The History and Evolution of the American Railroad

by

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The onset and evolution of the railroad in the United States had a dynamic impact in
American history. This Master’s Thesis covers the major angle of American railroad history and
looks forward to the future of high-speed rail. From a humble beginning in the 1830s, the steam
locomotive provided a key mode of transportation to meet the needs of far-reaching growth.
During the Civil War, the railroad played a definitive role. The completion of the
Transcontinental Railroad, in 1869, allowed Americans to travel easily from coast to coast. In the
1900s, diesel and diesel-electric locomotives were introduced. Both freight and passenger rail
advanced technologically. During the 1950s, the railroads fell into a deep decline with the
introduction of interstate highways and improved air travel. American culture changed with a
strong preference for individual travel. This thesis examines whether that preference can dovetail
with future rail possibilities. Several advanced nations have developed high-speed trains. Will
these work for Americans? Research underpinning this project utilizes historical texts, journals,
on-line databases, and first-hand responses to questionnaires. These questionnaires were
distributed to railroad workers, railroad enthusiasts, and railroad riders.
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GLOSSARY

- **Acela.** – In 2000, this train became the first scheduled high-speed rail transportation in the United States.

- **Air Brake.** – The general term used to describe the braking system used on most railways operating in North America.

- **Amtrak.** – A contraction of “American travel on track”

- **Bogie.** – See truck.

- **Boiler.** – Cylindrical chamber in which steam is produced to drive a steam locomotive.

- **Brakeman.** – A person who assists with train and yard operations.

- **Bullet Train.** – A high-speed passenger train especially of Japan

- **Caboose.** – A car usually placed at the rear of a train which provides an office and quarters for the conductor and/or trainmen while in transit, and for carrying the various supplies, tools, etc., used in freight train operations. From the caboose, the crew is also able to observe the condition of the train and initiate measures to stop the train if unfavorable conditions arise. Sometimes called “Cabin Car,” “Way Car,” or “Van.”

- **Catenary.** – On electric railroads, the term describing the overhead conductor that is contacted by the pantograph or trolley, and its support structure.

- **Conductor.** – The individual in charge of the train crew.
• Coupler. – A device located at both ends of all cars and locomotives in a standard location to provide a means for connecting one rail vehicle to another. The standard A.A.R. coupler uses a pivoting knuckle and an internal mechanism that automatically locks when the knuckle is pushed closed, either manually or by a mating coupler. A manual operation is necessary to uncouple two cars whose couplers are locked together.

• Credit Mobilier Scandal. – A fictitious company formed by Thomas Durant and George Train to make fake contracts to themselves.

• Diesel-Electric Locomotive. – A locomotive in which power developed by one or more diesel engines is converted to electrical energy and delivered to the traction motors for propulsion.

• Diesel Engine. – An internal combustion engine invented by Rudolf Diesel differing from other internal combustion engines because its compression is high enough to cause combustion without the necessity of introducing a spark for ignition.

• Engineer. - The driver or operator of a locomotive.

• Firebox. – The compartment within a steam engine where fuel is burned to provide heat.

• Fireman. - A person who feeds fuel to the firebox on steam locomotives and also monitors the water level in the boiler.

• HSR. – High-Speed Rail.

• HST. – High-Speed Train.
• Knuckle Coupler. – The pivoting hook-like casting that fits into the head of a coupler and rotates about a vertical pin to either the open position (to engage a mating coupler) or to the closed position (when fully engaged).

• Link and Pin Coupler. – An old type of connection between cars which employed a link and a pin arrangement.

• Locomotive. – A self-propelled, non-revenue rail vehicle designed to convert electrical or mechanical energy into tractive effort to haul railway cars.

• Multiple Unit. – A term referring to the practice of coupling two or more locomotives or electric passenger cars together with provision made to control the traction motors on all units from a single controller. Sometimes referred to as “MU.”

• Pantograph. – A device for collecting current from an overhead conductor (catenary) and consisting of a jointed frame operated by springs or compressed air, and having a suitable collector at the top.

• Pullman Company. – Luxury passenger railroad cars developed by George Pullman who established the Pullman Car Company in Chicago.

• Railroad Tie. – The transverse member of the track structure to which the rails are spiked or otherwise fastened to provide proper gauge and to cushion, distribute, and transmit the stresses of traffic through the ballast to the roadbed.

• Rolling Stock. – A general term used when referring collectively to a large group of railway cars.
- **Shinkansen.** – Means (“New Branch Line, or New Main Line”) in Japanese. A Japanese train which began operating in 1964 and became the world’s first high-speed rail service.

- **Standard Gauge.** – The standard distance between rails of North American railroads, being 4’ 8 ½” measured between the inside faces (top of rail) of the rail heads.

- **Truck.** – The complete assembly of parts including wheels, axles, bearings, side frames, bolsters, brake rigging, springs and all associated connecting components, the function of which is to provide support, mobility and guidance to a railroad car. (called a bogie in the United Kingdom.)

- **USMRR.** – United States Military Railroad.

- **Whyte Classification System/Whyte Notation.** – A system classifying wheel arrangements by counting first, leading wheels, then driving wheels, then trailing wheels.
INTRODUCTION

From their infancy, railroads have been a symbol of power. The size and beauty of these powerful engines is still an iconic symbol representing the strength of the United States. Trains filled a transportation need during a long era when roads were deplorable or nonexistent. Prior to the development of rail travel, the Conestoga Wagon was the dominant mode of travel for any lengthy distance. By the early 1900s, after less than a century, the passenger train was not only a dominant mode of transportation, but a moving social venue, thanks to Pullman and dining cars. The fine upholstery and woodwork in these Pullman cars made a fashion statement that epitomized prestige and convenience. During World War II, the railroad was the lifeline for moving passengers and materials. With the onset of luxurious automobiles and improved highways, Americans increasingly chose individual travel instead of being limited by timetables. Change in American habits and expectations led to hard times for the railroad. Despite the recent decline in railroad usage, however, trains still fill a vital need, especially moving freight in America. This Master’s Thesis begins from the starting assumption that railroads remain economically significant, despite the decline in their image across popular culture. The goal of this project is to chart the major historical patterns of railroad history, so as to explain the train’s place in the American imagination. I will explain technological advances in terms understandable to the general reader, and provide a glossary for that purpose. Then, I will forecast possible developments which might return the railroad to a more future-oriented place in the national psyche.

I have long had a keen interest in railroads and the impact they had on the development of American life. Pennsylvania, especially the Pennsylvania Railroad, was pivotal to the development of trains in this country. I feel fortunate to live in Strasburg, where the Railroad
Museum of Pennsylvania (RRMOP) is located. This public heritage site helped me to sharpen my understanding of railroad history and culture. The RRMOP has provided me with a wealth of information from displays, archival materials, and interviews with workers and volunteers. In addition to knowledge I have gained from RRMOP, I have visited the East Broad Top Railroad, Steamtown, the Baltimore & Ohio Railroad Museum, and the Georgia State Railroad Museum to further my expertise in railroads. This Master’s Thesis is the amalgamation of an array of sources I have studied over many years, as well as more recent research conducted while a graduate student in American Studies at Penn State Harrisburg. Primary research was obtained from information collected from railroad workers, biographies, responses to railroad questionnaires, printed sources, historical texts, on-line databases, and journals on railroad experiences. This research has brought to the forefront the development and advancements of the railroad in America over the past two hundred years including the industrial and cultural changes. In my research, I found vast numbers of books written about railroads, but most texts focused on one era of railroads or one specific rail line. This thesis provides a historical progression of railroads in the United States from infancy to current day developments. While the historical timeline is important, the focus is to depict how railroads influenced culture and social aspects in the growth of America. I have included biographies and first person accounts of railroad workers and train experiences to provide the reader with a sense of involvement with that person on railroads. In my research, I found that in several instances, people who made a tremendous contribution were not even mentioned in major texts. Sometimes this is because much railroad history caters to experts who can be assumed to know certain details. Sometimes it is because these peoples’ role is not widely known to people beyond the community of railroad historians. For example, during the Civil War, General Herman Haupt was hardly mentioned for his tremendous contribution to
keeping the railroads on the offensive. But without his leadership, the war might have had a different outcome. With the building of the Transcontinental Railroad, the Chinese workers received little recognition for their tremendous contribution in building a railroad through the Rocky Mountains. While modern trends in scholarship appreciate diversity throughout history, the details of the Chinese contributions should be recognized by more readers, since they not only worked hard, but contributed to improvements in building the railroad. All in all, it would be hard to overstate how the railroad has contributed to the building of this country.

**Introductory Historical Summary: Main Points and Developments**

By way of introduction, here is a brief summary of the historical and technological details to be explained in greater detail later in this project. Railroads were the backbone of American growth in the 1800s. They jumpstarted the United States drive to continental domination. In the 1830s, even though trains were already introduced in Europe, railroads epitomized the new and modern. With manufacturing industries starting to develop, the railroad helped to move raw materials and transport finished goods. Manufactures built several different designs of locomotive steam boilers to improve the efficiency of the boiler in the 1830s and 1840s. By the 1850s, steam locomotives were switching from burning wood to burning coal. The coal produced more heat and fewer sparks than burning wood, an improvement in cleanliness and safety. With locomotives becoming more powerful and faster, additional safety measures were always needed, and the system struggled to keep up with its improvements. Some of these added safety features included: headlights, bells and whistles, air brakes, and automatic couplers.

As for the 1860s, Robert Hodges Jr. writes, “The American Civil War is widely regarded as the world’s first major railroad war.” Military commanders, both Confederate and Union,
quickly took advantage of the railroads to transport troops and supplies. Commanders would take long roundabouts routes on the train as a decoy to surprise their enemy. This strategy allowed the soldiers to rest on the train so they would be fresh for the ensuing battle.

From the onset, railroad gauge was an obstacle for the southern railroads, due to the various widths between the inside of the rails on their tracks. The north had adopted a standard gauge of 4’ 8 ½’ distance between the inside of the rails. This standardized gauge allowed locomotives and rolling stock to be transferred from one track to another without causing a derailment. While in the south, trains often had to switch locomotives and rolling stock to accommodate the track width. Having to transfer trains was time-consuming, an inconvenience for travelers, and placed the Confederate Army at a disadvantage. The railroad tracks were often a scene of construction or destruction. Often an army would damage railroad tracks after they moved their soldiers and supplies into position. This tactic discouraged their enemy from pursuit using the same track. Soldiers spent as much time damaging railroad tracks as they did laying new railroad tracks and building bridges. As the war proceeded, the southern states realized their shortage in rails. The shortage evolved from the fact that the rails were manufactured in the northern states. In addition, the south could not get rails shipped from Europe, since the ports were blockaded. To further the shortage of rails, the Union soldiers would bend the rails in the shape of a “U” so they could no longer be used. Besides the destruction on the railroad tracks, railroad cars were mounted with cannons to bolster their artillery. The railroad provided many more advantages for the North.

The Union Army had the manufacturing facilities to build locomotives, rolling stock, and railroad rails. In addition, the North had several railroad engineers to provide support. One of the greatest assets for the North was General Herman Haupt, who was a Pennsylvania Railroad
superintendent and expert bridge builder. Christian Wolmar describes Haupt as “war’s wizard of railroading.” Haupt was dedicated to the war effort and got the best from his unskilled workforce. His adherence to strict timetables and willingness to pull rank on officers made Haupt a tremendous asset to the Union Army. His performance facilitated the building of the Transcontinental Railroad.

With the population in America rapidly increasing, the need for a direct overland route to the Pacific Ocean was a necessity. Several surveyors plotted maps depicting what they thought was the best route to the west coast. When the plans were presented to Congress, they could not agree. The southern states wanted a southern route and the northern states wanted a northern route. With the Civil War, Congress was able to gain approval for a northern route. One person that was instrumental in getting this route approved through Congress was Theodore Judah. The Federal Government granted approval for two companies to build the railroad. On the west coast the Central Pacific Railroad Company was awarded the contract and the Union Pacific Railroad Company was contracted to build west, starting at the Missouri River.

From the start, the two railroad companies had problems. Neither railroad company had a true interest in building an efficient and substantial railroad. Both companies were headed up by investors whose desire was to get rich quick, engaging in unscrupulous contracts to obtain more money from the government. Another major problem was the shortage of manpower to build the railroad. The Central Pacific had difficulty in maintaining workers due in part to the “California Gold Rush.” To fill this void of workers, the Central Pacific advertised and hired Chinese workers. In the beginning the Chinese workers were not well received by the American workforce, with the Chinese only given menial tasks. Within a short period, management realized that the Chinese were skilled laborers and very efficient. To fill the labor quota for the
Union Pacific, Irish immigrants were used. Frequently, the Irish got into trouble. With the Civil War ending, soldiers sought work on the railroad. As construction on the two railroads progressed, there were multitudes of problems. Tunnels had to be chiseled and blasted through the mountains. Workers had to endure the sub-zero temperatures through huge mounds of snow in winter and face the blazing heat in the summer. With the threat of Indians losing their land and hunting grounds, Indian raids were a threat to the railroad workers. Despite the obstacles and hardships, the Central Pacific Railroad and the Union Pacific Railroad laid the last rail on May 10, 1869 at Promontory Summit, Utah. The railroad was complete from coast to coast.

This event was a milestone in American history, providing easy access to travel all across the nation. Word of this occasion was printed in newspapers all over the country. The completion of the Transcontinental Railroad not only provided a better mode of transportation, but had a dramatic cultural impact. Along the new train route, towns were developing with an influx of people, both Americans and immigrants seeking a new frontier. This fresh mode of travel enhanced the social climate. America was rapidly growing with the railroad providing a plethora of opportunities.

During the late 1800s, railroads continued to expand with travel enhanced by the elaborately decorated Pullman cars. With Pullman sleeper cars equipped with bunks, overnight travel was more enjoyable. To accommodate the expanding railroads, manufactures were building larger and faster steam locomotives. About 1900, diesel and diesel-electric engines were introduced, but it was not until the 1930s, with refinements to these engines, that they were able to compete with the steam locomotives. The “Roaring Twenties” was a thriving period for railroads, both travel and freight service.
With the “Great Depression” railroads suffered severe financial losses, causing some small railroads to declare bankruptcy. To stay solvent, several of the larger railroads invested in other means of transportation. To kick-start the economy in 1934, as described by Arthur Tayler, the Burlington & Quincy Railroad built a “Three-car articulated unit with the cars constructed of stainless steel…called the Pioneer Zephyr.”¹ The streamlined styling of this locomotive was an instant success with the public. The futuristic styling gave Americans a bright hope for the future.

During World War II, the railroad was a major factor in transporting troops and military supplies to ports for overseas shipments. With extensive travel of inductees and troops gaining specialized training required the railroads to bring old steam locomotives out of storage to meet the demand. The end of the war created a new challenge for the railroad with automobile manufacturers building cars in record numbers. The development of the interstate highway system and the increased use of air travel was extremely detrimental to the railroad industry. Many railroads were going bankrupt or merging with other railroads. To provide freight service in the northeast region, seven bankrupt railroads were composed under the Regional Rail Reorganization Act of 1973, called Conrail. Conrail after losing billions of dollars was rescued by a law in 1980 called the Staggers Act that deregulated the railroad industry. To provide passenger service the National Railroad Passenger Corporation was formed, named Amtrak, with service beginning in 1971. This is the point at which many Americans’ awareness of rail development stops. Today, many Americans consider railroads a technology of the past. But 21st Century developments show that railroads continue to evolve, and Americans will need to modernize their awareness.

In November 2000, a new high-speed Amtrak train, *Acela* was introduced to accommodate the growing passenger traffic in the northeast corridor. The *Acela* did not meet the definition of high-speed rail as defined by World leaders, such as, Japan and China, but the *Acela* has temporarily filled a need in America. The northeast corridor is a heavily traveled route between major population centers, all of which have serious automobile traffic issues. Trains are therefore considered a way to avoid traffic jams. Ironically, the old independence which led Americans to cars in the first place now can lead them onto trains, at least in the northeast corridor. But other parts of the nation are experiencing similar evolution. Currently high-speed rail is being developed in Texas and California, with a planned completion of 2021 in Texas and 2024 in California. I sent questionnaires to several persons who either work on or for the railroad, are railroad enthusiasts, or frequently ride on the railroad. All respondents have varied forms of rail expertise. These exchanges occurred by mail and email, and within the confines of a class, and thus did not fall under IRB purview. All respondents are cited here as per their wishes. Their responses varied on where they thought the future of railroads in the United States is heading and what their thoughts were on the future of high-speed rail. But the conclusion of this thesis rests upon their collective attitudes, which blend optimism and pessimism about the future of railroads in the United States.

Having concluded this historical summary, which covers the shape of this project, it is now time to explore these issues in detail.
Chapter 1:  
AMERICAN RAILROADS: THEIR ROLE IN BUILDING THIS COUNTRY

The railroad has had a consistently dramatic impact on the growth of the United States. This chapter, which historicizes that impact, will focus on four key elements: the development of the locomotive, the workers who operated the train, the people that rode the trains, and the influence the railroad had on industry. Although much of this material is not original, it is condensed and presented here in order to provide needed context for this Master’s Thesis.

The enormous prosperity of the railroad in the latter 19th Century greatly diminished after World War II. From perhaps the most obvious symbol of lucrative American heavy industry, the railroad declined in the public mind as its profits fell. Eventually, the national rail system underwent a massive restructuring which made its historical dominance harder to recollect. This portion of the Master’s project seeks to reiterate the rise to dominance of the railroad, its decline and reorganization. Later in this thesis I will chart its potential future.

The locomotive started in the Jacksonian-era United States as a simple steam-powered vehicle that rolled on rails, but evolved to the advanced, extremely high-tech locomotives of today. The word ‘locomotive’ is defined by Merriam-Webster as “a self-propelled vehicle that runs on rails and is used for moving railroad cars.”² In the early 1800s, the locomotive served the needs for a growing population in America and was seen as the cutting-edge transportation technology of its day. Along with canals, railroads were seen by the public as altering the very landscape and opening up new possibilities for the movement of goods and people. From such beginnings, as the need for more efficient transportation arose, technology advanced with locomotives that became increasingly more efficient. Detailed technological milestones not

familiar to laymen describe the progression of the locomotives through the past two hundred years. With advancements in technology, diesel, electric, diesel-electric, and other alternative energy sources slowly replaced steam locomotives. This quest for greater power, speed, and efficiency became a constant in the industry. The public might simply notice trains, but railroad experts have long understood that trains are constantly under pressure to perform better and more efficiently. Later in this work, emphasis will be added on how advancements in the twentieth century improved comfort and functionality compared to locomotives in the nineteenth century.

From the beginning, new manufacturers strove to meet the need for locomotives. Railroad manufacturing was and is a heavy industry, requiring significant investment and a massive physical plant. Building such products is not the province of a backyard tinkerer. Along with the new manufacturers, standard codes were developed to identify the size and wheel configuration of the locomotives, so as to bring uniformity to a national industry. Larger engines were required to safely pull more cars at higher speeds. Safety standards were established to provide audible and visual signals of approaching locomotives. Braking systems were improved to increase safety. Trains became a vital means of transportation for carrying freight and passengers. The need for locomotives has diminished from past decades, but rail transportation still fills an essential need in America, especially for freight. As for passengers, certain areas such as the Northeast Corridor see ample rail traffic, and plans are underway for improvements in passenger rail.

Over the past two hundred years, it has been advances in locomotives that drove railroads to new levels of performance. The locomotive is the key piece of the railroad puzzle. As the American population grew and the national boundaries moved west, stronger and larger power units were required to meet the demands of the expanding country. The development of the
steam locomotive, now a heritage technology, was a slow process. Stationary steam engines were in operation almost one hundred years before the first steam locomotive was built. In 1804, the United States was about a quarter-century behind Great Britain in developing a railroad system. The following year, however, a steam-powered vehicle was driven through Philadelphia. The steam locomotive improved with Richard Trevithick’s invention in 1803. Trevithick used the steam that exhausted from the cylinders after moving the pistons by channeling the steam through a nozzle. The nozzle allowed more air to be drawn through the firebox, causing the fuel to burn faster and produce more steam. In 1828, Charles Carroll was instrumental in the building of the Baltimore and Ohio Railroad. This was the springboard for a new mode of transportation in the United States. Ralph Waldo Emerson wrote, “Railroad iron is a magician’s wand in its power to evoke the sleeping energies of land and water.” Emerson thus captured the imaginative power of a new technology. Railroad development was a vital link in the expansion of America.

The early boilers were of two designs, vertical and horizontal. Several of the American manufacturers preferred the vertical boiler with two of the American manufacturers favoring the horizontal British designs of Stephenson, and Bury styles. The Stephenson Works manufactured the Stephenson boiler. The design was a horizontal oval that allowed for a larger firebox grate. Being easy to manufacture, this boiler was popular in the 1830s and 1840s. The design of the Edward Bury boiler was known for the enormous crescent dome. The oversized dome provided

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6 Ogburn, 12.
8 Solomon, 27.
abundant steam capacity, but had a little firebox grate and was more costly to build and maintain than the Stevenson boiler. In the early years of steam locomotives, the Bury boiler was popular with American builders including Baldwin, Rogers, and Norris. During the same period, the Stephenson boiler was favored by the New England manufacturers.\(^9\)

In 1850, both Stephenson and Bury boilers were being replaced by an improved design by Rogers Locomotive Works, named Madison. The Wagon Top boiler used the best characteristics of Stephenson and Bury to become the premier boiler design in the United States. The Madison produced ample steam, included a large grate area, and was easy to build. The Rogers design contained a flaw which was that weak joints were located between the firebox and the steam dome. To correct this issue, long bolts were used with rods and angle bars to provide the needed durability.\(^10\)

The early boilers were built of iron plates attached together by rivets. Steel boilers initiated in the early 1850s, but nearly forty years passed until steel replaced iron as the metal of choice in boilers. The delay in changing to steel was the high cost and the brittle quality of steel. It was only after malleable steel alloys and less costly steel was available that steel replaced iron.\(^11\) See Figure 1.1 for cutaway view of a steam locomotive.

Until about 1850, American locomotives burned wood as their primary fuel. Early attempts at using anthracite coal, met with little success. Anthracite was expensive, unavailable in parts of the country, and did not burn efficiently in the small fireboxes of that time. The danger of burning wood was the spewing of burning sparks out the smokestack, posing an

\(^9\) Solomon, 27.
\(^11\) Solomon, 28.
obvious fire hazard. Sparks damaged equipment, injured railroad workers and passengers, and started fires along the tracks. Sophisticated smokestacks were designed to avoid sparks spewing from the locomotives. The most efficient and accepted design was the bonnet stack. The bonnet stack resembled an inverted cone that employed screens to trap the sparks while providing ample draft from the firebox.\textsuperscript{12} The need for a better fuel source was imminent.

The conversion to bituminous coal from wood was a major milestone in the development of American locomotives after the Civil War.\textsuperscript{13} With coal, firemen could load more fuel into the firebox than they could by stoking a firebox with wood. The coal produced more BTUs (British thermal units, the standard energy measurement) providing more power and more powerful locomotives. Along with the increased use of coal came modifications in the firebox. A firebrick arch was constructed which involved placing “a row of bricks mounted on arch tubes inside the firebox at an angle above the grate to act as a partial barrier between the grates and the firetubes.” This design directed the hot gases to travel an extended distance enabling the fuel to be more completely burned. The firebrick permitted the firebox to attract more heat.\textsuperscript{14}

\textsuperscript{12} Solomon, 29.
\textsuperscript{13} Solomon, 29.
\textsuperscript{14} Solomon, 29, 31.
At the age of sixteen, my grandfather, William B. Long, accompanied his older brother as they regularly rode the East Broad Top Railroad to the Robertsdale Coal Mine. William, in his journal, recalls the approximately nine-mile ride from their home on a hill outside Saltillo, Pennsylvania, to the mine. In the morning, they would walk down the hill about a quarter-mile. As the Number seventeen engine slowly passed pulling empty coal cars up the hill, my grandfather and his brother jumped on a car. They rode through the Sidling Hill tunnel to the mine. At the end of the day, they would ride a full coal car on the return trip. As the train slowly climbed the hill on the opposite side of their house, they would jump off, walking over the hill to their home. Today, this sounds adventurous if not downright dangerous, but it was the norm for that time. The East Broad Top Railroad not only served the mine but also provided transportation for some of its workers. To attract “reliable men with families,” several lines built accommodations to house their workers. There were many physical demands required by the men who operated steam locomotives.

In 1912, George E. Rudolph worked as a conductor at the Paoli station for the Pennsylvania Railroad. In those days the conductor was called “captain” being the final authority on the train. Rudolph recalls that you were supposed to wear your full uniform at all times including the vest and hat, regardless of the extreme heat.

The railroad engineer was responsible for the operation and maintenance of the locomotive. In the first half of the nineteenth century, the engineer was assigned to a particular locomotive. The engineer took pride in his locomotive, making sure the boiler was in good

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condition, and all the moving parts were well lubricated. As Kinert noted, “There was an old
timer that would beckon his fireman over to this side of the cab, then he would pull out his watch
and point at it ---- ‘See that watch, bub?’ he’d shout. ‘The only difference between my watch and
my engine is size!’”\textsuperscript{18} With a soot covered, weathered face, he would keep a keen watch through
his cab window for any danger with his left hand on the throttle. The locomotive engineer was
labeled America’s new hero.\textsuperscript{19} Another vital crewman was the fireman.

The fireman’s responsibility was to maintain the fire in the boiler and ensure the boiler
was kept in working order. To maintain the proper amount of steam in the boiler, the fireman
needed to consider several factors. Watching the steam gauge and maintaining a safe level in the
water column was imperative. Supplying fuel to the firebox was dependent on the load being
pulled and the grade of the route.\textsuperscript{20} Sustaining the boiler was the heart of the steam locomotive.

Another important crewmember was the brakeman, who had the most dangerous job on
the train. His job was to walk on top of the moving cars, turning the wheel on each car as
directed by the engineer. The brakeman was exposed to all types of weather with the danger of
low hanging bridges and tunnels. In addition, he was responsible for coupling and uncoupling
cars. The style on early trains was a link and pin that connected with perfect alignment. Many
brakemen suffered the loss of fingers or feet due to being caught between two moving cars
during coupling and uncoupling of cars.\textsuperscript{21} Superintendent of the Pennsylvania Railroad, Herman
Haupt, realized the dangers his workers encountered. Unlike management in many other railroad

\textsuperscript{18} Reed Kinert, \textit{Early American Steam Locomotives 1st Seven Decades...1830-1900} (New York: Superior Publishing
\textsuperscript{19} Kinert, 154.
\textsuperscript{20} Calvin Franklin Swingle, \textit{Modern Locomotive Engineering, with questions and answers...} (Chicago: Frederick J.
\textsuperscript{21} Ogburn, 98.
companies, Haupt showed empathy with a practice of visiting injured men and widows. To supplement the railroad crew with additional help boomers were used.

Boomers were “men in motion.” These men moved from one place to another without holding a permanent job. Most of the men were unmarried who were in their twenties or thirties. Boomers not only did physical tasks like clearing rights-of-way, and setting rails, but they also helped on locomotives. The boomers who had trade skills helped the crew on the locomotive. Over time, the boomers acquired skills that aided the development of the locomotive. As they roamed to various locations, they developed different techniques that helped to advance the locomotive industry. Some railroad superintendents, such as Herman Haupt, preferred family men that were dedicated employees. This choice was typical of industrial paternalism, which was common in railroads, since they viewed themselves as community pillars. Licht describes that by the 1870s, railroad leaders had diverse opinions and sediments concerning their workers. Some railroad leaders began urging their supervisors not to have any favorites or allow personal feelings to interfere. With powerful locomotives and the number of trains rapidly increasing, safety became a matter of concern.

Safety features on locomotives included, but were not limited to: headlights, bells and whistles, air brakes, and automatic couplers. One of the first safety features on a locomotive was the headlight installed in 1832. In the early stage of railroads, the trains only traveled during the

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daytime. As the volume of rail travel increased the need was evident to have a headlight. The early headlights were illuminated by burning such fuels as: coal oil, kerosene, or rape oil. Headlights became electrified, with the advances in electricity. Another safety feature that was added with the increased speed of trains was the bell and whistle. The steam whistle would notify the brakeman to apply the brakes or warn persons along the track of an approaching locomotive. The bell was used to notify people in a station or rail yard of a moving train in a less intrusive manner. Besides the safety aspect, the bell and whistle with their distinctive tones became symbols of the locomotive in the nineteenth century. One of the most important safety features of the locomotive was the introduction of the air brake.

On early trains, the braking system was very primitive and inefficient. To apply the brakes the brakeman would have to climb on top of the cars and apply the brake on a whistle signal from the engineer. With passenger trains going faster with heavier loads, numerous inventors from England and America attempted with little success to produce a new braking system. See Figure 1.2 for the hazards of the brakeman.

After three years of development, George Westinghouse devised an air brake that

Figure 1.2 Brakeman risking his life on top of a moving railcar

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27 Soloon, 29.
28 Veenendaal, 116.
improved breaking on railroad cars.\textsuperscript{29} Westinghouse was an American entrepreneur and an engineer.\textsuperscript{30} The Pennsylvania Railroad agreed to test the George Westinghouse brake and within a year, eight railroads were using his air brakes on their passenger trains. One fault with the Westinghouse brake was that when the air hose was disconnected the brake no longer functioned. To resolve this problem, Westinghouse reversed the function of the brake requiring air to release the brake.\textsuperscript{31} This revision provided quicker acting brakes and a fail-safe system in the event of a line break. Along with the development of the air brake, the automatic coupler was a huge safety improvement.

Early trains in America used a variety of link-and-pin couplers. See Figure 1.3 of brakeman applying link-and pin. To connect two cars, the car was moved slowly while the brakeman or conductor dropped the pin at the correct moment. Often accidents occurred due to inclement weather, and restricted visibility between the engineer and the brakeman. To improve safety an automatic “knuckle” coupler was invented but, it was several years before cars were installed with automatic couplers.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{link-and-pin-coupler.png}
\caption{Figure 1.3 coupling with the link-and-pin}
\end{figure}

\begin{flushright}
Courtesy of The Railroad Museum of Pennsylvania photograph by Jeffrey R. Long
\end{flushright}

\textsuperscript{30} George Westinghouse: American Inventor and Industrialist www.britannica.com/georgewestinghouse
\textsuperscript{31} Veenendaal, 117.
After years of lobbying with much credit to Iowa Railroad Commissioner, Lorenzo Coffin, the Safety Appliance Act of 1893 was passed. This act required all rolling stock to install some type of automatic coupler and an automatic brake. The automatic coupler was also a factor in the tractive ability of the locomotive.

A key component in the performance of a locomotive is the tractive capability, also referred to as traction. Gravity, resistance, adhesion, and the environment were the main obstacles a locomotive encountered in moving and stopping. The force to get the locomotive to start moving was reduced to about one-third of the energy with the use of the coupler between cars. With the coupling having a separation between the railroad cars, allowed the locomotive to start moving one car before the next car started moving. The automatic couplers permitted a train to start moving with less force than the earlier trains that used the link and pin couplers. Adhesion factors influenced the locomotives’ tractive ability.

The adhesive capability in a locomotive determines how effectively it can grip the rail without slipping. To put this into perspective, the contact area between the steel wheel and the steel rail is very small, especially when considered alongside the size of the entire train and track. The size of the wheel or the weight of the load has little effect on the adhesive capability of the wheel to the rail. Adverse weather conditions, wear of the wheels and rail, and foreign material on the rail all reduced the traction ability on a locomotive. John Armstrong describes, “The amount of tractive effort that a locomotive can generate, at its maximum, is the product of the coefficient of friction between the wheels and the rails and the weight on the driving axles of the locomotive.” In some situations, to improve traction, small amounts of sand are applied on the track.

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32 Veenendaal, 26-28.  
33 Armstrong, 51-52.  
34 Armstrong, 55.
The implementation of safety measures and improved tractive measures came at a time when the railroad was rapidly growing. Despite the safety measures implemented, railroad workers still endured many unsafe conditions. To improve safety for people crossing the railroad tracks, the highway grade-crossing warning signs, “Stop, Look, and Listen,” were first introduced on the Reading Railroad in 1884.\(^\text{35}\)

Even as late as the 1940s, some railroad workers were not treated fairly. Exploitation, accidents, injuries, and death were part of working in the industry. Clinton Scott, working as a wheel roller for the Norfolk & Western Railroad in 1941 describes his accident. As Scott was unloading a 750-pound wheel from a boxcar the wheel fell crushing his ankle. He was transported by ambulance to the hospital where he was taken to what was referred to as “the attic.” This was an area with two or three beds for the ‘colored’ patients, in keeping with racial segregation practices. While Scott was sedated, the railroad foreman asked him to sign a paper indicating he was involved in an accident. Scott realized later that he had signed away his rights with that paper stating that he was at fault in the accident.\(^\text{36}\) African American railroaders served primarily in laboring positions or filled jobs such as waiters or dining-car chefs. Even in the 1970s, one of the most notable jobs for African Americans was as sleeping-car porters for the Pullman Company.\(^\text{37}\) With locomotives getting larger, an identification system for determining wheel groups was developed.

To aid in identifying the size of a locomotive and the wheel arrangement, America adopted the Whyte Classification System. In this system, locomotives were identified by the

arrangement of their wheels in three groups. In Figure 1.4 is a Whyte Classification System chart. The wheel groups were identified as:

- forward or leading, driving, trailing with each group separated by a dash. If a wheel group had no leading or trailing wheels, it was identified with a zero. One of the most common wheel arrangements during the second half of the nineteenth century was the 4-4-0 known as the American Standard.  

By the 1890s, the electric powered trolley car and the locomotive emerged on the rail.  

Two main suppliers for electrical components used on electric cars and locomotives were General Electric and Westinghouse Electric. Growth of the electric propulsion systems was slow in the beginning. The electric locomotives did not have the power to move mainline trains. Advocates of the electric locomotives viewed distinct advantages. Brian Solomon writes, “Electrification was a more efficient use of energy and could lower fuel, labor, and maintenance costs. Electric motors provided greater starting power, and could simplify operations through the use of double-ended equipment and the elimination of fuel and water stops.” The American public viewed electrification as cleaner and quieter. Even though there were advantages to electrification, there were a few concerns. Some steam railroad companies were hesitant to invest substantial capital for high-voltage equipment, specialized locomotives, and specialty trained personnel.

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38 Solomon, American Steam Locomotive, 49.
40 Solomon, Electric Locomotives, 11-14.
Electric traction was an economical method to operate a railroad. Electric locomotives were power converting, instead of power generating units. Advantages of the electric units included the ease of drawing power from a central power plant for starting and pulling steep grades. Besides being cleaner and quieter, these units required less maintenance than the steam locomotives. The disadvantages were the costs for installing the current wires and structures along with their maintenance. In 1895, the Baltimore & Ohio Railroad (B&O) was the first to operate a commercial electric locomotive. This major milestone signaled the coming end of what, for many, was the most ‘romantic’ era of railroad history. It is worth pointing out that the steam railroad’s roots were part of the Romantic Era in American culture.

To eliminate the smoke in the residential district, and in the tunnel, B&O built a three-mile long Belt Line that included a 1.25-mile tunnel in Baltimore. General Electric in conjunction with B&O provided equipment and locomotives. The locomotives operated on a 600-volt direct current system. The Belt Line continued to operate until the 1950s when modern diesel-electrics eliminated the need for electrification. In 1902, New York State passed a law banning all steam locomotives in Manhattan after a fatal railroad accident occurred. The accident happened when a steam locomotive rammed another standing train in a smoke-filled Park Avenue Tunnel. With public sentiment against the steam locomotive railroad, New York City was compelled to develop electric railroad technology. One of the early inventions was the development of the electro-pneumatic multi-unit (MU) control system on a locomotive. The MU control allowed two or more electric units to be controlled by one engineer simultaneously.

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1905, the Pennsylvania Railroad (PRR) started experimenting with two electric locomotives in Altoona, Pennsylvania at their Juniata Shop. From the early stage of electric locomotives, the controversy on the use of alternating current (AC) or direct current (DC) system existed.

The debate continued with General Electric endorsing DC systems and Westinghouse endorsing AC system. DC transmission systems were less complicated than AC systems and were simpler to control. With the higher voltage of AC systems, they can more effectively distribute over long distances by the use of transformers. By the early 1900s, electrification was either accomplished by DC, single-phase AC systems with most at 11,000 volts at 25 Hz, and three-phase AC. The New Haven Railroad was a pioneer in building an AC system.

In a bold move, New Haven built an 11,000-volt, single-phase system. New Haven contracted Westinghouse, the primary sponsor of AC systems, to develop their locomotives being a joint venture with Baldwin-Westinghouse. Due to distribution problems at the power plant and flaws in the design of the overhead catenary providing power to the locomotive the first units were less than successful. Improvements made enabled the electrified railway to successfully operate between New York City and New Haven by 1915. The advancements New Haven made in the electrification of their railways set a trend worldwide. Along with increased use of electrified locomotives, the diesel engine was being developed.

The diesel locomotive made its debut about 1900. Initially, the diesel locomotive faced steep competition from the steam locomotive that could pull six times the load of the diesel. To improve efficiency, engineers designed diesels to operate a generator. Using developed

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46 Solomon, Electric Locomotives, 44.
49 Solomon, Electric Locomotives, 28-32.
technology, the generator provided DC electric power to the traction motors. In comparison to steam locomotives, Ross writes;

It was more thermally efficient, produced a better tractive effort when starting in relation to its potential full power, offered a better driving position, gave no risk to lineside fires, and required less in the way of ancillary equipment such as turntables. And one man could drive three linked-up.\(^{50}\)

In 1924, American Locomotive Co. (ALCO), General Electric (GE), and Ingersoll-Rand (IR) formed a consortium to build diesel locomotives. Most of the diesels built in the next ten years were used as low speed switchers.\(^{51}\) In the 1930s, the weight of the diesels was reduced enabling the diesels to compete with steam locomotives besides just in switching yards. An essential improvement to the diesel locomotives was the development of reliable controls to balance the electrical generating load to the power output of the diesel engine.\(^{52}\)

The Union Pacific (UP) and Burlington, in 1934 combined futuristic styling and lightweight material concepts that led to the first streamliner in the United States.\(^{53}\) The M-10000 three-car all-aluminum articulated train was built by Pullman. With 600 HP, this Winton V12 engine was capable of 110 mph.\(^{54}\) The style was so uniquely different that the UP streamliner drew over a million people to watch it pass as it traveled from coast to coast on an exhibition trip. The intrigue even had President Franklin Roosevelt catching a glimpse of the speeding train.\(^{55}\)


\(^{52}\) Armstrong, 61.


\(^{55}\) Schafer and Welsh, 12.
With trepidation, in 1933, General Motors built two of the two-cycle engines for display at the Century of Progress Exposition in Chicago. The success of the two-cycle diesel engines was a springboard for the railroad industry. Carper writes, “Ralph Budd, president of the Chicago, Burlington and Quincy Railroad, ordered this engine to power the *Burlington Zephyr*, then being developed in the plant of E. G. Budd in Philadelphia.”

The *Burlington Zephyr* was a three-car articulated train with a stainless steel shell. Houk describes the *Zephyr*, in 1934, “…[M]aking a record breaking dawn to dusk run from Denver to Chicago, 1016 miles, at an average speed of 77.6 mph and a top speed of 112.5 mph. It was the first diesel-electric streamliner in the US….” The *Zephyr* was powered by a 600 HP 201A two-stroke inline eight-cylinder Winton engine. See Figure 1.5 of the *Burlington Zephyr*. American culture was changing with a desire for better commodities. Americans liked the sleek lines of the *Zephyr* and the higher speeds. The railroad passenger service was still favorable despite automobile travel gaining popularity. During this time, automobiles were hampered by many substandard roads that were uneven and slow to travel.

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57 Houk, 5.
58 Houk, 5.
My grandmother, Kathryn Long, describes travel in the late 1920s in her memoirs. She boarded a train in Elizabethtown, Pennsylvania with a group of girlfriends who worked at the Masonic Homes. They would take the train to New York City and travel up the Hudson River to West Point Military Academy on a weekend to go to a dance. She praised the scenic view especially along the Hudson. Weekend excursions, like my grandmother took, were not uncommon during the “Roaring Twenties.”

Another locomotive that went into construction in 1934 was the Pennsy GG-1. This engine could develop 8,500 HP at a cost of $250,000. The GG-1 continued to be built until 1943. Due to the popularity of this streamlined locomotive, the GG-1 was used by Amtrak until the early 1980s. In 1935, eighteen GG-1s were constructed in Pennsylvania’s Altoona shops. The GG-1 provided high-speed passenger service between New York City and Washington. Before long, the GG-1 was also effective at pulling freight trains by modifying the gear ratio, allowing greater pulling power. To improve the appearance of the GG-1 the PRR acquired industrial designer Raymond Loewy. Two of his improvements included a seamless welded skin instead of using a riveted skin and painting five stripes on the front of the engine “cat whiskers.” See Figure 1.6 for a picture of the GG-1. As the diesel-electric locomotives gained in popularity and performance, the steam locomotive got a reprieve.

With the start of World War II, materials and factory output shifted to wartime production. Government restrictions severely limited production of diesel locomotives. The war created a huge demand on railroad traffic. To fill the need for more locomotives, steam

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60 Houk, 5.
61 Middleton, 44.
62 Solomon, Electric Locomotives, 55.
locomotives that were about to be taken out of service or were sitting idle in yards were put back in operation. Despite the steam engines requiring considerable service, the steam units filled the need to move the freight. With the end of World War II, many of the aged steam locomotives were retired from service or scrapped.\(^{63}\) There was a great need for additional locomotives and rolling stock. At the same time, women’s roles across American life dramatically changed, with women working on the railroad as ticket clerks and office clerks. Still, the positions of locomotive engineer, fireman, and conductor continued to be all male into the 1970s, when changing gender roles became more accepted.\(^{64}\)

The locomotive has experienced a great number of changes since the railroad locomotive came on the scene in the early 1800s. The progress can be divided into two fifty-year segments.

The first fifty years of locomotives included the period from 1810-1860. A comparison details enhancements to the locomotive and how the public viewed this new mode of

transportation. Locomotives were greatly improved by the mid-century as compared to the early wood burning steam boilers. Improvements included; the conversion to burning bituminous coal, larger steam boxes with the ability to pull heavier loads across the rail, and more ornately detailed shells on the locomotives. The population of the United States was rapidly growing with more people moving west. With more products being manufactured, the public desired a better means of travel for both freight and passengers.

The second fifty-year segment is from the 1880s to the 1930s. With increased rail traffic, a huge concern was placed on improving safety. The locomotives were traveling faster while progressively getting larger and heavier. Simple physics explains how dangerous this could be. To improve safety for the crew and for passengers, devices including air brakes, automatic couplers, bells, whistles, and headlights were installed on the trains. Locomotives were slowly switching to burning anthracite coal that provided passengers with a cleaner environment. By the 1930s, locomotives were becoming streamlined. The development of the diesel-electric was becoming more prominent and favored by the public over the steam locomotives. Passengers desired more comfort since they were traveling longer distances on trains. Plush seating and sleeping cars added to their comfort. This also shows a sharp contrast between the first fifty years and the second fifty-year segment of railroading. During World War II, the railroad provided tremendous support.

Although American railroads had less equipment at the start of World War II as compared to World War I, the railroad had better equipment. With the deployment of large military forces a huge demand for passenger equipment was needed. Pullman troop trains provided dining and sleeping accommodations for the troops. The tremendous demand for
transporting military equipment put a strain on the freight rolling stock.\textsuperscript{65} With the growing military rail traffic, public rail service was reduced to a minimum during the war. To support the growing number of people riding on the railroad after World War II, special excursions were offered.

The Grocers Picnic Excursion was advertised as “the most famous excursion of its kind held anywhere.” Sponsored by Associated Grocers Food Markets, the Pennsylvania Railroad would take thousands of Lancaster County residents to Atlantic City for a day trip in the summer. In 1948, 7,500 Lancaster County residents boarded the eighty-seven modern steel railway coaches for Atlantic City. A shortage of railroad cars hampered the excursion in 1960 with only space for 3,400 of an estimated 5,000 persons that planned to attend. After fifty-eight years, the annual event was cancelled in 1968 due to lack of rail coaches on the Penn Central Railroad.\textsuperscript{66} In an interview, my aunt Doris Williams, recalls going on the Grocers Picnic in 1950 or 1951. She went with her aunt and two cousins departing from the railroad station in Elizabethtown, Pennsylvania. Aunt Doris remembers the train car was crowded and her favorite memory was a dark green plastic gherkin pickle lapel pin she received from the Grocers Association that she wore all day. In the evening they went to the Atlantic City Steel Pier to see the diving horse before they returned home.\textsuperscript{67} The dwindling attendance to the Grocers Picnic in the 1960s is indicative of the culture change with more people desiring their independence and preference to travel in their own vehicle.

\textsuperscript{65} Donald J. Heimburger and John Kelly, \textit{Trens to Victory: America’s Railroads in World War II Including Foreign Theater Operations} (Forest Park, IL: Heimburger House Publishing Company, 2009), 41.
\textsuperscript{67} Doris Williams, interviewed by Jeffrey R. Long January 13, 2016.
The golden era of railroads that started in the 1880s ended by the 1950s. Even though American prosperity was growing in the 1950s, railroads were declining.\(^{68}\) In the decade after World War II, the transportation mode was changing. Automobile transportation was becoming more prevalent. This was due to improved automobiles that were more comfortable to drive, along with an improved highway system. In addition, air traffic was growing in popularity. The steam locomotive was fighting a losing battle with the new designed diesels.

With the railroads on the decline, efficiency and economics were key factors. The diesel engines were less costly to operate. Even though the large steam locomotives had more pulling ability, multiple diesels could be coupled in tandem to surpass the steam locomotives. Diesel-electric locomotives could travel longer distances between fuel stops than steam units that also required taking on water. The decreased amount of maintenance required on diesel locomotives was an important economic factor.\(^{69}\) By the early 1950s, the last of the steam locomotives were built.\(^{70}\)

Geoffrey Groff who is retired from the Strasburg Railroad provided the following responses to my questionnaire on locomotives. Groff has worked in several capacities on the railroad including: fireman, engineer, mechanic, and passenger conductor. When asked if a steam locomotive or a diesel locomotive was more difficult to operate, Groff replied, “I believe it’s more difficult to operate a steam locomotive, because there are more things to pay attention to with dire consequences possible if something goes wrong.” When asked whether steam or diesel locomotives were easier to repair, Groff wrote, “Diesel locomotives are easier to repair, for there

\(^{68}\) Ogburn, 142.
\(^{69}\) Ogburn, 142.
\(^{70}\) Solomon, *American Steam Locomotive*, 143.
are fewer moving parts and fewer maintenance items. This is partly what led to diesel locomotives replacing steam once the technology was perfected.  

With a surge of rail traffic in the mid-1950s, steam locomotives were brought out of retirement to fill the void. The increased volume of traffic was brief and by 1957, most steam locomotives were parked in a yard waiting their final fate.  

By 1959, the last Pennsylvania steam locomotive made its final trip in New Jersey.  

In a special history study at the Steamtown National Historic Site, it was stated that, “. . . [E]xcepting special cases such as short lines that emphasized steam passenger excursions, narrow gauge lines, or other special cases, America’s railroads were essentially dieselized by 1960, and the steam locomotive had nearly vanished from the railroads of the nation.”  

Not all of the steam engines were scrapped. Some were saved in museums or stored in round houses. It was more prevalent in the Midwest and the West to donate steam locomotives to communities to be displayed in parks. People in the West felt more of a bond with the railroad since it helped to build and enrich their community.  

The 1960s found about ninety percent of the locomotives were diesel-electric.  

I am fortunate to have Gary Marsden, a retired railroad conductor, for a neighbor. He spent thirty years on the Long Island Railroad and agreed to be interviewed. Marsden stated that;

As was stated in the [Long Island Railroad] LIRR Book of Rules (a trainman’s ‘Bible’), Rule No. 1 is safety is the utmost importance in the discharge of duties. Getting the train ‘over the road’ on time was an unwritten close second. On-time performance has always been a huge issue with the LIRR. Due to the large number of scheduled trains, one breakdown has a snowball effect. It was a problem when I started

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72 Solomon, American Steam Locomotive, 143.  
73 Carper, 71-72.  
75 Solomon, American Steam Locomotive, 144-145.  
76 Armstrong, 61.
and still is. Steam engines were phased out during the early 1950s, but it was common knowledge that they could achieve very fast speeds and they were more dependable than the diesel engines they replaced. No amount of snow or bad weather would stop them.  

With the railroads in financial trouble, government intervention was pursued to save passenger rail service. In 1970, Amtrak was established when Congress passed the Rail Passenger Service Act, signed by President Richard Nixon. By 2008, over 20 million customers rode on this national system of intercity trains annually. Amtrak’s Acela Express went into service in 2000, between Boston and Washington, with speeds capable of 120 miles per hour. While slower than foreign bullet trains, this was a major improvement in American passenger rail. The modern European styled locomotives utilized three-phase alternating current traction systems. With AC traction, they were able to accelerate faster and required fewer electric motors than with direct current technology. Advances in semiconductors and microprocessor technology made AC traction possible. In recent years, new technologies have developed in the locomotive industry.

The “dual-powered” locomotive emerged in 2007 that used a blend of diesel-electric and AC catenary unit. This technology allowed passengers to not have to switch trains when approaching cities where electrical power was required. Recently, interest in hybrid technology is being considered. This application is currently limited to yard switchers. The deep draw of current on mainline locomotives requires more power than currently available in battery systems. With integration in the latter part of the 1900s, African Americans began to hold more prestigious positions on the railroad. John Nutter, an African American who had been a

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78 Wolmar, 341.
79 Houk, 5.
80 Solomon, Electric Locomotives, 87-88.
81 Armstrong, 89.
tractor-trailer driver for years became a brakeman with Norfolk Southern. Within a short time, he was promoted to locomotive engineer and conductor. Nutter served as division president of the *Brotherhood of Locomotive Engineers and Trainmen* for eighteen years.\(^8\)

To obtain a current perspective from people involved with the railroad industry or who have ridden on the railroad, I developed a series of questions. The questions were individualized to the person being interviewed. I was pleased with the number of responses and the quality of their answers. In a questionnaire submitted in 2016 to Norfolk Southern Engineer and author, Dan Cupper, on his opinion of the future of railroads in the United States, he responded:

> Freight railroads will continue to do well, as they have rebounded, recovering from a terrible slump in the 1960s and 1970s when they were almost nationalized. The Staggers Act of 1980 deregulated the freight railroads, and that led to their rebirth. As for Amtrak, it has potential to grow, but has been chronically underfunded by Congress, which always manages to appropriate enough to keep it going, but not enough to allow significant replacement of infrastructure and rolling stock.\(^9\)

Dan Cupper, has done extensive research for his articles and books that provides a wealth of knowledge about railroads. He, also, has first-hand experience working on the railroad.

The development of the railroad in America was a key influence on the strong growth of the United States. Railroads provided transportation, jobs, and vital support during the Civil War and World War II. With the completion of the Transcontinental Railroad, the event was a joyous occasion with the country feeling unified, connecting the East and West coast. Trains have provided transportation to special events, such as the Grocers Picnic. Commuters find the railroad an effective means to getting to and from their workplace. Despite fierce competition from airlines and interstate highways, railroads still fill a need in moving goods and providing passenger service.

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\(^8\) Scarborough, 76.

In the next chapter, I will discuss the important role the railroads had in the American Civil War. Railroads provided many different functions and were a key factor in the outcome of the war.
Chapter 2:
THE IMPACT OF RAILROADS IN THE AMERICAN CIVIL WAR

The first section discussed the evolution of the railroad and its importance in American history. This chapter will focus on the use of the railroads during the American Civil War. The Civil War marks the first ‘railroad war’ in history. Both the Confederate and Union armies’ involvement with railroads will be discussed. Detailed accounts will describe the various railroad strategies used by the North and the South that influenced the outcome of the war. The emphasis of discussion will look at the uses and strategies the railroads contributed, while at the same time, avoiding the detailed accounts of military battles.

By the 1850s, the railroad industry had displayed considerable growth across the nation. At the start of the war in 1861, the United States economy was growing. The North was more industrialized with greater resources and raw materials. In the southern states, agriculture, with cash crops, was the predominant source of income for many wealthy plantation owners. This gap in industrial prosperity was part of the reason the South feared being overtaken by the North. Railroads were part of this phenomenon. The railroad growth was predominantly in the northern states, both in terms of building locomotives and in laying miles of track. Rail traffic in the South was inhibited due to varying widths (gauge) between the rails that changed from one railroad company to the next railroad company. This lack of uniformity was an impediment to systematic integration. It would also become a Confederate military burden. During the Civil War, trains were used for multiple purposes. Trains not only transported troops and food supplies, but also were used to move artillery, as battering rams, and even as hospitals. The majority of the battles were fought in the southern states, where the railroad tracks were of a lower quality. Frequently, the Confederates would demolish their own tracks to slow the advancement of the Union.
Armies. Thus, they destroyed their own infrastructure. Many of the railroad companies both in the North and in the South used the war for financial gain, often through price-gouging, for their companies. Price-gouging was an intrinsic part of the military contracting story, since the governments were in no position to scrutinize the contractors. But Washington recognized the strategic importance of the rail network. In the North, to allow government control of the railroads, President Lincoln signed a law permitting the government to seize a railroad for military use when necessary. In the South, Confederates were reluctant to place government control on the railroad companies. This was in keeping with the Confederacy’s suspicion of centralized political power, but it did little to help them overcome the disparity in rail capabilities. The Civil War was the first industrialized war that incorporated trains as a valuable resource, as mentioned before, and the two sides different experiences are a major part of the story.

To better understand the impact the railroad had on the Civil War, it is important to understand the prominence of the railroad in 1861 and how it blended into the scheme of growth in the United States. President Lincoln and Jefferson Davis, the president of the seceded states, had opposite views on the development of the railroad. Lincoln, with his foresight, was an advocate of railroad growth in the country. Davis strongly opposed government involvement with expanding railroads and fervently contested Lincoln over building the bridge across the Mississippi River. Davis’ reluctance to expand railroads, in the 1850s, hurt him during the war.84

In the North, from Pennsylvania to the New England states, industry was growing rapidly. To meet the needs of the North, an expanded railroad system was developed to deliver raw materials and to ship finished goods. In 1860, the American rail network could be divided

into thirds, with the Middle Atlantic states and the New England states having ten thousand miles of track. In the Middle West, eleven thousand miles were laid, and the Southern states operated nine thousand miles of track.\footnote{John F. Stover, \textit{American Railroads}: 2\textsuperscript{nd} ed. (Chicago: The University of Chicago Press, 1997), 43.} See \textbf{Figure 2.1} to view an American railroad map of 1861. The railroad was able to meet the demands of the war due to overproduction of rolling stock during the 1850s.\footnote{Hermon King Murphey, “The Northern Railroads and the Civil War.” \textit{The Mississippi Valley Historical Review.} Vol. 5 No. 3 (Dec 1918). pp. 324-338. JSTOR. 19 Feb 2014. \url{http://www.jstor.org/stable/1888813.}, 327.} Rolling stock is defined by Webster as wheeled vehicles owned and operated by the railroad.\footnote{\textit{Railroad: Rolling Stock}, Standard ed. CD-ROM, Encyclopedia Britannica, 2001.} In addition to the North having twice the amount of track as compared to the South, the North had many more locomotives. The rail line in Pennsylvania between Pittsburgh and Philadelphia had 220 locomotives, which were more locomotives than the entire state of Virginia possessed.\footnote{David Emer May, \textit{Trains in the Civil War}. 17 Feb 2014. \url{http://www.emer.org/TrainMag/TrainWritings/trainsinthecivilwar.htm} 1999, 1.} The combination of Pennsylvania and Erie railroads had almost as many locomotives as the entire Confederacy. With the start of the war, the Confederacy was at a distinct disadvantage in acquiring rolling stock and motive power. Most of the South’s locomotives were purchased in the northern states. The South had few engine-building manufacturers and those facilities were transformed into production of military ordnance.\footnote{Stover, 51.} In the decade before the Civil War, a burst of expansion in railroad mileage resulted in sloppy rail beds and inferior bridge structures. With the intense rate of railroad-building, railroad directors appeared to have the motto: “Let’s lay more track and to hell with maintenance.”\footnote{Stover, 44-45.} The lower quality rail beds were especially prevalent in the South. To
compound the issue with the Southern rail system, with a dislike for mechanical occupations in the South, many of the railroad employees were from the North. With the onset of war, many of the northerners returned home and the workers who remained were viewed with suspicion. Not only laborers, but also key railroad personnel returned to the North when war was declared. Railroad men being called up for military duty compounded the railroad labor shortage.

At the onset of the war, neither the Union nor Confederate armies envisioned the impact the railroad would have on the outcome of the Civil War.

In April 1861, President Lincoln reacted to the attack on Fort Sumter by recruiting 75,000 men into the Union Army. Lincoln utilized the railroad to transport troops from all the Northern States to Washington, where they convened. In the South, Robert E. Lee, General of the Army in Virginia, slowly gained confidence from state governors to assemble their troops under his command. Initially, the state governors desired to save their troops to defend their local state interests. Also, the wealthy plantation owners wanted troops to remain

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91 Stover, 51.  
92 Wolmar, 94.
local to protect their properties. Consequently, the transport of soldiers over long distances was limited in the South due to the inability to link numerous short lines into trunk lines. Rail traffic was further restricted in the South by tracks ending at the outskirts of settled communities and requiring horses to move cars through the town.93

At the start of the Civil War, the railroad was not a strategic part of their battle plan for either North or South. The Confederates were the first to utilize the railroads for transportation in battle, however. In July 1861, Major Thomas J. Jackson marched his Confederate 1st Virginia Brigade across the Blue Ridge Mountains to the Piedmont Station. At the Piedmont Station, the troops boarded the Manassas Gap Railroad for Manassas Junction. “The trip took eight hours, and it was a lark. At every stop enthusiastic crowds swarmed around the cars, girls in their finery waved and flirted, housewives showered them with food, and everybody sang patriotic songs as ‘Dixie’ and ‘The Bonnie Blue Flag.’”94 Within three months after the Confederate soldiers fired on Fort Sumter, the first battle occurred that Southerners refer to as “First Manassas.” The North labeled this battle as “Bull Run.” “It took an inexperienced Union army two days marching through oppressive Virginia heat to confront the equally raw army of the Confederate States of America” in Manassas.95 Southern troops were under the command of Confederate General Joe Johnson. He moved his troops by train in a mere few days from the Shenandoah Valley. Transporting the Rebel troops by train on the Manassas Gap Railroad provided fresh soldiers ready for battle. After one day of actual fighting, the Union forces retreated towards Washington.

95 Hankey, The Railroad War, 4.
The outcome of the war may have been significantly different if Johnson had not used the railroad or if the North had stopped the arrival of the train before arriving at Manassas.\(^{96}\) This was the first instance of the railroad playing a strategic role.

Nowhere symbolized the importance of railroads in the war more than the small railroad town of Manassas, close to the Bull Run battlefield. It was the site of a junction linking the short Manassas Gap Railroad with the Orange & Alexandria Railroad, which would change hands numerous times during the war. Consequently, the town became a supply depot for whichever force occupied it, and both sides fought hard to seize and retain the town.\(^{97}\)

The battle at Manassas was one of several in which the Confederate Army used the railroad to transport soldiers. The irony is that the South’s rail evolution was inferior, but they were the first to make effective use of this new military technology.

In 1862, Confederate General Braxton Bragg transported by rail nearly 32,000 men for a campaign in Kentucky. Bragg moved his soldiers in a circuitous route from Mississippi to Chattanooga traveling nearly 800 miles on the railroad. The rail trip was still three times faster than traveling on foot with the men in better physical condition. General James Longstreet, in September 1863, used the railroad to move his army of 12,000 and their equipment from Virginia to Georgia.\(^{98}\) Longstreet’s corps reached Georgia after a roundabout 900-mile travel over a dozen different railroad lines.\(^{99}\) “The response was rapid enough to secure a major Southern victory at the Battle of Chickamauga.”\(^{100}\) These Confederate victories were more the exception then the standard. As the war progressed, the South became less skillful at using the railroads, while the North became more adept.

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\(^{96}\) Hankey, *The Railroad War*, 4.
\(^{97}\) Wolmar, 101-102.
\(^{100}\) Hankey, *The Railroad War*, 5.
In a tactical move, President Lincoln arranged a meeting with John Garrett of the Baltimore & Ohio Railroad and Tom Scott of the Pennsylvania Railroad. The conference also included War Department personnel and U.S. Military Railroad (USMRR) chief David McCallum. The group developed a plan to move the 11th and 12th corps of the Army of the Potomac from Northern Virginia to within close proximity to Chattanooga. “Two days after Lincoln’s approval, the first of 25,000 men with their equipment boarded trains for the 12-day, 1,200-mile railroad-and-steamboat journey to the outskirts of Chattanooga.”101 Hankey writes that this tactical plan is often referred to as the turning point in the war. In a short period, the Northern railroads provided dozens of locomotives, three hundred freight and passenger cars with an ample crew to operate. The well-coordinated plan allowed the Army of the Potomac to reach Chattanooga in time to force the Confederates out of the region.102 With the increased use of trains in the North for military purposes, the USMRR was a strategic move sanctioned by President Lincoln. The North was prepared to catch up to the South’s quick start, and then to move ahead.

To further control the use of the railroads, in 1862, Lincoln enacted a series of congressional acts that permitted the federal government to utilize railroads. These acts, collectively referred to as the USMRR, included the use of locomotive depots, rolling stock, and other crucial equipment. To keep the railroad running smoothly, the USMRR placed railroad employees under military control. As the war wore on, the USMRR built 650 miles of line, and rebuilt the routes destroyed by sabotage.103 While the USMRR applied limited control of the

101 Hankey, The Railroad War, 5.
102 Hankey, The Railroad War.
103 Wolmar, 100.
railroad, the Confederate government was reluctant to impose government sanctions on the railroads.

   The Confederate government developed a branch as part of its Quartermaster Bureau to resolve railroad issues. This branch acted as a liaison between the railroads, individual states, and Jefferson Davis’s government. However, this Railroad Bureau was given a title without authority to enforce military demands on the railroads. “Throughout the war, Confederate government policies encouraged railroads to handle civilian traffic in preference to military traffic. There was little real co-operation between railroads and senior military officers, and there was resistance to creating interchange points.”¹⁰⁴ Distrust among the individual southern states hampered the efforts of a central railroad control. It was not until the waning days of the Civil War in February 1865, that the Confederate Congress passed legislation to control the southern railroads.¹⁰⁵ As the war continued, the North became savvier with using the railroad to their advantage while the South faltered in utilizing the railroad to its fullest extent. In the northern states, there was mistrust with the railroads. The southern states’ fitful approach to the rail situation mirrored their approach to many other questions of integration, all of which hindered the Confederate cause.

   In 1862, President Lincoln appointed Daniel McCallum as the military director and superintendent of the railroads. He was the former general superintendent of the New York & Erie Railroad. With interest in architecture and engineering, McCallum developed an interest in bridge design. He established the McCallum Bridge Company where he successfully patented his Arched Truss Bridge.¹⁰⁶ McCallum, a brilliant organizer, possessed both engineering and administrative skills. He had a reputation for strict discipline among his men. While McCallum

¹⁰⁴ Wolmar, 100.
¹⁰⁵ Wolmar, 101.
was handling much of the administrative details, Herman Haupt Figure 2.2, who worked closely with McCallum, was directing the fieldwork. As Wolmar notes, “He [Haupt] had passed through West Point... where he had been its youngest cadet ever [age fourteen], but resigned his commission to become a professor of mathematics and engineering, writing the definitive textbook on bridge building and later becoming superintendent of the Pennsylvania Railroad...”107 Haupt was labeled “war’s wizard of railroading,” and he was equally brilliant along with McCallum.108 To prevent interference from military officers an order from the War Department stated: “No officer, whatever his rank, would interfere with the running of the cars as directed by the superintendent, under penalty of being dismissed.”109 Haupt was unimpressed by military rank and was not afraid to speak up to high-ranking officers. He was firm on three fundamental rules:

1. Not to allow supplies to be forwarded to the advanced terminus until they are actually required, and only in such quantities as can be promptly removed.
2. To insist on prompt unloading and return of cars.
3. To permit no delays of trains beyond the time fixed for starting, but when necessary and practicable, to furnish extras, if the proper accommodation of business required it.110

With his dedication to restoring the fragile railroad in the South, Haupt spent endless hours rebuilding bridges

Figure 2.2 General Herman Haupt
U.S. National Archives and Records Administration, College Park, MD: 23 Apr 2014

107 Wolmar, 105.
108 Wolmar, 105.
110 Leavy, 53.
and track. At the same time, he was a strict disciplinarian and expected nothing but the best effort from his unskilled workforce. Haupt’s first military task was to rebuild the Richmond, Fredericksburg, & Potomac Railroads.¹¹¹

Rebuilding these three railroads was a vital line that linked the two capitals, Washington, D. C., and Richmond, Virginia. These railroads, also, provided an essential supply line for the Union Army. Another obstacle Haupt encountered was rebuilding several miles of railroad wrecked by the Confederates. In a defensive move, to impede the advancement of the Union, Confederates designed an iron claw that could dismantle both the rails and supporting ties. To further obstruct progression by the North, bridges were blown up.¹¹²

Using his skills, Haupt and his unskilled workers rebuilt the first three miles of track in three days and rebuilt bridges in an expeditious rate. As a result, on the fifteen-mile track previously destroyed by rebels, up to twenty trains were running within two weeks. President Lincoln was so impressed with the speed of the work he came himself to view the work. Lincoln marveled at “. . . the perilous-looking four-hundred-foot trestle bridge over the Potomac that had been erected in just nine days. . . .” Impressed, Lincoln stated, “That man Haupt has built a bridge across Potomac Creek . . . and upon my word, gentlemen, there is nothing in it but beanpoles and cornstalks.”¹¹³ The bridge is pictured in Figure 2.3. Lincoln provided the needed support to McCallum and Haupt to direct the field commanders on the most efficient use of the railroads. To rebuild railways, Haupt organized the Army Corps of Engineers with the majority

¹¹¹ Wolmar, 106.
¹¹² Wolmar, 106.
¹¹³ Wolmar, 106.
of the workers being freed slaves. In an account told by a railroad engineer, John Bailey, Jr. described the ingenious designs Haupt developed that he witnessed in person. Bailey recalls:

This 18-mile railroad—from City Point to all the Army outposts laying siege to Petersburg—was like none I ever drove on afterward. The Construction Corps had no time to excavate or contour the land. In places where a ravine was too steep for a train, they threw up trestles on the pre-fabricated head frames designed by the ingenious General Haupt. None of them collapsed under our heavy—but careful—use. Mostly the tracks simply followed the terrain.

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114 May, 2.
Besides restoration of the railway, Haupt reviewed schedules and on-time deliveries of the railroads. One time Haupt examined the non-arrival of four trains at a station in North Carolina. To his dismay, Haupt discovered that a general had delayed a train on the main line so his wife could sleep overnight in a local farmhouse.\textsuperscript{116} Arriving at the station, he gave a directive to the conductor to restart the train and then met face-to-face with the woman who caused the delay. In his autobiography, Haupt recalled the elegantly dressed lady tripping as she crossed the field. Looking back, he was embarrassed by his lack of manners: “I did not display extra gallantry on the occasion, nor even offer the lady assistance. She had detained four trains in three hours in a period of urgency, and I was not in an amiable mood.” He directed the lady to get on the train so service could be resumed.\textsuperscript{117} Priorities were needed to manage the military railroad traffic. Haupt was a strong advocate for ensuring that rail service was punctual.

McCallum and Haupt established guidelines for the military on usage of the railroads: the transport of subsistence stores received number one importance, followed by forage for the horses, ammunition, hospital supplies, and last was the carrying of troops based on the ability to travel by foot if necessary. A set of priorities also included the men, with urgency given to veteran infantry regiments, followed by raw recruits with cavalry and infantry troops entirely kept off the railroads. Haupt declared the railroad timetable should be controlled by railroad personnel instead of the military. To maximize use of rolling stock, Haupt urged prompt unloading of these cars. On one occasion, Haupt personally threw out a colonel for using a boxcar, parked on a siding, as his office.\textsuperscript{118} The importance of these rules was clearly exhibited in the supply operations in the Battle of Gettysburg.

\textsuperscript{116} Wolmar, 107.
\textsuperscript{117} Thomas Weber, \textit{The Northern Railroads in the Civil War 1861-1865}. (New York: King’s Crown Press, 1952), 144.
\textsuperscript{118} Wolmar, 108.
With word of the Confederate Army heading to Gettysburg, Haupt realized the potential for a huge battle. He quickly organized the operation of the Western Maryland Railroad on a route from Baltimore connecting through to Gettysburg. To prepare the inadequate single-track rail line, Haupt drafted four hundred men to rebuild the line expeditiously. As Wolmar stated, “Haupt established a service of three convoys of trains per day, each consisting of five ten-car sets carrying fifteen hundred tons of supplies and once the battle commenced, they were used to return to Baltimore with up to four thousand wounded soldiers each.”

Besides hauling supplies and transporting the wounded, the railroad served many different applications during the Civil War.

From the beginning of the war, both the Union and Confederate Armies used the railroad for rapid and enormous soldier movements. In June 1862, under the orders of Jefferson Davis and Robert E. Lee, ten thousand Confederate men were transported by rail in the Shenandoah Valley. About a month later, General Braxton Bragg transported his entire army numbering about thirty thousand soldiers from Mississippi to Chattanooga. Bragg used an indirect route traveling 776 miles through Mobile, Montgomery, and Atlanta using six different railroads arriving in a little over a week. A year later, General James Longstreet moved his entire army; consisting of twelve thousand to fifteen thousand men mobilized by rail 900 miles from Richmond to Georgia. In the fall of 1863, General William T. Sherman received special orders to rebuild the Memphis & Charleston Railroad. The track from Memphis to Corinth, ninety-six miles away, was in need of repair to move horses, supplies, and the battalion. In route they came under a Confederate artillery attack that damaged and set fire to their locomotive. The following

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119 Wolmar, 108.
120 Stover, 55-56.
day, repairs were made to the railroad and the locomotive and they went on to Corinth.\textsuperscript{121} The North, likewise, used the railroad to move troops.

In the fall of 1863, the largest single movement of Union troops by train occurred. In eleven and one-half days 25,000 men, 10 batteries of artillery, and all their horses, traveled 1,200 miles in a roundabout route from Washington to Tennessee on thirty trains.”\textsuperscript{122} General Sherman took his troops 473 miles from Louisville to Atlanta on the railroad. To feed 100,000 men and 35,000 animals Sherman required a daily supply of sixteen trains with ten cars each.\textsuperscript{123} Sherman calculated the supplies needed and went to great lengths to ensure the goods arrived daily on the single track. He stated, “If you don’t have my army supplied and keep it supplied, we’ll eat your mules up sir—eat your mules up.”\textsuperscript{124} In northern Georgia, Sherman recognized his vulnerability and wrote that “railroads are the weakest things in war; a single man with a match can destroy and cut off communications.”\textsuperscript{125} General Sherman, while his troops camped near the Etowah River, wrote; “For the purposes of rest, to give time for the repair of the railroads, and to replenish supplies, we lay by some few days in that quarter—Schofield with Stoneman’s cavalry holding the ground at Cassville Depot.”\textsuperscript{126} Sherman wrote in one of his many letters how the Union Army destroyed over two hundred miles of rails and consumed provisions that were vital to Lee’s army on his march to the sea.\textsuperscript{127} As the war progressed, the North became more adept at using the railroads while the South was more creative in the early stages of the war. Trains were also used as hospitals.

\textsuperscript{121} Memoirs of General William T. Sherman by himself. 1957, 350-353.
\textsuperscript{122} Stover, 56.
\textsuperscript{123} Ogburn, 24.
\textsuperscript{125} Alexander, 253.
The first ambulance trains were used as early as October 1861 seeing use on both sides as the war continued. Wolmar writes, “. . . The Virginia Central built two ambulance cars designed to hold forty-four casualties each, and in the North hospital cars were running between Boston, Massachusetts, and Albany, New York, as early as the spring of 1862 with basic facilities of hair mattresses, pillows, and blankets for each berth.”\textsuperscript{128} The demand for medical facilities far exceeded the anticipated number of victims by the military or the railroad companies. Unhealthy conditions and poor diet caused outbreaks of disease that were more dangerous than injuries from bullets. Often the wounded were dumped on the floors of freight cars. In the North the federal government’s new Sanitary Commission ordered special “ward” cars that could each hold twenty-four removable stretchers supported with heavy rubber bands. Figure 2.4 displays the inside of a “ward” car. With the swinging motion of the train, patients were sometimes tipped out.

\begin{figure}[h]
\centering
\includegraphics{inside_hospital_railroad_car}
\caption{Inside of hospital railroad car}
\end{figure}

\textsuperscript{128} Wolmar, 115.
of their beds. The South, with their crude setting of straw on the floor was actually safer for the wounded.\textsuperscript{129}

Being the first railroad war, leaders experimented with new uses for trains. Union forces developed a hospital train, which advanced into an institution on wheels. The hospital cars provided treatment and care for wounded soldiers as the train exited the battle area. On the cars were beds, a kitchen, medical supplies, and toilet facilities. The train was staffed with . . . medical personnel, nurses hired by the. . . Sanitary Commission, and local volunteers to help the wounded. A short leap of the imagination resulted in the outfitting of train cars to carry the wounded from the field of battle to safety.\textsuperscript{130}

Sherman, in his attack on Atlanta, used three entire trains with each able to transport two hundred wounded men in a mobile hospital.\textsuperscript{131}

In 1863, the Philadelphia, Wilmington, and Baltimore railroad company designed and built a hospital train to care for the wounded. Bunk beds provided comfort for the wounded in cars that were equipped with a stove, a water tank, a toilet, and a locker that also accommodated the medical personnel on the train. The cars were designed with wider doors on each end of the car to provide better mobility when carrying the injured on stretchers. With the added facilities on the cars, engineers were able to make far less comfort stops in route to hospitals.\textsuperscript{132} Toomey states, “To signify that the hospital trains were carrying non-combatants, each locomotive and tender was painted scarlet and ran during the day with two yellow hospital flags on either side of the cowcatcher.”\textsuperscript{133} A cowcatcher is described by Merriam-Webster as “an inclined frame on the front of a railroad locomotive for throwing obstacles off the track.”\textsuperscript{134} Both the Confederate and the Union Armies respected the humanitarian purpose of these trains. \textbf{Figure 2.5} illustrates a

\begin{footnotes}
\textsuperscript{129} Wolmar, 116.
\textsuperscript{130} Gordon, 142.
\textsuperscript{131} Wolmar, 116.
\textsuperscript{132} Gordon, 143.
\textsuperscript{133} Daniel Carroll Toomey, \textit{The War Came By Train: The Baltimore & Ohio Railroad During The Civil War.} (Baltimore: H. G. Roebuck & Son, Inc., 2013), 70.
\end{footnotes}
hospital train. Railroad engineer, John Bailey recalls transporting provisions to the Rappahannock Station in 1864 and details the return trip.

![Train Image]

**Figure 2.5**

**Union Army Hospital Railroad Locomotive**

Hodges, 11.

On the return trip, our trains carried wounded and sick men. Those were long hard days, hardest when there were many wounded. It was awful to see so many injured men, bloody and suffering on their stretchers, loaded into specially-fitted cars for the journey to the hospitals in Alexandria. We had no way to make the journey any smoother for them, nor any way to enhance their rate of survival.135

While the hospital cars provided an invaluable service in the war, the railroad also met other important needs.

Both the Union and Confederate Armies used innovation in building armored war fighting cars. On platform cars were mounted cannons or mortars with angled casemates to restrain the weapons and protect the soldiers. Some cars were encased in steel armor that resembled an early tank or an ironclad warship.136 **Figures 2.6 and 2.7** depict armored cars. Baldwin Locomotive Works, the largest manufacturer of locomotives in the world, had men working on a secret project for two weeks.

When completed, “The Philadelphia Fort on Wheels” as it was called was 65 feet long and 9 feet wide. It was covered with half-inch boilerplate that made it immune to rifle fire. At one end, a 9-lb. Howitzer was mounted on an adjustable carriage that

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135 Harris, 50.
136 Hankey, *The Railroad War.*
allowed it to be fired through portholes in three directions. The gun and crew were protected by retractable hatches similar to that of a naval war ship. The remainder of the car was lined with 50 loopholes to allow for the safe firing of infantry weapons. It could carry five gunners and up to 60 infantrymen.\textsuperscript{137}

The armored railcar was used by the Union on the Orange & Alexandria Railroad. In addition, the Union mounted a mortar, called “The Dictator” on a railroad platform that was mobile to prevent the Confederates from locating the mortar. This mortar is illustrated on Figure 2.8. Hankey noted, “‘The Dictator’ was a standard 13-foot coastal mortar . . . repurposed as a ‘siege’ weapon. Its objective was to throw exploding shells behind the earthen and masonry fortifications erected around the Virginia city of Petersburg.’”\textsuperscript{138} “He [Robert E. Lee] ordered his artillery commander to build a railroad gun wagon by placing a thirty-two-pounder on a railcar protected by a wall of steel rails, and this armored battery was deployed in the Seven Days’ Battle in Virginia in June 1862.”\textsuperscript{139} Mounting guns on railroad cars, making them mobile, was an important innovation during the Civil War.

Rolling stock, also, served as weapons of destruction. Individual cars were set ablaze to attack opposing troops or to burn bridges. In a few situations, locomotives were sent down the track with a full head of steam to ram an enemy train or a railroad facility. To prevent these rolling threats, commanders built obstructions on the rails.\textsuperscript{140}

At the start of the Civil War, the North had about two-thirds of the rail footage and eighty percent of the manufacturing facilities in the United States. During this period, there were over two hundred railroads across the country with the majority located in Union states. With a standardized gauge, transporting troops and supplies from one city to another was easier than

\textsuperscript{137} Toomey, 67.
\textsuperscript{138} Hankey, \textit{Civil War Rails}.
\textsuperscript{139} Wolmar, 116.
Figure 2.6
Confederate armored car
Hodges, 19.
Figure 2.7
Confederate artillery car with cannon
Leavy, 109.

Figure 2.8
Railroad mortar “Dictator”
having to transfer to another railroad, like often was the case in the South.\textsuperscript{141} In 1861, a trip from Charleston to Philadelphia involved having to change cars eight times due to variations in the railway gauge.\textsuperscript{142}

Besides having only one-third of the rail miles in the nation, the condition of southern rail beds, including rails and ties were inferior to railways in the North. Transporting 12,000 soldiers from northern Virginia to Chickamauga, an officer under Lt. Gen. James Longstreet described the horrific railways. “Never before were such crazy cars—passenger, baggage, mail, coal, box, platform, all and every sort, wobbling on the jumping strap-iron—used for hauling good soldiers. But we got there, nevertheless.”\textsuperscript{143} The increased use of the railroads in the South, hauling men, food, fodder, and other needed supplies, created further deterioration of the railways.

In Virginia, the Virginia Central Railroad President notified Jefferson Davis that, with overuse and lack of repair, the railroad “efficiency [was] most seriously impaired.”\textsuperscript{144} During March of 1863, the railroad sustained four derailments within five days. The deplorable condition of the railways was compounded by a severe shortage of railroad workers. As early as 1836, Superintendent of the Georgia Railroad, J. E. Thomson wrote to Matthias Baldwin requesting support in hiring locomotive men and mechanics. Baldwin replied, “It is out of the question to get good sober industrious [m]en to go to the South for anything like the sum they work for here.”\textsuperscript{145} Three causes contributed to the dilemma of employing only about half the workers prior to the start of the war. Some of the railroad men were recruited into the

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\textsuperscript{142} Stover, 45.
\textsuperscript{143} Ogburn, 21.
\textsuperscript{144} Joseph T. Glatthaar, General Lee’s Army: From Victory to Collapse. (New York: Free Press, 2008), 212.
\textsuperscript{145} M. W. Baldwin to J. E. Thomson, May 24, 1836, Baldwin Locomotive Papers, Letter Copy Book, no. 1, Historical Society of Pennsylvania
Confederate Army. Other workers were from the North, leaving to join the Union troops, and African-American railroad workers escaped to the North.\footnote{Glatthaar, 212.}

As the war continued, the southern railroads encountered depleted rails, locomotives, and rolling stock. Before the war, the South purchased railroad supplies from northern mills like locomotives in Patterson, New Jersey, and boiler tubes in Pittsburgh, Pennsylvania. Rails were manufactured in northern mills or imported from England. With Union blockades at southern ports, rails could not be delivered from England.\footnote{John E. Clark Jr., \textit{Railroads in the Civil War: The Impact of Management on Victory and Defeat}. (Baton Rouge: Louisiana State University Press, 2001), 49.} “Southern foundries, in contrast, did not roll a single new iron rail after 1861.”\footnote{Clark, 6.} In 1861, the only engine-building factory that existed in the South was the Tredegar Iron Works in Richmond, which was directed by the Confederacy to convert its facility into the production of cannons and ordnance supplies.\footnote{Stover, 51.}

By 1863, the shortage of rail had become acute. The authors stated “In May 1863 a new Confederate law permitted ‘the War Department to seize and manage railroads, regulate freight schedules, and interchange rolling stock.’”\footnote{Richard E. Beringer et al., \textit{Why the South Lost the Civil War}. (Athens, Georgia: the University of Georgia Press, 1986), 215.} The law provided some control for railroad management, but occurred long after action should have been administered. To allow railroad movement, the South began to hoard their own rail from branch lines to maintain the main stems. Near the end of the war, the Confederate government was desperate for railroad equipment. They were taking entire rail lines from Florida, Texas, and Georgia to support the Confederate military effort.\footnote{Stover, 52.} The Union armies capitalized on the southern deteriorated railroads by causing more destruction of railroads and bridges. In 1864, General Ulysses S. Grant directed McCallum to

\begin{thebibliography}{10}
\bibitem{Glatthaar} Glatthaar, 212.
\bibitem{Clark} John E. Clark Jr., \textit{Railroads in the Civil War: The Impact of Management on Victory and Defeat}. (Baton Rouge: Louisiana State University Press, 2001), 49.
\bibitem{Clark2} Clark, 6.
\bibitem{Stover} Stover, 51.
\bibitem{Beringer} Richard E. Beringer et al., \textit{Why the South Lost the Civil War}. (Athens, Georgia: the University of Georgia Press, 1986), 215.
\end{thebibliography}
rebuild the 151-mile main supply line on the Nashville and Chattanooga Railroad. McCallum found the railway in deplorable condition with track laid on an unballasted mud-road bed. Lightweight rails were sitting on decaying ties that would spread apart and cause frequent derailments. Early in 1864, Grant outlined an aggressive plan to capitalize on the weaknesses of the Confederates.

The mobility of the railroad was the focus of Grant’s plan. To break the Confederate stronghold in central Virginia, Grant relied on the USMRR to supply his army. Before his army could advance toward Richmond, Grant needed to construct two new rail lines that totaled twenty-two miles. During this same period, General Sherman moved his troops by rail toward Atlanta. With the support of the USMRR Construction Corps, seventy-five miles of track were replaced and eleven temporary bridges were built. Despite frequent Confederate raids, the Union was able to keep their supply line open to Chattanooga. 

The taking of Atlanta in September 1864, opened the way for Sherman’s March to the Sea. Capturing Atlanta was a crucial blow to the South. Atlanta was a key hub of rail traffic for the southern states. With fear of being attacked by regrouping Confederates, Sherman became more ruthless. Along the Georgia railroads, Sherman devastated nearly two hundred miles of rail. General Sherman describes how Colonel Poe, United States Engineers, under his direction was on a special task of destruction. In Atlanta, they leveled the great depot, machine-shops, and round-house of the Georgia Railroad and set fire to the wreckage. Destroying the railroad behind him, Sherman was labeled “the greatest railroad wrecker of all” and developed

152 Weber, 191.
153 Wolmar, 115.
154 Hankey, The Railroad War.
155 Hankey, The Railroad War.
the “Sherman hairpin.”¹⁵⁷ The twisted rails that were heated on a pile of ties and bent around a tree or pole were also known as “Sherman’s Neckties.”¹⁵⁸ Once the rails were heated and bent in this fashion they could not be reused on a railway. See photograph of “Sherman’s Neckties”

Figure 2.9. During the same timeline, General Grant moved his troops within twenty miles south of Richmond in Petersburg. With the support of the Union railroad, the Army of the Potomac was able to outlast the Confederates. No longer having control of the railroad, Lee was surrounded.¹⁵⁹ On April 8, 1865, Lee surrendered to Grant at Appomattox in the house of Major Wilmer McLean.¹⁶⁰ The first railroad war was over, having provided a critical role to both the North and the South.

The following chapter will describe the need for a railroad from the east coast to the west coast. The Transcontinental Railroad opened up a new frontier that influenced travel, communication, and culture.

¹⁵⁷ Wolmar, 115.
¹⁵⁸ May, 3.
¹⁵⁹ Hankey, *The Railroad War*.
¹⁶⁰ Alexander, 265.
Chapter 3:  
A RAILROAD TO THE WEST COAST

After writing about the importance of railroads in the Civil War, I will now discuss the building of a railroad from coast to coast. Construction of the transcontinental railroad was a major milestone in the transportation industry and in the growth of the United States. The emphasis of this chapter is the creation of a railroad from the Missouri River to the Pacific Ocean during the 19th Century. This section analyzes that famous tale and will focus on the multitude of obstacles in the 1860s that hampered the completion of the railroad. The methodology for this paper combines historicizing with contextualizing railroad details. Surveying and determining the best route to California was the first obstacle. With the country divided by the Civil War, the controversy ensued with the Confederates desiring a southern route to the west, while the Union officials wanted a northern route. The construction was hampered by rugged terrain, insufficient labor force, corrupt officials, and Indian attacks. Despite the difficulties incurred, the transcontinental railroad was completed in 1869. Crucially, however, before any construction could begin, surveys of the land, funding for the project, and Congressional approval were needed. Thus, the story began even before the first ties and rails were laid.

With the development of the railroad system in the East, several men had dreams of building a railroad to the Pacific Ocean. One was Asa Whitney, a shipping merchant in New York who traded in China, and presented a proposal to Congress in 1845. Because of his maritime business, Whitney was quite aware of the difficulty ships faced sailing around South America’s Cape Horn all the way to the Pacific. Thinking of a more efficient way to connect with the west coast and beyond, he proposed to build a railroad with his own money. Whitney asked Congress for a land grant sixty miles wide that covered an area from Lake Michigan to the
Pacific Ocean, in exchange for his cost to build the railroad. Whitney believed that by selling off plots of this land, he would be able to finance the cost of construction. He estimated the cost of construction at 65 million dollars. Since the proposed route ran through northern states, southern senators opposed this transcontinental line. The proposal was tabled in the House of Representatives Committee on Roads and Canals and Whitney’s proposal was never put to a vote in Congress.\footnote{David Haward. Bain, \textit{Empire Express: Building the First Transcontinental Railroad}. (New York: Penguin Group, 1999), 19.} With the American population rapidly growing, there was an increased desire to move west of the Mississippi River.

The discovery of gold near Sacramento, California, in 1848, further fueled western migration. The California Gold Rush created an incredible number of fortune hunters who traveled to California.\footnote{Rhoda Blumberg, \textit{Full Steam Ahead: The Race to Build a Transcontinental Railroad}. (Washington, D.C.: National Geographic, 1996), 13.} By the 1850s, travel by railroad was growing in popularity. Between 1852 and 1854, the miles of railroad track in America rose from 9,000 miles to 15,675 miles by 1854. The vast majority of track was in the Northeast. In 1854, a traveler could ride a train from New York to Council Bluffs, Iowa located on the east side of the Missouri River.\footnote{Monica Halpern, \textit{Railroad Fever: Building the Transcontinental Railroad 1830-1870}. (Washington, D.C.: National Geographic, 2003), 10.} Confronted with four transcontinental plans from Asa Whitney, Hartwell Carver, Thomas Benton, and George Wilkes; Congress asked Secretary of War Jefferson Davis to send five survey teams. The survey teams were directed to survey both northern and southern routes. Davis unashamedly advanced his preference tainting the data and budgetary figures before Congress to influence their decision toward choosing a southern route. His trickery caused yet another stalemate.\footnote{Bain, 41.}
During this period, another railroad engineer, Theodore Judah Figure 3.1 was instrumental in acquiring government approval to build the transcontinental railroad.

Theodore Judah grew up in Troy, New York, and was a very intelligent child. By age 11, Theodore was attending advanced science classes at Rensselaer Polytechnic Institute. At thirteen years old, he was hired as a surveyor’s assistant for the Schenectady & Troy Railroad. Judah was a visionary who had become one of America’s exceptional railroad engineers with a quest to succeed.165 While working in Buffalo, constructing what would become part of the Erie Railroad system, Judah received a notice from the Seymour brothers to go to New York City. Three days later, he telegraphed his wife, Anna, of their plans to sail to California. Arriving home Judah announces, “Anna, I am going to California to be the pioneer railroad engineer of the Pacific coast.”166

At the age of 28 in 1854, Judah was summoned to California by officials of the Sacramento Valley Railroad. The railroad owners wanted to build a rail line from Sacramento to Folsom, along the western bank of the Sierra to support the craze of the Gold Rush. In less than a month, Judah had completed his surveys. The Sacramento Valley Railroad sold stock to finance the $1.8 million needed for construction of the twenty-one mile track. In early 1855, grading began with a one-hundred-man labor force. The railroad was completed in seven weeks, being

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165 Blumberg, 19.
the first railroad on the Pacific Coast. Unfortunately, with diminished activity in the mines, the Sacramento Valley Railroad had difficulty staying in business. Judah wanted to continue on further east with the rail line through the mountains.\textsuperscript{167}

Some people in California referred to Theodore Judah as a foolish lunatic who was obsessed with building a railroad through the Sierra Nevada Mountains. This group of naysayers, failing to comprehend the superb railroad expertise of Judah, called him “Crazy Judah.”\textsuperscript{168} With his experience in building railroads and talented surveying traits, Judah was convinced he could build a transcontinental railroad pursuing a northern route. Despite his well-engineered plan, Judah ran into the same obstacles in Congress that his predecessors had encountered.

From 1856-1859, Theodore and Anna Judah sailed east three times to Washington to promote his plan for the transcontinental railroad. Judah believed that only the federal government could finance this venture by selling public lands that the government owned. Unable to break the gridlock with the South’s steadfast determination for a southern route, he and Anna returned to California.\textsuperscript{169} Theodore and Anna returned to Washington later in 1856. Judah had written a pamphlet, \textit{A Practical Plan for Building the Pacific Railroad} that he distributed to every member of Congress and relevant administrative heads. The pamphlet's proposal was accepted as a splendid idea with several bills being submitted. Again, the strife within Congress and President James Buchanan favoring a southern route, tabled any further action. In April of 1859, the California legislature with encouragement from Judah, passed a resolution for a convention to consider the Pacific railroad. The convention was held in San Francisco in September 1859 with Judah representing Sacramento. Out of the convention came

\begin{footnotes}
\item[167] Ambrose, 58.
\item[168] Blumberg, 19.
\item[169] Ambrose, 58-59.
\end{footnotes}
the proposal to keep decision making at the corporation level and limit government involvement.

Judah was appointed to represent California in Congress, with Judah and Anna sailing to Washington in October 1859. Representative Samuel Curtis of Iowa introduced a bill to build the transcontinental railroad from Iowa to Sacramento. Curtis proposed a government loan of $60 million. The bill was not approved, but the bill was entered in the upcoming session in 1860. Judah was encouraged by the Republican nomination of Abraham Lincoln for President.

Lincoln’s platform included full government support of the Pacific railway. His platform placed Lincoln and his new Republican Party squarely in the old political tradition of supporting national infrastructure. This is significant because Lincoln grew up admiring Kentucky Senator Henry Clay and the famous ‘American System.’ Some looked at the transcontinental railroad as a modern (for the time) version of that approach to building and funding infrastructure. Feeling confident with Lincoln’s support, Judah and Anna returned to California.

Judah surveyed and mapped a railroad route over the Sierra. In his quest to form the Central Pacific Railroad Company, Judah invited local businessmen in Sacramento to hear his proposal. In a convincing speech, he assured the audience that trains could safely travel through the mountains. The meeting sparked the interest of one merchant, Collis Huntington and his partner Mark Hopkins who owned the most prosperous hardware store in the West. Two other businessmen, Charles Crocker and Leland Stanford, who owned a dry goods store and a grocery business respectively were interested. Their major interest was not centered on building a railroad to connect the east and west coast merely to traverse the continent. They wanted to be able to transport more goods to the towns that were rising up to the east of Sacramento, to

170 Ambrose, 59-61.
171 Ambrose, 66-67.
expand their wealth and their market reach. Judah’s plan is important because not everyone involved with the proposal was thinking of a 3,000 mile journey. The point is that there were many regional reasons to support the larger product. With the election of President Abraham Lincoln, the transcontinental railroad was closer to reality.

The onset of the Civil War and the secession of the southern states eased the task for Congress of ratifying the transcontinental bill. On July 1, 1862, President Abraham Lincoln signed the Pacific Railroad Act of 1862. President Lincoln was delighted with this act that fulfilled a campaign promise to build a transcontinental railroad. The Act of 1862 specified the work would be completed by two separate corporations. The Central Pacific Railroad Company would lay tracks from Sacramento, California over the Sierra Mountains to the California-Nevada border. If the Central Pacific arrived at the border first, they would continue building east. A new corporation named the Union Pacific Railroad Company was established with a starting point at the Missouri River and would continue west to join the Central Pacific at a location yet to be determined. The Federal Government would pay each company in government bonds for the track laid. The Pacific Railroad Act awarded both companies a two hundred foot right-of-way on either side of the tracks. This property was given after each forty-mile section was completed. At that time the land could be sold or leased to settlers.\textsuperscript{173} In the Pacific Railroad Act, Pennsylvania congressman, Thaddeus Stevens insisted on an amendment stipulating that all iron used in construction had to be manufactured in America. The railroad companies were forbidden to purchase British iron that was considerably less expensive. Stevens, an iron mill owner who built track rails had a special interest in domestic steel production.\textsuperscript{174} The Central Pacific was comprised of four businessmen.

\textsuperscript{173} Blumberg, 27.
\textsuperscript{174} Bain, 114.
Four prominent businessmen in Sacramento, California, Collis Huntington, Leland Stanford, Charles Crocker, and Mark Hopkins were the principals in the Central Pacific Railroad Company. The four men became known as the “Big Four.” Early in 1863 the Big Four held a groundbreaking ceremony in Sacramento to celebrate the start of laying track. From the start of the project, Judah was at odds with the Big Four. The main concern of the Big Four was to make money and as soon as possible. Judah was excluded from business meetings because he was too precise in his engineering and disapproved of their shady tactics. To acquire additional money from the government, Huntington hired several geologists. The geologists were asked to swear that the mountains started seven miles from Sacramento instead of the actual twenty-two miles from the city. Without an investigation by the government, Huntington received $48,000 per mile for track laid on a slope as compared to $16,000 per mile for flat land. In addition, the Big Four received extra funds with the creation of the fictitious Crocker Contracting Company working for the Central Pacific. The Big Four awarded contracts to themselves that paid $90 million for material and labor that only cost $32.2 million. Appalled by these actions, Judah sailed for New York City to find new investors that would buyout the Big Four. While crossing Panama, Judah contracted yellow fever and died without ever seeing the first Central Pacific rails set. In the East, the Union Pacific was developing their plans.

The 1862 Pacific Railroad Act authorized the formation of the Union Pacific Railroad. Consider that this major act was passed in the middle of the Civil War. For President Lincoln, the task of building a railroad that would span from coast to coast seemed insurmountable. While the Central Pacific was making plans and proceeding to lay track in Sacramento, the Union Pacific was assembling a team under the direction of Thomas Durant. Durant of New York City

\[\text{Halpern, 12.}\]
\[\text{Blumberg, 30-31.}\]
graduated from Albany Medical College with an obsession for making money. He believed under his control, the Union Pacific could make him very wealthy. Unfortunately, Durant was faced with the lack of workers.

With vast numbers of men from the North and the South engaged in the Civil War, acquiring labor to build the railroad became a challenge. In 1862, Durant found obtaining investors to buy shares of stock in the Union Pacific Railroad demanding, since there was skepticism about the project’s feasibility. With difficulties in securing needed investors, both Durant and Huntington from the Central Pacific went to Washington to persuade Congress to modify the Pacific Railroad Act of 1862. Durant and Huntington offered congressmen private favors to secure a public bounty. Durant offered $250,000 in bonds to those individuals that could influence the passage of a new act. Central Pacific distributed convertible bonds that were later converted for federal bonds. These bonds were distributed to men Mark Hopkins referred to as “our friends of influence.” Financier, George Train, despite opposition from colleagues, he proceeded to raise funds for the great railway. The charter of 1862 authorized the issue of $100,000,000 of stock and $50,000,000 of bonds to be issued in sections. After failing to raise the money elsewhere, Train went to Boston and put out $150,000 of his money to launch the enterprise. The bonds only had value when the Pacific Railway Act of 1864 was passed.

To raise additional funds, in March 1864, Durant and George Train bought an obscure Pennsylvania corporation and renamed it Credit Mobilier of America, and listing it as a construction company. The very words ‘Credit Mobilier’ were destined to take their place in the

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177 Blumberg, 65.
lexicon of American corruption, alongside ‘Teapot Dome’ and ‘Watergate.’ Durant and Train reaped large profits from the Union Pacific awarding construction contracts to fictitious individuals who assigned the contracts to the Credit Mobilier. As president and principal stockholder of Credit Mobilier, Durant directed the Credit Mobilier to build the first hundred miles of railroad at $50,000 per mile. Peter Dey, the chief engineer of the Union Pacific was appalled by the action of Durant. Dey, an honest engineer, knew the cost per mile was no more than $30,000. To add to his corruption, Durant instructed a loop of nine unnecessary miles of rail bed be added to the route out of Omaha. The added miles meant more money and land grants from Washington. Durant was arrogant, used poor judgment, and lacked common sense. One attribute that Durant had was his persistence in offering General Grenville Dodge the position of chief engineer of the Union Pacific. Dodge repeatedly refused his generous offers stating that his heart was in winning the Civil War. On July 2, 1864, President Lincoln signed the Pacific Railroad Act of 1864. The new act pleased both the Central Pacific and the Union Pacific. This act provided more money for both railroad companies, and doubled the size of land grants from 6,400 to 12,800 acres per mile. Additional funding allowed the Central Pacific to begin building in earnest.

With the death of Theodore Judah, the Big Four did not have a qualified engineer to direct the rail construction crew. To fill the vacancy, Charles Crocker took charge even though he had no engineering training. Crocker used his intimidating 250-pound stature to bark out orders and boasted, “I know how to handle men.” Acquiring needed construction supplies was

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180 Ambrose, 92-93.
181 Blumberg, 69.
182 Ambrose, 129-130.
183 Blumberg, 67-68.
184 Blumberg, 32.
a major obstacle. Supplies were scarce with the war in the East. Huntington found himself competing with the Union Army for iron products such as rails, spikes and locomotives. Materials shipped from New York had a 14,000 mile ocean voyage to arrive in California. The trip took four months with the threat of being captured by Rebel warships.\textsuperscript{185} To fill the need for laborers, Crocker arranged through agents in New York and Boston to have men shipped to the west coast with many of them being Irish immigrants. The work was back breaking; digging, shoveling, bending, lifting rails, and pounding in spikes with a heavy sledgehammer. They did this work for about three dollars a day, plus board. Working conditions were dangerous with the use of as much as five hundred kegs of black powder per day. Of two thousand immigrants imported, about nineteen hundred soon abandoned their jobs and fled to the Nevada gold and silver mines.\textsuperscript{186} Even with the end of the Civil War in April 1865, there was still a shortage of men to perform hard labor.

To help with the recruitment and management of men, Crocker hired a construction boss, James Strobridge. Strobridge, who was called “Stro”, was an Irishman who started laying track when he was sixteen and became a contractor who built railroads in Connecticut.\textsuperscript{187} Strobridge began managing the work force at a salary of $125 per month. In early 1865, the California Supreme Court upheld the state railroad aid bill. The state released $1.5 million in state-guaranteed interest bonds. A notice was posted in the Sacramento newspaper that the Central Pacific needed five thousand laborers immediately. At that time, the Central Pacific had about six hundred workers. Unfortunately, less than two hundred laborers applied for work.\textsuperscript{188} With an additional four thousand laborers needed, Crocker suggested hiring Chinese to use shovels and

\textsuperscript{185} Blumberg, 34-35.\textsuperscript{186} Ambrose, 118-119.\textsuperscript{187} Blumberg, 37.\textsuperscript{188} Bain, 207.
picks. Strobridge was adamantly against hiring Chinese. “I will not boss Chinese,” Strobridge responded heatedly. “I will not be responsible for the work done on the road by Chinese labor.”

A few weeks later, after Irish workers had a discussion over wages, Crocker convinced Stro to hire fifty Chinese laborers. From this small beginning would come one of the important developments in the ethnic diversity of the United States. The Chinese were given the menial task of fillers of dump carts that was the lowest skilled job and they were supervised by white foremen. The Chinese were paid $26 per month with no board while the white workers were paid $30 per month that included board. Within a short time Crocker and Strobridge were proven wrong with the efficiency of the Chinese workers. Contacting several labor firms, they kept increasing the number of Chinese laborers until the total eventually exceeded twelve thousand. Strobridge was surprised to discover that the Chinese could do more than shovel rocks and dirt. With the large Chinese labor force, Crocker had difficulty identifying one so-called Chinaman from another.

To resolve this issue, Crocker organized the Chinese into crews of twelve to twenty men. Each Chinese crew had a headman, a cook, and laborers. The Chinese felled trees, did grading, made cuts and fills, and drilled holes for placement of and lighting the black powder in the construction of tunnels. In a note, Hopkins wrote to Huntington, “We find a difficulty in getting laborers on the RR work. Prospecting generally takes off our men.” The dream of finding gold or silver had many men going off to the mines. But sixteen hundred Chinese filled the employment void and “without them it would be impossible to go on with the work.” Thus, because of their

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189 Bain, 208.
190 Bain, 209.
191 Ambrose, 153-154.
excellent performance, the Chinese labor force was seen as top-rank, and the desire for more was natural, even if the nation at large was not ready to embrace a new ethnic group.

The Chinese were better workers, polite and less troublesome. At the end of a twelve hour day the Chinese would take a hot bath that the cook had heated for them. The men would lather with soap and rinse before drying off and put on clean clothes for dinner. Their dinner consisted of seaweed, dried fish, oysters, rice, Oriental fruits, and vegetables. During the day, their cooks would bring them hot brewed tea that was made with purified boiled water. By avoiding drinking the muddy water during the day, the Chinese avoided diarrhea, dysentery, and other stomach illnesses that afflicted other workers.\(^{192}\) See Figure 3.2 of Chinese man carrying tea to his people during construction of the Transcontinental Railroad. Building a railway around a mountain was a treacherous task.

One of the greatest challenges for the Central Pacific was cutting a rail bed through the precarious gorge along the American River, nicknamed “Cape Horn.” The steep slope with an angle of seventy-five degrees.

Figure 3.2 Chinese man carrying tea

\(^{192}\) Blumberg, 42-43.
degrees along with the river being twelve hundred to twenty-two hundred feet below the railway created a near impossible feat.\textsuperscript{193} The railway bed curved around the mountain with men grading the uneven contour. This work was extremely dangerous with men in a boson’s chair being lowered from above to place the charge and light the fuse. When the fuse was lit, the man in the chair was dependent upon his partner to pull him up to safety before the black powder charge exploded.\textsuperscript{194} The Chinese suggested a more efficient method to remove the rock ledge.

In 1865, a Chinese foreman approached Strobridge with a plan to reduce construction time on the mountain. He explained to Strobridge that the Chinese were skilled in removing shear ledges. The Chinese foreman requested reeds to be sent from San Francisco so baskets could be woven. Strobridge agreed and at night the Chinese wove round, waist-high baskets with four eyelets where ropes were attached. The Chinese, following the expertise of their ancestors, and they needed no direction. A crew of two Chinese co-workers would pull the baskets from above when the charge was lit. See Figure 3.3 for Chinese working in baskets. Despite engineers saying the task of building a railway around “Cape Horn” was impossible, the Central Pacific completed the job ahead of schedule.\textsuperscript{195} After completing the work around Cape Horn, there were higher mountains that required the building of tunnels.

The Sierra Mountains in this area rose steadily uphill for fifty miles from an elevation of 2,242 feet to an altitude of 7,042 feet. To get across the Sierra required the building of fifteen tunnels through granite. Engineers laid out plans for building five tunnels on the west slope, one at the summit, and nine tunnels on the east side. The longest tunnel was at the summit stretching 1,659 feet. Black powder was consumed at a rate of more than five hundred kegs each day.\textsuperscript{196}

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\textsuperscript{193} Ambrose, 156.
\textsuperscript{194} Ambrose, 156.
\textsuperscript{195} Blumberg, 45.
\textsuperscript{196} Ambrose, 155.
\end{flushright}
The granite dulled their picks and slowed their progress. California Governor Stanford, to speed the digging suggested the use of nitro-glycerin. To provide safer handling of the mixture, Crocker hired a Scottish chemist to mix the formula. Despite the safety precautions, many Chinese workmen were killed in the explosions. It is likely that their ethnicity made them seem expendable to many. Along with dangerous and strenuous labor the workmen encountered, they had to endure the harsh winter elements. The fact that they were Chinese and apparently able to withstand hardship made their trials seem endurable to outsiders. But there is no doubt that the Chinese workers suffered in the cold.

During the winter of 1866-67 there were 44 snowstorms with howling winds that created 40 foot high snow drifts. The harsh weather placed a halt on track-laying. The only work that continued during this time was tunnel construction. The Chinese with their shacks buried under the snow built chimneys that rose above the snow for ventilation. They excavated tunnels under the snow from their living quarters to their job sites. These passageways allowed the Chinese to work day and night completing the Summit Tunnel in thirteen months. From these horrific

197 Blumberg, 49.
working conditions, the Chinese encountered, the catchphrase “not a Chinaman’s chance” was
developed. Here again, we must consider the uncomfortable fact that the struggles of the
Chinese seemed acceptable to outsiders, even as their work excellence attracted corporate
approval. While the Central Pacific was moving ahead, despite the obstacles incurred, the Union
Pacific was encountering their own set of complications.

As the Union Pacific moved west with the railroad construction, towns sprang up. In
1865, Omaha, Nebraska doubled in population to fifteen thousand inhabitants. The Union Pacific
utilized five of their steamships to haul materials such as rails, ties, rolling stock, and machinery.
Other steamships transported additional laborers and supplies. To meet the needs of the railroad
an infrastructure needed to be built. To accommodate the growth of the city, water towers,
boarding terminals, unloading facilities, hotels, and eating places needed to be built. Along with
the huge influx of workers came a housing shortage, gambling, and prostitutes. Durant was
not as concerned with the day to day problems as he was with acquiring additional funds.

Durant was not ashamed to state that his desire was to “grab a wad from construction
fees—and get out.” The desire of Durant to build the transcontinental railroad was for
financial gain with no patriotic vision to unite the nation together. Another problem the Union
Pacific faced was the lack of hard wood for railroad ties. With the nearest hardwood tracts
located in Minnesota and Wisconsin the cost of transporting this lumber was too expensive.

Durant selected using cottonwood for the ties that was a softer wood with a tendency to rot. To
stretch the hardwood ties the rail bed was laid with four cottonwood and one hardwood tie
intermingled. The life of the cottonwood ties was extended by Burnettizing. This process placed

198 Blumberg, 49-51.
199 Ambrose, 167.
200 Blumberg, 73.
ties in large cylinders where water was pumped out of the wood and a zinc solution was injected into the wood. This process only extended the life of the ties a short period, but allowed the track to pass the government inspection.\textsuperscript{201} The Union Pacific had a lack of leadership with surveyors’ complaints of the difficult terrain. After several attempts by Durant to lure General Grenville Dodge away from the Army, Durant was finally successful. Dodge wrote to General Sherman requesting a leave of absence to allow him to work for the Union Pacific. Sherman wrote in his reply: “I consent to your going to begin what, I trust, will be the real beginning of the great road.”\textsuperscript{202} Durant hired Dodge as the new chief engineer. Like Judah, Dodge had a vision of building a first class railroad that connected the United States.

When Dodge took charge of the Union Pacific in 1866, a mere forty miles of track had been laid in two and a half years. In getting started, Dodge recalled a low pass across the Rockies he discovered the previous year while fighting unfriendly Crow Indians. To protect surveyors while they plotted this route through the pass, Dodge arranged military guards for protection.\textsuperscript{203} When Dodge took charge, Jack Casement and his brother were put in charge of transporting supplies. To bring supplies from Omaha, Casement developed an “army on wheels”—a town-on-rails. The train had up to twenty-two cars. The train cars included water tanks, kitchens, mess halls, washhouses, general stores, carpenters’ shops, and blacksmiths’ shops. Some of the boxcars had bunks stacked three levels high. Many of the workers chose to sleep outside the boxcars due to bedbugs and foul air.\textsuperscript{204} Hazarding the outdoors was preferable to the stink of being in the car. The cars were equipped with racks of rifles that were used in case of an Indian attack. Herds of cattle followed the train that provided meat for the workers. The men rose at

\textsuperscript{201} Bain, 242. 
\textsuperscript{202} Ambrose, 171. 
\textsuperscript{203} Bain, 288. 
\textsuperscript{204} Blumberg, 78.
dawn working a long day in conditions from extreme heat to snow and bitter cold. Rarely did the workers take a bath or wash their clothes.\textsuperscript{205} To celebrate the progress of the Union Pacific, Durant planned a lavish extravaganza.

Reaching the 100\textsuperscript{th} meridian of longitude, 247 miles west of Omaha, Durant sent out invitations to “The Great Pacific Railroad Excursion.” Durant invited members of Congress, foreign diplomats, millionaires, and Robert Todd Lincoln, the son of the late president. Newspaper reporters and professional photographers were invited to document the event. The tour began in Omaha with a tour of the roundhouse and several of the other structures. Two wood-burning locomotives pulled the elaborately decorated nine cars westward.\textsuperscript{206} Tourists were impressed with the bridge construction over Loup Fork. The bridge had ten spans of one hundred and fifty feet each that were placed on stone piers of fine masonry. One observer was enthralled with the use of red cedar rail ties instead of oak and cottonwood they had witnessed.\textsuperscript{207} The red cedar provided a more substantial rail bed and increased the longevity of the railway. When the train reached the end of the line, eastern tourists watched in amazement as Casement’s men laid 800 feet of track in 30 minutes.\textsuperscript{208} The excursion produced the desired results for Durant. Newspapers provided the Union Pacific with nationwide publicity. The favorable publicity attracted investors who bought millions of dollars in Union Pacific bonds.\textsuperscript{209} As the Union Pacific moved west, Indian raids became more prevalent, Durant feared that the attacks might scare away investors.

\textsuperscript{205} Halpern, 22.
\textsuperscript{206} Blumberg, 82-83.
\textsuperscript{207} The Great Union Pacific Railroad Excursion to the Hundredth Meridian: From New York to Platte City. Chicago: The Republican Company, 1867, 29.
\textsuperscript{208} Blumberg, 87.
\textsuperscript{209} Blumberg, 88.
In the wide plains, the railroad’s advent was forcing the Indians off their land. The demise of their sacred buffalo, being killed off by sportsmen and hunters such as Buffalo Bill, depleted their food source and pelts. Hunts were arranged by the railroad to shoot the buffalo and leave the animals to decay. One attack by the Sioux killed an entire troop of eighty Army soldiers. The Cheyenne tore up rails, pulled down telegraph wires and when the oncoming train derailed, they looted the cars. But their attempts to stop the progress were doomed to fail. General Sherman, angered by these attacks, dispatched cavalry units to guard the Union Pacific workers. Sherman stated, “The more we can kill this year, the less will have to be killed in the next war, for the more I see of these Indians the more convinced I am that they all have to be killed or be maintained as a species of paupers.”

With the presence of the Army, the Indian raids decreased. The Union Pacific had increased its pace as it moved across the Wyoming desert.

In 78 working days between July and October of 1868, the Casement crews had laid 181 miles of track. Casement directed the work of more than one thousand men. Regardless of the relatively flat desert, that required minimal digging, the workers were faced with several obstacles in accomplishing this feat. The workers endured the intense heat during the day and the cold temperatures at night. Indian raids were a threat to the crews with the need to keep rifles readily available. Providing supplies to the workers was also a burden. The “barren alkali desert . . .” was void of water and vegetation. Water and food had to be brought from the East by railcars and loaded on horse drawn wagons to supply the workers. Timber for the railroad ties

\[210\] Blumberg, 96-98.
\[211\] Ambrose, 274-275.
\[212\] Ambrose, 275.
was transported from the East in the same manner. Durant was concerned that the Central Pacific was gaining ground and could be encroaching on land that could belong to the Union Pacific.

To increase the pace, Durant ordered Dodge to direct his men to work through the bitter winter weather. The workers burned expensive railroad ties to stay warm and fend off frostbite with sub-zero temperatures. Trackmen placed ties and rails on top of ice and snow with no regard for spring thaws. Durant, in his quest to expedite the building of the railroad, called on Mormon leader Brigham Young for assistance. The position of the Latter Day Saints in Utah was confusing. They lay directly in the path of the railroad, and would clearly need to be integrated into the United States. But their religion – especially their stance on polygamy – made them controversial to mainstream Americans. Meanwhile, Mormons themselves were nervous about outsiders, having suffered at the hands of hostile neighbors, which was why they moved to Utah in the first place.

To establish a railroad through the Utah canyons to Salt Lake City, Durant knew he needed more graders to level the rail bed. To secure additional workers, Durant sent two of his managers to Salt Lake City to meet with Brigham Young. Young was receptive to provide men of his faith and signed a contract for $2,125,000. The contract included grading, bridge masonry, and tunneling for all work from Echo Canyon to Ogden. The contract provided paying jobs for farmers who had suffered hardship with crickets and grasshoppers. In addition, the farmers had been plagued for three years with locusts that affected their crops. Young knew the established railroad would increase sales of merchandise and provide a better mode of transportation for converted immigrants to settle in Salt Lake City. Church elders, pleased with the arrival of the railroad, were dismayed when the unruly workman disrupted their Mormon lifestyle. The elders

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213 Blumberg, 119.
214 Bain, 495.
were offended by the cursing, gambling, drinking, and fighting. The Mormons were eager to see the work completed and have the rowdy workers move on.\textsuperscript{215} They had an inducement to support the railroad’s progress, and, unlike the Cheyenne, they knew enough about the power of the United States to realize they could never stop the railroad. In 1868, with work in process, Dodge informed Young that Durant had made the decision to run the railroad around the north side of the lake and not run through Salt Lake City. Young was angered and even denounced Dodge. Dodge did not waver and persuaded Young that this was the best route.\textsuperscript{216} During this same period, Stanford approached Young to contract graders. Stanford, after a few months, convinced Young to sign a contract for the Mormons to build from Ogden west to Monument Point. In November 1868, Stanford moved his headquarters to Salt Lake City to facilitate spying on the Union Pacific.\textsuperscript{217} With the end in sight, both railroads had accelerated their pace to acquire more federal funding for miles of track laid.

Along the north side of the Great Salt Lake, both railroad companies constructed parallel rail beds in sight of each other. The fierce competition between the Chinese and the Irish crews became violent with boulders being rolled at each other.\textsuperscript{218} President, Ulysses S. Grant and Congress were disturbed that the two railroad companies had not selected a meeting point. Huntington and Durant after a lengthy meeting agreed to join tracks on May 10, 1869 at Promontory Summit, Utah.\textsuperscript{219} With all the favorable publicity the Union Pacific had received from the press, Crocker was determined to surpass Jack Casement’s accomplishment of laying

\textsuperscript{215} Blumberg, 125.  
\textsuperscript{216} Ambrose, 286.  
\textsuperscript{217} Ambrose, 290-291.  
\textsuperscript{218} Holbrook, 170.  
\textsuperscript{219} Blumberg, 126-127.
eight miles of track in one day.\textsuperscript{220} Crocker proclaimed that April 28, 1869 would be recognized as “Ten Mile Day.”\textsuperscript{221}

To witness the event of laying ten miles of track in one day, an audience of photographers, reporters, Thomas Durant, Grenville Dodge, Jack Casement, Union Pacific crews, and tourists were in attendance.\textsuperscript{222} At daybreak, 1,200 to 1,400 Chinese in squads began laying track. Horse drawn wagons carried the rails as crews dropped them on the ties. A train hauling more iron was moved forward with a crew unloading 200 tons of iron rails and ten tons of spikes in ten minutes. The ties were hauled in wagons on a parallel route with tools and water delivered in the same manner on the opposite side. By one o’clock the crews stopped for lunch with six miles already completed. A boardinghouse train had arrived at the sight as the white laborers retired to their dinner. The Chinese, carried their lunch with them and dined on the line as they continued to work. By six o’clock in the evening the work stopped for the day. At the end of the day, the Central Pacific had built ten miles, two hundred feet of track. See Figure 3.4 for sign erected. The feat was certified by Union Pacific engineers who measured the length.\textsuperscript{223} One of Crocker’s senior army officers, said, “I never saw such organization as this; it is just like an army marching across over the ground and leaving a track built behind them.”\textsuperscript{224} The Ten Mile Day is an achievement that has never been duplicated. On May 10, 1869, the last rail was placed.

At Promontory Summit the day of the celebration arrived for the entire nation. A crowd of people gathered around the two-rail gap that would join the railroad. The Chinese carried one

\begin{flushleft}
\textsuperscript{220} Bain, 639.
\textsuperscript{221} Blumberg, 128.
\textsuperscript{222} Ambrose, 349.
\textsuperscript{224} Ambrose, 350.
\end{flushleft}
last rail while the Irish crew carried the other rail. The rails were set in place and all the spikes were attached except the last two. After several speeches were given, the time had come that the country was waiting to hear, the telegraph operator tapped out the word “Done.” To send the message at the exact moment, one wire from the eastern line was wrapped around the spike and the other wire from the western overhead line was connected around Stanford’s

Figure 3.4 sign marks all-time record
Blumberg, 129.

silver maul. Governor Stanford and Doc Durant, after placing the spikes into the pre-drilled holes prepared to hit the spikes. Stanford swung first at the gold spike with the maul then Durant raised his hammer and swung at his spike. According to many accounts, it is alleged that both men missed hitting their spikes. Stanford and Durant raised their hammers signaling to the telegraph operator that the work was done. The gold spike was made of 14.03 troy ounces of 17.6 caret gold alloyed with copper and inscribed on the head with the words, “The LAST SPIKE.” The golden spike is now located in the Stanford Family Collection of the Stanford University Museum. See Figure 3.5 for railroad celebration. To celebrate the placement of the last spike, the Central Pacific’s locomotive, Jupiter, and the Union Pacific’s Number 119 faced each other at the last tie. The rival crews complimented each other and Durant shook hands with

225 Bain, 663.
226 Bain, 666.
Stanford and called out, “There is henceforth but one Pacific Railroad in the United States.”

The historic news of this event was published in newspapers all over the country. Especially after the bloodshed of the Civil War, it was refreshing to have a feel-good story of American accomplishment which concentrated on linking the nation together.

Along with the completion of the railroad across the continent, the nation was now connected by telegraph lines. As the last spike was driven in the railroad tie, dispatchers transmitted accounts of the event by Morse code all over the country. Greenville Dodge had the following message transmitted: “To President U. S. Grant: The time to which you have looked interested has today arrived. It is now all rail across the Continent. It gives me great satisfaction that the work was completed during your administration. G. M. Dodge.”

Headlines in newspapers across the nation read: “The Completion of the Pacific Railroad,” *The Charleston*

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228 Blumberg, 139.
229 Bain, 668.
The celebration was heard all over the United States. In San Francisco, two hundred, twenty cannons boomed and in Washington, D. C., a hundred cannons were fired. Even the fragile Liberty Bell in Philadelphia was rung. Fireworks, sirens, and steam whistles were sounded from New Orleans to Richmond. In Chicago, one hundred thousand people celebrated with a parade eight miles long. The Transcontinental Railroad had a dramatic impact on the development and growth of America.

In the following chapter, I will detail the evolution of the railroad from the completion of the Transcontinental Railroad to the present. It will include: the times of railroad prosperity, a period of decline, and delve into the future of the railroad.

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231 Ambrose, 366.
Chapter 4:
THE PROGRESSION OF RAILROADS AND THE INFLUENCE OF
HIGH-SPEED RAIL IN THE UNITED STATES

This chapter analyzes how railroad growth after the completion of the Transcontinental Railroad influenced American culture. Revisiting some of the events discussed in chapter 1, I will describe how the needs, wants, and desires of Americans evolved with the increasing population in the United States. In this chapter, I will discuss some of the railroad changes that occurred in this country over the past 150 years. For example, to meet the larger needs of Americans, coal-burning steam locomotives, were eventually phased out. This stemmed from the desire for cleaner locomotives, and can be seen as an environmental shift. The introduction of diesel, electric, and diesel-electric locomotives all filled this need. Railroads continue to respond to public sentiment today. Since highway congestion has significantly increased over the past 50 years, interest has been spurred to construct high-speed railroads in the United States. Many Americans look at high-speed networks in Europe and Asia with envy, seeing a domestic version of these fast, efficient, clean trains as an answer to traffic problems which seem to have no end. Riding in comfort which was introduced in the 1860s with the Pullman cars is still an important demand today.

George Pullman, who developed the Pullman coach, revolutionized overnight travel on the American railroads. To ensure that the luxury built into these cars remained, Pullman retained control of these cars through the manufacturing process. Cars which bore his name therefore had a guaranteed level of comfort. In 1865, Pullman designed the Pioneer coach at a production cost of $20,000. Subsequent models were even more expensive to produce as compared to previous coaches that cost no more than $5,000 to build. But the Pullman reputation was unbeatable. The Pullman sleeping car became the American standard and lasted into the
second half of the twentieth century. With this new taste of luxury, the Pullman Company grew rapidly in the 1870s and 1880s, expanding business and taking over competitors. The Pullman cars filled a desire for Americans by providing more personal services and comfort when traveling. The Pullman brand became the industry standard, even surviving massive labor unrest. When Americans traveled overnight, they did it in Pullman cars. See Figure 4.1 and 4.2 for pictures of a Pullman car.

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Figure 4.1 Interior of Sunbeam Pullman Car at Hildene
 Courtesy of Hildene—The Lincoln Family Home photographed by Jeffrey R. Long

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234 Wolmar, 187.
Between 1860 and 1890, more than nine million Europeans came to the United States. Often enticed by pamphlets advertising land and job opportunities, these immigrants, along with many American-born easterners, showed a desire to move West to the open frontier. With the joining of the railroads at Promontory Summit, travel to the new frontier was a safer and less tiring journey by rail. Conestoga Wagons were no longer required. This period was very profitable for the railroads. They, profited from the sale of lands along the railroad tracks and earned money from increased volume of freight and passenger service.235 With roads and road transportation still in a primitive state, more track and branch lines were laid to accommodate freight and passenger movement to outlying communities. Railroads, not highways, represented the pinnacle of technologically advanced transportation. After the end of the Civil War, industrialization started to attract vast numbers of workers to the cities, with railroad commuters

becoming more prominent. It became feasible to live near a city and take a train into work. This contributed to a differentiation in class, with blue-collar employees riding earlier trains, to accommodate their longer hours and white-collar staff riding trains at a later time. The social climate differed on these trains. To satisfy affluent riders, trains, for an extra fee, provided club cars with comfortable seating, a bar, and card tables. These club cars were accessed by invitation only. To satisfy the dramatic demand for transporting supplies and people by rail, larger and heavier locomotives were built that could pull more cars.

Prior to World War I, the phrase “Golden Age” was very prevalent with everything related to trains and everyone transported by the railroad. In 1903, the New York Central began rebuilding the train station in New York City. The station, designed to accommodate 100 million travelers a year, opened in 1913 as the “world’s grandest terminal.” The passenger numbers peaked in 1946 at 65 million with a decline to 40 million travelers a year in 1977. In 1917, with the start of American involvement in World War I, the Baltimore and Ohio Railroad (B&O) provided extensive transportation for the military cause. Located along a major seaport, the B&O Railroad hauled war materials to be shipped overseas. Hundreds of thousands of tons of freight were transported within the country to be shipped overseas. This included moving raw materials and products to and from factories for military and civilian use. People also moved by rail. The B&O Railroad transported over a million army inductees to three of the largest training camps located on B&O Railroad lines. The First World War was therefore a pivotal time for

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236 Wolmar, 211.
238 Ogburn, 166.
American railroads. Profitability continued during the Roaring Twenties, but there were some problems on the horizon.

During the Great Depression, many railroads encountered serious financial trouble. In the four years before the stock market crash, the Pennsylvania Railroad had passenger revenue losses of some $15 million. To fend off their revenue losses, the Pennsylvania Railroad, together, with a New York investment group, incorporated Transcontinental Air Transport, Inc. and also invested in several trucking firms.240 In Baltimore, the B&O Railroad was able to hold its own and introduced the first air-conditioned car in 1930.241 As previously mentioned in chapter 1, the Burlington & Quincy Railroad in 1934, built a stainless steel, three-car articulated unit called the Pioneer Zephyr. This streamlined train, with its sleek lines, was powered by a diesel-electric locomotive. The style of this train was an immediate success, drawing the public’s attention to a new era.242 This stylish look with the ability for long-distance runs at higher speeds was just what the country needed to jump-start the economy.

With the onset of World War II, the Depression gave way to another war economy. This time, the railroads were better prepared than they were during World War I. In World War II the railroads had less rolling stock, but larger and more powerful locomotives that could travel at higher speeds, as well as more passenger cars. The size of the military deployment in World War II was unprecedented in the nation’s history. Inductees came to more than 10 million as compared to 3.8 million in World War I. Travel by troops within the United States was extensive, with transports to induction stations, basic training, specialized training, and to ports

240 Yenne, 227.
241 Yenne, 35.
for overseas deployment. Most of this travel was by rail. Remember that the interstate highway system was a post-war development. Railroads still represented the most modern and fastest method for moving freight and people on a massive scale. Along with transport of troops, the railroads moved tanks, trucks, jeeps, and all types of artillery supplies. See Figure 4.3 for picture of American supply train on the Pennsylvania Railroad’s 1943 calendar.

![Figure 4.3 Pennsylvania Railroad 1943 Calendar of a Supply Train](image)

Ogburn, 141.

During the war, railroads were carrying raw materials to factories that were converted to making military supplies along with delivering finished goods to overseas ports. The two-front war enabled railroads to transport food, materials, and supplies to both the east and west coast ports involving much of the rail service across the country. After the end of World War II, with manufacturing returning to domestic production, railroad companies were optimistic they could

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rebound from their pre-war decline. Railroads were operating at a high point and thought that the future was bright. But developments such as the interstate highway system and better air travel meant that the railroads would face competition like never before.

To better understand the plight of railroads in the United States, it is important to understand the decline of passenger rail service that started 60 years ago. During the 1950s, under the Eisenhower administration, the focus was on developing an interstate highway system. With automobile transportation becoming more popular, the limited access interstate highways accommodated the needs of Americans traveling less than 300 miles. Air travel also, created competition for the rail passenger service. This was unlike in the early history of America, when there was government funding for the railroads to acquire land and tax incentives for private businesses. This time, railroads were on their own. By the 1960s, private rail companies in the United States struggled financially to stay in business. These companies wanted to be released of their unprofitable passenger service.

In the late 1950s, rail freight dropped sharply, due in part to the recession of 1957-1958. With the birth of the interstate highway system, more freight was being shipped by trucks that could provide door to door service. In the 1960s, high labor costs on passenger trains led passengers to find alternate modes of travel. A flight from Chicago to Denver on a Boeing 727 with a six-member crew had a labor cost of $391. Between the same cities, the California Zephyr with a crew of 47 had a labor cost of $2,288. The airline made a profit of $943, while the Zephyr had a loss of $334 for the same trip. With lost revenues on many of the railroads in the 1960s, mergers became prominent with the New York Central and the Pennsylvania Railroad being the

largest of these mergers.\textsuperscript{246} Forming the new huge Penn Central system did not solve their financial issues. Both railroads wanted to follow their old rules and use their own signal and computer systems, but these were not compatible, causing lost waybills, lost freight shipments, and even one lost train. By early 1970, Penn Central was losing one million dollars a day. In June of that year, Penn Central filed for bankruptcy, this being one of the largest business failures in United States history.\textsuperscript{247}

To maintain freight service in the northeast region, a large conglomerate of seven bankrupt railroads was composed under the Regional Rail Reorganization Act of 1973. The group centered around the Penn Central and included the Erie, the Lackawanna, and the Lehigh Valley, all renamed and called Conrail. In the beginning, Conrail lost billions of dollars, crucially needing a legislative change to save the freight lines. To the rescue came, the Staggers Act. This law was passed by Congress in 1980, deregulating the rail industry by repealing legislation that had created the Interstate Commerce Commission. Finally, the railroads could set their own rates for freight, which meant they could make improvements and earn a reasonable rate of return.\textsuperscript{248} The newly merged railroads included; Conrail, Burlington Northern, CSX, Norfolk Southern, and Union Pacific, all reducing their rail mileage by eliminating parallel or duplicate rail lines.\textsuperscript{249} After all the mergers and reduction in overhead, prosperity had returned to the American railroad with the passing of the Staggers Act.

To solve the dilemma with passenger service, the United States Congress passed the Rail Passenger Service Act of 1970. With this act, the National Railroad Passenger Corporation was formed, named Amtrak, which began service in 1971. Amtrak is a contraction for “American

\begin{flushleft}
\textsuperscript{246} Stover, 233.
\textsuperscript{247} Stover, 234.
\textsuperscript{248} Wolmar, 348.
\textsuperscript{249} Stover, 247.
\end{flushleft}
travel on track.” 250 By the mid-1970s, Amtrak was not living up to its first slogan, “We’re making the trains worth traveling again.” The trains were run haphazardly, with crew in all kinds of random uniforms and cars in such poor condition that they were labeled rolling junk boxes. 251

In 1975, with Paul Reistrup as president of Amtrak, they acquired, the multi-track line which improved travel from Washington, D. C. to Boston, buying it from the defunct Penn Central and New Haven Railroads. 252

In the 1970s, the United States Department of Transportation developed a plan for a more practical train called the “Metroliner.” Estler noted, “A consortium of Westinghouse, General Electric, the Budd Company, and the Pennsylvania Railroad joined forces to create a fleet of fifty stainless steel railcar units.” 253 The Metroliner was the first train used by Amtrak and by 1983 was capable of a speed of 124 mph. This marked a real improvement in passenger rail speed. Satisfying a desire for rail travel within the most densely populated area in the United States, from Washington, D. C. to Boston, the Metroliner fulfilled the initial need. To improve rail passenger travel in this densely populated area, referred to as the Northeast Corridor, the “Northeast High Speed Rail Improvement Project” was established. Improvements to the rail and infrastructure were implemented to correct maintenance deficiencies. One of the projects was to install overhead catenary wires from New Haven, Connecticut to Boston to increase speed and improve travel time. First, it is important to understand the definition of high-speed rail (HSR).

High-speed rail has been viewed as a modern-day revolution in transportation technology. HSR is a railway designed to attain speeds higher than 155 miles-per-hour. In most cases, the construction of a dedicated rail bed and rail placement is necessitated. In 1964, Japan

251 Wolmar, 343.
252 Stover, 237.
253 Estler, 139.
was the first country to develop and place into service a high-speed rail (*Shinkansen*) between Tokyo and Osaka. The introduction of high-speed rail was not only a celebrated achievement for post-war Japan, it was a landmark in passenger rail transportation.\textsuperscript{254} From the inception, *Shinkansen* made Japan one of the leading HSR countries in the world. *Shinkansen* means “New Branch Line” in Japanese. Throughout the world, high-speed trains are commonly referred to as bullet trains.\textsuperscript{255} Along with Japan, the top five countries in the world with miles of operating HSR include: China, Spain, France, and Germany. Travelers to these nations invariably return full of praise for the ease and efficiency of these trains. With almost every wealthy nation in the world investing in HSR, the United States is far behind, well in the distance. In this chapter, I will describe the reluctance of Americans to invest billions of dollars in order to provide a faster means of travel. (My father was a valuable resource, assisting me with some of the engineering technology involved). High-speed trains (HST) must take into consideration many engineering changes that are not required on conventional trains. A few of the modifications include: aerodynamics in the design, improved braking systems, and suspension systems that allow the train to tilt when traveling around curves. It is important to consider these trains, not as throwbacks, but as hypermodern transportation technology. However, it is important to first look at the infrastructure that is required to enable trains to safely and efficiently attain higher speeds.

Along with high-speed rail the need for an improved track design is vital. In many countries, HSR shares the rail with conventional tracks, allowing high-speed trains to travel to their destination in the inner city. The construction of the rail bed consists of a substructure and a superstructure. In the substructure, fine-packed material is graded to provide a firm base. The


\textsuperscript{255} Albalate, 35.
superstructure consists of several components with the first being large crushed stone called ballast, to distribute the load and provide proper drainage. The ballast has a deeper-than-normal profile to dampen the high-speed motion. Then the sleepers or ties are firmly placed on the ballast with a closer spacing between the sleepers then conventional tracks. The sleepers are constructed of concrete either mono- or bio-bloc with two blocks joined by a steel bar. To hold the rails in place on the sleepers, fasteners are attached. The fasteners maintain the track gauge and resist movement in a lateral, longitudinal, and vertical direction. For a more comfortable ride, the rails are usually continuously welded.\textsuperscript{256} With higher speeds, the vibration on trains increases due to the vibration between the wheels and the rails. Continuously welded rails and lighter weight construction reduce wear on the tracks.\textsuperscript{257} To accommodate higher speeds, the radii on the curves have increased from 2.5 miles to over 4 miles allowing for future increases in speed.\textsuperscript{258}

As an alternative to HST using tracks, a few countries are using magnetic levitation which is also referred to as MagLev. With MagLev, the train does not actually touch the track as it moves along. The train instead floats in a magnetic field about one-quarter of an inch above the rail with the dynamics of this technology.\textsuperscript{259} Obviously, this is a very advanced method. It reduces friction, of course, and offers an enticing future of rail possibilities. Construction of all kinds of HST is considerably different from construction of conventional trains.

To improve efficiency of HST, they are designed using lighter materials. Instead of the rolling stock being mounted on a steel chassis, the steel is rolled into thin sheets and the seams

\textsuperscript{257} Holly Cefrey, \textit{High Speed Trains: Built For Speed}. (New York: Children’s Press, A Division of Grolier Publishing, 2001), 25
\textsuperscript{258} Tzanakakis, 385.
\textsuperscript{259} Colin Uttley, \textit{Inside A High-Speed Train}. (Danbury, CT: Grolier Educational, 2001), 28.
welded together similar to current automobile construction. To reduce the weight even further, some trains are constructed with aluminum. The bogies or sets of wheels are attached directly to the undercarriage of the train. To provide a smooth ride on HSTs, special suspension is needed. With increased speeds, the tendency is for the wheels on the bogies to vibrate and literally bounce on the rails. This vibration creates flat spots on the wheels causing premature wear. To correct this issue, instead of using a coiled spring over each wheel, a damper is designed to rebound at a higher speed to absorb the vibration energy. Installing the damper on each wheel cushions the vibration providing a smoother ride. Incorporating such technologies, in November 2000, a new high-speed Amtrak train, Acela, made its maiden journey from Washington, D. C. to Boston. See **Figure 4.4** with picture of Acela.

The *Acela* is powered by two 5997 hp power cars, and six coaches in between. As one observer notes, “The large windows, excellent interior lighting, spacious, attractive restrooms, electrical outlets at every seat . . . created a profound impression on passengers.”

![Figure 4.4 The Acela](image)

**Figure 4.4 The Acela**


The *Acela* provides the impression of floating at speeds up to 149 mph in the quiet intermediate cars. *Acela* incorporates a tilting system that is fully operational at speeds above 62 mph.261 In

260 Uttley, 24.
261 Estler, 141.
the first quarter of 2004, Amtrak handled 61 percent of rail and air travelers on the Northeast Corridor. The *Acela* still has to deal with issues like the 100-year-old tunnel in Baltimore that slows the trip from Washington to New York. “A major setback occurred in spring 2005, when Amtrak had to take its entire fleet of *Acela Express* trains out of service on April 15, after hairline cracks were observed in the disc brakes of some cars. The hairline cracks were caused by vibration and material fatigue. Slower Metroliners and other regional trains ran as replacements.” With the installation of new brake discs, all twenty *Acela* units were back in service by September 2005. Magnetic levitation, or Maglev, as mentioned previously in this paper can take HSR to speeds never before imagined, and might avoid such breakdown problems thanks to the lack of contact between wheel and rail.

With Maglev, a train is able to lift above the track with the use of magnets. The train is able to float about one quarter of an inch above the rail without the need for wheels. Therefore, it eliminates friction losses from wheel contact and provides a smoother ride with no vibration on the wheels. Maglev trains require no engines, and do not burn fuel. They are magnetically propelled by electric power provided by coils positioned on the u-shaped guideway. Maglev allows the trains to accelerate and decelerate faster than conventional trains. Currently, speeds are limited to about 250 mph due to high air resistance. Maglev is an efficient long lasting mode of transportation. “Maglev guideways will last for 50 years or more with minimal maintenance, because there is no mechanical contact and wear, and because the vehicle loads are uniformly

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262 Estler, 142.
264 Estler, 142.
265 Estler, 142.
266 Uttley, 28.
distributed, rather than concentrated at wheels.” Maglev has several safety advantages. The vehicles are controlled electronically with automatic systems to prevent collisions. They are able to stop faster than rail trains and traveling on an elevated guideway, prevents the chance of collisions with automobiles. The United States, with its problems building HSR systems, is not currently ready for Maglev. It is still considered futuristic, but other countries are moving ahead with the technology. In the United States, Texas and California are the two primary states that are seriously considering building a high-speed rail system.

Business-friendly Texas is probably the most promising, to be the first to finish building a HSR system. There are several factors that contribute to the choice of a HSR line between Houston and Dallas-Fort Worth metropolitan areas. One of the prime aspects is that Houston and Dallas-Fort Worth had one of the fastest-growing populations nationally in 2013. The terrain between the two cities is relatively flat and uninhabited. Real estate is reasonably inexpensive. Air travel between these two metro regions has some of the highest volumes in the United States. Also, the distance between the two cities is about 230 miles which is considered an ideal length for operating a bullet train. Added to the fact that Texas is innovative and cooperative with industry, it is likely that Texas will see the first American HST system.

In an article by Dug Begley, of the Houston Chronicle, Texas Central Partners, a private railroad company, is planning on a 2021 completion date of the Houston to Dallas-Fort Worth high-speed corridor. Tim Keith, CEO of Texas Central Partners, stated that the company remains confident of an expected construction start in 2017. The proposed HST is planning to have

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268 Powell, 1.
“trains leaving every 30 minutes and making the trip between the two metro areas in 90 minutes.”

Anyone who has driven or flown between these cities would consider that a vast improvement. The rail line cost is expected to cost more than $10 billion. Final costs could be higher, dependent on land acquisitions, engineering costs, and the number of concrete viaducts for elevated crossings. Authorization by the Federal Railroad Administration is required before any construction can begin. This HST project is being funded by Texas Central, along with financing through Japan’s international bank, with no state funding anticipated.

Tim Keith projects this plan will be a boost for the Texas economy. The Texas Central project would mean billions of dollars in construction spending and job creation. Being privately owned, means it would bring in permanent tax revenue at the local and state levels.

Opposition to the plan has been raised by 33 local and state officials. Among their complaints is opposition to Japanese involvement. Members of the Texans Against High-Speed Rail group have written to Japanese Ambassador Kenichiro Sasae in Washington, D.C. to try and block the project. This group is against the use of the Japanese N700 Series Shinkansen train. The letter states, “Through their recently formed U.S. companies, the HSR project would unjustly take private property for the ultimate benefit of a foreign company.”

See Figure 4.5 for picture of N700 Japanese HST.

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271 Begley.
When Southwest Airlines was asked their opinion of the proposed high-speed rail line, they commented that they were diverse enough that it would not be a threat to their business. In fact, Southwest, which used to advertise itself as ‘The National Airline of Texas,’ is now an international carrier. In a letter, the mayors of Houston, Dallas and Fort Worth endorsed the project stating; “As Texans, we take great pride in blazing a path for the rest of the country to follow, [t]his project will do just that.” Additional groups oppose high-speed rail in Texas. An article in The Texas Tribune stated, “The resistance to public financing is widespread enough that a plank in the Texas Republican Party’s 2014 platform specifically rejects using gas tax revenue to support ‘mass transit, rail and bicycle paths,’ or anything else that is not highway construction.” In Grimes County, officials and residents are against the Texas Central Railway, fearing adverse environmental impact. Residents are concerned about the HSR splitting up their farm and ranch land. In a statement from Texas Central Railway, they have committed to reduce adverse impact from the project. Texas Central has agreed to treat landowners and communities fairly and with respect. With President Obama allocating funds and striving to improve the transportation system in the United States, is this opposition justified or is this more of a political ploy in Congress? The Republican

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274 Batheja, 5.
275 Batheja, 7.
opposition has delayed construction of the HSR while traffic congestion is increasing and construction costs are escalating. The second area of consideration for HSR is California.

In California, despite opposition and delays, construction has begun on a high-speed rail system from Los Angeles to San Francisco. California Governor Jerry Brown is a strong advocate of this high-speed corridor. The proposed financing for this project, utilizing state funding, has raised opposition on many fronts and generated a lawsuit. On July 31, 2013, an appeals court threw out the earlier ruling to bar state bond funding for this project. Funding for the HSR project is proposed to come from the state’s cap-and-trade program that imposes charges on industries for excess pollution. Concerns have risen on the escalating cost on the construction of the high-speed rail infrastructure. The estimated cost for phase I that would involve the section of rail between San Francisco and Anaheim has risen from $35.7 billion in 2008 to $65-74 billion in 2012. These estimates were issued by the California High-Speed Rail Authority and are comparable to the highest costs in Europe. Funding for the HSR corridor from Los Angeles to San Francisco is the major obstacle. California Republican Representative Jeff Denham, a chairman of the U. S. House Transportation subcommittee on railroads, commented that the state should not be in the railroad business. “It is doomed to be a failure,” Denham added. Vartabedian stated, “California has always had the philosophy of build it and they will come. That is no way to run a business.” In California’s Central Valley, more than 100 miles of construction on the high-speed rail system is underway. The California High-Speed Rail Authority, encountering high construction costs and political opposition in Southern

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\[\text{Nixon, 3.}\]
\[\text{Albalate, 16.}\]
\[\text{California High-Speed Rail Authority. Newsletter Jan 19, 2016.}\]
California, has reversed its construction plan. The first 250-mile section of HSR will be constructed in the northern section from Kern County line to San Jose. This reversal announced on February 18, 2016 is disheartening for Southern California, but officials said about $4 billion will be spent to improve the rail corridor infrastructure between Burbank and Anaheim. The Draft 2016 Business Plan issued on February 18, 2016 is a foundational document that reflects the transition from planning to construction to providing passenger service. This plan will reduce capital costs from $67.6 billion to $64.2 billion. With construction underway, construction of the HSR line between Silicon Valley and Central Valley will be complete by 2024, with passenger service beginning in 2025. The announcement of the Draft 2016 Business Plan is a game changer. Currently it takes three to four hours to drive from Fresno to the Silicon Valley, with very heavy traffic. With HSR, the distance would take about 45 minutes creating tremendous opportunities for Fresno entrepreneurs. Despite the opposition to proceed with this project, there are several benefits with HSR in California. Environmentally, this project would reduce air pollution and smog, along with reducing our dependence on foreign oil imports. HSR would improve travel time and improved transportation would foster business growth in metropolitan areas. For HSR systems to be successful in the United States, they must be able to compete with two effective existing alternative modes: private automobile travel and air transportation.

284 Albalate, 16.
Regardless of the staggering cost of HSR, it is estimated that about $140 billion is lost annually, due to traffic congestion on the freeway. This congestion equates to lost time and frustration.

After sending out a questionnaire to people who have worked on the railroad, ridden HSR, or are involved in construction of HSR in the United States, I received the following responses. Responding to my questionnaire, Amy MacPherson, public relations for California High-Speed Rail Authority, provided information on HSR and what is happening in California. MacPherson stated that the future of passenger rail in the United States will be HSR. “Americans want – and need – a faster, greener, more convenient way to travel.” MacPherson responded to the question on the future of HSR in America with, “In California, more than 100 miles of construction on the first high-speed rail system in the U.S. is already underway in the Central Valley.” She believes that, “Energy efficient systems, like the one we are building in California, will help fight climate change by significantly reducing emissions.”

In response to a questionnaire on train experiences, I received the following comments from John Thompson, Jr. who has ridden trains on many occasions. When asked if he had ever traveled on the Acela he responded, “no,” but Mr. Thompson recalled a trip about five years ago in China. He details the ride on a high-speed maglev train from Beijing to the airport. The trip was approximately 50 miles that only took 20 minutes. During the trip, the train reached speeds of 230 mph. He was impressed by the very comfortable ride, including the smooth starts and stops. As the maglev train started moving, he could feel the train lift slightly off the rail and the sensation of floating. He commented, “The view out the windows was great with no blurring or motion sickness due to a special type of glass at the windows.” Mr. Thompson said, “The ride

286 Smith, 3.
287 Amy MacPherson, California High-Speed Rail Authority, response to a railroad questionnaire by Jeffrey Long. Amy.MacPherson@hsr.ca.gov, January 19, 2016.
288 MacPherson.
was very quiet, except for the loud ‘whoosh’ when another maglev train passed.” He would ride another maglev train if the opportunity arose.\textsuperscript{289}

Also in response to my questionnaire, Dan Cupper, engineer for Norfolk Southern and author, stated that the most significant change he has witnessed in the past ten years is the Federal Hours of Service Law for T & E (train and engine) employees. Cupper commented, “It used to mandate eight hours of rest between assignments, with the railroad able to call you at the sixth hour to be ready for duty at the eighth hour. This was . . . exhausting if kept up for day after day after day. Then the law changed to ‘10-for-12,’ meaning that an employee is guaranteed 10 hours of undisturbed rest and can be called back to work in 12 hours.”\textsuperscript{290} In Cupper’s answer about the future in the United States, he believes that highway and airline lobbies are too adamantly against it. The Amtrak Acela in the Northeast Corridor is only capable of speeds up to 150 mph for a few miles in Rhode Island. Acela is restricted by sharing its right-of-way with Amtrak trains, commuter trains, and freight trains. Despite Acela not being a true HST, it still captures a significant part of the passenger market in the Northeast Corridor. Dan Cupper believes that once the first true HSR is completed others will follow, but that may take decades for that to happen.\textsuperscript{291}

John Snyder, a railroad enthusiast and rider of HSR, also, responded to my questionnaire. Snyder has ridden HSR both in Europe and one time on the Acela. In comparison, Snyder found the HSR in France and Germany more pleasant and comfortable to ride. The only experience he had with the Acela was one trip from New York City to Philadelphia. The ride was comfortable and the train was on-time, but Snyder was disappointed with the staff. The attendant repeatedly

\textsuperscript{289} John Thompson, Jr. response to a railroad questionnaire by Jeffrey Long, April 12, 2016.
\textsuperscript{290} Dan Cupper. response to a railroad questionnaire by Jeffrey Long, February 5, 2016.
\textsuperscript{291} Cupper
threatened passengers to be quiet or they would be put off the train at the next stop. Snyder believes the future of HSR in America is very doubtful, with maybe a glimmer of hope for progressive California to develop HSR. John Snyder senses the future of railroads is bright for the transport of container traffic and bulk commodities by rail.²⁹²

At this time, I do not know whether California or Texas will be the first to provide transportation on a HSR system. Despite opposition, both states are pursuing construction plans in earnest. I believe that once landowners are better informed, along with receiving a fair market price for land acquisitions, they will be more receptive to the benefits of HSR. Both HSR companies provide information on their websites to keep the public abreast of their current progress. California High-Speed Rail Authority has provided a slightly quicker response to inquiries than Texas Central Partners. On February 18, 2016, in a bold move, the California High-Speed Rail Authority revealed its draft plan. This draft plan will alter construction location and reduce overall costs. The first objective of their draft plan will concentrate on construction of the HSR between Silicon Valley and Central Valley. This plan will likely generate revenues from the private sector along with the advantage of having over 100 miles of active construction in the Central Valley already proceeding. With the distance of the HSR line being over twice as long in California as the HSR line in Texas it is difficult to predict which will be completed first. In my opinion, I believe with less distance and better terrain Texas Central will be in operation one to two years ahead of California. But the arrival of two HSR systems would generate huge publicity and probably boost prospects for more systems elsewhere in the United States. Perhaps the future of American rail will be bright.

²⁹² John Snyder. response to a railroad questionnaire by Jeffrey Long, January 18, 2016.
CONCLUSION:

The preceding four chapters describe how the railroad contributed to and influenced the United States both economically and culturally. The railroad from the onset has been a symbol of power and strength. This symbol exemplified the development and growth in America by just the sheer size and beauty of the powerful steam locomotives. Post-steam improvements to locomotive technology kept the railroad’s influence high. Over the past 200 years the railroad has undergone many changes which filled vital needs throughout America. From the onset of the steam locomotive, the mode of transportation has dramatically improved in the United States.

Chapter one of my thesis discussed the history of railroads in America. The following is a brief overview of the key points of this chapter. Although the railroad in America started slowly in the 1800s, with developments, the steam locomotive grew rapidly. The early wood burning steam locomotives were soon replaced by coal fired steam locomotives. More powerful steam engines were built to accommodate the added rolling stock they moved, as the steam locomotives became heavier and faster the need for safety features were added. Headlights, bells and whistles, air brakes, and automatic couplers all improved safety for the railroad workers and provided a public awareness for approaching trains. The introduction of the diesel and diesel-electric locomotives that shared the tracks with the steam locomotives created a new dimension in the railroads. America was entering a cultural change with a desire for more attractive passenger cars and sleek, streamlined locomotives. The most negative change in the railroads came in the 1950s. With the onset of the interstate highway system and commercial air travel, the railroads saw a sharp decline in usage. With support from Congress, new federal regulations were enacted to allow railroads to be profitable again. To fill a need for faster and more efficient
transportation, along the northeast corridor, the *Acela* was introduced with ridership rapidly growing.

An additional aim of this thesis was to clarify railroads influence on the Civil War. To recapitulate further, we have seen how, starting with, the introduction of steam locomotives in the United States, railroads grew rapidly as a prime mode of transportation by the 1850s. The Civil War was an opportunity for the railroad to prove its value. Besides transporting soldiers and supplies during the war, the railroad developed unskilled workers into skilled railroad men who could lay track and build bridges. Herman Haupt, was too often overlooked by historians more aware of battlefield officers. In the south, there were able generals, but their military and their railroads lacked a powerful leader. The south had no Herman Haupt, because of the Confederacy’s suspicion about centralization, each state desired to operate independently of the other southern states. Since the Civil War was the first industrialized railroad war ever fought, both the Union and Confederates had no railroad historical writings to reference, so each side was writing new pages in history. The development of railroad timetables was through the effort of on-time deliveries.

Another element reviewed in this thesis was the Transcontinental Railroad. The population growth of America and the desire to move west into the new frontier spurred the development of the Transcontinental Railroad. With the massive task of this project, that was labeled by some as an impossible feat, came the jointure of a nation from coast to coast. To fill the construction labor requirements, men came from Europe and Asia to fill this need. Ethnicity played a role in the Transcontinental Railroad. The influx of workers from other nations diversified the American culture and created technological advancements with the sharing of ideas and labor skills. The completion of the railroad at Promontory Summit was a big event for
the nation. Front-page newspaper headlines raved at the opportunities this new railroad created in America. Even the Liberty Bell in Philadelphia rang. Americans, realized the new possibilities this railroad had created celebrating in all corners of the country. Europeans were enticed with advertisements broadcasting the vast number of jobs and land available across the nation through expanded rail travel.

Railroads have always influenced American culture and life and I believe this trend will continue for decades. The Transcontinental Railroad, complete from coast to coast, made possible enhanced communication with the installation of telegraph lines. Mail delivery service was expedited along rail lines being much faster than the Pony Express. The excitement of riding on trains has encouraged authors to write many books about adventures on trains. Agatha Christie in her mystery series has written *Murder on the Orient Express* and John Godey wrote *The Taking of Pelham One Two Three*. Due to the popularity of these train adventure books, both were made into movies. In the movie *Back to the Future – Part III*, a steam locomotive is converted into a time machine. Even on the popular comedy series, *The Big Bang Theory*, an entire episode was filmed on a train. For children, the creation of Thomas the Tank Engine is a tremendous hit. At the Strasburg Railroad, Thomas makes about four appearances per year attracting hundreds of children. The influence railroads have on Americans is endless.

I believe the popularity of locomotives over the years is due in part to their massive size and the sights and sounds of watching a train go whizzing by. The attraction is hard to detail because it entails many aspects of trains. For some, the sounds of a high pitched whistle blowing as it approaches a railroad crossing or the clickety-clack as the wheels of the rolling stock travel over the rails. For others, it is the sight of their massive size with multiple engines connected in tandem. The enthusiasm of watching and hearing trains is spread across all age groups and from
all different occupations. I have witnessed, at the RRMOP, people sitting at length on one of the benches in the museum just admiring the detail on some of the early steam locomotives. Some of the volunteers at the RRMOP are retired employees of the railroad. These volunteers have held various positions on the railroad and exalt a sense of pride for the railroad and what it represents. With the era of steam locomotives traveling across the country, now history, diesel-electric engines pulling 100 plus freight cars is still enjoyable to view. My father told me a story of a man and his grandson that were parked in their car along a main freight rail line. After seeing the car there for some time, my father asked the man if they were having car trouble. The man commented that he had parked so his grandson could watch the freight trains go by. According to my father, from the enthusiasm in the man’s voice, he believes the man was enjoying watching the trains as much as his grandson.

Predicting the future of railroads is impossible to know for certain, but my guess envisions a bright forthcoming for the railroad industry. In the past twenty years, railroads have rebounded with increased ridership on their passenger trains. There are several factors that have contributed to this increase. The Rail Passenger Service Act of 1970 and the introduction of Amtrak were catalysts that focused on the needs of America. After a bumpy start, Amtrak has seen continuous quality improvement in the service they provide. Enhancements to the rail bed have improved riding comfort for passengers along with the installation of new electronic systems that provide a safe and secure feeling. Commuter trains provide fast and reliable service between many metropolitan areas across the nation. In 2000, the introduction of Acela has filled a need in the northeast corridor. While Acela does not qualify as a high-speed train in the sense of definition, it provides vital transport along the I-95 route from Washington, D.C. to Boston. This rail service has helped to reduce automobile congestion in the densely populated areas of
the I-95 corridor. At present, the two states with the most promise for high-speed rail are Texas and California. I believe that both Texas and California will have HSR operating within the next decade. The question remains which state will be the first to be providing transportation on HSR. Currently high-speed rail has a planned completion of 2021 in Texas and 2024 in California. With California’s proposed plan, they will have over twice the number of miles of track for their HSR and six times more cost as compared to HSR in Texas. I feel confident that Texas will be the first HSR in the United States. The arrival of two HSR systems will generate huge publicity and probably boost prospects for more systems elsewhere in the United States. I was pleased with the number of responses to my questionnaires I mailed or emailed to several persons who either work on or for the railroad, are railroad enthusiasts, or frequently ride on the railroad who provided very valuable insight. Their responses varied on where they thought the future of railroads in the United States is heading and what their thoughts were on the future of high-speed rail. But the conclusion of this thesis rests upon their collective attitudes, which blend optimism and pessimism about the future of railroads in the United States. The majority of the responses were favorable for a bright future for railroads with a little more pessimism on the future of HSR. Several of the responses believed that HSR will happen, but America is not ready for high-speed rail at this time.

In focusing on rail passenger service, rail freight service cannot be overlooked. The passage of the Staggers Act has provided railroads the latitude to enhance their freight service. Improved on time delivery and additional freight cars have made rail freight transportation competitive with over the highway trucking. With an increase in rail transport of container traffic and bulk commodities the future of railroad freight service looks bright.
Regardless of the future of high-speed rail in the United States, railroads will continue to be an iconic fixture. The vision of steam locomotives riding the rails has diminished, but the powerful engines of today will remain and prosper. Railroads fill a transportation need for both passenger and freight. Since volunteering at the RRMOP, I have witnessed children and adults, alike, in awe at the massive size of some of the locomotives. Railroads have shaped the nation, enhanced our culture, and developed industries. Railroads are here to stay.
APPENDIX OF FIGURES

Chapter 1

Figure 1.1 Cutaway of steam locomotive  parks.cityofboise.org/media/6669/Howsteamlocoworks.pdf


Figure 1.3 Brakeman applying link-and-pin  Courtesy of The Railroad Museum of Pennsylvania photograph by Jeffrey R. Long


Figure 1.6 The Pennsy GG-1  Courtesy of The Railroad Museum of Pennsylvania photograph by Jeffrey R. Long

Chapter 2


Figure 2.2 Herman Haupt  U.S. National Archives and Records Administration, College Park, MD: 23 Apr 2014.

Figure 2.3 Railroad bridge  Leavy, Michael. *Railroads of the Civil War: An Illustrated History.* Yardley, PA: Westholme Publishing, LLC, 2010.


Figure 2.5 Hospital railroad locomotive  Hodges, Robert R. Jr.

Figure 2.6 Armored railroad car  Hodges, Robert R. Jr.

Figure 2.7 Armored rail car with cannon  Leavy, Michael.

Chapter 3

Figure 3.1 Theodore Judah  Blumberg, Rhoda. *Full Steam Ahead: The Race to Build a Transcontinental Railroad.* Washington, D.C., National Geographic Society, 1996.

Figure 3.2 Chinese man carrying tea  Yenne, Bill. *The Great Railroads of North America.* Greenwich, CT: Dorset Press, 1992.

Figure 3.3 Chinese workers in woven baskets  Blumberg, Rhoda.

Figure 3.4 Sign marking 10 miles of track laid  Blumberg, Rhoda.

Figure 3.5 Celebration at Promontory Summit  Yenne, Bill.

Chapter 4

Figure 4.1 Interior of Pullman car  Courtesy of Hildene—The Lincoln Family Home photographed by Jeffrey R. Long

Figure 4.2 Exterior of Pullman car  Courtesy of Hildene—The Lincoln Family Home photographed by Jeffrey R. Long


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