. Over the next three decades, car length grew to forty and fifty feet. Height increased along with length, from eight feet around 1910, to ten feet six inches by 1942. Car capacity increased from thirty tons to forty and fifty-five tons.[92]

Early steel frame cars were built with steel-braced single sheath ends. The steel end was developed as a means of preventing damage to the car from suddenly shifting freight. The ribbed Murphy end, introduced in 1912 on a New York Central boxcar, was the first practical all-steel car end. Two years later the Pennsylvania Railroad introduced the flat "Pennsy" car end. This design used three internal vertical braces for stiffness and became standard on the railroad's X-29 series boxcars. In the mid-1920s, the Dreadnaught and Improved Dreadnaught car ends became popular. The Dreadnaught had large ribs that tapered at the corners, with raised "darts" between the ribs. By 1950, nearly all composite and all steel cars were built with steel ends of one design or another.[93]

The first steel roofs on wooden cars were fabricated with interlocking sheets. The design, known as a "flexible roof," allowed the panels to shift over each other as the car twisted. Steel and steel truss cars were rigid by design and had riveted roof panels. Roof strengthening ribs were either placed beneath the panel seams, producing a flat roof, or above the seams, giving the roof a corrugated appearance. After the mid-1940s, additional raised strengthening creases were added to the mid-section of each roof panel by companies such as Standard Railway Supply.[94]

Side doors increased in width from five feet to six feet after about 1910. By the 1950s, the standard was seven or eight feet

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[91] Nehrich, "The Box Car," 8-9.

[92] Ibid.

[93] Ibid., 8, 10.

[94] Ibid., 11.

wide, enabling the use of forklifts in loading and unloading the cars. The most common single type through the 1950s was the Youngstown door, which had multiple horizontal creases, like the Murphy car end. Other designs, such as those developed by the Chicago Railway Equipment Company, used three flat panels with internal stiffeners. After the 1950s, the single and double plug door design became popular. These doors featured three to five flat panels with external ribs at the panel seams. The doors were locked in place with rotating steel bars, sealing the car.[95]

Boxcars have grown in length since the early 1960s. Cars now range in size from sixty to eight-six feet and have capacities of as much as one-hundred tons and ten thousand cubic feet. Double-door and all-door boxcars are now common. Most modern cars are delivered with cushion underframes to soften impacts. The classic forty-foot steel car has become rare as the railroads turn to larger and more specialized conveyances, but the boxcar type remains one of the basic components of railroad freight hauling.[96]

Car History/Period of Construction

Delaware, Lackawanna and Western Railroad boxcar No. 43651 is a thirty-six foot, double sheathed, steel underframe wood boxcar built in 1922 by American Car and Foundry. The company built the car at its Berwick, PA, plant.[97]

Although coal was the single most valued commodity for the Lackawanna, other products were important to the railroad and most of these were shipped in boxcars. Bulk shipping of grain from the midwest to the Great Lakes and east coast ports began about 1860. The boxcar was best suited for this service. Wood half doors, called "grain doors," were fitted to the sides of the boxcars. Following loading in Buffalo, the cars were routed to Hoboken.[98]

The railroad also used boxcars to haul cement from its Bangor and Portland branches, and less-than-carload freight, known as "LCL." LCL was individual cargo that weighed between fifty and one-hundred pounds, usually destined for different locations. Sorting and

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[95] Ibid.; "Greenville Steel Car 60-foot Boxcar," Railroad Model Craftsman, August 1976, 48.

[96] "Greenville Steel Car," 48-51.

[97] Pincus, 13 April 1994; Krug, 25 April 1994. AC&F's Berwick plant was located on the DL&W's Bloomsburg Branch.

[98] White, Freight Car, 26-27; Taber and Taber, Twentieth Century, vol. 2, 686.

transporting these items was labor intensive, but it provided valuable business for the DL&W.[99]

The Lackawanna operated several types of boxcars. In 1899, the railroad owned about 12,000 thirty-four foot wood underframe and truss road boxcars. The railroad acquired thirty-six foot steel underframe cars after the turn of the century. After 1912, the railroad received cars with cast steel Bettendorf trucks. The Bettendorf was lighter, stronger and less complicated than the arch bar and the pressed steel trucks it replaced.[100]

In 1922, the Lackawanna received its last wood-construction boxcars. The total order was for 500 cars, numbered from 43500 to 43999. These cars were thirty-six feet long and had steel underframes, steel ends, double sheathed wood bodies, and a capacity of forty tons. Two-hundred-sixty of the boxcars had an inside length of 36 feet 4 5/8 inches and an internal capacity of 2,474 cubic feet. Two-hundred-thirty-six had an inside length of 36 feet 3 inches and an internal capacity of 2,465 feet. Steamtown's Lackawanna boxcar No. 46351 was in this latter group.[101]

The railroad acquired its first all-steel boxcars in 1929, when it bought 1,000 forty-foot forty-ton capacity cars. Over the next six steel car orders total capacity increased from forty to fifty tons and the cars grew in length to fifty feet. The Lackawanna made its seventh and last order for new steel boxcars in 1957, three years prior to the company's merger with the Erie Railroad.[102]

As the Lackawanna introduced larger steel boxcars it replaced the older wood cars. By April 1954, 325 of the thirty-six-foot boxcars were still in operation. By October 1962, following the merger of the Lackawanna and the Erie, only eight of the 43500-series cars remained in service.[103]

Number 43651 became the property of the Norton Abrasives Company of Worcester, MA, during the mid to late 1950s when the company

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[99] Taber and Taber, Twentieth Century, 686; White, Freight Car, 34-35.

[100] White, Freight Car, 476; Taber and Taber, Twentieth Century, Vol 2., 686.

[101] Taber and Taber, Twentieth Century, Vol. 2, 686, 708; The Official Railway Equipment Register, Vol. XLV, No. 7 (New York: The Railway Equipment and Publication Company, December 1929), 288.

[102] Taber and Taber, Twentieth Century, Vol. 2, 686, 708.

[103] Railway Equipment Register, Vol. LXIX, No. 4, December 1929, 165; Vol. LXXVIII, No. 2, October 1962, 288.

acquired a number of used, older style boxcars for use on its interplant railroad. The company purchased cars from the Boston and Maine, Lackawanna, Lehigh Valley, Boston and Albany, and New Haven Railroads. Norton renumbered the cars and painted them yellow. DL&W boxcar No. 436512 was renumbered to 309.[104]

In 1979 and 1980, Michael Robinson of the Connecticut Valley Railroad Museum/Railroad Museum of New England (RMNE) started a project to preserve the best cars of the Norton fleet. At the time, the Norton cars probably constituted the largest and best preserved group of early twentieth century freight equipment in the northeastern United States. Of some thirty cars, twelve were saved and moved from the Norton site. The RMNE acquired nine, including No. 43651. The former Norton cars were moved to storage tracks near the Valley Railroad in Essex, CT, during 1980 and 1981.[105]

The National Park Service acquired No. 43651 and two other cars from the RMNE collection on 3 March 1993, in trade for two cars and locomotive parts from the Steamtown NHS collection. The car was delivered to Scranton in July 1995, with Central Railroad of New Jersey boxcar No. 18049 and Pullman Company sleeping car Arsenal Tower.[106]

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[104] Howard Pincus to Ella S. Rayburn, 6 September 1993. Folder "DL&W Boxcar 43651." Building files, Steamtown National Historic Site, Scranton, PA.

[105] Ibid.

[106] Dr. John A. Latschar to Howard Pincus, 3 March 1993. Folder, "DL&W Boxcar No. 43651." Building files, Steamtown National Historic Site, Scranton, PA.

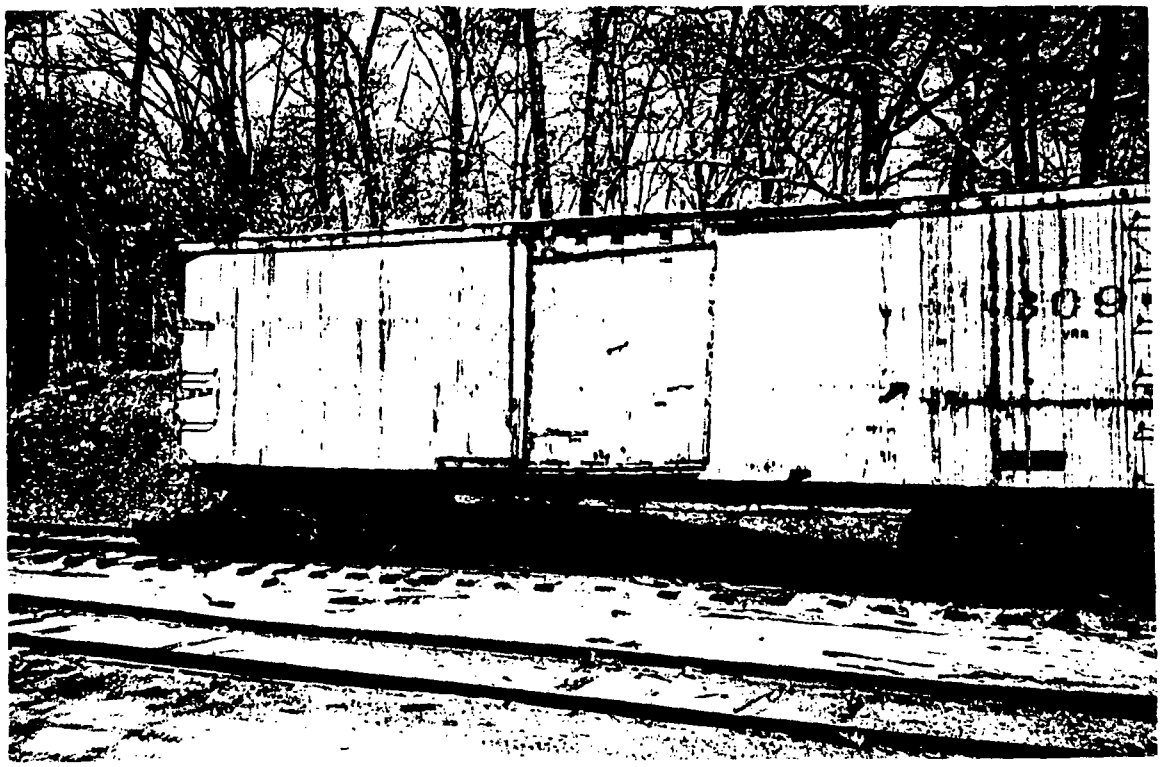

Fig. 7. DL&W boxcar No. 43651 parked on RMNE storage tracks in Essex, CT, 20 February 1993. Photograph by Howard Pincus. Folder, "DL&W Boxcar 43651." Building Files, Steamtown National Historic Site, Scranton, PA.

Physical Specifications/Modifications - DL&W Boxcar No. 43651

Reporting Marks: DL&W		**AAR Class:**	XM
Type of Car: boxcar		**Number of Cars:**	499
Builder: AC&F-Berwick		**Built:**	1922
Light Weight (lbs): 42,300			
Length-interior:	36′ 3"	Exterior: 36′ 7"	
Width-interior:	8′ 6"	Exterior: 9′ 6"	Extreme: 9′ 8"
Height-interior:	8′ 2"	Exterior: 12′ 8"	
Door openings - height:	7′ 8½"		Width: 6′ ½"
Type of construction:		Wood, double sheathed, steel under frame, Bettendorf trucks	

Underframe

Construction:	steel
Sills:	channel steel
Body bolsters:	steel

Body center plates:	steel
Body side bearings:	steel tip roller
Buffer:	Cardwell
Draft gear:	Cardwell friction

Car Body

Construction:	wood, tongue and groove
Ladder rungs:	steel, 1/2"
Roof:	steel
End sills:	steel
Door posts:	wood
Car ends:	Murphy pressed steel

Interior

Flooring:	wood
Walls:	wood

Trucks

Type:	Bettendorf
Wheelbase:	66"
Truck center plates:	cast
Truck side bearings:	steel flat plate
Springs:	coil
Wheels:	36" cast
Brake beams:	No. 2

Brakes

Type:	New York K-type
Brake stand:	ratchet wheel
Truck brake:	clasp

Finish

Exterior:	painted wood
Interior:	unfinished wood
Ceiling:	pressed steel

UNDERBODY DETAILS

Underframe - The frame is a riveted steel center I-beam with four lateral riveted steel bolsters, including two truck bolsters. Two individual lateral T-beams are spaced between the bolsters for additional support. The side rails are ten-inch channel steel, riveted to the bolsters. Four tip-roller steel side bearings are riveted to the undersides of the truck bolsters, providing lateral support to the car body. The rollers are removed from the "A" end bearings and wood blocks are wedged into the empty bearing housings.

The bearings appear to be Cardwells, manufactured by the Union Draft Gear Company of Chicago, IL.[107]

Couplers - The car is fitted with two ARA steel standard "E" type couplers with a 6" X 8" shank.[108] A cast "GCCo" on the upper main body of the couplers indicates they were manufactured by the Gould Coupler Company. The couplers on No. 43651 are functional and certified for freight use.

Fig. 8. "A" end coupler on No. 43651. Photograph by Mark Morgan.

Draft gear - The 43500-series boxcars were equipped with Cardwell brand buffers and draft gear. Buffers and draft gear employ springs and friction devices to serve as shock absorbers between the frame and the coupler. This serves to reduce violent coupling motions and makes for smoother acceleration and deceleration while the train is en route.[109]

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[107] Taber and Taber, Twentieth Century, vol. 2, 688; Roy V. Wright, ed., Car Builder's Dictionary, 8th ed. (New York: Simmons-Boardman Publishing Co., 1916), 593.

[108] Taber and Taber, Twentieth Century, vol. 2, 688.

[109] Taber and Taber, Twentieth Century, vol. 2, 688; Wright, Dictionary, 8th ed., 1045.

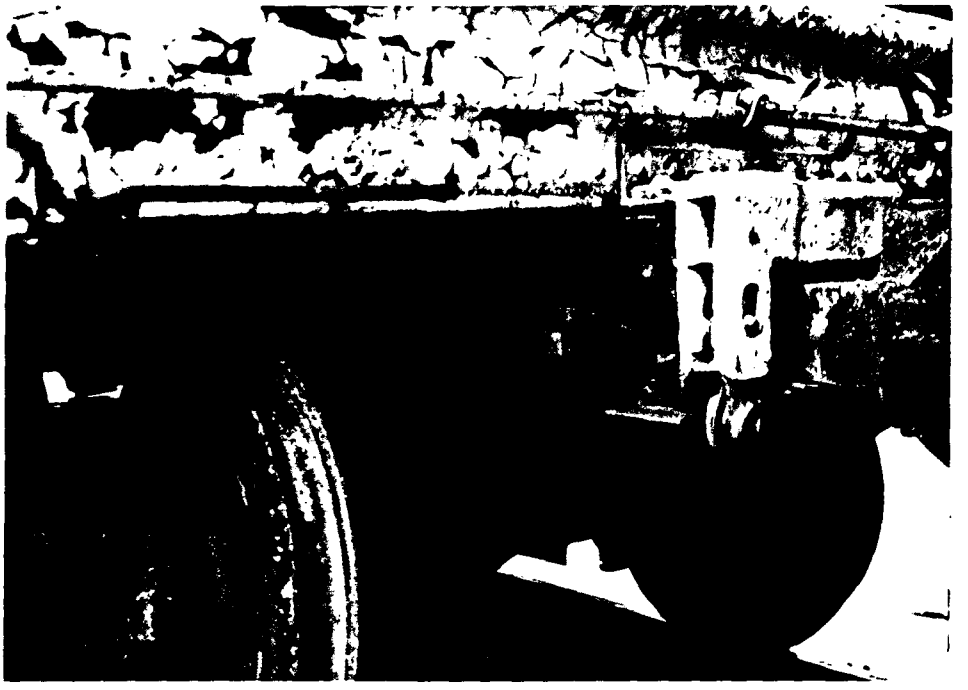

Fig. 9. Cardwell draft gear, "A" end. Photograph by Mark Morgan.

Trucks - The original trucks supplied with the car were four-wheel cast Bettendorf-type with integral pedestals. Each truck was equipped with two sets of quadruple coil springs mounted to upper and lower spring seats.

Number 43651 sits on correct style Bettendorf trucks. According to the Railroad Museum of New England's Howard Pincus, these trucks are not original and the "A" end truck currently on the car came from the Illinois Central Railroad.[110] However, both "A" truck side frames have cast markings indicating DL&W ownership:

8-42 PATENTED 5x9

GOULD TF-418 DL&W

AAR
38

The journal size is 5" X 9," indicating the size of the axle. The frames were manufactured by the Gould Coupler Company of New York, NY. The pedestals are integral to the truck frames and have Symington journal box covers, manufactured by the T.H. Symington

[110] Pincus, 6 September 1993.

Company of Rochester, NY. The "A" end left rear journal box cover is missing.[111]

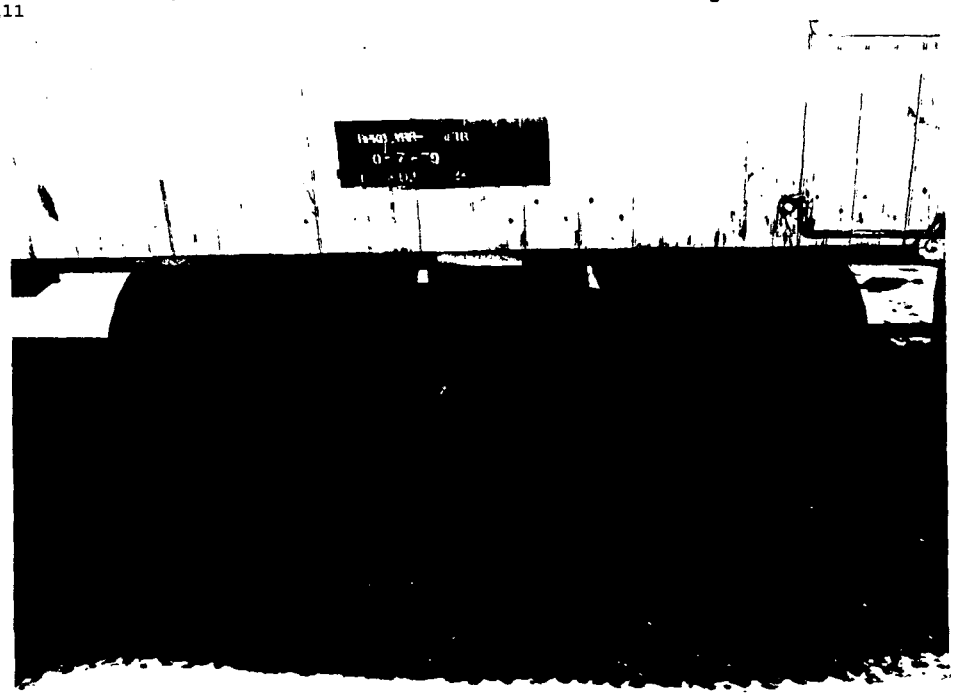

Fig. 10. "A" end Bettendorf truck of Lackawanna No. 43651. Photograph by Mark Morgan.

The "B" end left side truck frame has the same cast lettering as both "A" end frames. The "B" end right side truck frame has the following cast lettering:

B F-462 A.A.R:B-295 GN

5X9 PAT'D 1/49

The "GN" probably indicates that the truck frame was manufactured for a freight car belonging to the Great Northern Railroad and were installed on the boxcar during an unknown repair. The two pedestals have Symington journal box covers. The right side lower spring seat is rusted and two of the springs are off the car.

The Railroad Museum of New England provided a pair of matching DL&W Bettendorf trucks to Steamtown NHS at the time of No. 43651's transfer. Their origin is unknown.[112]

Wheels - The car was delivered with thirty-six inch cast steel wheels. The wheels currently on No. 43651 are the correct design and diameter. The "A" end right rear wheel has visible "AAR 1947"

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[111] Wright, Dictionary, 8th ed., 992.

[112] Pincus, 6 September 1993.

cast lettering on the exterior face. The "A" end right front wheel has visible "BERWICK" cast lettering on the exterior face. The remaining six wheels require cleaning in order to reveal any cast lettering.

Brakes - The cars of this series were originally equipped with type K air brake system, manufactured by either Westinghouse or New York Air Brake Company. The components included a K-2 triple valve, type C combined brake cylinder and reservoir, and centrifugal dirt collector (Fig. 11).[113]

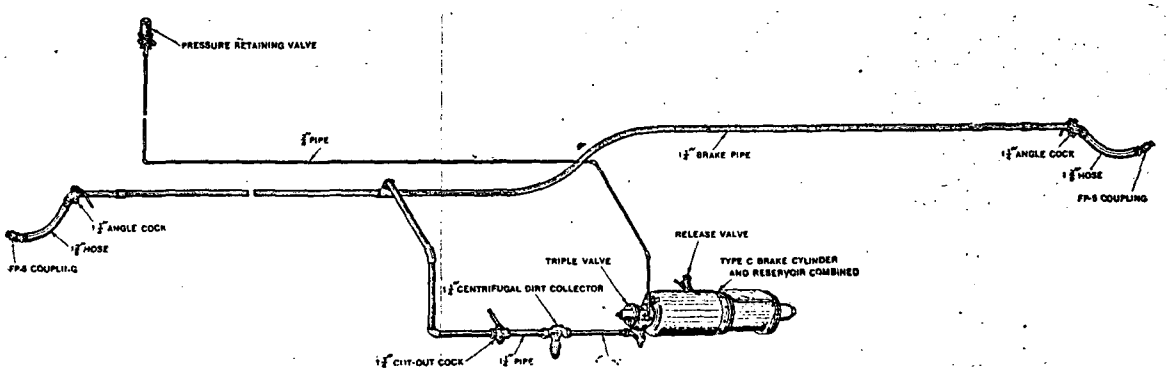

Fig. 11. Configuration of the Westinghouse KC-type air brake system for freight cars. From George V. Wright, ed., Car Builders' Dictionary, 8th ed. (New York: Simmons-Boardman Publishing Co., 1916), 647.

The car was fitted with freight-type clasp truck brakes mounted on mechanically actuated brake beams. The hand brake was actuated by a ratchet type brake stand, mounted on the upper "B" end car end.

Photographic evidence indicates that the Lackawanna later refitted No. 43651 with Type AB brakes.[114] Upgraded components included the type "AB" universal valve, brake cylinder, and air reservoir, manufactured by either Westinghouse or the New York Air Brake

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[113] Taber and Taber, Twentieth Century, vol. 2, 688; Wright, Dictionary, 8th ed., 647. Westinghouse and New York Air Brake parts are interchangeable.

[114] Clarence Tharp, photograph of boxcar No. 43651. From the Michael Del Vecchio collection. Folder, "DL&W Boxcar 43651." Building files, Steamtown National Historic Site, Scranton, PA. The brake information is stenciled on the lower right side of the car body, below the dimensional data.

Company. This equipment was consistent with brake installations for early 1950s freight equipment.[114]

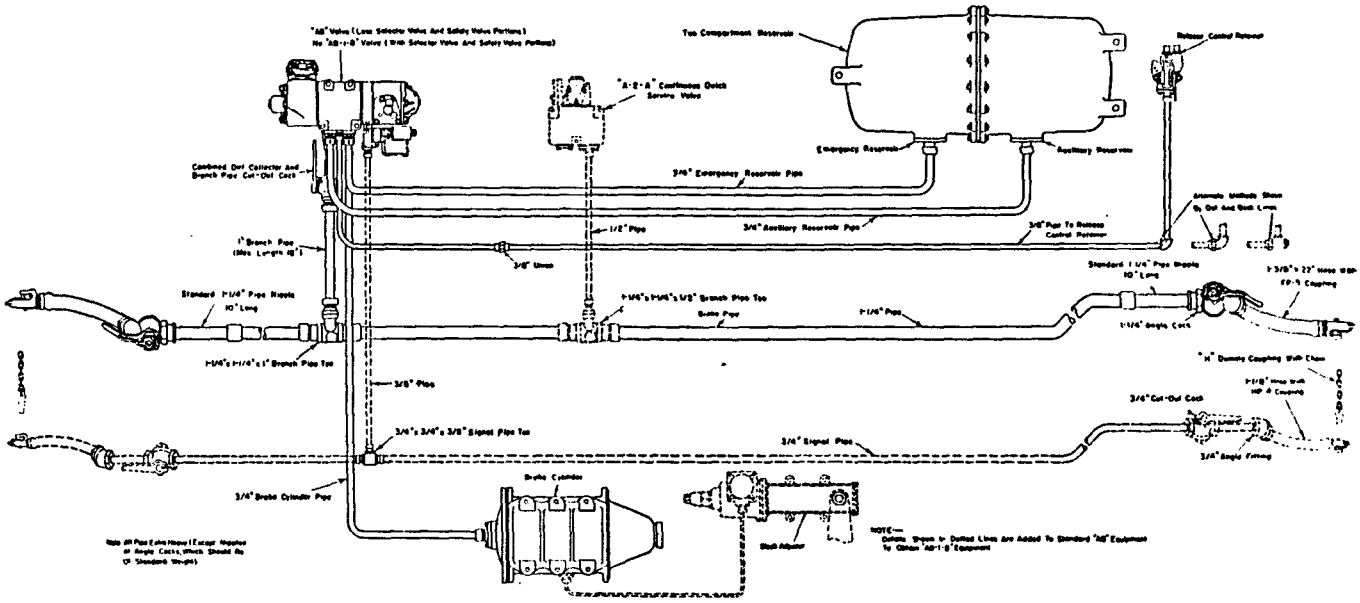

Fig. 12. Piping diagram of the New York Air Brake type "AB" installation. From C.B. Peck, ed., Car Builder's Cyclopedia of American Practice, 18th ed. (New York: Simmons-Boardman Publishing Corp., 1949), 896.

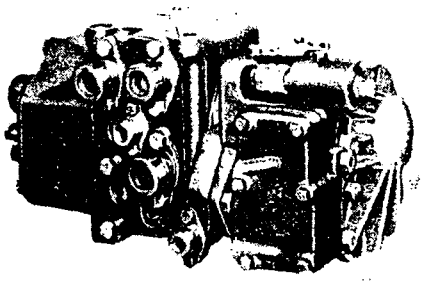

Fig. 13. New York Air Brake AB triple valve. From Peck, Cyclopedia, 18th ed., 898.

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[114] C.B. Peck, ed. Car Builder's Cyclopedia of American Practice, 18th ed. (New York, Simmons-Boardman Publishing Corp., 1949, 849, 896.

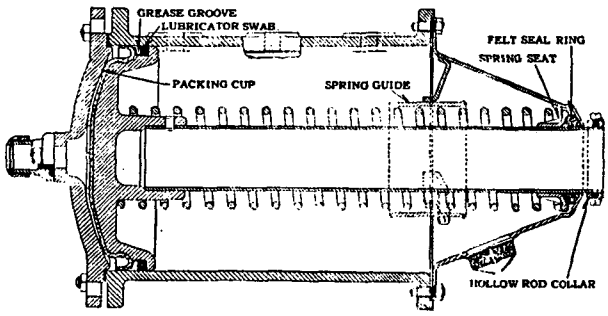

Fig. 14. New York Air Brake brake cylinder. From Peck, Cyclopedia, 898.

Norton did not use the air brake systems on its freight cars. the company removed the brake valves and other components from several of the cars, including No. 43651. The only remaining component on the car is a New York Air Brake Company centrifugal dirt collector with branch pipe cut-out cock. The triple valve, cylinder, reservoir, and brake rods which connected the bellcranks to the truck brake beams are removed. Several of the rods are stored in the boxcar; the disposition of the other parts is unknown.[116]

Fig. 15. Remnants of the brake gear on No. 43651. Photograph by Mark Morgan.

[116] Pincus, 6 September 1993.

The boxcar has a single "Universal" hand brake, mounted at the upper left corner of the "B" car end. The Universal Railway Devices Company of Chicago, IL, dates to the late 1940s, indicating replacement of the original unit. The handbrake is inoperative.[117]

EXTERIOR DETAILS

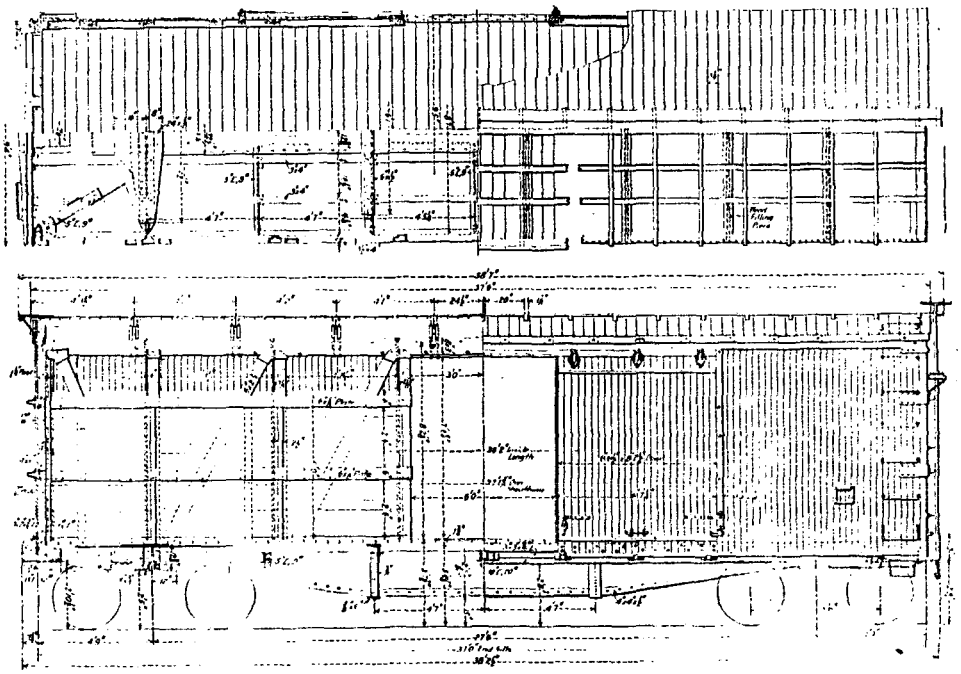

Fig. 16. Line drawing of a double-sheathed steel underframe boxcar built by American Car and Foundry for the Philadelphia and Reading Railroad. The car is marginally longer than No. 43651, but is otherwise of the same design. From Wright, Dictionary, 8th ed., 290.

Body - All wood bodywork and framing on No. 43651 has been identified as probably yellow pine and fir.[118]

The upper and lower side sills are fabricated from 34" L X 4½" W X 3½" T beams. The lower sills are bolted to the steel underframe's sills. The side framework consists of six vertical and six diagonal 5" W X 2½" T wood trusses on each side. The frame members are bolted to the upper and lower sills through cast iron brackets,

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[117] Peck, Cyclopedia of American Practice, 18th ed., 951.

[118] Wayne Dobson, conversation with author, 23 January 1996; George Canavan, conversation with author, 6 March 1996.

which help the maintain torsional rigidity of the structure. The corner posts are one-piece 7′ 7" L X 4" W X 4" T wood beams. The door posts are one-piece 7′ 7" L X 4" W X 3" T wood beams. The exterior sheathing is constructed of 5" W X 1" T tongue and groove vertically mounted planks. Interior sheathing is fabricated of 5" W X 1" T tongue and groove horizontal planks.

Norton reportedly resheathed several of its wood boxcars. It has not been determined whether the sheathing on No. 43651 was replaced. All wood body components are rotted and deteriorating and several exterior body planks, particularly those below the doors, are missing (Fig. 17).[119]

Fig. 17. Right side of boxcar No. 43651, showing the deteriorated condition of the sheathing. Photograph by Mark Morgan.

The floor is constructed of two layers of 5" W X 2" T tongue and groove planks. The lower layer planks are mounted crosswise. The upper layer planks are mounted lengthwise and serve as the interior deck. There is a gap in the deck between the side doors, running six feet to the front and rear of the car. The flooring is severely deteriorated and rotted through in places, particularly between the doors (Fig. 18).

[119] Pincus, 6 September 1993.

Fig. 18. Car floor at the right side door opening. Photograph by Mark Morgan.

Roof - The roof is fabricated from medium-gauge pressed steel panels, bolted directly to the car ends and upper side rails. The design is similar to those developed by the Standard Railway Equipment Manufacturing Company of Hammond, IN, with large rectangular stiffeners in each panel and external ribbing. The roof is intact and in good condition.[120]

Fig. 19. Structural ribbing on the roof of No. 43651. Photograph by Mark Morgan.

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[120] Roy V. Wright, ed., Car Builder's Cyclopedia, 15th ed. (New York: Simmons-Boardman Publishing Corp., 1940), 411.

Roof Walks - Photographic evidence indicates that No. 43651 was equipped with wood three-plank roof walks, running the length of the car. The walks were bolted to steel spacers which, in turn, were bolted to the roof. The roof walks jutted over the ends of the car approximately eight inches and were fastened to the car ends by a steel bracket and two one-foot steel braces (Fig. 20).

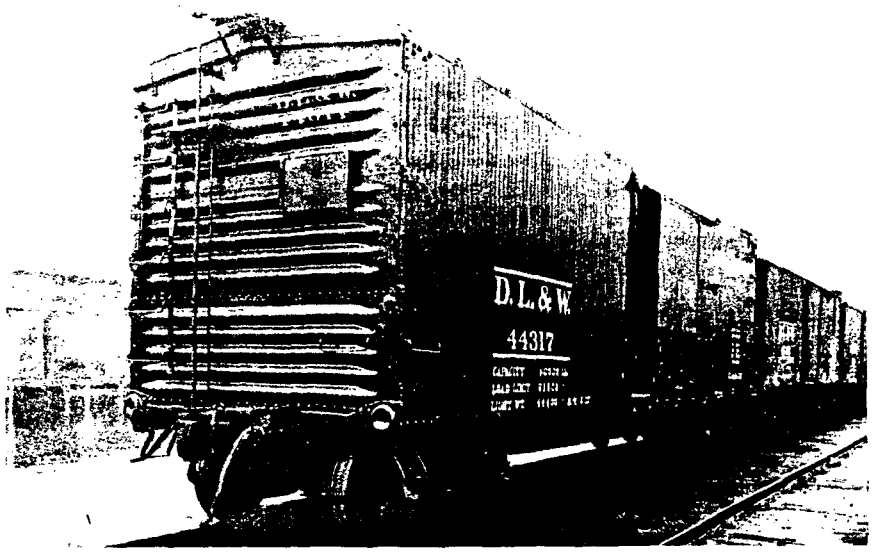

Fig. 20. DL&W automobile car No. 44317, showing the roof walk and braces. From Thomas Townsend Taber and Thomas Townsend Taber III, The Delaware, Lackawanna and Western Railroad In the Twentieth Century, vol. 2 (Muncy, PA: Thomas T. Taber III, 1981), 690. See figure 22 for a view of the roof walk bracing.

The majority of the steel spacers remain in place on the boxcar. The roof walks were removed, probably by Norton.

Doors - The doors are fabricated from the same 2" X 5" tongue and groove yellow pine as the car walls, with a wood backing frame. Each door has eleven boards, a lower edge sheet steel guide, two reinforcing pieces of one-inch angle iron across the front, and reinforcing channel iron on the ends and top. The upper and lower guide channels are fabricated from sheet steel.

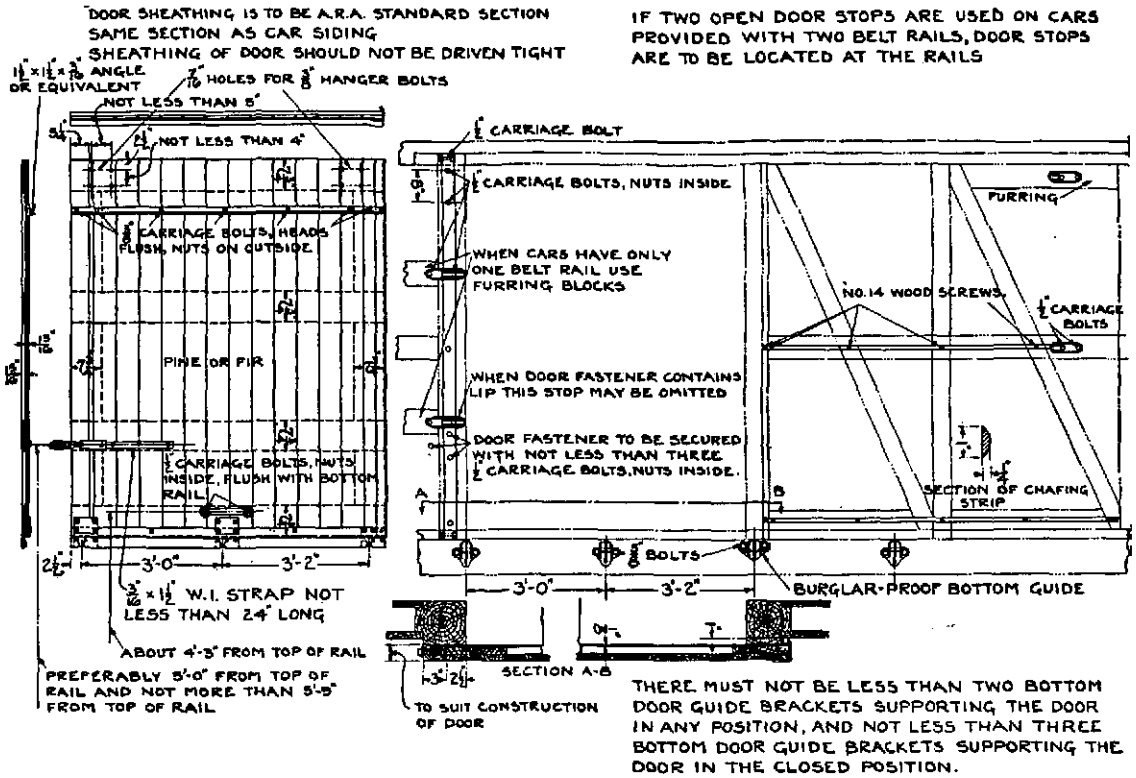

Fig. 21. Diagram of American Railway Association standard outside-hung boxcar side door. The design was adopted in 1912 and revised in 1920. From George V. Wright, ed., Car Builders' Cyclopedia of American Practice, 13th ed. (New York: Simmons-Boardman Publishing Co., 1931), 382.

Both doors from No. 43651 were removed and replaced with a set taken from another DL&W car in the RMNE collection. The replacement doors are of the correct design but are deteriorated and missing portions of their steel reinforcement.[121]

Car Ends - The 45500-series cars were delivered with two-panel pressed steel Murphy car ends. The panels are bolted to the corner posts, end framing and roof. Three 1½" H X 2" W reinforcing planks are bolted to the corner posts across the car ends. Four lengthwise mounted 3/4" steel rods, two each side, further secure the car ends to the side frames.

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[121] Pincus, 6 September 1993.

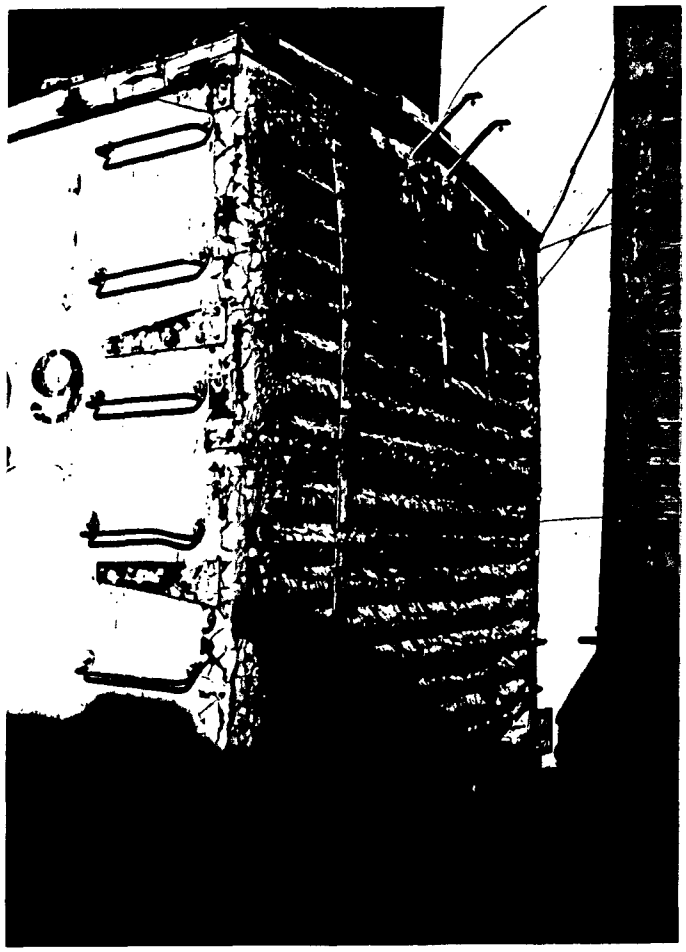

Fig. 22. Murphy steel car end, "A" end of No. 43651. Photograph by Mark Morgan.

The ends are intact on No. 43651 but are rusted and covered with peeling paint. The lower right side grab irons and left side end ladder, fabricated from half-inch steel, are intact and in place.

The car has quarter-inch cast iron pole pockets riveted to the four lower corners of the car ends. Each measures 7½" H X 10½" W and has a five inch diameter pocket.

The idea of using wood poles to push cars was developed around 1870. Train crews would place the "push pole" or "poling bar" diagonally between the pockets on a locomotive and a freight car and move the car to a desired location. This enabled the crew to move cars spotted on adjacent tracks and on curves that were too tight for the switcher. The poles were also useful for clearing debris off the track. Early pole pockets were shallow, made of cast iron

and were mounted on the ends of the locomotives and cars. Later pockets were manufactured of steel, mounted at the extreme corners, and had circular concave surfaces.

The procedure was highly dangerous. Poles often cracked and splintered under compression, causing injuries and deaths. In 1916, poling accidents killed 12 trainmen and injured an additional 250. Similar figures were recorded over the following forty years. The use of poles to move cars was outlawed in the early 1960s, at which time the railroads "officially" discontinued their use. Reportedly, the practice continues.[122]

INTERIOR DETAILS

Sheathing - The wood interior sheathing is relatively intact, with the exception of the upper planks on the left side of the car. The upper three planks to the rear of the door and one plank forward of the door are gone, exposing the car's side frames.

Floor - The floor is severely deteriorated, particularly in the area between the doors (Fig. 23; see also figure 18, page 52).

Fig. 23. Floor and side sheathing deterioration, left side, No. 43651. Photograph by Mark Morgan.

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[122] David Jones, "The Perilous Push Pole," Trains, March 1993, 66-67.

The gap between the floors and lower interior car sides is covered with protective 1" H X 2" W triangular wood molding. The molding is rotted and missing in several locations and requires replacement.

Maintenance and Repairs

No Lackawanna maintenance records have been located for No. 43651. Major maintenance and repairs on the car were probably performed at the railroad's Keyser Valley car shops.

No maintenance was performed on No. 43651 by the Railroad Museum of New England. The wheel bearings were repacked by the Valley Railroad in July 1979, in preparation for the car's move to RMNE storage.

Architectural & Restoration Data

Physical Studies

Number 43651 was part of the Railroad Museum of New England collection for about fifteen years. It became part of the Steamtown NHS collection in 1993 and was delivered to the park in July 1994. The remained stored outside and subject to exposure to the elements until February 1996, when it was moved inside the park's restoration shop.

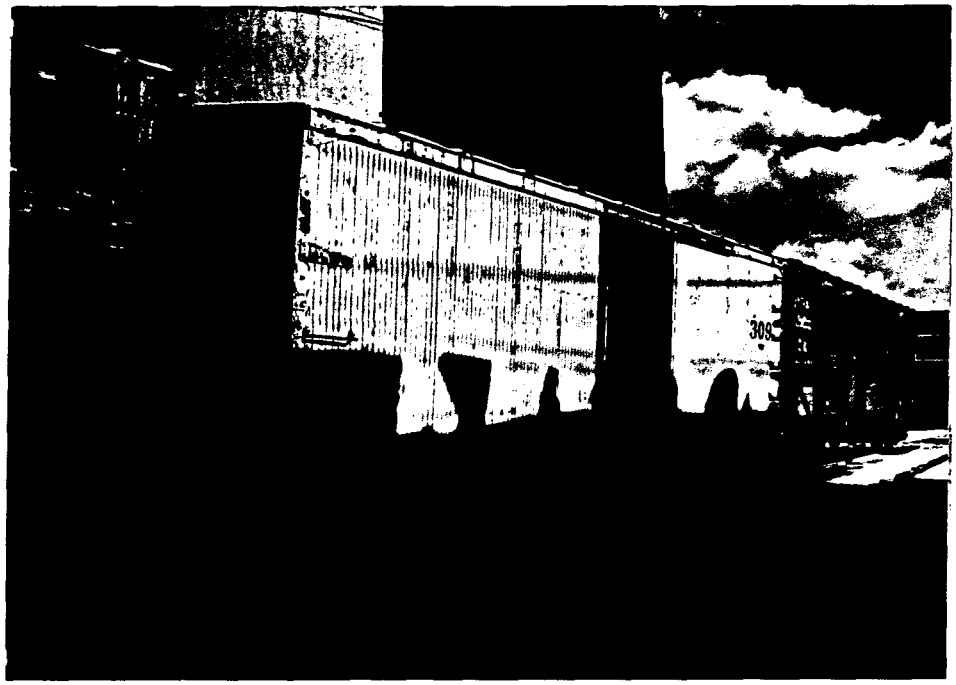

Fig. 24. DL&W boxcar No. 43651 at Steamtown NHS, prior to restoration. Photograph by Mark Morgan.

Modified Specifications - Steamtown NHS, 1995

In summary, the following are changes or modifications made to the car prior to its acquisition by the National Park Service:

Body	Roof walk removed Doors removed and stored in car Hand brake replaced
Frame	Brake cylinder removed Brake triple valve removed Brake air reservoir removed Handbrake actuator replaced Brake rods removed and stored in car

Paint Schemes

Railroads were as conscious of their public image as any other major industry. The paint and markings applied to locomotives and rolling stock over any period were designed to appeal to the passenger and freight customer, and to give the image of a solid, profitable, progressive company. As the corporate image and prospects changed, the markings were modified. The markings used by railroads also reflected the decorative designs popularized in contemporary society.

The Delaware, Lackawanna and Western Railroad used one basic boxcar scheme with five variations: late nineteenth century, early twentieth century, mid-steam era, late steam era, and Phoebe Snow. The variations were in the style and location of the lettering and car numbers. All Lackawanna boxcars were painted a shade of red-brown known as "boxcar brown."[123]

First Scheme

Evidence indicates that the earliest DL&W boxcars used Railroad Roman lettering, with the railroad's initials centered on the body to the left of each door and the car number centered to the right. The car number was placed at the upper left at each car end (Fig. 25).

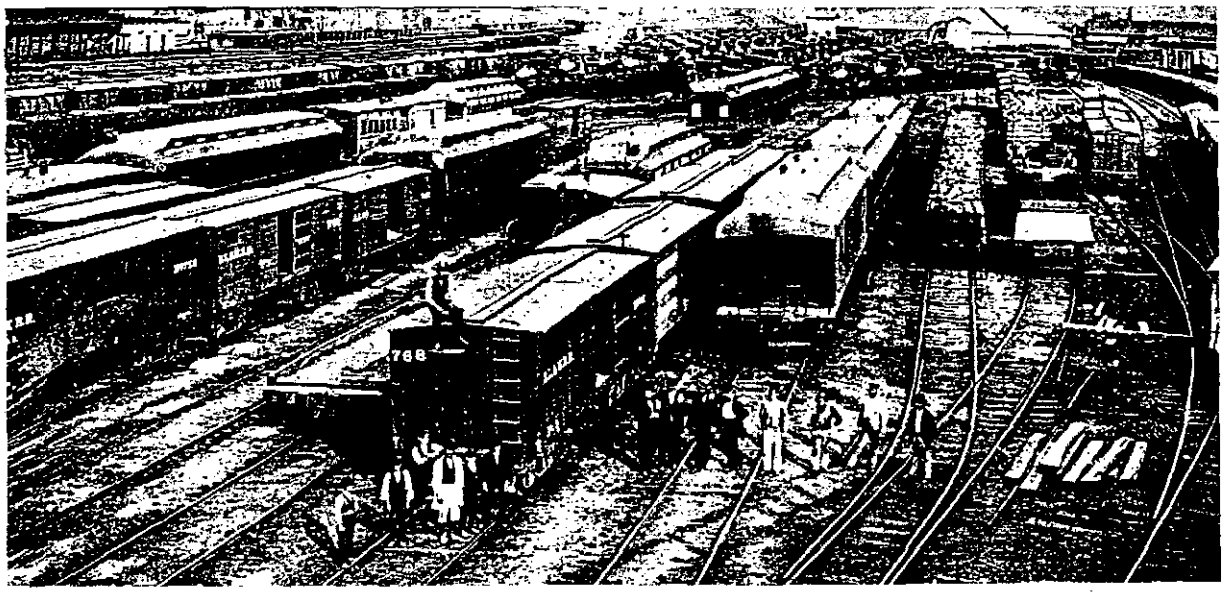

Fig. 25. DL&W boxcars stranded in the Scranton Yard during the 1877 railroad strike display the original boxcar paint and lettering scheme. From Taber, Nineteenth Century, 179.

[123] See page 69.

First Variant - Late Nineteenth Century

Photographs indicate the Lackawanna started painting the full railroad name on its boxcars in place of the initials during the late 1880s and early 1890s. Cars operated on the Morris and Essex division were lettered for the division, to the right of the side door and below the car number (Fig. 26). No evidence has been found to indicate this additional lettering was applied to boxcars of other divisions.

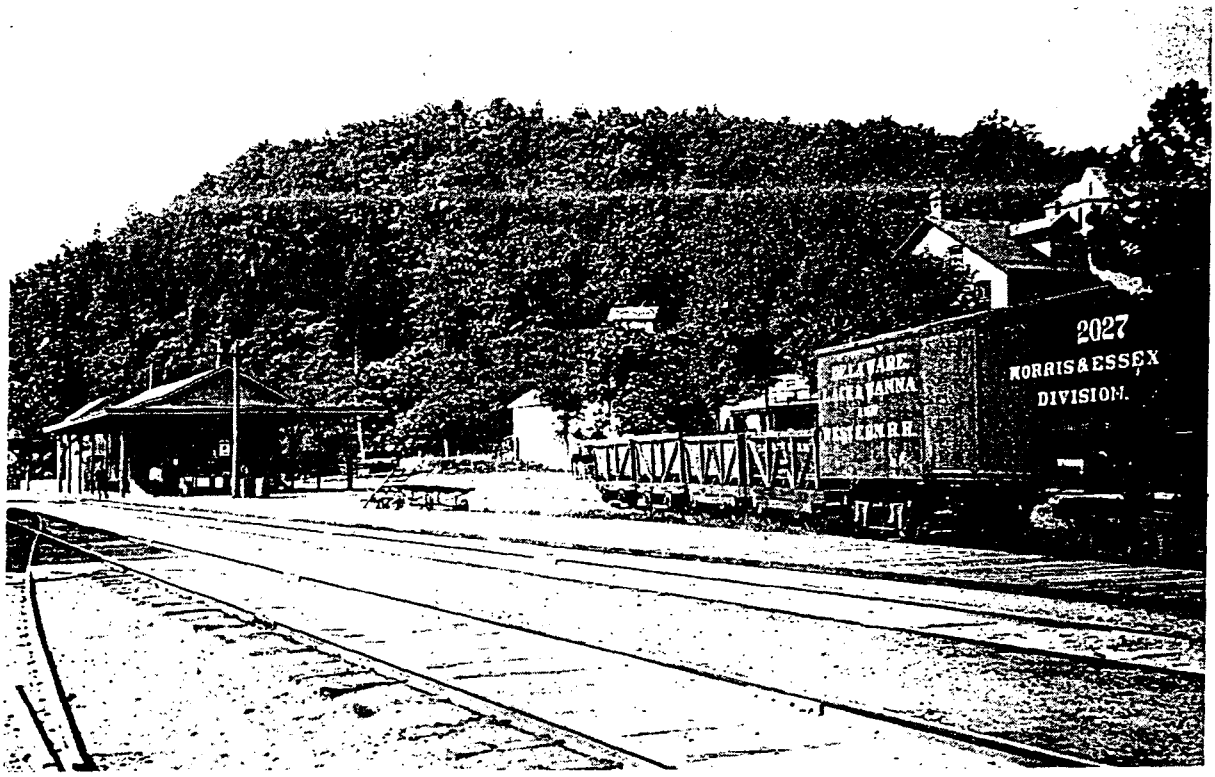

Fig. 26. DL&W boxcar No. 2027, assigned to the Morris and Essex Division, displays the first variation of the standard Lackawanna boxcar scheme. From Taber, Nineteenth Century, 183.

Second Variant - Early Twentieth Century

The second variation of the basic scheme appeared soon after the start of the twentieth century. The railroad returned to using its initials, moved the car number to the left of the door, and added both initials and number to the door. The new "Lackawanna Railroad" box was placed on both sides of the car to the right of the door.

Stenciled lettering was applied to the lower sides to indicate the car weight, build date, inside length, capacity in pounds, and air brake equipment. The division initials were stenciled at the

extreme upper left corners on the eaves. The car number was stenciled to the upper car ends at the "A" end left side and "B" end right side (Fig. 27).

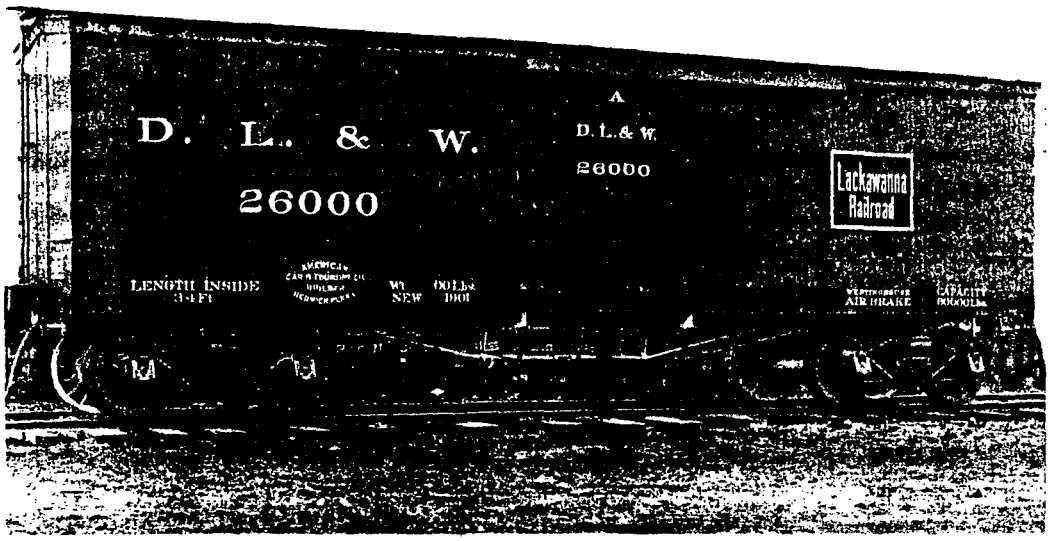

Fig. 27. Boxcar No. 26000 with the second variation of the basic boxcar paint scheme. The stenciled information includes "American Car & Foundry Co. - Builder - Berwick, Penna." From Taber and Taber, Twentieth Century, vol. 2, 688.

Third Variant - Mid-Steam

By the 1920s, the Lackawanna's boxcars were marked solely with the railroad's initials and car number to the left of each door. Stenciled to the right of the door were the car's height and width, length, class, build date, and type running gear. Additional stenciling on the body above the trucks indicated that the car met "United States Safety Appliances Standards." The railroad initials and car number were stenciled to the upper car ends at the "A" end left side and "B" end right side (Fig. 28).

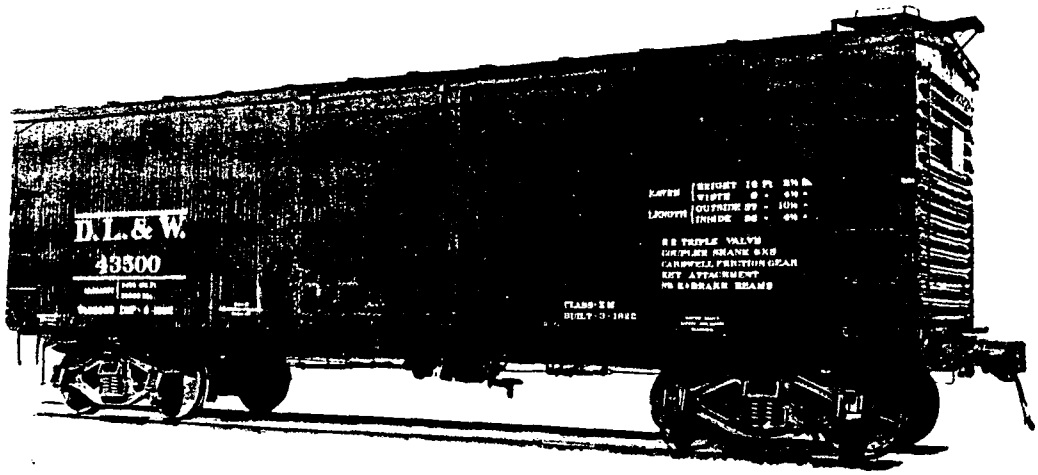

Fig. 28. Boxcar 43500, first car in the DL&W's last order for wood, thirty-six foot cars, with the third variation of boxcar markings. From Taber and Taber, Twentieth Century, vol. 2, 688.

Fourth Variant - Late Steam

The fourth variation of the basic scheme was developed during the 1930s and 1940s with the advent of the all-steel boxcar. The lettering style remained the same, with the addition of the logo "LACKAWANNA" to the upper portion of the body, opposite the railroad's initials. Stenciled underneath the initials and car number were the car's capacity, load limit, light weight, and build date. Car type information was stenciled at the lower right corner of the car. Dimensional data was stenciled above the car type (Fig. 29).

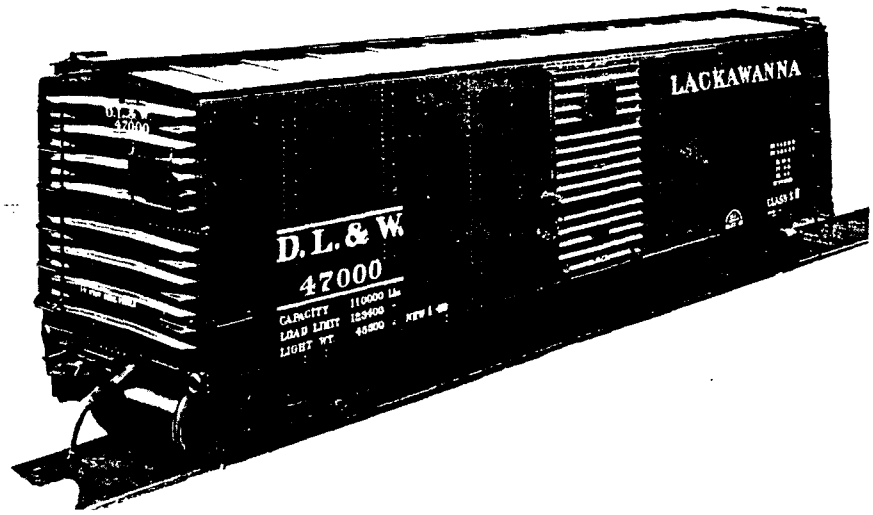

Fig. 29. Fourth variation of the Lackawanna paint scheme on all-steel boxcar No. 47000. From Taber and Taber, Twentieth Century, vol. 2, 691.

Fifth Variant - Phoebe Snow

The final variation of the Lackawanna's boxcar paint scheme was introduced in the 1950s as advertising for the railroad's Phoebe Snow passenger train. These were probably the most famous freight car markings ever employed by the DL&W and were applied to most of the company's rolling stock, including boxcar No. 43651. The scheme will be reapplied to the car following its restoration.

All lettering was white. The slogan, "The Route of Phoebe Snow," was added to the right of the car door underneath the railroad name. The slogan was in modified Cooper style lettering; the T, h, R, and t in "The Route of" were ten inches tall and the f measured eighteen inches tall. The lower case letters were six inches tall. The large capitals in "Phoebe Snow" measured thirty inches tall and the small capitals measured eighteen inches tall. The Helvetica style "LACKAWANNA" measured ten inches tall.

The following information was stenciled on the lower right side of the body, in three inch tall Roman lettering:

EX W	9-6	H 12-0
EW	9-8	H 12-8
IL	36-3	
IW	8-6	
IH	8-2	
CU FT	2516	
AB BRAKES		
XM		- five-inch tall lettering
BUILT-x-1922		- adjacent to lower end of door

The railroad initials and car number were painted in Railroad Roman letters on the lower left side of the car, between a pair of two-inch white lines. The initials measured ten inches and the car number measured eight inches.

The following information was stenciled on the lower left side of the body, below the railroad initials and car number, in four inch tall Roman lettering:

CAPY	80000 Lbs	
LD LMT	93700	
LT WT	42300	KV 10-51

"KV 10-51" indicated the date of the most recent overhaul or repair of the car at the railroad's Keyser Valley shops in Scranton. The following builder's information was stenciled on the lower left car side, centered between the door car capacity stenciling, in one

inch lettering. The upper and lower words were rounded, forming a partial circle around the center two lines:

AMERICAN
CAR & FOUNDRY CO.
BUILDER
BERWICK, PENNA.

The railroad initials and car number were repeated in four inch tall Railroad Roman letters at the extreme upper corners of the car ends, "A" end left side, "B" end right.

The trucks, couplers, running gear, and centerframe were painted black. The side frames were painted boxcar red to match the car body (Fig. 30).

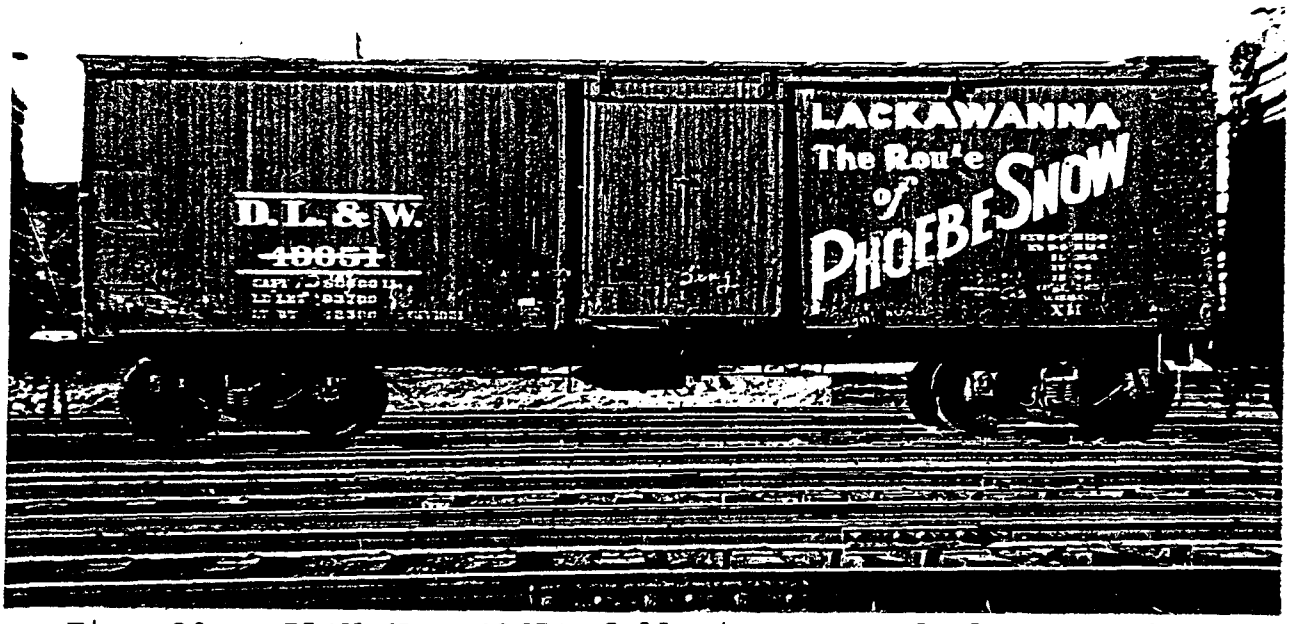

Fig. 30. DL&W No. 43651 following removal from service. Photograph by Clarence Tharp, from Michael DelVecchio collection. Folder, "DL&W Boxcar 43651." Building files, Steamtown National Historic Site, Scranton, PA.

Paint Analysis

Paint analysis will not be performed on No. 43651. There is no original paint left on the car.

The exterior of the boxcar is currently painted yellow, with evidence of newer yellow paint on the lower car sides. All paint on the car is peeled and failing.

Markings are limited to faded blue Norton emblems on the upper left sides of the body, "309" in black eight-inch Railroad Roman lettering on the upper right sides, and some stenciling. Two-inch "VRR" lettering, for the Valley Railroad, is hand painted below the car numbers on each side. Eight-inch by fourteen-inch black panels are painted at the lower right sides of the car body, with the following stenciling in one-inch letters:

RPKD-VRR-WOR
0-7-79

The stenciled information indicates that the wheel bearings were repacked by the Valley Railroad in July 1979.

Fig. 31. Right side of the boxcar, with remnants of the Norton company marking. Photograph by Mark Morgan.

The following three-inch stenciled advisory message is found forward of the left side door and to the rear of the right side door:

AVOID DAMAGE TO FREIGHT
HANDLE ALL FREIGHT CAREFULLY
STOW FREIGHT PROPERLY

The message on both sides is faded and partially obscured by a steel plate bearing the Norton car number, 309. The advisory messages are probably original to the car.

Determining the proper formula for Lackawanna "Boxcar Brown" has proven difficult. Sources indicate that DL&W paint records were destroyed and paint chips were not available. The consensus is that Lackawanna boxcars were painted a "dull red," which can be duplicated by mixing a small amount of Floquil Tuscan Red with Floquil Boxcar Red model railroad paint. No one was able to provide the exact proportions required for properly mixing the paint.[124]

In April 1996, several combinations of a Floquil Boxcar Red/Tuscan Red mix were prepared and compared to color photos of DL&W boxcars. A mixture of six parts Boxcar Red/four parts Tuscan, corresponding to Munsell 10R 3/4, appeared to give the best approximation of the correct paint color for No. 43651.

Evaluation of the Proposed Use On the Integrity of the Car

While boxcar No. 43651 has been subjected to a minimum of modifications, exposure to the elements, long term neglect and the removal of body parts have effected the car. Future display of the boxcar at Steamtown NHS following restoration should mitigate further deterioration. Any further degradation of the structure will be documented and corrected as required.

Restoration Recommendations

Boxcar No. 43651 is currently under restoration. Modifications made to the car are limited, with the exception of the removal of the brake gear. Major work will be required to repair the body, floor, and running gear.

Normally, several factors are considered in the process of selecting a restoration period for an object in the Steamtown NHS collection: the degree to which loss or alteration of existing historic fabric resulting from the restoration can be tolerated; the amount of historical documentation available to support various restoration alternatives; the cost of restoration; and how well the restoration would fit the interpretive themes of the park.

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[124] James Dalberg; Jeremiah Segure; Schuyler Larrabee; Chuck Yungkurth, telephone conversations with Mark Morgan, 24-27 January 1996. Floquil is a model railroad paint available in hobby shops.

One of the four major interpretive themes of Steamtown is to develop and present "the history of railroads in the steam era (1850-1950), with emphasis on the northeastern United States."[125] The boxcar fits the interpretive theme. It retains sufficient physical integrity to warrant restoration to its steam era condition and appearance.

The car requires a complete mechanical overhaul and restoration. This should include the rebuilding of the running gear and reinstallation of brake components. Portions of the exterior sheathing, particularly the lower sides, are rotted, exposing the frame and interior sheath. Portions of the interior sheathing are removed from the car. The floor is rotted through in several locations. The steel door hardware exhibit some corrosion and the doors are rotted to the point of losing structural integrity. The steel roof and pressed steel ends are rusting. Repairs, stabilization of the car frame and body, and restoration of the interior should be performed with the intent of removing or repairing deteriorated components of the car and preventing future damage.

Upon completion of the exterior, interior and mechanical restoration, No. 43651 should receive the Lackawanna's "The Route of Phoebe Snow" paint scheme, as described on pages 66 and 67. It is a classic boxcar design, strongly evocative of the late steam era Delaware, Lackawanna and Western Railroad, and is historically accurate for the car. The car will then be modified to serve as the "boxcar theater" in the park's Technology Museum.

At the time of this report, the planned modifications are limited in scope. Several removable crates and barrels will be placed in the car to provide seating for visitors. A partitioned compartment with video cassette recorder, forty-inch television monitor and associated electronics will be placed at one end of the car. The cabinet and electronics installation will be reversible. The front of the compartment wall will be fabricated to give the appearance of crates. Public access to the boxcar will be by both steps and a ramp leading to a platform.

An air conditioning system will be installed at the cabinet end to control the temperature and humidity for the electronic equipment, and for visitor comfort reasons. The installation will probably be wall mount, requiring a small external vent through the side of the car and a condensate line through the floor. The air conditioner may be mounted to the roof of the car, in which case lines will be run through a roof panel and the floor.

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[125] U.S. Department of the Interior, Steamtown National Historic Site, Pennsylvania, Railroad Yard Design Program/Interpretive Concept (Denver: National Park Service, Denver Service Center, 1989), 3.

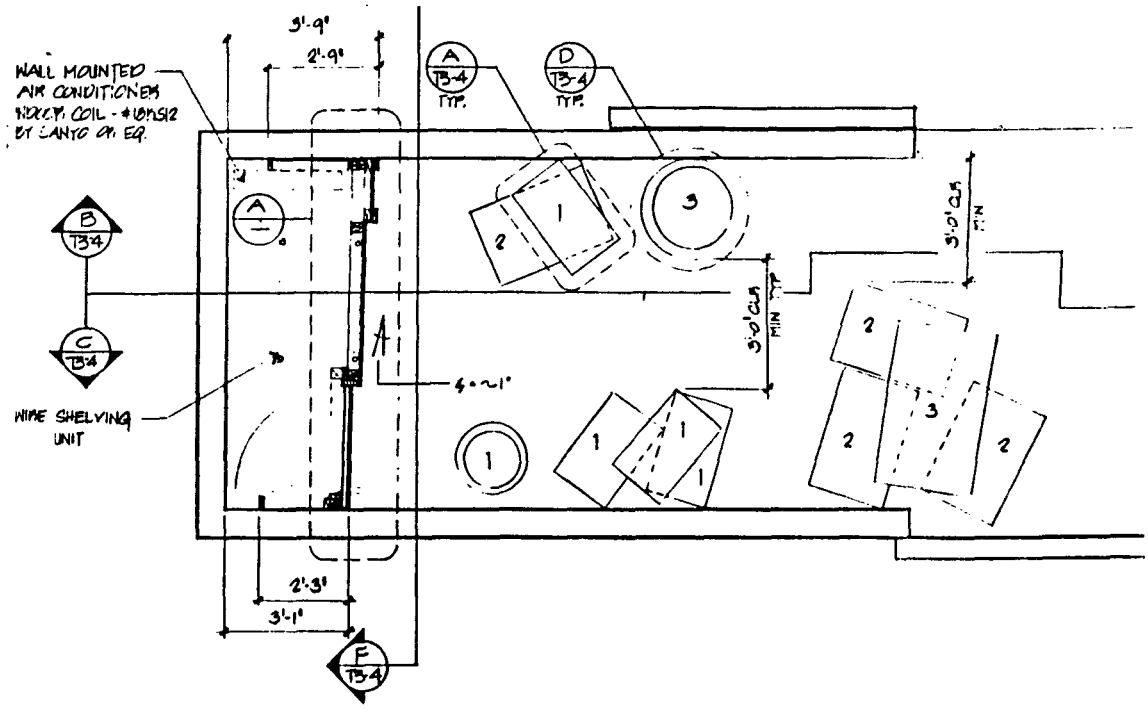


Fig. 32. Plan-view schematic of the cabinet installation. Drawing No. 329-13003-T3-3, sheet 75. Exhibit Design and Plan For the History and Technology Museums. Steamtown National Historic Site library, Scranton, PA.

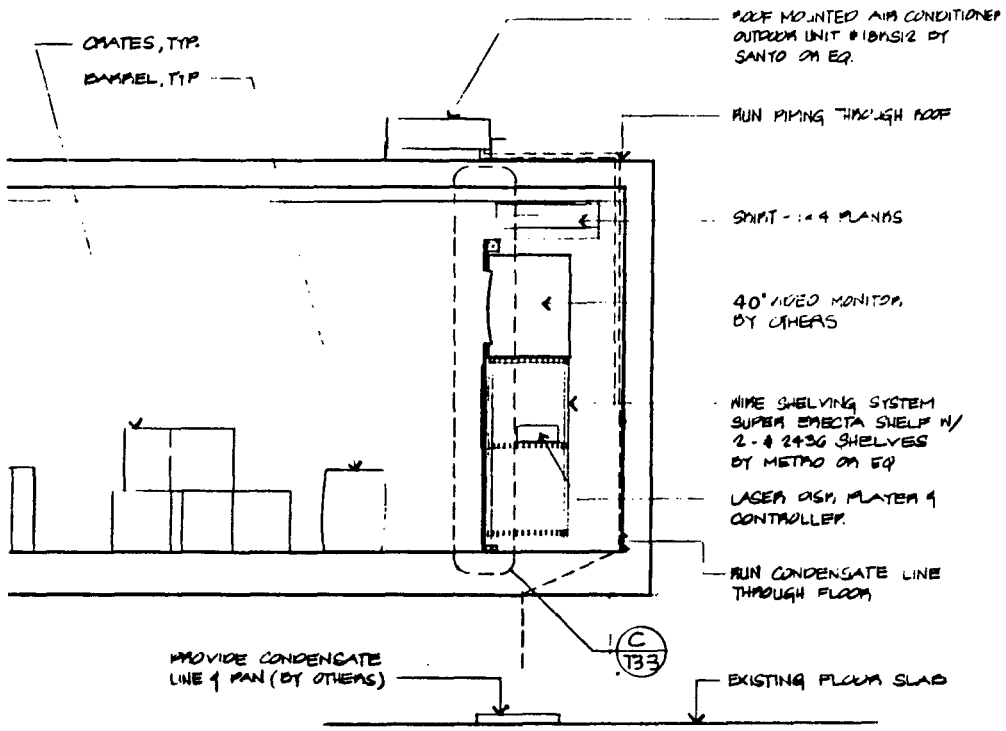
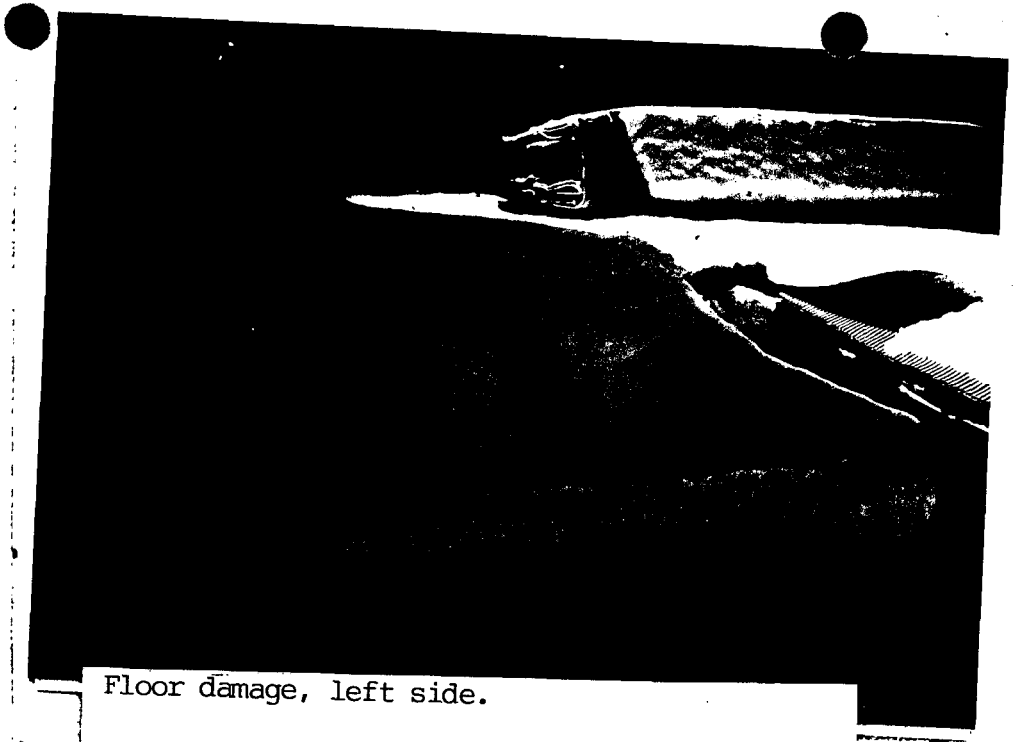


Fig. 33. Elevation schematic of the cabinet installation. Drawing No. 329-13003-T3-4, sheet 76. Exhibit Design and Plan For the History and Technology Museums. Steamtown National Historic Site library, Scranton, PA.

PHOTOGRAPHIC DOCUMENTATION

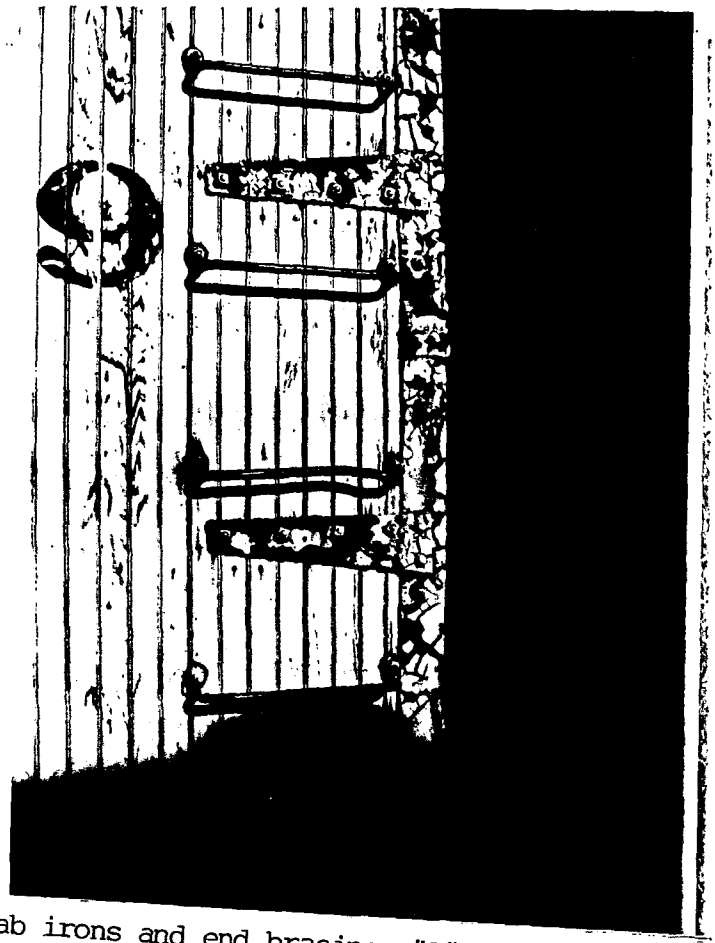
Norton car number painted on interior.



Floor damage, left side.

Floor damage and debris, right side.

Roof of boxcar showing mounts for roofwalk.

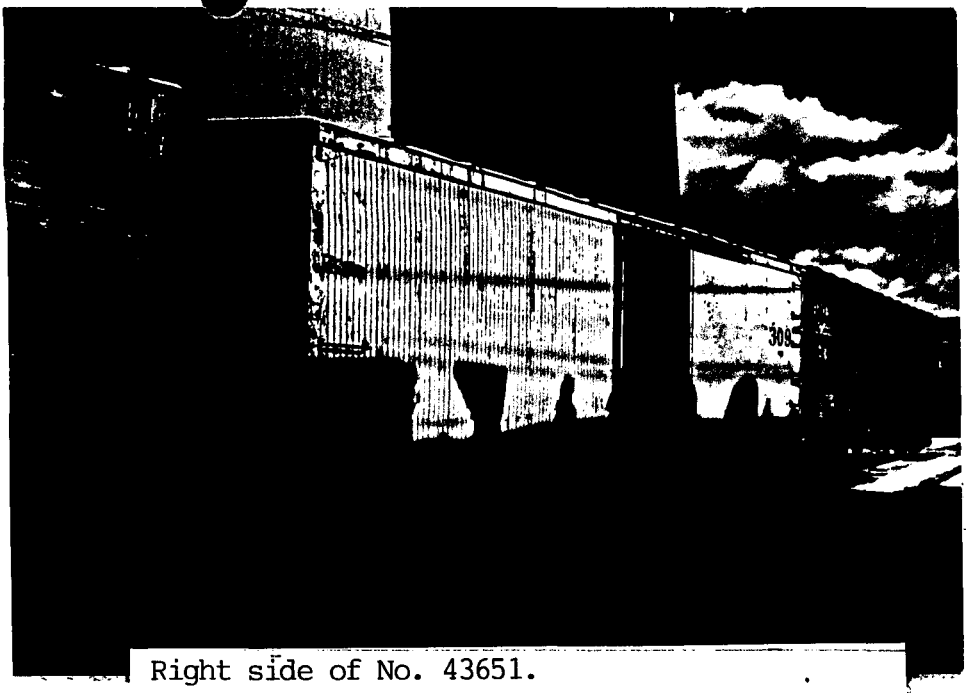


Grab irons and end bracing, "A" end right side.

Left side of boxcar No. 43651.

end of No. 43651.

"B" end of No. 43651

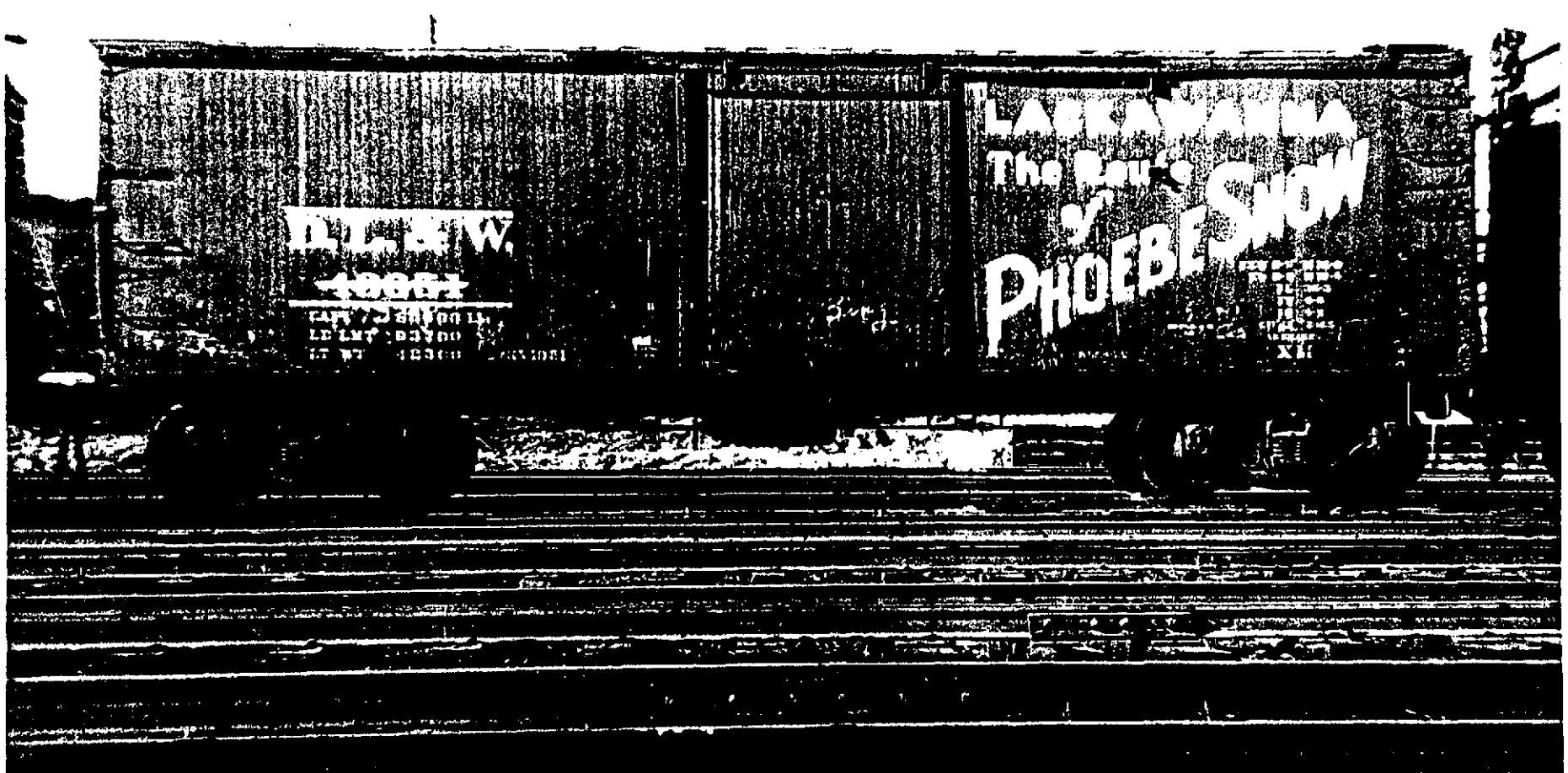


Right side of No. 43651.

ght side of No. 43651.

Right side of No. 43651.

DL&W No. 43651 following removal from service. Photograph by Clarence Tharp, from the Michael DelVecchio collection. Folder, "DL&W Boxcar 43651." Building files, Steamtown National Historic Site, Scranton, PA.



Appendix 1 - Legal Documentation

No information has been found to indicate when Norton Abrasives acquired this boxcar. Attempts to get information from Norton have been unsuccessful.

On 3 March 1993, Dr. John A. Latschar, Superintendent of Steamtown National Historic Site, wrote Howard Pincus, President of the Railroad Museum of New England, and concurred with the exchange of several pieces of railroad equipment. Included in the trade was boxcar No. 43651, to be exchanged for the park's Claremont and Concord Railroad caboose No. 50. A copy of the letter is in the Building Files in the park library.

United States Department of the Interior

NATIONAL PARK SERVICE
STEAMTOWN NATIONAL HISTORIC SITE
150 SOUTH WASHINGTON AVENUE
SCRANTON, PENNSYLVANIA 18503

IN REPLY REFER TO:

D62

March 3, 1993

Howard Pincus, President
Railroad Museum of New England
P. O. Box 97
Essex, Connecticut 06426

Dear Mr. Pincus:

We are pleased to have reached agreement with the Railroad Museum of New England (RMNE) to exchange certain pieces of equipment.

1. Steamtown's Central of Vermont outside braced boxcar 44369 for RMNE's Central of New Jersey outside braced boxcar 18049.

2. Steamtown's Claremont and Concord caboose 50 for RMNE's Delaware, Lackawanna & Western boxcar 43059.

3. Steamtown's superheater units and inspirator starting valve and a loan of any available patterns and drawings useful on Canadian Pacific 1246 for RMNE's Pullman, the Arsenal Tower.

Each museum is responsible for transporting their acquisitions. Mark Brennan is handling Steamtown's move from Old Saybrook to Scranton. He will accomplish the movements as quickly as possible.

We understand that the RMNE wishes to move the boxcar and caboose after the museum has relocated. Steamtown agrees to hold (at no cost) the boxcar and caboose for one year after we have received our rolling stock. A special use permit will be issued. RMNE will send a truck to pick up the superheater and associated parts. Chris Ahrens will coordinate the superheater situation.

After these exchanges are concluded, we can continue discussions about your apprentice models; side dump cars; and parts for the Boston and Maine gothic style coach and Steamtown's St. Johnsbury and Lake Champlain caboose, and the combination coach with a Baker heater.

Sincerely,

Mr. John A. Latschar
Superintendent

cc:
Bruce Gibson, Chief of Maintenance, Steamtown National Historic Site
Ella S. Rayburn, Curator, Steamtown National Historic Site

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