PUBLIC RELATIONS AND TECHNOLOGY:  
THE "STANDARD RAILROAD OF THE WORLD" AND THE CRISIS IN RAILROAD SAFETY, 1897-1916

Mark Aldrich  
Smith College

"SAFETY SIGNALS," announced the Pennsylvania Railroad's page two advertisement in the New York Times for May 19, 1916. The promotion explained that the Pennsylvania had invested $16 million in its signal system on the lines east of Pittsburgh, and went on to claim that "the signals which automatically protect our tracks both day and night . . . constitute only one of the protective measures adopted by this Company." The copy closed with the company's new motto: "Pennsylvania Railroad: The Standard Railroad of the World" (Figure 1).1

The claim that the "Pennsy" was the Standard Railroad of the World was something more than just advertising puffery; the company's managers really did believe they set the standards for rail travel. The Pennsylvania was the largest railroad in the world; in 1916 it carried 2.7 billion passenger miles or nearly eight percent of the U.S. total and 10 percent of all freight ton-miles as
The company was also technically progressive; in 1874 it had established the first corporate research laboratory in the United States where Yale Ph.D. chemist Charles B. Dudley helped develop quality standards in purchasing and did pioneer investigations into the chemistry of steel rails. The Pennsy also pioneered in locomotive research and its track was laid with heavy rail, purchased according to rigid specifications and maintained to the highest standard.2

The company was proud of its safety record: it had led the way to such safety improvements as automatic freight car couplers and air brakes. It was a powerhouse in obtaining industry-wide rules for shipping hazardous substances. The Pennsy had long featured safety in its promotional literature, along with comfort, speed and reliability. But these new advertisements were far more focused on safety, more detailed and broadly conceived than the traditional approach, and they were clearly goodwill not commercial advertisements. The company had kicked off the new campaign three months earlier with some straight talk: “The prosperity of the Pennsylvania Railroad System is dependent upon the good will of the people it serves,” the advertisement stated, and then it rather plaintively beseeched readers “we only ask that criticism be fair.” In later weeks there followed not only the feature on its signal system but also an announcement that the company had carried 362 million passengers without a fatality in 1914 and 1915. Other advertisements explained its procedures for testing the quality of steel rails, the methods employed to keep the track smooth, and described its system of “efficiency tests” designed to ensure that enginemen obeyed signals.3

This rather extraordinary new emphasis on the Pennsylvania’s safety record in its promotional literature was part of a publicity campaign that had been gathering steam since about 1906. In that year the company engaged as a public relations consultant Ivy Lee—who later became famous as the man responsible for burnishing John D. Rockefeller’s public image. The campaign reflected a new interest in public relations that characterized a number of America’s biggest businesses and it was but one of the Pennsylvania’s responses to a major safety crisis that had overtaken American railroads in the first two decades of the twentieth century.4

An upsurge in accidents after 1896 yielded swelling public criticism of the carriers’ safety record and a burst of proposed regulations on both the state and federal level that threatened fundamental management prerogatives. The Pennsy’s managers understood that the crisis was a matter of both perception and reality, and that company pioneered in the use of public relations to shape
popular perceptions. Other companies followed, and along with substantive changes that reduced accidents, the new railroad publicity campaigns muted public criticism and fought off most safety regulations. To understand this process we need to glimpse the railroad accident problem before World War I. We then detail the carriers’ response focusing primarily on the Pennsylvania by describing its developing public relations activities and its reaction to two accidents in 1912–1913. Finally we end with some broader conclusions about the significance of these events for the safety of the modern world.

![Safety Signals](image)

**FIGURE 1:** This advertisement was part of a large scale publicity campaign by the Pennsylvania Railroad to communicate its commitment to safety. (Source: New York Times, May 19, 1916, 2.)

The Crisis in Railroad Safety: 1897–World War I

Railroad safety been a matter of public concern in America since the first railroads. From the beginning public worries focused on passengers killed or injured in train accidents, although railroad accidents typically killed or injured far more workers, trespassers, citizens at grade crossings and passengers in non-train accidents. Nineteenth-century lines had been flimsy, single-track affairs and they spawned both collisions and derailments by the tens of thousands. Most were not very serious smashups and American—if not foreign—passengers took them in stride. In the 1850s when the Englishman Charles Weld complained that reckless running had caused the train he was on to derail he found that most passengers applauded the crew’s effort to make up time. “Accidents on railways
are thought so little of in America it is useless to remonstrate,” he concluded. But a few were major disasters. On July 17, 1856, a head-on collision on the North Pennsylvania Railroad, a forerunner of the Philadelphia & Reading, near Camp Hill, Pennsylvania took sixty-six lives. A bridge failure near Ashtabula, Ohio on December 29, 1876 killed eighty. At Mud Run, Pennsylvania, on October 10, 1888, a rear collision at a station on the Lehigh Valley telescoped the old wooden cars killing sixty-four (Figure 2). The Pennsylvania Railroad was not immune from such tragedies: on October 9, 1880, a rear collision near Pittsburgh killed thirty-two and the next year in a head-on collision near Severn, Maryland the company nearly killed President Rutherford B. Hayes. Despite such disasters passenger safety steadily improved during the nineteenth century as the carriers upgraded track and equipment and operating practices.5

FIGURE 2: A rear collision on the Lehigh Valley at Mud Run, Pennsylvania on October 10, 1888 telescoped the wooden cars, killing sixty-four people. (Courtesy Library of Congress.)

Even with such progress, as traffic expanded the number of accidents rose and with the boom that began in 1897 accident rates skyrocketed as well. In 1901 Congress passed the Accident Reports Act authorizing the Interstate Commerce Commission (ICC) to collect and publish information on the number of collisions and derailments, which it began to report the next year. In fiscal 1902 the commission reported 8675 collisions and derailments and by 1907 the number nearly doubled, rising to 15, 458, and averaging twelve to thirteen thousand before World War I ballooned the totals (Figure 3). As in the nineteenth century, most were minor dustups, but the period was also littered with catastrophic wrecks, a few of which remain part of public memory to this day.
day. On April 29, 1900 a rear end collision on the Illinois Central near Vaughan, Mississippi sent Casey Jones into immortality, while two years later the Southern Fast Mail jumped the track on a trestle near Danville, Virginia to become the Wreck of the Old '97. Again, the Pennsylvania contributed its share to these totals. On May 12, 1902 near Pittsburgh, and again on May 11, 1905 near Harrisburg, explosions of carloads of petroleum and dynamite each killed twenty-three and led the company to press for federal regulations and industry-wide rules governing transport of dangerous cargo. On October 28, 1906 a Pennsylvania derailment near Atlantic City took fifty-seven lives.6

![Collisions and Derailments](chart.png)

**Figure 3:** Collisions and derailments from 1902 through 1916. The increase in these accidents in the early twentieth century resulted in public outcry and many proposed safety regulations. (Source: Interstate Commerce Commission, *Accident Bulletin 62*, Washington: Government Printing Office, 1917.)

As a result of these and a host of less spectacular wrecks passenger fatality rates rose from about sixteen per billion passenger miles in 1896 to twenty-four in 1907 (Figure 4). The fatality rate for American commercial air travel in the late 1990s was around .27 per billion passenger miles; the reader should try to imagine how he or she would feel about flying were airlines ninety times more dangerous today. Not surprisingly, as safety deteriorated public criticism of the carriers rose, and in about the same proportion. Such criticism was by no means new, for headlines such as “Another Railway Horror” had sold newspapers for decades. But the breadth of the attacks grew with the rising number of popular periodicals, and if anything their vituperation increased. Many writers, it seemed, had entirely lost faith in railroad management, “Who is the Murderer?” wondered the *Washington Post*, as it
reviewed railroad casualties for 1902–1904. In “Slaughter on Railroads,” the Chicago Daily News voiced a common theme, bitterly asserting that passengers and trainmen were “being butchered day by day” because railroads “find it cheaper to kill than not to kill.” A cartoon in that paper (Figure 5) urged the safety benefits that might come from hanging a few railroad managers. World’s Work described a “Harvest of Death,” while Outlook discussed “Railway Massacres.”

![Figure 4: Passenger fatality rates per billion passenger miles by cause, 1896–1920. Passenger risks rose sharply up to 1907 and then began a long decline as railroads implemented new safety policies. (Source: Interstate Commerce Commission, Accident Bulletin, various years.)](image)

As the above titles suggest, not all of these stories were models of journalistic balance and many were also misleading or factually inaccurate. A good example is a July 21, 1912 story in the New York Times “How Railroads Can Cut Long Death Lists.” The article announced that “in [fiscal] 1911, 3519 passengers and employees were killed in railroad accidents.” In this case the paper cut the carriers a break; there were 3519 passengers and employees killed in train and train service accidents; for the broader category of railroad accidents the correct number was 3958. However it failed to note that 3163 of its total were employees, which might have reduced readers’ interest in the story, and then incorrectly asserted that “most of the dead and injured were the victims of accidents resulting from collisions.” Alas even in italics the numbers are wrong: “only” ninety-three passengers and 304 employees were killed in collisions that year.
The day after it got the facts on railroad accidents all wrong the *Times* explained the need for legislation, claiming that there were many automatic safety devices for preventing collisions that the carriers could install. Nearly all critics called for laws to require extension of block signals. (Block signals divide the track into sections or blocks protected by signals and no train is allowed to enter an occupied block, thereby preventing collisions.) The *Chicago Tribune* also claimed that overwork of trainmen was a major cause of accidents. In the *Atlantic Monthly* a writer called for adoption of the “British system of accident investigation.” At about this time Edwin A. Moseley, Secretary of the ICC and its long time spokesman urged the same proposals, leading *Railway Age* to conclude that the commission felt railroad safety was out of control.9

Public figures also began to clamor for greater regulation. In 1904, and in subsequent state of the union messages, President Theodore Roosevelt called on Congress to legislate limitation of trainmen’s hours, accident investigation, and block signals. Representative John J. Esch of Wisconsin advocated a similar legislative agenda in the *North American Review* (Figure 6). Esch was a member of the House Commerce Committee; he would later write the Transportation Act of 1920 expanding the ICC’s powers to regulate safety and become an ICC commissioner in 1921. After reviewing the beneficial effects of the Safety Appliance Act of 1893 that had required the carriers to install automatic freight car couplers and air brakes, Esch urged hours limits, steel cars and mandatory block signaling. However, he cautioned that “without the most
rigid . . . discipline, the best appliances will not ensure absolute safety." Such perfection, he would later argue, could come only with automatic train control [a device that can automatically stop the train if it passes a stop signal]. Still, most critics felt that what was needed was some more of that old time religion, and reformers and railroad labor unions began to press a broad safety agenda.10

The result was an avalanche of proposals for what the carriers viewed as intrusive and expensive safety regulations. As noted, in 1901 Congress passed the Accident Reports Act. In 1907 it legislated hours limitations for trainmen and railroad telegraphers, and the same year the rail unions achieved a law mandating locomotive ashpans that could be cleaned without going under the train. Both were passed despite fierce carrier opposition. In 1908 union pressures finally brought about a federal employers' liability law. It limited a number of defenses that companies had employed to avoid accident liability. Although the act received little publicity, it was probably the most important piece of federal safety regulation, for by raising the cost of casualties it stimulated a broad, continuing interest by the carriers in reducing all forms of work accidents that carried over into other aspects of safety.11

Unions also campaigned for "full crew" and train limit laws that typically required three brakemen to a freight train and limited its length. Although urged as safety measures, in reality such laws were efforts to prevent the carriers from achieving the labor saving consequences of the air brake.
Since at least the 1870s critics had called for federal investigation of railroad accidents. As the engineering-historian Henry Petroski has observed, failure is instructive. But who learns and what they learn are often complex and negotiated issues. Most public investigations of railroad accidents during the nineteenth century had been at best superficial and at worst whitewashes making it difficult for one railroad to learn from the experience of another. Private investigations by the railroads were more thorough, and by the twentieth century carriers like the Pennsylvania routinely commissioned thorough examinations of all major wrecks but the results were invariably kept secret making it unclear what lessons, if any, had been learned. In 1907 Outlook revealed that it understood the importance of corporate control of knowledge and it blasted the company asking “what do the Pennsylvania’s patrons . . . know of its investigation of the . . . disaster near Atlantic City?” It called for “something thorough, public and mandatory.” Scientific American expressed similar views about the same time and in 1910 Congress passed a second Accident Reports Act. This one required reporting of injuries and fatalities (not just train accidents) to the ICC and it authorized federal investigation of train accidents. It was an important milestone, for (as will be seen) the investigations broke the carriers’ monopoly of accident investigation and would provide the ICC ammunition for its campaigns to improve rails and require automatic train control.

That same year Congress gave the ICC power to govern freight car safety appliances. The commission promptly proposed detailed, potentially expensive regulations (the ratchet wheel on hand brakes might have no fewer than fourteen teeth). Even worse, the carriers felt, were union-inspired proposals for federal control over railway clearances (minimum distances between trains and roadside structures). One bill would have cost $716 million if it had passed, the railroads estimated, and while federal legislation failed, by 1914 eleven states had regulated clearances either by statute or through their railroad commissions.

The Brotherhood of Locomotive Engineers had pressed for government inspection of locomotives as early as 1904, and the next year New York instituted state inspection. Several bills to regulate locomotive safety were introduced into Congress in 1909 that were both highly detailed and expensive, and the carriers fought them vigorously.

Block signals and steel passenger cars were far bigger game and these causes were championed not by labor but rather by reformers, the ICC, and the trade press. In 1903 the ICC first proposed mandatory extension of the block system under its supervision, and it later requested control over
railroad operating practices. A similar bill introduced by Representative Esch went nowhere despite the Railroad Gazette's endorsement, but Esch persisted, re-introducing it each year. It carried a hefty price tag with capital costs of $465 million to equip all passenger lines, the carriers argued.\textsuperscript{17}

In 1906, Congress responded to critics' pressures and passed a joint resolution authorizing the commission to investigate block signals and automatic train control. To no one's surprise, the report, published in 1907, called for mandatory extension of the block system supervised by the ICC. It also persuaded Congress to fund the Block Signal and Train Control Board. Between 1908 and 1912 the board issued four annual reports and a final report that ranged widely over the problems of railroad safety and made many useful suggestions. Although the board advocated mandatory extension of the block system, its skepticism of railroad management matched that of any muckraker. "The primary cause of the lamentable record of collisions in this country . . . is chargeable to railroad officers and their employees," the board pronounced, and its reports reflected a gradual shift in reformers' interests away from the block system to some sort of automatic way of stopping trains to prevent collisions.\textsuperscript{18}

The year 1911 saw the first of many bills introduced into Congress that would require all passenger cars be made of steel. Some focused on new cars only; others would have required replacement of the entire stock within four years, or ten years, or left the matter up to the ICC. The proposals all had one thing in common, they were staggeringly expensive: one bill, the carriers claimed, would have cost $633 million.\textsuperscript{19}

Thus between 1901, with the passage of the first Accident Report Act, and 1912, when the Block Signal Board delivered its final report, the carriers' safety record had been under almost continuous public assault. The critics' proposals were detailed, intrusive and expensive; their combined impact, had all been legislated, would have removed a large proportion of capital investment and operating decisions from managers' exclusive control.\textsuperscript{20}

Public Relations and Progress: Accidents and Safety on the Pennsylvania, 1907–1913

The carriers responded to these threats to corporate autonomy with accident investigations that yielded information on how to improve safety and with new publicity and lobbying campaigns to highlight their good works. In 1906, when the Pennsylvania hired Ivy Lee, he may have been the first corporate
publicity agent in the country. With brief interruptions Lee was to remain with the company the rest of his life, and under his guidance the Pennsylvania innovated new procedures to tell its side of the story. While the Pennsy’s motives for hiring Lee are unclear, surviving records reveal that he immediately began to perform several functions. By the early twentieth century the Pennsylvania’s top executives were being inundated with requests for articles and interviews. Lee guided officials through these dangerous waters, turning down most requests but favoring those that could help the company. In 1908, when a reporter from Frank Munsey’s Railroad Man’s Magazine requested an interview with President James McCrea, Lee urged him to grant it for Munsey’s publications “have been very friendly indeed toward corporations.” Moreover, Lee informed him, Munsey owned the Philadelphia Evening Times whose editor had promised to be “very fair toward the Pennsylvania railroad.”

Lee was far more than simply a corporate mouthpiece. He served as an advisor on all aspects of public relations and he shaped company pronouncements on everything from freight rates to freight car shortages. Paralleling his selective use of interviews, Lee began to feed the press stories the Pennsylvania wanted in print. Press releases informed readers of the company’s efforts planting trees and decorating stations and they routinely told of the millions of passengers carried safely. Such stories were widely reported, the Pennsy’s publicity department noted with satisfaction.

Lee’s most important contribution was to stress the need for candor on safety matters. In early 1907 when the Pennsylvania Special derailed at Mineral Point, Pennsylvania General Manager W. W. Atterbury instructed a committee of his engineers to make a thorough investigation of the causes. This was standard procedure and probably had been so for some time. However at Lee’s urging, for the first time the company made the investigation results public. Outlook’s charge of secrecy, it seemed, had found is mark. In addition when the company determined that the source of the accident had been the inadequate strength of its experimental steel cross ties, it very publicly tore then all out—resulting in favorable headlines in the New York Times and consternation at United States Steel Corporation.

After Mineral Point these procedures became standard corporate policy; when major accidents occurred the Pennsylvania routinely issued press releases giving details, the state of the investigation, and finally publishing the engineers’ report and the company’s response. It was a brilliant stroke. As the headlines quoted above demonstrate, newspaper reporting on railroad accidents was usually sensational and sometimes misleading or simply wrong,
and it often portrayed the carriers as arrogant, secretive and indifferent to safety. Publishing internal accident investigations signed by company engineers along with the company’s remedy corrected the facts and devastated this critique as nothing else could have.24

Other carriers were also improving their investigations and making them public. At Lee’s urging, the Union Pacific, Southern Pacific and the other Harriman-controlled lines made the most thoroughgoing commitment to candor. In 1907 these companies began to convene boards of inquiry that included employees of the railroad and prestigious outsiders such as merchants, utility executives, retired military officers and, in one case, the ex-governor of Wyoming, and the company published their findings. In a memo, Julius Krutschnitt, Director of Maintenance and Operations of all the Harriman lines, emphasized to heads of operating companies “what we desire to ensure . . . is to allocate responsibility by name and to publish the findings, that is, THOROUGH INVESTIGATION and PUBLICITY.”25

Companies also increasingly advertised safety. The Union Pacific was rapidly expanding its use of block signals and it was probably Lee’s idea to feature them in its advertisements. The Delaware, Lackawanna & Western’s corporate symbol, Miss Phoebe Snow, whose dress of white extolled the “road of anthracite,” began to hymn its safety too:

Miss Snow draws near the cab to cheer
The level headed engineer
Whose watchful sight makes safe her flight
Upon the Road of Anthracite.26

Interest in public relations spread from the Pennsylvania to other lines as well. In 1910 the Lehigh Valley queried the Pennsylvania about Lee’s work and was informed that the publicity bureau “has been of considerable advantage” and “Mr. Ivy Lee . . . [is] an extraordinarily good man.” The railroad press also began to discuss whether all carriers needed public relations departments. The railroads also developed new industry-wide institutions to tell their side of matters that were part lobbying, part propaganda, and part research organizations. The Special Committee on the Relations of the Railways to Legislation was formed about 1909, apparently to co-ordinate the carriers’ response to pending legislation mandating federal inspection of locomotive boilers. It gathered information from members purporting to show that the engineman was usually at fault for boiler explosions, and was able to modify the original
These propaganda efforts were also notable in their impact. Logan McPherson, then on the faculty of Johns Hopkins University, to plant favorable articles in influential publications. In 1910 he became the first head of the Bureau of Railway Economics which promptly began to issue bulletins opposing full crew and train limit legislation. While twenty states—including Pennsylvania—enacted full crew laws by 1915, and one (Arizona) limited train length, the carriers managed to stave off both at the federal level.\textsuperscript{27}

These and other lobbying and publicity campaigns were an important part of the carriers’ efforts to shape public opinion and legislation. But even the best advertising campaign needs something to sell and the carriers’ efforts surely would have come to little had safety deteriorated. In fact, corporate propaganda was reinforced by the carriers’ safety work. Focusing on individual accidents can best demonstrate this response, and we are fortunate that two detailed investigations of wrecks on the Pennsylvania have been preserved. These are a derailment at Warrior Ridge, Pennsylvania on February 15, 1912 and a collision at Tyrone, Pennsylvania on July 30, 1913. Neither accident is in any way distinctive and that is their merit, for they are therefore typical of the sorts of wrecks that bedeviled all the carriers during these years. The causes of these tragedies and the company’s responses reveal some of the forces that yielded a dramatic improvement in railroad safety that began in the years before World War I and that allowed the carriers to stave off potentially expensive laws requiring block signals and steel cars.

As noted above, nineteenth-century rail travel yielded an epidemic of derailments. Such accidents usually reflected some sort of engineering failure—of either equipment or roadway—and they diminished as the carriers improved track and roadbed. But the economic expansion that began in 1897 reversed this trend, bringing an increase in derailments and casualties in every year from 1902–1907 (Figure 3), and contributing to public clamor over railroad safety. Thereafter the number of derailments steadily increased, in 1908 surpassing collisions, which were on the decline, and thoroughly alarming the ICC. In fiscal 1902 there had been 1609 derailments from equipment defects, most of them involving freights; by 1912 the total had risen by over 100 percent, reaching 3847. Roadway-related derailments tripled rising from 577 to 1877 during the same period, a troubling number of them from rails that broke, sometimes from internal transverse fissures
(a crack within the rail head that could not be detected from the outside)—a new and mysterious problem.\textsuperscript{28}

When the eastbound Pennsylvania Limited derailed and plunged over the embankment on Warrior Ridge (Figure 7), just before noon on February 15, 1912, the wreck made the sort of headlines the Pennsylvania could not have enjoyed. As was by now routine, the company immediately issued a press bulletin giving details of the accident. In the \textit{New York Times} the headline read "3 Die, Scores Hurt, in Wreck of Flier." The \textit{Philadelphia Inquirer} reported the tragedy as "3 Killed, 67 Hurt as Pennsy Flier Jumps the Tracks." Philadelphia's \textit{Evening Bulletin} featured a picture of the wreck on the front page along with a long article containing headings such as "How Women Died." Closer to home the stories were equally lurid. "Limited Goes Over Bank, 3 killed 75 are Injured" shouted the \textit{Altoona Mirror}, while the \textit{Huntingdon Globe} described it as "One of the most appalling wrecks in the history of the Pennsylvania Railroad."\textsuperscript{29}

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\textbf{FIGURE 7:} The derailment at Warrior Ridge on the Pennsylvania, February 15, 1912. The wreck resulted from a broken arch bar truck that should not have been used on passenger equipment, but steel cars prevented many deaths. Thus the wreck revealed both strengths and weaknesses in the company's safety program. (Courtesy Huntingdon County [Pennsylvania] Historical Society.)
\end{center}

The day of the wreck General Manager S. C. Long established a four-man committee to investigate its cause. The committee included transportation men, engineers and a car inspector—all the skills relevant to the task. They were to make a "prompt and thorough investigation" and to report as soon as possible. The Pennsylvania's investigation revealed both why derailments
were then so prevalent on American lines and the procedures that would diminish them. The ICC, which had obtained power to investigate accidents in 1910, also investigated the wreck and published its findings but the company’s efforts were far more searching.30

The day after the disaster the committee assembled at Warrior Ridge and began their engineering-detective work. They walked the track, talked with maintenance men who had been on the scene, and sent Long a four-page report of their findings. The train, which had left Altoona heading east, consisted of two locomotives pulling eleven steel cars that contained 157 passengers and crew. It had been traveling about sixty miles per hour and derailed at the end of a long straight stretch with ten of the eleven cars sliding down a thirty foot embankment and piling up in the bed of the old Pennsylvania Main Line Canal. The committee noted the comparatively modest fatality list, attributing it to the frozen ground that had caused the cars to slide rather than pile up, and “especially to the fact that the train was composed of steel cars.”31

The cause of the wreck was surprising clear from the physical evidence and testimony from trackmen who had been present. At the east end of the straight stretch there was a switch leading off to a spur. About a thousand feet west of the switch the committee discovered heavy marks on the outside of the crossties as if something had been dragging on them. Interviews of a track crew that had been working at about the same spot as the drag marks began revealed that when the train passed them two journal box bolts (subsequently discovered to be from the truck on one of the locomotive tenders) had snapped off with such force that one flew through a station window.

The committee followed the drag marks down the track to the spur switch that had been broken: “something had been wedged in between the stock rail and the switch point.” They discovered the “something” when they investigated the engine. The second locomotive’s tender ran on arch bar trucks and the right front one had broken (Figure 8). The accident therefore resulted because an arch bar of the truck had broken (the top bar in the truck), causing it to settle low enough to scour the ties and finally catch in the switch point, breaking it and leading the following cars to derail.32

But why did the truck break? Here the Pennsylvania’s meticulous record keeping and metallurgical expertise proved crucial. The committee checked records and found that the tender had been inspected before it left Altoona and in all events, the break was in a spot where ordinary inspection could not have found it. The committee also took the truck to the Altoona shops for further investigation and tests.33
FIGURE 8: A typical arch bar truck (top), and the part of the truck that broke (bottom). The photograph of the broken truck was part of a thorough company investigation that included physical and chemical tests and that ultimately led to the replacement of such trucks on passenger equipment (Top: author's collection; bottom courtesy Hagley Museum and Library.)

As noted, the Pennsylvania had pioneered in the development of testing and specifications and it now applied these familiar procedures to the offending truck. In its laboratory physical and chemical tests of the arch bar revealed nothing out of the ordinary. The truck had not broken because of bad metal; rather it was a "usual detail fracture that occurs . . . under certain conditions"—a result of metal fatigue.34 This raised two unsettling questions: what were such trucks doing on passenger tenders and how many others were almost ready to break? Three days later, on February 19, the company's superintendant of motive power, J. T. Wallis, ordered an inspection of such trucks on every tender on the line. He urged divisional superintendents "to give this subject your personal attention so that there shall be no question as to whether or not the inspection has been made thoroughly as I do not wish to have it slid over in a perfunctory manner." By 1913 the company was phasing out the arch bar truck on its tenders in favor of newer, stronger, designs. The company also formed a Committee on Tender Derailments that urged the need for better track maintenance and use of heavier rail.35

This investigation reveals much about both the dangers of early twentieth-century railroading and the sources of increasing safety. The arch bar truck
was an inherently unsatisfactory and unsafe design; it was universal on freight cars and a prolific source of freight derailments but for that reason was not used on passenger cars and should not have been on the tender of a passenger locomotive. The company’s investigation was impressive for its speed and seriousness, for the involvement of top corporate officials including President James McCrea, and for the application of engineering analysis, all of which ultimately led it to remove such trucks from passenger tenders.\textsuperscript{36}

Other causes of derailment would also yield to these procedures. As noted above, at about this time all the carriers were experiencing a rash of accidents from rails that broke mysteriously from internal transverse fissures. The cure—which lay in new methods of rolling rails—was only discovered after over two decades of investigations by the Pennsylvania and other carriers. It took serious accidents to teach such lessons but it took serious investigations to learn them. And as the Pennsylvania and other carriers were discovering, it took proper publicity if the companies were to gather the proper public reward for their labors.\textsuperscript{37}

Yet the most striking finding, obvious to even the most untrained investigator, was the value of steel cars. The New York Times observed, “only the fact that the cars were constructed of steel . . . prevented a larger death list and the serious injury of many more passengers.” When passenger cars had been made of wood such accidents usually turned them into kindling—with deadly results for the occupants. Or sometimes they telescoped, with the frame of one car pushing through a previous one, as at Mud Run. Warrior Ridge was therefore a test of soundness of the Pennsy’s decision to shift to steel cars.\textsuperscript{38}

The Pennsylvania had in fact led all carriers in the replacement of wooden passenger cars with newer steel and steel-framed models. The nineteenth century had seen many experiments with iron or steel cars, none of them successful. The cars were heavy and therefore expensive to haul and their one advantage was safety. The carriers scorned them, for better investments were available. The breakthrough came with the building of New York’s subways. Mindful of recent disastrous tunnel fires, engineer George Gibbs urged use of steel and the first experimental car was built in the Pennsylvania’s Altoona shops. The Pennsylvania’s own interest in steel cars derived from the tunnel it was then building under the Hudson to Penn Station. The Southern Pacific, the Long Island, the Southern, and other lines were also beginning to buy steel cars but the Pennsylvania’s order for two hundred steel cars of its own design placed in 1907 marked the beginning of an industry-wide stampede from wood to steel. Four years later, in February 1912 when the Limited tumbled down Warrior Ridge nearly a third of the Pennsy’s cars were
made of steel. These were, of course, on main line trains like the \textit{Limited}
where the high traffic density ensured that they protected far more than a
third of all passenger miles. Other carriers were also shifting rapidly to steel.
By 1911 about 90 percent of new passenger cars were steel or steel frame—an
d fact the railroads' Special Committee gave wide publicity. The rapid shift to
steel not only saved lives; properly publicized and marshaled as evidence it
avoided yet more regulation as no doubt the carriers hoped it would.\textsuperscript{39}

If derailments such as that at Warrior Ridge contributed to travelers' wor-
ries over railroad safety, collisions, such as the Pennsylvania's wreck near
Tyrone, Pennsylvania on July 30, 1913, remained the main focus of public
concern. As the nineteenth century progressed they had become the most
common form of train accident and as traffic rose after 1897, the number of
collisions also jumped, rising from 5042 to a peak of 8027 in 1907 (Figure
3). As with derailments, most involved freight trains and were comparatively
trivial with no one being hurt. But because derailments typically involved
one train and collisions two or more, they were more likely to yield major
disasters.

Nineteenth-century American railroads had been collision-prone because
most were single track and run by the time table and train order system,
which separated trains by a time interval and was prone to breakdown. A mis-
read train order, a watch that was off, a breakdown, a work train where none
was supposed to be, all might yield a wreck. From the 1880s on critics
pointed to British lines that employed the block system and were nearly
collision free and urged American carriers to follow the British lead.

Block signals separated trains not by time but by a space interval—the
block. The Pennsylvania had pioneered in block signaling as in so many other
things, having blocked its entire main line by the 1870s. This system
employed manual blocking where a telegrapher controlled the signals
governing entrance to each block. But with wages high in America manual
blocking was expensive and by the twentieth century automatic block
signaling was spreading. An electric track circuit controlled the signals for
each block. Typically these were a "home" signal at its entrance and a distant
signal that preceded it. If a train occupied the block it tripped the home
signal to "stop" and set the distant signal to show caution, warning a
following train to slow down preparatory to a stop. On single track lines,
similar arrangements protected against head-on collisions.\textsuperscript{40}

As noted, early twentieth-century critics of American railroad safety
almost universally urged the federal government to mandate block signaling

\textsuperscript{9/}
to prevent collisions. To their consternation however, as blocking spread it failed to yield the same safety bonus under American conditions as it had in Britain. In a small but troubling number of cases, wrecks occurred because enginemen ran the signals. Gradually critics’ enthusiasm for the block system waned; what was needed, Representative Esch and others eventually concluded, was a truly foolproof way to stop the train should the engineman fail to do his duty. That was certainly one interpretation that could be drawn from the Pennsylvania’s collision near Tyrone on July 30, 1913.\textsuperscript{31}

The company’s main line at Tyrone consisted of four tracks with tracks three and four for westbound passenger and freight trains respectively. The company had just finished installing automatic block signals protecting all tracks on that division. Train 15, heading west from Philadelphia to Chicago and consisting of eight steel cars, left Harrisburg at 11:41, one minute late and arrived at Tyrone station on track three at 2:34 pm. Train 13, guided by fifty-five year old engineman G. K. Funk, left Harrisburg at 12:29, four minutes late also headed for Tyrone on track three. Thus the trains were normally separated by forty-five minutes. But Train 13 arrived at Tyrone nine minutes late and loading and unloading passengers and baggage took time, while Train 15 arrived two minutes early. It was exactly the sort of situation that had yielded a bumper crop of accidents under the train order system and that block signals were intended to prevent. But engineman Funk ran a caution signal and a stop signal and his train, weighing 1.9 million pounds, plowed into the rear of Train 15 at thirty miles per hour some 1,000 feet beyond the stop signal.\textsuperscript{42}

Once again, the wreck yielded splashy headlines. “146 Hurt in Wreck; Saved by Steel Cars,” announced the New York Times. In the Altoona Mirror the story was “Passenger Trains Crash at Tyrone,” and for the next several days it ran stories such as “How the Modern Steel Car in Use on the Pennsy Withstands Force of Whole Train.” In Philadelphia’s Evening Bulletin, the headline were “Blame Dead Man in Wreck,” and unlike the Times and the Mirror that paper also editorialized that Tyrone “glaringly betrays a weakness in organization.”\textsuperscript{43}

As he had at Warrior Ridge, the Pennsylvania’s General Manager S. C. Long promptly commissioned an investigating committee. He also notified the ICC, informing his team to cooperate fully with the commission’s investigators who soon arrived at the scene. While most derailments had a physical cause, collisions usually resulted from human error, but not always, and Long’s investigators and the ICC immediately checked the brakes on Train 13 and the automatic block signals. The brakes worked perfectly and indeed the testimony of company executives riding on the last car of Train 13 indicated that they had felt the
engineman hit the emergency just before the crash. The signals also worked perfectly and a host of individuals present on the ground at the time of the collision testified that the distant signal had showed caution and the home signal stop.44

Why did engineman Funk run the signals? The investigators reviewed his recent time on duty and found no evidence of overwork; they studied his work history and training and discovered that although at fifty-five he was getting on, he had a good record in responding to surprise checking. Company personnel files also demonstrated that he had experience with block signals and in fact had run under them on this route before. The problem it seemed lay elsewhere. Although Funk had been killed in the collision—he was its only fatality—his fireman and Assistant Road Foreman of Engines C. C. Miller had also been in the cab and both of them lived to be interviewed. It was a company policy that both the fireman and the engineman call out signals as they passed. As Train 153 approached Tyrone station first Miller and then the fireman called the distant signal “clear.” Apparently they had mistaken it for the signal for track four and engineman Funk also perfunctorily called “clear” as well. Of course no one expected the home signal to be red, and when Miller looked up and saw it that color the engineman applied the brakes but by then it was too late.45

What lessons does this tragedy teach? Everyone agreed that like Warrior Ridge it provided a powerful case for steel cars, for had Train 15 been made of wood, its cars would have telescoped as at Mud Run (Figure 2) and many more people would have died. As a result, the accident yielded the Pennsylvania favorable publicity; by reducing casualties, steel cars took some of the sensation out of train wrecks and they diverted journalistic attention to the company’s safety achievements and away from its failings that yielded the wreck. Similarly, while a bridge accident at Glen Loch Pennsylvania on November 11, 1912 may have been due to lapses in company inspection procedures, many newspaper reports stressed the value of steel cars in saving lives. When the Literary Digest did a story on steel cars later that year it prominently featured the Tyrone wreck while Scientific American played up the value of steel in both the Glen Loch and Tyrone wrecks. In an almost perfect counterpoint to Tyrone, a month later, on September 2, 1913, a rear end collision occurred on the New York, New Haven & Hartford near North Haven, Connecticut. But that company’s cars were all made of wood and the two rear sleepers were demolished, killing twenty-one people.46

In addition, steel cars were not all equally safe, and if Warrior Ridge had taught the benefits of steel, Tyrone revealed that the Pennsylvania’s design was
particularly well conceived. The *Railway Review* noted that the Pennsylvania designed end frames "with the idea of preventing one car from sweeping off the superstructure of the next one." As one of the company's engineers later recalled, "the design of the vestibule was made so that one platform cannot readily override another; also that all of the material in the platform will draw inward [thereby protecting passengers] instead of spreading and pushing outward" (Figure 9).  

Unlike the Pennsylvania, other companies had initially focused only on a massive steel center sill intended to prevent telescoping. Almost immediately these proved defective; a rear end collision on the Chicago, Milwaukee, St. Paul & Pacific near Odessa, Minnesota, on December 12, 1911 caused one steel car to rear up and its frame to telescope a previous steel car killing ten people. Such designs also led to tragedy in the Mount Union disaster on the Pennsylvania several years later on February 27, 1917. The circumstances were almost identical to those at Tyrone. A passenger train had stopped at a station; although automatic block signals protected the track, the night was foggy and the engineman of a following freight working with only four hours of sleep missed a signal and plowed into the preceding train at nearly forty miles per hour. Although made of steel, the rear car was a Pullman sleeper and lacked the reinforced vestibule common to Pennsylvania cars. It telescoped, killing twenty people (Figure 9). Soon Pullman and other major car builders also began to produce cars with collapsible end platforms to absorb energy in collisions or derailments—about fifty years before automobile companies began to design their products with "crumple zones."  

Although they both agreed that properly designed steel cars had proved their worth, in other respects the ICC and the Pennsylvania interpreted the lessons from Tyrone and Mount Union differently. As critics such as *Outlook* had observed, the divergence emphasized the importance of independent and public investigations. While in its report on Tyrone the commission acknowledged on the need for better rules—perceptively pointing out that a road foreman of engines should observe and instruct but should not call signals before the train crew—the main conclusion it drew was the need for automatic train control. "This accident again calls attention to the necessity for some form of automatic train stopping device," it concluded and proceeded to list fifteen similar accidents it had investigated in the past two years. Such human failures, the ICC felt, were inevitable under the block system. Tyrone was thus one small piece of evidence in a very large case the commission was
assembling and Mount Union was another. In the latter accident the commission claimed that the introduction of an automatic train stop "was a duty which the railroads owed the public." There would be more accidents and more hectoring, and in 1922 the commission—now including the carriers' long-time critic John J. Esch (Figure 6)—would indeed mandate an experiment with automatic train control on all large carriers.49

The Pennsylvania drew different lessons from Tyrone, Mount Union, and similar accidents. The company's managers thought automatic train stops were expensive, experimental and unnecessary. There were cheaper organizational changes that could make block signals more protective, and the company had already begun to grapple with the problem. About 1912 the Pennsylvania, along with other major carriers, had begun surprise checking of enginemen to test their fidelity to rules. These were soon given the more palatable title "efficiency tests" and beginning in 1913 in its Information for Employees and the Public and later in its advertisements in the New York Times, it bragged that 99.9 percent were in perfect compliance. That, however, was not good enough, and anyone found in violation "has had his attention called to it in a special way and warned."50
Surprise checking was the mailed fist approach to increasing organizational efficiency; “Safety First” was the velvet glove. About 1911, the Pennsy adopted the Safety First campaign that Ralph Richards, general claim agent on the Chicago & North Western Railway, had originated in 1910. The primary focus of Richards’s safety activities on the North Western, and of subsequent Safety First campaigns on the Pennsylvania and other carriers, was always to prevent work accidents. But Safety First was also part of a strategy to reduce all kinds of accidents. “If the little accidents could be stopped the big ones would take care of themselves thus wiping out the whole accident business on the road,” Richards argued. Thus, as Railway Age pointed out, improved worker safety was a means as well as an end. Richards assumed that no appeal to employees to prevent accidents to others would be as effective as an appeal to prevent accidents to themselves, and furthermore, whatever reduced work accidents would reduce other casualties. Hence, while Safety First reflected the higher costs of work injuries the carriers faced after the federal employers’ liability law of 1908, it was also a direct response to the legislative threats the carriers were then facing. In 1912 Frederic Rice of the Chicago, Burlington & Quincy Railroad spoke to the American Railway Association Committee on Transportation urging members to begin a “campaign for the reduction of accidents.” Otherwise, he warned, the carriers would face the extension of “regulation . . . to all the details of operation.” The next year the committee tentatively endorsed a North Western-style safety organization and on the eve of World War I most large carriers had adopted some form of safety organization.51

On the Pennsy Safety First procedures included worker safety committees that investigated hazards, and the company began an extensive campaign to guard equipment and otherwise reduce the dangers of work. A new accident bureau investigated every personal injury while every train accident no matter how minor was reported and studied. In 1914 Railway Age reviewed safety policies on the Pennsylvania, concluding “no railway management in the country has adopted more comprehensive and detailed methods for making its operations safe than that of the Pennsylvania Railroad System.” Sounding like one of Ivy Lee’s publicity brochures (from which it was largely taken), the article detailed the Pennsy’s engineering prowess including its high track standards, heavy rail, fleet of steel cars, careful bridge inspection, and state of the art signaling. The Age also admired the company’s organization and management, describing the system of committees, rules, surprise checking, accident investigation, and safety work. And it observed that the
company was alive to the need to “appeal to popular intelligence and sentiment” in its efforts.52

Indeed, Safety First brought a bonanza of favorable publicity to the carriers. By 1913 both Outlook and Review of Reviews were commenting favorably on the railroads’ newfound interest in safety work. A particularly fruitful source of good press was the anti-trespassing campaigns that companies began as part of their safety work. Such activities were not only humanitarian; they emphasized that most railroad casualties were not passengers and they conveniently focused on government rather than railroad failings. The emphasis on trespassing also dovetailed nicely with rising public concern over tramps and vagrants. In 1907 Ivy Lee began to send articles on vagrancy and “the tramp evil” to newspapers, terming them “editorial suggestions,” and they were picked up by a number of papers. Gradually however railroad publicity began to downplay the role of tramps and emphasize that many of trespassers killed were solid citizens, probably because such deaths were more likely to arouse public concern. In 1911, the Pennsylvania reported that it had killed 7997 trespassers and injured another 7838 in the ten years after 1900. Most of them were local citizens and many of them women and children, leading President Samuel Rea to write the Boy Scouts in 1914 urging them to teach boys the danger of trespassing. When the Scouts sent his letter to the press it resulted in a flood of favorable articles. Later the Scouts began to offer a merit badge for safety work and Rea provided a brief statement over his signature to place in their handbook.53

Conclusion

As the “Standard Railroad of the World,” the Pennsylvania’s approach to the accident crisis that overtook the carriers in the early twentieth century was important in itself. It was also symptomatic of and sometimes a model for the stance taken by the carriers as a group. The Pennsy’s managers understood that the crisis was a matter of both perception and reality and their actions provide a model for how industries can respond to public criticism in a democracy. The reality included an appalling number of train accidents as well as the large-scale slaughter of employees and others. But the perception—that the carriers were indifferent to safety—was surely wrong and it motivated not only desirable laws but others that were ham handed and irrelevant (full crew laws) as well as expensive. The Pennsy and other lines fought off most of both kinds of legislation with a publicity campaign of brochures and advertisements to
explain and advertise their commitment to safety. While for many people the term corporate public relations conjures up an image of slick and sleazy half-truths, the carriers’ public relations blitz was fundamentally grounded in reality. The need to learn from accidents was central to the Pennsy’s procedures and major wrecks such as Warrior Ridge and Tyrone yielded searching investigations. Later the procedures were extended to cover all injuries and accidents. Other carriers followed similar procedures and over time they yielded results. Companies scrapped the arch bar truck; they puzzled out the solution to transverse fissures; they invested in automatic signals and employed surprise checking and Safety First. Passenger fatality rates peaked in 1907 (Figure 4), and after a brief setback during World War I, both passenger and employee safety steadily improved for decades.

And perhaps for that reason, the publicity campaign was largely successful. It is impossible to tell precisely what role corporate public relations played in fending off regulation, for publicity without safety progress would surely have failed. But publicity surely helped the carriers harvest the reward for their good works. The clearest example is with steel cars. In 1913 when Congress held hearings on bills to require them Representative Esch read into the record information collected by the Special Committee that 97 percent of all new cars were steel. He also cited an editorial from Railway Age that legislation to force additional purchases might jeopardize other (well-publicized) safety work. The bills died in committee.54

Yet if one lesson to learn from the Pennsylvania’s experience is how industries can respond to public criticism in a democracy, another is surely the value of public participation in accident investigations, for tragedies often contain multiple lessons, some of which may not appeal to private interests. To the carriers Tyrone, Mount Union, and similar disasters taught the need for improved managerial techniques; to the ICC they taught the need for better technology. The Transportation Act of 1920, which was drafted by Esch, authorized the ICC to require automatic train control, and as noted, it did so in 1922. Yet train control was the last of the great pulse of railroad safety legislation that began in 1901. Thereafter, although several minor laws were passed in the 1930s, and the ICC ordered more train control in 1948, railroad safety receded from popular concern, not to return until an upsurge of derailments involving hazardous cargo brought it back into public focus in the 1960s.55
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4. For Lee’s career see Ray Hiebert, *Courtier to the Crowd* (Ames, Iowa: Iowa State University Press, 1948). The best studies of the emergence of corporate public relations are Alan Raucher, *Public Relations and Business, 1900–1929* (Baltimore: Johns Hopkins University Press, 1968), Richard Tedlow, *Keeping the Corporate Image: Public Relations and Business, 1900–1950* (Greenwich, Conn.: JAI Press, 1969), and Roland Marchand, *Creating the Corporate Soul* (Berkeley: University of California Press, 1998). At the same time the railroads were conducting a safety publicity campaign they were also mounting a major publicity offensive to get the ICC to raise freight rates. For details see U.S. *Congressional Record*, 63rd Cong., 2d sess, 1914, vol. 51 part 8, pp 7727–8093. Hiebert, Raucher and Tedlow briefly discuss the Pennsy’s employment of Ivy Lee but all the writers emphasize railroad worries over rate regulation rather than safety.


service, and non-train accidents. The distinction between train and train service accidents was that the former required at least $150 of damage. Accidents involving trains that might kill or injure but did less than this amount of damage were termed train service accidents. The Times category missed non-train industrial accidents to railroad employees. All figures from ICC, Accident Bulletin 40 (Washington, D.C.: GPO, 1912), Table 1.


13. Henry Petroski, To Engineer is Human: the Role of Failure in Successful Design (New York: St. Martins, 1985). Surviving records do not indicate when the Pennsylvania began serious accident investigations; however the company's documented early interest in such safety devices as air brakes suggests that the procedures probably date from the 1870s if not earlier.


15. These costs figures and those below for block signals and steel cars should not be taken at face value for they cannot be independently verified and the railroads obviously had an interest in inflating the numbers. However they cannot be too wide of the mark for proponents of the legislation never criticized these numbers or supplied calculations of their own.

16. For details on the legislation and its impact see Aldrich, Safety First ch. 5.


20. The claim in the text is not that removing these decisions from managers' exclusive control was a bad thing, only that it was radical for the time. Three laws either would have or did assert public control over investment in locomotives, passenger cars, freight cars and signals. Between 1914 and 1919 Class I carriers invested about $797 million in these four areas, about 24 percent of total investment over that period.


24. That these procedures became corporate policy is from "Notice to the Press Relative to Method of Making Public Details of Accidents," May 26, 1909, box 145, PRRC, HML. In his work for the Rockefeller's Lee earned a reputation for deliberately misleading press releases ("Lee, Ivy Ledbetter," American National Biography online in n. 21). I can find no evidence of any such actions in his work for the Pennsylvania.


28. The ICC defined a train accident as anything involving a train that caused an injury or did at least $150 in damage. As a result the accident data are affected by inflation and as prices rose around World War I the number of reported accidents exploded. The data up to about 1912 are more accurate as inflation during this period was comparatively mild. The first recognized wreck from a transverse fissure is reported in ICC, *Report of Accident on the Line of the Lehigh Valley Railroad Near Manchester, N. Y., August 25, 1912* (Washington, D. C.: GPO, 1911) available at http://specialcollection.dotlibrary.dot.gov/ (accessed April 28, 2006).


31. W. G. Coughlin et al., to S. C. Long, February 16, 1912, WRF, PRRC, HML. In fact a total of six individuals died as a result of the wreck; however ICC procedures counted only fatalities occurring within twenty-four hours of the accident and so Warrior Ridge was typical of most train wrecks in that government figures underestimated its lethality.

32. The above two paragraphs are based on Coughlin to Long.

33. R. L. Kline to W. G. Coughlin et al., February 17, 1912, WRF, PRRC, HML.

34. A detail fracture is a progressive break that originates on the surface; readers can witness metal fatigue if they repeatedly bend a paper clip until it breaks.

35. The quotation is from Charles D. Young to J. T. Wallis, February 18, 1912. J. T. Wallis to R. K. Reading et al., February 19, 1912. Both in WRF, PRRC, HML. Replacement of the archbar is from Frederick Westing, *Apex of the Atlanticis.* The Committee on Tender Derailments is from J. T. Wallis to S. C. Long, June 10, 1912, Presidential Correspondence of Alexander Cassatt and James McCrea, 1899–1913, file 86/45, box 58, MG 286, PRRC, PSA.
36. James McCrea to W. W. Atterbury, November 24, 1911 discusses an accident at Monmouth Junction; McCrea to Joseph Wood, February 21, 1912, discusses problems resulting from Warrior Ridge, and McCrea to Wood, June 12, 1912 discusses a Bradford Junction wreck. All in Presidential Correspondence of Alexander Cassatt and James McCrea, 1899–1913, file 86/45, box 58, MG 286, PRRC, PSA.


41. Why the block system worked more poorly in America than in Britain at this time generated intense debate. Some writers thought it reflected differing labor markets in the two countries, for with jobs more plentiful in the United States companies found it more difficult to discipline engineers. The railroad press blamed the problem on lax railroad management, however, and with the advent of surprise checking and company Safety First work (see below) the problem diminished. See also Mark Aldrich, Death Rode the Rails, ch. 7.

42. This description is based on ICC, “In re Investigation of Accident on the Pennsylvania Railroad at Tyrone, Pa., on July 30, 1913,” available at http://specialcollection.dotlibrary.dot.gov/ (accessed April 28, 2006), and J. C. Alexander et al., to S. C. Long, August 1, 1913, Tyrone file (hereafter Tf), box 485, PRRC, HML.


44. Committee to S. C. Long, July 31, 1912, refers to “your telegram of July 30th.” The report on brakes is in General Road Foreman of Engines to R. K. Reading, August 4, 1913. Signals are discussed in Alexander et al., to S. C. Long, August 1, 1913. All in Tf, PRRC, HML.

45. This paragraph is based on Alexander et al., to S. C. Long, August 1, 1913, Tf, PRRC, HML and ICC, “In re Investigation of Accident on the Pennsylvania Railroad at Tyrone, Pa., on July 30, 1913.”

47. “With the idea” is from “Steel Passenger Cars for Passenger Trains, P.R.R.,” Railway Review 47 (June 8, 1907): 481–83, quotation on 482. W. F. Kneissel to J. T. Wallis, November 17, 1925, Spruce Creek file, box 484, PRRC, HML.


51. Aldrich, Safety First, ch. 5.


55. For the ICC’s decision to introduce automatic train control see Mark Aldrich, Death Rode the Rails, ch. 9.