Standard Gauge

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"As our frontier moved westward, it was the railroads that bore the great tide of Americans to the areas of new opportunities and hope. It was the railroads that linked together the diverse segments of this vast land so that together they might create the greatest economy the world has known." --- John F. Kennedy[1]

[1] Hallberg, M.C. "RAILROADS IN NORTH AMERICA: Some Historical Facts and An Introduction to an Electronic Database of North American Railroads and Their Evolution. 24 April, 2006. http://www.personal.psu.edu/faculty/m/c/mch/railroad/RAILROAD.DOC

Introduction

In modern society standardization is prevalent in all walks of life, and for most Americans, standards are an unnoticed, unrealized, unappreciated part of their daily lives. For example, when riding on metrorail in the Washington area, few riders take a moment to look up from their Blackberries while boarding the train let alone to think about how standards and the standardization process of the U.S. railways surround them in their daily commute; the average citizen does not notice, care, or think about the train track width. And if their brains do wander down this path, they probably believe, like I did before this project began, that track width is a simple, blatantly obvious, unmentionable given that has been that way forever. However, like many modern standards, the development and implementation of the standard railroad track width was anything but simple, straightforward, and obvious. In fact, as is the case with most U.S. standardization issues and developments, the train width, or standard gauge, as it is defined by train experts, was pushed forth and established by the free hand of the marketplace. The common worker, the businessman, executives, Southerners, Northerners, Presidents, Congressmen, and engineers, all played an important role in the standardization of the U.S. railways over many fanfare filled decades.

In the mid-1800's the development and standardization of the U.S. rail system was extremely market-driven; it came from the people, from the workers, and from the railroad owners – from the bottom up and not without substantial opposition and strife along the way. Simply put, rail standardization was driven by economic forces. To demonstrate just how not top-down the U.S. system of standardization was, as exemplified by the railways, in 1863 President Lincoln dictated a standard gauge of 5

feet. Not only did Congress overturn this edict, but the marketplace, the true driving force, essentially ignored the directive for over 20 years. It was not until the Civil War was dead and gone and Reconstruction was strongly in progress that the issue of commerce and trade between the North and South arose as a driving force behind rail standardization. Before the Civil War, both sides used rail extensively, as it developed independently in the respective regions, but maintained different gauges to prevent unwanted attacks, troop shipments, and supplies from reaching their borders. This project will analyze aspects of gauge standardization with respect to the Civil War and many other facets, to include: the technical reasoning and engineering basis behind standard gauge, the background of the individuals and groups involved in its implementation, the legislation and legal implications of various decisions, the processes and politics surrounding the drive towards standard gauge, the adamant backlash in many regions of the country, and finally the vigorous economic and national bonding benefits of standardizing the railways. The project is an exploration of why "standard gauge", at a unique, specific, and rather odd 4 feet 8.5 inches, is the American standard of today.

Technical Reasoning, Engineering, and Background

To understand how the process of standardization occurred for the American rail system and how the events comprising its background surged to produce today's standard rail width, it is necessary to define important engineering concepts within the realm of rails. Also, understanding the implications of standard gauge is vital to the appreciation of the economic benefits of standardization. As defined by the encyclopedia, "…rail gauge is the distance between the inner sides of the two parallel rails that make up a

railway track. Sixty percent of the world's railways use a gauge of 4 feet 8.5 inches (1435 mm), which is known as the standard or international gauge."[2] Inherent to the definition of gauge is an explanation of its standardized nature on a national and global scale. The last sentence of the passage shows just how standard 4 feet 8.5 inches has become, yet throughout this project, it will be shown that this was not always the case and by no means a foregone engineering conclusion. The defining sentence also subtly shows the globalizing appeal of standardization; with standard gauge a train can pass freely from one country to another without stopping, unloading, regrouping, braking, or re-packing. This improves economic efficiency and cuts costs by making all trips on each line occur more quickly thereby yielding higher product and service exchange between regions. This exchange, in Europe where countries are geographically closer, is strongly spurred by the use of standard gauge, and it yields a strong economic advantage; on a similar scale the standardization engenders similar economic benefits between the United States, Canada, and Mexico as well as among the American states, to the North and South and from coast to coast. Before standard gauge, freight would be loaded into railroad cars at the factory, then moved from one car to another when crossing from one railway to the next. The standard gauge allowed one car to go from origin to final destination without being unloaded.[3] This created an economically lean process for freight travel and provided access to the trade market which would explode across the continent over the next decade.

[2] "Rail Gauge," The Online Encyclopedia, 15 July, 2007. http://en.wikipedia.org/wiki/Rail_gauge
[3] O'hare, Tom. "W&H Main Yards: US Standard Railroad Gauge," 26 July, 2007. http://www.spikesys.com/Trains/st_gauge.html

America has followed the British model for many important aspects of society, such as democracy and the rule of law, and track gauge standardization is no exception and no less important. One train expert writes, "The standard gauge of 4 ft 8.5 in was chosen for the first main-line railway, the Liverpool and Manchester railway, by the British engineer George Stephenson, because it was the de facto standard for the colliery railways where Stephenson had worked. Whatever the origin of the gauge, it seemed to be a satisfactory choice: not too narrow and not too wide."[4] Yet, as noted by another scholar, "Why it (standard gauge) was retained by railroads also seems reasonable. It allowed passenger cars that seated two people in comfort on each side of an aisle wide enough for people to pass. It also permitted the use of freight cars that were large enough to accommodate the size of packages that people could carry in and stack."[5] The authors show that there are many reasons for the basis of gauge selection; there are more examples to follow later in the project, but the reasoning in the aforementioned examples is based on sound engineering, economic principle, and to a limited degree human systems integration of the 19th Century.

To demonstrate the timeframe of the British drive towards standard rail, which set the stage for the American adoption of a similar approach to rail standardization, one author writes, "in 1845 a British royal commission recommended adoption of 4 ft 8.5 inches as standard gauge, and in the following year Parliament passed the Gauge Act, which required the new railways use standard gauge…the last Great Western line was

[4] "Rail Gauge," The Online Encyclopedia, 15 July, 2007. http://en.wikipedia.org/wiki/Rail_gauge
[5] Hallberg, M.C. "RAILROADS IN NORTH AMERICA: Some Historical Facts and An Introduction to an Electronic Database of North American Railroads and Their Evolution. 24 April, 2006. http://www.personal.psu.edu/faculty/m/c/mch/railroad/RAILROAD.DOC

finally converted to standard gauge in 1892."[6] With respect to track standardization, it took Britain over fifty years to accomplish what America did in approximately thirty. This is a specific commentary on the partial fall from power of one great nation which was supplanted by the drive, economic desire, and prowess of a burgeoning United States, and the American train, spurred by standardization, never looked back. Britain set the stage, but the Americans added a modified version of a known success which led to the development of the largest economy the world has ever seen.

It is noteworthy that a wide range of gauges were used in the United States and Canada during the developmental timeframe of the railroad network. The Northeastern railways used standard gauge while other regions used gauges ranging from 4 feet to 6 feet. As described by one author, "…problems began as soon as lines began to meet and in much of the Northeastern United States, standard gauge was adopted. During this timeframe most Southern states used 5 ft gauge. Following the Civil War, trade between the South and North grew and the 'break of gauge' became a major economic nuisance. Competitive pressures had forced the Canadian railways to convert to standard gauge by 1880, and Illinois Central converted its south line to New Orleans to standard gauge in 1881, putting pressure on the southern railways."[7] Business owners, train owners, and government officials pushed for rail standardization to promote free trade during the Reconstruction Era; however, to further explore the standardization issue an exploration of George Stephenson, his approach, and the pressures he faced is necessary.

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[6] "Rail Gauge," The Online Encyclopedia, 15 July, 2007. http://en.wikipedia.org/wiki/Rail_gauge

[7] Hallberg, M.C. "RAILROADS IN NORTH AMERICA: Some Historical Facts and An Introduction to an Electronic Database of North American Railroads and Their Evolution. 24 April, 2006. http://www.personal.psu.edu/faculty/m/c/mch/railroad/RAILROAD.DOC

Stephenson Gauge

There are very few technologies in America's history that can be associated so closely with a single man as the standard gauge can be with George Stephenson. Stephenson was an expert coal engineer who brought the locomotive and its associated pieces, parts, and maintenance practices to England and America in the mid-1830s. He was the father of the Stephenson Gauge which by the end of the 19th Century was adopted by the entire rail network of the United States through force, politics, leadership, and struggle. In describing why the United States adopted a Stephenson or "standard" gauge, one author writes:

> "It was a result of strange twists of fate, money, and politics - and one man was ultimately responsible for the standard - George Stephenson. George grew up in the mining regions of Great Britain, and was the epitome of a self-made man. He was well respected for his knowledge of the mine, the railways used in the mines, and the engines used there as a young man of about 21…Railways existed within mines since at least the mid-1500's, so it is not strange that British mines had railways in 1800. Many different gauges were used, as the railway was not a part of any road or regular transportation system. The railway was meant to make it easier for pulling heavy wagons of ore and coal, and the gauge was placed to fit the mine - some narrow, some wide, some wider still. No standard was necessary."[8]

The last line of this passage shows the thinking of the time. Standardization of the rails was not yet an issue for many reasons: the U.S. rail network did not exist, interstate commerce was essentially non-existent, and each coal mine was different therefore requiring different track gauge to achieve different purposes and accommodate

[8] Hallberg, M.C. "RAILROADS IN NORTH AMERICA: Some Historical Facts and An Introduction to an Electronic Database of North American Railroads and Their Evolution. 24 April, 2006. http://www.personal.psu.edu/faculty/m/c/mch/railroad/RAILROAD.DOC

varying sizes. It made economic and engineering sense during this time that the rail gauge was not standardized. As locomotive development progressed, its early stages did not focus on the issue of standardization because the initial endeavor was small and the idea was new. The developers did not know what they did not know because the technology was not yet there; however, rail technology progressed more quickly in the next few decades, faster than and more impacting than any previous technology, and the country was ready to reap the economic benefits of this technology. For example, "The first rail was laid in the United States in 1828. By 1830, the rail network consisted of just 30 miles. But by 1848, that had grown to nearly 6,000 miles. By 1852, six rail lines had breached the Appalachian Mountains and the first had reached Chicago. By 1860, Chicago boasted service by no fewer than 11 railroads…Spurred by such disparate developments as the California Gold Rush, the Civil War, and exploration of the nation's vast interior, rail construction took on a dizzying pace in the last half of the 19th century, as rail mileage passed 30,000 by 1860, 90,000 by 1880, and 190,000 by the end of the century." [9]

In deciding to push the rails beyond the coal mine, Stephenson used what made sense to him and what he was familiar with. One author writes, "George (Stephenson) had a few mines that he worked on, with railways of at least three different gauges. He chose to place his first 'locomotive' on his railway with a 4 foot 8 inch gauge. It worked, but he learned that moving the rails another half inch apart on his short railway made the

[9] Hallberg, M.C. "RAILROADS IN NORTH AMERICA: Some Historical Facts and An Introduction to an Electronic Database of North American Railroads and Their Evolution. 24 April, 2006. http://www.personal.psu.edu/faculty/m/c/mch/railroad/RAILROAD.DOC

travel easier." [10] This shows the nexus of what became standard gauge in America. An intelligent engineer used his experience to develop a modification, and his motive was strictly engineering-based. He was a pioneer in the development of a previously untapped technology, and he proceeded with what he knew would work and brought his product to a relatively untapped, but strong market, namely America. "The first locomotive planned for use in the U.S. was ordered from George…he sent along his 'standard gauge' locomotive, along with sufficient parts to get a second one constructed in the US - this was the start of the first US locomotive production, in Lowell, Massachusetts…within only two years, the US was in the railroad business at a tremendous rate. Within a few more years, railroads were scattered throughout the US, and of varying gauges, of course. The southern states and California generally used 5 feet as 'standard gauge.' Massachusetts had taken its 4 feet 8 1/2 inch 'standard gauge' to Connecticut, and New York and other northern states generally followed suit."[11] Within a few years, interstate commerce, trade, and the economic benefit of rail technology was realized and standardization became increasingly important. Because Stephenson was respected and his opinion was highly valued, his ideas were used by many in the early stages of train development. For example, "…providing a railway as a public road was proposed, and George had already earned the respect of many, so he was consulted for many of the early railways. He did discuss the potential for other gauges, and his 'standard gauge' was typically used only as a matter of convenience." [12] The

[10] Gabriel, Gabe D. "Railroad Gauge: The Evolution of Railroad Standard Gauge," 26 July, 2007. http://www.discoverlivesteam.com/magazine/34.html

[11] Gabriel, Gabe D. "Railroad Gauge: The Evolution of Railroad Standard Gauge," 26 July, 2007. http://www.discoverlivesteam.com/magazine/34.html

[12] Ibid.

beginning of the railway standardization arose from a matter of convenience; this highlights an important parallel to standardization: when something is standardized it is more convenient and compatible. Also, the new rail companies incurred smaller start-up costs and instituted an efficient business model by adopting the standard gauge. However, "…as the introduction of new railways continued, the educated engineers generally agreed that no railway should be built with less than a 5 foot gauge. Unfortunately, as the politics and arguments began, one thing was certain above all else - George had been the basis for over 1,200 miles of railways! Many times that of any other single gauge in use - and when the fact that it is relatively cheap to 'kick in' the rail from a wider gauge to the Stephenson gauge and very costly do to the opposite...the Stephenson gauge was decided upon…the outcome was obvious before the arguments began, for economic reasons. 'Standard Gauge' became the Stephenson gauge."[13] Convenience, adaptability, and flexibility were important tenets of standardization during the golden era of the railroad, just as they are today.

As one author summarizes, " The success of the Stephenson gauge at becoming the US and British Standard Gauge began as the result of the enthusiasm of George Stephenson, and the tremendous respect he earned from a few early railway builders. This, coupled with the success of this relatively narrow gauge, resulted in the economic decision to make existing lines of narrower gauge rather than going to a larger gauge. This change was made very quickly on some railroads, and at a very low cost."[14] Stephenson was the subject matter expert on railroads at the time; his opinion

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[13] Gabriel, Gabe D. "Railroad Gauge: The Evolution of Railroad Standard Gauge," 26 July, 2007. http://www.discoverlivesteam.com/magazine/34.html

[14] Ibid.

commanded respect and forced companies to adopt the standard gauge of 4 feet 8.5 inches. His product was adaptable, convenient, and most importantly in the world of standardization: established. It remains established to this day as the standard gauge.

Legislation

Although the marketplace was the primary driver for the adoption of standardized rail, the U.S. government played an important role as overseer to the process and financial motivator in the form of bonds. The following is an excerpt from the Pacific Railway Act of 1862, authored during the 2nd session of the 37th U.S. Congress. Section 12 states, "And be it further enacted, that whenever the route of said railroad shall cross the boundary of any state or territory, or said meridian of longitude, the two companies meeting or uniting there shall agree upon its location at that point, with reference to the most direct and practicable through route, and in the case of difference between them as to said location the President of the United States shall determine the said location; the companies named in each state and territory to locate the road across the same between the points so agreed upon, except as herein provided. The track upon the entire line of railroad and branches shall be of uniform width, to be determined by the President of the United States so that, when completed, cars can be run from the Missouri River to the Pacific Coast."[15] The wording of this law shows how important the railways were to the national leadership—to the point where the President, the chief executive, would resolve differences between companies and decide upon the national rail width. Economically

[15] 37th U.S. Congress. "Pacific Railway Act." 1 July, 1862. http://www.loc.gov/rr/program/bib/ourdocs/PacificRail.html

connecting the coasts and unifying the North and South were priorities for the President and establishing a uniform, standardized width was an important aspect of the economic reconstruction plan for the country. The government was so involved because the railway standards would allow access to the market of commerce and trade emerging across the country. According to one scholar, "…there was no overwhelming practical reason for the adoption of the 4-foot 8 1/2-inch gauge in North America…the balance was probably tipped in favor of the narrower gauge by President Lincoln's call, in 1862, for a railroad to link the nation from sea to sea. The resulting road was known as the Union Pacific; legislation enacted in 1864 specified a "standard" 4-foot 8 1/2-inch gauge track. [16] The President was so involved because he wanted to unify the country on as many fronts as possible, and he had the foresight to realize that after the war, America would be one nation again, one nation that would have to compete on the global market, one nation that would need access to a market that only standardization could provide.

One railway expert summarizes, "…as the growth continued, the potential for a major east-west railroad was being discussed. Several routes were planned, and many arguments were heard, and tensions grew between the North and the South. By the time the Pacific Railway Act was passed in 1862, it was obvious that the North exerted more pressure. Although President Lincoln first decreed that the railroad 'standard gauge' was to be 5 feet (the California standard gauge), this was quickly over-ridden by Congress. The more common Union standard gauge of 4 foot, 8 1/2 inches was used, rather than the Southern states 5 foot gauge. Had the Pacific Railway been started many years before, the US would very likely have 5 feet as 'standard gauge'...the Civil War may be accepted as

[16] Nesmith, Achsah. "Long, Arduous March Toward Standardization," Reprinted from Smithsonian Magazine with Permission, 1985. http://www.asme.org/Communities/History/Resources/Long_Arduous_March_Toward.cfm

what settled the issue."[17] To the victors go the spoils and for the South to compete economically and to effectively trade with the North and Mexico, standard gauge was a requirement; it would financially benefit all parties involved. Many Americans opposed the implementation and standardization process due to local issues, initiating a strong backlash, which the next section of the project explores.

Backlash: A Case-study in Failed Opposition

In retrospect it could appear that during the mid to late 1800's many Americans were forward-looking and strategically focused on developing the entire country economically, and to some degree that is one of the main points of this project; however, more so than today, all politics and economics were local, and in making a sound argument, this cannot be ignored. Nationalization and globalization with Europe were of primary importance to the national leaders and urban businessman, especially since the economic benefits of standardizing applied primarily to the improvement of the urban environment and urbanites. However, the rural majority did not necessarily think in terms of unification and globalization. The country, in the grips of a Civil War, only eighty years after its inception, was not the most stable country the world had seen. The average American farmer from the average American small town, presented resistance to rail standardization. For example, as one author notes, "…one of the first serious efforts to bring uniformity to Northern rail gauges in 1853 resulted in bloody riots in places like Erie, Pennsylvania. As a junction point where three different widths of railroad met, Erie citizens stood to lose hundreds of jobs created by the need to load and unload, as well as

[17] Gabriel, Gabe D. "Railroad Gauge: The Evolution of Railroad Standard Gauge," 26 July, 2007. http://www.discoverlivesteam.com/magazine/34.html

jack up, all the arriving car in order to change their wheels. With so much well-paid work to lose, city officials refused to grant the railroads the right to close streets and bridges while the track-width changes were made, and the governor of Pennsylvania backed them. Families and even church congregations split into factions over the issue. At one point, a mob of women took sledgehammers and were tearing up the various tracks until federal marshals moved in."[18] But even in the midst of turmoil and opposition on the part of many citizens, the benefit of standardization reared its head and eventually convinced enough people within the marketplace that it was the right financial choice for the country and for an individual in the long run. Consider the following example:

> "The Sandersville Railroad was built in the 1890s by citizens who wanted to link their central Georgia town with neighboring Tennille, three miles away, and by way of Tennille's main-line railroad, with the world. When the little railroad came on hard times in 1916, the surviving owners turned to an up-and-coming young man named Ben J. Tarbutton and made him an offer. If he could restore its profitability, ensuring the town continued service, he could buy the railroad at a reasonable price. Tarbutton had no railroad experience, but he was single and eager to move around, so he agreed to try. Soon he had put the Sandersville back in the black, cheerfully tooting between the two towns with three round trips a day, and the railroad was his. As its president, he eagerly wrote the president of the Pennsylvania Railroad offering to exchange passes, a common practice among railroad officials in that day. The Northerner refused, noting acidly that the Pennsylvania had thousands of miles of track connecting major cities while all three miles of Sandersville track were within Washington County. 'It is true that my railroad may not be as long as yours,' Tarbutton is said to have replied, 'but it, sir, is just as wide.'" [19]

This amazing story shows the appeal of the standard gauge; to think that North and South, small and large, and rich and poor could now be united

[18] Nesmith, Achsah. "Long, Arduous March Toward Standardization," Reprinted from Smithsonian Magazine with Permission, 1985. http://www.asme.org/Communities/History/Resources/Long_Arduous_March_Toward.cfm
[19] Ibid.

through smooth rail travel was a new idea that standardization made possible. Access to the budding interstate commerce market was made possible through standard gauge. As a corollary to the anecdotal evidence above, the author also writes, "Tarbutton's sons, Ben Jr. and Hugh, still run the profitable little railroad. The fact that it was and still is the same width as the Pennsylvania came about through one of the most dramatic instances of mass standardization that ever took place. During two spring days in 1886, the rails were moved on more than 11,000 miles of track stretching from Virginia to Florida and Texas. When the great shift was over, trains could travel from the South to the North or the West without much of the time-consuming transfers of passengers and changing of wheels at connecting points that had gone on before. By Wednesday morning, June 2, 1886, the South's rails at last matched the gauge used by the mighty Pennsylvania."[20] Such a coordinated undertaking, which took over four months to plan and execute, was performed in the name of standardization to promote commerce and trade across the borders of all American states. The following section is an in-depth analysis of the "day they changed the gauge" with a focus on how the change reflected an economic and societal shift towards standardization once a significant majority observed the financial benefit.

The Day They Changed the Gauge

Standardization was quickly becoming essential to strong commerce in America, and the occurrence of the changing of the gauge in the South shows how important

[20] Nesmith, Achsah**. "**Long, Arduous March Toward Standardization," Reprinted from Smithsonian Magazine with Permission, 1985. http://www.asme.org/Communities/History/Resources/Long_Arduous_March_Toward.cfm

standard gauge was becoming to the American rail community and the American economy. Merely taking the time to plan this major event and pay thousands of workers more money than normal in the name of standardization shows the direction the country was heading. According to one source, "…the great day in 1886 when Southern rails were uniformly moved to conform to the narrower gauge of the Pennsylvania was a delayed Civil War victory for the North. One of the first railroads in the country, the South Carolina, which ran from Charleston to Hamburg, had 136 miles of track by 1833. That made it the longest railroad in the world. It was originally built to a 5-foot gauge and railroad builders all over the South followed suit. Meanwhile, in the North, the majority of railroad tracks were built to a 'standard' width which actually ranged from 4 feet 8 1/2 inches to 4 feet 10 inches, but some tracks were even wider than that. The Erie, for example, stretched a full 6 feet between the rails."[21] The marketplace advanced the idea that one region, North or South, had to modify their gauge, and the North, in victory, maintained their tracks at Stephenson gauge and pressured a downtrodden South to change. A few more tangible reasons for the Southern conversion are highlighted below. By 1886 Stephenson gauge, along with 4-foot 9-inch track, dominated the nation, because rolling stock could be used interchangeably on both. Also, the cost of changing wheels and reloading cars weighed heavily on Southern railroads. Early in 1886 they agreed to convert and chose the Pennsylvania's 4-foot 9-inch width.[22] This shows from a logistics perspective how cost, i.e. the marketplace, was the main driver in the decision to use standard gauge.

[21] Nesmith, Achsah. "Long, Arduous March Toward Standardization," Reprinted from Smithsonian Magazine with Permission, 1985. http://www.asme.org/Communities/History/Resources/Long_Arduous_March_Toward.cfm
[22] Ibid.

The following quotation summarizes one of the most eventful days in the history of the U.S. railroad and marks a shift towards unprecedented standardization for the United States of America. "When the day came for moving the rails, crews set out across the South at 3:30 A.M. on Monday, May 31. Passenger trains were placed on special schedules and shippers notified that freight deliveries would be delayed. Georgia had the most track, with 2,413 miles, but according to the *Savannah News* everything went so smoothly that passengers were barely aware of the great rail shift." [23] All in the name of standardization! Another author shows how heavily dependent the South was on standard gauge in order to gain access to the marketplace of commerce and trade. The South needed this access to become a financially stable, viable, and vibrant part of the American economy. In describing the difference in track gauge between the North and South and its economic implications, he writes, " ...in the North, the British example was dominant. It made little difference in the years preceding the War Between the States, since the two regions exchanged few goods requiring rail transportation. But as the south began its recovery from the war, it became readily apparent that complete economic reconstruction would require easy commerce with the rest of the nation-an impossibility so long as differences in gauge existed." [24] Strong commerce required standardization, as it does today. In 1871 the U.S. contained twenty-three different gauges and by June of 1886, in no small part due to the efforts described above, all major railways in America were using approximately the same track width—standard gauge.[25]

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[23] Nesmith, Achsah. "Long, Arduous March Toward Standardization," Reprinted from Smithsonian Magazine with Permission, 1985. http://www.asme.org/Communities/History/Resources/Long_Arduous_March_Toward.cfm

[24] Hallberg, M.C. "RAILROADS IN NORTH AMERICA: Some Historical Facts and An Introduction to an Electronic Database of North American Railroads and Their Evolution. 24 April, 2006. http://www.personal.psu.edu/faculty/m/c/mch/railroad/RAILROAD.DOC

[25] Ibid.

Benefits, Future, and Conclusion

One author suggests, "…further standardization of rail gauges seems likely, as individual countries seek to build inter-operable national networks, and international organizations seek to build macro-regional and continental networks."[26] This quote shows the importance of standardization to the global economy and illustrates the importance of standardization through the looking glass of the rail system. According to another rail expert, "…for railways, collaborating on track gauge standardization made transporting goods more affordable and more convenient." [27] The standard gauge cut across party, national, cultural, and financial lines; it reached across the American North and South, helping to unify a nation and build a global economy, and it continues to allow access to the marketplace by stimulating compatibility, convenience, competitiveness, and a lean business model. A standardized gauge is a necessity for the smooth flow of goods, services, people, and products—as the development of America's rail standards has shown, it is an essential part of a robust, enduring economy, and it will be a staple of America for many years to come.

[26] "Rail Gauge," The Online Encyclopedia, 15 July, 2007. http://en.wikipedia.org/wiki/Rail_gauge

[27] Cody, Marian. "Standard Update: Better Data Through Standards." Summer 1999, Vol. 1, No. 2. http://www.epa.gov/sor/1033summer99.pdf

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